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İletişim Ad: Yusuf BARSBUĞA
E-posta: turkjse@gmail.com
Telefon: +90 332 223 47 93
Adres: Alaeddin Keykubat Campus, Faculty of Sport Science, Selcuklu, Konya, Turkey.

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İÇİNDEKİLER- ARTICLE CONTENTS

1.	A Phenomenological Research on the Role of Paradoxical Behaviors of the Team Leader in the Grateful Team Climate Kamil Ahat (Research Article)	107-132
2.	The Effect of Physical Education and Sports Activities on the Motor Skills of Preschool Children Bekir Mehtap (Research Article)	133-137
3.	The Effect of Positional Differences on Technical Parameters in Different Parts of the Pitch in Soccer Veysel Böge (Research Article)	138-144
4.	Investigation of Athletic Performances of Racket Sportsmen Ali Saçıkara, Mehmet Kılıç (Research Article)	145-151
5.	Investigation of Exercise Addiction Levels of Firefighter Mine Taşkın, Kemal Baş (Research Article)	152-159
6.	The Effect of The Isokinetic Shoulder Strength on the Phases of Speed İbrahim Halil Şahin, Ali Osman Kıvrak (Research Article)	160-172
7.	The Impact of Body Composition and Physical Fitness on Parasympathetic Reactivation in Firefighters Nuray Demiralp, Hürmüz Koç (Research Article)	173-181
8.	Investigation of the Relationship Between Kinesiophobia, Foot and Ankle Function and Physical Activity of Athletes with Chronic Ankle Instability Sinan Seyhan, Görkem Açar, Yusuf Yaşasın, Berkay Üzümcü (Research Article)	182-188
9.	Attitudes Towards E-Learning of Disabled Students Studying in Sports Sciences Undergraduate Programs During the Covid-19 Period Turan Sezan (Research Article)	189-198
10.	Examination of Physical Activity Attitudes and Anti-Social Behaviors of Middle School Students Serkan Revan, Fatih Tuncer, Şükran İribalcı (Research Article)	199-213
11.	Examination of the Relationship Between Stress Coping and Problem Solving Skills of Physical Education Teachers Mehmet Denktaş, İlhan Gözen, Şeyma Elif Şimşek, Nizamettin Ulaş Çufadar (Research Article)	214-220
12.	Examination of the Effects of Pilates Exercises on Sleep Quality and Physical Activity. Osman Dişçeken, Aleyna Aslan, Sevket Cihat Özer, Hayri Demir (Research Article)	221-229
13.	Examining the Relationship Between Yo-Yo Intermittent Rest Test Results and Performance in Football Players Aydın Karabulak, Sedat Özcan (Research Article)	230-235
14.	The Effect of Dynamic Warm-Up Exercise Durations on Different Jump Types in Young Male Boxers Serkan Kızılca, Sedat Okut (Research Article)	236-244
15.	The Effect of Surgical Mask Use on Recovery Heart Rate During Gradually Increasing Walking	245-251

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	Berkay Löklüoğlu, Bilal Biçer, Hazal Ördek, Derya Törer, Cuma Günaydın, Tolga Selim Tosun, Egecan Aytekin, Oğuzcan Yılmaz, Abdurrahman Ay, Oğuzcan Aydoğmuş (Research Article)	
16.	Physical Fitness in the Armed Forces: A Comprehensive Study of International Assessment Practices Muhammed Sıddık Çemç, Recep Şahin (Research Article)	252-264
17.	Examination Of Metaverse Awareness Levels Of University Students Who Have Sports Education Kerim Ali Akgül, Ali Erdoğan, Erkan Faruk Şirin (Research Article)	265-274
18.	Sport and Art Elif Arzen Demirel İnal, Ramazan İnal (Research Article)	275-281
19.	Examination of Self-Efficacy Levels of Physical Education Teachers and Trainer Candidates in Terms of Different Variables Ertuğrul Gençay (Research Article)	282-288
20.	Exploring the Dynamics of Hamstring Strength in Volleyball: A Positional Perspective Through a Cross-sectional Lens Çağlar Soylu, Emre Altundağ (Research Article)	289-298
21.	Examining the Relationship Between Exercise Dependence and Loneliness in Fitness Individuals Recep Cengız, Batuhan Er (Research Article)	299-305
22.	Examining The Relationship Between Perceived Physical and Cognitive Fatigue and Cognitive Flexibility in Sports Higher Education Institution Students Ebru Karakuş, Gökhan İpekoğlu, Kaan Karakuş, Hacı Ali Çakıcı (Research Article)	306-319
23.	The Effect of Dominant Leg on Change of Direction Performance in Young Famele Football Players Ayşenur Turgut Kaymakcı, Ertuğrul Gelen, Volkan Sert (Research Article)	320-328
24.	Effect Of Psychological Fragility On Motivation In Sports Yunus Emre Büyükbasmacı, Murat Erdoğdu, Enes Buğra Öz (Research Article)	329-336

SELÇUK ÜNİVERSİTESİ YAYINLARI

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A Phenomenological Research on the Role of Paradoxical Behaviors of the Team Leader in the Grateful Team Climate

Kamil AHAT [1A]

[1] Selçuk Üniversitesi Universitesi, Mimarlık ve Tasarım Fakultesi, Konya, Türkiye

Address Correspondence to Ad Soyad: Kamil AHAT e-mail: kamilahat@selcuk.edu.tr

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A: Orcid ID: 0000-0003-4734-0929

Abstract

This research aims to investigate the relationship between the feeling of gratitude in team members and paradoxical leadership behavior in a sports team where a grateful team climate is experienced. For this purpose, the emotions, thoughts, and experiences of the athletes in a fencing team characterized by the phenomenon of gratitude were consulted. The "What are the paradoxical leadership behaviors that make team members feel grateful?" question constitutes the main problem of this research. In collecting research data, in addition to the grateful team climate scale, the team members' experiences within the team were accessed through structured open-ended questions, and the effects of paradoxical leadership behavior were sought in these experiences. Data was analyzed with MAXQDA 24 Analytıcs Pro based on the data obtained by the phenomenology pattern application, the inter-phenomenal relationships determined were evaluated in the context of the emergence of the gratitude climate and the paradoxical leader's attitudes and behaviors. According to the research findings, it has been concluded that paradoxical leadership attitudes and behaviors impact the formation of a grateful team climate. According to the research findings, it has been concluded that paradoxical leadership attitudes and behaviors have a decisive role in the formation of a grateful team climate.

Keywords: Team Climate, Grateful Team Climate, Sport Team Management, Leadership, Paradoxical Leadership

Özet

Minnettar Takım İkliminde Takım Liderinin Paradoksal Davranışlarının Rolü Üzerine Fenomenolojik Bir Araştırma

Bu araştırma minnettar takım ikliminin yaşanmakta olduğu spor takımında, takım üyelerinde oluşan minnettarlık duygusunun paradoksal liderlik davranışı ile ilişkisinin araştırılmasını amaçlamaktadır. Bu amaçla minnettarlık fenomeni ile karakterize edilmiş bir eskrim takımında sporcularının duygu düşünce ve deneyimlerine başvurulmuştur. "Takım üyelerinin minnettarlık hissetmelerine yol açan paradoksal liderlik davranışları nelerdir?" sorusu bu araştırmanın temel problemini oluşturmaktadır. Araştırma verilerinin toplanmasında minnettar takım iklimi ölçeğinin yanı sıra yapılandırılmış açık uçlu sorular aracılığı ile takım üyelerinin takım içi deneyimlerine ulaşılmış ve bu deneyimlerde paradoksal liderlik davranışının etkileri aranmıştır. Veriler MAXQDA 24 ANALYTICS Pro programı ile analiz edilmiştir. Fenomenoloji deseni uygulamasına uygun olarak elde edilen verilerden hareket ile tespit edilen olgular arası ilişkiler

minnettarlık ikliminin ortaya çıkışı ve paradoksal liderin tavır tutum ve davranışları bağlamında değerlendirilmiştir. Araştırma bulgularına göre minnettar takım ikliminin oluşumunda paradoksal liderlik tavır tutum ve davranışlarının belirleyici bir rolü olduğu sonucuna ulaşılmıştır.

Anahtar Kelimeler: Takım İklimi, Minnettar Takım İklimi, Spor Takımı Yönetimi, Liderlik, Paradoksal Liderlik

INTRODUCTION

Today's society is struggling with epidemics, climate crises, wars, and economic crises that threaten humanity on a global scale, and needs to be able to include positive emotions in its daily activities more than ever. It can be said that these conditions make research conducted in the context of positive psychology more prominent every day. The question of how to create a positive organizational climate that supports organizational effectiveness and efficiency is among the important research topics of human resources management. The answer to this question should be sought in leadership approaches that improve the quality of life of team members and support their psychological and spiritual health. However, it cannot be ignored that the positive emotions experienced by team members will depend on internal as well as environmental reasons. A person can only have satisfactory experiences to the extent that he can notice the positive events in his own life and enjoy these positive events (1). At this point, it is important to address the concept of gratitude, which emerges under the influence of internal and environmental conditions, in terms of building a desired positive team climate. Although the concept of gratitude is often confused with the concept of "being grateful", which causes discomfort in the person, gratitude is a pleasant experience, unlike gratitude, and is associated with positive emotions (2). The feeling of gratitude, as a state or emotional trait, is associated with subjective well-being. It can be easily seen that happy people are people who have a sense of gratitude in their lives. (3). As a predictor of quality of life, subjective well-being, and psychological and spiritual health, the feeling of gratitude is the key to success in both professional business life and recreational sports teams. Therefore, a climate of gratitude in the team can help team members cope with difficulties. At this point, another issue that has become as important as the concept of gratitude is the leadership style and approach that the management will display. Because benefiting from the synergistic effect of motivated human resources in an organization is only possible with the leadership competence of a manager. Team synergy is defined as the feeling of adopting common goals (4). The leader's ability to benefit from the synergistic effect of the team depends on the fact of being a team, which is the only tool he can use. The phenomenon of being a team requires effective management of the changing structure of internal and external environmental conditions by organizational flexibility within the framework of effective leadership. For this reason, it is necessary to focus on the team phenomenon and leadership behavior in the context of team management. There are two dimensions in each team: competition and cooperation (5) and the leader is the manager responsible for managing these dimensions in balance. Whether it is valid for a business activity or a recreational activity, teamwork is the basis of gaining a competitive advantage (6). Since the targeted success can only be possible by adopting a management approach appropriate to the requirements of the day (7), as in all institutions and organizations, the ability of sports institutions and organizations to work effectively and at the desired level of teamwork depends on the leadership ability of the management. There are some generally accepted common characteristics that all teams should have to create an effective and efficient team understanding (6). These;

- To have a common purpose and vision
- Creating healthy communication
- Team authorization
- A healthy conflict space and creativity
- A sense of belonging to the team
- Sharing of shared responsibility
- Commitment to the team

• Supporting individual development

The presence or emergence of these characteristics in the team is related to the leadership competence and style of the team leader. A team can only emerge if it is managed by competent leadership. Team climate is formed as a result of team members attributing common meanings to events (8). It is accepted that team climate is a structure consisting of three elements: commitment, trust, and innovation (9). Team members have complementary skills in the team, and each team member holds themselves accountable for the common goal (10). This situation indicates that the performance of team members as social beings should be managed on a target-based basis. A leadership approach that is accepted by the team members can guide the team climate and the success and high performance that the climate will bring with the mission, vision, and core values it will offer (11). Teams consist of two or more people and the interaction and communication of the members with each other serves the common goals of the organization. Since each of the members of the team is defined as a social being (12), it is necessary to bring the team members together in line with the common goals of the social group to which they belong (13) and to ensure coordination, coordination, supervision, and control in a planned manner. Intra-team communication should be established by the leadership with each team member and between the elements with each other at an aesthetic level. According to Goleman, leadership is not the art of dominating, but the art of persuading people to work together towards a common goal (14). It is now understood that the leaders who persuade and adopt aesthetic communication are accepted instead of the managers who shout orders. Organizational aesthetics is an important tool for team building and more human organizations. What will make the experiences that will reveal the aesthetic value in an organization, that is, the sensory value, aesthetic, is the aesthetic level of communication in the team. Managers' aesthetic communication competencies will gain more and more importance day by day (15).

The leadership sought should have the qualities of a coach with the ability to give responsibility to people, to invite them to responsibility, and to provide them with the opportunity to learn by learning from their own mistakes and successes. If goal-oriented coordination is desired in a team, the conflict should never be managed as one member prevailing over another team member. The ability of team members, who are social beings within the team, to establish close relationships with each other within the team is a bond that gives meaning to life outside the team. Such bonds mean individuals who respect the norms in social life. Teams are groups with a common goal and goal, and as stated by Emile Durkheim (1933), these groups act as an important buffer between the individual and society (16). There is cooperation in teamwork, and this cooperation emerges with the systematic integration of the efforts of the individuals who make up the team to achieve a common goal (4).

Teamwork is accepted as a basic tool for solving managerial problems, and its success will be shaped depending on the rules and methods applied by the organizational management approach (16).

Teams, which are the creators of important dynamics such as identity, attachment, harmony, social rapprochement, discussion, and negotiation on an individual and social scale (17), have become critical formations of organizational life in the twenty-first century (18). The new identity developed by the team members by identifying with the team they are included in is the common identity of the team that the other members of the team approve. Here, again, the leadership competencies of management come into play (19). Since the leader will be decisive in the success of a group (20) where individuals who share the responsibility for the results to be achieved within the organizational boundaries come together, the success of the leader can be understood by looking at the team climate and the achievements of the team. A good leader is naturally someone who knows his job very well, is flexible, promises team members in decision-making, and is open to suggestions on all aspects of the team. An effective leader will create a vision within the team, create changes, and unleash the talents of the team members (21). Each of the individuals that make up the team is a talent. It is important for each talent to be evaluated and recognized by the management within the framework of their knowledge and skills, and to emphasize their contribution and importance to the team (6). If creative ideas are valued and supported in a team, and if members can express their feelings and thoughts without fear of retaliation (22), they can live and support the three dimensions of the climate: engagement, trust, and innovation, while the team focuses on achieving its goals (8).

The concept of team spirit is another phenomenological concept and an important component of team climate. Team spirit and the members who share it make it possible to ensure unity in the team, to adopt goals in a common understanding, to accept standards and norms, to strengthen communication, and to internalize the rights and obligations arising from the team (16). To the extent that the sense of belonging develops, team spirit can also be mentioned. For this, team members must be able to internalize and adopt the norms of the team. At this point, the team leader is the implementer of the principles and principles that will make it possible for the team members to adopt the organizational norms as a whole with pride and satisfaction. At this point, it would be appropriate to talk about teamwork. Trust in team leaders directly affects the effectiveness of teamwork. In teamwork, there are authorities and authorizations. The in-team empowerment to be offered by the leader helps the team members to become aware that they are together with others in their work and responsibilities (23). One of the most important factors that make the team a team is the team leader. If the team is well managed, synergy will increase, the leader will gain the trust of the team members, and the feeling of gratitude will be reinforced as the team runs from success to success (13).

As can be understood from what has been conveyed so far, examining the grateful team climate is important for all team leaders who are intertwined with human resources. As for the subject of the research, the phenomenon of gratitude experienced in the team climate is much more than a simple emotion and is a perception that emerges in team members. Team climate has been seen to be related to the individual perceptions, attitudes, and behaviors of team members, and there is a sharing of perceptions in team climate. Sharing perceptions strengthens the tendency to joint actions as a team and the commitment of members to each other and their duties (24). The sense of commitment among the members within the team, the level of interest of the team members in each other, and the degree of willingness to help each other develop by the climate of the team (25). Team climate not only creates a collaborative environment but also makes it easier for team members to attribute common meanings to events that are important to the team and to achieve the targeted results.

The team leader is the manager who can balance emotions and expectations (26), intra-team competition, and intra-team cooperation (5) dimensions in the team climate. To improve the quality of working conditions, the team leader should be able to evaluate and develop the personality traits of the members and support their psychological health (27). At this point, it is necessary to understand the concepts of psychological capital and positive psychology and then evaluate the phenomenon of gratitude in the team climate in the context of what has been explained so far. Positive psychology, which is considered to have developed under the leadership of Martin Seligman (28), helps the individual on his journey to meaning and happiness in life (29). Psychological capital, on the other hand, was first proposed by Fred Luthans (30). Psychological capital is characterized by self-efficacy, hope, optimism, and resilience (31–33). In many of his studies (32–43), Luthans has defined psychological capital through four basic components such as hope, optimism, self-efficacy, and psychological resilience, and stated that the gratitude component can be added to these four basic components based on its improving and measurable effects on performance (27,38). The feeling of gratitude helps the team member to make the effort that will enable him to succeed in difficult tasks, to believe that he will achieve success in the future, to believe that there is a path to success in all circumstances, and to continue on his way by standing and persevering during crises (30,43). Gratitude is influenced by psychological capital (44), and when considered from the perspective of positive psychology, it is a prerequisite for important values (45). Gratitude is derived from the Latin words "gratia" meaning "goodness" and "gratus" meaning "gratifying" (46) and its Turkish equivalent is "gratitude, gratitude, knowing goodness" (27). According to Emmons, who has conducted numerous studies in the field of gratitude, gratitude is appreciation (46–48). Gratitude has the potential to make significant contributions to the individual and the team (49). Among the positive effects of the grateful climate on the team, results such as less burnout, less cynicism, higher proactive behavior, higher health and safety environment, higher job satisfaction, and less absenteeism due to illness were found (50).

It is accepted that gratitude improves organizational belonging behavior, strengthens teamwork (51), and has positive effects on self-confidence, mental resilience, and physical health (48,52,53). Again, the positive and significant relationship between happiness, life satisfaction, well-being, and gratitude has been demonstrated through many scientific studies (54–64) (27). In an interesting study conducted by Wood (65),

it is reported that sleep quality is higher in individuals who experience gratitude. In another study conducted by Wood et al., gratitude is strongly and positively associated with mental health and negatively associated with depression and stress (27). It has been pointed out that individuals who experience a sense of gratitude can focus on the solution instead of being depressed because they have more positive coping skills (66). Gratitude is a pleasant experience related to positive emotions (2) and it has been determined that expressing gratitude contributes positively to a person's physical, mental, and social well-being (44,63).

In a doctoral dissertation study (28) on the relationship between adolescent well-being and gratitude, the researcher quoted from a study conducted in 1976. Accordingly, it has been determined that a child's ability to thank for the candy given to him by an adult is quite weak if he is younger than six years old, while this ability develops at the age of ten and above (67). Based on this finding, it can be assumed that the expression of gratitude develops only between the ages of 7 and 10 (68). Experiencing positive emotions such as satisfaction and joy expands one's thought-action vocabulary (69). As a positive emotional environment, a climate of gratitude will also expand the actions and thoughts of teamwork, support positive relationships between peers (70), reduce stress (71), and prevent violent behaviors in a less anxious and happier environment (72) (73). Since the grateful individual is more successful in coping with problems (74), the members of a grateful team will be able to re-analyze and evaluate possible negative situations and continue on their way towards their goals thanks to the new ways of thinking and positive affect they will develop (75).

It has been reported in many scientific studies that gratitude has been accepted as a strong predictor of well-being (66,76,77) (78). When gratitude begins to be experienced as a climate within the team, it will be possible to respond to kindness with kindness as a moral motivation among members and prevent destructive behavior (30). One of the issues that the team leader should pay attention to here is that some individual characteristics have been identified that negatively affect the development of gratitude. These characteristics are the perception of victimization (79), inability to accept one's shortcomings (80), jealousy and anger (81), excessive emphasis on materialistic values (82), insensitivity to the rights of others (3), failure to take responsibility (83) and narcissism. It is quoted as (28). According to the results of a doctoral thesis examining the predictive effect of gratitude on well-being in adolescence, it is understood that there is a significant positive relationship between well-being and its sub-dimensions of commitment, determination, optimism, relatedness, happiness, and gratitude (28). The research in question cited literature that supports this. Some of these are as below. Accordingly, in a study examining the relationship between maternal attachment and organizational commitment, the mediating role of gratitude was emphasized (84). Another study is on the relationships between post-traumatic development and gratitude (85). Other studies have demonstrated the significant effect of gratitude on subjective well-being (61,63,86,87). The results of another study on gratitude conducted by Bono et al. are quite remarkable.

Accordingly, it has been reported that students who were able to develop the level of gratitude determined at the beginning of high school education until the end of high school education felt more empathy, self-awareness, self-efficacy, goals for the future, a strong sense of identity and motivation to improve society (28). Another study conducted on university students examined the relationship between gratitude and aggression and the mediating role of empathy (88). Another eight-week study on the well-being of university students focused on the effectiveness of gratitude intervention (89). In addition to the literature that has demonstrated a significant relationship between gratitude and positive social behavior patterns (28), there are also studies examining gratitude in a cultural context. One completed cross-cultural study found that behavioral factors within cultural context differentiate the effects of gratitude on well-being (90). Another interesting study is about whether gratitude intervention will reduce body dissatisfaction (91). Another similar study examined the effects of gratitude on psychological and physical well-being (48). In a content analysis study reminiscent of the method of this research, research was conducted on the compositions written by school-age children about the subjects they felt grateful for (92). Another supporting research result is that people who experience gratitude have a higher degree of motivation for behaviors that demonstrate social proactivity and are more energetic in maintaining their moral behavior. In this way, it has been determined that these people exhibit less destructive attitudes and behaviors (2).

The speed and impact of today's technological change conditions manifest themselves in the proactive attitudes and behaviors of team members. To lead and manage this proactivity, it is inevitable for team leaders to develop paradoxical leadership abilities. The increase in academic publications on paradoxical leadership in recent years may become more meaningful when evaluated from this perspective. (93). Paradox is the contradiction between interdependent elements (94). It is reported that today, paradoxes have become an ordinary phenomenon and leaders are expected to demonstrate competence in dealing with paradoxes while dealing with the tensions in the leadership role (95,96). "If excellent companies know anything, it is how to manage paradox" (97) is a striking statement. Organizations are built on paradoxes due to the independent human subject on one side and organizational patterns on the other. It is important to simultaneously integrate and meet competing demands in the organization. Management of paradox is about trying to accept and explore tensions rather than repressing them (98–100).

The subject of leadership inherently contains paradoxical tensions, and the paradoxical approach is a perspective that encourages the development of leadership competencies in the conditions of rapid change that are unique to our century (101). In today's conditions, the success of leaders should be sought in their ability to act flexibly and evaluate problems from different paradigms according to the way they arise. Organizational paradoxes within organizations can occur at macro and micro levels (102). The paradoxical leadership approach is becoming increasingly important in today's complex business environments (103). The effect of the paradoxical leadership approach on the performance of team members is accepted (93,104,105). Findings that the paradoxical leadership style increases employee ambidexterity, employee creativity (106), and organizational learning (107) are also mentioned (96).

The roots of paradox theory appear to be based on Buddhist and Hindu philosophies (108), and it is accepted that the subject of paradox was first discussed in academic literature by Cameron and Quin (109) in 1988 (96). Zhang et al. (2015) combined the paradoxical approach with leadership research with the concept of "paradox leadership", which is based on the Yin and Yang philosophy theory in China (102). However, over time, it has been reported that different and comprehensive studies have been conducted by many researchers in the context of management and organization (98). Paradoxes involve contradictory but interrelated elements that exist simultaneously (110). Paradoxical issues, each of which can be considered correct and logical when evaluated individually, become inconsistent and incompatible when brought together. This situation manifests itself in teams, in other words, in organizational cultures (109). A paradox is a situation that seems contradictory within itself but can be considered both true and false. According to Johnson (2014), human beings were born into a paradoxical order (111). For example, even our breathing is in two dependent states. This is also the case in organizations. For example, although it is necessary to be centralized to ensure the coordination of organizational units with the whole, there is also a need for a clear distribution of authority and encouraging initiatives so that the units are responsible for their work (112). If seemingly contradictory conditions can be managed by adopting a paradoxical "both and that" approach, they can contribute to the satisfaction of team members and the success of teamwork. Since the classical rational decision aims to approach the exact correct solution in general by acting according to the idea of "either this/or", it rejects paradoxes instead of solving them. Resolving paradoxes is only possible by bringing opposing elements side by side and making evaluations within the framework of "both that/and that" possibilities (95,96). Paradoxical leaders have learned to live with paradox, as Heraclitus stated, "Nothing endures but changes." The fundamental paradox in the leadership style of paradoxical leaders is that they are leaders who do not lead. The powers of these leaders; are in their capacity to allow, not to control; not in their wisdom, but in their accessibility; It lies not in their defense of their autonomy, but in their ability to adapt. (113).

Paradoxical leadership may make it possible to explore the structure of tension in the team climate and manage members' demands. Rather than choosing between tensions, it is necessary to make an effort to meet different demands (110) and to succeed in moving from the "either/or" dilemma to the "both/and" approach. The four key skills that help leaders embrace paradox are cognitive complexity, self-confidence, conflict management, and communication. Since paradoxes are dynamic, the demands of team members that are met today may change tomorrow. The leader must monitor change closely. In addition to increasing short-term performance, it should ensure long-term sustainability (100,114). For the organization, being more profitable in the long run from conflicting demands can be achieved by leaders embracing not just one of

the conflicting demands but all of them together (112). Paradoxical leadership is considered to be positively related to harmony, proactivity, and work commitment experienced at the level of team members (93,115). In the context of paradox categories, the four dimensions of paradoxical leadership (110) are as follows (93);

1. In the context of competitive paradoxes, leaders must show followers how to focus on both the details of a specific task and the big picture.

2. Within the framework of learning paradoxes, leaders should be able to show their followers how to look for new solutions as well as well-known approaches.

3. Within the scope of organizational paradoxes, leaders should be able to be role models in ensuring stability in processes and at the same time allowing flexibility.

4. Within the framework of paradoxes of belonging, leaders should teach their followers how to protect their values and adopt the cultural norms of the organization.

METHOD

Research Model: Based on the decision that phenomenology was the most appropriate research design for the research problem, the descriptive phenomenology design was adopted in the research (116,117). The purpose of phenomenology is to make sense of lived experiences. The phenomenon analyzed in the research is the phenomenon of grateful team climate. Since the grateful team climate emerges as a result of the feeling of gratitude experienced by team members, the phenomenon of grateful team climate can only be analyzed through the experiences of team members within the team (117).

Based on this, the relational screening model was used in this research, in which fencing athletes who accepted to participate in the research completely voluntarily were selected by convenience sampling method. The research model that aims to determine the change or degree of two or more variables together is called the relational screening model (118). The research was designed as a mixed-method-based survey study. The reason for using the quantitative method in the research is that it is necessary to determine whether a climate of gratitude already exists in the team. From this point of view, the team could be characterized primarily by the phenomenon of gratitude. After determining the existence of a grateful climate in the team, the team members' thoughts and actions were analyzed phenomenologically in a qualitative approach through their answers to the experience-oriented questions posed to them.

At this stage, team member experiences were obtained through open-ended questions, and the data obtained were interpreted and discussed in the context of a paradoxical leadership style. Thus, the relationship between the athletes' experiences and the results obtained from the applied gratitude scale could be revealed. The main purpose of qualitative research is to reveal perceptions and experiences. How the qualitative data explains the quantitative results makes the mixed method and relational scanning model of the research evident. The questions asked to the participants were designed to shed light on the factors that contribute to the level of gratitude in the group from a phenomenological perspective. In phenomenological research, participants are asked two general questions. These are "What experiences have you had regarding the phenomenon?", "What environments or situations have affected your experiences with the phenomenon?" These questions asked to the participants contribute to the understanding of experiences regarding the phenomenon under consideration. These suggested question types were adapted to the problem addressed in this research (116).

In line with Luria's (2019) approach, a group-based gratitude climate was adopted in the study, and data on gratitude at the individual or inter-individual level was not collected. Climate perception at the team level suggested by Luria (2019) emerges through a dynamic process consisting of three stages (119). According to this:

1. Climate emergence occurs when members of the same group share similar experiences that contribute to the emergence of climate.

2. Interpretation of climate,

3. Group members maintain their behaviors and perceptions based on their common thoughts and experiences.

These three stages are accepted as a cyclical process that develops and maintains a common team climate at the group level. Thus, the analysis of the process reveals the individual reasons why gratitude is experienced in the team, that is, the reasons under environmental, psychological, and economic influence, as well as the managerial reasons, that is, the reasons under the influence of leadership. Based on all these, during the analysis phase, participants' expressions of gratitude were sought in their answers, and for this purpose, the data obtained from the participants were meticulously read over and over again. Based on the data obtained, it was aimed to reach the phenomenon by creating codes and themes from these codes in the Maxqda program (120).

The content analysis analyzed within the framework of interpretive and inductive approach in the Maxqda program was analyzed in five stages as follows (121,122)

1. Sections that provide meaningful integrity within the data are coded

2. The coded sections were organized into certain categories and themes were found.

3. The consistency of codes and themes was checked.

4. Code and themes have been finalized.

5. Data were described and findings were interpreted according to codes and themes.

The five distinctive attitudes (102) adopted in the code map towards paradoxical leader behavior are as follows within the framework of the theoretical basis (93).

1. Combining Self-centeredness with Altruism: Although leaders are self-confident and charismatic, they must be able to look after not only their interests but also the interests of their followers.

2. Maintaining Distance and Being Close to Followers: the leader must be able to adjust social distance appropriately. Excessive closeness can lead to negative consequences. It values both distance and proximity to help maintain the leader's authority and influence.

3. Treating all team members equally while allowing individuality: An example of this is when the leader rewards team members but presents each reward by individual differences and positions.

4. Maintaining Control over Decision Making While Promoting Autonomy:

5. Enforcing Business Rules While Allowing Flexibility: They both need high rules and allow their subordinates to make mistakes.

Purpose of the research

This research aims to investigate the relationship between the feeling of gratitude in team members and paradoxical leadership behavior in a sports team where a grateful team climate is experienced. For this purpose, the feelings, thoughts, and experiences of the athletes in a fencing team characterized by the phenomenon of gratitude were consulted. "What are the paradoxical leadership behaviors that lead team members to feel gratitude?" question constitutes the main problem of this research.

Research Group

Ethics committee approval was received for the research from the Selçuk University Faculty of Architecture and Design Publication Ethics Board dated 13/12/2023 and decision number 10/04. While the population of the study is the participants who do fencing sports for reactive purposes in Konya, the sample is 15 fencing athletes who are active in the "Legendary Fencing" club.

Phenomenological research is conducted with individuals ranging from 5 to 25 people who have fully experienced the phenomenon. Creswell suggested ten (10) people when proposing this number (123–125). Phenomenological research aims to reach the essence of the phenomenon by reaching enough people who have experienced the phenomenon.

Collection of Data

Data was collected by volunteer individuals participating in fencing sports, who answered the scale items via the online form using the measurement and evaluation tools within the period they were convenient for. Application permission and research permission were obtained from the team managers, and the application was carried out voluntarily and without obtaining identity information. Quantitative evaluation questions aiming to reveal the existence of a gratitude climate were followed by open-ended experiential questions that will enable the gratitude phenomenon to be analyzed in the context of paradoxical leadership behaviors. For this purpose, the participants are asked to describe 1) an unforgettable memory they had with their team leaders, 2) coaching behaviors that made them feel positive and negative when they evaluated the training, 3) their feelings about success and failure in their sports goals, and finally 4) the place of the team and the training in their lives. , they were asked to share. The presence of a gratitude climate in the sample was determined by using the nine-item Sports Team Grateful Climate Questionnaire (126).

The scale is a current nine-item scale for which validity and reliability analyses have been conducted, aiming to detect and understand the existence of a gratitude climate in sports teams. The data obtained from the sample through this scale demonstrated that there was a climate of gratitude in the team. It should not be ignored that the team leader's behavior has a mediating effect on the internal and environmental causes of the feeling of gratitude that arises in team members.

On the other hand, considering that sports teams should be success-oriented and disciplined structures, the leader's ability to cause a feeling of gratitude in the team members must contain a paradoxical attitude and attitude in itself. For this reason, another scale used during the creation of the code map in the study was the Paradoxical Leadership Behavior scale developed by Zhang et al. (2015) (127). Zhang et al. (2015) developed, the paradoxical leadership behavior scale consisting of five sub-dimensions and 22 items, and its Turkish adaptation was previously carried out by Akça and Tuna (2019) after validity and reliability analysis (112). This scale was not directly applied to the researchers, and a code map was prepared to enable phenomenological analysis for the content analysis carried out in the MAXQDA 24 ANALYTIC Pro program through the dimensions and items of the scale.

Analysis of Data

After reaching a healthy data set suitable for phenomenological research, the data coding and analysis process was started. At this stage, the data obtained was first read meticulously several times to identify common themes. Important words and sentences were identified from the participant expressions that reveal how and in which interactions the phenomenon of gratitude is experienced. In the process of determining the themes, the research questions were taken into consideration and a deductive method was adopted. The athletes interviewed were coded between K1 and K15, respectively. Content analysis was carried out by separating the data obtained from the interviews into themes and sub-themes in the Maxqda 24 Analytics Pro qualitative research program. In ensuring the validity and reliability of the data, the elements of credibility, consistency, and confirmability (128) were taken into consideration. While determining the research questions and evaluating the answers given, the opinions of experienced human resources managers were consulted. Consistent information was obtained from the interviews held to ensure the internal and external validity of the research. The opinions of a sociology expert were taken during the creation of the Maxqda 24 Analytics Pro code map. For research reliability, subjective evaluations were avoided during the preparation of the findings, and reporting was carried out in line with the data obtained. Consistency was taken into consideration to ensure internal reliability of the research, and confirmability was taken to ensure external reliability. Since the Maxqda 24 Analytics Pro program used in the analysis of the research made it possible to systematically analyze the content of the research data, the validity and reliability of the research were also supported in this respect. The codes and themes of the data obtained from the application are reported in detail under the heading of findings.

FINDINGS

Within the scope of the research, 15 participants were included in the research. Participants were coded as K1-K15. The study is grouped under 4 themes, as seen in Figure 1; The themes are the climate of gratitude in the team, the paradoxical leadership approach, the place of the team/training in life, and the emotions felt in cases of success/failure.

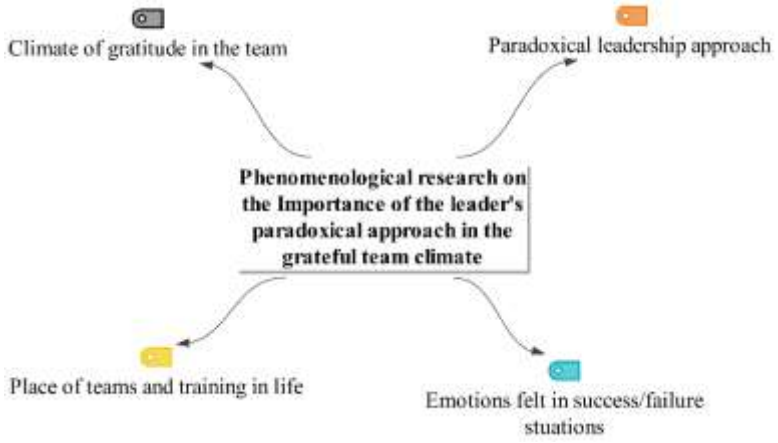
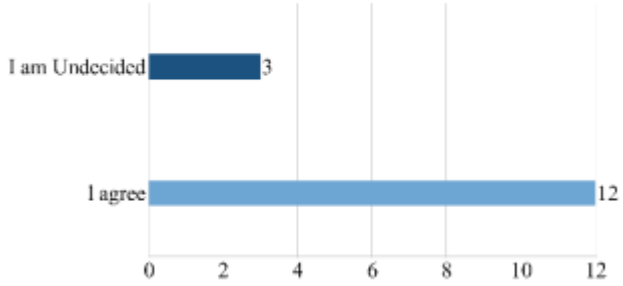


Figure 1. Theme Reveal

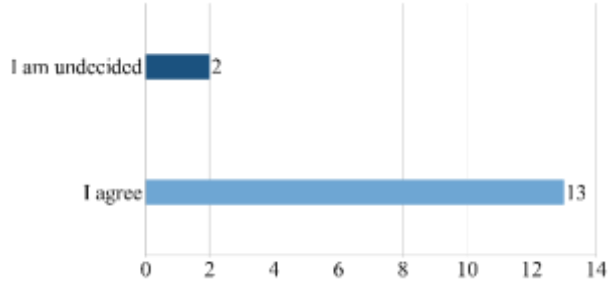
Theme: The Climate of Gratitude in the Team

First of all, based on the lived experiences, it was determined whether there was a feeling of gratitude in the sample where the phenomenological analysis would be carried out. Accordingly, the presence of a climate of gratitude in the team is as follows.



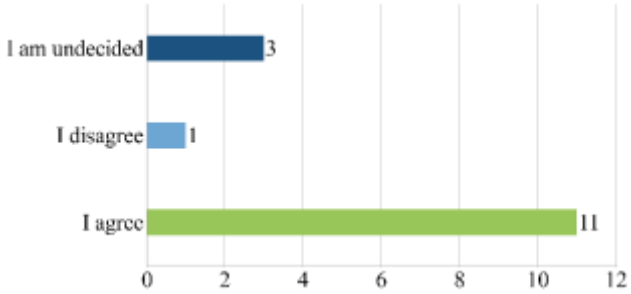
Graph 1. Gratitude for Educational Resources/Opportunities

To the expressions of gratitude for the educational resources/opportunities offered, 3 of the participants answered "undecided" and 12 people answered, "agree". The graph of gratitude for educational resources/opportunities offered is shown in Graph 1.



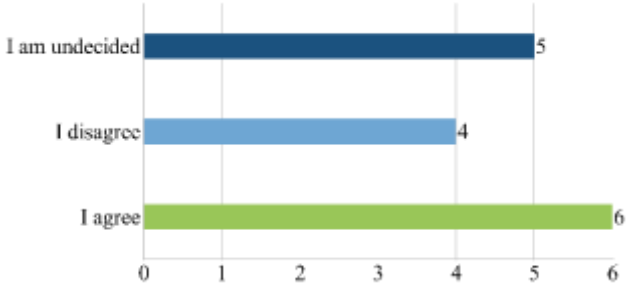
Graph 2. The Team thinks that success will be possible with the efforts of the coaches

To the statement that the team thinks that success will be possible with the efforts of the coaches, 2 participants answered "I am undecided" and 13 people answered, "I agree". The graph of the team's belief that success will occur with the efforts of the coaches is shown in Graph 2.



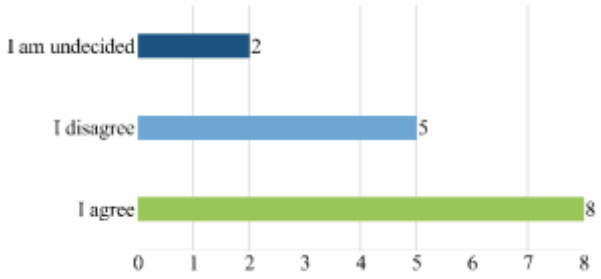
Graph 3. The team can easily express that they are grateful for the support

The team can easily express that they are grateful for the support. 3 of the participants answered "I am undecided", 1 person answered "I disagree", and 11 people answered, "I agree". The team can easily express that they are grateful for the support as shown in Graph 3.



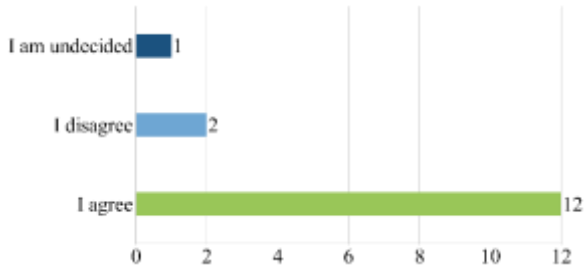
Graph 4. Thinking it's important to feel Grateful

To the statement that team members think it is important to feel gratitude, 5 of the participants answered "undecided", 6 people answered "disagree" and 1 person answered, "agree". The graph that team members think it is important to feel gratitude is shown in graph 4.



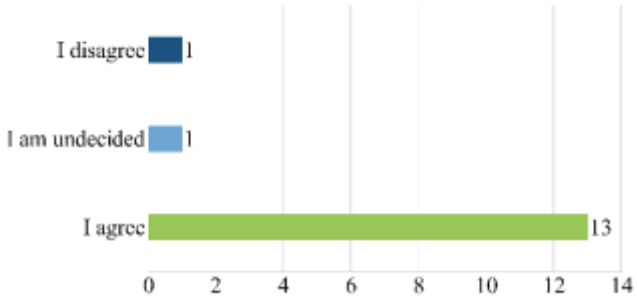
Graph 5. Statements that can refer to providing unpaid help in the team

To the statements that can refer to providing unpaid help in the team, 2 of the participants answered "I am undecided", 1 person answered "I disagree" and 11 people answered, "I agree". The graph of unpaid help in the team is shown in Graph 5.



Graph 6. Expressions of feeling grateful for the opportunities offered by the team managers

To the expressions of feeling grateful for the opportunities offered by the team managers, 1 participant responded "I am undecided", 2 participants responded "I disagree", and 12 participants responded, "I agree". The graph of feeling grateful for the opportunities offered by team managers is shown in Graph 6.



Graph 7. Expressions of the team members' efforts in response to the training/opportunities

To the expressions of the team members' efforts in response to the training/opportunities they received, 1 of the participants answered "I am undecided", 1 person answered "I disagree", and 13 people answered, "I agree". The graph of the training/opportunities received by the team members versus their effort is shown in Graph 7.

Theme: Paradoxical Leadership Approach

Six codes were created in the theme of the paradoxical leadership approach, which is the first theme discussed within the scope of the research: maintaining both distance and closeness, fulfilling job requirements while allowing flexibility, being self-centered, exhibiting altruism, giving a feeling of trust, granting autonomy, maintaining control, treating the individual individually and These are codes for being at equal distance.

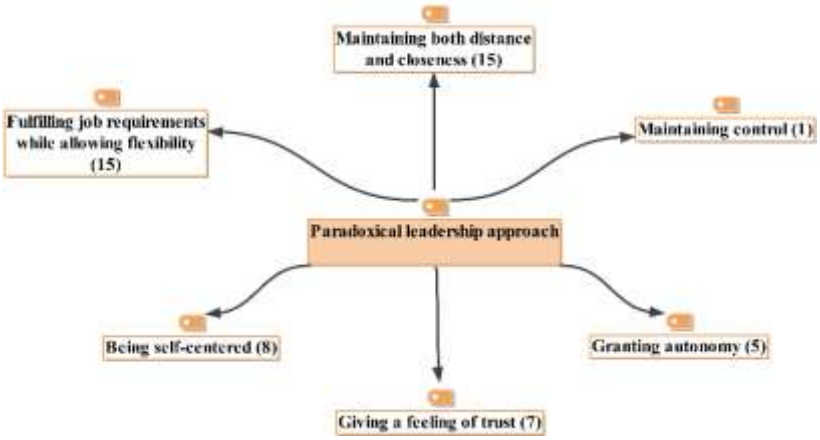


Figure 2. Paradoxical Leadership Approach Hierarchical Code-Sub-Code Model

In the paradoxical leadership approach theme, participants expressed intense opinions about maintaining both distance and closeness. Participants stated that they were positively affected by their coaches' motivational discourses, but at the same time, they were afraid of them. Participant expressions related to the subject are as follows:

"Frankly, it affects me positively when the coaches treat everyone as they deserve and give us motivating words, but when the opposite situation occurs, for example, when they scold someone for no real reason, it affects me badly, even if it is not me. But I can admit that this situation provides discipline in the team. Even if they are not angry with me, I think they take it upon myself and try to get better." (K4)

"I can't forget the reassuring words they spoke to me during our first training session. I am shy of them, but their motivation is among my best memories." (K14).

Another code expressed by participants in the paradoxical leadership approach theme is meeting job requirements while allowing flexibility. Participants stated that their coaches were very caring and understanding during the training sessions while maintaining seriousness. Participant expressions related to the subject are as follows:

"Their one-on-one attention during training is very positive. Even though we know they will get angry when training as a team, they are humorous and gentle enough to easily ask anything on one." (K3)

"His sense of fun makes me feel good. But I try not to seem like I'm going there for fun I remain serious. We laugh at the jokes, but the downside is that they don't seem to allow it. "I don't know which is positive and which is negative." (K14).

Another code expressed by the participants in the theme of the paradoxical leadership approach is being both self-centered and exhibiting altruism. Participants stated that their coaches were caring and supportive. Participant expressions related to the subject are as follows:

"Sometimes, they do this even better when they are very devoted to their work, and sometimes it may seem like they are very uninterested, and at those times, a question mark may arise. But they show great interest again in a short time." (K6)

"On the positive side, he is very supportive and it is noticeable that he has a lot of effort for everyone in the team. They are patient and try very hard to explain something. "They are friendly, funny and honest." (K10).

Another code expressed by the participants in the theme of the paradoxical leadership approach is providing a feeling of trust. Participants stated that their coaches gave them a feeling of trust. Participant expressions related to the subject are as follows:

"I can't talk about it as a memory, but my coach's reassuring behavior and the way he looked at me with confidence are the best moments that I remember that touched me the most. Even though I am afraid of them, I love and trust them very much." (K9)

"I can't forget the words they spoke to me and gave me reassurance during our first training session. I am shy of them, but their motivation is among my best memories." (K14)

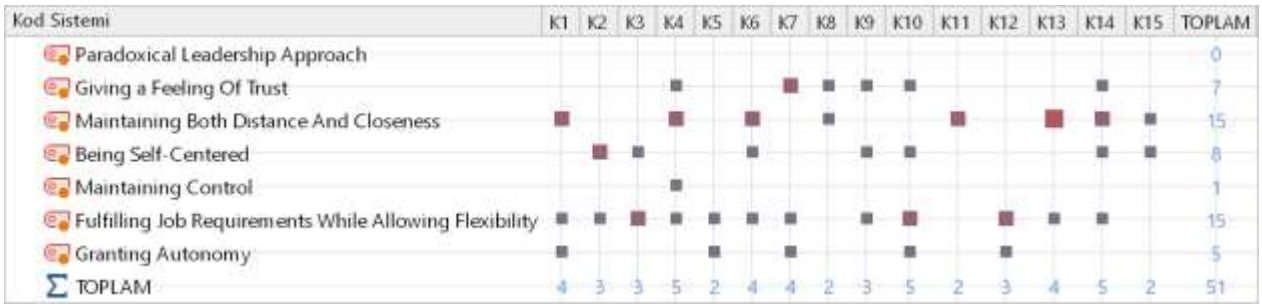
Another code expressed by the participants in the paradoxical leadership approach theme is both granting autonomy and maintaining control. Participants stated that they could feel different with their coaches' patience and perseverance. Participant expressions related to the subject are as follows:

"They didn't say anything was okay, this gave us determination, we can't ask them for anything anyway, they seem harsh, but they're not. Sometimes I feel like the man is being singled out. But when they do the same things to me after a while, I can feel like I am being distinguished." (K5)

"They make me feel that they trust me and they are patient in this regard. Even I can't be this patient with myself. "They seem very angry, especially during training, but if they are angry, I say there is a reason and I don't see anything negative." (K7).

Another code expressed by the participants in the paradoxical leadership approach theme is treating each person individually and being at an equal distance. Participants stated that their coaches approached everyone at an equal distance. Participant expressions related to the subject are as follows:

"Frankly, it affects me positively when the coaches treat everyone as they deserve and give us motivating words, but when the opposite happens, for example, when they scold someone for no real reason, it affects me badly, even if I am not the one." (K4)



Kod Sistemi	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12	K13	K14	K15	TOPLAM
Paradoxical Leadership Approach																0
Giving a Feeling Of Trust				■			■	■	■	■				■		7
Maintaining Both Distance And Closeness	■			■		■		■			■		■	■	■	15
Being Self-Centered		■	■			■			■	■				■	■	8
Maintaining Control				■												1
Fulfilling Job Requirements While Allowing Flexibility	■	■	■	■	■	■	■		■	■		■	■	■		15
Granting Autonomy	■				■		■			■		■				5
Σ TOPLAM	4	3	3	5	2	4	4	2	3	5	2	3	4	5	2	51

Table 1. Paradoxical Leadership Approach Code Matrix

The theme of the paradoxical leadership approach was examined according to the documents, and the code matrix scanner for this is included in Table 1. Accordingly, K1, K4, K6, K11, K13, K14 of the participants focused on the code of maintaining both distance and closeness, K2 on the code of being self-centered and displaying altruism, K3, K10, K12 on the code of fulfilling job requirements while allowing flexibility, and K7 on the codes of giving confidence.

The theme of Emotions Felt in Success/Failure Situations

The second theme discussed within the scope of the research, the emotions felt in success/failure situations, is divided into two categories; case of failure and case of success. In the first category, in case of failure, 10 codes were created; Feeling of shame/embarrassment, sadness, demoralization, returning to normal by focusing on the matches, feeling strong with the criticism of the coaches, regret, stress, anxiety, fear of not being able to learn new techniques are hate codes.

Figure 3. Emotions Felt in Success/Failure Situations Hierarchical Code-Sub-Code Model

In the case of the failure category, participants expressed intense opinions about shame/embarrassment. Participants stated that they felt ashamed of their coaches when they failed. Participant expressions related to the subject are as follows:

"I feel embarrassed when I fail. Even though I'm intimidated by my coaches, I feel stronger than before when they take my videos criticize me, and tell me what I need to do better. My confidence that I will do it is increasing." (K3)

“My coach, who is always harsh when I cannot do it in training, tells me the moves I cannot do in a more understanding way when I cannot win in the match. "I am indescribably ashamed of this." (K12).

Another code expressed by the participants in the category of failure is sadness. Participants expressed that they felt sad when they failed. Participant expressions related to the subject are as follows:

“When I lose, I feel very embarrassed and saddened by the efforts my teacher made for me.” (K7)

“When I lost a very important match, my coach lit a cigarette at the end of the match even though he did not like smoking, just because of me, he was very sad and thoughtful. His situation made me very sad, too. I decided to work hard. "I used to get angry at the warnings they gave me in anger, but now I try to fulfill them immediately." (K13).

Another code expressed by the participants in the category of failure is demoralization. Participants stated that they felt demoralized when they failed. Participant expressions related to the subject are as follows:

"There is a great demoralization. But with the warnings that we need to focus on the next matches, I usually return to normal after a while. My morale is getting back to normal. So, when I get upset, shame occurs, but then work begins that helps me eliminate this shame with my effort." (K1).

Another code expressed by the participants in the category of failure is returning to normal by focusing on matches. Participants stated that in cases where they were unsuccessful, they returned to normal order by focusing on the matches again. Participant expressions related to the subject are as follows:

“There is a great demoralization. But with the warnings that we need to focus on the next matches, I usually return to normal after a while. “My morale is returning to its previous state.” (K1)

“When I lose, I feel very embarrassed and sad for the efforts my teacher made for me. But they give me great support by telling me sweetly about my shortcomings for the next and next matches, without really making it obvious.” (K7).

Another code expressed by the participants in the category of failure is feeling strongly about the criticism of the coaches. Participants stated that they felt stronger with the criticism and suggestions of their coaches. Participant expressions related to the subject are as follows:

"I feel embarrassed when I fail. Even though I'm intimidated by my coaches, I feel stronger than before when they take my videos criticize me, and tell me what I need to do better. My confidence that I will do it is increasing." (K3).

Another code expressed by the participants in the category of failure is regret. Participants stated that they felt regret when they could not perform the techniques they could in some matches. Participant expressions related to the subject are as follows:

"There are matches where I feel regret, and my coach warns and tells me what I couldn't do when I could have done it anyway. My teacher also gets angry when he loses, but I feel that he is angry without upsetting me and I know he is right. "Just because I couldn't do it when I could have done it." (K13).

Another code in which opinions are expressed by participants in the category of failure is stress. Participants stated that they experienced stress when they failed. Participant statements on the subject are as follows:

"When I lose, feelings of Hate, Stress, Anxiety, Unhappiness, and Anger arise." (K13).

Another code that is expressed by participants in the category of failure is anxiety. Participants expressed that they experienced anxiety when they failed. Participant statements on the subject are as follows:

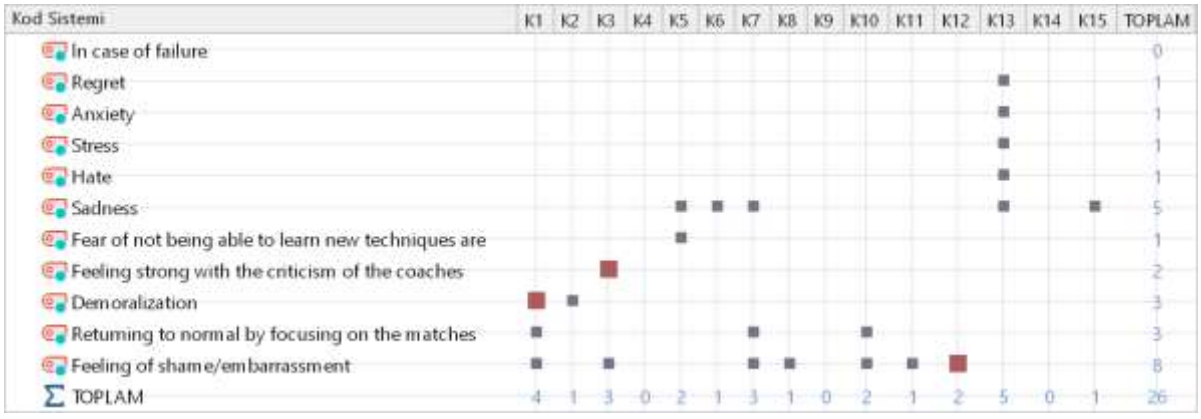
"When I lose, feelings of Hate, Stress, Anxiety, Unhappiness, and Anger arise." (K13).

Another code expressed by the participants in the category of failure is the fear of not being able to learn new techniques. Participants expressed that they were afraid of not being able to learn new techniques when they could not apply the techniques they learned. Participant expressions related to the subject are as follows:

"I kept losing because I was just starting, but I was relieved because my coach said I needed time. However, my biggest fear right now is not being able to move on to a new stage because he said that if I fail to succeed in a technique he taught me, he will never teach me a new one. "I followed the matches of all the friends and children in the team wholeheartedly, I was happy in the successes, and I was sadder than them in the failures" (P5).

Another code expressed by the participants in the category of failure is hate. Participants stated that they felt hatred when they failed. Participant expressions related to the subject are as follows:

"When I lose, feelings of Hate, Stress, Anxiety, Unhappiness, and Anger arise." (K13)



Kod Sistemi	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12	K13	K14	K15	TOPLAM
In case of failure																0
Regret													■			1
Anxiety													■			1
Stress													■			1
Hate													■			1
Sadness					■	■	■						■		■	5
Fear of not being able to learn new techniques are					■											1
Feeling strong with the criticism of the coaches			■													2
Demoralization	■	■														3
Returning to normal by focusing on the matches	■						■			■						3
Feeling of shame/embarrassment	■		■				■	■		■	■	■				8
TOPLAM	4	1	3	0	2	1	3	1	0	2	1	2	5	0	1	26

Table 2. Code Matrix in Case of Failure

In case of failure, the category was examined according to the documents, and the code matrix browser for this is given in Table 2. Accordingly, the participants focused on the K1 code of demoralization, the K3 code of feeling strong due to the coaches' criticism, and the K12 code of shame/embarrassment.

Within the scope of the research, 5 codes were created in the success category, which is the second category of the theme of emotions felt in success/failure situations; Excitement/happiness, satisfaction with success, feelings of pride, gratitude, and the idea that the coaches' efforts were not in vain are the codes. In the case of the success category, participants expressed intense opinions about excitement/happiness.

Participants stated that they were happy and excited in the matches they were successful in. Participant expressions related to the subject are as follows:

"In success, they can and feel happiness. When they lose, the opposite happens. Meetings where criticism is

made are good for us to regain my excitement." (K2)

"I was very happy when I was successful. "It feels like growing up and it's nice to feel like I have teachers who are proud of me." (K15).

Another code expressed by the participants in the success category is satisfaction with success. Participants stated that the feeling of accomplishment satisfied them. Participant expressions related to the subject are as follows:

"We have achieved many successes together. Thanks to my team leader, I eliminated a national athlete. It is a great pressure for them to watch me from the sidelines and give warnings, but I think I am successful thanks to their attention." (K2)

"I love being successful so much that I do whatever I can to achieve this, and achieving success as a result of these efforts satisfies me in every respect." (K4).

Another code expressed by the participants in the category of success is pride. Participants stated that they were proud of themselves when they were successful. Participant expressions related to the subject are as follows:

"I feel proud of myself when there is success, it makes me incredibly proud when my coach congratulates me." (K6)

"Happiness and Pride when you win." (K13).

Another code expressed by the participants in the category of success is the feeling of gratitude. Participants expressed that they felt grateful to their coaches when they were successful. Participant expressions related to the subject are as follows:

"In successful situations, I feel grateful. I think that I succeeded and won a sport that I did not know of, thanks to my coach. Otherwise, I feel embarrassed. But my teacher makes me forget immediately and that he will get angry if I don't improve myself. They do this very professionally." (K8)

"I feel nothing but gratitude towards my coaches, whether the result is success or failure. Thanks to them, I live this. But it is clear that when failure occurs, they are the first thing that comes to my mind and I feel great shame, I feel that I have wasted the efforts of my coaches. "It seems like they're going to get angry, but they always motivate me and prepare me for the next match." (K10).

Another code expressed by the participants in the success category is the idea that the coaches' efforts were not in vain. Participants stated that when they were successful, they showed that their coaches' efforts and efforts were not in vain. Participant expressions related to the subject are as follows:

"As for friends, it makes me happy again if my friends are happy for me because it shows that they are mature individuals and aware that they will improve themselves thanks to my success. "I also like to show that my coaches' efforts were not in vain when I am successful." (K4).

Kod Sistemi	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12	K13	K14	K15	TOPLAM
In case of success																0
Gratitude																2
Feelings of pride																4
Idea that the coaches efforts eere not in																1
Satisfaction with success																4
Excitement/happiness																7
TOPLAM	0	3	1	4	1	2	0	2	0	1	0	0	2	0	2	18

Table 3. Code Matrix in Case of Success

In case of success, the category was examined according to the documents, and the code matrix browser for this is given in Table 3. Accordingly, the participants focused on the K2 code of satisfaction with success, the K4 code of excitement/happiness, and the K6 code of feeling proud.

Team: The Place of Teams and Training in Life

In the third theme discussed within the scope of the research, the place of team/training in life, four codes were created; In the most important place of life, sports that are done with love, feeling good/happy, and stress-relieving/relaxing are the codes.

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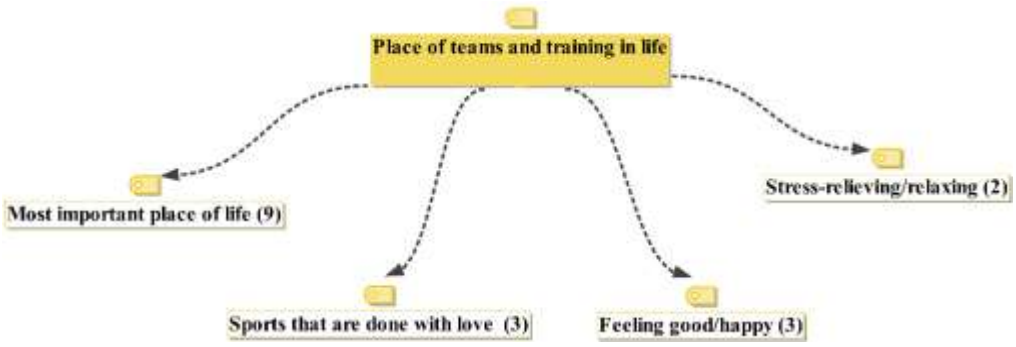

Figure 4. The Place of Team/Training in Life Hierarchical Code-Sub-Code Model

On the theme of the place of team/training in life, the participants expressed intense opinions about the most important place in life. Participants stated that their training has a very important place in their lives. Participant statements on the subject are as follows:

"It is very important to be a national fencer, to have Turkish degrees. Studying at the university for free thanks to sports. What can I tell you. It's a very important place in my life." (K5)

"First place for me in my life" (K11)

"Since most of my life has been spent in these trainings, it has become a big part of my life." (K14).

Another code that is expressed by the participants on the theme of the place of the team/training in life is the sport that is done with love. Participants stated that they love sports. Participant statements on the subject are as follows:

"It's a sport that I love and willing." (K7)

"It's one of my favorite activities in my life and one that I care about a lot." (K8).

Another code that is expressed by the participants in the theme of the life of the team/training is feeling good/happy. Participants stated that the workouts made them good and happy. Participant statements on the subject are as follows:

"Training makes me feel good, if I'm confused, training makes everything clear, but it's like home, I feel comfortable when I'm training." (K4)

"It positively affects my biological and psychological state." (K6)

"It's where I'm happy." (K10).

Another code that was expressed by the participants on the theme of the life of the team/training is the place of stress relief/relaxation. Participants stated that the workouts were relaxing and that they relieved their stress. Participant statements on the subject are as follows:

"It's my only stress-relieving environment and place of relaxation in life." (K1)

"Training makes me feel good, if I'm confused, training makes everything clear, but it's like home, I feel comfortable when I'm training." (K4)

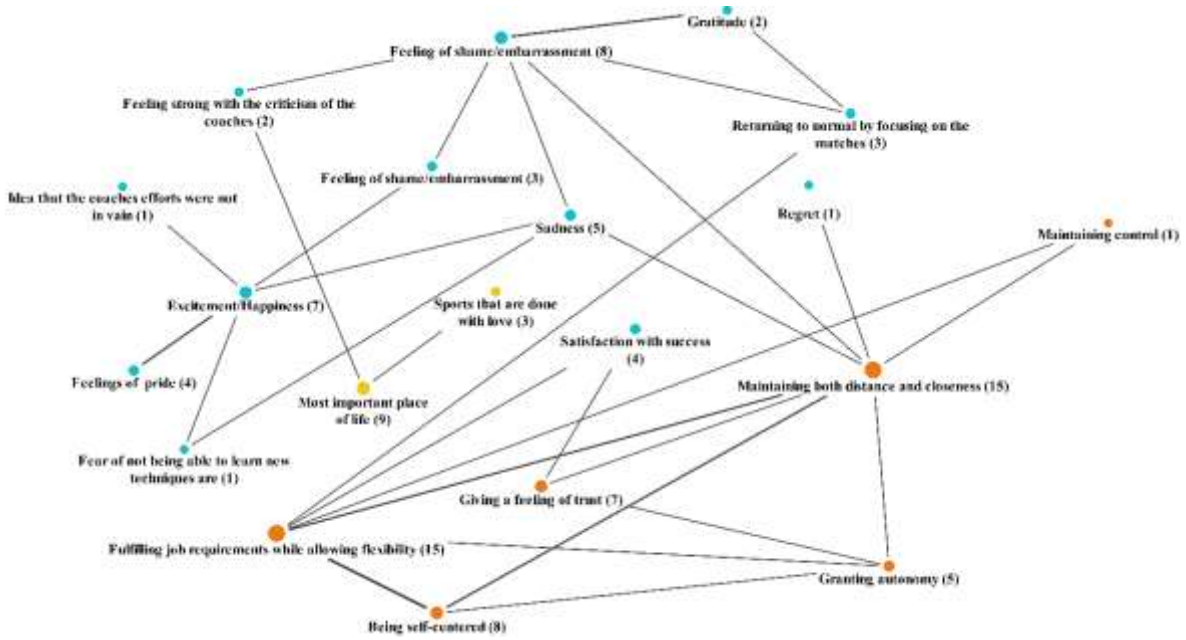

Figure 5. Code Map

The codes frequently mentioned by the participants are shown in Figure 5. The map shows the relationships between codes and which codes are frequently mentioned together. Lines are shown to reflect the relationship of more frequently mentioned codes that are mentioned together.

Figure 6. Code Cloud

The distribution of participant expressions of all participants by intensity is shown in Figure 6. Codes with larger fonts indicate expressions that are used more intensively, while expressions with smaller fonts indicate that codes are used less intensively.

DISCUSSION AND CONCLUSION

The findings revealed that there was a climate of gratitude in the sample where the research was carried out. It can be said that team members are individuals who are capable of expressing their feelings of gratitude easily. These abilities are important in terms of providing the content richness of the answers to be obtained from the experiential open-ended questions to be directed to them. In addition, team members have clearly stated their efforts to show the value of the training they have received and the opportunities they have through their success. These feelings are another indicator of the positive psychology they feel towards the team and team leaders. Team members also expressed their gratitude for the opportunities they have and the training they have received. The findings clearly showed that there was a climate of gratitude in the sample where the research was carried out.

The relationship between the dynamics within the team and paradoxical leadership behaviors that contributed to the emergence of the phenomenon in the answers given to the open-ended questions posed to the sample, which was characterized by the phenomenon of gratitude, was sought by content analysis. In this context, when the theme of the emotions experienced by the team members in case of success and/or failure was examined, it was seen that the team members felt embarrassed in case of failure, and they experienced excitement and happiness in case of success. This situation can be considered as strengthening the emergence of the phenomenon as a natural result of the bond that team members develop towards each other and team leaders within the team. Another theme is the place of the team and training in the lives of the team members. According to the team members, training and their teams are located in the most important part of their lives. In addition, they stated that they love fencing, that they feel good while doing this sport, and that they relieve stress in the team and training. All of these can be considered emotional states that reinforce the climate of gratitude. In the theme of the paradoxical leadership approach, coding was carried out for the attitudes and behaviors of the leader to maintain distance and closeness, to behave individually and to be at an equal distance to everyone, to be self-centered, to exhibit altruism, to recognize autonomy and to retain control, to fulfill job requirements while allowing flexibility, and to give confidence in general.

The experiences shared by the members indicate that the leader's behavior of allowing flexibility and fulfilling the requirements of the job, as well as keeping a distance and being close, have an effect on the emergence of the phenomenon. The findings indicate that the dynamics within the team, which reinforce the sense of gratitude in team members, have a strong interaction with the paradoxical leadership behaviors of team leaders. The findings confirm that the paradoxical understanding of leadership plays a decisive role in the formation of a grateful team climate, and may help professionals in the field of sports management to improve their decision-making processes based on scientific data. Deepening and expanding research in this field should be encouraged. While evaluating the findings of this research, it is important to know the historical process and the difficulties of fencing in terms of fencing. According to the research article titled "The First Article about Sports in the Turkish Press: Ali Ferruh Bey and Fencing" published in 2015, the sport of fencing is based on a historical background dating back to the weapons and martial arts that existed in China before Christ (129). Another study, which includes information about the history of fencing in Turkey and the introduction of this sport into the country, deals with the historical development and spread of fencing in Turkey (130). Although fencing is a safe sport, it requires qualities such as patience, determination, discipline, and competitiveness. Fencing has many positive contributions to development as well as its difficulties. The results of a study conducted on athletes between the ages of 10-12 in the Fencing Branch of Göztepe Sports Club are aimed at the contribution of fencing to the development of attention (131). The offensive and defensive dynamics encountered in fencing are extremely prominent. The rules faced by fencing athletes during the match and the difficulties brought by these rules have been shared in detail by the Fencing Federation of the Republic of Turkey on eskrim.org.tr (132).

In a study published under the title of "Evaluation of psychological factors affecting the performance of fencing athletes according to fencing coaches", psychological factors affecting the performance of fencing athletes were evaluated and the relationship between these factors and the difficulties faced by the athletes was emphasized (133). Based on the literature, it is understood that the fencing athlete should have technical skills, physical condition, mental endurance, psychological resistance to pressure during the match, and a reflex to protect against the risk of injury. The complexity of the rules specific to the sport of fencing is an area

of development that needs to be carefully addressed to understand the referee's decisions for each team member. Fencing competitions are intensely competitive internationally and routine training times are also quite long. In the academic literature, it has been observed that the research conducted directly within the framework of the importance of team climate and leadership in coping with difficulties in fencing has been quite limited. However, there is a large literature showing that the concepts of team climate and leadership are important components of team effectiveness (134). Research on team sports and leadership clearly shows that team climate and leadership are important in all kinds of sports, and therefore potentially in fencing as well. The effect of team climate and leadership practices on team dynamics has also been demonstrated (135). Leadership style is considered to play a decisive role in the management of members from different cultures (136) and in ensuring coordination in the team. Research shows that there is a strong emphasis on the relationship between team effectiveness and leadership (137). According to the results of a study that deals with team cohesion and performance in the context of paradoxical leadership, it has been revealed that paradoxical leadership is an important predictor of team cohesion and performance and that leadership style plays a mediating role in the development of an inclusive climate within the team (138). It has been determined that the mediating role of paradoxical leadership in regulating the positive climate in the team has been explained in different studies (138,139). A study on paradoxical leadership literature has discussed the concept of paradoxical leadership in terms of managing different dynamics and cultures in a team as the paradox of paradoxical leadership (140). The results of the research reveal that the leadership behaviors of coaches can play a critical role in the psychological development, satisfaction, training efficiency, and match results of the athletes. In addition, the effect of leadership style on athletes its relationship with team harmony, and its importance in the formation of a climate of gratitude are emphasized (141). All of these sources show that team climate and leadership style are critical to dealing with challenges in sports teams in general.

The findings of this research can guide fencing coaches and team managers in improving team climate and strengthening leadership skills. All the information conveyed so far contributes to the interpretation and discussion of the findings obtained from this research. The findings supported the view that the paradoxical leadership approach is effective in the formation of a climate of gratitude. It is understood that paradoxical leadership plays a decisive role in managing the expectations of team members, providing them with flexibility and freedom, instilling confidence in team members, and capturing an open communication language. Paradoxical leadership refers to a leadership style in which the leader leads his team by adopting unexpected or contradictory approaches. The findings supported the view that paradoxical leadership increases team members' flexibility, creativity, and adaptability. Among the paradoxical leadership behaviors identified in the research, attitudes and attitudes such as sharing authority and simultaneously holding control, giving independence and guidance to their employees, and maintaining perfectionism standards while allowing them to make mistakes stand out.

The findings of the research are revealing and explanatory of the effect and importance of the mediating role of paradoxical leadership in the creation of a grateful team climate in the context of paradoxical leadership behavior, as presented below, and support the views previously conveyed in the literature. Accordingly;

Paradoxical leaders have a balanced approach between authority and freedom, so they both encourage and guide team members to take responsibility. According to the findings, this created an environment that allowed team members to feel gratitude towards each other and their leaders. A climate of gratitude describes a work environment where team members feel gratitude toward each other and their leaders, positive relationships thrive, and appreciation is openly expressed. A climate of gratitude can have positive effects on job satisfaction, team cohesion, and overall performance.

Fencing athletes working under ever-changing conditions and intense competition are provided with the necessary flexibility to adapt to changing conditions, and this flexibility not only provides motivation for success but also increases the capacity of team members to cope with challenges and continuously improve, which reinforces feelings of gratitude.Rekabet koşullarında belirginleşen çatışma iklimi söz konusu olmaktadır. At this point, the paradoxical leadership approach is of critical value and has led to team members learning to appreciate the contributions of others other than themselves, as it involves bringing together different views and talents by consensus.

Personal support has developed among team members, which has led team members to feel gratitude towards their leaders and teammates.

Although there is a perfectionist attitude towards team goals, the paradoxical leadership approach has encouraged athletes to both surpass themselves and provide an environment for learning and development without fear of making mistakes.

In summary, the findings were interpreted as a multifaceted effect of paradoxical leadership in the sample group that supports the climate of gratitude in sports teams. Leaders' adoption of paradoxical behaviors can improve the overall cohesion and performance of the team by increasing the gratitude of team members to each other and their leaders. Therefore, paradoxical leadership behaviors for sports team managers and coaches are critical to fostering a climate of gratitude within the team. Paradoxical leadership can have an impact on team cohesion, adaptation, and performance, while a climate of gratitude increases the commitment and motivation of team members to each other. According to the findings of the research, it has been concluded that paradoxical leadership attitudes, attitudes, and behaviors have a decisive role in the formation of a grateful team climate. This discussion can provide valuable insights for sports team managers and coaches, guiding them on improving intra-team dynamics and maximizing team success.

REFERENCES

1. Langston CA. Capitalizing on and coping with daily-life events: Expressive responses to positive events. J Pers Soc Psychol. 1994 Dec;67(6):1112–25.
2. McCullough ME, Emmons RA, Kilpatrick SD, Larson DB. Is Gratitude a Moral Effect? Psychol Bull. 2001;127(2).
3. Watkins PC. Gratitude and Subjective Well-Being. In: The Psychology of Gratitude. Oxford University Press; 2004. p. 167–92.
4. Bateman B, Colin Wilson F, Bingham D. Team effectiveness – development of an audit questionnaire. Journal of Management Development. 2002 Apr 1;21(3):215–26.
5. Zhu YQ, Gardner DG, Chen HG. Relationships Between Work Team Climate, Individual Motivation, and Creativity. J Manage. 2018 May 20;44(5):2094–115.
6. İnce M, Bedük A, Aydoğan E. Örgütlerde Takım Çalışmasına Yönelik Etkin Liderlik Nitelikleri. Selçuk Üniversitesi Sosyal Bilimler Enstitüsü Dergisi [Internet]. 2004;(11):423–46. Available from: https://dergipark.org.tr/tr/pub/susbed/issue/61775/923553
7. Şirin T, Eratlı Şirin Y, Metin M. Kriz Zamanlarında Spor Örgüt Yönetimi: Covıd-19 Örneği. Akdeniz Spor Bilimleri Dergisi. 2020 Dec 28;3(2):331–45.
8. Okumuş MT, Bakan İ. Demografik Özellikler (Eğitim Düzeyi ve Kıdem) kapsamında Çalışanların İş Tatmini ve Takım İklimi Algıları: Bir Alan Araştırması. Aksaray Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi. 2022 Sep 30;14(3):267–78.
9. González-Romá V, Fortes-Ferreira L, Peiró JM. Team climate, climate strength and team performance. A longitudinal study. J Occup Organ Psychol. 2009 Sep 24;82(3):511–36.
10. Niraj K. Organizational Behaviour: A New Look : Concept, Theory & Cases. Mumbai: Himalaya Publishing House; 2008. 672.
11. Ronald R. Sims. Managing Organizational Behavior. Westport, Conn: Quorum Books; 2002. 390.
12. Steven L. McShane, Mary Ann Von Glinow, McGraw Hill. Örgütsel Davranış. Ankara: Nobel Akademik Yayıncılık; 2016.
13. Zehir C, Özşaahin M. Takım Yönetimi ve Takım Etkinliğiniz Belirleyen Faktörler: Savunma Sanayinde Ar-Ge Yapan Takımlar Üzerinde Bir Saha Araştırması. Doğuş Üniversitesi Dergisi [Internet]. 2008;9(2):266–79. Available from: https://dergipark.org.tr/tr/pub/doujournal/issue/66659/1042979
14. Yazıcı AG, Engin MÇ, Özdemir K. Sporcuların Bazı Değişkenlere Göre Liderlik Özelliklerinin İncelenmesi. Atatürk Üniversitesi Kazım Karabekir Eğitim Fakültesi Dergisi. 2020 Jun 30;(40):26–37.
15. Ahat K, Zerenler M. Estetik İletişim: Organizasyon Değerinin İnsan Kaynaklarının Aidiyet Duygusu Üzerindeki Etkisinde Deneyimin Aracılık Rolü. Süleyman Demirel Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi [Internet]. 2019;24(1):1–17. Available from: https://dergipark.org.tr/tr/pub/sduiibfd/issue/53003/703245
16. Özbay EM, Arslan H. Günümüz Yönetim Anlayışında Takım Oyununun Önemi. Elektronik Sosyal Bilimler Dergisi [Internet]. 2007;6(21):293–305. Available from: https://dergipark.org.tr/tr/pub/esosder/issue/6135/82288
17. Donnelon A. Takım Dinamiğinde Takım Dili. İstanbul: Sistem Yayıncılık; 1998. 342.
18. Ancona D, Kochan T, Scully M, Van Maanen J, Westney D. Eleanor. Managing for the Future: Organizational Behavior and Processes. 3rd ed. Ohio: South-Western College Publishing; 2005.
19. Demir Y, Çavuş MF. İşletmelerde Takım Dinamiğinin Önemi Etkileri. Çukurova Üniversitesi Sosyal Bilimler Enstitüsü Dergisi [Internet]. 2009;18(2):119–28. Available from: https://dergipark.org.tr/tr/pub/cusosbil/issue/4382/60128
20. Cohen SG, Bailey DE. What makes teams work: Group effectiveness research from the shop floor to the executive suite. J Manage. 1997;23(3).
21. Stoner JAF. Teamwork: What Must Go Right/What Can Go Wrong (Book). J Manage. 1991;17(1).

22. Bain PG, Mann L, Pirola-Merlo A. The Innovation Imperative. Small Group Res. 2001 Feb 18;32(1):55–73.
23. Eppler MJ, Sukowski O. Managing team knowledge: core processes, tools and enabling factors. European Management Journal. 2000 Jun 1;18(3):334–41.
24. Anderson NR, West MA. Measuring climate for work group innovation: development and validation of the team climate inventory. J Organ Behav. 1998 May;19(3):235–58.
25. Xue Y, Bradley J, Liang H. Team climate, empowering leadership, and knowledge sharing. Journal of Knowledge Management. 2011 Apr 5;15(2):299–312.
26. Pirola-Merlo A, Härtel C, Mann L, Hirst G. How leaders influence the impact of affective events on team climate and performance in R&D teams. Leadersh Q. 2002 Oct;13(5):561–81.
27. Özsoylar Ö, Türker MV. Çalışanların Minnettarlık Algısı ile Psikolojik Sermaye Algısı Arasındaki İlişki Üzerine Görgül Bir Araştırma. Öneri Dergisi. 2021 Jul 31;16(56):769–91.
28. Altuntaş S. Ergenlerde iyi oluşun yordayıcısı olarak yaşamda anlam, minnettarlık ve affedicilik [Doktora]. İnönü Üniversitesi; 2018.
29. Haidt J. Mutluluk Varsayımı. İstanbul: Hil Yayınları; 2019. 336.
30. Şevik Ü. Pozitif Psikolojik Sermayenin Mevcut ve Muhtemel Alt Boyutlarının Literatürdeki Seyri: Bibliyometrik Bir Analiz. MANAS Sosyal Araştırmalar Dergisi. 2023 Jul 17;12(3):1044–61.
31. Patnaik S, Mishra US, Mishra BB. Can psychological capital reduce stress and job insecurity? An experimental examination with Indian evidence. Asia Pacific Journal of Management. 2022 Sep 31;39(3):1071–96.
32. Luthans F, Avey JB, Avolio BJ, Peterson SJ. The development and resulting performance impact of positive psychological capital. Hum Resour Dev Q. 2010 Mar 24;21(1):41–67.
33. Avey JB, Luthans F, Mhatre KH. A call for longitudinal research in positive organizational behavior. J Organ Behav. 2008 Jul 22;29(5):705–11.
34. Luthans F, Norman SM, Avolio BJ, Avey JB. The mediating role of psychological capital in the supportive organizational climate—employee performance relationship. J Organ Behav. 2008 Feb 15;29(2):219–38.
35. Luthans F, Luthans KW, Luthans BC. Positive psychological capital: beyond human and social capital. Bus Horiz. 2004 Jan;47(1):45–50.
36. Luthans F, Avolio BJ, Walumbwa FO, Li W. The Psychological Capital of Chinese Workers: Exploring the Relationship with Performance. Management and Organization Review. 2005 Jul 2;1(02):249–71.
37. Luthans F, Avey JB, Patera JL. Experimental Analysis of a Web-Based Training Intervention to Develop Positive Psychological Capital. Academy of Management Learning & Education. 2008 Jun;7(2):209–21.
38. Luthans F, Youssef-Morgan CM. Psychological Capital: An Evidence-Based Positive Approach. Annual Review of Organizational Psychology and Organizational Behavior. 2017 Mar 21;4(1):339–66.
39. Luthans F, Jensen SM. Hope: A New Positive Strength for Human Resource Development. Human Resource Development Review. 2002 Sep 24;1(3):304–22.
40. Avey JB, Luthans F, Jensen SM. Psychological capital: A positive resource for combating employee stress and turnover. Hum Resour Manage. 2009 Sep 28;48(5):677–93.
41. Avey JB, Luthans F, Youssef CM. The Additive Value of Positive Psychological Capital in Predicting Work Attitudes and Behaviors. J Manage. 2010 Mar 17;36(2):430–52.
42. Luthans F, Broad JD. Positive psychological capital to help combat the mental health fallout from the pandemic and VUCA environment. Organ Dyn. 2022 Apr;51(2):100817.
43. Luthans F, Avolio BJ, Avey JB, N SM. Positive Psychological Capital: Measurement and Relationship with Performance and Satisfaction. Pers Psychol. 2007 Sep 4;60(3):541–72.
44. Karadeniz S, Cengiz Ö. Öğretmenlerin Minnettarlık, Psikolojik Sermaye ve İş Doyum Düzeyleri Arasındaki İlişkinin İncelenmesi. Turkish Studies-Educational Sciences. 2020;Volume 15 Issue 2(Volume 15 Issue 2):717–30.
45. Acar MC. Minnettarlık Ölçeği: Geçerlik ve Güvenirlik Çalışması. Artuklu Akademi. 2022 Jun 27;9(1):101–12.
46. Emmons RA, Shelton CM. Gratitude and the science of positive psychology. In: Handbook of positive psychology. New York, NY, US: Oxford University Press; 2002. p. 459–71.
47. Emmons AR. Teşekkür Ederim! İstanbul: Doğan Kitap; 2009. 176.
48. Emmons RA, McCullough ME. Counting blessings versus burdens: An experimental investigation of gratitude and subjective well-being in daily life. J Pers Soc Psychol. 2003 Feb;84(2):377–89.
49. J. Mills M, R. Fleck C, Kozikowski A. Positive psychology at work: A conceptual review, state-of-practice assessment, and a look ahead. J Posit Psychol. 2013 Mar;8(2):153–64.
50. Burke RJ, Ng ESW, Fiksenbaum L. Virtues, work satisfaction and psychological wellbeing among nurses. Int J Workplace Health Manag. 2009 Sep 25;2(3):202–19.
51. Dik BJ, Duffy RD, Allan BA, O'Donnell MB, Shim Y, Steger MF. Purpose and Meaning in Career Development Applications. Couns Psychol. 2015 May 3;43(4):558–85.
52. Chen LH, Wu CH. Gratitude Enhances Change in Athletes' Self-Esteem: The Moderating Role of Trust in Coach. J Appl Sport Psychol. 2014 Jul 3;26(3):349–62.

53. Celano CM, Beale EE, Beach SR, Belcher AM, Suarez L, Motiwala SR, et al. Associations Between Psychological Constructs and Cardiac Biomarkers After Acute Coronary Syndrome. Psychosom Med. 2017 Apr;79(3):318–26.
54. Dickerhoof RM. Expressing optimism and gratitude: A longitudinal investigation of cognitive strategies to increase well-being. Vol. 68. [US]; 2007.
55. Kerr SL, O'Donovan A, Pepping CA. Can Gratitude and Kindness Interventions Enhance Well-Being in a Clinical Sample? J Happiness Stud. 2015 Feb 19;16(1):17–36.
56. Chan DW. Gratitude, gratitude intervention, and subjective well-being among Chinese school teachers in Hong Kong. Educ Psychol (Lond). 2010 Mar 14;30(2):139–53.
57. Martínez-Martí ML, Avia MD, Hernández-Lloreda MJ. The Effects of Counting Blessings on Subjective Well-Being: A Gratitude Intervention in a Spanish Sample. Span J Psychol. 2010 Nov 10;13(2):886–96.
58. Froh JJ, Bono G, Fan J, Emmons RA, Henderson K, Harris C, et al. Nice thinking! An educational intervention that teaches children to think gratefully. School Psych Rev. 2014;43(2):132–52.
59. Wood AM, Froh JJ, Geraghty AWA. Gratitude and well-being: A review and theoretical integration. Clin Psychol Rev. 2010 Nov;30(7):890–905.
60. Watkins PC, Grimm DL, Kolts R. Counting your blessings: Positive memories among grateful persons. Current Psychology. 2004 Mar;23(1):52–67.
61. Wood AM, Joseph S, Maltby J. Gratitude predicts psychological well-being above the Big Five facets. Pers Individ Dif. 2009 Mar;46(4):443–7.
62. Arıcioglu A. Mediating the Effect of Gratitude in the Relationship between Forgiveness and Life Satisfaction among University Students. International Journal of Higher Education. 2016 Apr 19;5(2).
63. Oğuz Duran N, Tan Ş. Minnettarlık ve Yaşam Amaçları Yazma Çalışmalarının Öznel İyi Oluşa Etkisi. Turkish Psychological Counseling and Guidance Journal [Internet]. 2013;4(40):154–66. Available from: https://doi.org/10.17066/pdrd.37862
64. Toepfer SM, Cichy K, Peters P. Letters of Gratitude: Further Evidence for Author Benefits. J Happiness Stud. 2012 Mar 7;13(1):187–201.
65. Wood AM, Joseph S, Lloyd J, Atkins S. Gratitude influences sleep through the mechanism of pre-sleep cognitions. J Psychosom Res. 2009 Jan;66(1):43–8.
66. Wood AM, Froh JJ, Geraghty AWA. Gratitude and well-being: A review and theoretical integration. Clin Psychol Rev. 2010 Nov;30(7):890–905.
67. Gleason JB, Weintraub S. The acquisition of routines in child language. Language in Society [Internet]. 2008/12/18. 1976;5(2):129–36. Available from: https://www.cambridge.org/core/product/1FEFAF13976D9B8ED7DB0819E92D9A31
68. Graham S, Weiner B. From an Attributional Theory of Emotion to Developmental Psychology: A Round-Trip Ticket? Soc Cogn. 1986 Jun;4(2):152–79.
69. Fredrickson BL. What Good Are Positive Emotions? Review of General Psychology. 1998 Sep 1;2(3):300–19.
70. Froh JJ, Sefick WJ, Emmons RA. Counting blessings in early adolescents: An experimental study of gratitude and subjective well-being. J Sch Psychol. 2008 Apr;46(2):213–33.
71. Suldo SM, Huebner ES. Does life satisfaction moderate the effects of stressful life events on psychopathological behavior during adolescence? School Psychology Quarterly. 2004;19(2):93–105.
72. Gilman R, Huebner S. A review of life satisfaction research with children and adolescents. School Psychology Quarterly. 2003;18(2):192–205.
73. Valois RF, Zullig KJ, Huebner ES, Drane JW. Relationship Between Life Satisfaction and Violent Behaviors among Adolescents. Am J Health Behav. 2001 Jul 1;25(4):353–66.
74. Fredrickson BL, Tugade MM, Waugh CE, Larkin GR. What good are positive emotions in crisis? A prospective study of resilience and emotions following the terrorist attacks on the United States on September 11th, 2001. J Pers Soc Psychol. 2003 Feb;84(2):365–76.
75. 75.Lambert NM, Fincham FD, Stillman TF. Gratitude and depressive symptoms: The role of positive reframing and positive emotion. Cogn Emot. 2012 Jun;26(4):615–33.
76. 76.Toussaint L, Friedman P. Forgiveness, Gratitude, and Well-Being: The Mediating Role of Affect and Beliefs. J Happiness Stud. 2009 Dec 12;10(6):635–54.
77. 77.Kardas F, Cam Z, Eskisu M, Gelibolu S. Gratitude, Hope, Optimism and Life Satisfaction as Predictors of Psychological Well-Being. Eurasian Journal of Educational Research. 2019 Aug 9;19(82):1–20.
78. 78.Şahin Baltacı H, Özkılıç I, Küçüker D, Altan T. Covid-19 Pandemi Sürecinde Üniversite Öğrencilerinde Mental İyi Oluşun Yordayıcıları. Mehmet Akif Ersoy Üniversitesi Eğitim Fakültesi Dergisi. 2023 Jan 31;(65):288–313.
79. 79.Seligman MEP, Steen TA, Park N, Peterson C. Positive Psychology Progress: Empirical Validation of Interventions. American Psychologist. 2005 Jul;60(5):410–21.
80. 80.Solomon RC. Spirituality for the Skeptic. Oxford University PressNew York; 2002.
81. 81.Etchegoyen RH, Nemas CR. Salieri's Dilemma: A counterpoint between envy and appreciation. Int J Psychoanal. 2003 Feb 1;84(1):45–58.
82. 82.Kasser T, Ahuvia A. Materialistic values and well-being in business students. Eur J Soc Psychol. 2002 Jan 21;32(1):137–46.

83. 83.Chow RM, Lowery BS. Thanks, but no thanks: The role of personal responsibility in the experience of gratitude. J Exp Soc Psychol. 2010 May;46(3):487–93.
84. 84.Arslan S. Anneye bağlanma ve örgütsel bağlılık arasındaki ilişkinin yaşam doyumu, öğrenilmiş çaresizlik ve minnettarlık aracı rolüyle incelenmesi [Yüksek Lisans]. [İstanbul]: Beykent Üniversitesi; 2015.
85. 85.Topçu M. Minnettarlık ve travma sonrası gelişim: Erken yaş dönemi uyumsuz şemaları ve başa çıkma yolları, kontrol odağı ve sorumluluğun rolü [Doktora]. [Ankara]: Orta Doğu Teknik Üniversitesi; 2016.
86. 86.Datu JAD. Forgiveness, Gratitude, and Subjective Well-Being Among Filipino Adolescents. International Journal for the Advancement of Counselling. 2014 Sep 18;36(3):262–73.
87. 87.Chan DW. Subjective well-being of Hong Kong Chinese teachers: The contribution of gratitude, forgiveness, and the orientations to happiness. Teach Teach Educ. 2013 May;32:22–30.
88. 88.DeWall CN, Lambert NM, Pond RS, Kashdan TB, Fincham FD. A Grateful Heart is a Nonviolent Heart. Soc Psychol Personal Sci. 2012 Mar 6;3(2):232–40.
89. 89.Lyubomirsky S, Dickerhoof R, Boehm JK, Sheldon KM. Becoming happier takes both a will and a proper way: An experimental longitudinal intervention to boost well-being. Emotion. 2011 Apr;11(2):391–402.
90. 90.Boehm JK, Lyubomirsky S, Sheldon KM. A longitudinal experimental study comparing the effectiveness of happiness-enhancing strategies in Anglo-Americans and Asian-Americans. Cogn Emot. 2011 Nov 28;25(7):1263–72.
91. 91.Geraghty AWA, Wood AM, Hyland ME. Dissociating the facets of hope: Agency and pathways predict dropout from unguided self-help therapy in opposite directions. J Res Pers. 2010 Feb;44(1):155–8.
92. 92.Gordon AK, Musher-Eizenman DR, Holub SC, Dalrymple J. What are children thankful for? An archival analysis of gratitude before and after the attacks of September 11. J Appl Dev Psychol. 2004 Sep;25(5):541–53.
93. 93.Özgener Ş, Maraşlıoğlu B. Paradoksal Lider Davranışı ve Proaktif Davranışların Role Dayalı Performansa Etkisinde Algılanan Motivasyon İkliminin Aracı Rolü. Kastamonu Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi [Internet]. 2022;24(2):347–77. Available from: https://doi.org/10.21180/iibfdkastamonu.1193842
94. 94.Schad J, Lewis MW, Raisch S, Smith WK. Paradox research in management science: Looking back to move forward. Acad Manag Ann. 2016;10(1):5–64.
95. 95.Julmi C. Crazy, stupid, disobedience: The dark side of paradoxical leadership. Leadership. 2021 Dec 28;17(6):631–53.
96. 96.Yücel D. Paradoksal Liderlik Çalışan Çift Yönlülüğünü ve Çalışan Yaratıcılığını Nasıl Etkiler? Bingöl Üniversitesi Sosyal Bilimler Enstitüsü Dergisi. 2022 Oct 30;(24):557–74.
97. 97.Peters TJ, Waterman RH. In Search of Excellence: Lessons from America's Best-run Companies. Manhattan, New York: Harper & Row; 1982.
98. 98.Lewis MW. Exploring Paradox: Toward a More Comprehensive Guide. The Academy of Management Review. 2000 Oct;25(4):760.
99. 99.Lewis MW, Andriopoulos C, Smith WK. Paradoxical Leadership to Enable Strategic Agility. Calif Manage Rev. 2014 May 1;56(3):58–77.
100. 100.Yaşbay Kobal H. Sosyal Girişimler ve Paradoksal Liderlik Becerileri. Pamukkale University Journal of Social Sciences Institute. 2020 Jul 8;
101. 101.Lavine M. Paradoxical Leadership and the Competing Values Framework. J Appl Behav Sci. 2014 Jun 7;50(2):189–205.
102. 102.Zhang Y, Waldman DA, Han YL, Li XB. Paradoxical Leader Behaviors in People Management: Antecedents and Consequences. Academy of Management Journal. 2015 Apr;58(2):538–66.
103. 103.Volk S, Waldman DA, Barnes CM. A Circadian Theory of Paradoxical Leadership. Academy of Management Review. 2023 Oct;48(4):611–38.
104. 104.Zhang W, Liao S, Liao J, Zheng Q. Paradoxical Leadership and Employee Task Performance: A Sense-Making Perspective. Front Psychol. 2021 Dec 16;12.
105. 105.Zhang ID, Zhu JNY, Lee JH. Do Individuals and Teams Perform Better Under Paradoxical Leaders? The Role of Group Harmony. Academy of Management Proceedings. 2020 Aug;2020(1):14229.
106. 106.Klonek FE, Volery T, Parker SK. Managing the paradox: Individual ambidexterity, paradoxical leadership and multitasking in entrepreneurs across firm life cycle stages. International Small Business Journal: Researching Entrepreneurship. 2021 Feb 5;39(1):40–63.
107. 107.Kauppila O, Tempelaar MP. The Social-Cognitive Underpinnings of Employees' Ambidextrous Behaviour and the Supportive Role of Group Managers' Leadership. Journal of Management Studies. 2016 Sep 15;53(6):1019–44.
108. 108.Chen M, J. Inside Chinese Business: A Guide for Managers Worldwide. Boston: Harvard Business School Press; 2001.
109. 109.Cameron KS, Quinn RE. Organizational paradox and transformation. In: Paradox and transformation: Toward a theory of change in organization and management. New York, NY, US: Ballinger Publishing Co/Harper & Row Publishers; 1988. p. 1–18. (Ballinger series on innovation and organizational change.).
110. 110.Smith WK, Lewis MW. Toward a theory of paradox: A dynamic equilibrium model of organizing. The Academy of Management Review. 2011;36(2):381–403.
111. 111.Johnson B. Reflections: a perspective on paradox and its application to modern management. J Appl Behav Sci. 2014 Jun 8;50(2):206–12.

112.112.Tuna M, Akça İ. Paradoksal Liderlik Davranışı: Bir Ölçek Uyarlama Çalışması (Paradoxical Leadership Behavior: A Scale Adaptation Research). Journal of Business Research - Turk. 2019 Dec 29;11(4):2972–89.

113.113.Regine B, Lewin R. Leading at the Edge: How Leaders Influence Complex Systems. Emergence. 2000 Jun;2(2):5–23.

114.114. Smith WK, Lewis MW. Leadership Skills for Managing Paradoxes. Ind Organ Psychol. 2012 Jun 7;5(2):227–31.

115.115.Backhaus L, Reuber A, Vogel D, Vogel R. Giving sense about paradoxes: paradoxical leadership in the public sector. Public Management Review. 2022 Sep 2;24(9):1478–98.

116.116.Yalçın Hacer. Bir Araştırma Deseni Olarak Fenomenoloji. Anadolu Üniversitesi Sosyal Bilimler Dergisi. 2022;Özel Sayı(2):213–32.

117.117.Tekindal M, Arsu ŞU. Nitel Araştırma Yöntemi Olarak Fenomenolojik Yaklaşımın Kapsamı ve Sürecine Yönelik Bir Derleme. Ufkun Ötesi Bilim Dergisi, Türkiye Körler Federasyonu Yayını. 2020;20(1):153–82.

118.118.Niyazi K. Bilimsel Araştırma Yöntemi: Kavramlar İlkeler Teknikler. Vol. 38. Ankara: Nobel Akademik Yayıncılık; 2023.

119.119.Luria G. Climate as a group level phenomenon: Theoretical assumptions and methodological considerations. J Organ Behav. 2019;40(9–10).

120.120.Mayring P. Qualitative Content Analysis [Internet]. 2000. Available from: http://www.zuma-mannheim.de/research/en/methods/textanalysis/

121.121.Creswell JW. Research design : qualitative, quantitative, and mixed methods approaches. Sage; 2009. 260 p.

122.122.Yıldırım A, Şimşek H. Sosyal bilimlerde nitel araştırma yöntemleri. 12th ed. Ankara: Seçkin Yayıncılık; 2021. 448.

123.123.Yıldırım A, Şimşek H. Sosyal bilimlerde nitel araştırma yöntemleri. Ankara: Seçkin Yayınları; 2016.

124.124.Creswell JW. Nitel araştırma yöntemleri. Ankara: Siyasal Kitapevi; 2018.

125.125.Creswell JW. Araştırma deseni. Ankara: Eğiten Kitap; 2017.

126.126.Chen LH, Kuo CC, Ni YL, Wu CH, Hsu SC. Measuring the grateful climate at the sports team. J Posit Psychol. 2023 Sep 15;1–15.

127.127.Zhang Y, Waldman DA, Han YL, Li XB. Paradoxical Leader Behaviors in People Management: Antecedents and Consequences. Academy of Management Journal. 2015 Apr;58(2):538–66.

128.128.Merriam SB. Nitel Araştırma. Ankara: Nobel Yayıncılık; 2013.

129.129.Çetin E. Sporla İlgili Türk Basınında Yer Alan İlk Yazı: Ali Ferruh Bey ve Eskrim. The Journal of Academic Social Science Studies. 2015 Jan 1;7(Number: 37):149–149.

130.130.Gür B, Şimşekli F, Vural F. Yılmaz SF, Çapa S. Eskrim sporunun Türkiye'ye girişi ve Türkiye'deki tarihi. Bilkent Üniversitesi; 2017.

131.131.Kartal R, Dereceli Ç, Kartal A. Eskrim Sporu Yapan ve Yapmayan 10-12 Yaş Arası Çocukların Dikkat Düzeylerinin İncelenmesi. Sportif Bakış: Spor ve Eğitim Bilimleri Dergisi. 2016;3(2):82–8.

132.132.TC Gençlik ve Spor Bakanlığı GSM. https://www.eskrim.org.tr/resim/extra/mevzuat/Eskrim_kurallari.pdf. 2013. https://www.eskrim.org.tr.

133.133.Kalkan N, Zekioğlu A. Eskrim Antrenörlerine Göre Eskrim Sporcularinin Performansını Etkileyen Psikolojik Faktörlerin Değerlendirilmesi Nitel Çalışma. Ulusal Spor Bilimleri Dergisi. 2017 Jun 16;1(1):29–42.

134.134.Kozlowski SWJ. Enhancing the Effectiveness of Work Groups and Teams: A Reflection. Perspectives on Psychological Science. 2018 Mar 12;13(2):205–12.

135.135. Johnson SS. The Science of Teamwork. American Journal of Health Promotion. 2021 Jun 28;35(5):730–2.

136.136.Stahl GK, Maznevski ML. Unraveling the effects of cultural diversity in teams: A retrospective of research on multicultural work groups and an agenda for future research. J Int Bus Stud. 2021 Feb 18;52(1):4–22.

137.137.Shuffler ML, Diazgranados D, Maynard MT, Salas E. Developing, Sustaining, and Maximizing Team Effectiveness: An Integrative, Dynamic Perspective of Team Development Interventions. Academy of Management Annals. 2018 Jun;12(2):688–724.

138.138.Meng W, Xu Z, Abuliezi Z, Lyu Y, Zhang Q. Paradoxical leadership, team adaptation and team performance: The mediating role of inclusive climate. Front Psychol. 2023 Apr 6;14.

139.139.Chen Y, He X, Lu L, Gao X. In a team forgiveness climate, the influence of paradoxical thinking of leaders on the team voice behavior: Mediated by team cooperation. PLoS One. 2022 Mar 15;17(3):e0265018.

140.140.Batool U, Raziq MM, Sarwar N. The paradox of paradoxical leadership: A multi-level conceptualization. Human Resource Management Review. 2023 Dec;33(4):100983.

141.141.Jin H, Kim S, Love A, Jin Y, Zhao J. Effects of leadership style on coach-athlete relationship, athletes' motivations, and athlete satisfaction. Front Psychol. 2022 Dec 12;13.

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The Effect of Physical Education and Sports Activities on the Motor Skills of Preschool Children

Bekir MEHTAP [1A]

[1] *Faculty of Sports and Sciences, Selçuk University, Konya, TÜRKIYE*
Address Correspondence to Bekir MEHTAP: e-mail:. bekirmehtap@selcuk.edu.tr

Ethical Statement: It is declared that scientific and ethical principles have been followed while carrying out and writing this study and that all the sources used have been properly cited.

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A: Orcid ID: 0000-0002-8639-1983

Abstract

In the study, the effects of physical education and sports activities on the motor skills of preschool children were examined. Physical education and sports activities in the form of educational games were applied to 30 pre-school students aged 5 (n = 15) and 6 years (n = 15), 2 days a week and 30 minutes for 12 weeks. Physical education and sports activities; While it included walking, running, jumping and balance exercises, materials such as balls, ropes, funnels and hoops were used. The study was organized according to the pretest and posttest method. Children's motor skills were evaluated by applying motor performance tests developed by Morris, Atwater Williams and Wilmore (1980) that included balance, agility, running, catching, standing long jump and throwing criteria. The data obtained with the pretest and posttest method were analyzed by using the SPSS 23.0 statistical program and applying the t test (Paired-Sample t test) for dependent samples between the tests. According to the findings, a statistically significant improvement was noted in all motor performance criteria ($p<0.05$). It was determined that the lowest performance improvement occurred in the agility skill with a rate of 7.80%, and the highest improvement occurred in the catching skill with a rate of 19.57%. In conclusion; It can be said that physical education and sports activities can positively contribute to the development of motor skills of children aged 5-6. However, it should be examined whether the positive development observed in children's motor performance occurs as a result of the natural course of growth processes or as the positive contribution of physical education and sports movements.

Keywords: Physical education and sports, motor skills, motor performance, pre-school education.

Beden Eğitimi ve Spor Etkinliklerinin Okul Öncesi Dönemdeki Çocukların Motor Becerilerine Etkisi

Özet

Çalışmada, beden eğitimi ve spor etkinliklerinin okul öncesi çocukların motor becerilerine etkisi incelenmiştir. 5yaş(n=15) ve 6 yaş(n=15) grubu 30 okul öncesi eğitim gören öğrenciye, 12 hafta boyunca haftada 2 gün v e 30 dakika süren, eğitsel oyun formunda beden eğitimi ve spor aktiviteleri uygulanmıştır. Beden eğitimi ve spor aktiviteleri; yürüyüş, koşu, atlama ve denge egzersizleri içerirken, top, ip, hunu ve çember gibi materyaller kullanılmıştır. Çalışma ön test ve son test metoduna göre düzenlenmiştir. Çocukların motor becerileri Morris, Atwater Williams ve Wilmore (1980) tarafından geliştirilmiş, denge, çabukluk, koşu, yakalama, durarak uzun atlama ve fırlatma kriterleri içeren motor performans testleri uygulanarak değerlendirilmiştir. Öntest ve sontest yöntemi ile elde edilen veriler SPSS 23.0 istatistik programı kullanılarak, testler arasındaki bağımlı örneklemler için t testi (Paired-Sample t test) uygulanarak analiz

edilmiştir. Elde edilen bulgulara göre, motor performans kriterlerinin tamamında istatistiksel olarak anlamlı gelişim kaydedilmiştir ($p<0,05$). En düşük performans gelişiminin %7,80 oranla çabukluk becerisinde, en fazla gelişimin ise %19,57 oranla yakalama becerisinde oluştuğu belirlenmiştir. Sonuç olarak; beden eğitimi ve spor aktivitelerinin 5-6 yaş grubu çocukların motor becerilerinin gelişimine olumlu katkı sağlayabileceği söylenebilir. Fakat çocukların motor performansında gözlenen olumlu gelişmemin, büyüme süreçlerinin doğal seyri içerisindeki bir durum olarak mı yoksa beden eğitimi ve spor hareketlerinin olumlu katkısı olarak mı oluştuğu incelenmelidir.

Anahtar Kelimeler: Beden eğitimi ve spor, motor beceri, motor performans, okul öncesi eğitim.

INTRODUCTION

In childhood, when activity is quite intense, it is very important to meet the movement requirements and needs of children in this period in order for their development periods to proceed healthily. Studies involving basic movement skills are extremely important in the development of biomotor skills such as endurance, strength, flexibility and coordination of children in this period. Physical education, movement skills and sports activities performed during this period have positive effects on physiological parameters such as the circulatory system, skeletal and muscular system, and respiratory system. For this reason, physical activity is one of the basic needs in the development process for children in this period. For this reason, it is thought that regular and periodic physical activities for children in this period to improve their movement skills will positively affect their development processes (10, 19). Motor development is the changes in motor behavior over a period of time that includes the entire lifespan. Motor development is also evaluated in terms of both duration and result. Process evaluation; While defining the factors affecting changes in motor skills throughout life; Changes in motor behaviors and skill performances over a period of time are defined as results (12). It is known that the experiences gained in the first years of childhood affect the child's values, attitudes and behaviors in his future life (4, 11, 13). Preschool period is the period when the child's development accelerates. It includes many critical periods that children go through until they start basic education, and it is important because the development rate of children is very high during this period (6). By implementing pre-school education programs that include physical education and sports activities in children in this period, it is aimed to support the physiological development of small and large muscles of children, and it is evaluated that it will contribute to the development of features such as correct and healthy posture development and skills. In many studies; reported that physical education and sports-based training programs provide development not only in movement skills but also in small and large muscle groups, and supported these predictions (14, 18, 22). The purpose of this study is to examine the effects of regular physical education and sports activities on the motor development of 5-6 year old preschool children. However, the study was designed by evaluating the pretest and posttest data of the experimental group without a control group.

METHOD

In the study, the effects of physical education and sports activities on the motor skills of preschool children were examined. A total of 30 preschool students aged 5-6 [5 years old (n=15), 6 years old (n=15)] who were enrolled in a preschool program and had at least 1 year of preschool education history participated in the study. In the research, a pretest-posttest experimental design without a control group was used. The research was conducted using a single-group pretest-posttest experimental design, one of the quantitative research approaches.

A total of 30 pre-school students in the 5-6 age group were given a physical education and sports activity that included movement training for 30 minutes, 2 days a week, for 12 weeks. In order for the training process to run more smoothly, the participants were divided into age groups (15 students in the 5-year-old group and 15 students in the 6-year-old group) and were subjected to the same movement training on separate days and hours. Within the scope of movement training, exercises including warm-up movements were applied to the children in the form of educational games for the first 10 minutes from the beginning of the study, followed by walking exercises, jogging exercises, jumping exercises and balance exercises, exercises using balls and ropes, rings, hoops, funnels and so on. Exercises using similar materials were applied. In the final parts of the study, static stretching exercises were applied.

Motor Skills Tests

Motor skill tests were developed by Morris et al. (1980) to determine the motor performance of preschool children (14). The validity and reliability study of the test was tested in the study titled "Examination of the Motor Performance of Preschool Children" conducted by Sevimay (1986) with the participation of 205 children in the 3-6 age group (19). Skills tests; It includes 6 evaluation criteria: balance, agility, running, catching, standing long jump and throwing tests (16). In the study, pretest and posttest methods were used to measure the motor skill performances of preschool children.

Balance test; It measures how long it takes the child to complete the starting and finishing points on a 2-meter rope by walking and maintaining balance. Agilits Test; It measures the time between when the child is given a command while lying on his back, becomes vertical, runs the determined distance of 3.05 meters forward, picks up the tennis ball left at the end of the area with his hand, turns back and runs to his previous position. Running Test; It determines how long it takes the child to run forward for a distance of 12 meters within the test area. Capture Test; It determines the child's ability to catch a ball thrown high from the air while standing steadily. In the test, the distance the child moves backwards while catching the ball is determined. Standing long jump Test; It determines how far the child can jump forward with both feet, bending his knees, while standing on a stable surface with the soles of his feet on the ground. Launch Test; It determines the child's ability to pick up the tennis ball at a designated point and throw it forward. The distance between where the ball lands and the starting point is determined.

Data Analysis

The data obtained was analyzed using the SPSS 23.0 (Statistical Package for Social Sciences) package program. In descriptive statistical methods, parameters such as mean values and standard deviation are determined. It was determined that pretest/posttest measurements showed normal distribution (P> 0.05) using Kolmogorov-Smirnov and Shapiro-Wilk tests. After determining that normal distribution was observed, Paired-Samples T Test was applied for intra-group comparisons and related measurements. With this test, after two tests are applied to a single group, it is determined whether the difference between the averages of the tests is significant (21). Statistical significance evaluations were made at $p < 0.05$ and $p < 0.01$ levels.

Ethical approval and institutional permission

It was unanimously decided that the research protocol complies with the Ethics Committee Directive with the decision of Selçuk University Faculty of Sports Sciences Ethics Committee dated 30.01.2024 and numbered 2024/21.

FINDINGS

The data obtained after the motor performance tests applied to 5-6 years old children studying in a pre-school education institution are presented in a table 1.

Table 1. Comparison of pre-test and post-test data of engine performance tests.

Variables	Test	Mean	SD	t	P	Df ($\bar{X}$)	%
Balance (sec)	Pre	9,42	0,57	11,757	0,000*	0,99	-10,47
	Post	8,43	0,48				
Agility (sec)	Pre	5,73	0,32	5,580	0,000*	0,45	-7,80
	Post	5,28	0,21				
Running (sec)	Pre	4,90	0,58	11,217	0,000*	0,74	-15,10
	Post	4,16	0,36				
Catching (m)	Pre	2,50	0,37	6,283	0,001*	0,49	-19,57
	Post	2,01	0,28				
Long Jumping (cm)	Pre	74,22	5,27	-11,837	0,000*	10,48	14,12
	Post	84,71	4,68				
Throwing (m)	Pre	4,62	0,59	-6,416	0,000*	0,61	13,24
	Post	5,23	0,45				

*P<0,01, P<,0,05 , SD:standart deviation, sec:second, cm: centimeter, m: meter, df: difference %: percent

According to the results of balance, agility, running, catching, standing long jump and throwing tests, which include performance criteria; When the data obtained in the post-tests were compared with the pre-test results, it was determined that positive progress was made in each parameter. This improvement shows statistical significance ($p<0.05$). It was observed that the participants completed the balance test in 0.99 seconds less time and 10.47% improvement compared to the first measurements, and completed the agility test in 0.45 seconds better time and 7.80% faster. A similar development was also observed in the running test. The experimental group completed the running track 15.10% faster, improving by 0.74 seconds. The best improvement in engine performance tests was achieved in the catch-up test. While the catching distance was 0.49 m better, a 19.57% better result was achieved. The results obtained in long jump distance and throwing distance are respectively; It produced better results: 14.12% with 10.48 cm and 13.24% with 0.61 m.

DISCUSSION AND CONCLUSION

This study was conducted to examine the effects of physical education and sports activities on the motor skills of preschool children. In the study, the motor skills of 30 preschool children aged 5-6 were tested. Pretest and posttest data of the movement inclination program, which included physical education and sports movements lasting 12 weeks, 2 days a week and 30 minutes a day, were compared. To evaluate motor performance criteria, balance, agility, running, catching, long jump and throwing tests were applied.

According to the research results, the data obtained showed that the process involving movement training had a positive effect on preschool children. These results are parallel to the study conducted by Şen (2004) in which static balance performance was examined (20). In another study comparing the balance performances of the control and experimental groups, it was reported that the results obtained were significant in favor of the experimental group (1). Durukan et al. (2016), in their study examining the effect of gymnastics training on balance performance in preschool children, concluded that the post-test data improved the balance parameter of the experimental group (8). These results are parallel to the results obtained in our study. Accordingly, it can be said that the applied movement training program can have a positive effect on improving balance skills.

Data on agility performance revealed that our study group improved after the training program. Yıldırım (2023) noted that there was a statistically significant improvement in agility skills after basic movement training applied 2 days a week (23). In other studies examining agility performance, while an improvement was observed in both groups (experimental, control), it was reported that the improvement in the experimental groups was at a higher level than in the control group and this improvement was significant ($p<0.05$). In the study conducted by Avcu (2016), it was reported that the game-based training program improved the agility performance in 5-year-old preschool children (2). The results obtained in our study are similar to other studies.

The post-test data obtained in our study indicate that the training program improved running performance. In studies examining the motor performance of preschool children, there are generally studies in which the post-test data obtained from the experimental groups are better than the pre-test data, the running times are reduced, and this is expressed as an improvement in performance (1, 2, 22). On the other hand, Çelebi et al. (2018), in their study where they applied the 9 m running test, reported that there was no significant difference in the pre-test and post-test data of the control group (5). It can be said that the contradiction of this situation with the positive development in our study may be due to the different running test applied (9 m).

The data obtained in our study in the catching, standing long jump and throwing tests indicate that the applied physical education and sports movement training provided positive development in the post-test values. When the literature was examined, Avcu (2016) reported that although the game-based education program had a positive effect on the catching performance of 5-year-old preschool children, it did not contribute to long jump and throwing skills (2). There are different studies reporting that physical education and sports activities provide improvement in catching performance (8, 9, 15). Erol (2022), in his study examining the effects of movement training on children in the 4-6 age group, reported that a positive improvement was achieved in throwing performance (9). Durukan (2016) similarly noted that the movement training program made a positive contribution to the development of standing long jump performances of preschool children (8).

In general, it can be said that educational program applications that include physical education and sports movements can have a positive impact on the balance, agility, running, catching, standing long jump and throwing performance of preschool children. This interpretation is similar to the data obtained in various studies. In addition, it should be evaluated whether the development in children's motor performance is a situation that occurs within the natural course of their growth period or is a result of the contribution of physical education and sports activities. For this reason, conducting more comprehensive studies in which physical education and sports movements are regularly applied in different and large groups will contribute to the literature.

REFERENCES

1. Aslan T, Yamak B. Examining the effect of movement training on motor skill development in preschool children. ROL Journal of Sports Sciences, 2021; 2(1), 60-72.
2. Avcu A.U. Examining the effect of the game-based training program on basic movement skills of children in the age group of five. Eurasia Journal of International Studies, 2016; (4), 8.
3. Cole M & Cole SR. The Development of children, 4"th edition, New york, Worth Publisher. 2001, 30-122.
4. Çoban B, Nacar E, 2010. Educational Games in Preschool Education, 2nd edition, Nobel Publications, Ankara, 2010, 5-58.
5. Çelebi C, Bayazıt B, Tuncil OS, Yılmaz O. The effect of movement education activities on motor development in the preschool period. SSTB International Refereed Academic Journal of Sports, Health and Medical Sciences, 2018, 29, 162-176.
6. Draper, CE, Achmat M, Forbes J, & Lambert EV. Impact of a community-based programme for motor development on gross motor skills and cognitive function in preschool children from disadvantaged settings. Early Chi Develop Care, 2012 182(1), 137.
7. Dursun, M. Z. Investigate the effect of physical education program on motor skill performance of six years old preschool children, Hacettepe University Institude of Health Science, Master Thesis, Ankara, 2004.
8. Durukan H, Koyuncuoğlu K, Şentürk U. İnvestigation of basic gymnastics program in terms of motor development among pre-school children. CBÜ J Physi Edu Sport, 2016, 11(2), 131-140.
9. Erol S. The effect of the movement training program applied in children aged 4-6 on motor development, Int J Bozok Sports Sciences, 2022; (1), 100-107.
10. Feldman R. Child development, 2"edition, NJ: Prentice Hall, 2001; 5-100.
11. Gallahue DL, Ozmun JC, Goodway JD. Understanding motor development .D.S. Özer ve A. Aktop (Çev.). Ankara: Nobel Akademia Publishing, 2020; 5-80.
12. Kail R. Children and their development, 2"nd edition, Verlag: Prentice Hall, 2001, 10-65.
13. McKenzie T, Acaraz JE, Sallis JF & Faucette FN. Effects of a physical education program on children's manipulative skills. Journal of Teaching in Physical Education, 1998; 17, 327-341.
14. Morris MA, Williams EA, Wilmore, HJ. Motor performance and antropometric screening measurements for preschool age children. Motor Development: Theory into Practice, Managroph 3 Motor Skills, 1980.
15. Özbar, N, Observing The Effect of Movement Education Programme Motor Skills And Body Composition for Children of 4-6 Ages. Marmara University Institude of Health Sciences, Phd Thesis, İstanbul, 2007 Özer DS, Özer K. Motor development in children (7.baskı), Ankara: Nobel Publishing, 2012.
16. Özkan İ. Evaluation of motor development and movement training (Ed.: A.Özyürek). Physical Education and Sports in Early Childhood. Vize Publishing: Ankara, 2017; ss: 5-117.
17. Saka T, Yıldız Y, Tekbaş ÖF & Aydın T. Effects of sports school on some anthropometric and functional tests of young adult men. Niğde University, Journal of Physical Education and Sports, 2008; 2(1), 1-8.
18. Sevimay D. Examination of motor performance of preschool children. Hacettepe University Institude of Health Science, Master Thesis, Ankara, 1986.
19. Şen M. Examining the effect of physical education activities on the motor development of six-year-old children attending kindergarten.. Mater Thesis, Ankara University Institute of Science and Technology, Ankara, 2004.
20. Ural A, Kılıç İ. Scientific research process and data analysis with SPSS. Expanded 2nd Edition. Ankara, Detay Publishing, 2006.
21. Yavuz NF, Özyürek A. Physical education and sport activities on motor skills of preschool children. Karaelmas Journal of Edu Sci, 2018 6, 40-50.
22. Yıldırım M. Comparison of the effects of basic movement training and gymnastics programs on gross motor skills in children. Master's Thesis, Istanbul Gelişim University Graduate Education Institute, Istanbul, 2023.

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The effect of positional differences on technical parameters in different parts of the pitch in soccer

Veysel BÖGE [1A]

[1] *Selcuk University, Faculty of Sport Sciences, Department of Coaching Education, Department of Sport and Health, Konya, TÜRKİYE*
Address Correspondence to Veysel BÖGE: e-mail:. veyselboge@selcuk.edu.tr

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A: Orcid ID: 0000-0002-8639-1983

Abstract

The aim of this study was to investigate the effect of positional differences on technical parameters in different parts of the pitch in soccer. For this purpose, 22 healthy male soccer players participated in the study. The mean age of the participants was 22±1,46 years, mean height was 176,27±5,76 cm, mean body weight was 68,83±5,60 kg and mean body mass index (BMI) was 21,67± 1,23 kg/m². The participants were divided into 3 groups according to their positions as defender, midfielder and attackers with 5 people in each group, in addition to this, a fixed group of 5 players was formed and two different goalkeepers were included in the study at different stages of the game. One-Way Anova test was used to determine the difference between the groups. In the first zone, the rating of perceived exertion (RPE) values of the attacker players showed a significant difference, while no difference was observed in the other parameters. In the second zone, only the ball possession (BP) values of midfielder players made a significant difference. In the third zone, both defense and midfielder players made more vertical and diagonal passes (DVP). In conclusion, when the various technical actions of players in different positions in the three zones of the game are analyzed, although there are differences in some parameters, in general, positional differences in different zones do not show a significant change.

Keywords: Ball possession, diagonal passes, rating of perceived exertion and soccer.

Futbolda Sahanın Farklı Bölümlerinde Pozisyonel Farklılıkların Teknik Parametrelere Etkisi

Özet

Bu çalışma ile futbolda sahanın farklı bölümlerinde pozisyonel farklılıkların teknik parametrelere etkisinin incelenmesi amaçlanmıştır. Bu amaçla çalışmaya sağlıklı 22 erkek futbolcu katılmıştır. Çalışmaya katılan futbolcuların yaş ortalamaları 22±1,46 yıl, boy uzunluğu ortalamaları 176,27± 5,76 cm, vücut ağırlığı ortalamaları 68,83± 5,60 kg ve vücut kütle indeksi (VKİ) 21,67± 1,23 kg/m² dir. Katılımcılar mevkilerine göre savunma, orta saha ve hücum olmak üzere her grupta 5 kişi olacak şekilde 3 gruba ayrılmış, buna ek olarak 5 kişilik sabit bir grup oluşturulmuş ve oyunun farklı aşamalarında iki farklı kaleci de çalışmaya dahil edilmiştir. Gruplar arasındaki farkın tespit edilmesinde One-Way Anova testi kullanılmıştır. Birinci bölgede hücum oyuncuların algılanan zorluk dereceleri anlamlı fark oluştururken diğer parametreler de fark görülmemiştir. İkinci bölgede ise sadece orta saha oyuncularının topa sahip olma değerleri anlamlı fark yaratmıştır. Üçüncü bölgede ise hem savunma hem de orta saha oyuncuları daha fazla dikey ve diagonal pas yapmıştır. Sonuç olarak, oyunun üç bölgesinde farklı pozisyonlarda yer alan oyuncuların çeşitli teknik aksiyonları analiz

edildiğinde, bazı parametrelerde farklılıklar görülse de genel olarak farklı bölgelerdeki pozisyonel farklılıklar önemli bir değişiklik göstermemektedir.

Anahtar Kelimeler: Algılanan zorluk derecesi, diyagonal pas, futbol ve topa sahip olma.

INTRODUCTION

Soccer is a game consisting of two halves of 45 minutes each, with a 15-minute half-time break. To be successful in soccer, many factors need to come together, including high levels of tactical, technical and physical parameters. For 90 minutes, various versions of power and explosiveness should be displayed intermittently, as well as various technical and tactical combinations (2, 10, 22). In some studies, it is stated that the most critical moments and determining factors of soccer include explosive actions such as high-speed runs and sprints along with various technical skills (3, 21, 12). As can be seen from this information, soccer involves a very complex structure. The complex structure of soccer also leads coaches to search for various training methods. Research shows that there is an evolution towards training that incorporates different approaches rather than traditional training models (17). These new trends have different methodological perspectives, such as the modified use of the game (7). In this context, drills-oriented activities in training are the most preferred practices by coaches, especially in team sports (14).

Small-sided games (SSGs) have recently become a very popular training practice with various manipulations made by coaches on the playing field. SSGs are also seen as smaller versions of official competition conditions to increase athletes' perception of tactical problems that occur during competitions and to create desired behaviors in athletes (8). When considering official soccer competitions, small-sided games are considered as a practice that encompasses all dynamic and complex elements, especially the basic features of the chaotic nature of soccer (20).

When the positional differences in modern football are considered in terms of physical and motor characteristics, it is thought that the differences are gradually disappearing (1). When we consider that the details in soccer make a difference, it is expected that the technical parameters of the players in different positions will constitute the main differences in the game.

In the light of this information, there are many studies in the literature on various manipulations such as the dimensions of the field (small, medium and large) in training. With this study, unlike small-sided games, the sections of the game (Zone 1, Zone 2 and Zone 3) in the official soccer competition are preserved exactly in the training sessions and players of different positions are made to play soocer in these areas and the observation of the difference between them is a subject that is not included in the literature, which reveals the originality of the study. With this study, it is aimed to examine the effect of positional differences on technical parameters in different parts of the field in soccer.

METHOD

Participants

This study was carried out with 22 male soccer players between the ages of 18-25 who are actively training in Konya Amateur league teams. It was determined as a criterion that the participants did not have any health problems and sportive injuries.

According to the positions of the participants, they were divided into 3 groups as defense, midfield and offense with 5 people in each group, in addition to this, a fixed group of 5 people was formed, and two different goalkeepers were also involved in the study at different stages of the game. The main condition for participation was that the participants had been actively playing soccer in the last 3 years and had no health problems.

Table 1. Descriptive statistics of participants in different positions

Variables	N	Mean	Standard Deviation (SD)
Age (years)	22	22	1.46
Height (cm)		176.27	5.76
Body weight (kg)		68.83	5.60
Body mass index (BMI)		21.67	1.23

Measurement Methods

Height and Body Weight Measurement

In the study, the height of each subject was measured with a stadiometer with an accuracy of 0.01 meters (m) and body weight (BW) was measured with an electronic scale (SECA, Germany) with an accuracy of 0.1 kilogram (kg). During the height measurements, the volunteers were standing with bare feet, heels together, knees stretched, body and head erect, and eyes facing forward. When the sliding caliper bar touched the head of the volunteers, it was stopped, and the closest value was recorded as the height value in centimeters (cm). During weight measurements, subjects participated with bare feet and wearing shorts that would not affect their weight. The value obtained on the scale screen was recorded in kg.

Technical Actions and Analysis

All actions from the beginning to the end of the study were recorded with a camera at a height of 10m and technical actions were evaluated in 12 categories. These categories were; Ball possession (BP), successful passing (SP), diagonal and vertical passing (DVP), landscape and behind passing (LBP), dribbling (DRB), interception (INT), use of goalkeeper (UGK), lost ball (LB), Transition(T), transition from zone 1 to zone 2 (T1-2), transition from zone 2 to zone 3 (T2-3), transition from zone 3 to zone 2 (T3-2), transition from zone 2 to zone 1 (T2-1) and transition from zone 3 to zone 2 (T3-2). The studies were carried out by using an observational methodology (coding of actions) to obtain data on technical actions from images recorded from a height of 20 meters with a view of the entire playground. Each action of the technical parameters was recorded as a marking and the total numbers at the end of the two sets were divided by 2.

Rating of perceived exertion

Rating of perceived exertion (RPE) is a psycho-physical measure of effort and is traditionally obtained on a 6-20 or 10-point scale (4). In this study, the perceived exertion of the athletes will be determined after the sets using the Borg scale of 0-10.

Design of Experiments

Ethics Committee Decision

This study was approved by the Non-Interventional Ethics Committee of Selçuk University Faculty of Sport Sciences (Approval number: E.776233).

Data Analysis

Statistical evaluation was performed using SPSS 29.0 package program. The data obtained in the study were presented as mean and standard deviation. Shapiro-Wilk test was applied to determine the distribution of the data and the data showed normal distribution. According to the result of the normality distribution, One-way ANOVA test was applied to determine the difference in the balance performances of soccer players by position. The results were evaluated at 95% confidence interval and $p<0.05$ was considered significant.

FINDINGS

Table 2. Rating of perceived exertion (RPE) in different parts of the soccer field

Zone	*Defenders (n=5)*	*Midfielders(n=5)*	*Attackers(n=5)*	P
Zone 1	4 ± 1.41	4.8 ± 0.76	2.4± 0.89	**0.011***
Zone 2	3.4± 0.42	3.5± 1.6	3.7± 0.84	0.278
Zone 3	3.8± 0.57	3.9± 0.89	2.9± 0.65	0.092

*: shows a significant difference **(P<0.05).**

When Table 2, which shows the rating of perceived exertion of the soccer players in three different zone, it was observed that only in the 1st zone, rating of perceived exertion the attacker's players showed a significant difference compared to the midfield players (P<0,05).

Table 3. Some technical actions of soccer players in different positions in zone 1 of the soccer field

Parameters	*Defenders(n=5)*	*Midfielders(n=5)*	*Attackers(n=5)*	f	P
BP (sc)	106.5 ± 0.71	101.5± 36.06	122.5± 7.78	0,530	0.635
SP (t)	30.5 ± 2.12	36.5± 4.95	30 ± 1.41	2,532	0.227
DVP (t)	18.5 ± 0.71	16.5± 0.71	15.5± 0.71	9,333	0.052
LBP(t)	17.5 ± 0.71	15± 5.66	19 ± 2.83	0,605	0.602
DRB(t)	3 ± 1.41	1± 1.41	1 ± 1.41	1,333	0.385
INT(t)	1.5 ± 0.71	2 ± 0	1 ± 0	3,000	0.192
LB(t)	5.5 ± 2.12	5 ± 0	5 ± 1.41	0,167	0.854
UGK(t)	7.5 ± 0.71	5.5± 2.12	9,5 ± 4.95	0,814	0.522
T1-2(t)	4.5 ± 2.12	3.5± 2.12	4 ± 0	0,167	0.854

BP: Ball possession, **SP: Successful pass, DVP:** Diagonal and vertical pass, **LBP:** Landscape and behind pass, **DRB:** dribbling**, INT:** Interception**, LB:** Lost ball**, UGK:** use of goalkeepers**, T1-2:** Transition from Zone 1 to Zone 2. **sc:** seconds**, t:** times *: shows a significant difference **(P<0.05).**

In Table 3, some technical parameters of soccer players of different positions in the first zone of the game were analyzed. No significant differences were observed in the nine different parameters analyzed (P>0,05).

Table 4. Some technical actions of soccer players in different positions in the 2nd zone of the soccer field

Parameters	*Defenders(n=5)*	*Midfielders(n=5)*	*Attackers(n=5)*	f	P
BP (sc)	49 ± 11.31	68 ± 11.31	119.5± 10.61	21,665	**0.016***
SP(t)	25 ± 7.07	34.5 ± 3.53	42 ± 7.07	3,871	0.148
DVP(t)	9 ± 2.83	16 ± 1.41	16.5± 3.54	4,689	0.119
LBP(t)	11.5 ± 9.50	10.5± 0.71	20.5 ± 2.12	6,169	0.086
DRB(t)	2.5 ± 2.12	0.5 ± 0.71	3 ± 1.41	1,500	0.354
INT(t)	3 ± 0	2.5 ± 0.71	3 ± 0	1,000	0.465
LB(t)	3 ± 1.41	3.5 ± 0.71	2.5 ± 0.71	0,500	0.650
T2-3(t)	3.5 ± 0.71	2.5± 0.71	3 ± 0	1,500	0.354
T2-1(t)	2.5 ± 0.71	3.5± 0.71	2.5 ± 0.71	1,333	0.385

BP: Ball possession, **SP: Successful pass, DVP:** Diagonal and vertical pass, **LBP:** Landscape and behind pass, **DRB:** dribbling**, INT:** Interception**, LB:** Lost ball**, T2-3:** Transition from Zone 2 to Zone 3, **T2-1:** Transition from Zone 2 to Zone 1. **sc:** seconds**, t:** times *: shows a significant difference **(P<0.05).**

In Table 4, some technical parameters of soccer players of different positions in the second zone of the game were analyzed. When the ball possesion (BP) of attacker players was examined, it was observed that they possessed the ball more than defensive players in the second zone of the game, and this difference was statistically significant (P<0,05).

Table 5. Some technical actions of soccer players in different positions in the 3rd zone of the soccer field

Parameters	*Defenders(n=5)*	*Midfielders(n=5)*	*Attackers(n=5)*	f	P
BP (sc)	76 ± 22.63	54.5 ± 14.85	54.5±14.85	0,970	0.473
SP(t)	30.5 ± 3.54	29.5 ± 4.95	19 ± 2.83	5,411	0.101
DVP(t)	15 ± 0.0	15.5 ± 0.71	11.5 ± 0.71	28,500	**0.011***
LBP(t)	12.5 ± 2.12	9.5 ± 3.54	5 ± 1.41	4,500	0.125
DRB(t)	3 ± 1.41	3.5 ± 0.71	3.5 ± 2.12	0,071	0.933
INT(t)	1 ± 1.41	2.5 ± 0.71	2.5 ± 2.12	0,643	0.586
LB(t)	2.5 ± 0.71	4 ± 0	6 ± 1.41	7,400	0.069
T3-2(t)	4 ± 0	3.5 ± 0.71	4 ± 1.41	0,200	0.829

BP: Ball possession, **SP: Successful pass, DVP:** Diagonal and vertical pass, **LBP:** Landscape and behind pass, **DRB:** dribbling**, INT:** Interception**, LB:** Lost ball**, T2-3:** Transition from Zone 2 to Zone 3, **T3-2:** Transition from Zone 3 to Zone 2. **sc:** seconds**, t:** times. *: shows a significant difference **(P<0.05).**

In Table 5, some technical parameters of soccer players from different positions in the third zone of the game were analyzed. When the diagonal and vertical passing (DVP) numbers of midfielders and defenders were examined, it was observed that both groups made more diagonal and vertical passes than attacker players in the third zone of the game, and this difference was statistically significant (P<0,05). No significant difference was observed in other parameters in the third zone (P>0,05).

DISCUSSION AND CONCLUSION

In soccer, development is targeted through various situations such as the limitation of field space, manipulation of training times and recovery times. In addition, in today's soccer, a player is expected to perform in every area of the game regardless of his position. In this study, it was aimed to examine the effect of positional differences of players on technical parameters in different parts of the pitch considering these current situations. Like the method used in this study, we see that researchers use notational analysis to examine parameters such as passing, dribbling and interception (19). In addition to technical parameters, there are many methods for determining the training load. One of the most preferred among these methods is the rating of perceived exertion (13). Similarly, in our study, rating of perceived exertion was used to determine the training load.

In the literature, RPE values of soccer players after SSG games were found to be in the range of 5-8,9 (11, 9). In this study, when we examined the general RPEs of the three zones, the average RPE values were observed between 2,4 and 4,8. It is thought that the difference may be because the players played in wider areas than the SSGs. In addition, in the study, the average of the two RPE values taken at the end of the sets of the offensive games in the first zone was found to be 2,4. This value may suggest that the offensive players moved more easily in the first zone. In other zones, there were no significant positional differences in RPE values.

Joo et al (15) observed a significant increase in the number of vertical passes and total passes of players in larger field formats in the 7-vs 7+GK format application. While there was no significant difference between the groups in the number of vertical passes (P>0,05) in the format where +1 numerical superiority was provided by the use of a goalkeeper in the first zone of the field, it was found that the number of vertical and diagonal passes of the defensive and midfield players increased significantly compared to the offensive players when the opponent had +1 superiority in the third zone (P<0,05).

In a study examining various technical actions during SSG in three different dimensions, no significant difference was found in the number of passes, interceptions and headers (16). Similarly, when the technical actions in the first, second and third zones of the study were analyzed, no significant positional differences were found.

The number of possession of midfielders in the second zone of the field was significantly higher than the number of possession of defenders in the same zone (P<0,05). It can be thought that this may be because midfield players have the ball more frequently in the second zone in official competitions. One of the most important factors affecting the outcome of the competition in football is offensive (from defense to offense)

and defensive (from offense to defense) transitions (6, 18, 5). In particular, the main goal of offensive transitions is to gain numerical superiority in the opposition half by moving at high speeds (5). In this study, which examined the effect of transitions from defense to offense and from offense to defense in each zone of the game, no significant differences were found when the parameters of transitions were examined in all three zones (P>0,05).

As a result, when the various technical actions of the players in different positions in the three regions of the game are analyzed, although there are differences in some parameters, in general, positional differences in different regions do not show a significant change.

REFERENCES

1. Aslan CS, Koç H. Amatör futbolcuların seçilmiş fiziksel, fizyolojik ve motorik özelliklerinin mevkilerine göre karşılaştırılması. cbü beden eğitimi ve spor bilimleri dergisi, 2015, 10.1: 56-65.
2. Bangsbo J, Mohr M, Krustrup P. Physical and metabolic demands of training and match-play in the elite football player. J Sports Sci, 2006, 24(7), 665-674. https://doi.org/10.1080/02640410500482529.
3. Barnes C, Archer DT, Hogg B, Bush M, Bradley P. The Evolution of Physical and Technical Performance Parameters in the English Premier League. Int J Sports Med. 2014; 35(13):1095–1100.
4. Borg, G., Hassmén, P., & Lagerström, M.. Perceived exertion related to heart rate and blood lactate during arm and leg exercise. European journal of applied physiology and occupational physiology, 1987, 56, 679-685.
5. Bortnik L, Bruce-Low S, Burger J, Alexander J, Harper D, Morgans R, Carling C, McDaid K, Rhodes D. Physical match demands across different playing positions during transitional play and high-pressure activities in elite soccer. Biol Sport. 2024 Mar;41(2):73-82. doi: 10.5114/biolsport.2024.131815. Epub 2023 Apr 10. PMID: 38524824; PMCID: PMC10955741.
6. Carling C, McCall A, Harper D, Bradley P.Comment on: "The Use of Microtechnology to Quantify the Peak Match Demands of the Football Codes: A Systematic Review". Sports Med. 2019; 49(2):343–345.
7. Clemente, F.; Mendes, R. Aprender o jogo jogando: Uma justificaçao transdisciplinar. Exedra Rev. Científica 2011, 5, 27–36.
8. Davids K, Araújo D, Correia V, Vilar L. How small-sided and conditioned games enhance acquisition of movement and decision-making skills. Exerc Sport Sci Rev 2013;41:154–61.
9. Dellal A, Owen A, Wong DP, Krustrup P, Van Exsel M, Mallo J. Technical and physical demands of small vs. large sided games in relation to playing position in elite soccer. Human movement science, 2012; 31(4), 957-969.
10. Dolci F, Hart N, Kilding A, Chivers P, Piggott B, Spiteri T.. Physical and Energetic Demand of Soccer: A Brief Review. Strength and Conditioning Journal, 2020, 42, 1. https://doi.org/10.1519/SSC.0000000000000533.
11. Halouani J, Chtourou H, Gabbett T, Chaouachi A, Chamari K. Small-sided games in team sports training: a brief review. The journal of strength & conditioning research, 2014; 28(12), 3594- 3618.3.
12. Harper D, Carling C, Kiely J. High-Intensity Acceleration and Deceleration Demands in Elite Team Sports Competitive Match Play: A Systematic Review and Meta-Analysis of Observational Studies. Sports Med. 2019; 49(12):1923–1947.
13. Impellizzeri FM, Rampinini E, Coutts AJ, Sassi AL, Marcora SM. Use of RPE-based training load in soccer. Medicine & Science in sports & exercise, 2004; 36(6), 1042-1047.
14. Jeong, T. S., Reilly, T., Morton, J., Bae, S. W., & Drust, B. Quantification of the physiological loading of one week of "pre-season" and one week of "in-season" training in professional soccer players. Journal of Sports Sciences, 29(11) 2011; 1161–1166.https://doi.org/10.1080/02640414.2011.583671.
15. Joo CH, Hwang-bo K, Jee H. Technical and physical activities of small-sided games in young Korean soc- cer players. J Strength Cond Res. 2016;30(8):2164–2173; doi: 10.1519/JSC.0000000000001319.
16. Kelly, D.M, Drust, B. The effect of pitchdimensions on heart rate responses and technical demands of small-sided soccer games in elite players. J Sci Med Sports , 2009; 12, 475–479.
17. Kinnerk, P.; Harvey, S.; MacDonncha, C.; Lyons, M. A review of the game-based approaches to coaching literature in competitive team sport settings. Quest 2018, 70, 401–418.
18. Lago-Peñas C, Gómez-Ruano M, Yang G. Styles of play in professional soccer: an approach of the Chinese Soccer Super League. Int J Perform Anal in Sport. 2018; 17(6):1073–1084.
19. Owen A, Twist C, Ford P. Small-sided games: The physiological and technical effect of altering pitch size and player numbers. Insight, 2004; 7(2), 50-53.
20. Serra-Olivares J, Clemente FM, González-Víllora S. Tactical expertise assessment in youth football using representative tasks. Springerplus. 2016;5(1):1301; doi: 10.1186/s40064-016-2955-1.
21. Stølen T, Chamari K, Castagna C, Wisløff U. Physiology of Soccer: an Update. Sports Med. 2005; 35(6):501–536.
22. Turner AN, Stewart PF. Strength and conditioning for soccer players. Strength & Conditioning Journal, 2014, 36(4), 1-13.

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Investigation of Athletic Performances of Racket Sportsmen

Ali SAÇIKARA [1A], Mehmet KILIÇ [2A]

[1] *Sport Sciences, Independent Researcher, Konya, TÜRKİYE*
[2] *Faculty of Sport Sciences, Selcuk University, Konya, TÜRKİYE*
Address Correspondence to Ali SAÇIKARA: e-mail:. byali.sacikara@gmail.com

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A: Orcid ID: 0009-0004-3504-422X B: Orcid ID: 0000-0002-8917-9048

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Abstract

The aim of this study was to determine the performance and physical fitness of racket sports players. Sport is a biological and social pursuit that involves an individual's physical activity and motor skills, aiming to enhance their mental, emotional, and social behaviors within specific regulations and compete under certain rules. The study included 36 male athletes, with 12 participants in each of the table tennis, badminton, and tennis branches. Measurements were taken for the age, height, body weight, body mass index, t-test, reaction test, 30-meter speed test, aerobic power test, and anaerobic power test for the participating athletes. The data were recorded using the SPSS 22.00 package program. Npar tests were used for the overall averages of the groups. One-Way Anova Analysis test was used for the pairwise averages of the groups ($p<0.05$). Duncan's multiple comparison test was used for intergroup differences ($p<0.05$). In terms of body weight values, the tennis group is similar to the badminton and table tennis groups, with the table tennis group significantly higher than the badminton group ($p<0.05$). T-test values for agility are similar for badminton and table tennis, while the tennis group's agility test performance is significantly higher than both the table tennis and badminton groups ($p<0.05$). MaxVo2 levels are similar for the table tennis group and the tennis and badminton groups, with the badminton group significantly higher than the tennis group ($p<0.05$). No statistically significant results were found in other measurements examined ($p>0.05$). In conclusion, the differences in body weight, agility, aerobic power, and field-movement dimensions are thought to be influenced by the duration and types of competitions.

Keywords: Athletic performance, badminton, table tennis, tennis.

Raket Sporcularının Atletik Performanslarının İncelenmesi

Özet

Bu çalışmanın amacı raket sporları oyuncularının performansını ve fiziksel fitness'ını belirlemektir. Spor, bireyin fiziksel aktivitesi ve motor becerilerini içeren biyolojik ve sosyal bir uğraştır; zihinsel, duygusal ve sosyal davranışlarını geliştirmeyi ve belirli kurallar altında yarışmayı amaçlar. Çalışmaya 36 erkek sporcu dahil edildi; masa tenisi, badminton ve tenis branşlarında her birinde 12 katılımcı bulunmaktadır. Katılımcı sporcuların yaş, boy, vücut ağırlığı, vücut kitle indeksi, t-testi, reaksiyon testi, 30 metre hız testi, aerobik güç testi ve anaerobik güç testi ölçümleri alınmıştır. Veriler SPSS 22.00 paket programı kullanılarak kaydedilmiştir. Grupların genel ortalamaları için Npar testleri kullanılmıştır. Grupların ikili ortalamaları için Tek Yönlü Anova Analiz testi uygulanmıştır ($p<0.05$). Gruplar arası farklılıklar için Duncan'ın çoklu karşılaştırma testi kullanılmıştır ($p<0.05$). Vücut ağırlığı değerleri açısından tenis grubu, badminton ve masa tenisi gruplarıyla benzerlik göstermektedir; masa tenisi grubunun vücut ağırlığı badminton grubundan anlamlı derecede yüksektir ($p<0.05$). Çeviklik için t-testi değerleri badminton ve masa tenisi için benzerdir, ancak tenis grubunun çeviklik testi performansı hem masa tenisi hem de badminton gruplarından anlamlı derecede yüksektir ($p<0.05$). MaxVo2 seviyeleri açısından masa tenisi grubu ile tenis ve badminton grupları benzerdir; badminton grubu tenis grubundan anlamlı derecede yüksektir ($p<0.05$). Diğer incelenen ölçümlerde istatistiksel olarak anlamlı sonuçlar bulunamamıştır ($p>0.05$). Sonuç olarak, vücut ağırlığı, çeviklik, aerobik güç ve saha-hareket boyutlarındaki farklılıkların, yarışma süreleri ve türlerinden etkilendiği düşünülmektedir.

Anahtar Kelimeler: Atletik performans, badminton, masa tenisi, tenis.

INTRODUCTION

Sports should be introduced into a child's life at an early age because it plays a crucial role in their growth, maturation, cognitive development, and socialization (1). In today's world, there is a need for talented athletes to compete on international platforms and establish a presence in the field globally. The development of these children requires systematic and coordinated efforts, along with the selection of individuals suitable for sports (2).

Early detection of potential performance in sports, directing athletes to the right sport, and laying the groundwork for optimal success are essential. To achieve this, performance criteria in different sports should be established, and talent selection should be aligned accordingly (2).

One critical aspect of talent selection is the necessity of creating databases that include measurements related to all aspects of talented athletes. It is emphasized that knowing the physical characteristics and anthropometric measurements of Olympic athletes can serve as a reference in talent selection. Additionally, the importance of how coaches perceive and define talent is discussed, with some coaches recognizing talent in individuals in different ways. It is pointed out that cross-sectional analyses may not adequately account for the dynamic development of young athletes in talent identification stages, and longitudinal analyses could be more beneficial. The adoption of a multidisciplinary approach, conducting a holistic assessment, and developing tests that mimic competition tasks are emphasized (3).

Racket sports are among the few individual sports where opponents face each other directly. Athletes in racket sports need to be patient, self-controlled, and demonstrate mastery in both success and failure. They must cope with uncertainty, develop a successful playing style, and learn from their mistakes (4).

Racket sports is an Olympic sport embraced by the modern world, which is exciting to play and awe-inspiring to watch. This sport requires a combination of aerobic and anaerobic loading, as well as a high level of biomotor abilities such as strength, speed, endurance, flexibility, and coordination (5).

Physical fitness values, including the physical, physiological, and anthropometric characteristics of athletes, are crucial in talent selection. For high performance in national and international racket sports competitions, it is essential to assess the sport-specific physical requirements and the capacity of players and teams to meet these requirements. Therefore, to achieve optimal performance, a combination of technical and tactical skills with physical fitness must be evaluated together (6).

Identifying potential performance at an early age in sports will pave the way for directing athletes to the right sport and achieving optimal success. To achieve this, performance criteria in different branches need to be determined, and talent selection should be made accordingly (7, 8).

METHOD

Participants

The study included 36 volunteer athletes with an average age of 15.47±0.50 years, average height of 174.06±7.11 cm, and average weight of 63.34±8.05 kg.

In the tennis group, 12 male athletes participated with an average age of 15.50±0.522 years, average height of 172.58±6.14 cm, and average weight of 63.66±8.32 kg. In the badminton group, 12 male athletes participated with an average age of 15.42±0.51 years, average height of 173.50±9.00 cm, and average weight of 59.58±9.35 kg. In the table tennis group, 12 male athletes participated with an average age of 15.50±0.52 years, average height of 176.08±5.91 cm, and average weight of 66.79±4.60 kg.

Procedure

T-Test:

The T-Test involved athletes starting with a suitable posture at cone 1. Each athlete had to use the same starting position. While in motion, the athlete ran towards cone 2 and touched the top with the right hand. The athlete then ran to cone 3 with lateral movement, touching the top with the left hand. The athlete then ran laterally towards cone 4 and touched the top with the right hand. The athlete returned to cone 2, touched it with the left hand, and finally ran backward from the starting line to cone 1. Timing started with the initial movement, and the athlete stopped when passing the starting line (8).

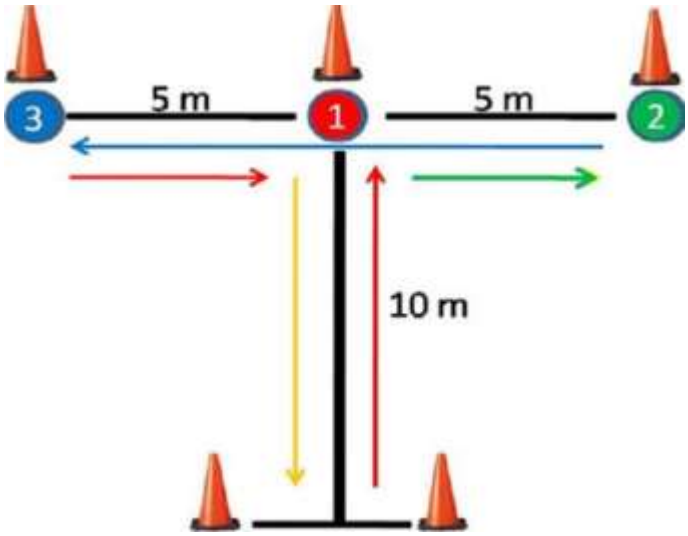

Figure 1. T-Test Setup

Computer Reaction Time Measurement

The reaction time was the elapsed time between the onset of a stimulus and the motor response. To determine visual reaction time, a computer program was used. Random stimuli (appearing between 2-10 seconds) with an unpredictable appearance time were presented on the computer screen, and the subject responded by pressing a designated key to turn off the image. The test data were recorded by the computer, and the average Optical (visual) Reaction Time (ORT) was determined (9).

30-Meter Sprint Test

To determine the participants' speed performance, a 30-meter sprint test was conducted. The 30-meter sprint measurements were taken on a track equipped with photoelectric cells placed at 0 and 30 meters. Participants were given two attempts in the 30-meter sprint test, and the best result, i.e., the fastest time

achieved, was recorded as the test result. All participants underwent a warm-up session before the sprint test (10).

Anaerobic Power Test (Vertical Jump Test)

The subject stood barefoot on the ground, looking straight ahead, and lifted their dominant hand as high as possible, fully extending the shoulder upward. This standing height was recorded in centimeters. The subject then used an arm swing and counter-movement to jump as high as possible. The take-off had to be from both feet without taking a step forward or experiencing friction; however, the feet could separate comfortably. The athlete performed at least three attempts, and the highest distance reached was recorded as the jump height. The vertical jump result was determined by calculating the difference between the jump height and the standing reach height in centimeters (11). Subjects were allowed to perform a few vertical jump attempts after a warm-up session lasting approximately 5 to 10 minutes before starting the test.

Aerobic Power Test (20-Meter Shuttle Run Test)

Participants, adapting to previously recorded sound signals, ran between two lines placed 20 meters apart. The starting speed was 9.0 km/h, with an increase of 0.5 km/h per minute. The test ended when the participant failed to reach the end lines twice in a row following the sound signals or stopped due to fatigue. Results were recorded at the closest stage achieved (12). Participants received necessary explanations before the test and were allowed 5-10 minutes for warm-up.

Statistical Analysis

Data obtained at the end of the research were evaluated using the Statistical Package for Social Science (SPSS) 22.00 statistical program. Npar tests were used for the overall average of the data obtained from the groups. One-Way Anova analysis test was used for the pairwise averages of the groups ($p<0.05$), and Duncan's multiple comparison test was used for intergroup differences ($p<0.05$).

Ethical approval and institutional permission

The study was approved by the local ethics committee (Protocol number 07, 25 January 2016, Ethics Committee of Selcuk University, Faculty of Sports Science, Konya, Turkey) in accordance with the Declaration of Helsinki. Before the assessment, every participant received the same detailed information about the testing procedure. Every participant signed the informed consent.

FINDINGS

Table 1. Physical characteristics of athletes in tennis, badminton, and table tennis groups.

Parameters	Tennis	Badminton	Table Tennis
	Mean±SD	Mean±SD	Mean±SD
Age (years)	15,50±0,52	15,42±0,51	15,50±0,52
Height (cm)	172,58±6,14	173,50±9,00	176,08±5,91
Body Weight (kg)	**63,66±8,32^{ab}**	**59,58±9,35^{b}**	**66,79 ±4,60^{a}**
BMI (Body Mass Index)	21,14±2,44	19,66±1,74	21,60 ±1,98

a,b: The difference between group means with different letters in the same row is significant **($p<0.05$). BMI:** Body Mass Index

There were no statistically significant differences ($p>0.05$) in age, height, years of sports experience, body mass index (BMI), and body fat percentage among the groups participating in the study. Although no significant differences were found in the body weight values of athletes in the tennis group compared to other groups, a significant difference was observed in the body weight of the table tennis group compared to the badminton group, indicating that the table tennis group had a statistically heavier weight ($p<0.05$). While no significant differences were found in the weekly training duration values of the badminton group compared to other groups, a significant difference was detected in the weekly training duration of the tennis group compared to the table tennis group, indicating a higher training time statistically ($p>0.05$).

Table 2. Performance test data of athletes in tennis, badminton, and table tennis groups.

Parameters	Tennis	Badminton	Table Tennis
	Mean±SD	Mean±SD	Mean±SD
T-Test (Seconds)	**9,89±0,60[b]**	**10,55±0,22[a]**	**10,57±0,55[a]**
Reaction Time Test (Milliseconds)	0,27±0,03	0,26±0,01	0,26±0,02
30-Meter Sprint Test (Seconds)	4,90±0,37	5,30±1,56	4,98±0,36
MaxVO2 (ml/kg/min)	**40,03±3,72[b]**	**44,21±4,65[a]**	**43,07±3,52[ab]**
Anaerobic Power Test (kgm/sec)	90,66±11,20	89,97±17,3	93,48±9,42

a,b: The difference between group means with different letters in the same row is significant **(p<0.05). MaxVO2:** Maximum Oxygen Consumption Capacity

There were no statistically significant differences (p>0.05) in reaction time, 30-meter sprint time, and anaerobic power test among the groups participating in the study. Although no significant differences were found in the t-test values between the badminton and table tennis groups, the t-test value of the tennis group was statistically faster than the other groups, indicating a significant difference with both groups (p<0.05). While no significant differences were found in the maxVO2 value of the table tennis group compared to other groups, a significant difference was detected in the maxVO2 value of the badminton group compared to the tennis group, indicating a higher value statistically (p>0.05).

DISCUSSION AND CONCLUSION

In this study, the physical parameters of 12 male athletes training competitively in the sports of table tennis, tennis, and badminton were determined, and comparisons were made with other studies and sports.

After the measurements, the average ages of the tennis, badminton, and table tennis branches were found to be 15.50±0.52 years, 15.42±0.51 years, and 15.50±0.52 years, respectively. The average heights were 172.58±6.14 cm, 173.50±9.00 cm, and 176.08±5.91 cm, and the average body weights were 63.66±8.32 kg, 59.58±9.35 kg, and 66.79±4.60 kg, respectively (p>0.05).

In the studies of Juárez et al. (13), 21 top-level Spanish young football players reported an average age of 16.1±0.2 years and an average height of 1.77±0.06 cm (p<0.05). Chaleh et al. (14) reported in their findings on 14-16-year-old football players that the average age was 15.25±1.15 years, and the height was 172.3±2.90 cm (p<0.05). The average height values in these studies support the values of the athletes in our study who participated in the research.

In the test where we measured reaction times, the averages for the sports of tennis, badminton, and table tennis were found to be 0.27±0.03 s, 0.26±0.01 s, and 0.26±0.02 s, respectively. Additionally, the average sprint times for 30 meters were determined as 4.90±0.37 s, 5.30±1.56 s, and 4.98±0.36 s for the same sports, respectively (p<0.05).

In the studies of Açikada et al. (15), visual reaction times of star national and young national water polo players with average ages of 16.06±0.57 years and 18.91±1.04 years were found as 397.62±52.84 ms and 383.63±52.26 ms, respectively (p<0.05). Akarsu (16) determined the reaction times of male athletes in the adolescent period aged 14-18 years as 384.44±32.6 ms for the right hand and 385.02±31.97 ms for the left hand (p<0.05).

Yıldız (17) measured the 30m speeds of 11-15-year-old national badminton players, finding averages of 4.89±0.34 s for males and 5.08±0.19 s for females (p<0.05). Gil et al. (18) reported the 30-meter sprint test averages in star-level football players with an average age of 15.5±0.6 years as 3.95±0.24 s (p<0.05). Yamaner (19) determined the 30-meter speed scores of adolescent wrestlers in his study as 4.81±0.75 s in the pre-test and 5.24±0.32 s in the post-test (p<0.05).

Although the results obtained in our study are qualitatively supported by some of the studies mentioned above regarding reaction times and sprint times, it is considered that the values of our study are lower, and this may be due to the fact that the research group's reaction and speed values, specific to racket sports, develop more during competitions in other sports, or differences in measurement methods.

In the tests conducted to measure agility time, the averages for the sports of tennis, badminton, and table tennis were found to be 9.89±0.60 s, 10.55±0.22 s, and 10.57±0.55 s, respectively. Additionally, the aerobic powers for these same sports were determined as 40.03±3.72 ml/kg/min, 44.21±4.65 ml/kg/min, and 43.07±3.52 ml/kg/min, while their anaerobic powers were also specified as 90.66±11.20 kgm/s, 89.97±17.39 kgm/s, and 93.48±9.42 kgm/s, respectively ($p<0.05$).In the study of Gökten (20), the t-test times of male national indoor and beach volleyball players with an average age of 15.76±0.83 years were reported as 9.06±0.83 s ($p<0.05$). Lovell et al. (21) found t-test times of 16-year-old football players in their study as 9.63±0.48 s in the first quarter, 9.60±0.51 s in the second quarter, 9.61±0.53 s in the third quarter, and 9.80±0.58 s in the fourth quarter ($p<0.05$). The t-test values in the studies support our study and indicate that similar results can be obtained in trained athletes in this age group. Lieshout (22) determined the maxVO2 capacities of male badminton players with an average age of 17.00±1.00 years as 50.7±3.0 ml/kg/min ($p<0.05$). Bilim et al. (23) found maxVO2 averages of athletes aged 16.53±0.51 years as 44.89±4.44 ml/kg/min ($p<0.05$). Some of the results in these studies support our study, while in some studies, the average value was higher. Cicioğlu et al. (23) found anaerobic powers of 15-17-year-old wrestlers to be between 102.26±13.57 kgm/s and 117.94±13.84 kgm/s in a study on seasonal changes in anaerobic capacities before and after the season ($p<0.05$). Ceker (25) determined the anaerobic power values of 16-17-year-old wrestlers in their studies as follows: the pre-test value for the research group was 113.98 kgm/s, the post-test value was 117.89 kgm/s, the pre-test value for the control group was 104.21 kgm/s, and the post-test value was 105.83 kgm/s ($p<0.05$).

The results obtained in our findings regarding agility times are supported by some of the studies mentioned above. According to other studies in the literature, the aerobic capacities of the athletes in our study were observed to be slightly below the average level. This is thought to be due to factors such as competition environments, competition and training durations, being individual or team sports, and the small age-related differences, which may affect muscular development, leading to the conclusion that the studies in the literature are at a higher level compared to our study. In these studies, average anaerobic power values, as seen in our research, support the values in most studies, while in some studies, they have yielded lower or higher results. It is thought that the reason for this may be that athletes in racket sports do not come into contact with opponents, making some individual and team sports more conducive to this, causing differences in strength.

The variation in body weight among athletes of the same age is thought to be influenced by whether the sports branches are in the competition season. The difference in body weight is believed to affect other performance tests of athletes. The faster results in the T-test for the tennis group may suggest that the test protocol is more closely related to tennis, and in other agility tests made according to the general characteristics of the sport, badminton and table tennis groups may perform better. The difference in MaxVO2 values is thought to be due to the measurement times of the branches coinciding with the off-season times for the branches. It can be said that taking measurements during general training periods may yield more homogeneous results. The differences in the general strength performance of the groups are thought to be due to the use of rackets, balls, and court sizes. The varying weights of sport-specific rackets and balls, and the changing structure of court lengths, may lead to specific muscular hypertrophies in different areas of the athlete.

After this research, it is recommended that future studies could enhance the usefulness of research results by increasing the number of subjects and measurement data. The importance of selecting talented children for racket sports, and comparing the performance levels of children based on the results of this study, can be significant. It is recommended to have trained coaches in sports facilities for performance testing and to provide necessary measurement facilities for the cultivation of talented athletes. Measuring the same group of children in older age groups will provide insights into changes in their values during adolescence and facilitate the assessment of technical skills, especially gross motor skills. Additionally, evaluating data from children in different regions, socio-economic levels, and sports branches will enable a comprehensive analysis.

REFERENCES

1. Muratlı S. Çocuk ve Spor.(3. Baskı). Ankara: Bağırgan Yayınevi. 1997.
2. Ayan V, Mülazimoğlu O. Sporda yetenek seçimi ve spora yönlendirmede 8-10 yaş grubu erkek çocuklarının fiziksel özelliklerinin ve bazı performans profillerinin incelenmesi (Ankara Örneği). FÜ Sağ Bil Tıp Derg. 2009;23(3):113-8.
3. Barraclough S, Till K, Kerr A, Emmonds S. Methodological approaches to talent identification in team sports: A narrative review. Sports. 2022;10(6):81. https://doi.org/10.3390/sports10060081
4. Rowland TW. Tennisology: Inside the Science of Serves, Nerves, and On-court Dominance: Human Kinetics; 2014.
5. Ferrauti A, Maier P, Weber K. Tennistraining. Meyer und Meyer Verlag. Deutchland; 2002.
6. Ölçücü B, Canikli A, Hadi G, Yalçın Taşmektepligil M. 12-14 yaş kategorilerindeki bayan tenis oyuncularinin fiziksel ve fizyolojik özellikleri. Spor ve Performans Araştırmaları Dergisi. 2011;3(1):15-24.
7. Eyuboğlu E. İlköğretim çağı çocuklarında antropometrik ölçümlerin bazı fiziksel ve fizyolojik parametrelerle ilişkisi. Samsun: Ondokuz Mayıs Üniversitesi; 2006.
8. Dawes J. Developing agility and quickness: Human Kinetics Publishers; 2019.
9. Tatlici A, Çakmakçi E, Yilmaz S, Arslan F. Comparison of Visual Reaction Values of Elite Deaf Wrestlers and Elite Normally Hearing Wrestlers. Turk J Sport Exe. 2018;20(2):63-6. https://doi.org/10.15314/tsed.440813
10. Dane S, Yilmaz M. The reaction times of upper, lower, right and left visual fields in normal human subjects: The men is better in visuomotor activities. School of Fundamental Medicine Journal. 1998;4(29):33-4.
11. Hadi G. Futbolda dar alan çalışmalarıyla, topsuz sürat çalışmalarının sürat, çeviklik, hızlanma ve beceri özelliklerine etkisinin incelenmesi. Konya: Selçuk Üniversitesi; 2015.
12. Tanner R, Gore C. Physiological tests for elite athletes: Human kinetics; 2012.
13. Ramírez-Vélez R, Rodrigues-Bezerra D, Correa-Bautista JE, Izquierdo M, Lobelo F. Reliability of health-related physical fitness tests among Colombian children and adolescents: the FUPRECOL study. PLoS One. 2015;10(10):e0140875. https://doi.org/10.1371/journal.pone.0140875
14. Juárez D, López de Subijana C, Mallo J, Navarro E. Analysis of the soccer kick and its relationship with the vertical jump in young top-class soccer players. Revista Internacional de Ciencias del Deporte. 2010;19(6):128-40. doi:10.5232/ricyde2010.01903
15. Chaleh M, Fatemi R, Shahsavar A. Relationship between speed, agility and anaerobic power of 14-16 years elite soccer players. International Research Journal of Applied and Basic Sciences. 2012;3(2):427-32.
16. Açikada C, Cinemre Ş, Koruç Z, Aşcı A, Hazir T. Yıldız ve genç elit sutopu oyuncularının bir kısım performans kriterlerinin karşılaştırılması. Spor Bilimleri Dergisi. 2001;12(3):3-18.
17. Akarsu S. Sedanter ve çeşitli branşlardaki sporcu adelösan ve yetişkinlerde reaksiyon zamanı, kuvvet ve esneklik arasındaki ilişkiler. Erzurum: Atatürk Üniversitesi; 2008.
18. Yıldız S. 11-15 yaş milli badminton oyuncularının motorik ve fiziksel özellikleri. Kocaeli: Kocaeli Üniversitesi; 2002.
19. Gil S, Gil J, Irazusta A, Ruiz F, Irazusta J, editors. Anthropometric and physiological profile of successful young soccer players. Science and Football V: The Proceedings of the Fifth World Congress on Sports Science and Football; 2003 Apr; Portugal. Routledge; 2005.
20. Yamaner E. Güreş eğitim merkezlerindeki adolesan sporculara ait büyüme gelişme metabolik ve hormonal parametrelerin değişikliklerinin araştırılması. Samsun: Ondokuz Mayıs Üniversitesi; 2012.
21. Gökten H. U17-U18 yaş grubu plaj ve salon voleybolu milli takım altyapı hazırlık gruplarında antrenman eğitimi alan sporculardan elde edilen bazı değişkenlerin değerlendirilmesi. Bartın: Bartın Üniversitesi; 2016.
22. Lovell R, Towlson C, Parkin G, Portas M, Vaeyens R, Cobley S. Soccer player characteristics in English lower-league development programmes: The relationships between relative age, maturation, anthropometry and physical fitness. PLoS One. 2015;10(9):e0137238. https://doi.org/10.1371/journal.pone.0137238
23. Lieshout K. Physiological Profile of Elite Junior Badminton Players in South Africa. Johannesburg; Rand Afrikaans University; 2002.
24. Bilim AS, Çetinkaya C, Ayfer D. 12-17 yaş arasi spor yapan ve spor yapmayan öğrencilerin fiziksel uygunluklarinin incelenmesi. Spor ve Performans Araştırmaları Dergisi. 2016;7(2):53-60. https://doi.org/10.17155/spd.74209
25. Cicioğlu İ, Kürkçü R, Eroğlu H, Yüksek S. 15-17 yaş grubu güreşçilerin fiziksel ve fizyolojik özelliklerinin sezonsal değişimi. Spormetre beden eğitimi ve spor bilimleri dergisi. 2007;5(4):151-6. https://doi.org/10.1501/Sporm_0000000085
26. Çeker B. Çabuk kuvvet antrenmanının 16-17 yaş grubu güreşçilerin bazı fiziksel ve fizyolojik parametreleri üzerine etkisi. Ankara: GaziÜniversitesi;1996.

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Investigation of Exercise Addiction Levels of Firefighter

Mine TASKIN [1A], Kemal BAS [1B]

[1] *Selcuk University, Beysehir Ali Akkanat School of Applied Sciences, Department of Emergency Aid and Disaster Management, Konya, TÜRKİYE*
Address Correspondence to Kemal BAS: e-mail: kemal.bas@selcuk.edu.tr

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A: Orcid ID: 0000-0002-6120-8935 B: Orcid ID: 0000-0003-0881-9793

Abstract

Exercise addiction is defined as the situation of restricting daily life and exercising more than once a day, exercising before other activities, and experiencing emotional deprivation if the exercise program is disrupted. This descriptive cross-sectional study aims to examine the exercise addiction of 219 firefighters working in the Konya Fire Department and the factors affecting this addiction. Personal Information Form and Exercise Addiction Scale were used in the research. One Way Anova and Post Hoc test were used to compare the data analyzed with the SPSS program. According to research findings, those who do sports two or three times a week have a higher level of focus and emotional change than those who do not do sports at all. In addition, tolerance development and passion scores of those who do sports twice a week are higher than those who do not do sports at all. The average of excessive focus and emotional change was highest in fire sergeants, the average of postponement of individual social needs was highest in fire sergeants, and the average of tolerance development and passion was highest in trainees. In conclusion, exercise addiction can pose a significant problem for professional firefighters. Any physical, social, or psychological problems that may arise due to the increased addiction level of fire personnel may negatively affect their success during duty. For this reason, firefighters should be encouraged to do sports under the title of sports.

Keywords: Exercise, exercise addiction, firefighter.

İtfaiyecilerin Egzersiz Bağımlılık Düzeylerinin İncelenmesi

Özet

Egzersiz bağımlılığı, günlük yaşamı kısıtlayarak günde birden fazla egzersiz yapma, egzersizin diğer aktivitelerin önüne geçmesi, egzersiz programının aksaması durumunda duygusal yoksunluk yaşama durumu olarak tanımlamaktadır. Tanımlayıcı kesitsel tipteki bu araştırma Konya İtfaiyesinde çalışan 219 itfaiye personelinin egzersiz bağımlılığının ve bu bağımlılığa etki eden faktörleri incelemeyi amaçlamaktadır. Araştırmada Kişisel Bilgi Formu ve Egzersiz Bağımlılığı ölçeği kullanılmıştır. SPSS programı ile analiz edilen verilerin karşılaştırılmasında One Way Anova ve Post Hoc testi kullanıldı. Araştırma bulgularına göre haftada iki veya üç kez spor yapanlar, hiç spor yapmayanlara göre

daha yüksek düzeyde odaklanma ve duygusal değişime sahiptir. Ayrıca haftada iki kez spor yapanların tolerans gelişimi ve tutku puanları hiç spor yapmayanlara göre daha yüksektir. Aşırı odaklanma ve duygun değişimi ortalaması en fazla itfaiye çavuşlarında, bireysel sosyal ihtiyaçların ertelenmesi ortalaması en fazla itfaiye çavuşlarında, tolerans gelişimi ve tutku ortalaması en fazla stajyerlerde tespit edildi. Sonuç olarak egzersiz bağımlılığı profesyonel itfaiyeciler için önemli bir sorun teşkil edebilir. İtfaiye personelinin bağımlılık düzeyinin artmasına bağlı olarak ortaya çıkabilecek herhangi bir fiziksel, sosyal veya psikolojik sorun, görev esnasında başarısını olumsuz yönde etkileyebilir. Bu nedenle itfaiyecilerin spor başlığı altında spor yapmaları teşvik edilmelidir.

Anahtar Kelimeler: Egzersiz, egzersiz bağımlılığı, itfaiye personeli.

INTRODUCTION

Exercise is a set of planned, structured, voluntary, continuous activities aimed at improving one or more elements of physical fitness, considered as a subclass of physical activity. [1]. Exercise includes activities that help individuals control weight, lower blood pressure and cholesterol, improve respiratory functions, and reduce the risk of heart attack [2]. Physical exercise contributes significantly to the maintenance of health and recovery from diseases. Regular physical exercise contributes to primary and secondary prevention of a wide range of diseases and prolongs life expectancy. Many studies have shown that physical exercise is associated with sleep patterns, cognitive and emotional well-being [3]. It has been explained that physical exercise has positive effects on anxiety, depression, and stress through physiological and biochemical mechanisms [4]. Exercise has been shown to reduce inflammation in physical health-related complaints (inflammation, cytokines, etc.) in people with mood disorders [5]. The additional benefits of exercise increase in proportion to the duration of exercise, but some problems arise in the case of excessive exercise [6]. It has been stated that exercise at the level of addiction does not contribute to the improvement of stress and depression symptoms in both men and women [4]. While exercise plays an important role in keeping individuals physically, mentally, emotionally, and socially healthy, excessive and uncontrolled exercise can lead to negative consequences such as exercise addiction rather than the expected benefit [7]. In addition, constant exercise may cause a person to become addicted without realizing it.

Exercise addiction is a mental illness that is called the "dark side" of exercise and negatively affects the health of the individual [8]. Important signs of exercise addiction are that the individual constantly increases the duration, intensity, and frequency of exercise, does not spare time for family, friends, and even social life to exercise, and perceives and plans his/her life around exercise [9]. Exercise addiction is divided into two groups: positive addiction and negative addiction. When an individual exercises excessively to cope with some difficulties and obstacles in his/her life, it is considered a positive addiction; when an individual who exercises excessively experiences problems such as stress, anxiety, depression, irritability, sleep, etc. when he/she does not exercise, it is considered as negative addiction [10]. In his research, Bishop found that athletes engage in more exercise activities for high motivation, physical appearance, and weight loss, and that these exercises increase the risk of addiction [11]. Other studies have found that excessive exercise to control weight, look good, and increase body motivation is addictive [12, 13]. In a study, the relationship between exercise addiction symptoms and some variables of people exercising in the fitness center was examined. It has been reported that the risks related to the development of exercise addiction are higher in men aged 18-20 and with an income of 3000-5000 Turkish lira [14]. In another study, the relationship between exercise addiction level of people who exercise and some variables was examined; It has been explained that exercise frequency and age level are related to exercise addiction [15]. There are many studies in the literature about exercise addiction of different groups. However, there is no study on the exercise addiction levels of firefighters, who are a professional group that responds to emergencies and has the task of saving lives in difficult conditions and needs to be strong for this purpose.

Fire personnel provide critical emergency services to communities across the country despite experiencing one of the highest occupational injury rates [16]. Firefighting is a profession that is carried out under tiring and difficult conditions that will physically push human limits due to negative factors such as smoke, high heat, chemical gases, and humidity. For this reason, firefighting is a profession that requires high

physical and physiological performance [17]. Firefighters have duties such as intervening in fires, responding to incidents requiring rescue such as collapse, explosion and stranding, providing first aid services, responding to floods, and participating in search and rescue efforts in natural disasters and extraordinary situations [18]. In addition, firefighters, a professional group where work-related musculoskeletal disorders are seen, face physically demanding activities due to the requirements of the profession [19]. Firefighting is an emotionally demanding job that puts significant stress on the physical, mental, and musculoskeletal systems [20]. The physical readiness of fire personnel, who work in difficult situations such as fires, earthquakes, floods and traffic accidents, must have at a good level of physical readiness for the task, when evaluated within the concept of "being ready for duty at any time". However, firefighters who exercise constantly may develop an exercise addiction without realizing it. It shows that the firefighter must have physical strength and fitness and exercise is a necessary profession to perform activities such as firefighting, climbing stairs, rescuing victims and carrying equipment. As a result, it is imperative that firefighters are physically fit to perform their professional duties, ensuring the safety of their colleagues and those to be rescued, as well as maintaining their own physical health.This study aims to examine the exercise addiction level of firefighters working in Konya city center and the variables affecting this addiction level. In addition, this study is important in terms of being the first study to examine the exercise addiction levels of fire brigade personnel, which is a professional occupational group.

METHOD

Design and Purpose of the Study

This cross-sectional study was designed to examine the effect of exercise on the addiction level of firefighters. In addition, this study aims to reveal the effects of age, gender, marital status, income level, male and body weight, working hours, and exercise time variables on the exercise addiction of firefighters.

Research Group

This study was carried out with 268 firefighters working in Konya between 07.02.2022 and 28.05.2022. 268 firefighters agreed to administer the questionnaire. The total number of firefighters working in Konya is 600, and the sample size was calculated using the suggested formula when the number of universes is known [21]. According to this formula, the minimum sample size should be 235 with 95% confidence interval and 5% sampling error. The data were applied when firefighters had available time at the fire station.

Data Collection Tool

Personal Information Form: It was designed by the researchers to obtain demographic information of the participants such as age, title, marital status, height/body weight, working time in the fire department, sports facility in the department, and frequency of exercise.

The data were obtained by using the questionnaire form used by Demir et al [1]. The questionnaire form consists of 17 questions in total and consists of 3 parts. Grading of the scale is done with a 5-point Likert-type rating. When the sub-dimensions were examined, it was determined that the first sub-dimension consisted of the first 7 items (1, 2, 3, 4, 5, 6, 7) under the name of "Excessive Focus and Emotional Change". This sub-dimension alone explains 34.89% of the exercise dependence variable in the scale. The second sub-dimension, "Postponement of Individual-Social Needs and Conflict", consists of 6 items (8, 9, 10, 11, 12, 13). This sub-dimension alone explains 13,06% of the exercise dependence variable in the scale. It was determined that the third sub-dimension consisted of 4 items (14, 15, 16, 17) under the name of "Development of Tolerance and Passion" and that the third sub-dimension alone explained 6.65% of the exercise addiction variable in the scale. Cronbach's alpha values of the data obtained from the participants were calculated as 0.71 in the dimension of excessive focus and emotion change; 0.78 in the dimension of postponement of individual-social needs and conflict; and 0.76 in the dimension of development of tolerance and passion.

Statistical Analysis

Data were analyzed using SPSS (Statistical Package for the Social Sciences) 26 statistical package program. According to the normality test, parametric tests were used for normally distributed data. Accordingly, one-way analysis of variance (ANOVA) and Post Hoc test statistics (Tukey HSD) were used to analyze the data. Significance was accepted as $p<0.05$.

Ethical approval and institutional permission

Ethical approval was obtained from the Selcuk University Faculty of Medicine Local Ethics Committee to conduct the study (E-70632468-050.01.04-178906). Additionally, institutional permission was obtained from Konya Metropolitan Municipality Fire Department (E-11421874-622.01-71911).

FINDINGS

Table 1 shows the characteristics of the participants. 219 participants agreed to apply the face-to-face survey. All firefighters are men (100%). Many participants (34.7%) are between the ages of 40-49. Many participants (73.76%) are married. The education level of the participants is mostly (31.51%) at high school level. The largest number of personnel (68.95%) are firefighters (Table 1).

Table 1. Characteristics of the participant

Characteristics	n	%
Gender (n=219)		
Male	219	100.0
Age(n=219)		
18-19	5	2.28
20-29	62	28.31
30-39	39	17.81
40-49	76	34.70
50-59	35	15.98
>59	2	0.91
Marital status (n=219)		
Married	163	73.76
Single	58	26.24
Education (n=219)		
Secondary school	46	21.00
High school	69	31.51
Associate degree	65	29.68
License	35	15.98
Postgraduate	4	1.83
Degree		
Fire driver	41	18.72
Firefighter	151	68.95
Fire chifer	8	3.65
Inters	11	5.02
Fire sergeant	8	3.65

The mean (SD) age was 44,28±6,72 years, height was 1,76±0,06 m and weight was 83,60±11,62 for the 41 Firefighter driver; the mean (SD) age was 37,84±10,13 years, height was 1,75±0,05 m and weight was 82,58±11,65 for the 151 firefighter; the mean (SD) age was 44,50±5,61 years, height was 1,81±0,05 m and weight was 81,50±13,04 for the 8 Fire Chief; the mean (SD) age was 19,73±0,91 years, height was 1,76±0,10 m and weight was 69,73±12,26 for the 11 Interns; the mean (SD) age was 43,75±3,28 years, height was 1,79±0,09 m and weight was 85,37±6,78 for the 8 Fire Sergeant (Table 2).

Table 2. Physical characteristics of the firefighters participating in the study.

Variables	Age (years)	Height (m)	Weight (kg)
	Mean±SD	Mean±SD	Mean±SD
Firefighter driver (n=41)	44,28±6,72	1,76±0,06	83,60±11,62
(n=151)	37,84±10,13	1,75±0,05	82,58±11,65
Fire Chief (n=8)	44,50±5,61	1,81±0,05	81,50±13,04
Interns (n=11)	19,73±0,91	1,76±0,10	69,73±12,26
Fire Sergeant (n=8)	43,75±3,28	1,79±0,09	85,37±6,78

The Fire Chief, who participated in the study, was in the dependent group in terms of exercise addiction, while the Firefighter driver, firefighter, Interns, and Fire Sergeant were in the risk group (Table 3).

Table 3. Exercise addiction levels of the firefighters participating in the study

Variables	Firefighter driver (n=41)	firefighter (n=151)	Fire Chief (n=8)	Interns (n=11)	Fire Sergeant (n=8)
	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD
Excessive Focus and Emotion Change	24,20±5,81	25,13±6,04	25,12±7,62	24,91±5,52	25,50±5,13
Individual-Social Needs Deferral and Conflict	13,98±4,41	14,67±4,77	15,25±4,16	14,09±4,72	14,63±4,98
Tolerance Development and Passion	10,56±4,91	11,37±4,18	12,50±4,72	12,82±5,23	11,38±3,42
Exercise addiction total score	48,24±12,85	51,20±11,99	52,88±9,80	51,82±13,93	51,50±8,82

Exercise addiction: 1-17 normal group, 18-34 low-risk group, 35-51 risk group, 52-69 dependent group, 70-85 highly dependent group.

In comparing the weekly exercise frequency of firefighters participating in the study in terms of exercise addiction, it was found that those who exercised twice a week and those who exercised three times a week or more exhibited higher scores for hyperfocus and emotional development than those who never exercised ($P < 0.05$). However, no difference was found between non-exercisers and exercisers in terms of postponement of individual social needs and conflict ($P > 0.05$). In terms of tolerance development and passion, the scores of those who never exercised were found to be lower than the scores of those who exercised twice a week ($P < 0.05$). In terms of the total score for exercise addiction, the score of those who exercised was found to be higher than the score of those who never exercised ($P < 0.05$) (Figure 1).

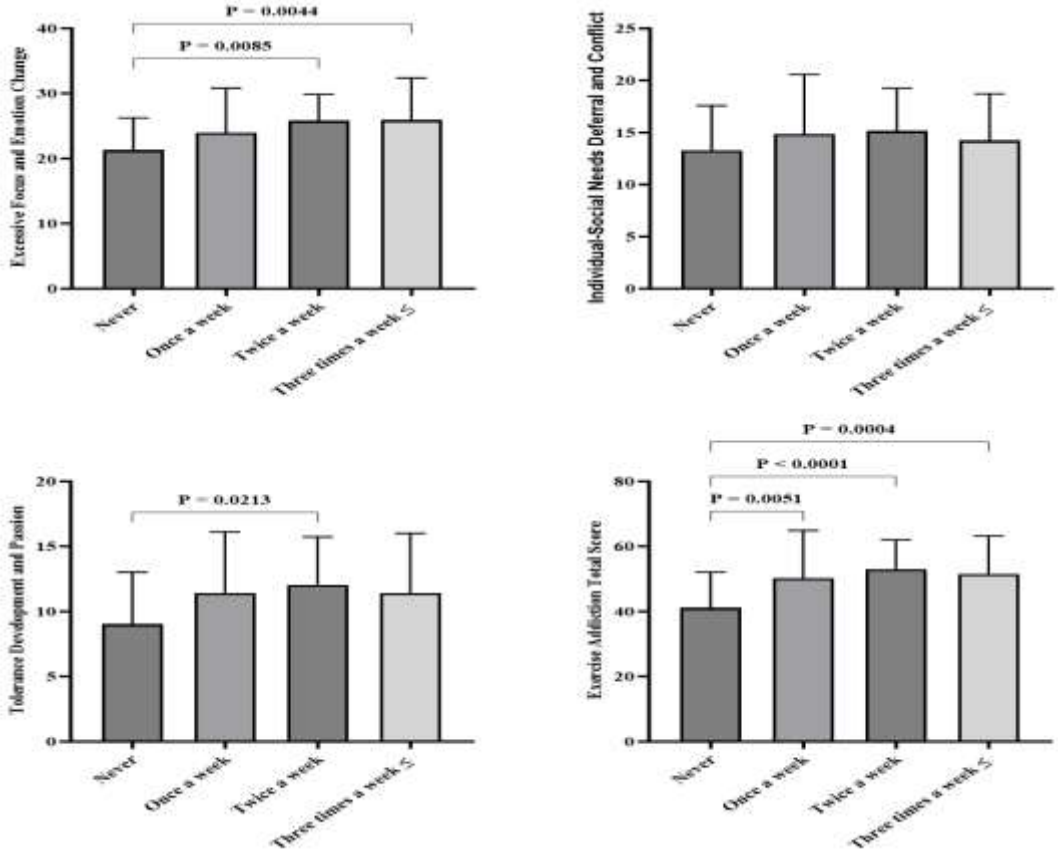

Figure 1. Comparison of exercise addiction in terms of weekly exercise frequency of the firefighters participating in the study

DISCUSSION AND CONCLUSION

People's duration of physical activity is increasing day by day. This situation leads to addiction in exercise. Exercise addiction has started to emerge in almost every segment and has led people to unethical situations. This study is the first to examine exercise addiction and the variables affecting this addiction in firefighters. In this study, the levels of exercise addiction of fire brigade personnel were examined, and comparisons were made with various variables.

Considering the harms that exercise addiction can cause on individuals, it is thought that examining the addiction levels of firefighters will have an impact on their duties. In this context, a total of 219 firefighters participated in the research. Many fire department employees are firefighters. The reason for this is thought to be that firefighters directly intervene in the fire and perform search and rescue. On the other hand, fire chiefs, sergeants, interns, and drivers do not have the priority to intervene directly in the fire. Physical problems that may arise due to exercise addiction include joint/muscle damage, injuries, bone loss, stress fractures, etc [22]. Firefighters who are dependent on exercise may experience torn ligaments, arthritis, and increased anxiety and irritability. Excessive dependence on exercise can lead to bad and immoral behaviors in individuals [23].

According to the Municipal Fire Brigade Regulation, male fire brigade personnel must be at least 1.67 m tall and there should be no more than 10 kg difference between the part of the height more than 1 m and the weight (+,-) [24]. The weight and height conditions of all individuals participating in the study were compatible with the literature.

When the addiction levels of the employees are examined, fire chiefs are in the exercise-dependent group, while fire drivers and privates are in the risk group. The higher exercise scores of fire chiefs were found to be an unexpected result. It is thought that firefighters who directly intervene in fire and search and rescue

activities should act quickly against a sudden event and that this action can be improved by continuous sports and exercise. However, a study conducted abroad in this field states that exercise addiction is related to factors such as personality characteristics, psychological factors, physiological factors, exercise type, gender, and year of participation in exercise [10].

It was found that those who exercised twice a week and those who exercised three or more times a week exhibited higher scores in hyperfocus and emotional development than those who did not exercise at all. In addition, it was determined that the scores of those who did not exercise at all in terms of tolerance development and passion were lower than the scores of those who exercised twice a week. In parallel with the research results, Çakır's research examining the exercise addiction levels of university students concluded that regular exercise will affect exercise addiction [25]. In the study conducted by Cicioğlu et al. to determine the 'Exercise Addiction Levels of Elite Level Athletes and Sports Sciences Faculty Students', it was concluded that regular exercise affects exercise addiction [26]. In the study of Polat and Şimşek, which examined the exercise addiction of 242 participants who regularly exercise in sports centers in Eskisehir, a significant difference was found between exercise addiction according to exercise frequency [27]. In another study, Costa et al. concluded that exercise frequency, daily exercise duration, and sports age may be effective in the emergence of exercise addiction [6]. Therefore, it is known that physiological, psychological, and social problems such as exercise addiction occur as a result of the inability to control exercise frequency and exercise duration.

In conclusion, those who do sports twice or three times a week have higher levels of focus and emotional changes than those who do not do sports at all. In addition, tolerance development and passion scores of those who do sports twice a week are higher than those who do not do sports at all. In this context, it can be said that exercise addiction poses a significant problem for professional firefighters. Any physical, social, or psychological problems that may occur due to the increase in the addiction level of fire personnel may negatively affect the success of their jobs. For this reason, firefighters can be encouraged to do sports under sports.

Limitations

Because this study has several limitations, caution is needed when interpreting these findings. Data collection was cross-sectional (evaluation occurred at a single point in time) and therefore study results may not be generalizable to other fire departments. Finally, selection bias may be present in the data due to the sampling method. For future research, it would be interesting to examine whether it is mediated by other factors

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REFERENCES

1. Tekkurşun Demir, G., Hazar Z, Cicioğlu Hİ. Exercise Addiction Scale (EAS): A Study of Validity and Reliability. Kastamonu Education Journal, 2018; 26(3), 865-874. Doi: 10.24106/kefdergi.413383
2. Arslanoglu C, Acar K, Mor A, Arslanoglu E. Exercise Addiction in Future Coaches. Spormetre The Journal of Physical Education and Sport Sciences, 2021; 19(1), 137-146. https://doi.org/10.33689/spormetre.758693
3. Hausenblas HA, Downs DS. How much is too much? The development and validation of the exercise dependence scale. Psychology and health, 2002; 17(4), 387-404. https://doi.org/10.1080/0887044022000004894
4. Jee YS, Eun D. Exercise addiction and psychophysiological health in Korean collegiate students. International Journal of Mental Health and Addiction, 2018; 16, 451-465. https://doi.org/10.1007/s11469-017-9802-7
5. Mikkelsen K, Stojanovska L, Polenakovic M, Bosevski M, Apostolopoulos V. Exercise and mental health. Maturitas, 2017; 106, 48-56. https://doi.org/10.1016/j.maturitas.2017.09.003

6. Costa S, Cuzzocrea F, Hausenblas Ha, Larcan R, Oliva P. Psychometric examination and factorial validity of the Exercise Dependence Scale-Revised in Italian exercisers. Journal of Behavioral Addictions, 2012; 1(4), 186-190. https://doi.org/10.1556/jba.1.2012.009
7. Lejoyeux M, Guillot C, Chalvin F, Petit A, Lequen V. Exercise dependence among customers from a Parisian sports shop. Journal of Behavioral Addictions, 2012; 1(1), 28-34. https://doi.org/10.1556/jba.1.2012.1.3
8. Landolfi, E. Exercise addiction. Sports medicine, 2013; 43(2), 111-119. https://doi.org/10.1007/s40279-012-0013-x
9. Yıldırım İ, Yıldırım Y, Ersöy Y, Isık O, Saracli S, Karagöz Ş, Yağmur R. Correlation Between Exercise Dependence and Eating Attitudes and Behaviors. CBU Journal of Physical Education and Sports Sciences, 2017; 12(1), 43-54.
10. Hausenblas HA, Downs DS. Exercise dependence: A systematic review. Psychology of sport and exercise, 2002; 3(2), 89-123. https://doi.org/10.1016/S1469-0292(00)00015-7
11. Bishop, Ian. "Health or harm? Exercise dependence and its effects on body satisfaction and self-esteem", 2009; Electronic Theses and Dissertations. 25
12. LePage ML, Crowther H, Harrington EF, Engler P. Psychological correlates of fasting and vigorous exercise as compensatory strategies in undergraduate women. Eating behaviors, 2008; 9(4), 423-429. https://doi.org/10.1016/j.eatbeh.2008.06.002
13. Prichard I,Tiggemann M. Relations among exercise type, self-objectification, and body image in the fitness centre environment: The role of reasons for exercise. Psychology of sport and exercise, 2008; 9(6), 855-866. https://doi.org/10.1016/j.psychsport.2007.10.005
14. Kayhan, R.F., A. Kalkavan, and E. Terzi. Exercise Addiction Levels of Individuals Exercising in Fitness Centers and Related Variables. Journal of Dependence, 2021; 22(3), 248-256. https://doi.org/10.51982/bagimli.893414
15. Katra, H. Exercise Addiction and Self-Esteem in Individuals Exercising. Journal of Dependence, 2021; 22(4), 370-378. https://doi.org/10.51982/bagimli.897106
16. Peterson DJ, Houser A, Jackson BA. Emergency Responder Injuries and Fatalities, 2004; 112, 2004.
17. AktaS S, Kamuk YU. Effects of Participation in an 8-Week Exercise Program on the Physical Readiness Levels of the Firefighters. International Sport Science Student Studies, 2020; 2(2), 108-120.
18. Gökkaya E, Aynur K. Structural Evaluation Of Firefighting Training With Air Rescue And Firefighting Unit In Turkey. Journal of Pre-Hospital, 2021; 6(1), 143-158.
19. Demiralp N, Demiralp K. Occupational Musculoskeletal Diseases in Firefighters. Journal of Adnan Menderes University Health Sciences Faculty, 2019; 3(3), 164-170.
20. Smith DL, Haller JM, Korre M, Sampani K, Porto LGG, Fehling PC, Christophi CA, Kales SN. The relation of emergency duties to cardiac death among US firefighters. The American journal of cardiology, 2019; 123(5), 736-741. https://doi.org/10.1016/j.amjcard.2018.11.049
21. .Charan J, Biswas T. How to calculate sample size for different study designs in medical research? Indian journal of psychological medicine, 2013; 35(2), 121-126. https://doi.org/10.4103/0253-7176.116232
22. Vardar, E, Vardar SA, Toksöz İ, Süt N. Exercise Dependence and Evaluations of Psychopathological Features. Düşünen Adam The Journal of Psychiatry and Neurological Sciences, 2012; 25(1), 51-57. Doi: 10.5350/DAJPN2012250106
23. Aydın G, Soyer F. Examination of Active Athletes' Levels of Exercise Addiction and Attitudes Towards Performance Enhancers. Gazi Journal of Physical Education and Sports Sciences, 2023; 28(2), 135-141. https://doi.org/10.53434/gbesbd.1193981
24. İç İşleri Bakanlığı. Belediye İtfaiye Yönetmeliği. 2006.
25. .Çakir, E. The Examination of Exercise Addiction Levels of University Students Studying in Health Field. Journal of Education and Training Studies, 2019; 7(3), 177-181.
26. Cicioğlu Hİ, Tekkurşun DG, Bulgay C, Çetin E. Exercise Addiction Levels among Elite Level Athletes and Students of Sports Sciences Faculty, Journal of Dependence, 2019; 20(1), 12-20.
27. Polat C, Şimşek KY. The Study Of Individuals' Exercise Addiction Levels At Sports Centres: Eskişehir Sample. The Journal of Academic Social Science, 2019; 15(15), 354-369. Doi: 10.16992/ASOS.76

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The Effect of the Isokinetic Shoulder Strength on the Phases of Speed

İbrahim Halil ŞAHİN [1A], Ali Osman KIVRAK [2B]

[1] *Selcuk University, Faculty of Sport Sciences Konya, TÜRKİYE*
[2] *Selcuk University, Faculty of Sport Sciences, Department of Coaching Education, Department of Sport and Health, Konya, TÜRKİYE*

Address Correspondence to İbrahim Halil ŞAHİN: e-mail:. ibrahim.h.sahin27@gmail.com

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A: Orcid ID: 0000-0002-8455-4574 B: Orcid ID: 0000-0003-4699-0401

Abstract

This study aimed to investigate the effect of the isokinetic shoulder strength on the phases of speed performance. The study included 45 male participants who were athletes or had a sports background. The mean age of the participants was 19.64±2.02 years, the mean height was 175.11±14.54 cm, the mean body weight was 68.44±5.96 kg, and the mean sports age was 5.40±3.90 years. In the study, data on the isokinetic shoulder strength and phases of speed were collected. A 100-meter sprint test was used to evaluate the phases of speed, and a Cybex Humac Norm 2004 device was used to determine the isokinetic shoulder strength. In light of the results obtained, left shoulder extension peak torque (left SEPT) and left shoulder flexion peak torque (left SFPT) values were found to affect all phases of speed except reaction speed, while right shoulder extension peak torque (right SEPT) values were found to affect only reaction speed and middle acceleration phase. Furthermore, right shoulder flexion peak torque (right SFPT) values were found to affect all speed phases except early acceleration and the transition phase. In general, the isokinetic shoulder strength was found to affect all phases of speed, with the highest effect level in the maximum speed and in the continuity phases of speed. In conclusion, the isokinetic shoulder strength is thought to have a significant effect on overall speed performance. The isokinetic shoulder strength has the most effect, especially in the maximum speed and speed continuity phases. Shoulder strength should be taken into consideration when organizing the training programs of athletes in all sports branches that include short- or long-distance speed performance.

Keywords: Speed, strength, isokinetic.

İzokinetik Omuz Kuvvetinin Süratin Evrelerine Etkisi

Özet

Bu çalışmanın amacı, izokinetik omuz kuvvetinin sürat performansının evreleri üzerindeki etkisini araştırmaktır. Araştırmaya sporcu ya da spor geçmişi olan 45 erkek katılımcı dahil edilmiştir. Katılımcıların yaşları ortalaması 19,64±2,02 yıl, boyları ortalaması 175,11±14,54 cm, vücut ağırlıkları ortalaması 68,44±5,96 kg ve spor yaşları ortalaması 5,40±3,90 yıl olarak tespit edilmiştir. Araştırmada izokinetik omuz kuvveti ve süratin evrelerine ilişkin veriler toplanmıştır. Süratin evrelerinin değerlendirilmesi için 100 m sprint testi ve izokinetik omuz kuvvetinin belirlenmesi için Cybex Humac Norm 2004 cihazı kullanılmıştır. Elde edilen bulgular neticesinde sol omuz ekstansiyon peak tork (Sol OEPT) ve sol omuz fleksiyon peak tork (sol OFPT) değerlerinin reaksiyon sürati hariç, süratin tüm evrelerini etkilediği görülürken, sağ omuz ekstansiyon peak tork (sağ OEPT) değerlerinin yalnızca reaksiyon sürati ve orta ivmelenme evresini etkilediği belirlenmiştir. Ayrıca sağ omuz fleksiyon peak tork (sağ OFPT) değerlerinin ise erken ivmelenme ve geçiş evresi dışındaki tüm sürat evrelerini etkilediği görülmüştür. İzokinetik omuz kuvvetinin genel olarak süratin tüm evrelerini etkilediği görülürken en yüksek etki düzeyinin maksimum hız ve süratte devamlılık evrelerinde olduğu tespit edilmiştir. Sonuç olarak, izokinetik omuz kuvvetinin genel sürat performansı üzerinde oldukça önemli bir etkiye sahip olduğu düşünülmektedir. İzokinetik omuz kuvveti özellikle maksimum hız ve süratte devamlılık aşamasında en fazla etkiye sahiptir. Kısa veya uzun mesafeli sürat performansını içerisinde bulunduran tüm spor branşlarında yer alan sporcuların, antrenman programları düzenlenirken omuz kuvveti göz önünde bulundurulmalıdır.

Anahtar Kelimeler: Sürat, kuvvet, izokinetik.

INTRODUCTION

Sprint is running a predetermined short distance (100 m - 400 m) in as short a time as possible (8, 20). An athlete's ability to move from one position to another with the maximum speed he/she can reach, to make a movement at the highest possible speed, and to move a part or all of the body at the highest speed is defined as speed (9). Sprint is determined by the ability to accelerate, the magnitude of maximal speed, and the ability to maintain speed against the onset of fatigue (7).

Sprinting is one of the most powerful forms of human movement. Understanding the individual biomechanical factors, kinematics, and kinetic variables that are most important for sprinting is important for improved performance. Athlete-specific analyses may provide detailed biomechanical feedback to a coach that can facilitate the development of specific technical training programs designed to improve sprint performance (2). Performance in sprint events is largely dependent on the athlete's ability to accelerate mass and produce a high running speed in the forward direction. In order to accomplish this, the neuromuscular system, specifically the body and lower limbs, generate strength, which is applied to the ground during the support phase of the running stride cycle, i.e., during the brief contact between the foot and the ground with each stride (19).

Sprint performance differs from maximal speed because sprint performance refers to the best time over a given distance, whereas maximal speed refers to the highest instantaneous speed an athlete can achieve. The ability to generate strength and speed become the fundamental parts from which an athlete's ability to accelerate begins (17, 27). The technical essence of sprint encompasses many aspects, including strength application characteristics, biomechanical concerns, and motor learning aspects. There is no doubt that technical elements play a very important role in sprint performance. The technical skills of athletes enable the modulation of their genetically inherited and developed physical abilities. Hence, by outlining a training plan that elevates the athlete's physiological state, a coach aims to provide greater physical capabilities so that the athlete can modulate their technical ability (15). Weyand et al. (26) linked the ability to run at high speed to the production of high amounts of vertical ground reaction strength per unit body weight and the available time needed. Ground reaction strength is defined in Newton's Third Law of Reaction as; “For every action there is an equal and opposite reaction”. That is, “every time the feet touch the ground, the ground generates an upward reaction strength (11). Ground reaction strength is measured in terms of vertical strength or

horizontal strength. The vertical strength pushes the individual upwards. This is antagonistic to the horizontal strength pushing the individual further forward. In both cases, the greater the strength applied to the ground, the further the individual will move in that direction. During sprinting, both vertical strength and horizontal strength are required. However, it is preferred to limit the vertical strength and maximize the horizontal strength to allow the individual to cover the horizontal distance faster during sprinting (11). Therefore, this study aimed to examine the effect of the isokinetic shoulder strength on the phases of speed performance.

METHOD

This study was conducted to investigate the effect of the isokinetic shoulder strength on the phases of speed performance and included 45 male participants who were licensed athletes or had a sports background. The mean age of the participants was 19.64±2.02 years, the mean height was 175.11±14.54 cm, the mean body weight was 68.44±5.96 kg and the mean sports age was 5.40±3.90 years.

Ethical approval and institutional permission

This study was conducted in accordance with the decision of the ethics committee of Selçuk University, Faculty of Sports Sciences, Non-Interventional Clinical Research, dated 05.12.2022 and numbered 163. Additionally, all participants gave written informed consent to participate in this study after being informed about the procedures approved by the ethics committee and in accordance with the Declaration of Helsinki.

This study was produced from the doctoral thesis "Examination of the Phases of Speed in Terms of Strength, Anaerobic Endurance and Balance". Additionally, this research was supported by Selçuk University Scientific Research Projects Coordination with Project number 22212045.

Experimental Protocol

In the study, a 100-meter sprint test was used to evaluate the phases of speed, and a Cybex Humac Norm 2004 device was used to determine shoulder strength. Each test was performed for all participants on different days, at least 72 hours later, in the same environment and conditions. Before each test, the necessary information about the test was given to the participants by the researcher. Before all tests were applied, a test-specific warm-up program was applied. In addition, each test was applied to the participants twice and the best degree was evaluated.

The 100-meter Sprint Test

The 100-meter sprint was performed on the tartan track at the 15 Temmuz Stadium of Selçuk University. During the 100-meter sprint, times were measured with an 11-gate wireless photocell system. The photocells were placed at the start (0 m), 5 m, 15 m, 25 m, 35 m, 45 m, 55 m, 65 m, 75 m, 85 m, and finish (100 m) (8, 17).

Speed performance was evaluated by dividing into 5 phases:

- Reaction speed (0-5 m)
- Acceleration: Early acceleration (5-15 m)

  Middle acceleration (15-25 m)

  Late acceleration (25-35 m)
- Transition phase (35-45 m)
- Maximum speed (45-75 m)
- Continuity in speed (75-100 m) (8, 17).

An active warm-up program was applied to the participants for 15 minutes before the test. At the starting point (0 meters), the subject takes a linear static standing position with one knee in front and one behind, and starts running when ready. The time spent at each stage was recorded.

The Isokinetic Shoulder Strength Test

The isokinetic shoulder strength test was performed with an isokinetic dynamometer (Cybex, Humac Norm 2004) in the laboratory of Selçuk University, Faculty of Sport Sciences. Before the test, the participants warmed up with a bicycle ergometer (55-65 rpm) for 7 min, followed by stretching for 3 min. The isokinetic muscle strength of the upper extremities of the athletes was measured at an angular velocity of 60°/s. The isokinetic muscle strengths were measured in two different joint movements, the right and left shoulder flexion/extension. Following the preliminary information about the test, the anthropometric data were entered into the Cybex apparatus one by one, and the device was adjusted. The range of motion of the joint was determined by the computer by making a sample movement. After the trial measurements were taken, the test measurement values made in accordance with the determined protocol were transferred to the computer environment. The gravity effect, which may cause false results in the measurements made in these joint movements, is also canceled by the device (4, 5, 25).

In 5 repetitions of maximum contraction, shoulder extension and flexion torque values were obtained at a speed of 60°/s. 5 minutes of rest were given between shoulder changes (4, 5, 25). During the tests, participants received verbal encouragement in the form of motivating words to enhance their performance. The best values were also recorded during the exercise.

Statistical analysis

SPSS IBM 27 package program was used to organize and calculate the data. The data were summarized by giving the mean and standard deviations. The normal distribution of the data was tested by One-Sample Kolmogorov Smirnov test, and it was determined that the data showed a normal distribution. To ascertain the connection between the isokinetic shoulder strength and speed phases, a Pearson correlation test was used. The level of influence of the data acquired for the isokinetic shoulder strength on the speed phases was determined using a Linear Regression test. The data obtained in this study were tested at a 0.95 confidence interval.

FINDINGS

Table 1. Physical characteristics of the participants

Variables	Mean	Standard Deviation
Age (year)	19.64	2.02
Height (cm)	175.11	14.54
Weight (kg)	68.44	5.96
Sports Age (year)	5.40	3.90

Table 2. Times of the subjects participating in the research to pass the phases of speed

Variables	Mean	Standard Deviation
Reaction Speed (sec)	1.11	0.15
Early Acceleration (sec)	1.39	0.13
Middle Acceleration (sec)	1.19	0.11
Late Acceleration (sec)	1.16	0.12
Transition Phase (sec)	1.14	0.16
Maximum Speed (sec)	2.43	0.29
Continuity in Speed (sec)	1.83	0.22

When Table 2 is examined, it was found that the mean reaction speed of the subjects participating in the study was 1.11±0.15 sec, the mean of early acceleration was 1.39±0.13 sec, the mean of middle acceleration was 1.19±0.11 sec, the mean of late acceleration was 1.16±0.12 sec, the mean of the transition phase was 1.14±0.16 sec, the mean of maximum speed 2.43±0.29 sec, and the mean of continuity in speed was 1.83±0.22 sec.

Table 3. Shoulder peak torque values of the subjects participating in the research

Variables	Mean	Standard Deviation
Left SEPT (Nm)	49.82	9.71
Left SFPT (Nm)	41.62	9.02
Right SEPT (Nm)	54.38	20.42
Right SFPT (Nm)	42.58	10.13

When Table 3 is examined, it was found that the mean of left SEPT of the subjects participating in the study was 49.82±9.71 Nm, the mean of left SFPT was 41.62±9.02 Nm, the mean of right SEPT was 54.38±20.42 Nm and the mean of right SFPT was 42.58±10.13 Nm.

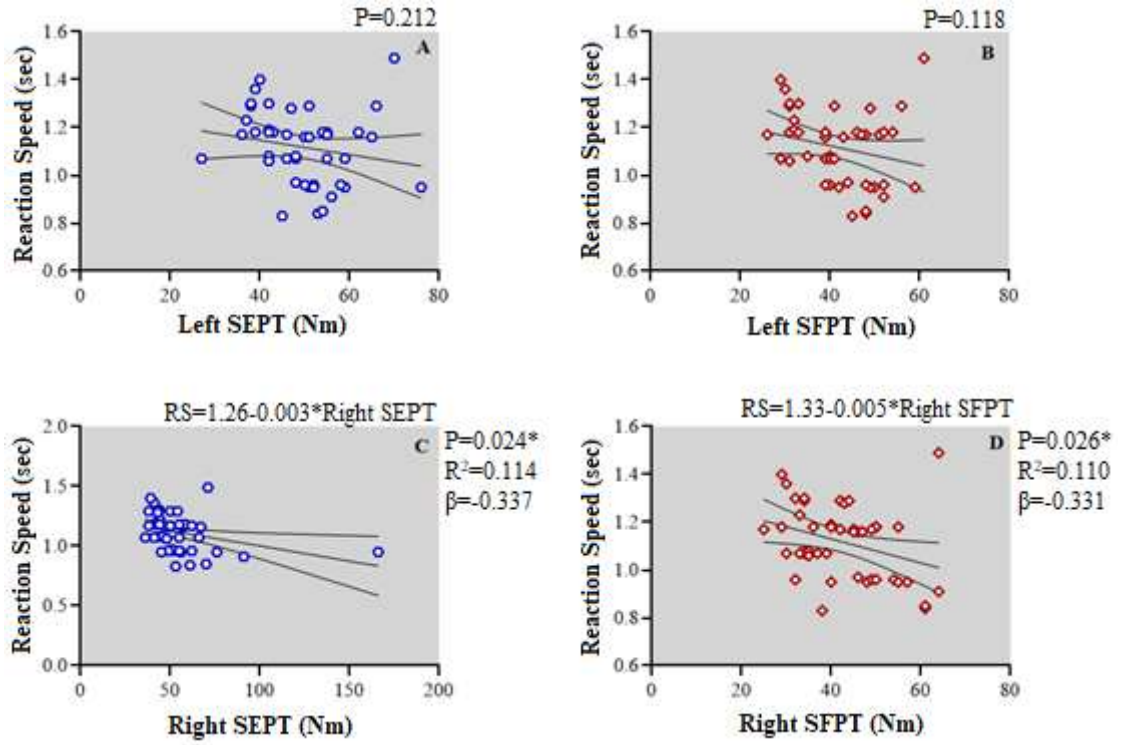

Figure 1. A: Relationship between reaction speed and left SEPT, B: Relationship between reaction speed and left SFPT, C: Relationship between reaction speed and right SEPT, D: Relationship between reaction speed and right SFPT.

Analyzing figure 1.A, it was determined that there was no significant relationship between reaction speed and the left SEPT of the subjects who participated in the study. It was observed that the change in the left SEPT values did not affect reaction speed (P>0.05). When figure 1.B was examined, it was determined that there was no significant relationship between reaction speed and the left SFPT of the subjects who participated in the study. It was observed that the change in the left SFPT values did not affect reaction speed (P>0.05). According to figure 1.C, it was determined that there was a significant relationship between the reaction speed of the subjects participating in the study and the right SEPT in the same direction (P<0.05). It was seen that the right SEPT value explained 11.4% of the reaction speed. A one-unit change in the right SEPT value affects reaction speed by 0.003. Figure 1.D shows that there is a significant relationship between the reaction speed and the right SFPT in the same direction (P<0.05). It was seen that the right SFPT value explained 11% of the reaction speed. A one-unit change in the right SFPT value affects the reaction speed by 0.005.

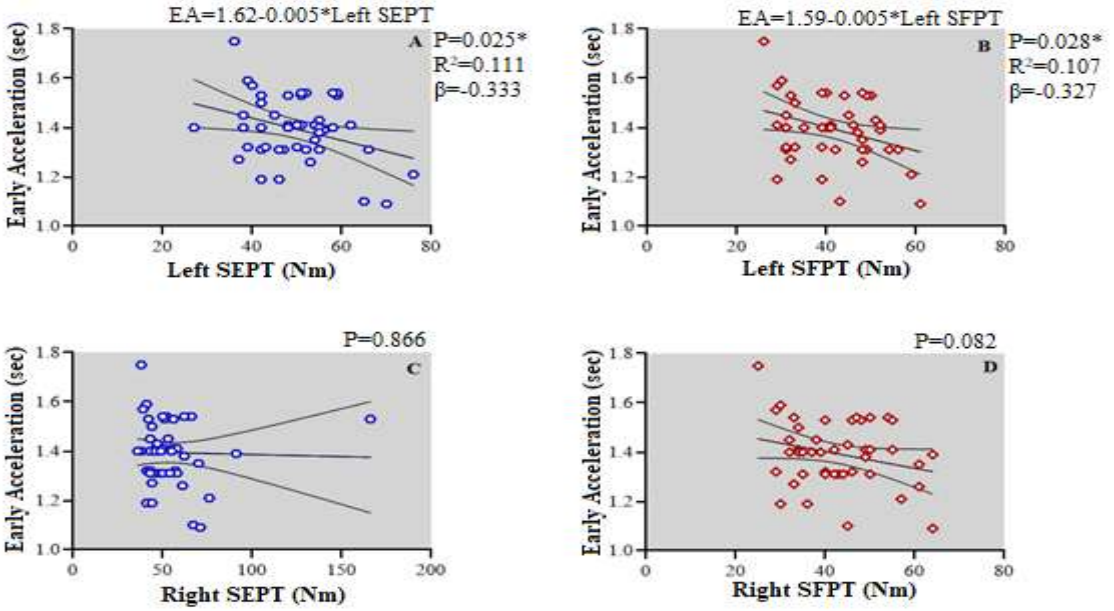

Figure 2. A: Relationship between early acceleration and left SEPT, B: Relationship between early acceleration and left SFPT, C: Relationship between early acceleration and right SEPT, D: Relationship between early acceleration and right SFPT.

As seen in figure 2.A, it was determined that there was a significant relationship between the early acceleration values of the subjects participating in the study and the the left SEPT in the same direction ($P<0.05$). It was observed that the left SEPT value explained 11.1% of the early acceleration. A one-unit change in the left SEPT value affects early acceleration by 0.005. According to figure 2.B, it was determined that there was a significant relationship between the early acceleration values of the subjects participating in the study and the left SFPT in the same direction ($P<0.05$). It was observed that the left SFPT value explained 10.7% of the early acceleration. A one-unit change in the left SFPT value affects early acceleration by 0.005. Analyzing figure 2.C, it was found that there was no significant relationship between the early acceleration values of the subjects participating in the study and the right SEPT values ($P>0.05$). It was observed that the change in the right SEPT values did not affect early acceleration. Figure 2.D shows that there was no significant relationship between the early acceleration values and the right SFPT values of the subjects who participated in the study ($P>0.05$). It was observed that the change in the right SFPT values did not affect early acceleration.

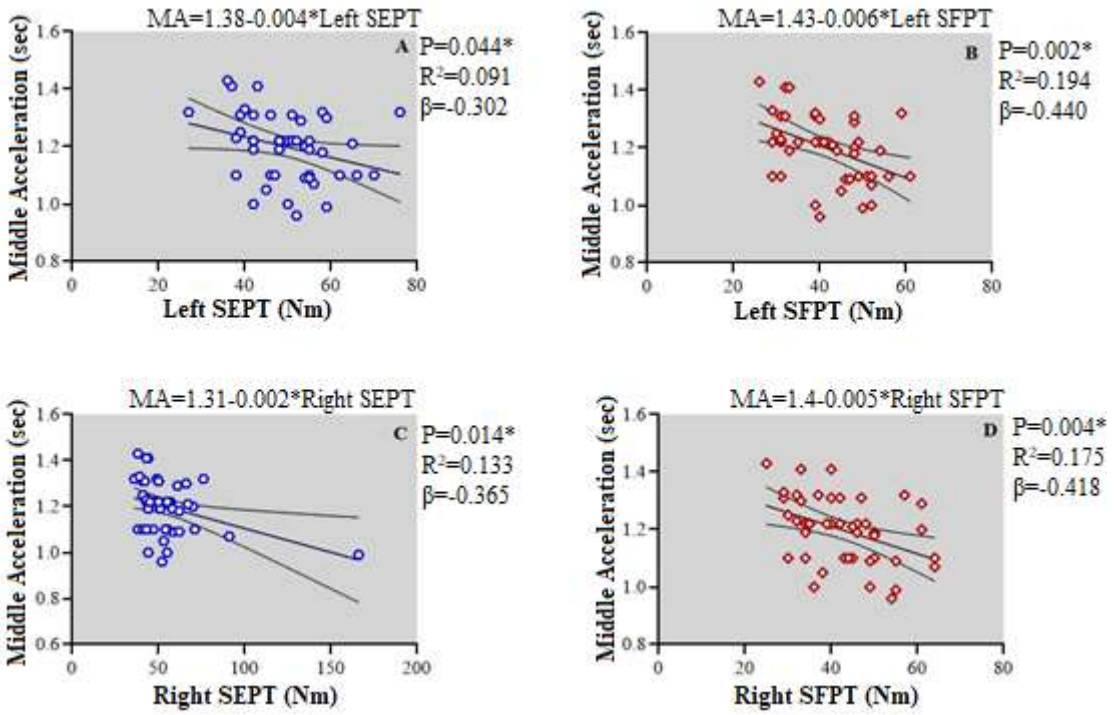

Figure 3. A: Relationship between middle acceleration and left SEPT, B: Relationship between middle acceleration and left SFPT, C: Relationship between middle acceleration and right SEPT, D: Relationship between middle acceleration and right SFPT,

As seen in figure 3.A, it was determined that there was a significant relationship between the middle acceleration values of the subjects participating in the study and the left SEPT in the same direction (P<0.05). It was observed that the left SEPT value explained 9.1% of the middle acceleration. A one-unit change in the left SEPT value affects middle acceleration by 0.004. When figure 3.B is analyzed, it is determined that there is a significant relationship between the middle acceleration values of the subjects participating in the study and the left SFPT in the same direction (P<0.05). It was observed that the left SFPT value explained 19.4% of the middle acceleration. A one-unit change in the left SFPT value affects the middle acceleration by 0.006. Analyzing figure 3.C, it was found that there was a significant relationship between the middle acceleration values of the subjects participating in the study and the right SEPT in the same direction (P<0.05). It was observed that the right SEPT value explained 13.3% of the middle acceleration. A one-unit change in the right SEPT value affects middle acceleration by 0.002. When figure 3.D is examined, it is determined that there is a significant relationship between the middle acceleration values of the subjects participating in the study and the right SFPT in the same direction (P<0.05). It was observed that the right SFPT value explained 17.5% of the middle acceleration. A one-unit change in the right SFPT value affects the middle acceleration by 0.005.

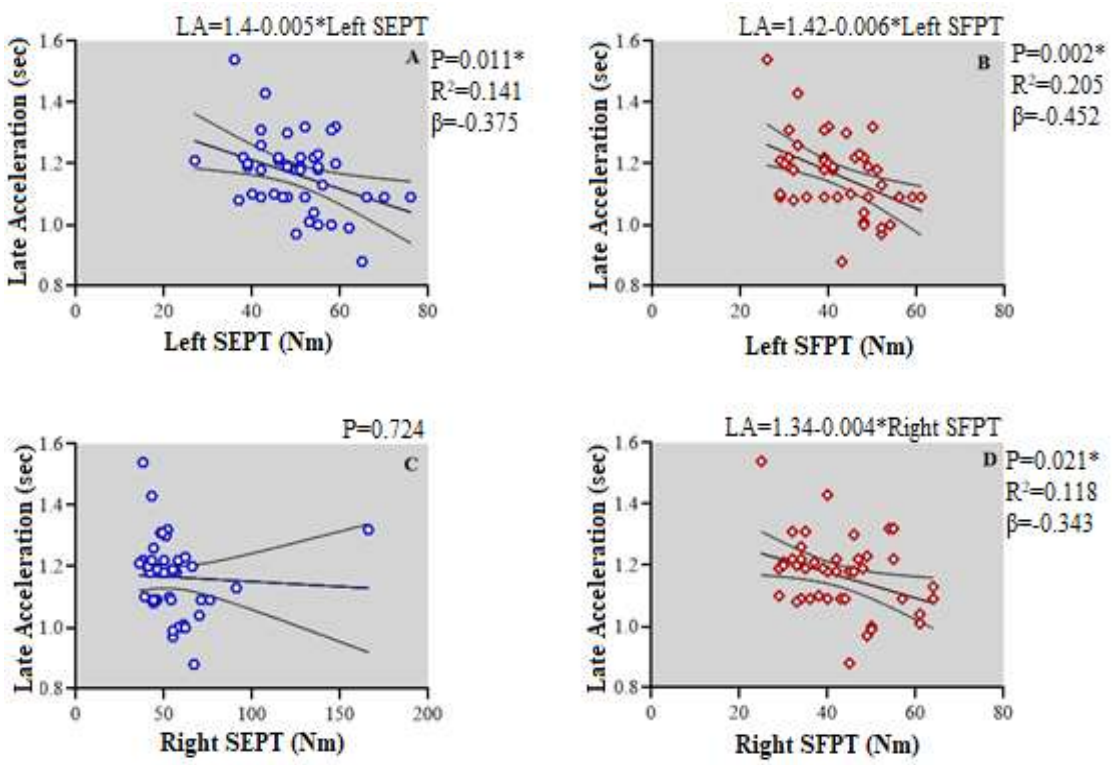

Figure 4. A: The relationship between late acceleration and left SEPT, B: The relationship between late acceleration and left SFPT, C: The relationship between late acceleration and right SEPT, D: The relationship between late acceleration and right SFPT.

When figure 4.A is analyzed, it was found that there was a significant relationship between the late acceleration values of the subjects participating in the study and the left SEPT in the same direction ($P<0.05$). It was observed that the left SEPT value explained 14.1% of the late acceleration. A one-unit change in the left SEPT value affects late acceleration by 0.005. According to figure 4.B, it was determined that there was a significant relationship between the late acceleration values of the subjects participating in the study and the left SFPT in the same direction ($P<0.05$). It was observed that the left SFPT value explained 20.5% of the late acceleration. A one-unit change in the left SFPT value affects late acceleration by 0.006. Analyzing figure 4.C, it was found that there was no significant relationship between the late acceleration values of the subjects participating in the study and the right SEPT ($P>0.05$). It was observed that the change in the right SEPT value did not affect the middle acceleration. Figure 4.D shows that there is a significant relationship between the late acceleration values of the subjects participating in the study and the right SFPT in the same direction ($P<0.05$). It was observed that the right SFPT value explained 11.8% of the late acceleration. A one-unit change in the right SFPT value affects late acceleration by 0.004.

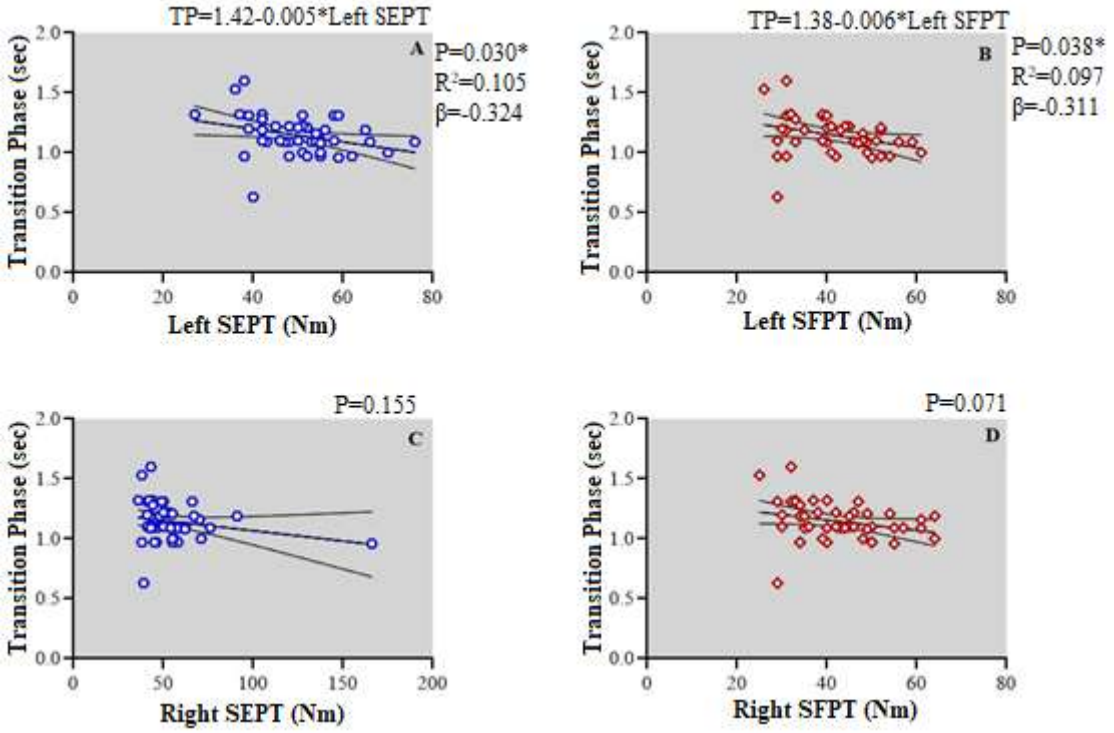

Figure 5. A: The relationship between the transition phase and the left SEPT, B: The relationship between the transition phase and the left SFPT, C: The relationship between the transition phase and the right SEPT, D: The relationship between the transition phase and the right SFPT.

Figure 5.A shows that there is a significant relationship between the transition phase values of the subjects participating in the study and the left SEPT in the same direction (P<0.05). It was seen that the left SEPT value explained the transition phase by 10.5%. A one-unit change in the left SEPT value affects the transition phase by 0.005. Figure 5.B shows that there is a significant relationship between the transition phase values of the subjects participating in the study and the left SFPT in the same direction (P<0.05). It was observed that the left SFPT value explained 9.7% of the transition phase. A one-unit change in the left SFPT value affects the transition phase by 0.006. An analysis of figure 5.C shows that there was no significant relationship between the transition phase values of the subjects who participated in the study and the right SFPT (P>0.05). It was observed that the change in the right SEPT did not affect the transition phase. According to figure 5.D, it was determined that there was no significant relationship between the transition phase values of the subjects participating in the study and the right SFPT (P>0.05). It was observed that the change in the right SFPT did not affect the transition phase.

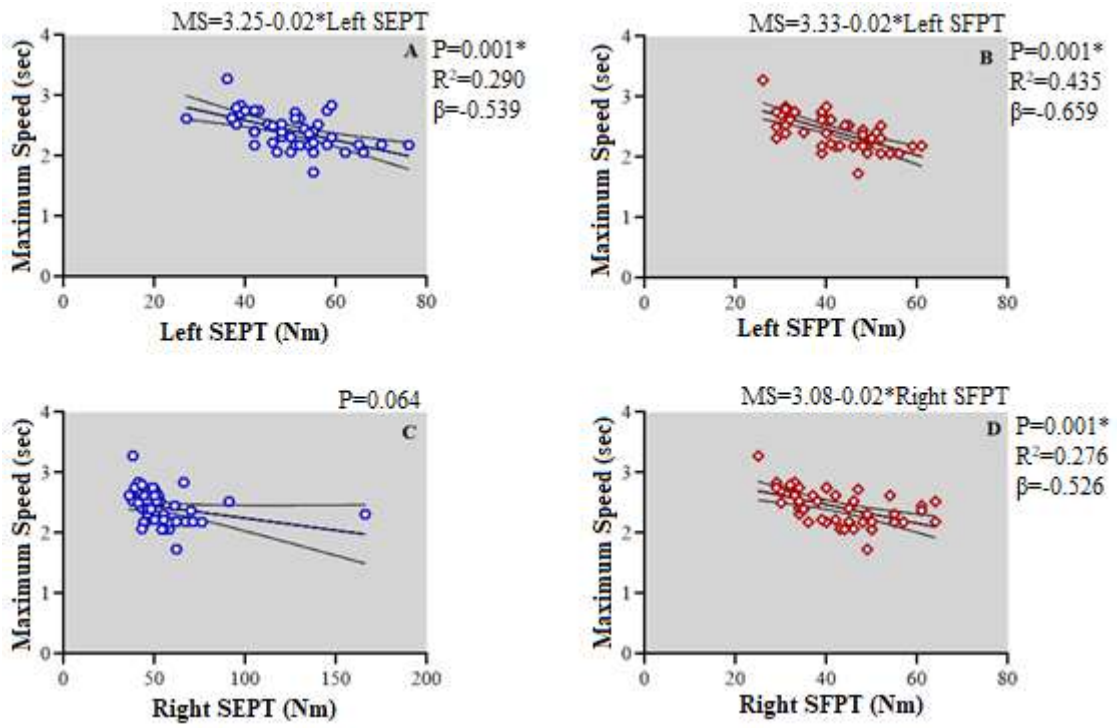

Figure 6. A: Relationship between maximum speed and left SEPT, B: Relationship between maximum speed and left SFPT, C: Relationship between maximum speed and right SEPT, D: Relationship between maximum speed and right SFPT.

Figure 6.A shows that there is a significant relationship between the maximum speed values of the subjects who participated in the study and the left SEPT in the same direction (P<0.05). It was observed that the left SEPT value explained 29% of the maximum speed. A one-unit change in the left SEPT value affects the maximum speed by 0.02. According to figure 6.B, it was found that there was a significant relationship between the maximum speed values of the subjects participating in the study and the left SFPT in the same direction (P<0.05). It was observed that the left SFPT value explained 43.5% of the maximum speed. A one-unit change in the left SFPT value affects the maximum speed by 0.02. Analyzing figure 6.C, it was found that there was no significant relationship between the maximum speed values of the subjects participating in the study and the right SEPT (P>0.05). It was observed that the change in the right SEPT did not affect the maximum speed. When figure 6.D was analyzed, it was determined that there was a significant relationship between the maximum speed values of the subjects participating in the study and the right SFPT in the same direction (P<0.05). It was observed that the right SFPT value explained 27.6% of the maximum speed. A one-unit change in the right SFPT value affects the maximum speed by 0.02.

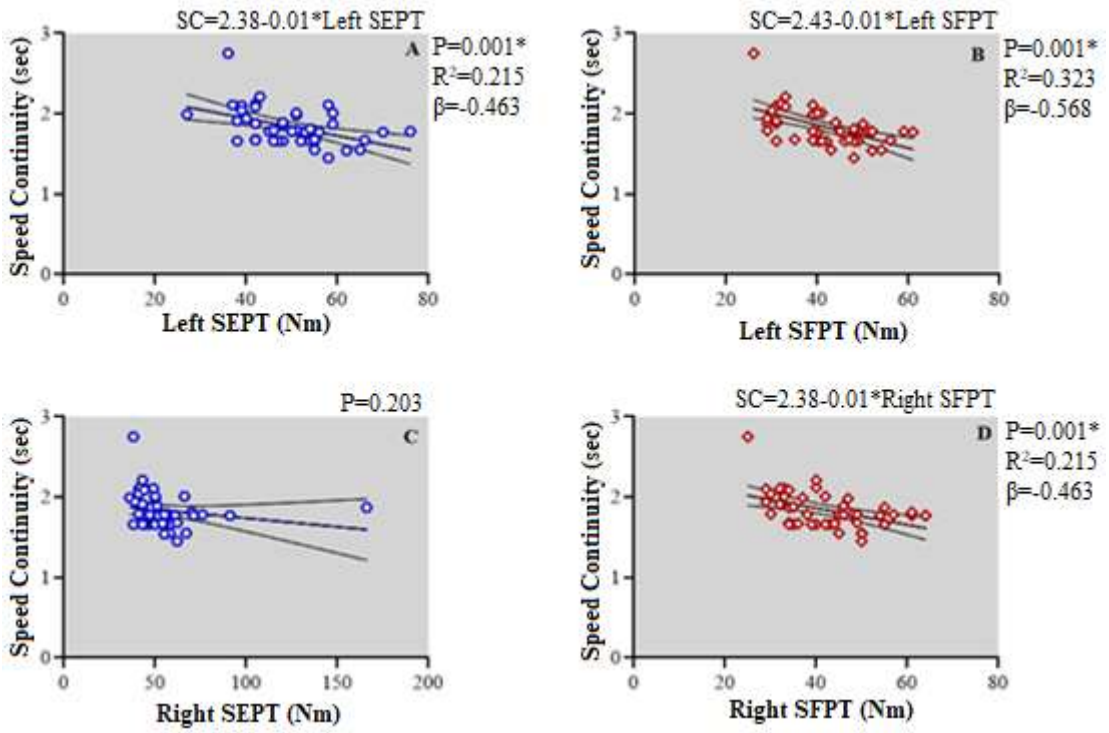

Figure 7. A: The relationship between continuity in speed and left SEPT, B: The relationship between continuity in speed and left SFPT, C: The relationship between continuity in speed and right SEPT, D: The relationship between continuity in speed and right SFPT.

Figure 7.A shows that there is a significant relationship between the speed continuity values of the subjects participating in the study and the left SEPT in the same direction (P<0.05). It was observed that the left SEPT value explained 21.5% of the speed continuity. A one-unit change in the left SFPT value affects speed continuity by 0.01. When figure 7.B was analyzed, it was determined that there was a significant relationship between the speed continuity values of the subjects participating in the study and the left SFPT in the same direction (P<0.05). It was observed that the left SFPT value explained 32.3% of the speed continuity. A one-unit change in the left SFPT value affects speed continuity by 0.01. Analyzing figure 7.C, it was determined that there was no significant relationship between the speed continuity values of the subjects who participated in the study and the right SEPT (P>0.05). It was observed that the change in the right SEPT did not affect the speed continuity. According to figure 7.D, it was determined that there was a significant relationship between the speed continuity values of the subjects participating in the study and the right SFPT in the same direction (P<0.05). It was seen that the right SFPT value explained 21.5% of the speed continuity. A one-unit change in the right SFPT value affects the speed continuity by 0.01.

DISCUSSION AND CONCLUSION

While there was no significant relationship between the left SEPT and reaction speed (Figure 1.A.), there was a significant relationship between the left SEPT and early acceleration (Figure 2.A.), middle acceleration (Figure 3.A.), late acceleration (Figure 4.A.), transition phase (Figure 5.A.), maximum speed (Figure 6.A.) and speed continuity (Figure 7.A.) No significant relationship was found between the left SFPT and reaction speed (Figure 1.B.), whereas there was a significant relationship in the same direction between the left SFPT and early acceleration (Figure 2.B.), middle acceleration (Figure 3.B.), late acceleration (Figure 4.B.), transition phase (Figure 5.B.), maximum speed (Figure 6.B.) and speed continuity (Figure 7.B.).

It was found that there was no significant relationship between the right SEPT and early acceleration (Figure 2.C.), late acceleration (Figure 4.C.), transition phase (Figure 5.C.), maximum speed (Figure 6.C.) and speed continuity (Figure 7.C.), while there was a significant relationship between the right SEPT and reaction speed (Figure 1.C.) and medium acceleration (Figure 3.C.). There was no significant relationship between the

right SFPT and early acceleration (Figure 2.D.) and transition phase (Figure 5.D.), while there was a significant relationship between the right SFPT and reaction speed (Figure 1.D.), medium acceleration (Figure 3.D.), late acceleration (Figure 4.D.), maximum speed (Figure 6.D.) and speed continuity (Figure 7.D.).

In a study, it was found that shoulder extensor and flexor muscles, concentric and the eccentric isokinetic strength characteristics had a good significant relationship with 5 m and 25 m sprint performance, and knee flexors and extensors and some concentric muscle strength characteristics had a moderately significant relationship with 25 m sprint performance, while the eccentric strength characteristics of these muscles had weak relationships with sprint performance (10). Hermassi et al. (12) observed that weightlifting strength training for upper body development improved 15-meter sprint performance in handball players, while Ortega-Becerra et al. (21) reported that upper extremity strength plays an important role in jump and sprint capacity. Hori (13) examined the relationship between sprinter and nonsprinter participants' sprint performance and the isokinetic strength and reported that there was a difference in the level of relationship as the angular velocity increased. In a study conducted on different age categories, although there was no significant relationship between the isokinetic strength values and sprint performance of 15-year-old soccer players, significant relationships were found at different levels in the 16, 17, and 18 age groups (22). Ibret (14) found a negative relationship between the isokinetic strength parameters and 10 m, 20 m, and 30 m sprint performance. Some studies have reported that there is no significant relationship between maximal strength, reaction speed and acceleration performance (23, 18, 24). Chelly and Denis (6) stated that muscle power is needed to maintain acceleration and maximum speed in sprint performance. Majumbar and Robergs (16) stated that muscle power makes a greater contribution to the acceleration phase of sprinting. In the study of 61 athletes, the highest change in acceleration and speed was observed in the 9.1 m range. At the same time, it was determined that lower body strength affects especially the first acceleration (3). In his study, Anahtarcıoğlu (1) examined the effect of upper extremity isokinetic muscle strength on 30-meter sprint performance in elite amputee soccer players. He stated that shoulder flexor strength increased 30-meter sprint performance.

In conclusion, the isokinetic shoulder strength is thought to have a significant effect on overall speed performance. The isokinetic shoulder strength has the most effect, especially in the maximum speed and speed continuity phases. Shoulder strength should be taken into consideration when organizing the training programs of athletes in all sports branches that include short- or long-distance speed performance.

REFERENCES

1. Anahtarcıoğlu KE. Ampute futbolunda üst ekstremite kuvvetinin koşu performansına etkisinin incelenmesi. Yüksek Tezi, Marmara Üniversitesi Sağlık Bilimleri Enstitüsü, İstanbul; 2024.
2. Bezodis I, Salo A, Kerwin D. Athlete-specific analyses of leg joint kinetics during maximum velocity sprint running. In ISBS-Conference Proceedings Archive; 2009.
3. Brechue WF, Mayhew JL, Piper FC. Characteristics of sprint performance in college football players. Journal of Strength and Conditioning Research, 2010; 24, 1169-1178.
4. Brown LE. Isokinetics in human performance. Human Kinetics, USA, p. 3-10; 2000.
5. Chan KM, Maffulli N. Principles and practice of ısokinetics in sports medicine and rehabilitation. Williams and Wilkins Asia-Pacific, Hong Kong; 1996.
6. Chelly SM, Denis C. Leg power and hopping stiffness: relationship with sprint running performance. Medicine and Science in Sports and Exercise, 2001; 33, 326-333.
7. Cunha L. The relation between different phases of sprint run and specific strength parameters of lower limbs. In Q. Wang, p. 183–186; 2005.
8. Gonzales FK. Comparison of stride length and stride frequency patterns of sprint performance in overground vs motorized treadmill sprinting. The University of Texas at El Paso; 2018.
9. Günay M, Yüce A. Futbol antrenmanının bilimsel temelleri, Gazi Kitabevi. Baskı, Ankara; 2008.
10. Gür H. Kısa mesafe koşu başarısı üzerine eklem kuvvet özellikleri ve takoz oturma pozisyonun etkileri; 1998.

11. Hall SJ. Basic biomechanics. New York, NY: McGraw-Hill Education; 2015.
12. Hermassi S, Schwesig R, Aloui G, Shephard RJ, Chely MS. Effects of Short-Term in-Season Weightlifting Training on the Muscle Strength, Peak Power, Sprint Performance, and Ball-Throwing Velocity of Male Handball Players. Journal of Strength and Conditioning Research, 2019; 33(12), 3309-3321.
13. Hori M, Suga T, Terada M, Tanaka T, Kusagawa Y, Otsuka M, Isaka T. Relationship of the knee extensor strength but not the quadriceps femoris muscularity with sprint performance in sprinters: a reexamination and extension. BMC Sports Science, Medicine and Rehabilitation, 2021; 13, 1-10.
14. İbret OS. Futbolda izokinetik bacak kuvvetinin fiziksel performans parametrelerine etkisi. Yüksek Lisans Tezi, Dumlupınar Üniversitesi, Sosyal Bilimler Enstitüsü, Kütahya; 2021.
15. Magrum ED. Outcomes of an ıntegrated approach to speed and strength training with an elite-level sprinter. Electronic Theses and Dissertations, p. 3187; 2017.
16. Majumbar AS, Robergs RA. The science of speed: Determinants of performance in the 100m sprint. International Journal of Sport Science and Coaching, 2011; 6, 479-494.
17. Mann RV. The mechanics of sprinting and hurdling. Charlestown, SC; 2013.
18. Morin JB, Bourdin M, Edouard P, Peyrot N, Samozino P, Lacour JR. Mechanical determinants of 100-m sprint running performance. European journal of applied physiology, 2012; 112, 3921-3930.
19. Morin JB, Edouard P, Samozino P.. New insights into sprint biomechanics and determinants of elite 100m performance. New Studies in athletics, 2013; 28, 87-103.
20. Nesser TW, Latin RW, Berg K, Prentice E. Physiological determinants of 40- meter sprint performance in young male athletes. Journal of Strength and Conditioning Research, 1996; 10, 263-267.
21. Ortega-Becerra M, Pareja-Blanco F, Jimenez-Reyes P, Cuadrado-Penafiel V, Gonzalez-Badillo JJ. Determinant Factors of Physical Performance and Specific Throwing in Handball Players of Different Ages. Journal of Strength and Conditioning Research, 2018; 32(6), 1778-1786.
22. Özdemir FM. Genç futbolcularda çeviklik, sürat, güç ve kuvvet arasındaki ilişkinin yaşa göre incelenmesi. Yüksek Lisans Tezi. Başkent Üniversitesi Sağlık Bilimleri Enstitüsü, Ankara; 2013.
23. Rabita G, Dorel S, Slawinski J, Saez-de-Villarreal E, Couturier A, Samozino P, Morin JB. Sprint mechanics in world-class athletes: a new insight into the limits of human locomotion. Scandinavian Journal of Medicine and Science in Sports, 2015; 25, 583- 594.
24. Slawinski J, Termoz N, Rabita G, Guilhem G, Dorel S, Morin JB, Samozino P. How 100-m event analyses improve our understanding of world-class men's and women's sprint performance. Scand J Med Sci Sports, 2017; 27, 45-54.
25. Şahin Ö, 2010. Rehabilitasyonda izokinetik değerlendirmeler. Cumhuriyet Medical Journal, 32, 386-396.
26. Weyand PG, Sandell RF, Prime DNL, Bundle MW, 2010. The biological limits to running speed are imposed from the ground up. J Appl Physiol, 108, 950–961.
27. Yu J, Sun Y, Yang C, Wang D, Yin K, Herzog W, Liu Y, 2015. Biomechanical insights into differences between the mid-acceleration and maximum velocity phases of sprinting. Journal of Strength and Conditioning Research, 30, 1906-1916.

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The Impact of Body Composition and Physical Fitness on Parasympathetic Reactivation in Firefighters

Nuray DEMİRALP [1A] **Hürmüz KOÇ** [2B]

[1] *Kastamonu University, Bozkurt Vocational High School Civil Defense and Firefighting Program, Kastamonu, TÜRKİYE*
[2] *Çanakkale Onsekiz Mart University Faculty of Sport Sciences, Coaching Education, Çanakkale, TÜRKİYE*

Address Correspondence to Nuray DEMIRALP: e-mail: ndemiralp@kastamonu.edu.tr

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A: Orcid ID: 0000-0002-3002-7752 B: Orcid ID: 0000-0003-1588-7583

Abstract

Firefighting involves aerobic and anaerobic physical activities that cause heart rates to rise from submaximal to above maximal levels. These varying demands can occur with each call firefighters respond to during their shift, imposing both acute and cumulative cardiovascular loads. Heart rate is commonly used to measure cardiovascular responses during disasters, emergencies, firefighting, and firefighting simulations. There is substantial evidence suggesting that heart rate recovery (HRR) parameters are associated with body composition and aerobic fitness. Therefore, the primary aim of this study is to determine the relationship between body composition, physical fitness, and HRR parameters in firefighters. This cross-sectional descriptive study was conducted among firefighters working in a metropolitan municipality. Using the G-Power 3.1 program, seventy-four firefighters (age = 32.61 ± 8.9 years, height = 1.76 ± 0.6 cm, weight = 83.9 ± 13 kg) volunteered to participate in this study. Body mass index (BMI), waist circumference (WC), and body fat percentage (BFP) were recorded for each subject. To determine aerobic fitness (VO_2max), each participant performed a submaximal exercise test on a treadmill. HRR was calculated as the difference between peak heart rates post-exercise (HRmax) and heart rates at the first and second minutes of the recovery phase, recorded as HRR1 and HRR2, respectively. The mean VO_2max and BMI of the participants were 48.32 ± 9.18 ml/kg/min and 27.10 ± 3.49 kg/m², respectively. No significant relationship was found between the HRR1 and HRR2 parameters and the variables of BMI, WC, and BFP in firefighters ($p>0.05$). However, positive significant relationships were detected between HRR1 and HRR2 and VO_2max ($p<0.05$). A statistically significant negative relationship was found between VO_2max and the variables of BMI, WC, BFP, and weight ($p<0.05$). These findings indicate that higher aerobic capacity is associated with better heart rate recovery and lower body fat percentage. The results of this study demonstrate that cardiovascular autonomic function is significantly related to maximum aerobic fitness. However, no measure of body composition appears to affect the overall HRR response of the firefighters. This research provides important insights into how the aerobic capacity of firefighters affects their heart rate recovery responses.

Keywords: Heart rate recovery, body composition, body mass index, physical fitness, firefighter.

Özet

Vücut Kompozisyonun ve Fiziksel Uygunluğun İtfaiyecilerde Parasempatik Reaktivasyona Etkisi

Yangınla mücadele, kalp atış hızlarının submaksimalden maksimumun üzerine çıkmasına neden olan aerobik ve anaerobik fiziksel aktiviteleri içermektedir. Bu değişen talepler, itfaiyecilerin vardiya sırasında yanıt verdiği her çağrıda ortaya çıkabilmekte ve itfaiyecilere hem akut hem de kümülatif kardiyovasküler yük bindirmektir. Kalp atım hızı, afet ve acil durumlarda, yangınla mücadelede ve yangınla mücadele simülasyonları sırasında kardiyovasküler tepkileri ölçmek için yaygın olarak kullanılmaktadır. Kalp atış hızı toparlanma (HRR) parametrelerinin vücut kompozisyonu ve aerobik kondisyonla ilişkili olduğuna dair önemli kanıtlar bulunmaktadır. Bu nedenle, mevcut çalışmanın temel amacı, itfaiyecilerde vücut kompozisyonu ve fiziksel uygunluğun, HRR parametreleri arasındaki ilişkiyi belirlemektir. Kesitsel tanımlayıcı tipte planlanan çalışma, bir büyükşehir belediyesinde görev yapan itfaiyeciler arasında gerçekleştirilmiştir. G-Power 3.1 programı kullanılarak yetmiş dört itfaiyeci (yaş = 32,61 ± 8,9 yıl, boy = 1,76 ± 0,6 cm, ağırlık = 83,9 ± 13 kg), bu çalışmaya katılmaya gönüllü oldu. Her denek için beden kütle indeksi (VKİ), bel çevresi (BÇ) ve vücut yağ yüzdesi (VYY) kaydedildi. Aerobik uygunluğu (VO2max) belirlemek için, her katılımcı bir koşu bandı üzerinde submaksimal egzersiz testi gerçekleştirdi. HRR, egzersiz sonrası pik kalp atım sayıları (KAHmax) ile dinlenme fazının ilk iki dakikasındaki kalp atım sayıları arasındaki farklar olarak hesaplandı ve HRR1 ve HRR2 dakika olarak kaydedildi. Katılımcıların; VO2max ve BKİ ortalamaları sırasıyla; 48,32 ± 9,18 ml/kg/dk ve 27,10 ± 3,49 kg/m2 olarak bulunmuştur. BKİ, BÇ, VYY değerlerinin ile itfaiyecilerin HRR1 ve HRR2 parametreleri arasında anlamlı ilişki saptanmamıştır. ($p>0,05$). Ancak, HRR1 ve HRR2 ile VO2max ile pozitif yönlü anlamlı ilişkiler tespit edilmiştir ($p<0,05$). BKİ, BÇ, VYY ve kilo değişkenleri ile VO2max arasında negatif yönlü istatistiksel olarak anlamlı ilişki bulunmuştur ($p<0,05$). Bu bulgular, daha yüksek aerobik kapasitenin daha iyi kalp atış hızı toparlanması ve daha düşük vücut yağ yüzdesi ile ilişkili olduğunu göstermektedir. Bu çalışmanın sonuçları, kardiyovasküler otonomik fonksiyonun maksimum aerobik kondisyon ile önemli ölçüde ilişkili olduğunu göstermektedir. Bununla birlikte, hiçbir vücut kompozisyonu ölçüsünün, itfaiyecilerin genel HRR tepkisini etkilemediğini göstermektedir. Bu araştırma, itfaiyecilerin aerobik kapasitesinin, kalp atış hızı toparlanma tepkilerini nasıl etkilediğini anlamada önemli katkılar sağlamaktadır.

Anahtar Kelimeler: Kalp atış hızı toparlanması, vücut kompozisyonu, beden kütle indeksi, fiziksel uygunluk, itfaiyeci

INTRODUCTION

Firefighting is a high-risk profession where numerous physical and psychological stress factors pose countless threats to the health of firefighters. The physical demands of firefighting are characterized by the significant activation of the cardiovascular, metabolic, and hormonal systems (1,2). Heart rates exceeding 95% of the maximum (188-190 beats per minute), high oxygen consumption rates (33.6-49.0 ml/kg/min), and significant activation of the sympathoadrenal axis have been recorded during firefighting, demonstrating the substantial physiological stresses that arise during these tasks (1–4). In addition to the anxiety caused by unknown conditions, critical time urgency, extreme temperatures, fire smoke and toxic gases, and a heavy workload, the weight of personal protective equipment (including a self-contained breathing apparatus, approximately 25 kg) significantly contributes to the excessive physiological responses and substantial activation of the cardiovascular system in firefighters. Numerous studies have also proven that sudden cardiac events are the leading cause of duty-related fatalities among firefighters (5–8).Therefore, it is not surprising that nearly half of the on-duty deaths among firefighters in the past decade have been attributed to sudden cardiac events (9). Most of these sudden cardiac deaths occur during or shortly after firefighting activities. Researchers have shown that a firefighter's likelihood of experiencing sudden cardiac death after responding to a call is 2.2 to 10.5 times higher compared to non-emergency duties (10). Firefighting involves aerobic and anaerobic physical activities that cause heart rates (HR) to rise from submaximal to maximal levels. These varying demands can arise with every call firefighters respond to during their shifts, imposing both acute and cumulative cardiovascular strain (11).

Heart rate (HR) is commonly used to measure cardiovascular responses during disasters and emergencies, firefighting, and firefighting simulations (12,13). Time and frequency domain analyses of spontaneous heart rate variability (HRV) based on R-R interval series in electrocardiography are important indicators for evaluating cardiac autonomic modulation in different functional states for both healthy and clinical populations. This outcome is widely used as a reliable non-invasive tool for monitoring cardiac

autonomic function (14,15). Based on the markedly elevated heart rate responses observed during firefighting activities among firefighters, the hypothesis posits that subsequent inappropriate activation of the sympathetic nervous system may increase the risk of sudden cardiac death (16). The post-exercise heart rate recovery (HRR) period is a widely utilized method for assessing the influences of the autonomic nervous system, including sympathetic and parasympathetic functions. HRR refers to the decrease in heart rate immediately following the cessation of exercise, predominantly due to the reactivation of parasympathetic or vagal nerve activity (17,18). The initial decrease in heart rate following exercise is largely attributed to the reactivation of the parasympathetic nervous system, primarily through input from the vagus nerve (19,20). HRR is considered a non-invasive and clinically useful measure for assessing the parasympathetic nervous system's ability to regain control of the sinoatrial node of the heart after physical exertion. Previous research has shown that the decrease in heart rate in the first minute after exercise (≤12 beats/min) is an independent predictor of all-cause and cardiovascular mortality, including in asymptomatic individuals (19). Given the high sympathetic nervous system activity linked to cardiovascular stress during firefighting and the subsequent risk of developing dangerous arrhythmias, using HRR measurements is crucial for assessing the reactivation of the parasympathetic nervous system after exertion among firefighters (21,22). Recent studies conducted with firefighters have measured the dynamic interaction between the sympathetic and parasympathetic nervous systems during recovery following exercise through Heart Rate Recovery (HRR). It has been found that firefighters with higher fitness levels exhibit enhanced HRR kinetics after both submaximal and maximal exercise, suggesting that physical fitness may positively influence the recovery of the autonomic nervous system in firefighters (23,24).

There is significant evidence showing that the autonomic control of heart rate is associated with body composition and aerobic fitness. For instance, poor HRR and HRV have been correlated with higher levels of body mass index (BMI), larger waist circumference (WC) measurements, and higher body fat percentages (BFP) (25,26). Research also indicates that the level of obesity is associated with poor HRR response after exercise in non-firefighter populations (26,27). In obese individuals, clinical studies have observed reductions in parasympathetic nervous system activity, which, combined with weight gain, can contribute to the poor HRR response post-exercise due to the delayed reactivation of the parasympathetic nervous system (25). Given the high prevalence of obesity among both active-duty firefighters and military firefighters, coupled with the significant sympathetic nervous system activity associated with firefighting, there is a need to identify the impact of body composition on firefighters' HRR response (28,29).

Due to the elevated heart rate (HR) response observed during firefighting activities, it has been hypothesized that the inappropriate increase in sympathetic nervous system activation following such activities may contribute to the risk of sudden cardiac death. We hypothesized that HRR, as a measure of parasympathetic reactivation, would be associated with obesity, central adiposity, and body fat measurements. Additionally, we anticipated a positive correlation between HRR and exercise performance, suggesting that greater parasympathetic activity would correspond to faster vascular recovery and an improvement in overall fitness.

METHOD

Research population and sample: This cross-sectional descriptive study sampled firefighters serving in a metropolitan area. The sample size was determined using the G-Power 3.1 program, with effect sizes classified according to Cohen's (1992) criteria of small, medium, and large effect sizes (30) The study comprised 74 volunteer firefighters, surpassing the initially calculated sample size of 68 participants with a power (1-β) of 0.90, effect size of 0.4, and alpha value of 0.05. Inclusion criteria required participants to have no diagnosed chronic illnesses confirmed by a physician and to be physically capable of engaging in physical activity. Before conducting physical tests and measurements, participants were assessed using the "Physical Activity Readiness Questionnaire (PAR-Q)" to identify any health conditions that could potentially hinder their participation in these activities. This questionnaire consists of seven items used to determine whether participants' medical needs and overall health are suitable for physical performance tests and exercise sessions. If a participant answered "yes" to any of these seven questions, they were excluded from participating in physical activity (31).

Anthropometric measurements: Height was measured using a stadiometer (SECA; Seca Instruments Ltd, Hamburg, Germany) with ±0.1 mm precision, while participants stood in anatomical position, feet together, and body weight evenly distributed on both feet. Body weight was measured using a digital scale (Tanita BC-545, Tanita Corp, Tokyo, Japan) with a precision of ±0.05 kg. Participants were instructed to remove their shoes and wear light sports attire (such as shorts and a t-shirt) during the measurement. Body Mass Index (BMI) was calculated using the formula "weight/height2 (kg/m2)." Waist circumference was measured with a tape measure at the umbilical level while participants stood upright with their abdomen relaxed.

Exercise Test: The Bruce protocol treadmill exercise test was conducted to determine firefighters' submaximal VO2max values. All tests were supervised by a healthcare professional and a sports scientist. The test started at a speed of 2.74 km/h (1.7 mph) and a 10% incline, with the treadmill incline increased by 2% every three minutes (32,33). During each three-minute incline increment, participants' instantaneous heart rates and perceived exercise difficulty levels were recorded. Test termination criteria were considered to determine when participants reached maximum effort during the test. These criteria included reaching above 85-90% of Maximum Heart Rate and perceiving a difficulty level above 16 at the end of exercise. The total duration spent by the participant in minutes during the test was considered as the "T" test score. The Maximum Heart Rate (HRmax) was calculated using the Karvonen method (220 - age). The numerical value obtained at the end of the applied test protocol was recorded as the participants' score. All data were transferred to a computerized environment. The Bruce Protocol Formula used for estimating VO2max for males is $VO2max = 14.8 - (1.379 \times T) + (0.451 \times T^2) - (0.012 \times T^3)$ (33).

Heart Rate Recovery Index (HRR): Data were recorded from participants following a treadmill exercise test for the analysis of the HRR index. All participants underwent a treadmill exercise test according to the Bruce protocol. Differences between the maximum heart rates measured just before terminating the exercise (peak heart rate) and the heart rates measured during the first and second minutes of the recovery phase were denoted as HRR1 and HRR2, respectively. Participants were subjected to the treadmill exercise test under Bruce protocol guidelines and heart rate monitoring. After reaching the target maximum heart rate, they transitioned to the rest phase. The heart rate during the first minute of the rest phase was recorded, and HRR was calculated by subtracting the heart rate at the highest point from this recorded value. A result of 12 beats per minute or higher was considered normal.

Ethical Considerations: The study received approval from the Clinical Research Ethics Committee of Kastamonu University Faculty of Medicine (2023-KAEK-51), and institutional permissions were obtained from the Metropolitan Municipality Fire Department where the study was conducted. Participants were informed about the research, and written and verbal consent were obtained from each participant.

Statistical Method: The data were analyzed using IBM SPSS. Descriptive statistics were reported for the unit count (n), percentages (%), mean (X), standard deviation (SD), median (M), minimum (min), and maximum (max) values. Normality of the numerical variables was assessed using the Shapiro-Wilk test. Correlation analysis was conducted to examine the relationship between independent variables (body composition parameters; BMI, WC, BF%, and VO2 max) and cardiovascular autonomic modulation indicators (HRR1, HRR2), with statistical significance set at $p<0.05$.

FINDINGS

Table 1. Descriptive statistics for participants' demographic characteristics (n=74).

Parameters	Statistics
Age, (*years*)	
X ± SS	32,61±8,99
M (min-max)	29 (23-60)
Marital Status, *n* (%)	
Single	37 (50%)
Maried	37 (50%)
Educational Status, *n* (%)	
High School	18 (24,3%)
Bachelor' s degree and above	56 (75,7%)
Working Hours as a Firefighter, (*years*)	
X ± SS	8,27 ± 7,37
M (min-max)	4 (2-40)
Total Working Time, (*years*)	
X ± SS	10,86 ± 8,72
M (min-max)	7,5 (2-40)
Smoking Use, *n* (%)	
Yes	41 (55,4%)
No	33 (44,6%)
* **Smoking Status**, *n* (%)	
Less than 10 years	26 (63,4%)
Over 10 years	15 (36,6%)

Descriptive statistics are presented as mean (X), standard deviation (SD), median (M), minimum (min), maximum (max), number (n), and percentage (%) values. * Percentages are calculated based on respondents who answered "Yes" (Multiple choice).

The average height of the participants was found to be 1.76 ± 0.06 cm, with an average weight of 83.98 ± 13.05 kg and a mean BMI of 27.10 ± 3.49 kg/m². According to BMI classification, 21 individuals (28.4%) were classified as normal weight, 40 (54.1%) as overweight, and 13 (17.6%) as obese. The average body fat percentage was 19.88 ± 5.54%, waist circumference averaged 93.47 ± 10.18 cm, hip circumference averaged 102.78 ± 7.48 cm, and waist-to-hip ratio averaged 0.91 ± 0.06 units, VO_2max level of the participants was determined as 48,32 ± 9,18 ml/kg/min. (Table 2).

Table 2. Descriptive statistics for participants' physical fitness characteristics (n=74).

Parameters	Statistics
Body Height, (*m*)	
X ± SS	1,76 ± 0,06
M (min-max)	1,8 (1,7-2)
Body Weight, (*kg*)	
X ± SS	83,98 ± 13,05
M (min-max)	81,8 (60-123,8)
Body Mass İndex, (kg/*m*²)	
X ± SS	27,10 ± 3,49
M (min-max)	27,3 (19,8-37)
Body Mass İndex Class, *n* (%)	
Suitable	21 (28,4%)
Overweight	40 (54,1%)
Obesity	13 (17,6%)
Body Fat Percentage, (%)	
X ± SS	19,88 ± 5,54
M (min-max)	20,5 (6,7-29,9)
Waist Circumference, (*cm*)	
X ± SS	93,47 ± 10,18
M (min-max)	92,5 (67-122)
Hip Circumference, (*cm*)	

X ± SS	102,78 ± 7,48
M (min-max)	102 (89-121)
Waist Hip Ratio, (%)	
X ± SS	0,91 ± 0,06
M (min-max)	0,9 (0,7-1,1)
VO_2 max Level, *(ml/kg/min)*	
X ± SS	48,32 ± 9,18
M (min-max)	46,8 (30,1-74,3)

Descriptive statistics are presented as mean (X), standard deviation (SD), median (M), minimum (min), maximum (max), number (n), and percentage (%) values.

Table 3. Descriptive statistics for participants' HRR data (*n*=74).

Parameters	**Statistics**
Max. KAH (beat/min)	
X ± SS	176,12 ± 10,59
M (min-max)	176 (144-197)
HR_{60}*(beat/min)*	
X ± SS	130,51 ± 14,2
M (min-max)	126,5 (88-165)
HR_{120}*((beat/min)*	
X ± SS	109,68 ± 16,27
M (min-max)	110 (84-144)
HRR_1. *((beat/min)*	
X ± SS	56,2±15,7
M (min-max)	58(12-82)
HRR_2. *((beat/min)*	
X ± SS	80,5±15,1
M (min-max)	84(39-110)

HR_{60}: heart rate at 60 seconds post-exercise; HR_{120}: heart rate at 120 seconds post-exercise; HRR_1: heart rate recovery at 60 seconds; HRR_2: heart rate recovery at 120 seconds

As seen in Table 4, there is a statistically significant positive relationship between HRR at minute 1 and HRR at minute 2 ($p<0.05$). There was also a positive relationship between HRR_1, HRR_2, and VO_2max ($p<0.05$), indicating that higher VO_2max values are associated with better heart rate recovery. Negative relationships were found between BMI, waist circumference (WC), body fat percentage (BF%), weight variables, and VO_2max ($p<0.05$), suggesting that higher cardiovascular fitness levels are associated with lower BF%, WC, and BMI.

Table 4. Correlations between body composition and HRR indices (*n*=74).

Parameters	**HRR_1.**	**HRR_2.**	**BMİ.**	**WC**	**BF(%)**	**BW**	**Age**
HRR_2	**r=0,812 p<0,001**						
BMİ	r=-0,103 p=0,384	r=-0,068 p=0,566					
WC	r =-0,159 p= 0.176	r =-0,131 p=0,267	**r =0,733 p<0,001**				
BF	R =-0,175 P=0,135	R=-0,112 P=0,342	**r=,0789 p<0,001**	**r= 0,721 p<0,001**			
BW	r=-0,095 p=0,419	r=-0,075 p=0,527	**r=0,872 p<0,001**	**r=0,728 p<0,001**	**r=0,730 p<0,001**		
Age	**r=-0,535 p<0,001**	**r=-0,470 p<0,001**	**r=0,369 p<0,001**	**r=0,421 p<0,001**	**r=0,353 p=0,002**	**r=0,254 p=0,029**	
VO_2max	**r = 0.324, p < 0.01**	**r = 0.381, p < 0.01**	**r=-0,409 p<0,001**	**r=-0,457 p<0,001**	**r=-0,351 p=0,002**	**r= -0,352 p=0,002**	**r=-0,350 P=0,002**

Bold-written spearman correlation coefficients (r) indicate statistically significant results ($p<0.05$).

DISCUSSION AND CONCLUSION

The aim of this study was to investigate the impact of body composition and physical fitness on post-exercise HRR in firefighters. It was hypothesized that measurements of BF%, BMI, and WC would significantly influence HRR responses. Contrary to this hypothesis, the study findings indicate that none of the body composition measures significantly affected overall HRR response in firefighters. However, VO2max values showed positive and significant correlations with HRR1 and HRR2 (Table 3).

In our study, it was found that body composition did not significantly affect the overall HRR response during rest periods among firefighters. This contrasts with previous research that identified significant relationships between various body composition measurements and HRR responses (27,34). Similarly, previous studies have predominantly used HRR60 and/or HRR120 measurements to characterize participants HRR responses. In their study examining post-exercise recovery in firefighters, Cornell et al. (2021) found no significant relationship between BMI, WC, BF%, and HRR, which aligns with our findings (21).

Cardiovascular fitness has been correlated with firefighting performance. Additionally, high cardiorespiratory fitness contributes to reducing the risk of sudden cardiac events while firefighters are engaged in their occupational activities (1,11). Similarly, it has been shown that post-exercise conditioning improves parasympathetic reactivation in well-trained athletes (35). In our study, based on firefighters' exercise test results, VO2max values show positive and significant correlations with HRR1 and HRR2 (Table 4). Similarly, in a study investigating the relationship between VO2max and HRR parameters in firefighters following submaximal and maximal exercise activities, firefighters with higher VO2max values demonstrated a faster decrease in HRR (24). High physical fitness is associated with improved recovery of the autonomic nervous system after maximum effort; this can mitigate the already heightened sympathetic nervous system activation during tasks of maximum or near maximum intensity among firefighters, compounded by factors such as advancing age and high BMI. This is particularly relevant during firefighting activities, where maximum effort is typically exerted. This is also the time when the risk of sudden cardiovascular events is highest during duty. Therefore, increasing physical fitness has been recognized as a method to reduce cardiovascular risk factors and combat sudden cardiac death incidence among the firefighter population. Moreover, combining improved physical fitness with reductions in obesity can also assist in developing adaptations specific to the autonomic nervous system. Low fitness levels among male firefighters have been associated with the risk of both electrocardiographic and non-electrocardiographic abnormalities during both maximum exercise testing and rest periods (36).

While the current study's findings offer valuable insights into the impact of body composition and physical fitness on HRR responses among firefighters, a population underrepresented in scientific literature, its strength is constrained by a small sample size (n = 74). Furthermore, the study exclusively included male firefighters, complicating the assessment of potential gender-mediated effects on the association between body composition, physical fitness, and HRR responses.

HRR response was characterized only after submaximal exercise in this study. Furthermore, the current study did not include aspects inherent to the occupational duties of firefighting, such as heat stress or the use of personal protective equipment, which add additional cardiovascular and physiological burdens to firefighters. Therefore, future research should encompass larger sample sizes comprising actively serving firefighters from various fire departments and should utilize both submaximal and maximal exercise paradigms to further characterize responses under conditions with and without heat stress and personal protective equipment. Moreover, while previous research has identified improvements in parasympathetic nervous system activity as a result of weight loss, the most effective interventions to investigate such adaptations in the firefighter population are currently unknown (27,34). It is believed that in the future, research exploring the effects of diverse health and fitness interventions such as aerobic exercise, resistance training, dietary behavior modifications, and others on BF adaptations among firefighters will be crucial.

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REFERENCES

1. Gledhill N, Jamnik VK. Characterization of the physical demands of firefighting. Can J Sport Sci [Internet]. 1992 Sep 1 [cited 2023 Aug 10];17(3):207–13. Available from: https://europepmc.org/article/med/1325260
2. Horn GP, Blevins S, Fernhall B, Smith DL. Core temperature and heart rate response to repeated bouts of firefighting activities. https://doi.org/101080/001401392013818719 [Internet]. 2013 Sep [cited 2023 Aug 10];56(9):1465–73. Available from: https://www.tandfonline.com/doi/abs/10.1080/00140139.2013.818719
3. Al-Zaiti S, Rittenberger JC, Reis SE, Hostler D. Electrocardiographic Responses during Fire Suppression and Recovery among Experienced Firefighters. J Occup Environ Med. 2015 Sep 1;57(9):938–42.
4. Pluntke U, Gerke S, Sridhar A, Weiss J, Michel B. Evaluation and Classification of Physical and Psychological Stress in Firefighters using Heart Rate Variability. Proc Annu Int Conf IEEE Eng Med Biol Soc EMBS. 2019 Jul 1;2207–12.
5. Kales SN, Soteriades ES, Christophi CDA, Christiani DC, Bs MPHA, Ac TR. Emergency Duties and Deaths from Heart Disease among Firefighters in the United States. https://doi.org/101056/NEJMoa060357 [Internet]. 2007 Mar 22 [cited 2023 Jul 19];356(12):1207–15. Available from: https://www.nejm.org/doi/full/10.1056/NEJMoa060357
6. Smith DL, Barr DA, Kales SN. Extreme sacrifice: Sudden cardiac death in the US Fire Service. Extrem Physiol Med [Internet]. 2013 Feb 1 [cited 2023 Jul 28];2(1):1–9. Available from: https://link.springer.com/articles/10.1186/2046-7648-2-6
7. Rodrigues S, Paiva JS, Dias D, Cunha JPS. Stress among on-duty firefighters: An ambulatory assessment study. PeerJ [Internet]. 2018 Dec 11 [cited 2023 Jul 19];2018(12):e5967. Available from: https://peerj.com/articles/5967
8. Fahy RF, Leblanc PR, Molis JL. Firefighter Fatalities in the United States-2016. 2017 [cited 2023 Aug 10]; Available from: www.nfpa.org/research
9. Haller JM, Smith DL. Examination of Strenuous Activity Preceding Cardiac Death during Firefighting Duties. Saf 2019, Vol 5, Page 50 [Internet]. 2019 Aug 9 [cited 2024 May 31];5(3):50. Available from: https://www.mdpi.com/2313-576X/5/3/50/htm
10. Kales SN, Smith DL. Firefighting and the heart. Circulation [Internet]. 2017 Apr 4 [cited 2024 May 31];135(14):1296–9. Available from: http://ahajournals.org
11. Soteriades ES, Smith DL, Tsismenakis AJ, Baur DM, Kales SN. Cardiovascular disease in US firefighters: A systematic review. Cardiol Rev [Internet]. 2011 Jul [cited 2023 Jul 28];19(4):202–15. Available from: https://journals.lww.com/cardiologyinreview/Fulltext/2011/07000/Cardiovascular_Disease_in_US_Firefighters__A.5.aspx
12. Dolezal BA, Boland DM, Carney J, Abrazado M, Smith DL, Cooper CB. Validation of heart rate derived from a physiological status monitor-embedded compression shirt against criterion ECG. J Occup Environ Hyg [Internet]. 2014 Dec 15 [cited 2023 Jul 19];11(12):833–9. Available from: https://pubmed.ncbi.nlm.nih.gov/24896644/
13. Smith DL, Horn GP, Fernhall B, Kesler RM, Fent KW, Kerber S, et al. Electrocardiographic Responses Following Live-Fire Firefighting Drills. J Occup Environ Med [Internet]. 2019 Dec 1 [cited 2023 Jul 19];61(12):1030. Available from: /pmc/articles/PMC8630674/
14. Pumprla J, Howorka K, Groves D, Chester M, Nolan J. Functional assessment of heart rate variability: physiological basis and practical applications. Int J Cardiol. 2002 Jul 1;84(1):1–14.
15. Kleiger RE, Stein PK, Bigger JT. Heart Rate Variability: Measurement and Clinical Utility. Ann Noninvasive Electrocardiol [Internet]. 2005 Jan 1 [cited 2023 Aug 28];10(1):88–101. Available from: https://onlinelibrary.wiley.com/doi/full/10.1111/j.1542-474X.2005.10101.x
16. Smith DL, DeBlois JP, Kales SN, Horn GP. Cardiovascular strain of firefighting and the risk of sudden cardiac events. Exerc Sport Sci Rev [Internet]. 2016 Jun 1 [cited 2022 Sep 16];44(3):90–7. Available from: https://journals.lww.com/acsm-essr/Fulltext/2016/07000/Cardiovascular_Strain_of_Firefighting_and_the_Risk.2.aspx
17. Peçanha T, Silva-Júnior ND, Forjaz CL de M. Heart rate recovery: autonomic determinants, methods of assessment and association with mortality and cardiovascular diseases. Clin Physiol Funct Imaging [Internet]. 2014 Sep 1 [cited 2023 Aug 28];34(5):327–39. Available from: https://onlinelibrary.wiley.com/doi/full/10.1111/cpf.12102
18. Sandercock GRH, Brodie DA. The use of heart rate variability measures to assess autonomic control during exercise. Scand J Med Sci Sports [Internet]. 2006 Oct 1 [cited 2023 Aug 28];16(5):302–13. Available from: https://onlinelibrary.wiley.com/doi/full/10.1111/j.1600-0838.2006.00556.x
19. Hristopher C, Ole RC, Ugene E, Lackstone HB, Ashkow RJP, Laire C, et al. Heart-Rate Recovery Immediately after Exercise as a Predictor of Mortality. https://doi.org/101056/NEJM199910283411804 [Internet]. 1999 Oct 28 [cited 2023 Jul 31];341(18):1351–7. Available from: https://www.nejm.org/doi/full/10.1056/nejm199910283411804
20. Goldberger JJ, Le FK, Lahiri M, Kannankeril PJ, Ng J, Kadish AH. Assessment of parasympathetic reactivation after exercise. Am J Physiol - Hear Circ Physiol [Internet]. 2006 Jun [cited 2023 Aug 28];290(6):2446–52. Available from: https://journals.physiology.org/doi/10.1152/ajpheart.01118.2005
21. Cornell DJ, Noel SE, Zhang X, Ebersole KT. Influence of Body Composition on Post-Exercise Parasympathetic Reactivation of Firefighter Recruits. Int J Environ Res Public Heal 2021, Vol 18, Page 339 [Internet]. 2021 Jan 5 [cited 2024 Jun 1];18(1):339. Available from: https://www.mdpi.com/1660-4601/18/1/339/htm

22. Cornell DJ, Noel SE, Zhang X, Ebersole KT. Influence of a Training Academy on the Parasympathetic Nervous System Reactivation of Firefighter Recruits—An Observational Cohort Study. Int J Environ Res Public Heal 2021, Vol 18, Page 109 [Internet]. 2020 Dec 26 [cited 2024 Jun 1];18(1):109. Available from: https://www.mdpi.com/1660-4601/18/1/109/htm
23. Dzikowicz DJ, Carey MG. Correlates of Autonomic Function, Hemodynamics, and Physical Activity Performance During Exercise Stress Testing Among Firefighters. Biol Res Nurs [Internet]. 2023 [cited 2023 Jul 19];25(3). Available from: https://pubmed.ncbi.nlm.nih.gov/36446383/
24. Cornell DJ, Flees RJ, Shemelya CM, Ebersole KT. Influence of Cardiorespiratory Fitness on Cardiac Autonomic Recovery Among Active-Duty Firefighters. J strength Cond Res [Internet]. 2024 Jan 1 [cited 2024 Jun 22];38(1):66–73. Available from: https://journals.lww.com/nsca-jscr/fulltext/2024/01000/influence_of_cardiorespiratory_fitness_on_cardiac.8.aspx
25. Millis RM, Austin RE, Hatcher MD, Bond V, Faruque MU, Goring KL, et al. Association of body fat percentage and heart rate variability measures of sympathovagal balance. Life Sci. 2010 Jan 30;86(5–6):153–7.
26. Esco MR, Henry NW, Michele SO. Skinfold thickness is related to cardiovascular autonomic control as assessed by heart rate variability and heart rate recovery. J Strength Cond Res [Internet]. 2011 Aug [cited 2024 Jun 1];25(8):2304–10. Available from: https://journals.lww.com/nsca-jscr/fulltext/2011/08000/skinfold_thickness_is_related_to_cardiovascular.31.aspx
27. Barbosa Lins TC, Valente LM, Sobral Filho DC, Barbosa e Silva O. Relation between heart rate recovery after exercise testing and body mass index. Rev Port Cardiol (English Ed. 2015 Jan 1;34(1):27–33.
28. C Poston WS, Keith Haddock C, Jahnke SA, Jitnarin N, Tuley BC. The Prevalence of Overweight, Obesity, and Substandard Fitness in a Population-Based Firefighter Cohort HHS Public Access. J Occup Env Med. 2011;53(3):266–73.
29. Hosick PA, Matthews EL, Leigh S. Cardiorespiratory fitness and the relationship between body fat and resting testosterone in men. https://doi.org/101080/1381345520181491996 [Internet]. 2018 Jan 1 [cited 2022 Sep 14];126(1):61–6. Available from: https://www.tandfonline.com/doi/abs/10.1080/13813455.2018.1491996
30. Cohen J. Statistical Power Analysis. Curr Dir Psychol Sci [Internet]. 1992 Jun 1 [cited 2024 Aug 6];1(3):98–101. Available from: https://journals.sagepub.com/doi/abs/10.1111/1467-8721.ep10768783
31. ACSM's Exercise Testing and Prescription - Madeline Paternostro Bayles - Google Kitaplar [Internet]. [cited 2024 Jul 8]. Available from:https://books.google.com.tr/books?hl=tr&lr=&id=X8SpEAAAQBAJ&oi=fnd&pg=PT20&dq=American+College+of+Sports+Medicine.+(2018).+ACSM%27s+Guidelines+for+Exercise+Testing+and+Prescription+(10th+ed.).+Philadelphia:+Wolters+Kluwer.&ots=FScoYpGIdF&sig=1unBDFjWUI9WSXbRMA_5XkdzYn4&redir_esc=y#v=onepage&q=American College of Sports Medicine. (2018). ACSM's Guidelines for Exercise Testing and Prescription (10th ed.). Philadelphia%3A Wolters Kluwer.&f=false
32. Bruce RA, Kusumi F, Hosmer D. Maximal oxygen intake and nomographic assessment of functional aerobic impairment in cardiovascular disease. Am Heart J. 1973 Apr 1;85(4):546–62.
33. Foster C, Porcari JP, Anderson J, Paulson M, Smaczny D, Webber H, et al. The talk test as a marker of exercise

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Investigation of the Relationship Between Kinesiophobia, Foot and Ankle Function and Physical Activity of Athletes with Chronic Ankle Instability

Sinan SEYHAN [1A], Görkem AÇAR [2B], Yusuf YAŞASIN [2C], Berkay ÜZÜMCÜ[3D]

[1] *Celal Bayar University, Faculty of Sport Sciences, Manisa, TÜRKİYE*
[2]*Bahçeşehir University, Institute of Graduate Studies, Physiotherapy and Rehabilitation Doctora Program, Istanbul, TÜRKİYE*
[3]*Berton Robotic Technology and Health Inc., Istanbul, TÜRKİYE*

Address Correspondence to Sinan SEYHAN: e-mail: sinanseyhan@gmail.com

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A: Orcid ID: 0000-0002-4979-7992, B: Orcid ID: 0000-0002-0970-8625, C: Orcid ID: 0009-0004-7193-7252, D: Orcid ID: 0000-0002-6519-6273

Abstract

Lateral ankle sprains (LAS) are common in athletes and 40% lead to chronic ankle instability (CAI). CAI is characterised by recurrent sprains and limitation of motion. Our study investigated the relationship between kinesiophobia, foot-ankle function, and physical activity in athletes with chronic ankle instability. In our study, 112 individuals with CAI who have been doing regular sports for at least 5 years were included. Tampa kinesiophobia test, Foot and Ankle Ability Measure (FAAM), and International Physical Activity Questionnaire (Short Version) were administered to the included individuals via Google form. IBM Statistical Package for Social Sciences Version 26.0 (SPSS inc, Chicago, IL, USA) was used. Pearson's test analysis was used in the study, and statistical significance was taken as $p \leq 0.05$ for all measurements in two directions. 115 participants (75 males and 40 females) were included in the study. The descriptive characteristics of the participants were 20.43±3.92 (years), 176.14±9.28 (cm) and 67.88±11.57 (kg). In addition, the subjects' International Physical Activity Score (Short Version) showed that 34 were inactive, 54 were minimally active, and 27 were very active. There was a moderate negative correlation between the Tampa Kinesiophobia score and FAAM sport and DLA subscores ($p<.001$). Individuals with increased kinesiophobia scores had decreased Foot and Ankle Ability Measure scores. According to the studies, studies on foot and ankle range of motion, position perception, and balance in individuals with CAI may decrease kinesiophobia.

Keywords: Chronic foot instability, kinesiophobia, foot function.

Kronik Ayak Bileği İnstabilitesi Olan Sporcularda Kinezyofobi, Ayak ve Ayak Bileği Fonksiyonu ve Fiziksel Aktivite Arasındaki İlişkinin İncelenmesi

Özet

Lateral ayak bileği burkulmaları (LAS) sporcularda sık görülmektedir ve %40'ı kronik ayak bileği instabilitesine (KAİ) yol açmaktadır. KAİ, tekrarlayan burkulmalar ve hareket kısıtlılığı ile karakterizedir. Çalışmamızda, kronik ayak bileği instabilitesine sahip sporcularda kinezyofobi, ayak-ayak bileği fonksiyonu ve fiziksel aktivitenin arasındaki ilişkinin incelenmesi hedeflenmiştir. Çalışmamıza en az 5 yıl düzenli spor yapan 112 KAİ'li bireyler dahil edilmiştir. Dahil edilen bireylere Google form aracılığıyla, Tampa kinezyofobi testi, Ayak ve Ayak Bileği Yetenek Ölçüsü (FAAM) ve Uluslararası

Fiziksel Aktivite Anketi (Kısa Versiyon) uygulanmıştır. IBM Statistical Package for Social Sciences Version 26.0 (SPSS inc, Chicago, IL, USA) ile incelenmiştir. Çalışmada Pearson test analizi ile hesaplanmış olup, tüm ölçümlerde istatistiksel anlamlılık p≤0.05 olarak iki yönlü alınmıştır. Çalışmamıza 115 kişi (75 erkek ve 40 kadın) dahil edilmiştir. Çalışmaya katılanların tanımlayıcı özellikleri 20,43±3,92 (yıl), 176,14±9,28 (cm) ve 67,88±11,57 (kg) olarak bulundu. Ayrıca kişilerin Uluslararası Fiziksel Aktivite Skoru (Kısa Versiyon) 34 kişi inaktif, 54 kişi minimal aktif ve 27 kişi çok aktif bulundu. Kişilerin Tampa Kinezyofobi skoru ile FAAM spor ve GYA alt skorları arasında orta derecede negatif korelasyon bulundu (p<.001). Kinezyofobi skoru puanında artış olan kişilerde Ayak ve Ayak Bileği Yetenek Ölçüsü puanında azalma bulunmuştur. Yapılan çalışmalara göre, KAİ'li bireylerde ayak ve ayak bileği eklem hareket açıklığı, pozisyon algısı ve denge üzerine yapılan çalışmaların, kinezyofobi üzerinde azalmaya yol açabileceği düşünülmektedir.

Anahtar Kelimeler: Kronik ayak instabilitesi, kinezyofobi, ayak fonksiyonu.

INTRODUCTION

The foot is a complex structure comprising 26 bones, 33 ligaments, and many joints located in the distal part of the body. It provides contact with the ground and carries body weight during activities such as walking, running, and jumping. It consists of three main arches: medial longitudinal, lateral longitudinal, and transverse (28).

Lateral ankle sprains (LAS) are common musculoskeletal injuries, accounting for 10-30% of sports-related injuries, affecting many physically active individuals (14,15). Complications from LAS include osteoarthritis, sensory limb dysfunction, reduced quality of life, and significant life burdens (34). Around 40-70% of LAS patients develop chronic ankle instability (CAI), characterized by a history of LAS, recurrent sprains, and ankle deficits lasting over a year (19,10). CAI involves impairments in range of motion, muscle strength, postural control, and movement strategies, leading to recurrent sprains, stability issues, frequent ankle injuries, and biomechanical abnormalities (10,36). Frigg et al. identified the bony structures of the ankle joint as a risk factor for CAI. The ankle's biomechanics involve complex movements, with the lateral collateral ligaments of the subtalar joint (STJ) playing a critical role in stability during supination (6-23). The anterior talofibular ligament (ATFL) is a second stabilizer when the ankle reaches varus through plantar flexion (8). The STJ, which includes the talus and calcaneus, connects ligaments commonly damaged in LAS. CT scans revealed that CAI patients have distinct morphological features in the calcaneus and talus, potentially contributing to CAI risk (29). In 2010, ankle sprains in U.S. emergency departments were 3.29 per 1,000 persons yearly (26). A 2016 study on sub-elite Australian football athletes reported an incidence of 3.1 per 1,000 athletes during the season (33).

Kinesiophobia is an irrational and excessive fear of movement that leads to avoidance of physical activity due to perceived risk of injury. This fear can transform acute pain into chronic pain as individuals limit movement to avoid potential pain increase. It has three components: a threatening stimulus, increased sympathetic arousal, and defensive behavior (22). Kinesiophobia negatively impacts athletes by hindering rehabilitation and return to sport (16). It involves a debilitating fear of physical activity due to vulnerability to painful injury or re-injury (27). This condition affects athletes both physically (e.g., decreased muscle strength, impaired proprioception, and reduced range of motion) and psychologically (e.g., anxiety, depression, and lower health-related quality of life) (1,35). Fear of movement increases pain-related fear and is associated with avoidance behaviors (3). Various movements performed using muscles and requiring energy expenditure are called physical activity. Physical activity can be performed in daily life, leisure time, work life, or during active transport (21). Various movements performed using muscles and requiring energy expenditure are called physical activity. Physical activity can be performed in daily life, leisure time, work life or during active transport (21). Given the connection between physical activity and a lower risk of mortality, heart disease, obesity, asthma, and some cancers, it is important to identify factors like musculoskeletal injuries that could lead to long-term reductions in physical activity (24).

In general, CAI is frequently encountered, especially in contact sports. Increasing kinesiophobia in athletes after CAI affects the performance, daily life activities and physical activities of athletes. In athletes with CAI, joint perception, decreased strength, decreased range of motion and impaired balance occur. Although they return to the field after rehabilitation, decreases in performance due to kinesiophobia are also observed. However, there are not many studies in the literature on whether there is a direct relationship between foot and ankle function and kinesiophobia in athletes with CAI.

Our primary hypothesis was to examine the relationship between kinesiophobia and foot and ankle function and our secondary hypothesis was to examine the relationship between kinesiophobia and physical activity.

Therefore, in this study, the relationship between kinesiophobia and foot and ankle and athletes' physical activity in individuals with chronic ankle instability were investigated.

METHOD

Participants

The participants' inclusion criteria were being between the ages of 18 and 35, having had at least one foot and ankle injury in the last year, and having been participating in regular sports activities for at least 5 years. In addition, the participants' exclusion criteria were having undergone any lower extremity surgery in the last year and having any neurological or psychiatric problems.

Data Collection Tools

- Sociodemographic Form: It consists of information such as gender, height, weight, etc.

- Tampa Kinesiophobia Test: The Tampa Kinesiophobia Scale (TSK), developed in 1991 by R. Miller, S. Kopri, and D. Todd, measures an individual's excessive fear of physical movement and activity, known as kinesiophobia (31). This fear stems from a perceived vulnerability to injury. Burak Kese and colleagues validated and found the Turkish version of the TSK reliable. Scores on the self-administered test range from 17 to 68 points, with higher scores indicating higher levels of kinesiophobia (18).

- Foot and Ankle Ability Measure (FAAM): The Foot and Ankle Ability Measure (FAAM) consists of 29 items divided into two subscales: 21 items for 'Activities of Daily Living' (ADL) and 8 items for 'Sports.' Each item is rated from 0 to 4, with 4 representing 'no difficulty' and 0 representing 'unable.' The maximum possible scores are 84 for ADL and 32 for Sports, scaled from 0 to 100, with higher scores indicating better physical function (9). The Turkish version of the FAAM has been validated. It is considered reliable for evaluating physical function in individuals with chronic ankle instability, with intraclass correlation coefficients of 0.97 for ADL and 0.94 for Sports (20).

- International Physical Activity Questionnaire (Short Version): The International Physical Activity Assessment Questionnaire (IFAA) developed by Öztürk was developed to determine individuals' physical activity and sedentary lifestyles. There are two separate designs as short and long form. The short form consists of 7 questions; it provides data on vigorous and moderate vigorous physical activities and time spent walking. Time spent at rest is assessed as a separate question. The total score is calculated in the short form by summing the duration and frequency according to the exercise intensity class. Severe physical activity= 8.0 METs, Moderate physical activity= 4.0 METs, Walking= 3.3 METs. For example, the score of an individual who walks for 40 minutes 2 days a week is calculated as 3.3x40x2= 264 MET-min/week. UFAA categorization: I category: inactive: <600 MET-min/hf II category: minimally active: 600 < 3000 MET-min/hf 42 (25).

Statistical Analysis

Statistical analysis will be conducted using IBM SPSS Statistics for Windows, Version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables will be expressed as mean ± standard deviation, while categorical variables will be presented as frequencies and percentages. Descriptive statistics for quantitative variables will include measures of central tendency and dispersion, and the distribution of categorical variables will be assessed using frequency analysis. Pearson's correlation test will examine relationships between variables, with a threshold for statistical significance set at $p \leq 0.05$ for all two-tailed tests.

The study's sample size was determined using the G*Power 3.1.9.7 program for a correlation test. Based on an effect size of 0.950, a 5% margin of error, and 95% power, 115 participants were calculated (32).

Ethics Approval and Institutional Permission

Ethical approval was obtained from Çankırı Karatekin University Ethics Committee Institutional Review Board within protocol 2024-13. In addition, this study adhered to the principles outlined in the Declaration of

Helsinki. All participants gave informed consent and written informed consent was obtained from each participant. Evaluations were conducted online via Google Forms.

FINDINGS

As a result of the study, 115 people (75 males and 40 females) out of 177 people with CIA were included. The participants participated in football, athletics, basketball, futsal, handball, gymnastics, judo, karate, kickbox, korfball, taekwondo, tennis, triathlon, volleyball, and swimming. The demographic data of the participants are given in Table 1. The physical activity scores of the participants were found to be 34 people inactive, 54 people minimally active, and 27 people very active. The physical activity scores of the participants are given in Table 2.

As a result of the correlation test, a moderate negative correlation (r= -,37, r= -,36) was found in the Tampa Kinesiophobia test score, FAAM sports, and daily life activity (DLA) sub-parameters (p<,0001). The Pearson correlation results of the parameters are given in Table 3.

Table 1. Demographic data

	n	Means	SD
Age (years)	115	20,43	±3,92
Height (cm)	115	176,14	±9,28
Weight (kg)	115	67,88	±11,57
Tampa Kinesiophobia Test	115	39,03	±8,07
FAAM Sports Subscale (%)	115	74,08	±22,25
FAAM Daily Living Activity (DLA) Subscale (%)	115	70,95	±24,86

FAAM: foot and ankle ability measure.

Table 2. International physical activity test (short version)

	n	**Percentage (%)**
Inactive	34	%29,5
Minimal Active	54	%47
Very Active	27	%23,5
Total	115	%100

Table 3. Pearson's correlation test result

	Tampa Kinesiophobia Test	**Faam Sports Subscale**	**Faam Dla Subscale**
Tampa Kinesiophobia Test	-	-	-
Faam Sports Subscale	**-.37***	-	-
Faam Dla Subscale	**-.36***	**.86***	-

*P<0.05, FAAM: Foot and ankle ability measure; DLA: Daily living activity.

DISCUSSION AND CONCLUSION

Our study found that FAAM sports and DLA scores decreased inversely proportional to the increase in kinesiophobia score. Therefore, athletes with kinesiophobia may experience significant loss of function in the foot and ankle during sports activities or daily life activities.

Studies conducted on athletes have observed in the literature that parallel with the increase in the score of the kinesiophobia test in individuals with CAI, balance with eyes open and closed worsens, foot-ankle joint range of motion decreases, and position perception decreases in foot-ankle joint range of motion (1,32). Watanabe et al. In a study conducted in 2023, 42 college-active athletes with kinesiophobia, ankle instability and ankle and 42 college-active athletes with chronic ankle instability were included. Cumberland Ankle Instability Instrument (CAIT) score and Tampa Kinesiophobia Scale-11 (TSK-11), Foot and Ankle Ability Measurement (FAAM) tests were evaluated between genders. In addition, the numeric pain scale (NPS) was used to assess ankle pain. As a result of the study, an increase in kinesiophobia scores was associated with lower CAIT scores in FAAM sports subscale scores in women. Therefore, it was found that increased kinesiophobia was associated with increased balance problems and decreased foot-ankle function in athletes with CAI (32). A 2024 study examined the effect of kinesiophobia on static and dynamic balance in individuals with chronic ankle instability (CAI). The study included 70 participants divided into three groups based on the Tampa Kinesiophobia Scale results: 25 without kinesiophobia, 25 with kinesiophobia, and 20 without CAI. Participants with CAI performed single-leg balance tests with eyes open and closed and the Y balance test with eyes open. The Romberg ratios for individuals with CAI were also analyzed. The study found no significant differences in static balance tests with eyes open and closed. However, the kinesiophobia group had a higher mediolateral Romberg ratio during static balance assessments compared to both the non-kinesiophobia and non-CAI groups. Additionally, a higher anterior-posterior Romberg ratio was observed in the kinesiophobia group compared to the non-CAI group. In the Y balance test, the kinesiophobia group had less anterior reach than the non-kinesiophobia and non-CAI groups (11).

Another study by Alshahrani and Reddy in 2022 investigated the relationship between kinesiophobia, ankle position sense, and postural control in individuals with CAI. This study included 55 participants with CAI. Kinesiophobia was assessed using the Tampa Kinesiophobia Scale, and ankle range of motion was measured with a digital inclinometer. Postural control was evaluated using the TecnoBody IsoFree system and a stabilometric force platform, which measured the center of pressure oscillations, ellipse area, and sway parameters. Participants were asked to actively reposition their ankles to 10° dorsiflexion and 15° plantar flexion positions, with accuracy measured in degrees. The study found a moderate positive correlation between kinesiophobia scores and ankle repositioning accuracy and postural control parameters. Higher kinesiophobia scores were associated with significant impairments in foot-ankle range of motion and postural control in individuals with CAI (1).

Considering the limitations of the study, the balance of individuals with CAI could not be evaluated with eyes open and closed and static and dynamic. We think that balance assessment of individuals with CAI may better explain the relationship between kinesiophobia and kinesiophobia in the study.

As a result of our study, a negative correlation was found between the FAAM sport and DLA subheadings in athletes with high kinesiophobia scores. It is thought that decreased FAAM scores due to kinesiophobia may improve athletes' fear of injury during competition or training. In addition, in other studies in the literature, we think that performing studies on foot-ankle range of motion, position perception and balance in individuals with CAI may reduce kinesiophobia.

REFERENCES

1. Alshahrani MS, Reddy RS. Relationship between kinesiophobia and ankle joint position sense and postural control in ındividuals with chronic ankle ınstability-A Cross-Sectional Study. International journal of environmental research and public health, 2022; 19(5): 2792.
2. Brown OS, Hu L, Demetriou C, Smith, TO, Hing, CB. The effects of kinesiophobia on outcome following total knee replacement: a systematic review. Archives of orthopaedic and trauma surgery, 2020; 140(12), 2057–2070.
3. Castanho B, Cordeiro N, Pinheira V. The influence of kinesiophobia on clinical practice in physical therapy: an integrative literature review. Int J Med Res Health Sci, 2021; 10, 78-94.

4. Cross SJ, Gill DL, Brown PK, Reifsteck EJ. Prior ınjury, health-related quality of life, disablement, and physical activity in former women's soccer players. Journal of athletic training, 2022; 57(1), 92–98.
5. Donovan L, Hertel JA. New paradigm for rehabilitation of patients with chronic ankle instability. The physician and sportsmedicine, 2012; 40(4), 41–51.
6. Frigg A, Frigg R, Hintermann B, Barg, A, Valderrabano V. The biomechanical influence of tibio-talar containment on stability of the ankle joint. Knee surgery, sports traumatology, arthroscopy: Official journal of the ESSKA, 15(11), 2007; 1355–1362.
7. Frigg A, Magerkurth O, Valderrabano V, Ledermann HP, Hintermann B. The effect of osseous ankle configuration on chronic ankle instability. British journal of sports medicine, 2007; 41(7), 420–424.
8. Golanó P, Vega J, de Leeuw PA., Malagelada F, Manzanares MC, Götzens V, van Dijk CN. Anatomy of the ankle ligaments: a pictorial essay. Knee surgery, sports traumatology, arthroscopy: Official journal of the ESSKA, 2016; 24(4), 944–956.
9. Gonzalez-Sanchez M Li GZ, Ruiz Munoz M, Cuesta-Vargas AI. Foot and ankle ability measure to measure functional limitations in patients with foot and ankle disorders: a Chinese cross-cultural adaptation and validation. Disability and rehabilitation, 2017; 39(21): 2182-2189.
10. Gribble PA, Bleakley CM, Caulfield BM, Docherty CL, Fourchet F, Fong DT, Hertel J, Hiller CE, Kaminski TW, McKeon PO, Refshauge K M, Verhagen EA, Vicenzino BT, Wikstrom EA, Delahunt E. Evidence review for the ınternational ankle consortium consensus statement on the prevalence, impact and long-term consequences of lateral ankle sprains. British journal of sports medicine, 2016; 50(24), 1496–1505.
11. Han S, Oh M, Lee H, Hopkins JT. The effects of kinesiophobia on postural control with chronic ankle instability. Gait & posture, 2024; 107: 269–274.
12. Hertel J. Functional anatomy, pathomechanics, and pathophysiology of lateral ankle ınstability. Journal of athletic training, 2002; 37(4), 364–375.
13. Hoch JM, Druvenga B, Ferguson BA, Houston MN, Hoch MC. Patient-reported outcomes in male and female collegiate soccer players during an athletic season. Journal of athletic training, 2015; 50(9), 930–936.
14. Hølmer P, Søndergaard L, Konradsen L, Nielsen PT, Jørgensen LN. Epidemiology of sprains in the lateral ankle and foot. Foot & ankle international, 1994; 15(2), 72–74.
15. Hootman JM, Dick R, Agel J. Epidemiology of collegiate injuries for 15 sports: summary and recommendations for injury prevention initiatives. J Athl Train. 2007; 42(2): 311–319.
16. Hsu CJ, Meierbachtol A, George SZ, Chmielewski TL. Fear of Reinjury in Athletes. Sports health, 2017; 9(2), 162–167.
17. Hubbard-Turner T, Turner M. J. Physical activity levels in college students with chronic ankle ınstability. Journal of athletic training, 2015; 50(7), 742–747.
18. Kese B, Salcı Y, Yılmaz ÖT. Validity and reliability of the Tampa Kinesiophobia-Fatigue Scale in patients with multiple sclerosis. Irish journal of medical science, 2023; 192(1), 285–290.
19. Konradsen L, Bech L, Ehrenbjerg M, Nickelsen T. Seven years follow-up after ankle inversion trauma. Scandinavian journal of medicine & science in sports, 2002; 12(3), 129–135.
20. Kulunkoglu BA, Celik D. Reliability and validity of the Turkish version of foot and ankle ability measure for patients with chronic ankle disability. The journal of foot and ankle surgery, 2019; 58(1): 38-41.
21. Kusan O. Culture of being healthy and physical activity status in individuals who do and do not do sports. Gümüşhane University journal of health sciences, 2023; 12(1), 192-200.
22. Luque-Suarez A, Martinez-Calderon J, Falla D. Role of kinesiophobia on pain, disability and quality of life in people suffering from chronic musculoskeletal pain: a systematic review. British journal of sports medicine, 2019; 53(9), 554–559.
23. Magerkurth O, Frigg, A, Hintermann B, Dick W, Valderrabano V. Frontal and lateral characteristics of the osseous configuration in chronic ankle instability. British journal of sports medicine, 2010; 44(8), 568–572.
24. McPhie ML, Rawana JS. The effect of physical activity on depression in adolescence and emerging adulthood: a growth-curve analysis. Journal of adolescence, 2015; 40, 83–92.
25. Öztürk M. Validity and reliability of the ınternational physical activity questionnaire and determination of physical activity levels in university students. H.Ü. Institute of Health Sciences, Master's Thesis, 2005. Ankara.
26. Shah S, Thomas AC, Noone JM, Blanchette CM, Wikstrom EA. Incidence and cost of ankle sprains in United States emergency departments. Sports Health. 2016; 8(6): 547–52.
27. Stiller-Ostrowski J, Granquist MD, Flett R. Kinesiophobia. Athletic training & sports health care, 2014; 6(6), 248-251.
28. Towers JD, Deible CT, Golla SK. Foot and ankle biomechanics. Seminars in musculoskeletal radiology, 2003; 7(1), 67–74.
29. Tümer N, Vuurberg G, Blankevoort L, Kerkhoffs GMMJ, Tuijthof GJM, Zadpoor AA. Typical shape differences in the subtalar joint bones between subjects with chronic ankle ınstability and controls. Journal of orthopaedic research : Official publication of the orthopaedic research society, 2019; 37(9), 1892–1902.
30. Verhagen RA, de Keizer G, Van Dijk, CN. Long-term follow-up of inversion trauma of the ankle. Archives of orthopaedic and trauma surgery, 1995; 114(2), 92–96.

31. Vlaeyen JWS, Kole-Snijders AMJ, Boeren RGB, van Eek H. Fear of movement/(re)injury in chronic low back pain and its relation to behavioral performance. Pain, 1995; 62(3), 363–372.
32. Watanabe K, Koshino Y, Kawahara D, Akimoto M, Mishina M, Nakagawa K, Ishida T, Kasahara S, Samukawa M, Tohyama H. Kinesiophobia, self-reported ankle function, and sex are associated with perceived ankle instability in college club sports athletes with chronic ankle instability. Physical therapy in sport : official journal of the association of chartered physiotherapists in sports medicine, 2023; 61, 45–50.
33. Whalan M, Lovell R, McCunn R, Sampson JA. The incidence and burden of time loss injury in Australian men's sub-elite football (soccer): A single season prospective cohort study. Journal of science and medicine in sport, 2019; 22(1), 42–47.
34. Wikstrom EA, Hubbard-Turner T, McKeon PO. Understanding and treating lateral ankle sprains and their consequences: a constraints-based approach. Sports medicine (Auckland, N.Z.), 2013; 43(6), 385–393.
35. Wright SA, Snyder Valier AR. Health-related quality of life in former division ıı collegiate athletes using the disablement of the physically active scale. Athletic Training & Sports Health Care, 2021; 13(2), 85-92.
36. Yu P, Mei Q, Xiang L, Fernandez J, Gu Y. Differences in the locomotion biomechanics and dynamic postural control between individuals with chronic ankle instability and copers: a systematic review. Sports biomechanics, 2022; 21(4), 531–549.

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Attitudes Towards E-Learning of Disabled Students Studying in Sports Sciences Undergraduate Programs During the Covid-19 Period

Turan SEZAN [1A]

[1] *Mardin Artuklu Universty, School of Physical Education and Sport, Department of Coaching Education, Mardin, TÜRKİYE*
Address Correspondence to Turan SEZAN: e-mail: turansezan@artuklu.edu.tr

Ethical Statement: It is declared that scientific and ethical principles have been followed while carrying out and writing this study and that all the sources used have been properly cited.

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A: Orcid ID: 0000-0003-4322-1703

Abstract

The purpose of this study is to examine the attitudes of disabled students studying in sports science undergraduate programs towards e-learning during the Covid-19 period. The study group of the research consists of 96 disabled students studying in sports science undergraduate programs of 24 state universities in the 2020-2021 academic year and participating in the study voluntarily. The data of the research were collected with the "Attitude Scale Towards E-Learning". According to research findings; While there was no significant difference in gender, age, class, disability type and department variables, has the e-learning system make your life easier? If there were no variable isolation days, would you want distance education under normal conditions? Significant differences were detected between the attitude scale towards e-learning and its sub-dimensions in the variable.

Keywords: Covid 19, disable student, distance learning, physical education and sports, attitude.

Covid-19 Döneminde Spor Bilimleri Lisans Programlarında Öğrenim Gören Engelli Öğrencilerin E-Öğrenmeye Yönelik Tutumları

Özet

Bu çalışmanın amacı, Covid-19 döneminde spor bilimleri lisans programlarında öğrenim gören engelli öğrencilerin e-öğrenmeye yönelik tutumlarının incelenmesidir. Araştırmanın çalışma grubunu 2020-2021 eğitim-öğretim yılında 24 devlet üniversitesinin spor bilimleri lisans programlarında öğrenim gören ve çalışmaya gönüllü olarak katılan 96 engelli öğrenci oluşturmaktadır. Araştırmanın verileri "E-Öğrenmeye Yönelik Tutum Ölçeği" ile toplanmıştır. Araştırma bulgularına göre; cinsiyet, yaş, sınıf, engel türü değişkenlerinde anlamlı farklılık rastlanmazken, bölüm, e-öğrenme sistemi hayatınızı kolaylaştırdı mı? değişkeni ile izolasyon günleri olmasaydı normal şartlarda uzaktan eğitim ister miydiniz? değişkeninde e-öğrenmeye yönelik tutum ölçeği ve alt boyutları arasında anlamlı farklılıklar tespit edilmiştir.

Anahtar Kelimeler: Covid 19, engelli öğrenci, uzaktan eğitim, beden eğitimi ve spor, tutum

INTRODUCTION

The Coronavirus pandemic, which emerged in Wuhan, China, in 2019, rapidly spread worldwide. This virus, also known as SARS-CoV-2, can start with mild cold-like symptoms but can lead to more severe respiratory illnesses. The World Health Organization declared this outbreak a pandemic on March 11, 2020. On the same date, the first coronavirus case was detected in our country. Due to the virus's rapid transmission characteristics, minimizing physical contact became necessary. Consequently, measures were taken in our country, and a transition from face-to-face education to remote learning was implemented. From March 23, 2020, all universities shifted to remote learning platforms. During this period, the demand for remote education also increased (6).

Due to the Coronavirus pandemic, the remote education system, which provides opportunities in electronic environments, offered students a contact-free learning environment (16). Additionally, remote education can directly or indirectly affect students' performance or mediate their performance (10). The Higher Education Council (YÖK) undertook work on regulations, infrastructure, human resources, content, and application areas during this process. In the spring semester of 2020, universities with the infrastructure for remote education were permitted to conduct comprehensive remote education applications. Along with the remote education system, e-learning, which involves the distribution of instructional content primarily through computers and their connected networks, gained importance. Within the scope of the Coronavirus pandemic, efforts were made to prevent students from falling behind in their courses through digitalization in education. However, it was identified that disabled students faced challenges with e-learning, and YÖK announced on May 7, 2020, that it had initiated a study on this issue (19). There are 51,647 disabled students in Turkish universities. Among them, 68% are male, 32% are female, and 89% are enrolled in open education programs. Of these students, 8,735 have visual impairments, 3,760 have hearing impairments, and 14,955 have physical disabilities. A total of 23,581 are undergraduate students (18).

In this context, the Higher Education General Council held a meeting on February 8, 2018, and implemented a series of decisions regarding the admission of students to departments with special talent exams. According to these decisions: For hearing-impaired students, course contents should be provided in text format and, if possible, with subtitles; for students who can lip-read, the instructor's face should be visible on the screen during presentations. For visually impaired students, rich text formats should be used, graphics and visuals should be described with large fonts and contrasting colors, and care should be taken to explain graphics in online exams. Additionally, extra time should be provided as a general measure based on the type of disability. These measures were communicated to universities to ensure that disabled students could follow the remote education process more effectively. A 10% quota was allocated for these students, and for programs with fewer than ten quotas, an additional quota of one person was created for disabled students. Candidates who passed the talent exam but could not be placed in the disabled students quota were designated as reserves. If the number of applicants for the relevant program exceeded the allocated quota, the evaluation of candidates who passed the exam but could not be placed was conducted by including their ÖSYS score. If the quotas for disabled students were not filled, they were transferred to the quotas allocated for other students (18).

The literature review indicates that numerous studies related to remote education processes in universities during the Covid-19 period have been conducted (4, 5, 14). However, no specific studies investigating the attitudes of disabled students enrolled in undergraduate sports science programs towards e-learning have been found. Therefore, this study aims to contribute to the relevant literature and provide insights for stakeholders in the field. The purpose of this study is to examine the attitudes of disabled students enrolled in undergraduate sports science programs towards e-learning during the Covid-19 period and to determine whether their attitudes differ based on demographic variables. In line with this objective, the following questions were addressed:

What are the attitudes of disabled students enrolled in undergraduate sports science programs towards e-learning during the Covid-19 period?

Do the attitudes of disabled students enrolled in undergraduate sports science programs towards e-learning during the Covid-19 period significantly differ based on demographic variables?

METHOD

Research Model

This study, designed in a descriptive survey model, examines the attitudes of disabled students enrolled in undergraduate sports science programs towards e-learning during the Covid-19 pandemic.

Sample and Population of The Study

The research population consists of disabled students enrolled in sports science undergraduate programs at 24 state universities during the academic year 2022-2023 in Türkiye. Because the population size was not attained, the research sample group consists of 96 students who were reached using the convenience sampling approach and freely participated in the study. Table 1 shows the distribution of the sample group's demographic characteristics.

Table 1. Demographic characteristics of the students participating in the study

Variable	Category	n	%
Gender	Female	21	21,9
	Male	75	78,1
	Total	96	100
Age	21 years and under	19	19,8
	22-26 years	50	52,1
	27-31 years	11	11,5
	32 years and over	16	16,7
	Total	96	100
The program of currently studying	Physical Education and Sports Teaching	17	17,7
	Coaching Education	42	43,8
	Sports Management	37	38,5
	Total	96	100
Class	First year	25	26,0
	Second year	17	17,7
	Third year	24	25,0
	Fourth year	30	31,3
	Total	96	100
Has the e-learning system made your life easier?	Yes	63	65,6
	No	33	34,4
	Total	96	100
Would you prefer distance learning under normal conditions if there were no days of isolation?	Yes	32	33,3
	No	64	66,7
	Total	96	100
What is your disability type?	Physical	46	47,9
	Auditory	8	8,3
	Blind	42	43,8
	Total	96	100

In Table 3, it is determined that 78.1% of the students participating in the study are male, and 21.9% are female. It is observed that 52.1% of the students are between the ages of 22-26, 19.8% are 21 years old or younger, 16.7% are 32 years old or older, and 11.5% are in the age range of 27-31. Additionally, 43.8% of the students are enrolled in the Coaching Education program, 38.5% in the Sports Management program, and 17.7% in the Physical Education and Sports Teaching program. Regarding academic standing, 31.3% are in their fourth year, 26.0% in their first year, 25.0% in their third year, and 17.7% in their second year. When asked, “Has the e-learning made your life easier?” 65.6% of the students responded "yes," and 34.4% responded "no." In response to the question, “Would you prefer distance learning under normal conditions if there were no days of isolation?” 66.7% of the students answered "no," and 33.7% answered "yes." Furthermore, 47.9% of the students have physical disabilities, 43.8% have blind, and 8.3% have auditory disabilities.

Tools of Data Collection

The data for the research were collected using a "Personal Information Form" created by the researcher and the "Attitude Towards E-Learning" scale. The personal information form contains seven questions regarding the participants' gender, age, program, class, whether they would prefer distance education under normal circumstances without the isolation days, whether the e-learning system has made their lives easier, and the type of disability. The "Attitude Towards E-Learning" scale, developed by Kisanga (11) and adapted into Turkish by Biçer and Korucu (2) with validity and reliability studies, consists of four sub-dimensions (tendency to use technology, satisfaction, motivation, and usefulness) and a total of 23 items. The scale items are rated on a 4-point Likert type scale as "1- Strongly Disagree, 2- Disagree, 3- Agree, 4- Strongly Agree." Negative items are reverse-coded.

During the scale adaptation process, researchers determined that the 23-item scale had a KMO value of 0.847, a Bartlett test value of x^2=8821.036; df=253 (p= 0.000), and explained 44.947% of the total variance as a result of the exploratory factor analysis. The confirmatory factor analysis revealed that the goodness of fit indices for the scale were at excellent and acceptable levels [(x^2(df=253, N=1721) = 8821.036, p<0.000, RMSEA= 0.061, RMR= 0.049, S-RMR= 0.042, GFI= 0.95, AGFI= 0.93, CFI= 0.93, NFI= 0.98, and IFI= 0.98)]. The internal consistency coefficients for the sub-dimensions of the scale were calculated to be between 0.69 and 0.76, and 0.79 for the entire scale (2). In the present study, the internal consistency coefficients for the sub-dimensions of the scale were found to be 0.71 for the tendency to use technology, 0.78 for satisfaction, 0.83 for motivation, and 0.76 for usability, with an overall scale consistency of 0.81.

Due to the Covid-19 pandemic, the data for this research were collected online via a Google Docs form. The link to the online survey was distributed to participants through their academic advisors, as well as via email and WhatsApp. Prior to answering the questions, participants were required to provide consent by ticking a declaration box on the survey form. For visually impaired participants, the survey questions were administered via telephone through their advisors, and their responses were recorded online.

Statistical Analysis

The data were analyzed using the SPSS-26 software package. Initially, the skewness and kurtosis values were examined to determine whether the data were normally distributed (Table 2). The analysis revealed that the skewness and kurtosis values of the data obtained from the study ranged between -1 and +1, indicating a normal distribution. Huck (8) stated that for data to exhibit a normal distribution, the skewness and kurtosis values should be between -1 and +1. Within this framework, in addition to descriptive statistical techniques, an independent samples t-test was used to determine differences between two groups concerning demographic variables, and a one-way analysis of variance (ANOVA) was used to determine differences among more than two groups. The Post Hoc Tukey test was employed to measure significance between groups. A significance level of p<0.05 was accepted for evaluating differences between groups

Table 2. Skewness and kurtosis values

Scale		Skewness	Kurtosis
Attitude Scale Towards E-Learning	**n**	**Value**	**Value**
Tendency To Use the Technology Sub-Dimension	96	-,142	,016
Satisfaction Sub-Dimension	96	,038	,197
Motivation Sub-Dimension	96	,287	-,107
Usefulness Sub-Dimension	96	-,059	,266

Ethical approval and institutional permission

Ethical approval for the study was obtained from the Non-Interventional Clinical Research Ethics Committee of Mardin Artuklu University with the decision numbered 2023/15-27 dated 12.01.2023.

FINDINGS

This section includes descriptive statistics for the e-learning attitude scale in Table 3, analysis results according to the gender variable in Table 4, analysis results according to the age variable in Table 5, analysis results according to the program variable in Table 6, analysis results according to the class variable in Table 7, analysis results according to the variable "Has the e-learning system make your life easier?" in Table 8, analysis results according to the variable " Would you prefer distance learning under normal conditions if there were no days of isolation?" in Table 9, and analysis results according to the variable "Type of disability" in Table 10.

Table 3. Descriptive statistics results regarding the attitude scale towards e-learning

Scale	n	M	SD
Tendency To Use the Technology Sub-Dimension	96	2,12	0,52
Satisfaction Sub-Dimension	96	2,66	0,64
Motivation Sub-Dimension	96	2,45	0,61
Usefulness Sub-Dimension	96	2,41	0,59

According to Table 3, the mean scores of disabled students regarding their attitudes towards e-learning are as follows: for the tendency to use technology sub-dimension (M=2.12, SD=0.52), for the sub-dimension of satisfaction (M=2.66, SD=0.64), for the sub-dimension of motivation (M=2.45, SD=0.61), and for the sub-dimension of usefulness (M=2.41, SD=0.59). When examining the means according to the scale score ranges, it is observed that students' attitudes towards e-learning are positive in the sub-dimensions of tendency to use technology, satisfaction, and usefulness, while their attitudes towards e-learning in the motivation sub-dimension are negative.

Table 4. Analysis results by gender variable

Scale	Gender	n	X	Ss	p
Tendency To Use the Technology Sub-Dimension	Male	75	2,13	0,53	0,692
	Female	21	2,08	0,49	
Satisfaction Sub-Dimension	Male	75	2,65	0,63	0,678
	Female	21	2,71	0,70	
Motivation Sub-Dimension	Male	75	2,46	0,61	0,983
	Female	21	2,45	0,66	
Usefulness Sub-Dimension	Male	75	2,41	0,61	0,997
	Female	21	2,41	0,54	

According to the results of the independent samples t test performed according to Table 4, no statistical significance was observed in the gender variable related to the attitude scale towards e-learning ($p>0.05$).

Table 5. Analysis results by age variable

Scale	Age	n	X	Ss	p
Tendency To Use the Technology Sub-Dimension	21 years and under	19	2,17	0,56	0,404
	22-26 years	50	2,15	0,51	
	27-31 years	11	2,20	0,38	
	32 years and over	16	1,92	0,60	
	Total	96	2,12	0,52	
Satisfaction Sub-Dimension	21 years and under	19	2,57	0,60	0,426
	22-26 years	50	2,60	0,70	
	27-31 years	11	2,84	0,44	
	32 years and over	16	2,84	0,59	
	Total	96	2,66	0,64	
Motivation Sub-Dimension	21 years and under	19	2,37	0,58	0,233
	22-26 years	50	2,38	0,60	
	27-31 years	11	2,62	0,63	
	32 years and over	16	2,69	0,67	
	Total	96	2,45	0,61	
Usefulness Sub-Dimension	21 years and under	19	2,54	0,67	0,760
	22-26 years	50	2,39	0,59	
	27-31 years	11	2,35	0,60	
	32 years and over	16	2,38	0,53	
	Total	96	2,41	0,59	

According to the results of one-way analysis of variance according to Table 5, no statistically significant difference was detected according to the age variable (p>0.05).

Table 6. Analysis results by program variable

Attitude Scale Towards E-Learning	Program	n	X	Ss	p	Tukey
Tendency To Use the Technology Sub-Dimension	A- Coaching Education	42	2,11	0,53	0,586	
	B- Sports Management	37	2,08	0,53		
	C- Physical Education and Sports Teaching	17	2,24	0,51		
	Total	96	2,12	0,52		
Satisfaction Sub-Dimension	A- Coaching Education	42	2,71	0,67	0,007*	A>C/B>C
	B- Sports Management	37	2,81	0,60		
	C- Physical Education and Sports Teaching	17	2,24	0,46		
	Total	96	2,66	0,64		
Motivation Sub-Dimension	A- Coaching Education	42	2,57	0,64	0,016*	A>C/B>C
	B- Sports Management	37	2,5	0,57		
	C- Physical Education and Sports Teaching	17	2,08	0,51		
	Total	96	2,45	0,61		
Usefulness Sub-Dimension	A- Coaching Education	42	2,42	0,61	0,986	
	B- Sports Management	37	2,41	0,59		
	C- Physical Education and Sports Teaching	17	2,39	0,61		
	Total	96	2,41	0,59		

According to Table 6, when examining the results of the one-way analysis of variance conducted for the program variable in the study, there were no significant differences in the "tendency to use the technology" and "usefulness" sub-dimensions of the attitude scale towards e-learning, while statistically significant differences were found in the "satisfaction" sub-dimension and the "motivation" sub-dimension. According to these results, in the Post Hoc test conducted to measure the significance between the groups, the table states that the scores of students in the coaching education program are higher than those in the physical education

and sport education program in the satisfaction sub-dimension and the motivation sub-dimension, and that the scores of the sport management program are higher than those in the physical education and sport education program. ($p<0.05$).

Table 7. Analysis results by class variable

Scale	Class	n	X	Ss	p
Tendency To Use the Technology Sub-Dimension	First year	25	2,06	0,62	
	Second year	17	2,19	0,46	
	Third year	24	2,24	0,48	0,483
	Fourth year	30	2,04	0,51	
	Total	96	2,12	0,52	
Satisfaction Sub-Dimension	First year	25	2,86	0,72	
	Second year	17	2,66	0,44	
	Third year	24	2,51	0,63	0,293
	Fourth year	30	2,63	0,67	
	Total	96	2,66	0,64	
Motivation Sub-Dimension	First year	25	2,70	0,72	
	Second year	17	2,39	0,61	
	Third year	24	2,40	0,58	0,134
	Fourth year	30	2,33	0,51	
	Total	96	2,45	0,61	
Usefulness Sub-Dimension	First year	25	2,17	0,70	
	Second year	17	2,57	0,60	
	Third year	24	2,53	0,55	0,097
	Fourth year	30	2,43	0,48	
	Total	96	2,41	0,59	

According to Table 7, according to the results of one-way analysis of variance performed on the class variable, no statistically significant difference was found ($p>0.05$).

Table 8. Has the E-Learning system made your life easier? analysis results by variable

Has the E-Learning System Made Your Life Easier?		n	X	Ss	p
Tendency To Use the Technology Sub-Dimension	Yes	1,96	0,46	0,46	0,000*
	No	2,43	0,50	0,50	
Satisfaction Sub-Dimension	Yes	2,77	0,64	0,64	0,021*
	No	2,45	0,60	0,60	
Motivation Sub-Dimension	Yes	2,62	0,62	0,62	0,000*
	No	2,14	0,47	0,47	
Usefulness Sub-Dimension	Yes	2,24	0,55	0,55	0,000*
	No	2,74	0,54	0,54	

In Table 8, when examining the results of the independent samples t-test for the variable "Has the e-learning system made your life easier?", statistically significant differences were found in all four sub-dimensions of the attitude scale towards e-learning (tendency to use the technology, satisfaction, motivation, and usefulness). The t-test scores reveal that students who answered "no" had higher scores in the sub-dimensions of the tendency to use the technology and usefulness compared to those who answered "yes" Conversely, students who answered "yes" had higher scores in the sub-dimensions of satisfaction and motivation compared to those who answered "no" ($p<0.05$).

Table 9. Would you prefer distance learning under normal conditions if there were no days of isolation? analysis results by variable

Would you prefer distance learning under normal conditions if there were no days of isolation?		n	X	Ss	p
Tendency To Use the Technology Sub-Dimension	Yes	32	1,9	0,50	0,003*
	No	64	2,23	0,50	
Satisfaction Sub-Dimension	Yes	32	2,9	0,77	0,023*
	No	64	2,54	0,54	
Motivation Sub-Dimension	Yes	32	2,82	0,61	0,000*
	No	64	2,27	0,54	
Usefulness Sub-Dimension	Yes	32	1,98	0,57	0,000*
	No	64	2,63	0,48	

In Table 9, when examining the results of the t-test for independent samples for the variable "Would you prefer distance learning under normal conditions if there were no days of isolation?", statistically significant differences were found in all four sub-dimensions of the attitude scale towards e-learning (tendency to use the technology, satisfaction, motivation and usefulness). The results of the t-test indicate that students who answered "no" had higher values in the sub-dimensions of tendency to use the technology and usefulness than those who answered "yes" in the sub-dimensions of satisfaction and motivation, on the other hand, students who answered "yes" had higher values than those who answered "no" ($p<0.05$).

Table 10. Analysis results by disability type variable

Scale	Disability Type	n	X	Ss	p
Tendency To Use the Technology Sub-Dimension	Physical	46	2,04	0,49	0,327
	Auditory	8	2,27	0,69	
	Blind	42	2,18	0,53	
	Total	96	2,12	0,52	
Satisfaction Sub-Dimension	Physical	46	2,66	0,71	0,863
	Auditory	8	2,55	0,32	
	Blind	42	2,69	0,62	
	Total	96	2,66	0,64	
Motivation Sub-Dimension	Physical	46	2,54	0,59	0,38
	Auditory	8	2,48	0,41	
	Blind	42	2,36	0,67	
	Total	96	2,45	0,61	
Usefulness Sub-Dimension	Physical	46	2,41	0,58	0,993
	Auditory	8	2,44	0,59	
	Blind	42	2,41	0,62	
	Total	96	2,41	0,59	

According to Table 10, no statistically significant difference was observed according to the results of one-way analysis of variance performed according to the disability type variable ($p>0.05$).

DISCUSSION AND CONCLUSION

In this study, which investigates the attitudes of disabled students enrolled in undergraduate sports science programs towards e-learning during the Covid-19 period, it was found that their attitudes were positive in terms of technology usage tendency, satisfaction, and usability, but negative in terms of motivation. A review of the literature reveals that studies conducted during and after the Covid-19 period predominantly focused on samples of sports science undergraduate students without disabled students (1, 3, 9, 12, 15), and no studies examining the attitudes of sports science undergraduates with disabled students towards e-learning

were found. In this context, the findings of the current study are discussed in light of the findings from studies on the attitudes, opinions, styles, etc., of sports science undergraduate students towards e-learning.

A review of the literature indicates that the studies by Özdemir and Aydoğan (12) and Söyler and Altıngül (15) found that university students studying sports education generally had positive attitudes towards e-learning. These findings are in parallel with the results of our study.

Another conclusion reached in this study is that students' attitudes towards e-learning significantly differed according to the variables of the program they are enrolled in, whether the e-learning system made their lives easier, and whether they would prefer distance education under normal circumstances if there were no isolation days. However, there were no significant differences based on the variables of gender, age, class, and type of disability. While there were no significant differences in the sub-dimensions of technology usage tendency and usability in students' attitudes towards e-learning according to the program variable, significant differences were found in the sub-dimensions of satisfaction and motivation. In the sub-dimensions of satisfaction and motivation, the attitude scores of students in coaching education and sports management programs were higher compared to those in physical education and sports teaching programs.

Different results have been obtained in the literature. Özdemir and Aydoğan (12) found that the attitudes of university students studying sports education towards e-learning did not significantly differ according to gender and class variables. Özdemir and Erdoğan (12), in their study on sports science students, observed significant differences in the program variable between the teaching and management programs. These results align with our study findings concerning the variables of gender, class, and program. However, Doğar (3) observed that the attitudes of sports science students towards e-learning did not differ according to the program variable. The emergence of different results regarding the program variable is thought to be due to the differing aims and visions of the programs within the field. In the study conducted by Geri (7) on students of the school of physical education and sports, a significant difference was found in the program variable. Additionally, Akgül et al. (1) found in their study, which examined the e-learning attitude levels of sports science faculty students, that students' attitudes towards e-learning differed according to the gender variable but did not differ according to age, program, and class variables. Similarly, Söyler and Altıngül (15) found that the attitudes of sports science students towards e-learning differed according to gender and program variables but did not differ according to age and class variables. In line with these findings, Türker (17) observed that female students' average e-learning attitude scores were higher than those of male students, and significant differences were found in the sub-dimensions of technology usage and usability according to the class variable.

In general, when examining studies that investigate university students' attitudes towards e-learning, different results have also been observed. Rafiq et al. (13) found in their study on higher education students that male student had more positive attitudes towards e-learning compared to female students. The results from these studies align with our findings only in terms of the program variable but do not align in other aspects. The fact that the sample group of the current study specifically consists of disabled students, as well as the use of different data collection tools in the studies, is thought to have led to different results. In the study, students' opinions significantly differed in all sub-dimensions for the questions "Has the e-learning system made your life easier?" and "Would you prefer distance learning under normal conditions if there were no days of isolation?" It is believed that the distance education system during the COVID-19 period benefited disabled students, but their inclination towards face-to-face education under normal circumstances was stronger. Additionally, the attitudes of disabled students towards e-learning did not significantly differ according to the type of disability variable. No studies were found in the literature that investigated the e-learning attitudes of disabled students in light of these variables. It can be said that all students had similar attitudes, regardless of the type of disability.

In conclusion, the attitudes of disabled students towards e-learning do not vary according to gender, age, class, or disability type variables, and the program "Has the e-learning system made your life easier?" and "Would you prefer distance learning under normal conditions if there were no days of isolation?" vary significantly depending on the variables. This research, which examines the attitudes of undergraduate sports science disabled students towards e-learning during the COVID-19 period, contributes to the literature but also has some limitations. First, this study is limited to disabled students studying at 24 state universities. The

study could be replicated with a larger sample group. Second, the findings of the study were compared with findings from studies conducted on samples of students without disabled students. The study findings could be generalized to similar studies. Third, a quantitative research approach was used in this study. Studies using qualitative research approaches could be conducted to obtain more in-depth results.

REFERENCES

1. Akgül A, Göksel G. A, Yaraş A. Üniversite öğrencilerinin e-öğrenme tutum düzeylerinin incelenmesi: spor bilimleri fakültesi örneği. Akdeniz Spor Bilimleri Dergisi, 2023; 6 (4)1262-1276.
2. Biçer H, Korucu A.T. E-öğrenmeye yönelik tutum ölçeğinin uyarlanması. Eğitim Teknolojisi Kuram ve Uygulama, 2020 10 (1), 237-256.
3. Doğar B, Covid-19 pandemi sürecinde beden eğitimi ve spor yüksekokulu öğrencilerinin e- öğrenmeye yönelik tutumlarının incelenmesi (vakıf üniversitesi örneği). (Yüksek Lisans Tezi). İstanbul; İstanbul Gelişim Üniversitesi, 2021.
4. Duman N, Üniversite öğrencilerinde COVID-19 korkusu ve belirsizliğe tahammülsüzlük. The Journal of Social Science, 2020, 4(8), 426-437.
5. Ercan Ş, Keklicek H, COVID-19 pandemisi nedeniyle üniversite öğrencilerinin fiziksel aktivite düzeylerindeki değişimin incelenmesi. İzmir Katip Çelebi Üniversitesi Sağlık Bilimleri Fakültesi Dergisi, 2020, 5(2), 69-74.
6. Genç S.Z, Engin G, Yardım T, Pandemi Covid-19 sürecindeki uzaktan eğitim uygulamalarına ilişkin lisansüstü öğrenci görüşleri, Atatürk Üniversitesi, Kazım Karabekir Eğitim Fakültesi Dergisi, 2020, 41, 134-158.
7. Geri S, Investigation of physical education and sports school students' e-learning styles in terms of some variables. African Educational Research Journal, 2021, 9(1), 51-59.
8. Huck S. W. Reading Statistics And Research. Boston, USA, 2012:103-112.
9. Isikgoz M. E, An analysis of the ıntention of students studying at physical education and sports school to use synchronous virtual classroom environments during the covıd-19 pandemic period. Turkish Online Journal of Educational Technology-TOJET, 2021, 20(4), 16-22.
10. Isikgöz, M. E, Analysis of the Relationship between Online Learning Activities and Academic Achievement of Physical Education and Sports School Students. Turkish Online Journal of Educational Technology-TOJET, 2023, 22(1), 29-36.
11. Kisanga D, Determinants of teachers' attitudes towards e-learning in Tanzanian higher learning institutions. International Review of Research in Open and Distributed Learning, 2016, 17(5), 109-125.
12. Özdemir E, Aydoğan H,. Spor eğitimi alan üniversite öğrencilerinin e-öğrenmeye yönelik tutumlarının incelenmesi. Spor Eğitim Dergisi, 2021, 5(3), 187-195.
13. Rafiq F, Hussain S, Abbas Q, Analyzing students' attitude towards e-learning: A case study in higher education in Pakistan. Pakistan Social Sciences Review, 2020, 4(1), 367-380.
14. Saltürk A, Güngör C, Üniversite öğrencilerinin gözünden covid-19 pandemisinde uzaktan eğitime geçiş deneyimi. Adıyaman Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 2020, (36), 137-174.
15. Söyler Y. D, Altungül O, Spor bilimleri öğrencilerinin sporda e-öğrenmeye yönelik tutumlarının incelenmesi. Kahramanmaraş Sütçü İmam Üniversitesi Sosyal Bilimler Dergisi, 2023, 20(2), 729-734.
16. Telli Y.G, Altun D, Coronavirüs ve çevrimiçi (online) eğitimin önlenmeyen yükselişi. Üniversite Araştırmaları Dergisi2020, 9(1), 22-40.
17. Türker Ü,. Koronavirüs (covıd-19) pandemisinin yükseköğretim öğrencilerinde anksiyete düzeyi ile e-öğrenme tutumlarına etkisi. (Doktora Tezi). Samsun; Ondokuz Mayıs Üniversitesi Lisansüstü Eğitim Enstitüsü, 2021.
18. Yüksek Öğretim Kurumu (YÖK), [Internet]. 2020. [cited 2023 Oct. 10]. Avaliable from: https://engelsiz.yok.gov.tr/Sayfalar/Haberler/2020/engelsiz-erisim-engelsiz-egitim.aspx
19. Yüksek Öğretim Kurumu (YÖK), [Internet]. 2020. [cited 2023 Aug. 9]. Avaliable from: https://www.yok.gov.tr/Sayfalar/Haberler/2020/universitelerde-uygulanacak-uzaktan-egitime-iliskin-aciklama.a

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Examination of Physical Activity Attitudes and Anti-Social Behaviors of Middle School Students

Fatih TUNCER [1A], Serkan REVAN [2B], Şükran İRİBALCI [2C]

[1]*Fahir İlkel Secondary School, İstanbul, TÜRKİYE.*
[2]*Selçuk University, Faculty of Sports Science, Konya, TÜRKİYE.*

Address Correspondence to Serkan REVAN: e-mail: serkanrevan@gmail.com

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A: Orcid ID: 0000-0002-1330-3882 B: Orcid ID: 0000-0002-9056-3514 C: Orcid ID: 0000-0002-2625-0898

*This article was produced by Fatih TUNCER from Selçuk University, Institute of Health Sciences, Department of Recreation.

Abstract

The aim of this study is to examine the physical activity attitudes and antisocial behaviors of middle school students. The research group of the study consisted of a total of 1046 students, 509 boys and 537 girls, aged between 11 and 13, studying in 5-6-7-8th grades in three secondary schools affiliated to the Ministry of National Education in Esenyurt district of Istanbul province in the 2022-2023 academic year. "Personal Information Form", "Physical Activity Attitude Scale for Secondary School Students" and "Antisocial Behavior Scale for Secondary School Students" were used as data collection tools. SPSS 25.0 statistical package program was used to evaluate the data and to find calculated values. Data were summarized by giving mean and standard deviations. Whether the data were normally distributed was checked with the range of Kurtosis and Skewness coefficients and it was determined that the data were normally distributed. Since the data were normally distributed, independent group t-test was used for pairwise cluster comparisons and One-Way Analysis of Variance (ANOVA) was used for more than two cluster comparisons. Tukey HSD multiple comparison test was used to determine the source of significant differences as a result of ANOVA. The Pearson Product Moment Correlation Coefficient was used to determine whether there was a significant relationship between the mean scores of the Physical Activity Attitude Scale and Antisocial Behavior Scale sub-dimensions of the participants who participated in the study. Within the scope of this study, the scale reliability coefficient was calculated as .77. The significance level was taken as 0.05. As a result of the analysis, no significant difference was found between the physical activity attitudes of secondary school students and family income level and mother's working status ($p>0.05$), while a significant difference was found between gender, grade level, mother's education level and father's education level variables ($p<0.05$). While no significant difference was observed between antisocial behaviors and family income level ($p>0.05$), a significant difference was found between other demographic variables ($p<0.05$). In addition, while no significant difference was found between the self-confidence sub-dimension of the Physical Activity

Attitude Scale and the inappropriate behavior sub-dimension of the Antisocial Behavior Scale (p>0.01), significant differences were found between the other sub-dimensions (p<0.01) As a result, it can be said that students' physical activity attitudes affect antisocial behaviors.

Keywords: antisocial behaviors, attitude towards physical activity, secondary school students.

Ortaokul Öğrencilerinin Fiziksel Aktivite Tutumlarının ve Antisosyal Davranışlarının İncelenmesi

Özet

Bu araştırmanın amacı ortaokul öğrencilerinin fiziksel aktivite tutumlarının ve antisosyal davranışlarının incelenmesidir. Çalışmanın araştırma grubunu 2022-2023 Eğitim-Öğretim yılında İstanbul ili Esenyurt ilçesinde Milli Eğitim Bakanlığı'na bağlı üç ortaokulda 5-6-7-8. sınıfta öğrenim gören, yaşları 11 ile 13 arasında değişen, 509 erkek, 537 kız olmak üzere toplam 1046 öğrenci oluşturmaktadır. Veri toplama aracı olarak "Kişisel Bilgi Formu", "Ortaokul Öğrencileri İçin Fiziksel Aktivite Tutum Ölçeği" ve "Ortaokul Öğrencileri İçin Antisosyal Davranış Ölçeği" kullanılmıştır. Verilerin değerlendirilmesinde ve hesaplanmış değerlerin bulunmasında SPSS 25.0 istatistik paket program kullanılmıştır. Veriler ortalama ve standart sapmalar verilerek özetlenmiştir. Verilerin normal dağılım gösterip göstermediği Basıklık ve Çarpıklık (Kurtosis - Skewness) kat sayıları aralığı ile kontrol edilmiştir ve verilerin normal dağıldığı tespit edilmiştir. Veriler normal dağılım gösterdiğinden dolayı ikili küme karşılaştırmaları için bağımsız grup t testi, ikiden fazla küme karşılaştırmaları için Tek Yönlü Varyans Analizi (ANOVA) kullanılmıştır. ANOVA sonucu anlamlı farklılıkların kaynağını belirlemek üzere Tukey HSD çoklu karşılaştırma testi kullanılmıştır. Araştırmaya katılan katılımcıların Fiziksel Aktivite Tutum Ölçeği ve Antisosyal Davranış Ölçeği alt boyutlarının puan ortalamaları arasında anlamlı bir ilişki olup olmadığına, Pearson Momentler Çarpım Korelasyon Katsayısından faydalanılarak bakılmıştır. Bu çalışma kapsamında ölçek güvenirlik katsayısı .77 olarak hesaplanmıştır. Araştırmada anlamlılık düzeyi 0.05 olarak alınmıştır. Yapılan analizler sonucunda ortaokul öğrencilerinin fiziksel aktivite tutumları ile aile gelir seviyesi ve anne çalışma durumu arasında anlamlı bir farklılık bulunmazken (p>0,05), cinsiyet, sınıf düzeyi, anne öğrenim düzeyi ve baba öğrenim düzeyi değişkenleri arasında anlamlı farklılık tespit edilmiştir (p<0,05). Antisosyal davranışlarla aile gelir seviyesi arasında anlamlı bir farklılık gözlenmemişken (p>0,05), diğer demografik değişkenler arasında anlamlı farklılık bulunmuştur (p<0,05). Ayrıca Fiziksel Aktivite Tutum Ölçeğinin özgüven alt boyutu ile Antisosyal Davranış Ölçeğinin uygun olmayan davranış alt boyutu arasında anlamlı farklılık saptanmazken (p>0,01), diğer alt boyutlar arasında anlamlı farklılıklar tespit edilmiştir (p<0,01) Sonuç olarak, öğrencilerin fiziksel aktivite tutumlarının antisosyal davranışları etkilediği söylenebilir.

Anahtar Kelimeler: antisosyal davranışlar, fiziksel aktiviteye yönelik tutum, ortaokul öğrencileri.

INTRODUCTION

The human body needs to move constantly due to its genetic structure. From the beginning of humanity to this time, people have been in constant motion and have had to use muscle power to meet their needs (63). We can define physical activity as activities that occur with energy consumption by using our muscles and joints in our daily lives, increase heart and respiratory rate and result in different degrees of fatigue (51). Physical activity contributes to people to be in a state of complete physical, mental and mental well-being and to live a quality and long life (22). People's physical activities contribute to them physically and psychologically in every period of their lives (15). In cases where mobility, which is a basic necessity of human genetics and life, is not given enough importance, mental, physical and psychological disorders may occur (24). We can call these psychological and mental behavioral disorders antisocial behaviors. In the most general sense, antisocial behaviors can be defined as actions that violate socially determined behavioral patterns, harm others, violate the rules and rights of others, and damage social norms (37,16). Many factors such as gender, grade level, mother's education level, father's education level, family socioeconomic level, number of siblings, antisocial behavior of one or both parents, and long-term violent computer games can affect antisocial behavior (6,35). The impact value of each factor on antisocial behaviors may vary depending on the life stages of the individual (32). For example, while family influence is more important for individuals in childhood, peer influence will become more important for individuals in adolescence (44). During adolescence, antisocial behaviors may appear in various forms. The most

common antisocial behaviors in this period are aggression, violent behavior and bullying (58). According to Morrison et al (45), individual risk factors include academic failure, difficulty in adapting to school and having developmental difficulties. While negative parental model is included in familial risk factors, low socioeconomic status is a social risk factor. Finally, school-related risk factors can be listed as teacher attitudes, low student participation and insufficient social activities. Considering these situations, it is stated with some study findings that physical activity has a positive effect on mental state, emotional management and coping with stress (7,9). Therefore, for the development of a healthy individual, the continuity of physical activity should be ensured. In this way, children and young people can be successful in overcoming stress (47,46). From this point of view, the aim of this study is to examine the physical activity attitudes and antisocial behaviors of secondary school students.

METHOD

Working Group

The population of the study consisted of secondary school students attending public schools affiliated to the Directorates of National Education in the central districts of Istanbul in the 2022-2023 academic year. The sample of the study consisted of a total of 1046 students, 537 girls and 509 boys, aged between 11 and 13, studying in the 5th, 6th, 7th, and 8th grades in three secondary schools affiliated to the Ministry of National Education in Esenyurt district of Istanbul province.

Data Collection Tools

In the process of collecting the information in this study, the necessary permissions were obtained from the Istanbul Provincial Directorate of National Education, and then the participants were asked to fill out the personal information form prepared by the researcher and the informed consent form. In addition, a report was obtained from the Selçuk University Faculty of Sports Sciences Non-Interventional Clinical Research Ethics Committee for the study. In this study, the "Personal Information Form" created by the researcher, "Physical Activity Attitude Scale for Secondary School Students" (61) and "Antisocial Behavior Scale for Secondary School Students" (53) were used.

Personal Information Form

This form included questions about the participants' gender, grade level, perception of family income level, parents' education level, number of siblings and whether they had their own rooms.

Physical Activity Attitude Scale for Secondary School Students

This scale is a 5-point Likert-type scale consisting of 25 items. This scale consists of 5 factors: love, willingness, benefit, socialization and self-confidence, and according to the total score of the answers given to the items, a high score from a sub-dimension indicates a high attitude, while a low score indicates a low attitude (61).

Antisocial Behavior Scale for Secondary School Students

The scale consists of 3 sub-dimensions: violence, appropriate behavior structure and inappropriate behavior structure. Scores that can be obtained from the total scale vary between 13-39. The higher the score obtained, the higher the level of antisocial behavior of the student (53).

Data Analysis

In this study, SPSS 25.0 statistical package program was used to evaluate the data and to find the calculated values. The data were summarized by giving mean and standard deviations. Whether the data were normally distributed or not was checked with the range of Kurtosis and Skewness coefficients, and since the range did not exceed +1.5 and -1.5, it was determined that the data were normally distributed (52). Since the data were normally distributed, independent group t-test was used for pairwise cluster comparisons and One-Way Analysis of Variance (ANOVA) was used for more than two cluster comparisons. Tukey HSD multiple comparison test was used to determine the source of significant

differences as a result of ANOVA. The Pearson Product Moment Correlation Coefficient was used to determine whether there was a significant correlation between the mean scores of the Physical Activity Attitude Scale and Antisocial Behavior Scale sub-dimensions. Within the scope of this study, the scale reliability coefficient was calculated as .77. The significance level was accepted as 0.05 in the study.

FINDINGS

The distribution of personal information of the students participating in the study is given in Table 1.

Table 1. Distribution of personal information of the students who participated in the study.

Variables		**f**	**%**
Gender	Female	537	51,3
	Male	509	48,7
Class Level	Grade 5	180	17,2
	Grade 6	180	17,2
	Grade 7	387	37,0
	Grade 8	299	28,6
Income Status	Medium and Low	618	59,1
	Good and High	428	40,9
Mother's Education Status	Primary School	511	48,9
	Middle School	282	27,0
	High School and Above	253	24,2
Father's Education Status	Primary School	345	33,0
	Middle School	352	33,7
	High School and Above	349	33,4
Mother's Employment Status	Not working	748	71,5
	Working	298	28,5
Number of Siblings	1	216	20,7
	2	266	25,4
	3	290	27,7
	4 and above	274	26,2
Room Availability	There is	534	51,1
	No	512	48,9
Total		**1046**	**100**

Table 2. t test results of the mean scores of the sub-dimensions of the physical activity attitude scale according to the gender variable of the students participating in the study.

	Gender	**N**	**X**	**SS**	**t**	**p**
Love	Female	537	1,86	0,71	2,61	**0,01***
	Male	509	1,99	0,86		
Willingness	Female	537	2,69	0,54	0,34	0,73
	Male	509	2,7	0,66		
Benefit	Female	537	3,45	0,84	1,24	0,22
	Male	509	3,52	0,92		
Socialization	Female	537	3,71	0,87	1,28	0,21
	Male	509	3,64	1,03		
Self-confidence	Female	537	3,49	0,87	1,4	0,16
	Male	509	3,57	0,95		

***P<0,05.**

As a result of the examination of the students participating in the study according to the gender variable, no statistically significant difference was found in the willingness, benefit, socialization and self-confidence sub-dimensions of the physical activity attitude scale (p>0.05), while a significant difference was found in favor of male students in the love sub-dimension (p<0.05).

Table 3. ANOVA and Tukey test results of the mean scores of the sub-dimensions of the physical activity attitude scale according to the grade level variable of the students participating in the study.

	Classroom	N	X	Ss	F	p	Tukey
Love	A 5	180	1,80	0,78	2.41	0,07	
	B 6	180	1,98	0,8			
	C 7	387	1,90	0,77			
	D 8	299	1,99	0,80			
Willingness	A 5	180	2,71	0,61	5,17	**0,00***	C<D
	B 6	180	2,69	0,60			
	C 7	387	2,61	0,56			
	D 8	299	2,79	0,63			
Benefit	A 5	180	3,64	0,88	3,92	**0,01***	D<A
	B 6	180	3,5	0,83			
	C 7	387	3,5	0,92			
	D 8	299	3,36	0,86			
Socialization	A 5	180	3,79	0,97	2,94	**0,03***	D<A
	B 6	180	3,66	0,94			
	C 7	387	3,73	0,93			
	D 8	299	3,55	0,97			
Self-confidence	A 5	180	3,65	0,85	2,77	**0,04***	D<A
	B 6	180	3,45	0,92			
	C 7	387	3,57	0,94			
	D 8	299	3,44	0,88			

***P<0,05.**

As a result of the examination of the students participating in the study according to the class variable, while there was no statistically significant difference in the love sub-dimension of the physical activity attitude scale (p>0.05), a statistically significant difference was found between the 7th and 8th grade participants in the willingness sub-dimension in favor of the 8th grade participants (p<0.05). In the sub-dimensions of utility, socialization and self-confidence, a statistically significant difference was observed only between the 5th and 8th grade students in favor of the 5th grade participants (p<0.05).

Table 4. t test results of the mean scores of the sub-dimensions of the physical activity attitude scale according to the family income level variable of the students participating in the study.

	Family Income Level	N	X	Ss	t	P
Love	Medium and Low	618	1,90	0,74	0,91	0,38
	Good and High	428	1,95	0,86		
Willingness	Medium and Low	618	2,69	0,61	0,27	0,79
	Good and High	428	2,70	0,59		
Benefit	Medium and Low	618	3,45	0,87	1,51	0,13
	Good and High	428	3,54	0,90		
Socialization	Medium and Low	618	3,70	0,94	0,72	0,47
	Good and High	428	3,65	0,97		
Self-confidence	Medium and Low	618	3,53	0,89	0,17	0,86
	Good and High	428	3,52	0,94		

As a result of the examination of the students participating in the study according to the income level variable, there was no statistically significant difference in the sub-dimensions of the physical activity attitude scale (p>0.05).

Table 5. ANOVA and tukey test results of the mean scores of the sub-dimensions of the physical activity attitude scale according to the mother's education level variable of the students participating in the study.

		Mother's Level of Education	N	X	Ss	F	P	Tukey
Love	A	Primary School	511	1,96	0,77	3,78	**0,02***	C<A C<B
	B	Middle School	282	1,97	0,79			
	C	High School and Above	253	1,80	0,81			
Willingness	A	Primary School	511	2,71	0,61	0,61	0,54	
	B	Middle School	282	2,68	0,62			
	C	High School and Above	253	2,67	0,57			
Benefit	A	Primary School	511	3,48	0,85	1,29	0,28	
	B	Middle School	282	3,44	0,87			
	C	High School and Above	253	3,56	0,96			
Socialization	A	Primary School	511	3,72	0,96	2,04	0,13	
	B	Middle School	282	3,58	0,92			
	C	High School and Above	253	3,70	0,97			
Self-confidence	A	Primary School	511	3,52	0,88	1,50	0,22	
	B	Middle School	282	3,47	0,89			
	C	High School and Above	253	3,60	0,98			

***P<0,05.**

As a result of the examination of the students participating in the study according to the mother's education level variable, while there was no statistically significant difference in the willingness, benefit, socialization and self-confidence sub-dimensions of the physical activity attitude scale (p>0.05), a statistically significant level difference was found in favor of the participants whose education level was high school and above and the participants whose education level was primary and secondary school level in the love sub-dimension (p<0.05).

Table 6. ANOVA and tukey test results of the mean scores of the sub-dimensions of the physical activity attitude scale according to the father's education level variable of the students participating in the study.

	Father's Level of Education		N	X	SS	F	p	Tukey
Love	A	Primary School	345	1,91	0,75	2,20	0,11	
	B	Middle School	352	1,99	0,83			
	C	High School and Above	349	1,87	0,78			
Willingness	A	Primary School	345	2,72	0,62	4,02	**0,02***	C<B
	B	Middle School	352	2,74	0,64			
	C	High School and Above	349	2,62	0,53			
Benefit	A	Primary School	345	3,44	0,86	0,76	0,47	
	B	Middle School	352	3,50	0,9			
	C	High School and Above	349	3,52	0,89			
Socialization	A	Primary School	345	3,66	0,97	0,23	0,79	
	B	Middle School	352	3,67	0,95			
	C	High School and Above	349	3,71	0,94			
Self-confidence	A	Primary School	345	3,51	0,87	1,16	0,32	
	B	Middle School	352	3,58	0,95			
	C	High School and Above	349	3,48	0,89			

P<0,05.

As a result of the examination of the students participating in the study according to the father's education level variable, while there was no statistically significant difference in the sub-dimensions of love, benefit, socialization and self-confidence from the sub-dimensions of the physical activity attitude scale ($p>0.05$), a statistically significant difference was found in favor of the participants with an education level of high school and above and the participants with an education level of secondary school in the willingness sub-dimension ($p<0.05$) .

Table 7. t test results of the mean scores of the sub-dimensions of the physical activity attitude scale according to the working status of the mother of the students participating in the study.

	Mother's Employment Status	N	X	SS	t	p
Love	Not working	748	1,92	0,77	0,01	0,99
	Working	298	1,92	0,83		
Willingness	Not working	748	2,68	0,58	0,71	0,50
	Working	298	2,71	0,65		
Benefit	Not working	748	3,49	0,87	0,04	0,97
	Working	298	3,49	0,93		
Socialization	Not working	748	3,70	0,94	1,08	0,28
	Working	298	3,63	0,98		
Self-confidence	Not working	748	3,52	0,88	0,23	0,83
	Working	298	3,54	0,97		

As a result of the examination of the students participating in the study according to the working status of their mothers, there was no statistically significant difference in the sub-dimensions of the physical activity attitude scale ($p>0.05$).

Table 8. t test results of the mean scores of the antisocial behavior scale sub-dimensions according to the gender variable of the students participating in the study.

	Gender	N	X	Ss	t	P
Violence	Female	537	1,74	0,38	0,27	0,79
	Male	509	1,74	0,42		
Appropriate Behavior	Female	537	1,45	0,46	2,64	**0,01***
	Male	509	1,53	0,49		
Inappropriate Behavior	Female	537	2,73	0,38	5,04	**0,00***
	Male	509	2,60	0,44		

P<0,05.

As a result of the examination of the students participating in the study according to the gender variable, no statistically significant difference was observed in the violence sub-dimension of the antisocial behavior scale (p>0.05), while a statistical difference was found in favor of male students in the appropriate behavior sub-dimension (p<0.05). In the sub-dimension of inappropriate behavior, a statistical difference was observed in favor of female students (p<0.05).

Table 9. ANOVA and tukey test results of the mean scores of the antisocial behavior scale sub-dimensions according to the grade level variable of the students participating in the study.

	Classroom		N	X	Ss	F	P	Tukey
Violence	A	5	180	1,72	0,40	0,34	0,79	
	B	6	180	1,74	0,43			
	C	7	387	1,75	0,38			
	D	8	299	1,74	0,39			
Appropriate Behavior	A	5	180	1,38	0,45	4,93	**0,00***	A<C
	B	6	180	1,50	0,49			
	C	7	387	1,54	0,48			
	D	8	299	1,48	0,46			
Inappropriate Behavior	A	5	180	2,83	0,28	12,46	**0,00***	B<A C<A D<A
	B	6	180	2,68	0,42			
	C	7	387	2,60	0,45			
	D	8	299	2,65	0,41			

P<0,05.

As a result of the examination of the students who participated in the study according to the class variable, while no statistically significant difference was found in the violence sub-dimension of the antisocial behavior scale sub-dimensions (p>0.05), a statistically significant difference was found between the 5th grade and 7th grade participants in the appropriate behavior sub-dimension in favor of the 7th grade participants (p<0.05). In the sub-dimension of inappropriate behavior, it was determined that there was a statistically significant difference in the mean scores between the 5th grade and all other grade level students in favor of the 5th grade participants (p<0.05).

Table 10. t test results of the mean scores of the antisocial behavior scale sub-dimensions according to the family income level variable of the students participating in the study.

	Family Income Level	N	X	Ss	t	P
Violence	Medium and Low	618	1,72	0,37	1,87	0,07
	Good and High	428	1,77	0,43		
Appropriate Behavior	Medium and Low	618	1,50	0,47	0,88	0,38
	Good and High	428	1,48	0,48		
Inappropriate Behavior	Medium and Low	618	2,67	0,42	0,48	0,63
	Good and High	428	2,68	0,41		

As a result of the examination of the students participating in the study according to the income level variable, there was no statistically significant difference in the sub-dimensions of the antisocial behavior scale ($p>0.05$).

Table 11. ANOVA and tukey test results of the mean scores of the antisocial behavior scale sub-dimensions according to the mother's education level variable of the students participating in the study**.**

		Mother's Level of Education	N	X	Ss	F	P	Tukey
Violence	A	Primary School	511	1,75	0,38	1,49	0,23	
	B	Middle School	282	1,76	0,43			
	C	High School and Above	253	1,70	0,38			
Appropriate Behavior	A	Primary School	511	1,50	0,48	6,11	**0,00***	C<A C<B
	B	Middle School	282	1,55	0,49			
	C	High School and Above	253	1,41	0,44			
Inappropriate Behavior	A	Primary School	511	2,67	0,41	1,50	0,23	
	B	Middle School	282	2,64	0,42			
	C	High School and Above	253	2,70	0,41			

P<0,05.

As a result of the examination of the students who participated in the study according to the mother's education level variable, it was seen that there was no statistically significant difference in the sub-dimensions of violence and inappropriate behavior from the sub-dimensions of the antisocial behavior scale ($p>0.05$), while in the appropriate behavior sub-dimension, it was seen that the mean scores differed statistically significantly in favor of the participants whose education level was high school and above and the participants whose education level was primary and secondary school ($p<0.05$).

Table 12. ANOVA and tukey test results of the mean scores of the antisocial behavior scale sub-dimensions according to the father's education level variable of the students participating in the study.

		Father's Level of Education	N	X	Ss	F	P	Tukey
Violence	A	Primary School	345	1,76	0,39	0,83	0,44	
	B	Middle School	352	1,72	0,42			
	C	High School and Above	349	1,75	0,38			
Appropriate Behavior	A	Primary School	345	1,51	0,48	2,41	0,09	
	B	Middle School	352	1,52	0,49			
	C	High School and Above	349	1,45	0,45			
Inappropriate Behavior	A	Primary School	345	2,68	0,41	6,89	**0,00***	B<C
	B	Middle School	352	2,61	0,44			
	C	High School and Above	349	2,72	0,39			

P<0,05.

As a result of the examination of the students who participated in the study according to the father's education level variable, no statistically significant difference was found in the sub-dimensions of violence and appropriate behavior sub-dimensions of the antisocial behavior scale (p>0.05), while in the sub-dimension of inappropriate behavior, it was found that there was a statistically significant difference in the mean scores between the participants whose education level was at the secondary school level and the participants whose education level was high school and above in favor of the participants whose education level was high school and above (p<0.05).

Table 13. t test results of the mean scores of the antisocial behavior scale sub-dimensions according to the working status of the mother of the students participating in the study.

	Mother's Employment Status	N	X	Ss	t	P
Violence	Not working	748	1,74	0,39	0,15	0,88
	Working	298	1,74	0,42		
Appropriate Behavior	Not working	748	1,49	0,48	0,32	0,75
	Working	298	1,48	0,46		
Inappropriate Behavior	Not working	748	2,69	0,40	2,23	**0,03***
	Working	298	2,63	0,44		

P<0,05.

As a result of the examination of the students participating in the study according to the working status of their mothers, no statistically significant difference was found in the sub-dimensions of violence and appropriate behavior from the sub-dimensions of the antisocial behavior scale (p>0.05), while in the sub-dimension of inappropriate behavior, it was determined that the mean scores differed statistically significantly in favor of non-working mothers (p<0.05).

Table 14. Pearson product-moment correlation coefficient results to determine the relationship between the mean scores of the physical activity attitude scale and antisocial behavior scale sub-dimensions of the students participating in the study.

Physical Activity Attitude Scale			Love	Willingness	Benefit	Socialization	Self-confidence
Antisocial Behavior Scale	Violence	r	**0,15****	**0,08****	**-0,08****	**-0,09****	**-0,12****
		p	0,00	0,01	0,01	0,00	0,00
	Appropriate Behavior	r	**0,21****	**0,07****	**-0,12****	**-0,14****	**-0,14****
		p	0,00	0,02	0,00	0,00	0,00
	Inappropriate Behavior	r	**-0,18****	**-0,12****	**0,17****	**0,18****	-0,00
		p	0,00	0,00	0,00	0,00	0,99
	TOTAL	N	1046	1046	1046	1046	1046

** **P<0,01**

In the results of Pearson Product Moment Correlation Coefficient, which was performed to determine the relationship between the mean scores of the Physical Activity Attitude Scale and Antisocial Behavior Scale sub-dimensions of the students who participated in the study, a statistically significant relationship was found between the violence and appropriate behavior sub-dimension of the Antisocial Behavior Scale and the love and willingness sub-dimension of the Physical Activity Attitude Scale, and a statistically significant relationship was found in the negative direction in the benefit, socialization and self-confidence sub-dimension ($p<0.01$). While there was a statistically significant relationship between the inappropriate behavior sub-dimension of the Antisocial Behavior Scale and the love and willingness sub-dimension of the Physical Activity Attitude Scale ($p<0.01$), there was no statistically significant difference in the self-confidence sub-dimension ($p>0.01$).

DISCUSSION AND CONCLUSION

In the study conducted to examine the physical activity attitudes and antisocial behaviors of secondary school students, it was concluded that both physical activity attitudes and antisocial behaviors were affected by some demographic factors. In addition, while there was no significant difference between the self-confidence sub-dimension of the physical activity attitude scale and the inappropriate behavior sub-dimension of the antisocial behavior scale, significant differences were found between the other sub-dimensions.

Research has shown that children with positive attitudes towards physical activity develop into physically active and healthy adults. Acquisition, change and modification in attitudes are the result of various experiences at various stages of life, especially adolescence (49). In a study conducted on secondary school students, it was reported that there was a significant difference between the levels of attitudes towards physical activity and the gender variable, while there was no significant difference between the class level, mother and father education levels (10). In a different study, middle school students' attitudes towards physical education course differed significantly according to grades, but did not differ according to gender (36). Türksoy and Özlü (54) stated that age, gender, sporting status and grade level did not cause a difference in the attitudes of secondary school students towards physical education course. Yetiş et al. (59), on the other hand, concluded that gender, class factor, school type, mother/father occupation were effective in students' attitudes towards physical education and sports course. The researchers stated that male students studying in the tenth grade, studying at a sports high school, whose father's occupation was self-employment, and whose mother's occupation was civil servant had higher attitudes towards physical education and sports course. In a meta-analysis study, it was reported that variables such as gender, research region, research type, grade level, research year and sample size were not directive on secondary school students' attitudes towards physical education and sports course (14). In elementary school students, factors such as physical education teacher, relationships between friends, doing sports and having a family member who does sports affect the attitude towards physical education course, while the economic income level of the family, gender and age factors did not affect student attitudes (41). When the attitudes of secondary school students towards physical education course were examined, it was observed that there were significant differences according to the variables of gender, age, licensed sports and regular sports (20). In a study conducted on high school students, it was stated that attitudes towards physical education course were not affected by class, age and gender variables (2,29). In contrast to these studies, in a different study, independent variables such as gender, sports, place of residence and grade level create a significant difference on high school students' attitudes towards physical activity (1). In a study examining the attitudes of secondary school students towards physical education and sports course according to some variables, it was stated that the attitudes of the family towards sports and the status of doing sports, economic levels and socio-economic levels of the region where the schools are located have a positive effect on students' attitudes towards physical education course (33). In the current study, significant differences were found between the love sub-dimension and gender and mother's education level; between the willingness sub-dimension and father's education level; and between the class level and willingness, benefit, socialization and self-confidence sub-dimensions. In addition, no significant difference was observed between the income level and mother's working status variables and the sub-dimensions of the physical activity attitude scale. When the literature was examined, it was determined that students' physical activity attitudes were affected differently by demographic factors. It can be said that this situation is caused by socio-cultural and socio-economic structure variables among students.

It was reported that antisocial behaviors differed significantly according to gender variable and male students showed higher levels of antisocial behavior (43,31, 28,4,13,23,6,48,25,34,26,17,50,5,38). Unlike these research findings, there are also studies in which antisocial behaviors are not affected by gender (42,12,3,57,11,53). In the current study, a significant difference was found between gender and antisocial behavior scale sub-dimensions of appropriate behavior and inappropriate behavior in secondary school students. It was determined that female students had more inappropriate behavior scores than male students.

It is said that antisocial behaviors increase as the grade level of adolescents increases (56,23,35). Similarly, it was stated that 8th grade students were more prone to violence and had lower levels of school engagement than 5th, 6th and 7th grade students (50). In a different study, it was found that grade level did not significantly affect vandalistic behaviors (55). In contrast to these studies, in the current study, it was observed that the

appropriate behavior and inappropriate behavior sub-dimensions of the antisocial behavior scale differed according to the grade levels. It can be said that as the grade level increases, appropriate behavior scores increase.

Studies have shown that as the perceived socioeconomic level of secondary school students decreases, their susceptibility to antisocial behaviors increases (8,18, 21,40,53). Low socio-economic status may lead to a decrease in the family's interest in the child, which in turn may cause children to be prone to problematic behaviors (27). In contrast to these studies, in a study conducted on secondary school students studying in Adıyaman province, it was reported that children from families with low monthly income exhibited less vandalistic behaviors compared to other children (55). In the current study, it was observed that students' antisocial behavior scale sub-dimensions were not affected by the income level variable.

It was found that adolescents' perceptions of democratic attitudes increased as the level of father and mother education increased, and adolescents whose parents had democratic behavior had a low tendency to aggression (60). Similarly, in a study conducted on high school students, it was stated that as the education level of parents increased, aggression levels decreased (62). While the father's education level contributed significantly to the increase in aggression, it was determined that the effect of the mother's education level on aggression was not significant (39). Contrary to these studies, there was no significant difference between the mean scores of students' trait anger and aggression according to their parents' education level (30). In the current study, a significant difference was observed between father's education level and inappropriate behavior sub-dimension, and between mother's education level and appropriate behavior sub-dimension.

The research has some limitations. The fact that the scale was tested on a limited sample group, the limitations arising from the fact that the human element is at the center of the research conducted in the field of social sciences and the limitations related to the sensitivity of the statistical methods used in this field are also in question for this research.

While no significant difference was found between the self-confidence sub-dimension of the physical activity attitude scale and the inappropriate behavior sub-dimension of the antisocial behavior scale, significant differences were found between the other sub-dimensions. As a result, it can be said that students' physical activity attitudes affect antisocial behaviors.

REFERENCES

1. Altın Y, İlter İ, Gül M. The Investigation of Attitudes Towards Physical Activity and Their Levels of Life Satisfaction of High School Students. International Journal of Progressive Education, 2021; 17(1):16-34.
2. Akıncı AY, Türkay IK, Arısoy A, Deniz C. Investigation of high school students' physical education course attitudes according to some variables (Isparta Sample). Çanakkale Onsekiz Mart University Journal of Sport Sciences, 2020; 3(3): 53-62.
3. Allen TJ, Dougherty DM, Rhoades HM, Cherek DR. A study of male and female aggressive responding under conditions providing an escape response. The Psychological Record, 1996; 46(4): 651-665.
4. Arslan C, Hamarta E, Arslan E., Saygın Y. Investigation of aggression and interpersonal problem solving in adolescents. İlköğretim Online, 2010; 9(1): 379-388.
5. Balıkçı R. Investigation of the relationship between online game addiction and aggressive behaviors in children and adolescents. Master's Thesis, Fatih Sultan Mehmet University Institute of Social Sciences, Istanbul, 2018.
6. Bayrak B. Aggression tendencies of students aged 10-12 years and determination of the factors affecting this. Master's Thesis, Hacettepe University Institute of Health Sciences, Ankara, 2011.
7. Belair MA, Kohen DE, Kingsbury M, Colman I. Relationship between leisure time physical activity, sedentary behaviour and symptoms of depression and anxiety: evidence from a populationbased sample of canadian adolescents. BMJ Open, 2018.
8. Beyers JM, Bates JE, Pettit GS, Dodge K. Neighborhood structure, parenting processes and the development of youths' externalizing behaviors: a multilevel analysis. American Journal of Community Psychology, 2003; 31: 35-53.
9. Biddle SJ, Ciaccionni S, Thomas G, Vargeer I. Physical activity and mental health in children and adolescents: an updated review of reviews and an analysis of causality. Psychology of Sport and Exercise, 2019; 42: 55-146.
10. Birgün A, Özen E, Sevim Uğraş B, Sevim Pehlivan B. Investigation of the attitude levels of secondary school students towards physical activity. International Journal of Mountaineering and Climbing, 2020; 3(2): 64-75.
11. Björkqvist K. Gender differences in aggression. Current Opinion in Psychology, 2018; 19: 39-42.
12. Björkqvist K, Lagerspetz KM, Kaukiainen A. Do girls manipulate and boys fight? developmental trends in regard to direct and indirect aggression. Aggressive Behavior, 1992; 18(2): 117-127.

13. Bor W, McGee TR, Hayatbakhsh R, Dean A, Najman JM. Do antisocial females exhibit poor outcomes in adulthood? an australian cohort study. Australian and New Zealand Journal of Psychiatry, 2010; 44 (7): 648-657.
14. Böke H, Norman G. Evaluation of secondary school students' attitu destowards physical education and sports classes: A metaanaly sisstudy. International Journal of Curriculum and Instruction, 2021; 13(3): 3042-3056.
15. Bulut S. A social determinant of health; physical activity. Turkish Journal of Hygiene and Experimental Biology, 2013; 70(4): 205-214.
16. Burt AS, Donnellan BM. Development and validation of the subtypes of antisocial behavior questionnaire. Aggressive Behavior, 2009; 35: 376-398.
17. Cansever D. Investigation of the relationship between perceived parental conflict and aggression in adolescents.Master's Thesis, Akdeniz University Institute of Educational Sciences, Antalya, 2017.
18. Cao L, Cao J, Zhao J. Family, welfare and delinquency. Journal of Criminal Justice, 2004; 32: 565-576.
19. Chandler JM. Egocentrism and antisocial behavior. Developmental Psychology, 1973.
20. Cengiz Ö, Kılıç MA, Soylu Y. Investigation of middle school students' attitudes towards physical education course. Academy of Social Sciences Journal, 2018; 1(2): 141-149.
21. Coley RL, Morris JE, Hernandez D. Out-of-school care and problem behavior trajectories among low-income adolescents: individual, family, and neighborhood characteristics as added risks. Child Development, 2004; 75: 948-965.
22. Çetin L. Quality of life in classroom teachers and some factors affecting it. Master's Thesis, Cumhuriyet University Institute of Health Sciences, Sivas, 2010.
23. Çetinkaya Yıldız E, Hatipoğlu Sümer Z. Perception of environmental risk, environmental safety and school climate in predicting aggressive behaviors. Turkish Journal of Psychological Counseling and Guidance, 2010; 4(34): 161-173.
24. Demirbaş T. The effect of physical activity level of individuals on healthy lifestyle and health perception during the Covid-19 pandemic process. Master's Thesis, Selçuk University Institute of Health Sciences, Konya, 2021.
25. Donat Bacıoğlu S, Özdemir Y. Relationships between aggressive behaviors of primary school students and age, gender, achievement status and anger. Journal of Educational Sciences Research, 2012; 2(2): 169-187.
26. Ergür G. Examination of the aggression tendencies and self-esteem levels of second level students who play violent computer games.Master's Thesis, Istanbul Arel University Institute of Social Sciences, Istanbul, 2015.
27. Fan X, Chen M. Parental involvement and students' academic achievement: a meta-analysis. Educationa l Psychology Review, 2001; 13: 1-22.
28. Giles JW, Heyman GD. Preschoolers' use of trait-relevant information to evaluate the appropriateness of an aggressive response. Aggressive Behavior, 2005; 31: 498-509.
29. Göksel AG, Caz Ç. Investigation of Anatolian high school students' attitudes towards physical education course. Marmara University Journal of Sport Sciences, 2016; 1(1): 1-9.
30. Gönültaş O, Atıcı M. Investigation of anger levels and aggression levels of senior high school students according to some variables. Çukurova University Journal of Institute of Social Sciences, 2014; 23(1): 370-386.
31. Gullane E, Moore S. Risk taking in adolescents and the five-factor model of personality. Journal of Adolescence, 2000; 23(4): 393-407.
32. Güler M. Development of criminal behavior in children and adolescents from the perspective of social psychology. Journal of TBB, 2010; 89: 355-372.
33. Güllü M, Şarvan Cengiz Ş, Öztaşyonar Y, Kaplan B. Investigation of secondary school students' attitudes towards physical education and sports course according to some variables (Şanlıurfa Province Example). Gaziantep University Journal of Sport Sciences, 2016; 1(2): 49-61.
34. Haskan Avcı Ö. The frequency of violence tendency in adolescents. Journal of Theoretical Educational Science, 2015; 8(1): 106-124.
35. Hoşgörür V, Polat M. Reasons for absenteeism of secondary school students (söke district example). MSKU Faculty of Education, 2015; 2(1): 25-42.
36. Ibrahimli R. Investigation of middle school students' attitudes towards physical education and sports course and physical activity levels. Unpublished Master's thesis, Marmara University, Institute of Educational Sciences, Department of Sports Education, Istanbul, 2019.
37. Kaner S. Antisocial behavior tendency inventory development studies. Ankara University Faculty of Educational Sciences, Ankara, 1991.
38. Karakulak F. Aggression tendency in adolescents exposed to domestic violence in childhood.Master's Thesis, Istanbul Gelisim University Institute of Social Sciences, Istanbul, 2018.
39. Kaya Z, İkiz FE, Asıcı E. Prediction of adolescents' aggression level in terms of value orientations, gender and parents' education level. Kastamonu Journal of Education, 2019; 27(1): 75-84.
40. Keiley MK, Lofthouse N, Bates JE, Dodge KA, Pettit GS. Differential risks of covarying and pure components in mother and teacher reports of externalizing and internalizing behavior across ages 5 to 14. Journal of Abnormal Child Psychology, 2003; 31: 267-283.

41. Keskin Ö. Investigation of secondary school students' attitudes towards physical education course according to some variables: The case of Sakarya province. Sakarya University Institute of Educational Sciences, Department of Physical Education and Sports Teaching, Master's thesis, Sakarya, 2015.
42. Köksal F. The relations between control focus and aggressive behaviors. Doctoral Thesis, Atatürk University, Institute of Social Sciences, Erzurum, 1991.
43. Laird RD, Pettit GS, Dodge, KA, Bates JE. Best friendships, group relationships and antisocial behavior in early adolescence. The Journal of Early Adolescence, 1999; 19(4): 413-437.
44. Moffitt TE. Adolescence-limitedand life course-persistent antisocial behavior: A developmental taxonomy. Psychological Review, 1993; 100: 674-701.
45. Morrison GM, Furlong MJ, Morrison RL. School violence to school safety: reframing the issue for school psychologists. School Psychology Review, 1994; 23(2): 236-256.
46. Mulye TP, Park JM, Nelson CD, Adams SH, Irwin CE, Brindis CD. Trends in adolescent and young adult health in the united states. Journal of Adolescent Health, 2009; 45(1): 8-24.
47. Nelson MC, Story M, Larson NI, Neumark-Sztainer D, Lytle LA. Emerging adulthood and college-aged youth: an overlooked age for weight-related behavior change. Obesity, 2008; 16(10): 2205-2211.
48. Özgür G, Yörükoğlu G, Baysan Arabacı. High school students' perceptions of violence, violence tendency levels and affecting factors. Journal of Psychiatric Nursing, 2011; 2(2): 53-60.
49. Pethkar V, Shraddha Naik S, Sonawane, S. Attitude stoward physical activityan ditsmea surement. Journal of Physical Education and Sportvol, 2010; 29(4): 30 -36.
50. Sağlam A, İkiz F. Examining the relationship between secondary school students' violence tendencies and their school engagement levels. Elementary Education Online, 2017; 16(3): 1235-1246.
51. Savcı S, Öztürk M, Arıkan H, İnal İD, Tokgözoğlu L. Physical activity levels of university students. Turkish Cardiol Assoc. Archives, 2006; 34(3): 166-172.
52. Tabachnick BG, Fidell LS. Using multivariate statistics (sixth ed.).Pearson Education Inc. Boston, MA, 2013.
53. Taşkın S. Investigation of antisocial behaviors in secondary school students. Master's Thesis, Ahi Evran University Institute of Social Sciences, Kırşehir, 2022.
54. Türksoy KK, Özlü K. Investigation of the relationship between middle school students' attitudes towards physical education course and sportsmanship behaviors. International Journal of Turkish Literature Culture Education, 2022; 11(3): 1304-1321.
55. Ünişen A, Demirbağ B. Investigation of vandalism in secondary school students in terms of family relationships and some variables (Adıyaman province example). Education Sciences (NWSAES), 2016; 11(2): 49-60.
56. Van Lier PA, Vitaro F, Barker ED, Koot HM, Tremblay RE. Developmental links between trajectories of physical violence, vandalism, theft and alcohol-drug use from childhood to adolescence. Journal of Abnormal Child Psychology, 2009; 37(4): 481-492.
57. Werner NE, Crick NR. Relational aggression and social-psychological adjustment in a college sample. Journal of Abnormal Psychology, 1999; 108(4): 615-623.
58. Yavuzer Y. Aggression/violence in schools: risk factors and prevention strategies related to schools and teachers. Journal of National Education, 2011; 41(192): 43-61.
59. Yetiş Ü, Aytaç KY, Çalğan G. Investigation of the attitudes of secondary school students towards physical education and sports course. Mediterranean Journal of Sport Sciences 2022; 5(2): 906-917.
60. Yıldız E, Erci B. Investigation of the relationship between parental attitudes and adolescent aggression. Journal of Düzce University Institute of Health Sciences, 2011; 1(3): 6-11.
61. Yıldızer G, Bilgin E, Korur EN, Yılmaz Y, Demirhan G. Development of physical activity attitude scale for secondary school students. Journal of sport sciences, 2019:63-73.
62. Yönet E, Çalık F, Yaşartürk F, Çimen K. Investigation of High School Students' Participation in Recreational Activities and Aggression-Violence Tendencies. IntJSCS. 2016; 4(1): 368-82.
63. Zorba E, Saygın Ö. Physical activity and physical fitness. Ankara, Perspektif Matbaacılık, 2017.

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The Examination of the Relationship Between Stress Coping and Problem-Solving Skills of Physical Education Teachers

Mehmet DENKTAŞ [1A], İlhan GÖZEN [1B]

Şeyma Elif SIMSEK [2C], Nizamettin Ulaş CUFADAR [1D]

[1]*Selçuk University, Faculty of Sport Sciences, Department of Sport Management, Konya, TÜRKİYE*
[2]*Near East University, Faculty of Sports Sciences, Department of Sport Management, Turkish Republic of Northern Cyprus*

Address Correspondence to Mehmet DENKTAS: e-mail: denktasmehmet42@gmail.com

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A: Orcid ID: A: 0000-0001-8205-8764 B: Orcid ID: 0000-0002-4682-967X C: Orcid ID: 0009-0006-7445-2132 D: Orcid ID: 0009-0009-6812-4425

Abstract

This study aimed to investigate the relationship between coping with stress and problem-solving abilities among physical education teachers. The research sample comprised 64 female and 89 male physical education teachers, totaling 153 individuals, employed in schools under the Ministry of National Education in Mardin. Data collection instruments included a personal information form developed by the researcher, the Coping with Stress Scale developed by Türküm (2002), and the Problem Solving Inventory developed by Heppner and Peterson (1982) and adapted into Turkish by Şahin, Şahin, and Heppner (1993). Statistical analyses involved testing for variance and homogeneity, employing independent t-tests for pairwise comparisons, One-Way ANOVA for multiple comparisons, and conducting Correlate analysis to determine relationships. Results revealed no significant differences in mean scores for coping with stress or problem-solving skills among physical education teachers based on gender, school type, or years of service in the profession. However, a positive low-level relationship was identified between the coping with stress scores and problem-solving scores of the physical education teachers. In summary, the study revealed notably high mean scores for both coping with stress and problem-solving skills among physical education teachers, suggesting their adeptness at managing stressors and addressing challenges effectively. Additionally, it is postulated that physical education teachers who exhibit effective stress coping mechanisms are also proficient in resolving encountered problems.

Keywords: Physical education teacher, stress, problem solving.

Beden Eğitimi Öğretmenlerinin Stresle Başa Çıkma ve Problem Çözme Becerileri Arasındaki İlişkinin İncelenmesi

Özet

Bu çalışma ile beden eğitimi öğretmenlerinin stresle başa çıkma ve problem çözme becerileri arasındaki ilişkinin incelenmesi amaçlanmıştır. Araştırmanın örneklemi Mardin'de Milli Eğitim Bakanlığına bağlı okullarda görev yapan 64 kadın 89 erkek toplam 153 beden eğitimi öğretmeninden oluşmaktadır. Veri toplama araçları olarak araştırmacı tarafından oluşturulan kişisel bilgi formu, Türküm, (2002) tarafından geliştirilen Stresle Başa Çıkma Ölçeği ve Heppner ve Peterson (1982) tarafından geliştirilen, Türkçeye uyarlaması ise Şahin, Şahin ve Heppner (1993) tarafından yapılan Problem Çözme Envanteri, kullanılmıştır. Elde edilen verilerin varyans ve homojenlikleri test edilmiş, ikili karşılaştırmalarda Independent t testi, çoklu karşılaştırmalarda One Vay Anowa ve ilişki tespit etmede Correlate analizi yapılmıştır. Yapılan analizler sonucunda beden eğitimi öğretmenlerinin cinsiyet, okul türü ve meslekteki görev sürelerine bağlı olarak hem stresle başa çıkma hem de problem çözme puan ortalamalarında anlamlı farklılık tespit edilmemiştir. Ancak beden eğitimi öğretmenlerinin stresle başa çıkma puanları ve problem çözme puanları arasında pozitif yönlü düşük düzeyde bir ilişki tespit edilmiştir. Sonuç olarak; beden eğitimi öğretmenlerinin hem stresle başa çıkma hem de problem çözme puan ortalamalarının çok yüksek olduğu görülmüştür. Bu da beden eğitimi öğretmelerinin stresle baş edebildikleri ve bir problem durumunda problemin üstesinden gelebildiklerine işaret etmektedir. Ayrıca stres ile baş edebilen beden eğitimi öğretmenlerin karşılaştıkları problemleri de çözebilecekleri düşünülmektedir.

Anahtar Kelime: Beden eğitimi öğretmeni, stres, problem çözme.

INTRODUCTION

In modern times, the term "stress" has been examined under a broad and comprehensive scope. In fact, some psychologists have endeavored to answer the question "what stress is not" by exploring the definition of stress itself. Due to the diverse usage of the term "stress," it has been investigated in two separate directions. Firstly, it encompasses the state when the balance mechanism of the organism is disrupted when faced with factors and situations encountered during moments of danger. Secondly, another interpretation refers to all factors within the organism's environment that could disrupt its balance (6).

Coping with stress, also referred to as coping or adaptation, encompasses all emotional and behavioral responses exhibited with the purpose of reducing or eliminating the emotional tension evoked by constructive stressors and enduring such tension. This concept has been elucidated as the ways individuals cope with difficulties encountered in their lives (22). Scientists have examined coping with stress from various perspectives. According to Baltaş and Baltaş (2013), coping with stress involves efforts aimed at bringing oneself into a more favorable situation by controlling behaviors and momentary situations in circumstances perceived as threatening in daily life. Dressler (1980), on the other hand, defines coping with stress as the entirety of behavioral and cognitive efforts exhibited to tolerate, avoid, or change stressors and their sources. According to Lazarus (1993), coping with stress entails continuously changing behavioral or cognitive efforts aimed at reducing, controlling, or tolerating perceived stressful behaviors and conflicts with personal resources, as well as specific external and internal demands.

Problem can be defined as the difficulties and obstacles encountered by societies or individuals within them in their pursuit of goals and success (3). Problem-solving, on the other hand, is the process of developing skills to solve the problem or controlling the problem as a result of understanding it. With the help of knowledge, individuals consciously solve the problem as part of decision-making, experiencing the values of the experience and using the skills they have gained (4). However, this process has been perceived more as a coping process rather than a decision-making mechanism (19). From a different perspective, the concept of problem can be defined as a mental distress or confusion experienced by an individual in achieving their goal or encountering obstacles, perceived as a gap between the desired and existing situation. However, Problem Solving is defined as an emotional, cognitive, and behavioral process aimed at overcoming obstacles, complications, and coping with stress (34). Problem Solving is a kind of mental activity for individuals. These include decision-making and creative and critical thinking activities (11).

Coping with stress is defined as efforts by an individual to control the situation and behavioral patterns in order to improve themselves when they perceive a situation as threatening to their life. This study is designed with the intention of revealing how physical education teachers cope with stress and their level of

problem-solving ability. It is believed that this study will contribute to the literature by determining whether the coping with stress and problem-solving skills of physical education teachers vary according to age, gender, and years of experience in the profession.

METHOD

In this study, a survey model, which is a quantitative research method, has been utilized. Survey models aim to describe a past or present situation as it is, without attempting to change it. The phenomenon under investigation, whether it is an individual or an object, is defined as it is (23).

Population and Sample

The population of our study consists of physical education teachers working under the Ministry of National Education, while the sample comprises a total of 153 physical education teachers, including 64 females and 89 males, who are working in Mardin.

Data Collection Instruments

In our study, a Personal Information Form created by the researcher, the Coping with Stress Scale, and the Problem-Solving Inventory were utilized.

Coping with Stress Scale

The scale developed by Türküm (2002) consists of 23 items on a five-point Likert format. The scale comprises three sub-dimensions named social support, problem-focused coping, and avoidance. The Avoidance sub-dimension consists of 8 items (1,3,11,14,15,19,21,22), the Problem-Focused Coping sub-dimension consists of 8 items (2,5,6,7,8,9,12,16), and the Seeking Social Support sub-dimension consists of 7 items (4,10,13,17,18,20,23). Three items in the scale are reverse-scored (10,17,20). According to the reliability test results of the scale, the internal consistency coefficient is 0.78. As for the sub-dimensions, Seeking Social Support has a coefficient of 0.85, Problem-Focused Coping has a coefficient of 0.80, and Avoidance Coping has a coefficient of 0.65. In this study, the Cronbach's alpha value of the scale is found to be 0.74.

Problem-Solving Inventory

The Problem Solving Inventory, developed by Heppner and Peterson (1982) and adapted into Turkish by Şahin, Şahin, and Heppner (1993), consists of 35 items on a 6-point Likert scale. The response options for the 6-point Likert scale are: "I always behave this way", "I mostly behave this way", "I often behave this way", "I sometimes behave this way", "I rarely behave this way", and "I never behave this way". Responses are scored between 1 and 6. Items 9, 22, and 29 are excluded from scoring. Items 1, 2, 3, 4, 11, 13, 14, 15, 17, 21, 25, 26, 30, and 34 are reverse-scored. The score range that can be obtained from the inventory is between 32 and 192. The Cronbach's Alpha reliability coefficient of the scale was found to be .88. In our study, the Cronbach's Alpha was found to be 0.86.

Data Analysis

The data obtained were first uploaded to Microsoft Excel and then imported into the IBM SPSS 25.0 software package. Variance and homogeneity tests were conducted to ensure homogeneity, and it was determined that they were homogenous. In pairwise comparisons, independent t-tests were used, while in multiple comparisons, the One-Way ANOVA test was employed. Correlational analysis was conducted to determine relationships. A significance level of $p<0.05$ was considered in the statistical analysis and interpretation of the data.

Additionally, permission has been obtained from the Selçuk University Faculty of Sports Sciences Research Ethics Committee (05.02.2024-E.692924).

FINDINGS

Table 1. The mean scores of coping with stress and problem-solving skills according to the gender variable

Coping with Stress						
Gender	**N**	**%**	**X**	**Sd**	**T**	**P**
Female	64	41.8	3.648	.463	-0.16	.987
Male	89	58.2	3.649	.427		
Total	153	100	3.649	.445		
Problem Solving						
Gender	**N**	**%**	**X**	**Sd**	**T**	**P**
Female	64	41.8	4.403	.764	.957	.329
Male	89	58.2	4.289	.666		
Total	153	100	4.346	.715		

As seen in Table 1, no significant difference was found in the mean scores of coping with stress based on the gender variable. Similarly, it was observed that there is no significant difference in the mean scores of problem-solving skills.

Table 2. The mean scores of coping with stress and problem-solving skills according to the type of school variable

Coping with Stress						
School	**N**	**%**	**X**	**Sd**	**T**	**P**
Middle school	64	41.8	3.593	.491	**-1.267**	**.192**
High school	89	58.2	3.688	.399		
Total	153	100	3.640	.445		
Problem Solving						
School	**N**	**%**	**X**	**Sd**	**T**	**P**
Middle school	64	41.8	4.372	.729	.519	.612
High school	89	58.2	4.311	.696		
Total	153	100	4.341	.712		

As seen in Table 2, no significant difference was found in the mean scores of coping with stress based on the type of school where the participants work. Similarly, it is observed that there is no significant difference in the mean scores of problem-solving skills.

Table 3. The mean scores of coping with stress and problem-solving skills according to the variable of years of experience in the profession

Coping with Stress						
Years of experience	**N**	**%**	**X**	**Sd**	**F**	**p**
0-5	73	47.7	3.63	.491	.624	.646
6-10	45	29.4	3.65	.392		
11-l5	15	9.8	3.54	.439		
16-20	8	5.2	3.70	.278		
20 and above	12	7.8	3.80	.397		
Problem solving						
Years of experience	**N**	**%**	**X**	**Sd**	**F**	**p**
0-5	73	47.7	4.21	.671	2.197	.072
6-10	45	29.4	4.30	.702		
11-l5	15	9.8	4.60	.785		
16-20	8	5.2	4.62	.832		
20 and above	12	7.8	4.67	.637		

Table 3 indicates that there is no statistically significant difference in the mean scores of coping with stress based on participants' years of service in the profession, although the mean scores were higher for those with 20 years or more of service. Similarly, no statistically significant difference was found in the mean scores of problem-solving skills, despite the higher mean scores for those with 20 years or more of service.

Table 4. The correlation between the variables of coping with stress and problem-solving

Variables	Coping with Stress	Problem Solving
Coping with Stress	-	.275**
Problem Solving	.275**	-

** Correlation is significant at the 0.01 level (2-tailed).

Table 4 illustrates a positive, albeit low, relationship between the coping with stress scores and problem-solving scores of physical education teachers ($r = 0.275$, $p = 0.01$).

DISCUSSION AND CONCLUSION

This study aimed to examine the relationship between coping with stress and problem-solving skills among physical education teachers. The statistical analyses revealed that there was no significant difference in coping with stress mean scores based on the gender variable of physical education teachers (Table 1). Additionally, it was observed that the mean scores of both female and male participants are similar and high. In the study conducted with students of physical education and sports teaching departments, it was found that coping with stress scores did not vary depending on the gender variable (30). However, the study conducted with students enrolled in departments admitting students through special talent exams reported that the coping with stress scores of females were higher than males (13). In another study, it was observed that male participants had higher scores than female participants in some sub-dimensions (15).

Another finding of our study is that there was no significant difference in problem-solving mean scores among physical education teachers based on the gender variable (Table 1). The study conducted with physical education teachers revealed that there was no significant difference in problem-solving mean scores based on the gender variable (27), which is consistent with our study. In the study involving students who engage and do not engage in sports, researchers reported no variation in problem-solving scores based on the gender variable (26). Furthermore, several studies indicated no notable discrepancy in problem-solving mean scores based on gender (31, 29, 20, 18). However, a study conducted with basketball players revealed that males exhibited higher mean scores than females (21).

Our study found that there was no significant change in coping with stress mean scores among physical education teachers based on the type of school where they work (Table 2). It is observed that coping with stress among physical education teachers working in high schools or middle schools is similar. A study conducted with physical education teachers indicated that there was no difference in coping with stress mean scores based on the type of school (17). Similarly, another study involving school counselors revealed no difference in coping with stress mean scores based on the type of school, aligning with our study (5).

Our study revealed that there was no significant change in problem-solving mean scores among physical education teachers based on the type of school where they work (Table 2). It is observed that problem-solving skills among physical education teachers working in high schools or middle schools are similar. A study conducted with teachers working in preschool education institutions found no significant difference in problem-solving skills based on the type of school (10). Similarly, another study involving preschool education teachers showed no significant difference in problem-solving skills based on the type of school, which is in line with our findings (24).

In the present study, no significant difference was found in coping with stress mean scores among physical education teachers based on their years of service in the profession (Table 3). However, it was observed that the mean scores of those with 20 years or more of service were higher than those in other groups. Literature also supports these findings, indicating no change in coping with stress mean scores of teachers

based on years of service in the profession (12). Nevertheless, some studies have suggested an increase in problem-solving skills as years of service in the profession increase (9, 8, 17).

Our study showed no significant difference in problem-solving mean scores among physical education teachers based on their years of service in the profession (Table 3). However, it is observed that the mean scores of those with 20 years or more of service are higher than those in other groups. One study conducted with teachers working in preschool education institutions reported no significant change in problem-solving mean scores based on years of service in the profession (10). Similarly, Serin (2006) obtained similar results in a study conducted with classroom teachers (28). However, Demirtaş and Dönmez (14) reported in their study that teachers with fewer years of service exhibited higher problem-solving skills.

In the current study, a positive but low-level correlation was observed between coping with stress and problem-solving skills among physical education teachers ($r = 0.275$, $p = 0.01$, Table 4). It is suggested that physical education teachers adept at managing stress may find it easier to navigate problem-solving scenarios. Conversely, a study involving taekwondo coaches (7) and another focusing on bocce athletes (1) found no significant relationship between coping with stress and problem-solving skills. Similarly, research with students in physical education teaching programs found no correlation between coping with stress sub-dimensions and problem-solving sub-dimensions (2).

In conclusion, it is evident that physical education teachers exhibit exceptionally high mean scores in both coping with stress and problem-solving. This underscores their capacity to effectively manage stress and surmount challenges encountered in their profession. Furthermore, it is hypothesized that physical education teachers who demonstrate proficiency in coping with stress are also skilled in addressing the challenges they encounter.

REFERENCES

1. Acar, H. Bocce (volo) sporcularının stresle başa çıkabilme ile problem çözme becerileri arasındaki ilişkinin incelenmesi (Master's thesis, Bartın Üniversitesi, Sosyal Bilimler Enstitüsü). 2019.
2. Ağbuğa, B., & Şener, M. R. Beden Eğitimi ve Spor Öğretmenliği Bölümü Öğrencilerinin Stresle Başa Çıkma ve Problem Çözme Becerileri Arasındaki İlişkinin İncelenmesi. International Journal of Sport Culture and Science, 4(Special Issue 1), 139-145. 2016.
3. Aksoy, B. Problem çözme yönteminin çevre eğitiminde uygulanması. Pamukkale Üniversitesi Eğitim Fakültesi Dergisi, 14(14), 83-98. 2003.
4. Altun, I. The perceived problem solving ability and values of student nurses and midwives. Nurse education today, 23(8), 575-584. 2003.
5. Aysan, F. & Bozkurt, N. Okul Psikolojik Danışmanlarının Yaşam Doyumu, Stresle Başa çıkma Stratejileri İle Olumsuz Otomatik Düşünceleri: İzmir İli Örneklemi, XIII. Ulusal Eğitim Bilimleri Kurultayı, 6-9 Temmuz 2004 İnönü Üniversitesi, Eğitim Fakültesi, Malatya. 2004.
6. Baltaş Z, Baltaş A. Stres ve Başa Çıkma Yolları. 39. Baskı, İstanbul: Remzi Kitabevi, 2013.
7. Bezci, Ş. Taekwondo antrenörlerinin stresle başa çıkma ve problem çözme becerileri arasındaki ilişkinin incelenmesi. Enstitüsü Beden Eğitimi ve Spor Öğretmenliği Anabilim Dalı. 2010.
8. Bozkurt, N. İlköğretim Öğretmenlerinde, Stres Yaratan Yaşam Olayları Ve Stresle Başa çıkma Tarzlarının Çeşitli Değişkenlerle İlişkisi, XIII. Ulusal Eğitim Bilimleri Kurultayı, 6-9 Temmuz 2004 İnönü Üniversitesi, Eğitim Fakültesi, Malatya.2004.
9. Bulut, N. İlköğretim Öğretmenlerinde, Stres Yaratan Yaşam Olayları Ve Stresle Başa çıkma Tarzlarının Çeşitli Değişkenlerle İlişkisi, Kastamonu Eğitim Dergisi, 13:2, 467-478. 2005.
10. Ceylan, R., Biçakçi, M. Y., Neriman, A. R. A. L., & Gürsoy. Okul Öncesi Eğitim Kurumunda Çalişan Öğretmenlerin Problem Çözme Becerilerinin Incelenmesi. Trakya Üniversitesi Sosyal Bilimler Dergisi, 14(1), 85-98. 2012.
11. Cüceloğlu, D. İyi Düşün Doğru Karar Ver, İstanbul, Sistem Yayıncılık. 2000.
12. Çetin, E. Öğretmenlerin psikolojik dayanıklılığı ile stresle başa çıkma tarzları arasındaki ilişkinin incelenmesi (Master's thesis, İstanbul Sabahattin Zaim Üniversitesi, Sosyal Bilimler Enstitüsü, Eğitim Bilimleri Anabilim Dalı). 2019.
13. Demir, H., Altın, M., Demirel, H., Buğdaycı, S. ve Yalçın, YG. Özel Yetenek Sınavı İle Öğrenci Kabul Eden Okullarda Öğrenim Gören Öğrencilerin Stresle Başa Çıkma Tarzları. Avrupa Beden Eğitimi ve Spor Bilimleri Dergisi. 2017.
14. Demirtas, H., & Dönmez, B. Ortaöğretimde görev yapan öğretmenlerin problem çözme becerilerine ilişkin algıları. İnönü Üniversitesi Eğitim Fakültesi Dergisi, 9(16), 177-198. 2008.
15. Eraslan, M. Spor Bölümlerinde Öğrenim Gören Üniversite Öğrencilerinin Kişilik Özelliklerinin Ve Stresle Başa Çıkma Stillerinin Çeşitli Değişkenlere Göre İncelenmesi. Mehmet Akif Ersoy Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 7(12), 65-82. 2015.

16. Ergin A, Ergin A, Uzun SU, Bozkurt Aİ. Tıp Fakültesi Öğrencilerinde Stresle Başa Çıkma Yöntemleri ve Bu Yöntemlerin Sosyodemografik Özelliklerle İlişkisi. Pamukkale Üniversitesi, Tıp Fakültesi Halk Sağlığı Anabilim Dalı, Fırat Tıp Dergisi, 2014; 19(1): 31-37 Denizli. 2014.
17. Erkmen, N., & Çetin, M. Ç. Beden Eğitimi Öğretmenlerinin Stresle Başa Çıkma Tarzlarının Bazı Değişkenlerle İlişkisi. Selçuk Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, (19), 231-242. 2008.
18. Gültekin, A. Psikolojik Danışma ve Rehberlik Öğrencilerinin Problem Çözme Becerilerinin İncelenmesi. Yayınlanmamış Yüksek Lisans Tezi. Atatürk Üniversitesi, Sosyal Bilimler Enstitüsü, Eğitim Bilimleri Anabilim Dalı, Erzurum. 2006.
19. Heppner, P. P., & Baker, C. E. Applications of the Problem Solving Inventory. Measurement and Evaluation in Counseling and Development, 29(4), 229-241. 1997.
20. Izgar, H., Güreşş, M. Önder Davranışların Problem Çözme Becerisine Etkisi. XIII. Ulusal Eğitim Bilimleri Kurultayı, 6-9 Temmuz. İnönü Üniversitesi, Eğitim Fakültesi, Malatya. 2004.
21. İnce G, ve Şen C. Adana İl'inde deplasmanlı ligde basketbol oynayan sporcuların problem çözme becerilerinin belirlenmesi. Spormetre Beden Eğitimi ve Spor Bilimleri Dergisi. 4 (1), 5-10. 2006.
22. Karadavut Y. İlköğretim Okulu Öğretmenlerinin Örgütsel Stres Kaynakları, Stres Belirtileri ve Stresle Başa Çıkma Yolları. Yüksek lisans Tezi, Gazi Üniversitesi Eğitim Bilimleri Enstitüsü, Eğitim Yönetimi ve Denetimi Anabilim Dalı, Ankara 2005. 90.
23. Karasar, N. Bilimsel Araştırma Yöntemi, 20. Baskı, Nobel Yayın Dağıtım, Ankara. 2009.
24. Kesgin, E. Okul öncesi eğitim öğretmenlerinin öz-yeterlilik düzeyleri ile problem çözme yaklaşımlarını kullanma düzeyleri arasındaki ilişkinin incelenmesi (Denizli ili örneği) (Master's thesis). 2006.
25. Lazarus, R.S. From psychological stress to the emotions: A history of changing outlooks. Annu. Rev. Psychol., 44, 1-21. 1993.
26. Mirzeoğlu, D., Özcan, G., Kıyak, Ö., & Aydemir, F. Ortaöğretimde Lisanslı Olarak Spor Yapan Ve Spor Yapmayan Öğrencilerin Problem Çözme Becerilerinin Çeşitli Değişkenlere Göre İncelenmesi. Gazi Beden Eğitimi ve Spor Bilimleri Dergisi, 15(2), 3-19. 2010.
27. Öztürk, M., Şahin, Ş., & Güngör, A. K. Beden Eğitimi ve Spor Öğretmenlerinin Mental Rotasyon ve Problem Çözme Becerileri Üzerine Bir İnceleme: Bursa İli Örneği. Uluslararası İnsan ve Sanat Araştırmaları Dergisi, 6(4), 535-547. 2021.
28. Serin, O., ''Sınıf öğretmenlerinin problem çözme becerilerinin çeşitli değişkenler açısından incelenmesi'', Eğitim ve Bilim, 31(142), 2006, 80-88.
29. Tanrıkulu T. Yetiştirme yurtlarında ve aile ortamında yasayan ergenlerin bilişsel yapıları (Olumsuz otomatik düşünceler) ve problem çözme becerileri açısından incelenmesi. Yayımlanmamış Yüksek Lisans Tezi. Marmara Üniversitesi Eğitim Bilimleri Enstitüsü, İstanbul. 2002.
30. Taşğın, Ö., & Çağlayan, H. S. Beden Eğitimi Ve Spor Öğretmenliği Bölümü Öğrencilerinin Stresle Başa Çıkma Tarzlarınıı İncelenmesi. Van Yüzüncü Yıl Üniversitesi Eğitim Fakültesi Dergisi, 8(Özel). 2011.
31. Tümkaya, S. ve Oflazoğlu, A. Ç.Ü. Sınıf Öğretmenliği Öğrencilerinin Otomatik Düşünce ve Problem Çözme Düzeylerinin Bazı Sosyo-Demografik Değişkenlere Göre incelenmesi. Çukurova Üniversitesi Sosyal Bilimler Dergisi. 6 (6), 143-158. 2000.
32. Türkçapar, Ü. Beden eğitimi ve spor yüksekokulu öğrencileri ile eğitim fakültesi sınıf öğretmenliği öğrencilerinin strese karşı problem çözme becerilerinin karşılaştırılması. Yayımlanmamış Yüksek Lisans Tezi. Gazi Üniversitesi Eğitim Bilimleri Enstitüsü Beden Eğitimi ve Spor Öğretmenliği Anabilim Dalı, Ankara. 2007.
33. Türküm, A.S. Stresle başa çıkma ölçeğinin geliştirilmesi: Geçerlik ve güvenilirlik çalışmaları. Türk Psikolojik Danışma ve Rehberlik Dergisi, 2(18), 25-33. 2002.
34. Yılmaz, E., Karaca, F., ve Yılmaz, E. Sağlık Yüksekokulu Öğrencilerinin Problem Çözme Becerilerinin Bazı Değişkenler Açısından İncelenmesi. Atatürk Üniversitesi Hemşirelik Yüksekokulu Dergisi, 12(1), 38-48. 2009.

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Examination of the Effects of Pilates Exercises on Sleep Quality and Physical Activity

Osman DİŞÇEKEN [1A], Aleyna ASLAN [1B], Şevket Cihat ÖZER [1C], Hayri DEMİR[2D]

[1] *Nevsehir Hacı Bektaş Veli University, Sport Science Faculty Nevşehir, TÜRKİYE*
[2] *Selçuk University, Sport Science Faculty, Konya, TÜRKİYE*

Address Correspondence to Osman DISCEKEN: e-mail: osmandisceken@gmail.com

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A: Orcid ID: 0000-0003-2500-4932 B: Orcid ID: 0009-0002-2316-9215 C: Orcid ID: 0000-0002-0521-7431 D: Orcid ID: 0000-0001-9496-8992

Abstract

This study aimed to investigate the effects of an 8-week Pilates exercise program on physical activity levels and sleep quality among university students. A total of 40 students from Nevşehir Hacı Bektaş Veli University, comprising 20 females and 20 males, participated voluntarily. The International Physical Activity Questionnaire (IPAQ), Pittsburgh Sleep Quality Index (PSQI), and demographic information forms were administered. The experimental group engaged in Pilates exercises twice a week for 90 minutes each session over the 8-week period. The control group continued their daily lives without doing any regular sports. Data collected before and after the intervention were compared. Normality of the data was tested using the Kolmogorov-Smirnov and Shapiro-Wilks tests, while Pearson correlation analysis was applied to examine relationships between normally distributed variables. Independent Sample T-Tests were conducted to compare group differences, with a 95% confidence interval and significance level set at $p<0.05$. According to the results of the analysis, there were significant improvements in the Sleep Quality score of the experimental group ($p=0.041$), Physical Activity total score ($p=0.000$), and physical activity sub-dimensions (High, Moderate, Walking) compared to the control group. Additionally, a moderate positive correlation ($r=0.637$) was found between total physical activity score and its sub-dimensions. In conclusion, regular Pilates exercises were found to significantly enhance both daily physical activity levels and sleep quality in participants, suggesting that Pilates can be recommended to improve these aspects of health.

Keywords: Physical activity, pilates, sleep quality.

Pilates Egzersizlerinin Uyku Kalitesi ve Fiziksel Aktivite Üzerine Etkilerinin İncelenmesi

Özet

Bu çalışmada, 8 haftalık bir Pilates egzersiz programının üniversite öğrencileri arasında fiziksel aktivite düzeyleri ve uyku kalitesi üzerindeki etkilerini araştırmak amaçlanmıştır. Nevşehir Hacı Bektaş Veli Üniversitesi'nden 20'si kadın ve 20'si erkek olmak üzere toplam 40 öğrenci gönüllü olarak katılmıştır. Katılımcılara Uluslararası Fiziksel Aktivite Anketi (IPAQ), Pittsburgh Uyku Kalitesi İndeksi (PUKİ) ve demografik bilgi formları uygulanmıştır. Deney grubu, 8 hafta boyunca haftada iki kez, her biri 90 dakika süren Pilates egzersizlerine katılmıştır. Kontrol grubu ise düzenli herhangi bir spor yapmadan günlük hayatına devam etmiştir. Araştırma öncesi ve sonrasında toplanan veriler karşılaştırılmıştır. Verilerin normalliği Kolmogorov-Smirnov ve Shapiro-Wilks testleri ile değerlendirilmiş, normal dağılım gösteren

değişkenler arasındaki ilişkileri incelemek için Pearson korelasyon analizi uygulanmıştır. Grup farklılıklarını karşılaştırmak için Bağımsız Örneklem T-Testi kullanılmış olup, %95 güven aralığı ve p<0,05 anlamlılık düzeyi olarak belirlenmiştir. Analiz sonuçlarına göre, deney grubunun Uyku Kalitesi skoru (p=0,041), Fiziksel Aktivite toplam skoru (p=0,000) ve fiziksel aktivite alt boyutlarında (Yüksek, Orta, Yürüme) kontrol grubuna kıyasla anlamlı iyileşmeler görülmüştür. Ayrıca, toplam fiziksel aktivite skoru ile alt boyutları arasında orta düzeyde pozitif bir korelasyon (r=0,637) bulunmuştur. Sonuç olarak, düzenli Pilates egzersizlerinin katılımcıların günlük fiziksel aktivite düzeylerini ve uyku kalitesini anlamlı derecede artırdığı tespit edilmiş, bu bulgular ışığında Pilates'in bu sağlık alanlarını iyileştirmek için önerilebileceği sonucuna varılmıştır.

Anahtar kelimeler: Fiziksel aktivite, pilates, uyku kalitesi.

INTRODUCTION

It is widely acknowledged that engaging in physical activity yields beneficial effects on bothiphysical and mentalywell-being of individuals. These effects are beneficial in both prevention and treatment of diseases (7, 37). Studies show that physical activity positively affects health-related quality of life (7, 12, 32). Additionally, participating in such activities helps diminish feelings of inadequacy or inferiority experienced in social interactions to some extent (37). It is known that those who participate in physical activity have better physical performance and experience lower social-physical anxiety (20). Research on physical activity's health impacts indicates it lowers cardiovascular disease risk, aids weight management, decreases diabetes risk, guards against cancer, supports musculoskeletal health, and yields psychological benefits like reducing depression, stress, and anxiety. It also fosters positive social effects (24).

The prevalent sedentary lifestyle seen today adversely impacts individuals' quality of life and disrupts their sleep patterns (22). Given the persistence of these problems and their health ramifications, it's crucial to assess them within society (5). Sleep, which covers approximately 20-25 years of human life, has received special emphasis in academic research due to the increase in complaints, the potential of poor quality sleep to cause various diseases and the strong link between good sleep and physical and psychological health (6). Researches have indicated a correlation between insufficient physical activity and the occurrence of insomnia (23, 8). Exercises are recommended as an alternative treatment because they are non-pharmacological, low-cost and easily accessible. The anxiety-reducing and antidepressant effect of exercises are being very important factor in alleviating the aetiology of insomnia and subsequent psychological comorbidities (8, 31). Regular exercisers often encounter fewer issues with insomnia. Exercise can enhance sleep quality by facilitating a smoother transition between sleep cycles and stages. Engaging in moderate-intensity exercises for 20-30 minutes, four to five times weekly, can promote improved sleep (34).

Pilates is an exercise method created to increase muscle strength, flexibility and muscle control (27, 13, 4, 3). Pilates, popular among women, blends elements of yoga, gymnastics, and other sports with mental concentration and specialized breathing techniques drawn from Eastern and Western philosophies (3). Pilates exercises, which can be easily applied by people of all age groups, including disabled individuals, are performed on a mat or with specially designed tools (reformer, cadillac, etc.) (18). Literature findings demonstrate that exercise enhances body composition, lowers the risk of coronary artery disease and diabetes, diminishes pain and depression, extends life expectancy, improves quality of life, and combats obesity (11). Pilates exercises are a type of exercise developed by Joseph Pilates, aiming to make the mind and body work in a holistic way, improving balance and respiratory system (17). In addition, Research has revealed beneficial effects associated with pilates exercises on psychological, physical and motor functions (25).

Considering that Pilates is based on principles that aim to work the body as a whole (18), it wouldn’t be wrong to state that it is a suitable physical activity for healthy and sick individuals. A 12-week pilates programme was observed to improve sleep quality and reduce delayed sleep in individuals with sleep problems. In addition, it was determined that 16-week pilates exercises in geriatric individuals increased the PSQI scores of the patients and regulated their sleep quality (23). In studies conducted in patients with chronic heart failure, it was found that regular personalised Pilates programme improved sleep quality for 10 weeks. Pilates requires professional guidance at the beginning of regular practice and training (28). Therefore, Pilates is recommended as a regular exercise programme to deal with sleep disorders. Based on all this information,

our current study was conducted to evaluate the effects of an 8-week Pilates exercise program on sleep quality and physical activity among university students.

METHOD

This section includes information about the research group, procedure, data collection tools and data analysis. In this study, experimental design with control group was used and correlational research method was used to examine the effect of pilates exercises applied to university students for 8 weeks on sleep quality and physical activity scores.

Participants

A total of 40 volunteer sports science students, 20 male and 20 female, with a mean age of 19.63±1.606 years took part in the study (Table 1). Sample size efficiency was calculated using G*Power software (version 3.1.9.7; Heinrich-Heine-Universität Düsseldorf, Düsseldorf, Germany). When (1-β) was set to 0.80 and α was set to 0.05 in G-Power, the calculation using G-Power indicated that each group should consist of at least 18 participants. Before the study, each athlete was given accurate knowledge of the research and the potential risks, and permission to participate was gained by reading the declaration of consent. Individuals who had sustained an injury during the previous six months were excluded from the trial.

Table 1. Descriptive statistics of participants

Variables	Gender	N	$\bar{X}$	SD	Min	Max
Age (Year)	Male	19	19,63	1,61	18	22
	Female	21	19,62	1,43	18	23
Class	Male	19	1,47	,513	1	2
	Female	21	1,52	,512	1	2
Experimental Group	Male	9	19,23	20,75	19	23
	Female	11				
Control Group	Male	10	18,50	,946	18	22
	Female	10				

Ethical approval and institutional permission

Within the scope of the study, permission was given from Nevşehir Hacı Bektaş Veli University Non-Interventional Clinical Research Ethics Committee (Ethics Committee Document No: 2300082004; Meeting No: 12; Decision Number 2023/07) and all measurements were performed in accordance with the Declaration of Helsinki.

Data Collection Tools

Demographic Information: After explaining the process related to the study, demographic information will be collected with the demographic information form. Participants were asked questions such as age, gender and sports age.

International Physical Activity Questionnaire (IPAQ): The abbreviated version of the International Physical Activity Questionnaire (IPAQ), devised by Craig et al. (16) was used to assess the engagement of participants in physical activity. The Turkish version of the questionnaire for university students was conducted by Öztürk (30), yielding valid and reliable results for this demographic. Participants were asked for their assessment the questionnaire they were given before starting the study and after 8 weeks of pilates practices by thinking about what changes in their physical activity levels. The questionnaire consisted of seven items that asked about time spent sitting, low level intensity activities (such as walking), and moderate and high level intensity activities. A score of "MET/minute/week" was calculated by multiplying the survey's minute, day and MET values. The computation took into account 3.3 METs for walking, 4.0 METs for moderate-intensity physical activity, and 8.0 METs for vigorous-intensity physical activity. Physical activity was classified into three levels: inactive (<600 MET-min/week), marginally active (600-3000 MET-min/week),

and sufficiently active (>3000 MET-min/week). The quantity of time spent sitting was assessed independently during the investigation.

Pittsburgh Sleep Quality Index (PSQI): The PSQI is a self-report scale designed to evaluate sleep quality and disturbances experienced over a one-month timeframe. The PSQI was developed by Buysse et al. in 1989 and has been demonstrated to possess sufficient internal consistency (0.83), test-retest reliability and validity (10). Ağargün et al. evaluated the scale's validity and reliability in Turkey, revealing an internal consistency coefficient of 0.80 for Cronbach's alpha. The PSQI examination has 18 components for scoring (1). The PSQI has seven subcomponents: subjective sleep quality, sleep latency, sleep length, sleep medication usage, habitual sleep efficiency, sleep disruption, and daytime dysfunction. Certain components are represented by a single object, but others are created by putting many elements together. Each item is scored on a scale of 0 to 3, and the total PSQI score is the sum of the seven component values. An overall score on the PSQI defines as ≤5 indicates "good sleep quality," whereas >5 indicates "poor sleep quality" (1).

Data Collection Process

First of all, the participants informed with all the details about the purpose and process of the study. The volunteers participating in the study were administered the IPAQ scale to determine their physical activity levels, the PSQI scale to assess their sleep quality, and personal information forms indicating their age, gender and sports age as pretests. The participants were split into two groups as experimental and control groups with equal numbers of men and women by random sampling method. The participants who were part of the experimental group practiced pilates exercises for 8 weeks, 2 times a week, 90 minutes a day, accompanied by an expert trainer. Detailed information about the pilates exercise applied is given in Figure 1. The control group was not involved in any application and continued their standard lives. After the 8-week period for Pilates exercises was over, the IPAQ and PSQI scales administered to the participants at the beginning of the study were re-administered to the participants and the measurement and exercise process of the study was completed and the data obtained were recorded for analysis.

1. Week	Set	Repeat	Rest	Intensity	Frenquency(Day)
Hundred	2	8-10	1:1	%70	2
Roll up	2	6-8	1:1	%70	2
One Leg Circle	2	6-8	1:1	%70	2
Theaser	2	4-6	1:1	%70	2
2. Week	**Set**	**Repeat**	**Rest**	**Intensity**	**Frenquency(Day)**
Rolling Like a Ball	2	6-8	1:1	%70	2
Single Leg Strech	2	10-12	1:1	%70	2
Double leg Strech	2	10-12	1:1	%70	2
Single Straight Leg	2	10-12	1:1	%70	2
3. Week	**Set**	**Repeat**	**Rest**	**Intensity**	**Frenquency(Day)**
Double Straight Leg	2	10-12	1:1	%70	2
Criss Cross	2	10-12	1:1	%70	2
Spine Stretch For.	2	6-8	1:1	%70	2
Corkscrew	2	6-8	1:1	%70	2
4. Week	**Set**	**Repeat**	**Rest**	**Intensity**	**Frenquency(Day)**
Saw	2	6-8	1:1	%70	2
Swan neck Roll	2	3-5	1:1	%70	2
Rest Position	2	10 sn	1:1	%70	2
Shoulder Bridge	2	6-8	1:1	%70	2

5. Week	Set	Repeat	Rest	Intensity	Frenquency(Day)
Front Back Up	2	10-12	1:1	%80	2
Inner Thigh Lift	2	12-15	1:1	%80	2
Beats on Belly	2	12-15	1:1	%80	2
Theaser	2	3-5	1:1	%80	2
6. Week	**Set**	**Repeat**	**Rest**	**Intensity**	**Frenquency(Day)**
Theaser one Leg	2	6-8	1:1	%80	2
Swimming Prep	2	6-10	1:1	%80	2
Push Up	2	6-8	1:1	%80	2
Mermaid strech	2	3-5	1:1	%80	2
7. Week	**Set**	**Repeat**	**Rest**	**Intensity**	**Frenquency(Day)**
Double Straight Leg	2	10-12	1:1	%80	2
Criss Cross	2	10-12	1:1	%80	2
Spine Stretch For.	2	6-8	1:1	%80	2
Corkscrew	2	6-8	1:1	%80	2
8. Week	**Set**	**Repeat**	**Rest**	**Intensity**	**Frenquency(Day)**
Rolling Like a Ball	2	6-8	1:1	%80	2
Single Leg Strech	2	10-12	1:1	%80	2
Double leg Strech	2	10-12	1:1	%80	2
Single Straight Leg	2	10-12	1:1	%80	2

Figure 1: Pilates exercise programme

Analysis of the Data

The normality of the data gathered was established employing the Kolmogorov-Smirnov and Shapiro-Wilk tests, and the analysis of Pearson correlation was employed to evaluate correlations among variables with normal distributions. Variables were compared using the Independent Sample T Test. The confidence range was 95%, and values below $p<0.05$ were considered significant.

FINDINGS

Table 2. Comparison of control and experiment group pre-test and post-test

Variables	Group	Pre-Test (n=20)			Post-Test (n=20)		
		$\bar{X}$ ±SD	t	p	$\bar{X}$ ±SD	t	p
PUKİ	Experimental	7,20±2,17	0,63	,950	5,45±2,01	-2,113	,041*
	Control	7,15±2,81			7,05±2,72		
MET Total	Experimental	6043,65±1610,69	-,188	,852	6648,10±1555,75	,149	,543
	Control	6145,70±1814,03			6315,50±1856,30		
High	Experimental	2880,50±1173,54	,009	,993	3010,00±1254,94	,251	,628
	Control	2877±1212,14			3030±1441,26		
Moderate	Experimental	923,90±637,55	-,074	,941	1290±759,40	,274	,129
	Control	938,40±597,73			946,50±636,34		
Walking	Experimental	2239,25±1308,86	-,217	,829	2534,60±1177,29	,782	,630
	Control	2330,30±1341,77			2339±1365,40		

***p<0,05**

When Table 2 was analyzed, no differences of statistical significance were discovered between the groups in Total Sleep Quality (PSQI), Physical Activity Level total score (MET Total), High, Moderate and Walking pre-test values ($p < 0.05$). In the post-test values, while there was a statistically significant difference in favor of the experimental group in Total Sleep Quality (PSQI) values, there was no statistically significant difference in Physical Activity Level total score (MET Total), High, Moderate and Walking post-test values ($p < 0.05$).

Table 3. Pretest and Post test Comparison of Control and Experimental Groups According to Gender Variable

Variables	**Gender**	**Pre-Test**			**Post-Test**		
		$\bar{X}$ **±SD**	**t**	**p**	$\bar{X}$ **±SD**	**t**	**p**
PUKİ	Male	8,26±2,40	2,879	,007*	7,37±2,45	2,946	,005*
	Female	6,19±2,16			5,24±2,12		
MET Total	Male	5,805,16±1788,69	-,1,029	,310	6094,32±1711,03	-1,388	,173
	Female	6356,62±1601,52			6832±1649,75		
High	Male	2743,16±1134,20	-,688	,496	2772,63±1293,52	-,693	,493
	Female	3001,43±1230,08			3065,71±1373,26		
Moderate	Male	863,68±625,49	-,661	,513	963,68±603,24	-1,142	,261
	Female	992,19±603,48			1240,48±794,48		
Walking	Male	2198,32±997,71	-,393	,697	2338±954,93	-,466	,644
	Female	2363±1559,66			2526,19±1506,18		

*p<0,05

As it appears on Table 3, a statistical significant difference favoring female participants was identified in both pre-test and post-test Total Sleep Quality (PSQQI) scores, based on the gender variable. There was no statistically significant difference in Physical Activity Level total score (MET Total), High, Moderate and Walking values in both tests according to gender variable ($p < 0.05$).

Table 4. Pre-Test and post-test comparison results within the group

Variables	Group	Experimental Group (n=20)			Control Group (n=20)		
		$\bar{X}$	SD	p	$\bar{X}$	SD	p
MET Total	Pre-Test	6043,65	1610,691	,000**	6145,70	1814,03	,206
	Post-Test	6648,10	1555,752		6315,50	1856,30	
High	Pre-Test	2880,50	1173,54	,019*	2877	1212,14	,218
	Post-Test	3010,00	1254,94		3030	1441,36	
Moderate	Pre-Test	923,90	637,55	,000**	938,40	596,73	,729
	Post-Test	1290,50	759,40		946,50	636,34	
Walking	Pre-Test	2239,25	1308,86	,002**	2330,30	1341,77	,859
	Post-Test	2534,60	1177,29		2339	1365,40	
PUKİ	Pre-Test	7,20	2,17	,000**	7,15	2,82	,629
	Post-Test	5,45	2,01		7,05	2,72	

*p<0,05, **P<0.01

When Table 4 is reviewed, a statistical significant difference was identified in the experimental group Total Sleep Quality (PSQI), Physical Activity Level total (MET Total), High, Moderate and walking pre-test and post-test values ($p < 0.05$). In the control group, there was not a statistically significant difference found in Total Sleep Quality (PSQI), Physical Activity Level total score (MET Total), High, Moderate and Walking pre-test and post-test values ($p < 0.05$).

Table 5. Table of the relationship between physical activity total score and physical activity subscales

Variables		MET Total	High	Moderate	Walking
MET Total	Pearson's r	1	**,637****	,294	**,509****
	p		,000	,065	,001
	N	40	40	40	40
High	Pearson's r	**,637****	1	,013	-,201
	p	,000		,936	,214
	N	40	40	40	40
Moderate	Pearson's r	,294	,013	1	-,183
	p	,065	,936		,259
	N	40	40	40	40
Walking	Pearson's r	**,509****	-,201	-,183	1
	p	,001	,214	,259	
	N	40	40	40	40

*p<0,05

When Table 5 was reviewed, there was a positive, moderate, statistically significant relationship found between the Physical Activity Level total score (MET Total) and High (r=.637) and Walking (r=.509), which are sub-dimensions of physical activity. No statistically significant relationship was found between the total score of Physical Activity Level (MET Total) and Moderate exercise ($p < 0.05$).

DISCUSSION AND CONCLUSION

The aim of this study was to investigate the changes in physical activity and sleep quality levels after 8 weeks of Pilates exercises applied to the students from Faculty of Sports Sciences of Nevşehir Hacı Bektaş Veli University. A total of 40 volunteer sports science students, 20 male and 20 female, with a mean age of 19.63±1.606 years participated in the study.

In the classification for physical activity; low level: individuals with a value below 600 MET-min/week, medium level: individuals with a value between 600-3000 MET-min/week and high level: 3000 MET-min/week (16). When evaluating the total sleep quality score, it is stated that individuals with a score of "≤5" have good sleep quality, whereas individuals with a score of ">5" have poor sleep quality (1).

According to our findings, no statistically significant difference was observed between the two groups in Total Sleep Quality (PSQI), Physical Activity Level total score (MET Total), High, Medium and Walking pre-test values ($p<0.05$). This shows that both groups are distributed homogeneously. In the post-tests, a statistically significant difference was observed in Total Sleep Quality (PSQI) values that favor the experimental group (Experimental Group: pre test Mean:7.20, post test Mean:5.45, Control Group: pre test Mean:7.15, post test Mean:7.05). Although there were increases in Physical Activity Level total (MET Total) score, High, Medium and Walking values from post-test that favor the experimental group, no statistically significant difference was detected ($p<0.05$). When reviewing the literature, it is commonly stated that pilates training generally improves the sleep quality of individuals, but the effects are not clear in individuals after the age of 40 and more studies are needed. It has been observed that regular physical activity and Pilates exercises, which are usually performed between 8 and 16 weeks, improve sleep quality and reduce delayed sleep in individuals with sleep problems in young, middle-aged and older ages (21). Similarly, it is noteworthy that Pilates exercises improve sleep quality in individuals with chronic heart disease (28). Leopoldino et al. (26) stated that 12-week Pilates training had positive effect on improving the life quality and sleep quality. Our study's results are similar to the studies conducted. Therefore, Pilates is recommended as a regular exercise program in the fight against sleep disorders.

When we looked at the values from pre-test and post-test that collected from the participants according to the gender variable, a statistically a significant differences was found between the Total Sleep Quality (PSQI) score averages. Accordingly, it was found that females had better sleep quality scores than males in both pre-test ($t=2.879$, $p=.007$) and post-test ($t=2.946$, $p=.005$) values. This suggests that some factors affecting sleep quality such as sleeping hours, adaptation to common living spaces and similar factors are better practiced by female students than male students. However, Işık et al. (22) reported that men had higher physical activity scores than women, while women had higher total sleep quality and depression scores than men. There are studies reporting similar results in the literature. This situation is considered to be influenced by personal lifestyle habits and the living environment.

The experimental group had significantly higher scores in Total Sleep Quality (PSQI) ($p=.000$), Physical Activity Level Total (MET Total) ($p<0.05$), High ($p<0.01$), Moderate ($p=.000$), and Walking ($p<0.01$) compared to the control group. Accordingly, it is seen that 8-week regular pilates exercises caused positive changes in Total Sleep Quality (PSQI) and Physical Activity Level total (MET Total) scores of university students. In the literature, similar to our study results, Garcia-Soidan et al. (21) reported that the general activity value was 12,539.7 on average in the pre-test data of the study and 13,095.8 in the post-test data, which provided an increase of approximately 10.9% in the Pilates group, but there was no change in the control group. Bulgurluoğlu et al. (9) reported that online pilates trainings increased physical activity, quality of life, depression levels and sleep quality scores in favor of the experimental group ($p<0.05$). According to the results obtained in the study conducted by Saltan (33), it was reported that Pilates-based exercises in women were effective on BMI, emotional state, waist hip ratio and posture, which are sub-parameters of quality of life assessment. Similarly, Vergili (36) investigated the effect of 12 weeks of Pilates-based exercise on quality of life in 153 sedentary women and reported that exercise positively affected parameters such as quality of life and mobility, respiration, excretion, normal activities, and mental function in women.

We investigated the connection between the participants' Physical Activity Level Total (MET Total) scores and the Physical Activity sub-dimensions. Table 5 shows a positive and moderate link between Physical Activity Level total score and High Intensity Exercises ($r=.637$) and Walking Exercises ($r=.509$). According to these results, it is seen that all of the exercises performed as physical activity such as high intensity, moderate or walking positively affect the total Physical Activity scores. We think that regular pilates exercises increase the physical activity level of the individuals and accordingly increase their self-confidence while walking, going up and down and encourage them to physical activity.

Many studies in the literature have reported that physically active participants have improved mental states such as fatigue, anxiety, depression, self-efficacy, etc. However, as in our current study, there are studies that applied pilates for physical activity and reported positive effects on the sleep quality of the participants (14, 15, 26, 2).

As a result, both the pre-test and post-test Physical Activity Total Scores of the Universty students were in the category classified as high. We think that this reflects the participants' habits of practicing sports on their level of physical activity participation in daily life. However, regular pilates exercises provided statistically significant differences in physical activity total score and physical activity sub-dimensions even in participants with a sports experince and increased the daily physical activity level. In addition, there were improvements in the sleep quality scores of the participants after Pilates exercises.

For all these reasons, it is seen that Pilates exercises positively improve the daily physical activity levels of people and as frequently stated in the literature (9, 21, 28, 33, 36), there are significant changes in sleep quality, depression perceptions, quality of life, mobility, etc. with increasing physical activity.

REFERENCES

1. Ağargün MY, Kara H, Anlar O. Pittsburgh uyku kalitesi indeksinin geçerliği ve güvenirliği. Türk Psikiyatri Dergisi, 1996;7(2), 107-115.
2. Aibar-Almazán A, Hita-Contreras F, Cruz-Díaz D, de la Torre-Cruz, M, Jiménez-García JD, & Martínez-Amat A. Effects of Pilates training on sleep quality, anxiety, depression and fatigue in postmenopausal women: A randomized controlled trial. Maturitas, 2019;124, 62-67.
3. Aslan Ş. Kadınlarda Pilatesin Vücut Kompozisyonuna Etkisi. İnönü Üniversitesi Beden Eğitimi ve Spor Bilimleri Dergisi, 2019;6(1):24-35.
4. Ateş B, Öztürk MA. Düzenli pilates egzersizi yapan kadınlar ile sedanter kadınlarda Y denge testi performansının karşılaştırılması. Ege Tıp Bilimleri Dergisi, 2019;1, 2-7. Doi: 10.33713/egetbd.510183.
5. Ayar S. Milli kürekçiler ile sedanter bireylerde algılanan ve ölçülen gerçek uyku kalitesinin karşılaştırılması. Yayınlanmış Yüksek Lisans tezi, Düzce Üniversitesi, Sağlık Bilimleri Enstitüsü, Beden Eğitimi ve Spor Anabilim Dalı, Düzce, 2017.
6. Aydın BE. Üniversite öğrencilerinin fiziksel aktivite düzeyleri, metabolik sendrom riskleri ve uyku kaliteleri arasındaki ilişkinin incelenmesi. Yayınlanmış Yüksek Lisans tezi, Ondokuz Mayıs Üniversitesi, Lisansüstü Eğitim Enstitüsü, Antrenörlük Eğitimi Anabilim Dalı, Samsun, 2020.
7. Balboa-Castillo T, Leon-Munoz LM, Graciani A, Rodriguez-Artalejo F, Guallar-Castillon P. Longitudinal association of physical activity and sedentary behaviorduring leisure time with health-related quality of life in community-dwelling older adults. Health and quality of life outcomes, 2011; 9: 47.
8. Bernard P, Savard J, Steindorf K, Sweegers MG, Courneya KS, et al. Effects and moderators of exercise on sleep in adults with cancer: Individual patient data and aggregated meta-analyses. J Psychosom Res, 2019;124:109746.
9. Bulguroğlu Hİ, Bulguroğlu M, Özaslan A. COVID-19 Pandemisi Sürecinde Çevrim İçi Pilates Eğitiminin Sağlıklı Bireylerde Yaşam Kalitesi, Depresyon ve Uyku Kalitesi Üzerine Etkilerinin İncelenmesi. Turkiye Klinikleri Journal of Health Sciences, 2021;6(3).
10. Buysse DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. Psychiatry research, 1989;28(2), 193-213.
11. Biçer Y, Peker İ, Savucu Y. Kalp Tek damar tıkanıklığı olan kadın hastalarda planlanmış düzenli yürüyüşün bazı kan lipitleri üzerine etkisi. Fırat Üniversitesi Doğu Araştırmaları Dergisi, 2005;4(1):102-111.
12. Bize R, Johnson JA, Plotnikoff RC. Physical activity level and health-related quality of life in the general adult population: a systematic review. Preventive medicine, 2007; 45(6): 401-415.
13. Bueno de Souza RO, Marcon LF, Arruda A, Pontes Junior FL, Melo RC. Effects of mat pilates on physical functional performance of older adults: A meta-analysis of randomized controlled trials. American Journal of Physical Medicine & Rehabilitation, 2018;97(6), 414–425. Doi: 10.1097/PHM.0000000000000883.
14. Caldwell K, Harrison M, Adams M, Triplett NT, Effect of Pilates and taiji quan training on self-efficacy, sleep quality, mood, and physical performance of college students. Journal of Bodywork and Movement Therapies. 2009; 3,155e163.
15. Caldwell K, Harrison M, Adams M, Quin RH, Greeson J, Developing mindfulness in college students through movement-based courses: effects on self-regulatory self-efficacy, mood, stress, and sleep quality. The Journal of American College Health. 2010; 58, 433e442.
16. Craig CL, Marshall AL, Sjöström M, Bauman AE, Booth ML, Ainsworth BE, Pratt M, Ekelund U, Yngve A, Sallis JF, Oja P. International physical activity questionnaire: 12-country reliability and validity. Med sci sports Exerc, 2003;195(9131/03), 3508-1381.
17. Cruz-Ferreira A, Fernandes J, Laranjo L, Bernardo LM, Silva A. A systematic review of the effects of pilates method of exercise in healthy people. Archives of Physical Medicine and Rehabilitation, 2011;92(12):2071-2081.
18. Demir C, Çilli M. 12 haftalık pilates mat egzersizinin 14-15 yaş voleybol kız öğrencilerinin bazı biyomotor özellikler ve teknik performans üzerine etkilerinin incelenmesi. Online Türk Sağlık Bilimleri Dergisi, 2018; 3, 1-13. Doi: 10.26453/otjhs.364026.
19. Di Lorenzo CE. Pilates: what is it? Should it be used in rehabilitation? Sports health, 2011; 3(4): 352–361.

20. Doğru Y. Comparison of Social Physique Anxiety of Fitness and Pilates Exercise in Women. Turkish Journal of Sport and Exercise, 2020; 21(3), 411-414. https://doi.org/10.15314/tsed.635500
21. Garcia-Soidan JL, Giraldez, VA, Zagalaz, JC, Lara-Sánchez AJ. Does pilates exercise increase physical activity, quality of life, latency, and sleep quantity in middle-aged people? Percept Mot Skills, 2014;119(3): 838-850.
22. Işık Ö, Özarslan A, Bekler F. Üniversite öğrencilerinde fiziksel aktivite uyku kalitesi ve depresyon ilişkisi. Niğde Üniversitesi Beden Eğitimi ve Spor Bilimleri Dergisi, 9 (Özel Sayı), 2015;65-73.
23. Karakaş D. 40-60 yaş arasındaki kadınlarda uykuya etki eden faktörlerin incelenmesi. Yayınlanmış Yüksek Lisans tezi, Gedik Üniversitesi, Sağlık Bilimleri Enstitüsü, Beden Eğitimi ve Spor Bilimleri Ana Bilim Dalı, İstanbul, 2020.
24. Kelley GA, Kelley KS. Exercise and sleep: a systematic review of previous meta‐analyses. J Evid Based Med, 2017;10: 26‐36.
25. Kodama S, Tanaka S, Heianza Y, Fujihara K, Horikawa C, Shimano H, et al. Association between physical activity and risk of all-cause mortality and cardiovascular disease in patients with diabetes: a meta-analysis. Diabetes care, 2013; 36(2): 471-479.
26. Lange C, Larkam E, Latta PM, Ma EL. Maximizing the benefits of Pilates-inspired exercise for learning functional motor skills. Journal of Bodywork and Movement Therapies, 2000;4(2);99-108.
27. Leopoldino AA, Avelar NC, Passos GB Jr, Santana NÁ Jr, Teixeira VP Jr, de Lima VP, et al. Effect of Pilates on sleep quality and quality of life of sedentary population. J Bodyw Mov Ther, 2013;17(1):5-10.
28. Mokhtaria P, Nezakatalhossainib M, Esfarjanic F. The effect of 12-week pilates exercises on depression and balance associated with falling in the elderly. Procedia- Social and Behavioral Sciences, 2013;70,1714–1723. Doi: 10.1016/j.sbspro.2013.01.246.
29. Naqadeh HN. The Effect of Pilates Exercises on Anxiety and Quality of Sleep in Patients with Chronic Heart Failure. Journal of sport and exercise psychology, 2017; 3(1):8-12.
30. Öztürk, M. Üniversitede Eğitim-Öğretim Gören Öğrencilerde Uluslararası Fiziksel Aktivite Anketinin Geçerliliği Ve Güvenirliği Ve Fiziksel Aktivite Düzeylerinin Belirlenmesi. Yüksek Lisans Tezi. Hacettepe Üniversitesi Sağlık Bilimleri Enstitüsü, 2005.
31. Passos GS, Poyares D, Santana MG, D'Aurea CVR, Youngstedt SD, Tufik S, de Mello MT. Effects of moderate aerobic exercise training on chronic primary insomnia. Sleep medicine, 2011;12(10):1018-1027.
32. Rhodes RE, Mark RS, Temmel CP. Adult sedentary behavior: a systematic review. Am J Prev Med, 2012; 42(3): 3-28.
33. Saltan, A. Kadınlarda pilates temelli egzersizin postür, yaşam kalitesi, depresyon belirtileri ve ağrı üzerine etkisinin araştırılması. FÜ Sağ. Bil. Tıp. Derg, 2018;32(1), 31-36.
34. Tuncer A, Enzin F, İri SGF, Dinler E, Pelin Z, Bayramlar K. Uyku bozukluklarında egzersiz tedavisinin önemi. Zeugma Health Res. 2020;2(2):89-97.
35. Tüzer, BF ve Demirel H. Sports Participation Motivation in Disabled Individuals. Turkish Journal of Sport and Exercise. 2022;24(3), 254-263.
36. Vergili Ö. Sağlıklı sedanter kadınlarda kalistenik ve pilates egzersizlerinin sağlıkla ilişkili yaşam kalitesi üzerindeki etkileri. Kırıkkale Üniversitesi Tıp Fakültesi Dergisi, 2012;14:14-20.
37. Warburton DE, Nicol CW, Bredin SS. Health benefits of physical activity: the evidence. CMAJ: Canadian Medical Association journal = journal de l'Association medicale canadienne 2006;14;174(6): 801-809.

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Investigation of the relationship between yo-yo intermitted rest test results and performance in soccer players

Aydın KARABULAK [1A], Sedat OZCAN [1B]

[1] *Suleyman Demirel University, Faculty of Sport Sciences, Department of Sport Science, Isparta, TÜRKİYE*
Address Correspondence to Aydın KARABULAK E: e-mail: aydinkarabulak@sdu.edu.tr

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A: Orcid ID: 0000-0001-7741-3899 B: Orcid ID: 0000-0002-0428-3883

Abstract

The purpose of your study; The aim is to determine the relationship between aerobic endurance and the performance of football players. 30 licensed male football players (age 18,33±0,47 years, height 179,5±10,6 cm, body weight 76,6±11,5 kg) playing in the Turkish Football Federation U-19 Development League voluntarily participated in the research. Football players' Yo-Yo IRT1 test was measured twice at eight-week intervals on an artificial football field. During the test, Heart rate (HR) (beats/min) and afterwards Maximal Aerobic Power (VO_2max) values were measured and calculated. IBM SPSS Statistics v29.0 (IBM Corp., USA) was used for statistical tests. Paried T-test, one of the parametric tests, was used to determine whether there was a difference in terms of Yo-Yo IRT 1 test, VO_2max values and pulse values. All analyzes were processed at the 0.05 significance level. In conclusion; There is no statistically significant difference $p>0.005$ between the first and last values of the distances traveled by the football players who were subjected to the Yo-Yo IR1 test first and last measurement test, their HR and their measured VO2max values.

Keywords: Football, aerobic endurance, performance.

Futbolcularda Yo-Yo Aralıklı Dinlenme Test Sonuçları ile Performansları Arasındaki İlişkinin İncelenmesi

Özet

Çalışmanı amacı; aerobik dayanıklılık ile futbolcuların performansları arasındaki ilişkinin belirlenmesidir. Araştırmaya Türkiye Futbol Federasyonu U-19 Gelişim Liginde oynayan (yaş 18,33±0,47 yıl, boy 179,5±10,6 cm, vücut ağırlığı 76,6±11,5 kg) lisanslı 30 erkek futbolcu gönüllü olarak katılmıştır. Futbolcuların Yo-Yo IRT1 testi suni futbol sahasında sekiz hafta aralıklarıyla iki kez ölçülmüştür. Test sırasında Kalp atım hızı (KAH) (atım/dk) ve sonrasında Maksimal Aerobik Güç (VO_2max) değerleri ölçülüp hesaplanmıştır. İstatistiksel testler için IBM SPSS Statistics v29.0 (IBM Corp., ABD) kullanıldı. Yo-Yo IRT 1 testi, VO_2max değerleri ve nabız değerleri bakımından fark olup olmadığının belirlenmesinde parametrik testlerden Paried T-testi kullanılmıştır. Tüm analizler 0,05 anlamlılık düzeyinde işlenmiştir. Sonuç olarak; Yo-Yo IR1 testi ilk ve son ölçüm testine tabi tutulan futbolcuların test sonucunda kat ettikleri mesafelerin ilk ve son değerleri arasında ayrıca KAH arasında anlamlı fark bulunmuşken $p<0,05$, VO_2max değerleri arasında ilk ve son ölçümler arasında istatistik olarak anlamlı bir fark $p>0,05$ yoktur.

Anahtar Kelimeler: Futbol, aerobik dayanıklılık, performans.

INTRODUCTION

Football is a physically demanding sport characterized by high-intensity activities interspersed with submaximal periods (16). Many laboratory and field test protocols have been developed to assess aerobic capacity and endurance. In recent years, different training methods such as endurance training, high-intensity interval training (HIIT) and strength training have been proposed to improve physical, technical and tactical skills (9). Football matches consist of intermittent and dynamic movements (running, jumping and kicking) interspersed with low-intensity periods with changes in speed and direction from high to maximum intensity (1). Therefore, physical performance in football is largely dependent on intermittent exercise (13).

The Yo-Yo Intermittent Recovery Test Level 1 (YYIR1) is a fitness test that can conveniently and accurately measure intermittent exercise fitness in team athletes (2). Previous studies have shown that the YYIR1 is a reliable and valid field test for the assessment of fitness in field soccer players (13,19). Aerobic endurance is crucial for endurance sports, where oxygen must be supplied at all times to release energy from muscle materials. The Yo-Yo IR1 test offers a novel and potentially practical approach to routinely assess the physical response to intermittent exercise in young soccer players (7). Therefore, a person needs to have a good VO2 max to be able to do activity for a long time. This requires the development of aerobic endurance training first, then anaerobic endurance training (22). Frequently used interval elite football tests. Speed endurance training is an important training that allows elite football players to improve their match performance throughout the year. This type of training is highly recommended for top-level professional players. It is very important to see a very high increase in the number of accelerations per match during the period in question with the implementation of speed endurance training (12).

The purpose of your study; The aim is to determine the relationship between aerobic endurance and the performance of football players.

METHOD

Study Group

The study included 30 volunteers who are licensed Isparta 32 Sports male football players playing in the U-19 Development League.

Procedure

The first measurements were taken at the beginning of the second week of the preparation season, the second measurements were taken at the eighth It was conducted after 1 week. The Yo-Yo IRT1 test was applied to the football players. Wimu Fit (Spain) brand athlete tracking system devices were used to measure their pulses during the tests.

Yo-Yo Intermittent Recovery Tests (YIRT1): The Yo-Yo IRT1 test consisted of 2 x 20 m shuttle runs, repeated at an increasing speed, controlled by audible beeps (13). Between each running competition, the players were given a 10-second active rest period in a 5 m area where they were encouraged to walk or run. The test was terminated when the players could not complete the 2 x 20 m track in the desired time twice and the distance covered was recorded. Heart rate was recorded throughout the entire fitness trial. Maximal Aerobic Power (VO2max) capacity, which determines the capacity of the heart, lungs and blood to carry oxygen to the working muscles and the oxygen use of the working muscles during exercise, was calculated using the formula used by Bangsbo et al. (2). All tests were conducted on the artificial turf where football players train and play official matches.

VO_2max= 24.8+(0.014x Running distance)

Statistical Analysis

SPSS 29 statistical package program was used to evaluate the data. Descriptive statistics method was used to calculate mean and standard deviation values for all variables. Shapiro Wilk test was used to determine whether the data showed normal distribution. Since the data showed normal distribution, Yo-Yo IRT 1 test, Paried T-test from parametric tests were used to determine whether there was a difference in VO2max values

and HB values and correlation test was used to compare the positions. All analyzes were processed at 0.05 significance level.

Ethical approval and institutional permission

The study was conducted with the permission of Süleyman Demirel University Faculty of Medicine Clinical Research Ethics Committee dated 29.12.2023 and numbered 357.

FINDINGS

Table 1. Demographic characteristics of football players

Variables n=30	**Mean SD**	**SS**
Age (years)	18,33	,479
Height (cm)	179,5	10,6
Body Weight (kg)	76,2	11,5

Table 2. Distribution of football players according to their positions

Variables n=30		**n**	**f**
Position	Defender	6	%20
	Forvet	10	%33,3
	Goalkeeper	5	%16,7
	Midfield	9	%30
Total		30	% 100

Of the football players participating in the study, 5 were goalkeepers, 6 were defenders, 9 were midfielders and 10 were forwards.

Table 3. Test data of football players (Paried T-test)

Parameter (n 30)	**Mean ±SS**	**MD**	**t**	**p**
Yo-Yo IR1 test (First Measurement)	2173,3±705,82			
Yo-Yo IR1 testi (Second Measurement)	2559,3±663,3	-386	-4,90	**,001**
HB (beats/min) (First Measurement)	178,3±10,11			
HB (beats/min) (Second Measurement)	172,1±12,05	6,2	4,200	**,023**
VO_2max (First Measurement)	57,64±12,05			
VO_2max (Second Measurement)	58,57±7,8	-0,9	-,688	,770

There is no statistically significant difference between the first and last values of the distance covered by the football players who were subjected to the first and last measurement test of the Yo-Yo IR1 test. Similarly, there is no statistically significant difference between the first and last measurements between the pulse values and the measured VO_2max values. p>0.005.

Table 4. Correlation between pre-test values

Variables	X	SS	1	2	3
Yo-Yo IR1 (m)	2173,3	705,82	1		
HB (min/beat)	178,3	9,73	0,142	1	
VO_2max (ml / kg / min)	57,64	12,05	,888**	0,135 1	57,64

Note: Yo-YO IR1: Intermittent Recovery Test (m), HB: Heart Rate /min/beat), VO_2max; Maximal Aerobic Power (ml/kg/min) **p<0,01, *p<0,05

Table 4 shows the correlation analyses between the variables. A positive relationship was found between the intermittent recovery test variable and maximal aerobic power (r=0.888, p<0.01).

Table 5. Correlation between post-test values

Variables	X	SS	1	2	3
Yo-Yo IR1 (m)	2559,3	663,3	1		
HB (min/beat)	172,1	10,11	0,114	1	
VO2max (ml / kg / min)	58,57	7,82	,822**	-0,044	58,57

Note: Yo-YO IR1: Intermittent Recovery Test (m), HB: Heart Rate /min/beat), VO_2max; Maximal Aerobic Power (ml/kg/min) **p<0,01, *p<0,05

Correlation analyses between variables are shown in Table 5. A positive relationship was found between the intermittent recovery test variable and maximal aerobic power (r=0.822, p<0.01).

Graph 1. First and last test running distances of the positions

In Graph 1, the first and last measurement distance values are given according to the positions of the football players. When the distances covered between the tests are examined, the results seem to be in favor of the last values. When the differences between the positions are considered, we see that the defenders, forwards, midfielders and goalkeepers are ranked respectively. When looked at individually, we see that the midfielders made the best grades, and when looking at the averages, the defenders were in the first place in both tests.

DISCUSSION AND CONCLUSION

As a result of our study; a statistically significant difference p<0.05 was found between the distance covered and the first and last values of HB (beats/min) of the football players who were subjected to the first and last measurement test of the Yo-Yo IR1 test. VO2max values, which are an indicator of athletic performance, increased in favor of the last test between the first and last measurements, but a statistically significant difference p>0.005 was not found. We concluded that the Yo-Yo IR1 test has high discriminant and concurrent validity due to its ability to distinguish between players at different intra-league and inter-league competitive levels and its relation to other leagues. The Yo-Yo IR1 test can be considered an aerobic-anaerobic, football-specific field test (3). When the aerobic endurance of the football players between the two tests is considered, it is seen that some of them improved while some of them regressed. When the averages of all the players participating in the tests are taken and the Yo-Yo IR1 test results are examined, it is seen that the running distances of the football players did not improve and even regressed on average when the 8-week time evaluation is made. It is seen that there is a direct proportion between the ranking of the players of the team that finished the league as the leader and their performance. Our results show that the Yo-Yo IR1 is applicable in the endurance assessment of young and adult football players.

It has been shown that football players who achieve better results in Yo-Yo IR1 (i.e., have a higher level of specific endurance) can cover more total distance, perform more acceleration and deceleration, and cover

more high-intensity distance during exercise (14). Suryadi et al., indicated that endurance is one of the most important aspects of improving performance, that it is needed only for athletes or endurance athletes to maintain the physical and mental health of non-athletes, and that the YIRT1 test will give closer results in assessing only the endurance level in the assessment of VO2max endurance level (23, 8).

In conclusion, the application of Yo-Yo IR tests shows that football players increase both aerobic and anaerobic capacities. Yo-Yo intermittent recovery test level 1 (Yo-Yo IR1) is one of the most commonly used tests to monitor the ability to cope with intermittent exercise in team sports. Many studies in the literature support our result.

It is accepted that it has high discriminant and concurrent validity because it distinguishes between players at different intra- league and inter-league competitive levels and is related to other frequently used intermittent elite football tests (10,17).

The Yo-Yo IR1 test results may vary depending on many parameters. The psychological, physical and mental arousal of the football players is the biggest factor. When the performance of the football players is considered, it is quite variable throughout the season in a football league and is affected by the league ranking, the regularity of the competitive game and the playing position (16).

In our study, when we looked at the correlation between the Yo-Yo IR1 test data and the HR (min/beat) numbers, a negative relationship was observed. In order to follow the performance, the changes in HR should be followed and the presence of a negative relationship is quite sensitive and is recommended for monitoring the training (5).

It provides evidence that the Yo-Yo interval test reference values vary according to the type and level of the sport performed. The results presented can be used by practitioners, coaches, and athletes to rate Yo-Yo interval testing performance levels and monitor training effects (20).

We can use the Yo-Yo IR1 test to observe VO2max results and HB data and evaluate football players. Schmitz et al., 2020, stated that they used the Yo-Yo IR1 test to follow VO2max data in their studies (21,

15).

Several studies have examined the effect of high-intensity training through soccer-specific exercises, showing that it is possible to achieve high exercise intensity using a ball, as indicated by high heart rates, significant blood lactate accumulations, and high rates of perceived exertion (10). High-intensity shuttle running and explosive strength training are recommended to improve the ability of soccer players to move efficiently during matches (3).

Yo-Yo interval tests are simple, inexpensive, and allow multiple participants to be tested on the field simultaneously, and in team sports, performance on these tests is closely related to the amount of high-intensity running performed during matches for adolescents and adults. Yo-Yo interval tests are popular in soccer, and many studies have analyzed the reliability and validity of Yo-Yo interval tests for team sports athletes. Our study suggests that the Yo-Yo IR1 test can be used to determine aerobic and anaerobic endurance in young soccer players. In the literature, we can see that this test is used in many studies in the football branch. In terms of discrimination and match performance validity, the Yo-Yo test can be considered as a relevant field test to evaluate the endurance preparation of experienced football referees and a useful tool in talent selection (4).

Tests need to be done to follow the developments in macro and micro training programs and training practices. The Yo-Yo IR1 test is both reliable and very economical to follow a large number of athletes at the same time.

As a result, the motoric characteristics of football players required for training and matches must be worked on in a program-integrated and scientific manner. Tests are important for us to measure the efficiency of training. In our study, the efficiency of training content is sufficient or not when considering the performance of football players in matches. In this context, we believe that the Yo-Yo IR1 test is a good method to compare training efficiency and performance. The development and goodness of Yo-Yo IR1 test results can be considered as the performance being good in this direction.

REFERENCES

1. Bangsbo, J., & Michalsik, L. (2002). Assessment of the physiological capacity of elite soccer players. Science and football IV, 5362.
2. Bangsbo, J., Iaia, F. M., & Krustrup, P. (2008). The Yo-Yo intermittent recovery test: a useful tool for evaluation of physical performance in intermittent sports. Sports medicine, 38, 37-51.
3. Castagna, C., Impellizzeri, F. M., Chamari, K., Carlomagno, D., & Rampinini, E. (2006). Aerobic fitness and yo-yo continuous and intermittent tests performances in soccer players: acorrelation study. The Journal of Strength & Conditioning Research, 20(2), 320-325.
4. Castagna, C., Abt, G., & D'ottavio, S. (2005). Competitive-level differences in YoYo intermittent recovery and twelve minute run test performance in soccer referees. The Journal of Strength & Conditioning Research, 19(4), 805-809.
5. De Freitas, V. H., Pereira, L. A., De Souza, E. A., Leicht, A. S., Bertollo, M., & Nakamura, F. Y. (2015). Sensitivity of the YoYo Intermittent Recovery Test and cardiac autonomic responses to training in futsal players. International journal of sports physiology and performance, 10(5), 553-558.
6. Delahunt, E., Callan, L., Donohoe, J., Melican, R., & Holden, S. (2013). The YoYo intermittent recovery test level 1 as a high intensity training tool: Aerobic and anaerobic responses. Preventive medicine, 56(5), 278-282.
7. Doncaster, G., Scott, M., Iga, J., & Unnithan, V. (2019). Reliability of heart rate responses both during and following a 6 min Yo-Yo IR1 test in highly trained youth soccer players. Science and Medicine in Football, 3(1), 14-20.
8. Gürses, V. V., & Akalan, C. (2018). Determination of Relationships Between Aerobic Performance, 20m Shuttle Run and YoYo Intermittent Recovery Tests in Basketball Players. CBU Journal of Physical Education and Sports Sciences, 13(1), 12-21.
9. Hammami, M., Negra, Y., Shephard, R. J., & Chelly, M. S. (2017). The effect of standard strength vs. contrast strength training on the development of sprint, agility, repeated change of direction, and jump in junior male soccer players. Journal of strength and conditioning research, 31(4), 901-912.
10. Ingebrigtsen, J., Bendiksen, M., Randers, M. B., Castagna, C., Krustrup, P., & Holtermann, A. (2012). Yo-Yo IR2 testing of elite and sub-elite soccer players: performance, heart rate response and correlations to other interval tests. Journal of sports sciences, 30(13), 1337-1345.
11. Izzo, R., & Giovannelli, M. (2018). Session RPE and Speed High Intensity Distance in Meters (D_SHI mt): A valid method to analyze training load in soccer players. Journal of Sports Science, 6(3), 159-164.
12. Izzo, R., Altavilla, G., Cejudo, A., Raiola, G., D'Isanto, T., & Giovannelli, M. (2020). Performance improvement in yo-yo intermittent recovery test Level 2 and during official matches: The role of speed endurance training production in Élite football players. Sport Mont, 18(3), 61-66.
13. Krustrup, P., Mohr, M., Amstrup, T., Rysgaard, T., Johansen, J., Steensberg, A., ... & Bangsbo, J. (2003). The yo-yo intermittent recovery test: physiological response, reliability, and validity. Medicine & Science in Sports &Exercise, 35(4), 697-705.
14. Modric, T., Versic, S., & Sekulic, D. (2021). Relations of the weekly external training load indicators and running performances in professional soccer matches. Sport Mont, 19(1), 31-37.
15. Michailidis, Y., Chavlis, S., Mitrotasios, M., Ispirlidis, I., Vardakis, L., Margonis, K., ... & Metaxas, T. (2020). The use of YoYo intermittent recovery test level 1 for the estimation of maximal oxygen uptake in youth elite soccer players.
16. Mohr, M., & Krustrup, P. (2014). Yo-Yo intermittent recovery test performances within an entire football league during a full season. Journal of sports sciences, 32(4),315-327.
17. Owen, C., Jones, P., & Comfort, P. (2017). The reliability of the submaximal version of the Yo-Yo intermittent recovery test in elite youth soccer. Journal of Trainology, 6(1), 31-34.
18. Papadakis, L., Tymvios, C., & Patras, K. (2020). The relationship between training load and fitness indices over a pre-season in professional soccer players. The Journal of Sports Medicine and Physical Fitness, 60(3), 329-337.
19. Rampinini, E., Bishop, D., Marcora, S. M., Bravo, D. F., Sassi, R., & Impellizzeri, F. M. (2006). Validity of simple field tests as indicators of match-related physical performance in top-level professional soccer players. International journal of sports medicine, 228-235.
20. Schmitz, B., Pfeifer, C., Kreitz, K., Borowski, M., Faldum, A., & Brand, S. M. (2018). The Yo-Yo intermittent tests: a systematic review and structured compendium of test results. Frontiers in physiology, 9, 870.
21. Schmitz, B., Pfeifer, C., Thorwesten, L., Krüger, M., Klose, A., & Brand, S. M. (2020). Yo-Yo intermittent recovery level 1 test for estimation of peak oxygen uptake: Use without restriction? Research Quarterly for Exercise and Sport, 91(3), 478-487.
22. Supriatna, E., Suryadi, D., Haetami, M., & Yosika, G. F. (2023). Analysis Endurance Profile (Vo2max) of Women's Volleyball Athletes: Yo-yo intermittent test level 1. Indonesian Journal of Physical Education and Sport Science, 3(1), 12-19.
23. Suryadi, D., Samodra, Y. T. J., & Purnomo, E. (2021). Efektivitas latihan weight training terhadap kebugaran jasmani. Journal Respecs, 3(2), 9-19.

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The effect of dynamic warm-up exercise durations on different jump types in young male boxers

Serkan KIZILCA [1A], Sedat OKUT [2B]

[1] Bitlis Eren University, Faculty of Sport Sciences, Department of School of Physical Education and Sports, Bitlis, TÜRKİYE
[2] Muş Alparslan University, Faculty of Sports Sciences, Muş, TÜRKİYE

Address Correspondence to Serkan KIZILCA: e-mail: serkankizilca@hotmail.com

Ethical Statement: It is declared that scientific and ethical principles have been followed while carrying out and writing this study and that all the sources used have been properly cited.

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A: Orcid ID: 0000-0002-0030-7999 B: Orcid ID: 0000-0002-8194-5844

Abstract

This study was conducted to determine the effects of various durations of dynamic warm-up exercise on different jump types in young male boxers. Fourteen young male athletes (mean age: 16.86±1.03 years, height: 172.57±11.34 cm, body weight: 65.21±16.42 kg) voluntarily participated in the study, which employed a pretest-posttest experimental research model, a quantitative method, without a control group. Our athlete group was selected from individuals with at least 3 years of sports history. The athletes were instructed to run for 5 minutes at an average heart rate of 120 beats/min, followed by dynamic stretching consisting of 10 different exercises for durations of 5, 10, and 15 minutes on different days. After each period of different dynamic exercises, the participants performed drop jump, countermovement jump, and squat jump tests. The SPSS package program was used to analyze the data obtained from the research. Repeated Measures ANOVA and the Bonferroni test, a post-hoc test, were applied to normally distributed data. Examining the drop jump test results, a significant difference was detected between the various dynamic warm-up times ($p < .05$), with the distance measured after the 10-minute exercise period higher than those following the 5- and 15-minute warm-up periods. There were no significant differences between the dynamic warm-up times ($p > .05$) for the countermovement jump and squat jump tests. As a result, dynamic warm-up exercises were determined to improve the drop jump performance of young male boxers, with the 10-minute exercise duration more positively affecting drop jump performance than either the 5- or 15-minute warm-up periods. According to the results of the study, dynamic warm-up exercises can be added to training to increase performance in young male boxers.

Keywords: Boxing, dynamic warm-up, jumping.

Genç Erkek Boksörlerde Dinamik Isınma Egzersiz Sürelerinin Farklı Sıçrama Türleri Üzerindeki Etkisi

Bu araştırma, genç erkek boksörlerde dinamik ısınma egzersiz sürelerinin farklı sıçrama türleri üzerindeki etkisini belirlemek amacıyla yapılmıştır. Araştırmaya 14 genç erkek sporcu (yaş: 16,86±1,03 yıl, boy: 172,57±11,34 cm, vücut ağırlığı: 65,21±16,42 kg) gönüllü olarak katılmıştır. Araştırmada nicel araştırma yöntemlerinden kontrol grupsuz ön test-son test deneysel araştırma modeli kullanılmıştır. Sporcu grubumuz en az 3 yıllık spor geçmişi olan bireylerden seçildi. Sporculara ortalama 120 atım/dk kalp atım hızında 5 dk koşu, sonrasında 10 farklı egzersizden oluşan dinamik germe egzersizleri farklı günlerde 5, 10 ve 15 dk süreyle uygulanmıştır. Her uygulama gününde farklı dinamik egzersiz sürelerinden sonra sporculara drop jump, counter movement jump ve squat jump sıçrama testleri uygulanmıştır.

Araştırmadan elde edilen verilerin analizinde SPSS paket programı kullanılmıştır. Normal dağılım gösteren verilere Repeated Measures ANOVA ve Post Hoc testlerden Benferroni testi uygulanmıştır. Araştırma bulgularında drop jump testi sonuçlarına bakıldığında dinamik ısınma süreleri arasında anlamlı bir fark tespit edilmiştir ($p<0,05$). Genç boksörlerde 10 dk dinamik ısınma egzersiz süresi sonrasında ölçülen drop jump sıçrama mesafesinin 5 dk ve 15 dk dinamik ısınma sürelerine göre daha yüksek olduğu belirlenmiştir. Counter movement jump ve squat jump testi sonuçlarına bakıldığında dinamik ısınma süreleri arasında anlamlı bir fark bulunmamıştır ($p>0,05$). Sonuç olarak genç erkek boksörlere uygulanan dinamik ısınma egzersizlerinin drop jump performansını arttırdığı, ayrıca 10 dk'lık dinamik egzersiz süresinin drop jump performansını 5 dk ve 15 dk ısınma sürelerine göre daha olumlu etkilediği belirlenmiştir. Çalışma sonuçlarımıza göre genç erkek boksörlerde performans artışı için antrenman programına dinamik ısınma egzersizleri eklenebilir.

Anahtar Kelimeler: Boks, dinamik ısınma, sıçrama.

INTRODUCTION

Boxing, a sport involving two opponents from the same weight group, is based on the principle of punching, whereby the athletes protect themselves and take positions with their feet within the predetermined rules of the game (10). The main goal in a boxing match is to protect oneself against the opponent, to punch the opponent without getting punched, and to score points accordingly with these hits (18). In a boxing match, athletes hit their opponents with the front side of the hand in a fist position, wearing boxing gloves rather than with their bare hands. As per the rules, striking the neck and below the waist is prohibited. In this sport, the main goal is to acquire points, which are awarded by five referees who determine the scores based on the accuracy and number of clear punches. In matches, the outcome is determined by good technique, tactics, and the fighting spirit of the athletes (7). Although the main goal in boxing is to strike the opponent above the belt as specified in the rules with good technique, to be successful in this sport it is also crucial to keep one's guard up against the opponent's attacks to avoid getting struck and thus surrendering points to him by employing effective defensive techniques (31, 40).

An indispensable component of competitions and competitions is the warm-up. Warm-up incorporates essential techniques to improve athletic performance, minimize injuries that may occur during competitions and training, and ensure that the athlete attains optimal physiological and psychological adaptation to the stresses he will be exposed to (27). With warm-up exercises, the organism shortens the transition time to exercise, and the body becomes primed for exercise with increased blood flow rate and warming muscles. The range of motion in connective tissue expands and consequently, the risk of musculoskeletal system injuries decreases. In addition, as the flexibility level of the joints increases, sports performance also improves (28). Athletes and coaches agree that stretching exercises, a component of the warm-up, contribute to enhanced athletic performance (38). Stretching exercises achieve this by optimizing the athletes' musculoskeletal efficiency levels prior to competition (33).

Body composition is one of the important factors for athletic success. Body composition represents a critical factor in producing the highest levels of athletic performance, involving essential components for athletic success such as strength, power, mobility, speed, endurance, and agility, known as basic motor characteristics (1, 29). Speed is also known as a skill that directly affects sporting success. In sports sciences, speed is defined as an athlete moving from one point to another in the shortest possible time. Viewed from a physiological perspective, this skill is dependent on the effective functioning of the central nervous system and skeletal muscles. (26,29). Employing a different definition, speed can be defined as reaching the distances to be covered earlier (5).

When considering the definition of jumping force, athletes can be said to possess the ability to jump horizontally far and vertically high. The lower extremity flexor and extensor muscles are very effective in jumping (35). In order to achieve optimal performance in sports, the ability to jump as fast and as high as possible is a critical factor (20). The vertical jump is a movement incorporating many joints in the body and requiring high levels of muscular strength in the hip, knee, and ankle joints. Proprioceptive exercises increase the strength of the flexor and extensor muscles in the foot and the muscles in the back of the thigh (15). A vertical jump is affected by the speed of the explosive force that occurs during the execution of the jump proceeding from eccentric muscle contraction to concentric muscle contraction. In view of this, proprioceptive training practices are effective in developing faster strength, increasing the frequency and rate of the motor units involved in the movement, and accordingly improving vertical jump execution and height. In addition,

the mobility of the hip joint has a significant impact on vertical jump performance, thus determining the difference between submaximal and maximal vertical jumping ability (15).

Strength constitutes one of the basic motor skills of an organism, and with force, it is possible to move a mass (whether one's own body weight or the equipment used in a sport). Depending on the application of force, resistance is either overcome or opposed by the muscle mass (32). In their study, De Ste Croix et al. (8) found that with an increase in leg strength, anaerobic performance and strength levels increased in the thighs, calves, muscle mass of the leg, and legs with high mass but low fat levels. This observation can be explained by increased muscle mass in the legs and a high number of muscle fibers resulting in an increase in strength (30). When athletes with superior anaerobic performance were compared to their competitors, it was determined that their fast-twitch muscle fibers, called type II, were denser and that they possessed higher muscle volume (34).

The topic of the present study, which aimed to determine the effect of dynamic warm-up exercise periods on different types of jumps in young male boxers, has been little investigated in the literature. As such, the results of the present study may foster innovation in the training parameters of an important sport such as boxing in order to improve athletic performance, thus also representing an important contribution to the literature. Our study results show that the level of winning and success in book sports is very significant.

METHOD

Study Participants

For this study, which employed a quantitative experimental research design, a pretest-posttest model with no control group was preferred. Athletes in the youth category from Ağrı province, Turkey were recruited for the study, with the research group consisting of 14 young male boxers who participated voluntarily. Our athlete group was selected from individuals with at least 3 years of sports history. According to our study, it may be possible to achieve higher performance in sports.

Ethics Approval

Prior to the start of this study, ethical approval was obtained from Muş Alparslan University Scientific Research and Publication Ethics Board on 5 October 2023 (meeting number 8, decision number 37).

Data Collection Tools

Study Design: Body and body weight measurements were taken before the study. In this study, composed of a single experimental group, the participants performed dynamic stretching exercise protocols of varying durations. The different protocols were comprised of 5 minutes of jogging + 5 minutes of dynamic stretching, 5 minutes of jogging + 10 minutes of dynamic stretching, and 5 minutes of jogging + 15 minutes of dynamic stretching. Following each period of dynamic stretching, the young male boxers completed three different jump tests (the drop jump, squat jump, and countermovement jump) in order to determine the effects of the various dynamic stretching exercise protocols.

Dynamic Stretching Exercise Protocols: After running for 5 minutes at an average heart rate of 120 beats/min, the participants performed dynamic stretching exercises lasting 5, 10, or 15 minutes. These consisted of 10 different exercises of medium to high intensity (walking knee to chest, butt kicks, carioca, leg swings, walking lunges, Frankenstein walk, high knee skip, high knee run, A skip, and B skip; Table 1). The testing protocols, all of which included 5 minutes of aerobic running, were carried out at 48-hour intervals. In order to prevent fatigue, a 3-minute rest period was allowed following completion of each set for the 10- and 15-minute dynamic stretching protocols.

Table 1: Dynamic Stretching Exercise Protocol

Dynamic Stretching Exercise	Explanation of Exercise	5 Min	10 Min	15 Min
Walking Knee to Chest	Walk taking normal walking steps, pulling hands and knees upwards	30 sec	2x30 sec	3x30 sec
Butt Kicks	Move forward with running steps, touching the buttocks with the heels	30 sec	2x30 sec	3x30 sec
Carioca	Run while the body is turned to the left or right, rotating the hips and with feet moving left or right	30 sec	2x30 sec	3x30 sec
Leg Swings	Legs swing forward and backward	30 sec	2x30 sec	3x30 sec
Walking Lunge	While walking forward with lunging steps, the knee of the hind foot touches the ground	30 sec	2x30 sec	3x30 sec
Frankenstein Walk	While walking, the arms are held parallel to the floor in front of the body and the tip of the toes touch the hands (performed without bending the knees)	30 sec	2x30 sec	3x30 sec
High Knee Skip	While running forward, the right knee is lifted in line with the left arm and the left knee with the right arm	30 sec	2x30 sec	3x30 sec
High Knee Run	While running, knees are pulled to the chest and arms swing	30 sec	2x30 sec	3x30 sec
A Skip	Proceed with hopping steps, pulling the knees to the chest	30 sec	2x30 sec	3x30 sec
B Skip	Proceed with hopping steps, with legs stiff and swinging upwards	30 sec	2x30 sec	3x30 sec

The following measurements and tests were performed for this study:

Height: Height was measured in cm with a tape measure, while the study participants were bare-footed.

Weight, Body Fat Percentage, and Muscle Mass: The body weights, fat percentages, and muscle masses of the athletes participating in the study were determined using the TANİTA MC 780 device.

Determination of Heart Rate: The heart rate of the athletes during jogging was monitored using a tablet with the IOS Polar Team application and Polar brand H10 (Polar Electro, Finland) model chest bands.

Drop Jump Test: The participants were tested on the jumping mat (Smart Jump; Fusion Sport, Australia). In this test athletes fall from 40 cm high crates onto the mat on the floor with both feet, keeping their hands on their waist and elbows bent outward (akimbo stance); as soon as their feet touch the mat, they jump as high as they can from a half squat position (23). Athletes perform 2 jumps with 30 seconds allowed between each attempt for recovery (4).

Figure 1: Drop Jump Test

Countermovement Jump Test: The participants performed this test on the jumping mat (Smart Jump; Fusion Sport, Australia). In our study, arm swing was not allowed during the test so that the focus would remain on lower extremity explosive strength. Each athlete started the test in a standing position on the platform with hands on the waist and elbows bent outwards (akimbo stance). As soon as they descended into a squat position, they then jumped as high as possible (6).

Figure 2: Countermovement Jump Test

Squat Jump Test: As with the countermovement jump test, arm swing was not allowed while performing the squat jump test. Each athlete started the test in a standing position on the platform, waiting for 3 seconds at an average knee flexion of 90-100° before jumping as high as possible. Reviewing the literature, the most common waiting time for knee flexion for this test was found to be 3 seconds (6, 9).

Statistical analysis

The SPSS package program was employed in the statistical analysis of the data obtained from this study. The normality level of the data was determined using the Shapiro-Wilk test. Repeated measures ANOVA (analysis of variance), a parametric test, and the Bonferroni test, a post-hoc test, were applied to normally distributed data. In the study, a value of $p < .05$ was accepted as statistically significant.

FINDINGS

Descriptive statistics of the demographic features of the young boxers participating in this study are given in Table 1.

Table 1. Descriptive statistics of the athletes' demographic characteristics

Demographic Variable	n	Mean	Std. Dev.
Age (years)	14	16.86	1.03
Height (cm)	14	172.57	11.34
Weight (kg)	14	65.21	16.42

Table 2. Drop jump repeated measures ANOVA test results

Test	**Duration**	**n**	**Mean**	**Std. Dev.**	**f**	**p**	**Variance**
Drop Jump	5 min.1	14	27.82	6.35	5.683	0.011*	2>1
	10 min.2	14	31.00	6.31			2>3
	15 min.3	14	28.56	5.27			

*p < .05

According to the drop jump test results of the young male boxers shown in Table 2, a significant difference was detected based on the dynamic warm-up times ($p < .05$). The jump distances of the participants following the 10-minute dynamic warm-up exercise were higher than those obtained after the 5-minute and 15-minute warm-up periods.

Table 3. Counter movement jump repeated measures ANOVA test results

Test	Duration	n	Mean	Std. Dev.	f	p	Variance
Counter Movement Jump	5 min.	14	30.39	4.06	0.443	0.635	p > .05
	10 min.	14	30.44	5.52			
	15 min.	14	30.99	5.29			

As can be seen from the results presented in Table 3, no significant difference was observed between the countermovement jump test results of the participants with respect to the various dynamic warm-up times (p > .05).

Table 4. Squat jump repeated measures ANOVA test results

Test	Duration	n	Mean	Std. Dev.	f	p	Variance
Squat Jump	5 min.	14	28.44	5.64	0.463	0.587	p > .05
	10 min.	14	28.86	5.91			
	15 min.	14	28.92	5.52			

According to the data shown in Table 4, there was no significant difference between the squat jump test results based on the different warm-up times (p > .05).

DISCUSSION AND CONCLUSION

In the present study, the effect of different dynamic warm-up exercise periods on various jump types performed by young male boxers was examined. According to our findings, upon examining the results of the drop jump, countermovement jump, and squat jump tests performed following the protocols incorporating 5, 10, and 15 minutes of jogging and dynamic stretching exercises, a significant difference was detected only for the drop jump distances. The mean drop jump distance of the young boxers following the 10-minute dynamic warm-up exercise period was higher than those following the 5-minute and 15-minute warm-up periods. No statistically significant differences were observed between the countermovement jump and squat jump test results with respect to the various warm-up periods, but the jump distances for the 15-minute warm-up times were greater than those for the 10-minute warm-up times, which exceeded those associated with the 5-minute warm-up periods.

Dynamic warm-up movements with a high warm-up time have been observed to contribute more to vertical jump height than those with a shorter warm-up time. A review of the literature reveals numerous studies in support of our findings. Examining the acute effects of different warm-up protocols on jumping performance, Gelen (17) concluded that static warm-up protocols resulted in a decrease in vertical jump performance, but found that dynamic warm-up protocols had positive effects on vertical jump performance. Faigenbaum et al. (12) examined the acute effects of different warm-up methods on the anaerobic performance levels of athletes, determining that dynamic warm-up protocols positively impacted vertical jump performance. In their study on post-activation model warm-up incorporating squat and 10-repetition multiple jump tests, Harmancı et al. (22) showed that dynamic warm-up exercises caused a significant increase in jump heights, whereas static warm-ups resulted in a significant decrease. Atan (3) examined the effects of different warm-up protocols on joint range of motion, jumping, and sprint performance, concluding that a jogging + dynamic stretching protocol had a more positive effect on vertical jump performance than jogging + static stretching. Wright et al. (39) investigated the effects of static stretching, dynamic stretching, and warm-up on vertical jumping in their study involving 36 athletes between the ages of 18-30 and found that dynamic stretching warm-up exercises improved vertical jump performance. Conversely, static stretching exercises have been shown to negatively affect vertical jump performance.

In study by Faigenbaum et al. (13) examined the effects of warm-up protocols applied after static and dynamic warm-up on the physical conditions of young athletes and their acute effects on the athletes, and found that vertical jump performance was significantly reduced after static warm-up compared to dynamic warm-up. In another study comparing dynamic and static warm-up methods, Thompsen et al. (36) found that dynamic warm-up exercises more positively impacted vertical jump performance than static methods. Güler (19), in his study examining how active jumping performance following different neuromuscular warm-up

protocols affected biomechanical parameters in young football players, observed a significant difference in the body surface temperature and vertical jump heights of 24 football players who employed dynamic and FIFA 11+ warm-up protocols, compared to a static warm-up protocol. Mohammadtaghı et al. (25) examined the acute effect of static and dynamic stretching on hip range of motion during step kicks in 18 professional football players, finding that warm-ups incorporating dynamic stretching movements improved performance. In his study investigating the effects of different warm-up protocols on flexibility and jumping performance involving 20 male basketball players aged 13-14, Andrejic (2) employed dynamic warm-up and static warm-up protocols; significant differences were detected in the vertical jump results of the dynamic warm-up group. Esmer et al. (11) examined the effects of static warm-up and dynamic warm-up protocols on the motor characteristics of adolescent basketball players, observing statistically significant differences in the vertical jump heights of the participants. Fattahi et al. (14) researching the effects of dynamic and static warm-up exercises on the vertical jump heights of 57 male volleyball players, concluded that the vertical jump performance of the dynamic warm-up group was superior to the static warm-up group. According to their findings, dynamic warm-up exercises were more suited to exercises requiring explosive power. In his research examining the effects of static and dynamic warm-up exercises on the vertical jump and sprint performances of 20 basketball players, Galazoulas (16) found that dynamic warm-up exercises had a positive effect on vertical jump heights compared to static warm-up exercises. In their study on 32 female volleyball players, Haghshenas et al. (21) investigated the acute effects of different warm-up methods and observed that dynamic warm-up exercises resulted in a significant increase in anaerobic power compared to static warm-up exercises.

Although a review of the literature uncovered many studies supporting our results, nonetheless, some studies have obtained results that are not consistent with our findings. Kahraman et al. (23) examined the acute effects of different warm-up protocols on speed, vertical jump, balance, and leg strength in young male futsal players and found that the static warm-up group was more successful in vertical jump performance than the group employing dynamic warm-up practices. The reason for this discrepancy may be due to differences in the actual content of the warm-up protocols and/or the different branches of sport involved. In their study, Torres et al. (37) reported that neither the static nor the dynamic warm-up protocol produced any effect on the development of leg strength. The fact that this study's results did not coincide with our findings may be explained by the higher mean age of their study participants compared to ours and/or the different branch of sport involved.

In conclusion, the present study determined that dynamic warm-up exercises improved the drop jump performance of young male boxers, and that the 10-minute dynamic exercise duration affected this performance more positively than either the 5- or 15-minute warm-up periods. For young boxers, employing dynamic warm-ups of a duration that will increase muscle elasticity by reaching a sufficient temperature, without the warm-up period being too short or too long, can increase vertical jump heights.

RECOMMENDATIONS

According to the results of our study conducted to determine the effect of dynamic warm-up exercise periods on different jump types in young male boxers, the following recommendations can be made:

- Applying dynamic warm-up protocols for a sufficient period of time (10 minutes) before competitions and training can increase the performance of athletes.
- Studies should be conducted on warm-up times for different warm-up protocols.
- Coaches and athletes should be provided with more information regarding dynamic warm-up exercises.

REFERENCES

1. Açıkada C. Study of body composition parameters in athletes, Beden Eğitimi ve Spor Programı Doktora Tezi, Marmara Üniversitesi, Sağlık Bilimleri Enstitüsü. 1990.
2. Andrejic, O. An Investigation Into The Effects of Different Warm-up Protocols on Flexibility and Jumping Performance in Youth. Facta Universitatis: Series Physical Education & Sport, 2012; 10(2), 107-114.
3. Atan, T., Farklı Isınma Protokollerinin Eklem Hareket Genişliği, Sıçrama ve Sprint Performansına Etkisi, Uluslararası Toplum Araştırmaları Dergisi - International Journal of Society Researches 2019; 2528-9535.
4. Bobbert, M. F., Huijing, P. A., & van Ingen Schenau, G. Drop jumping. I. The influence of jumping technique on the biomechanics of jumping. Med Sci Sports Exerc.1987; 19(4), 332-338.
5. Bompa, T., Buzzichelli, C. Periodization training for sports, 3e: Human kinetics, 2015.
6. Caia, J., Doyle, T. L. A., & Benson, A. C. A Cross-Sectional Lower-Body Power Profile of Elite and Subelite Australian Football Players. Journal of Strength and Conditioning Research, 2013; 27(10), 2836-2841.
7. Chaabène, H., Tabben, M., Mkaouer, B., Franchini, E., Negra, Y., Hammami, M., Hachana, Y. Amateur boxing: physical and physiological attributes. Sports medicine, 2015; 45(3), 337-352.
8. De Ste, C., Armstrong, M.B.A., Chia, N., Welsman, M.Y.H., Parsons, J.R., Sharpe, G.P. Changes in short-term power output in 10 to 12–year-olds, Journal of Sports of Sciences, 2000; 19, 141-148.
9. Edwards, T., Weakley, J., Woods, C.T., Comparison of Countermovement Jump and Squat Jump Performance Between 627 State and Non-State Representative Junior Australian Football Players. Journal of Strength and Conditioning Research, 2022; 10(15), 1-18.
10. El-Ashker, S., Nasr, M. Effect of boxing exercises on physiological and biochemical responses of Egyptian elite boxers. Journal of Physical Education and Sport, 2012; 12(1), 111.
11. Esmer, O., Eskiyecek, C. G. Adölesan basketbolcularda statik ve dinamik ısınma germe egzersizlerinin bazı motorik özelliklerine etkisi. Journal of Social and Humanities Sciences Research, 2020; 7(54), 1454-1459.
12. Faigenbaum, A.D., Kang, J., McFarland, J., Bloom, J.M., Magnatta, J., Ratamess, N.A., Hoffman,J. Acute Effects of Different Warm-Up Protocols on Anaerobic Performance in Teenage Athletes , Pediatric Exercise Sciences, 2006; 18(1): 64-75.
13. Faigenbaum, A. D., Bellucci, M., Bernieri, A., Bakker, B., ve Hoorens, K. Acute effects of different warm-up protocols on fitness performance in children. The Journal of Strength & Conditioning Research, 2005; 19(2), 376-381.
14. Fattahi, A., Sadeghi, H., Rezaei, M., Einanloo M. Effects of Two Warm-Up Protocols on Vertical Jump Performance in Mini-volleyball Players. Department of Physical Education and Sport Science, Iran, 2015; 3 (3): 350-356.
15. Federici, A., Zumbo, F., Lucertini, F., Marini, F. Proprioceptive training and sports performance. Journal of Human Sport and Exercise. 2020; 1160-1168.
16. Galazoulas, C. Acute Effects of Static and Dynamic Stretching on the Sprint and Countermovement Jump of Basketball Players. Journal of Physical Education and Sport, 2017; 17(1), Art: 33, pp: 219-223.
17. Gelen, E. Farklı Isınma Protokollerinin Sıçrama Performansına Akut Etkileri, Spormetre Beden Eğitimi ve Spor Bilimleri Dergisi, 2008; VI (4) 207-212
18. Guidetti, L., Musulin, A., Baldari, C. Physiological factors in middleweight boxing performance. Journal of sports medicine and physical fitness, 2002; 42 (3), 309.
19. Güler, U. Dinamik Ve Fıfa 11+ Isınma Yöntemlerinin Futbol Oyuncularının Esneklik, Dikey Sıçrama Ve Çeviklik Performansları Üzerine Akut Etkisi, Yüksek Lisans Tezi, Marmara Üniversitesi Sağlık Bilimleri Enstitüsü, Beden Eğitimi ve Spor Anabilimdalı, 2019.
20. Günay, M., Sevim, Y., Savaş, S., Erol, A.E. Pliometrik çalışmaların sporcularda vücut yapısı ve sıçrama özelliklerine etkisi. H. ü. Spor Bilimleri Dergisi, 1994; (4), (2), 38-4.
21. Haghshenas, R., Beydokhti, İ.T., Avandi, S.M. Acute effect of different warm-up stretch protocols on vertical jump performance in volleyball players. International Journal of Sport Studies. Science Research Publications, 2014; 4(8), 907-913
22. Harmancı, H. Karavelioğlu, M.B., Ersoy, A., Yüksel, O., Erzeybek, M.S., Başkaya, G., Post Aktivasyon Potansiyel (Pap) ve Statik Germe Modeli Isınmalarının Sıçrama Performansına Etkisi, Sportif Bakış: Spor ve Eğitim Bilimleri Dergisi, 2017; 4 (2), 56-68.
23. Kahraman, M.Z., Balıca, D., Çelik, M. Genç erkek futsalcılarda farklı ısınma protokollerinin sürat, dikey sıçrama, denge ve bacak kuvvetine akut etkisi. ROL Spor Bilimleri Dergisi, 2023; 4 (1), 229- 246.
24. Kaya, S. Basketbolculara Farklı Set İçi Dinlenme Süreleri İle Uygulanan Trifazik Antrenman Modelinin Dikey Sıçrama Ve Reaktif Kuvvet Endeksine Etkilerinin İncelenmesi, Doktora Tezi. Marmara Üniversitesi Sağlık Bilimleri Enstitüsü, İstanbul. 2022.
25. Mohammadtaghı, A.K., Noor, A. Abu O., Ashrıl, Y. Acute Effect of Static and Dynamic stretching on Hip Dynamic Range of Motion During instep Kicking in Professional Soccer Player. Journal of Strength Condition, 2011; 25 (6), 1647-1652.
26. Muratlı, S., Kalyoncu, O., Şahin, G. Antrenman ve Müsabaka, Ladin Matbaası. İstanbul; 2007; 188-189.
27. Muratlı, S, Sevim, Y. Antrenman Bilgisi, Anadolu Üniversitesi, Açıköğretim Fakültesi Yayın No: 277, Eskişehir: 1993; 76-77.

28. Nosaka, K., Clarkson, P.M. Influence of previous concentric exercise on eccentric exercise-induced muscle damage. J Sports Sci; 1997; 15: 477-483.
29. Özkan, A., Arıburun, B., Kin-İşler, A. Ankara'daki Amerikan Futbolu Oyuncularının Bazı Fiziksel ve Somatotip Özelliklerinin İncelenmesi, Gazi Beden Eğitimi ve Spor Bilimleri Dergisi, 2009; X (2),35-42.
30. Özkan, A., Sarol, H. Alpin ve kaya tırmanışçılarının bazı fiziksel uygunluk ve somatotip özelliklerinin karşılaştırılması. Gazi Beden Eğitimi ve Spor Bilimleri Dergisi, 2008; S:3,23-26.
31. Öztürk, Y. Türk Boks Antrenörü Profilini Sportif Başarıyla İlişkisi. Yayımlanmış Yüksek Lisans Tezi, Sakarya. 2006.
32. Sevim Y. Antrenman Bilgisi. 7. Baskı. Nobel Yayın Dağıtım. 2007; 39, 53, 98, 295-297
33. Siatras, T., Papadopoulos, G., Mameletzi, D., Gerodimos, V., Kellis, S., . Static and dynamic acute stretching effect on gymnasts' speed in vaulting. Pediatr Exerc Sci; 2003;15: 383-391.
34. Staron, R.S., Hagerman, F.C., Hikida, R.S., Murray, T.F., Hostler, D.P., Crill, M.T. Fiber type composition of the vastus lateralis muscle of young men and women. The Journal of Histochemistry and Cytochemistry; 2000; 48(5), S:623-29.
35. Şimşek, B., Ertan, H., Göktepe, A.S., Yazıcıoğlu, K. Bayan Voleybolcularda Diz Kas Kuvvetinin Sıçrama Yüksekliğine Etkisi. Egzersiz, 2007;1 (1): 36-43.
36. Thompsen, A.G., Kackley, T., Palumbo, M.A., Faigenbaum, A.D. Acute Effects of Different Warm-up Protocols With and Without a Weighted Vest on Jumping Performance in Atletic Women. Journal of Strength and Conditioning, 2007;21(1), pp: 52-56.
37. Torres, E. M., Kraemer, W. J., Vingren, J. L., Volek, J. S., Hatfield, D. L., Spiering, B. A. Effects of stretching on upper-body muscular performance. The Journal of Strength & Conditioning Research, 2008; 22(4), 1279-1285.
38. Woolstenhulme, M.T., Griffiths, C.M. Woolstenhulme EM, Parcell AC. Ballistic stretching increases flexibility and acute vertical jump height when combined with basketball activity. J Strength Cond Res, 2006;20: 799-803.
39. Wright, G., Williams, L., Greany, J., Foster Effect of Static Stretching, Dynamic Stretching, a Warm-up on Active Hip Range of Motion and Vertical Jump. Medicine & Science in Sports & Exercise, 2006;38 (5): S280–281.
40. Zorba, E., Ziyagil, M.A., Erdemli İ. Türk ve Rus Boks Milli Takımlarının Bazı Fizyolojik Kapasite ve Antropometrik Yapılarının Karşılaştırılması. Gazi Üniversitesi Beden Eğitimi ve Spor Bilimleri Dergisi, 1999; 1: 17-28.

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The effect of surgical mask use on recovery heart rate during gradually increasing walking*

Berkay LÖKLÜOĞLU [1A], Bilal BİÇER [1B], Hazal ÖRDEK [1C], Derya TÖRER [1D], Cuma GÜNAYDIN [1E], Tolga Selim TOSUN [1F], Egecan AYTEKİN [1G], Oğuzcan YILMAZ [1H], Abdurrahman AY [1I], Oğuzcan AYDOĞMUŞ [1J]

[1] *Hatay Mustafa Kemal University, Faculty of Sport Sciences, Department of Coaching Education, Hatay, TÜRKİYE*
Address Correspondence to Berkay LÖKLÜOĞLU: e-mail: berkaylokluoglu@mku.edu.tr

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A: Orcid ID: 0000-0003-2177-1624, B: Orcid ID: 0000-0003-2403-9922, C: Orcid ID: 0009-0006-5247-8980, D: Orcid ID: 0009-0004-1603-4640, E: Orcid ID: 0009-0009-0754-9497, F: Orcid ID: 0009-0002-8503-2409, G: Orcid ID: 0009-0007-7509-1938, H: Orcid ID: 0009-0004-7151-9499, I: Orcid ID: 0009-0004-5862-7989, J: Orcid ID: 0009-0000-6091-681X

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Abstract

The World Health Organization (WHO) and the Ministry of Health recommend distance, hygiene, and the use of masks in the fight against epidemics. Therefore, everyone from children to the elderly, from healthy people to all individuals with chronic diseases must wear a mask while performing their daily activities. After the activities they perform at a slow or fast rhythm, they rest in a mask. Therefore, the study aimed to examine the effect of surgical mask use on recovery heart rate during gradually increasing walking. Nine healthy university students without chronic diseases and orthopedic disorders participated in the study voluntarily. Participants performed a gradually increasing walking protocol on a treadmill with and without surgical masks on two different days at least 48 hours apart, and then recovered in a sitting position for 10 minutes, again with and without masks. Data on body temperature, blood pressure (BP), blood lactate level (LA), heart rate (HR), total quality of recovery (TQR), and borg-breathlessness (B-B) were collected. The paired sample t-test was used for normally distributed data, and the Wilcoxon signed-rank test was used when the distribution was not normal. The significance level was set as $p<0.0\ 5$. No statistically significant differences were found between unmasked and masked body temperature, lactate level, systolic and diastolic blood pressure, mean recovery HR, end-of-recovery HR, and total heart rate. On the other hand, breathlessness was felt more in masked recovery compared to unmasked recovery and total quality of recovery was felt lower. As a result; it can be said that the use of surgical masks during gradually increasing walking affects the participants psychologically, although it does not affect them physiologically in recovery.

Keywords: Surgical mask, recovery, breathlessness, heart rate, lactate level.

Berkay LOKLUOGLU Orcid ID: 0000-0003-2177-1624 / Bilal BICER Orcid ID: 0000-0003-2403-9922 / Hazal ORDEK Orcid ID: 0009-0006-5247-8980 / Derya TORER Orcid ID: 0009-0004-1603-4640 / Cuma GUNAYDIN Orcid ID: 0009-0009-0754-9497 / Tolga Selim TOSUN Orcid ID: 0009-0002-8503-2409 / Egecan AYTEKIN Orcid ID: 0009-0007-7509-1938 / Oğuzcan YILMAZ Orcid ID: 0009-0004-7151-9499 / Abdurrahman AY Orcid ID: 0009-0004-5862-7989 / Oğuzcan AYDOGMUŞ Orcid ID: 0009-0000-6091-681X

Kademeli Artan Yürüyüş Sırasında Cerrahi Maske Kullanımının Toparlanma Kalp Atım Hızına Etkisi

Özet

Dünya Sağlık Örgütü (WHO) ve T.C. Sağlık Bakanlığı, salgın hastalıklarla mücadelede mesafe, hijyen ve maske kullanımını önermektedirler. Dolayısıyla çocuğundan yaşlısına, sağlıklısından kronik hastalığı olan tüm bireylere kadar herkes günlük aktivitelerini gerçekleştirirken maske takmak zorundadır. Yavaş veya hızlı ritimde gerçekleştirdikleri aktivitelerin ardından maskeli şekilde dinlenmelerini gerçekleştirmektedirler. Bu nedenle çalışmanın amacı; kademeli artan yürüyüş sırasında cerrahi maske kullanımının toparlanma kalp atım hızına etkisini incelemektir. Çalışmaya gönüllü olarak üniversitede öğrenim gören kronik hastalığı ve herhangi bir ortopedik rahatsızlığı olmayan sağlıklı 9 öğrenci katılmıştır. Katılımcılar en az 48 saat arayla iki farklı günde cerrahi maskeli ve maskesiz olarak koşu bandında kademeli artan yürüyüş protokolü ve sonrası yine maskeli ve maskesiz olarak 10 dakika oturur pozisyonda toparlanma gerçekleştirmişlerdir. Katılımcıların; vücut ısısı, kan basıncı, kan laktat düzeyi, kalp atım hızı (KAH), algılanan toparlanma derecesi ve dispne şiddetine ilişkin verileri toplanmıştır. Normal dağılım gösteren veriler için eşleştirilmiş örneklem t testi, dağılım normal olmadığında ise Wilcoxon işaretli sıralar testi kullanılmıştır. Anlamlılık seviyesi $p<0.05$ olarak belirlenmiştir. Katılımcıların maskesiz ve maskeli vücut ısısı, laktat düzeyi, sistolik ve diastolik kan basıncı, toparlanma ortalama KAH, toparlanma sonu KAH ve toplam kalp atım sayısı değerleri arasında istatistiksel olarak anlamlı farklar bulunmamıştır. Buna karşın maskeli toparlanmada dispne şiddeti maskesiz toparlanmaya göre daha fazla hissedilmiş, algılanan toparlanma da daha düşük hissedilmiştir. Sonuç olarak; kademeli artan yürüyüş sırasında cerrahi maske kullanımının toparlanmada fizyolojik olarak katılımcıları etkilemese de psikolojik olarak etkilediği söylenebilir.

Anahtar Kelimeler: Cerrahi maske, toparlanma, nefes darlığı, kalp atım hızı, laktat düzeyi.

INTRODUCTION

The World Health Organization (WHO) declared the novel coronavirus (COVID-19) pandemic a global pandemic in March 2020. Following the outbreak of the pandemic, international, national, and local authorities have taken some measures to reduce human-to-human transmission. People were advised to reduce social contact, avoid traveling, stay at home, pay attention to personal hygiene and wear surgical masks (12). Experts have stated that the primary route of transmission of COVID-19 and similar diseases is likely to be small droplets excreted by carriers during conversation, breathing, coughing, or sneezing. It has also been stated that the main source of transmission of the virus is the young population, which is mostly asymptomatic (11).

COVID-19 and similar diseases affecting the world and our country have caused some new habits to enter our lives. One of these is the obligation to wear a surgical mask. Many health authorities recommend, and some even require the use of surgical masks in public places (8). Research shows that surgical masks reduce respiratory virus infections and the risk of human-to-human transmission. It is recommended that all individuals, from children to the elderly, from the healthy to the chronically ill, wear masks while performing their daily activities (9).

After any exercise, metabolic events in the body continue for a while. The reason for this is the removal of metabolic wastes (CO2, lactic acid, etc.) in the body due to the exercise performed, replacing the energy spent, that is, recovery. Recovery is a process in which the muscles and the whole organism return to their pre-exercise state. It is especially important in terms of preparing for the next activity and load (14). Post-exercise heart rate recovery is the difference between the heart rate at the end of exercise and the heart rate at the end of the first minute of the recovery period (3). Recovery continues until heart rate, blood pressure, and ECG return to baseline (16), which takes approximately 9 minutes. In normal asymptomatic individuals and athletes, a rapid decline in heart rate is observed in the first 30 seconds after exercise, followed by a slower decline. This early rapid decline is prevented by atropine, indicating that this rapid decline is caused by vagal influence (17). The factors determining the recovery process are the heart rate, the time for respiration to return to normal, and the return of the lactic acid level to normal levels. During recovery, the VO2 consumed increases to help return to pre-exercise conditions. A so-called oxygen debt occurs (27). In a healthy heart, beats are not regular like clockwork. There are autonomic tone-related changes in heart rate in coordination with respiration. This condition, called heart rate variability, can be used as an indicator of sympathetic-parasympathetic balance, that is, whether the autonomic nervous system is functioning properly. In people in whom the sympathetic system is dominant and the parasympathetic system is not activated, the heart works faster than normal and changes coordinated with respiration are not seen (7).

There are many studies in the relevant literature showing the effects of the masks used during exercise (2,4,18,26). In addition, there is only one study examining the physiological effects of surgical mask use during walking (1). Especially considering that people are in a rush for several reasons in daily life and can take fast walks in a hurry to get from one place to another, no study has been found to examine the effects of mask use during recovery after these and similar situations. Therefore, this study is important in terms of contributing to the literature in terms of the widespread increase in mask use knowing the effects of this situation on recovery heart rate in healthy individuals and being a source for other studies. Based on this information, our study aimed to examine the effect of surgical mask use on recovery heart rate during gradually increasing walking.

METHOD

Research Model and Participants

The experimental model was used in the study. In addition, a randomized crossover design method was utilized. Nine healthy university students (21,89 ± 1,69 ages and 169,78 ± 10,18 height) without any chronic disease or orthopedic disorder participated in the study. The participants were selected based on volunteerism among the students studying at Hatay Mustafa Kemal University School of Physical Education and Sports. Participants were informed about the study in detail. They were also asked to sign a consent form indicating that they were volunteers. Before starting the study, approval was obtained from Hatay Mustafa Kemal University Clinical Research Ethics Committee for all stages of the study.

Research Procedure

In the study, participants performed gradually increasing walking on a treadmill with and without standard surgical masks on two different days 48 hours apart. After gradually increasing walking performance in the speed ranges from walking to running, they recovered in a sitting position for 10 minutes, again with and without masks. Data such as body temperature (BT), blood pressure (BP), blood lactate level, heart rate (HR), total quality of recovery (TQR), and borg-breathlessness (B-B) were collected.

Data Collection

The body temperature of the participants was measured with a Saubern BNT9603 non-contact infrared thermometer on the forehead according to the instructions (Saubern, China). BP was measured in the arm using an Omron M3 (Healthcare; Kyoto, Japan) digital sphygmomanometer. During the measurement, it was ensured that the participant was not talking, leaning back, sitting on a chair, with feet touching the floor, and the arm supported at the level of the heart. Blood lactate level was determined by taking blood samples from the earlobe with a Lactate Plus portable blood lactate analyzer (Nova Biomedical, Waltham, MA, USA). Heart rate (HR) was recorded with Polar RS800CX (Polar Electro Ov, Kempele, Finland) telemetric device in RR (beat-to-beat) intervals. Data on heart rate (HR mean, HR standard deviation, 10-min HR, and total heart rate) were obtained through Polar Pro Trainer 5 software. The TQR during recovery was determined using a modified Borg scale. In this scale, the participants expressed the total quality of recovery they felt in a range between 0 and 20 (5). The Modified Borg Dyspnea Scale was used to determine the breathlessness during recovery. In this scale, the participants expressed the breathlessness they felt in a range between 0 and 10 points (the higher the score, the more breathlessness) (6,15).

Statistical Analysis

Mean, standard deviation and rank mean were used to describe the data. The normality of the data was evaluated statistically (Shapiro Wilk, skewness, kurtosis) and graphically (Histogram, Q-Q plot). For the comparison of masked and unmasked protocols, the paired sample t-test was used for normally distributed data, and the Wilcoxon signed-rank test, the nonparametric equivalent of the t-test, was used when the distribution was not normal. The data were analyzed in SPSS 23.0 (SPSS Inc., Chicago, IL, USA) and the significance level was set as $p<0.05$.

Ethical approval and institutional permission

The research procedure was carried out in adherence to the principles outlined in the Declaration of Helsinki and after the approval of the Hatay Mustafa Kemal University Clinical Research Ethics Committee (Decision Number: 24).

FINDINGS

The comparison of body temperature, blood lactate, systolic, and diastolic blood pressure values of the participants during recovery is shown in Table 1.

Table 1. Comparison of body temperature, lactate level and blood pressure variables

Variables	Group	Mean	Std. Dev.	z / t	p
BT (°C)	No Mask	36.63	0,05	z= -0,71	0,48
	Mask	36,31	0,12		
LA (mmol/l)	No Mask	2,49	0,93	t= 0,40	0,70
	Mask	2,34	1,24		
SBP (mmHg)	No Mask	105,44	10,73	z= -0,35	0,73
	Mask	104,56	8,76		
DBP (mmHg)	No Mask	74.33	7,65	t= 0,69	0,51
	Mask	74.89	6,49		

BT: Body temperature, LA: Lactate level, SBP: Systolic blood pressure, DBP: Diastolic blood pressure

There were no statistically significant differences between unmasked and masked body temperature (p=0.48), blood lactate level (p=0.70), systolic blood pressure (p=0.73), and diastolic blood pressure (p=0.51) values (Table 1).

The comparison of heart rate (HR) values is shown in Table 2.

Table 2. Comparison of heart rate variables

Variables	Group	Mean	Std. Dev.	z / t	p
HRmean (beats/min)	No Mask	96,56	18,53	z= -0,12	0,91
	Mask	97,00	14,71		
SD (msec)	No Mask	19,07	12,93	t= 1,05	0,32
	Mask	15,26	8,95		
HR10.min (beats/min)	No Mask	80,67	16,84	z= -1,44	0,19
	Mask	84,67	15,39		
THR (beats)	No Mask	965,56	185,80	z= -0,24	0,81
	Mask	971,67	147,40		

HR: Heart rate; SD: Heart rate standard deviation, HR10.min: 10. Heart rate at 10 minutes, THR: Total heart rate

There were no statistically significant differences between the mean HR (p=0.91), SD (p=0.32), HR at 10 minutes (p=0.19), and total heart rate (p=0.81) values of the participants without and with masks (Table 2).

The comparison of the TQR and B-B is shown in Table 3.

Table 3. Comparison of total quality of recovery and borg-breathlessness

Variables	Group	Mean	Std. Dev.	z	p
TQR	No mask	16,78	2,99	z= -1,40	0,16
	Mask	15,00	2,06		
B-B	No Mask	0,83	0,50	z= -2,39	0,02*
	Mask	2,17	1,62		

TQR: Total quality of recovery, B-B: Borg-breathlessness, *: p<0.05.

Although there was no statistically significant difference between unmasked and masked TQR (p=0.16), participants stated that they recovered less with masks than without masks. However, B-B (p=0.02) values were found to be statistically significantly higher in the masked protocol (p<0.05) (Table 3). The graph of the rate of perceived recovery is shown in Figure 1.

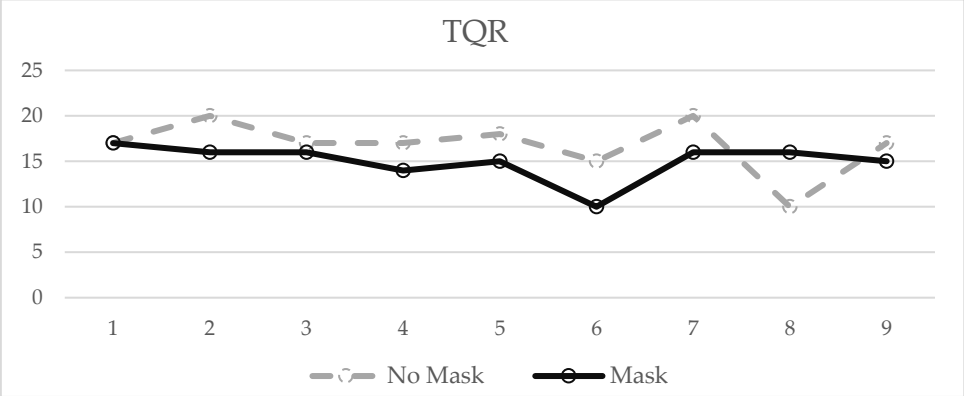

Figure 1. Total Quality of Recovery

Except for one participant, all unmasked participants felt a higher rate of recovery than masked participants (Figure 1). The B-B graph of the participants is shown in Figure 2.

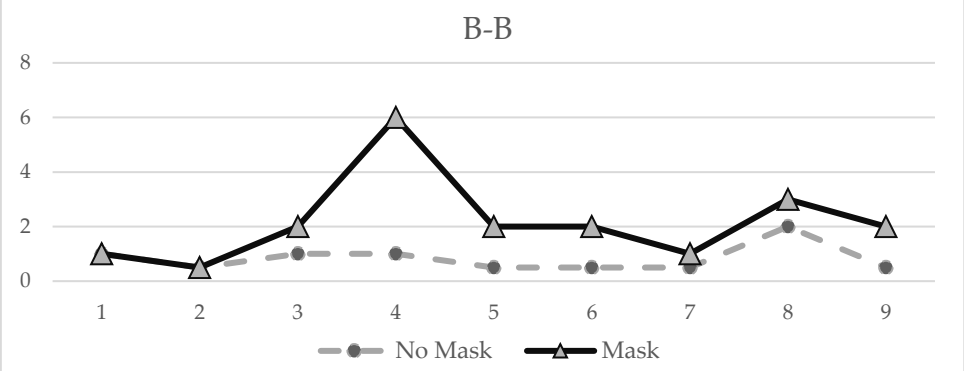

Figure 2. Borg-Breathlessness

Except for two participants, all unmasked participants had lower breathlessness values than masked participants (Figure 2).

DISCUSSION AND CONCLUSION

Our study was conducted to examine the effects of surgical mask use during gradually increasing walking on heart rate, total quality of recovery, and breathlessness during recovery. The main finding of the study was that the use of a surgical mask can have a significant negative effect on breathlessness during recovery. On the other hand, the use of surgical masks during gradually increasing walking did not significantly affect the participants in terms of recovery body temperature, blood pressure, blood lactate level, heart rate, and total quality of recovery. However, it is noteworthy that the values in unmasked recovery were lower than in masked recovery.

In the relevant literature, all of the studies on a surgical mask and exercise focused on the effects of surgical mask use on various parameters during exercise (1,2,4,10,11,12,18,20,21,22,25,26). Only two studies investigated the physiological effects of the mask during the recovery period after exercise. In a study examining the physiological effects of surgical mask use during as well as immediately after walking exercise, it was found that using a surgical mask did not show any difference for HR and BP immediately after brisk walking and similar values of HR and BP were determined with and without surgical mask after brisk walking in the recovery period (1). In the other study, Kwon and Kim (2023) investigated the effects of mask use on recovery HR and LA during a gradually increasing running test and in the recovery period. As a result of the study, no statistically significant differences were found for both variables with and without masks (19). In our study, no differences were found between the groups in terms of HR, BP, and LA during the recovery process after gradually increasing walking exercise. Therefore, there is a similarity between the results of these two studies and the results of our study in terms of the variables mentioned.

Although studies have shown that the use of surgical masks during different types of exercises has effects on various physiological parameters, it can be said that the use of surgical masks in the recovery period after walking or running exercises does not show any physiological differences and brings similar physiological loads to the person. In addition, the fact that the lactic acid level in the blood did not decrease significantly in the recovery period after the test with the mask may be due to the high activation of anaerobic lactic acid metabolism. However, further studies are needed to better understand the physiological effects of mask use during and after exercise on the recovery period and the underlying reasons for this.

Although the number of studies examining the effects of surgical mask use on feeling-based parameters such as total quality of recovery and breathlessness other than physiological parameters is quite small in the literature, all of these studies focused on feelings during exercise (13,21,23,24,26,28). There is no other study in the literature that examined the effects of surgical mask use during exercise on total quality of recovery and breathlessness in recovery similar to the protocol of our study. Therefore, our study is unique in this respect.

There were no statistically significant differences between unmasked and masked body temperature, lactate level, systolic and diastolic blood pressure, recovery mean HR, recovery end HR, and total HR. However, breathlessness was felt more in masked recovery than in unmasked recovery and the total quality of recovery was felt lower. The results of this study suggest that wearing a surgical mask during recovery from gradually increasing walking does not place additional physiologic demands on the person, although it may require slightly more respiratory effort and psychologically affect them.

REFERENCES

1. Akgul, M. S., Ozcan, N., Uzun, M. E., Gurses, V. V., & Baydil, B. Physiological impact of wearing a surgical face mask during walking in the COVID-19 pandemic. Pedagogy Phys Cult Sports, 2021; 25(4): 202-207.
2. Akgül, M. N., Baltacı, Ş., Yıldız, K. C., Özcan, N., & Akgül, M. Ş. Covid-19 Pandemisinde Pilates Egzersizi Sırasında Cerrahi Yüz Maskesi Takmanın Etkilerinin BORG Skalası Özelinde Değerlendirilmesi. Akdeniz Spor Bilimleri Dergisi, 2021; 4(2): 222-228.
3. Aktürk, Y., Yeşilbursa, D., Uçar, H., Yücel, E., Özdabakoğlu, O., Eryılmaz, S., . . . Aydınlar, A. Tedavi alan hipertansif olgularda diürnal kan basıncı değişikliğinin efor testi sonrası kalp hızı toparlanmasına etkisi. Uludağ Üniversitesi Tıp Fakültesi Dergisi, 2008; 34(1): 9-13.
4. Aydın, K., Karlı, Ü., Sözbir, K., & Kocaağa, T. Sağlıklı Erişkin Erkeklerde Şiddeti Artan Egzersiz Sırasında Tıbbi Maske Kullanımının Kalp Atım Hızı, Egzersiz Süresi ve Egzersiz Zorluk Algısına Etkisi: Randomize Klinik Çalışma. Turkiye Klinikleri J Sports Sci, 2021; 13(3): 434-441.
5. Borg, G. A. Perceived exertion. Exerc Sport Sci Rev, 1974; 2: 131-153.
6. Burdon, J. G., Juniper, E. F., Killian, K. J., Hargreave, F. E., & Campbell, E. J. The perception of breathlessness ın asthma. Am Rev Respir Dis, 1982; 126: 825-828.
7. Carney, R. M., Blumenthal, J. A., Stein, P. K., Watkins, L., Atelier, D., & Berkman, L. F. Depression, heart rate variability, and acute myocardial infarction. Circulation, 2001; 104(17): 2024-2028.
8. Cheng, K. K., Lam, T. H., & Leung, C. C. Wearing face masks in the community during the COVID-19 pandemic: altruism and solidarity. Birmingham: Lancet, 2020.
9. Cowling, B. J., Chan, K. H., Fang, V. J., Cheng, C. K., Fung, R. O., Wai, W., . . . Leung, G. M. Facemasks and hand hygiene to prevent influenza transmission in households: a cluster randomized trial. Ann Intern Med, 2009; 151(7): 437-446.
10. Doherty, C. J., Mann, L. M., Angus, S. A., Chan, J. S., Molgat-Seon, Y., & Dominelli, P. B. Impact of wearing a surgical and cloth mask during cycle exercise. Appl Physiol Nutr Metab, 2021; 46: 753-762.
11. Epstein, D., Korytny, A., Isenberg, Y., Marcusohn, E., Zukermann, R., Bishop, B., . . . Miller, A. Return to training in the COVID-19 era: The physiological effects of face masks during exercise. Scand J Med Sci Sports, 2021; 31: 70-75.
12. Fikenzer, S., Uhe, T., Lavall, D., Rudolph, U., Falz, R., Busse, M., . . . Laufs, U. Effects of surgical and FFP2/N95 face masks on cardiopulmonary exercise capacity. Clin Res Cardiol, 2020; 109: 1522-1530.
13. Georgi, C., Haase-Fielitz, A., Meretz, D., Gäsert, L., & Butter, C. The impact of commonly-worn face masks on physiological parameters and on discomfort during standard work-related physical effort. Dtsch Arztebl Int, 2020; 117: 674-675.
14. Günay, M., Tamer, K., & Cicioğlu, İ. Spor Fizyolojisi ve Performans Ölçümü (3. Basım b.). Ankara: Gazi Kitapevi, 2013.
15. Hareendran, A., Leidy, N. K., Monz, B. U., Winnette, R., Becker, K., & Mahler, D. A. Proposing a standardized method for evaluating patient report of the intensity of dyspnea during exercise testing in COPD. Int J COPD, 2012; : 345-355.
16. Higgins, J. P., & Higgins, J. A. Electrocardiographic exercise stress testing: An update beyond the ST segment. Int J Cardiol, 2007; 116: 285-299.

17. İmai, K., Sato, H., Hori, M., Kusuoka, H., Ozaki, H., Yokoyama, H., . . . Kamada, T. Vagally mediated heart rate recovery after exercise is accelerated in athletes but blunted in patients with chronic heart failure. J Am Coll Cardiol, 1994; 24: 1529-1535.
18. Köroğlu, Y., & Kaya, M. Eğitsel Oyunlar Esnasında Maske Kullanmanın Denge, Reaksiyon ve Çeviklik Üzerine Etkisi. Uluslararası Bozok Spor Bilimleri Dergisi, 2021; 2(2): 108-118.
19. Kwon, H. T., & Kim, D. Effects of High-Intensity Exercise on Physiological Indicators of Recovery Period by Wearing Face Masks of Elite Athletes. Healthcare, 2023; 11(2): 268-276.
20. Lässing, J., Falz, R., Pökel, C., Fikenzer, S., Laufs, U., Schulze, A., . . . Busse, M. Effects of surgical face masks on cardiopulmonary parameters during steady state exercise. Sci Rep, 2020; 10(22363): 1-9.
21. Otsuka, A., Komagata, J., & Sakamoto, Y. Wearing a surgical mask does not affect the anaerobic threshold during pedaling exercise. J Hum Sport Exerc, 2022; 17(1): 22-28.
22. Portela, M. A., Lopez-Rodriguez, A., Mollinedo-Cardalda, I., & Cancela, J. M. Differential effects of the use of surgical or FFP2/N95 face masks on the performance of the 20-m multistage shuttle run test by adolescents. Med dello Sport, 2022; 75(3): 371-384.
23. Radtke, K. L., Porcari, J. P., Foster, C., Miller, M., & Helget, A. Evaluation of Six-Minute Walk Test (6MWT) Performance with and without a Facemask. Int J Res Ex Phys, 2021; 16(2): 67-80.
24. Shaw, K. A., Butcher, S., Ko, J. B., Absher, A., Gordon, J., Tkachuk, C., . . . Chilibeck, P. D. Wearing a Surgical Face Mask Has Minimal Effect on Performance and Physiological Measures during High-Intensity Exercise in Youth Ice-Hockey Players: A Randomized Cross-Over Trial. Int J Environ Res Public Health, 2021; 18: 10766.
25. Shaw, K., Butcher, S., Ko, J., Zello, G. A., & Chilibeck, P. D. Wearing of Cloth or Disposable Surgical Face Masks has no Effect on Vigorous Exercise Performance in Healthy Individuals. Int. J. Environ. Res. Public Health, 2020; 17(8110): 1-9.
26. Swiatek, K. M., Lester, C., Ng, N., Golia, S., Pinson, J., & Grinnan, D. Impact of Face Masks on 6-Minute Walk Test in Healthy Volunteers. Pulm Circ, 2021; 11(1): 1-3.
27. Tomlin, D. L., & Wenger, H. A. The relationship between aerobic fitness and recovery from high intensity intermittent exercise. Sports Med, 2001; 31(1): 1-11.
28. Tornero-Aguilera, J. F., Rubio-Zarapuz, A., Bustamante-Sánchez, A., & Clemente-Suárez, V. J. The Effect of Surgical Mask Use in Anaerobic Running Performance. Appl Sci, 2021; 11: 6555.

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Physical Fitness in the Armed Forces: A Comprehensive Study of International Assessment Practices

Muhammed Sıddık ÇEMÇ [1A], Recep ŞAHİN [2B]

[1] *Boğaziçi University, Department of Physical Education and Sport, İstanbul, TÜRKİYE*
[2] *İstanbul Aydın University, Graduate Education Institute, Department of Physical Education and Sport, İstanbul, TÜRKİYE*

Address Correspondence to Muhammed Sıddık ÇEMÇ: e-mail: mscemc@gmail.com

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A: Orcid ID: 0000-0001-5442-0869 B: Orcid ID: 0009-0005-0334-0849

Abstract

The aim of this study is to thoroughly examine the physical fitness assessment methods used in the armed forces of various countries and to evaluate the physical fitness criteria necessary for military personnel to maintain their operational capabilities and overall health. Within the scope of the research, physical fitness assessment tests used in the armed forces of 17 countries, including the United States, Germany, Australia, Austria, the Czech Republic, China, Finland, France, Georgia, Canada, Ireland, the United Kingdom, Israel, Sweden, Latvia, Russia, and Turkey, were examined. It was observed that the tests aim to determine the soldiers' muscle strength, aerobic capacity, endurance, and overall physical fitness status. Additionally, it was found that while the physical fitness test and evaluation criteria applied by these countries vary, their fundamental purposes in practice are similar. Research has shown that maintaining physical fitness levels results in increased resilience of soldiers against problems and difficulties they may face in combat conditions, contributing to operational success. In this context, it is of great importance for national armies to continue and enhance their physical fitness programs. Moreover, it is essential to systematically review and update physical fitness test evaluations in accordance with scientific advancements, which will contribute to varying operational requirements in the armies. In conclusion, maintaining and improving physical fitness levels is a critical factor for the operational success of soldiers. Therefore, it should be regularly monitored and enhanced. This research aims to emphasize the importance of physical fitness test evaluations applied in national armies and contribute to the development of related studies. By sharing the practices implemented, it aims to take significant steps internationally towards enhancing soldiers' physical capacities.

Keywords: Armed forces, physical fitness, testing methods.

Silahlı Kuvvetlerde Fiziksel Uygunluk: Uluslararası Değerlendirme Uygulamalarının Kapsamlı Bir İncelemesi

Özet

Bu çalışmanın amacı çeşitli ülkelerin silahlı kuvvetlerinde kullanılan fiziksel uygunluk değerlendirme yöntemlerini detaylı bir şekilde incelemek ve askeri personelin operasyon yetenekleri ile genel sağlık durumlarını sürdürebilmeleri için gerekli olan fiziksel uygunluk kriterlerini değerlendirmektir. Araştırma kapsamında; Amerika Birleşik Devletleri, Almanya, Avustralya, Avusturya, Çekya, Çin, Finlandiya, Fransa, Gürcistan, Kanada, İrlanda, İngiltere, İsrail, İsveç,

Letonya, Rusya ve Türkiye olmak üzere 17 ülke ordusunda kullanılan fiziksel uygunluk değerlendirme testleri incelenmiştir. İcra edilen testlerin askerlerin kas kuvvetini, aerobik kapasitesini, dayanıklılığını ve genel fiziksel uygunluk durumlarını belirlemeyi amaçladığı gözlenmiştir. Ayrıca, ülkelerin uygulamış olduğu fiziksel uygunluk test ve değerlendirme kriterlerinin değişiklik gösterdiği fakat uygulamadaki temel amaçlarının birbiri ile benzer olduğu anlaşılmıştır. Yapılan araştırmalar ile fiziksel uygunluk seviyesinin muhafaza edilmesi sonucu, askerlerin savaş şartlarında yüzleşebilecekleri problem ve sıkıntılara karşı dayanıklılıklarının yükseldiği ve bu durumun operasyon başarısına katkı sağladığı gözlenmiştir. Bu kapsamda, ülke ordularının fiziksel uygunluk programlarını sürdürme ve geliştirmeye devam etmeleri büyük önem taşımaktadır. Ayrıca, fiziksel uygunluk test değerlendirmelerinin bilimsel gelişmelere uyum sağlayacak şekilde sistemli olarak gözden geçirilmesi ve güncellenme çalışmalarının yapılması, ordularda değişiklik gösteren operasyon gereksinimlerine katkı sağlayacaktır. Sonuç olarak, fiziksel uygunluk seviyelerini korumak ve geliştirmek, askerlerin operasyon başarısı açısından kritik bir etmendir. Bu sebeple düzenli olarak gözlenmeli ve geliştirilmelidir. Bu araştırma, ülke ordularında uygulanan fiziksel uygunluk test değerlendirmelerinin önemini vurgulayarak, bu kapsamda yapılacak çalışmaların geliştirilmesine katkı sağlamayı amaçlamıştır. Böylece yapılan uygulamaların paylaşılması ile uluslararası alanda askerlerin fiziksel kapasitesini artırmaya yönelik önemli adımların atılması hedeflenmiştir.

Anahtar Kelimeler: Silahlı kuvvetler, fiziksel uygunluk, test yöntemleri.

INTRODUCTION

Physical fitness is defined as an individual's capacity to perform work. It ensures the optimal completion of all activities, including the basic necessities of routine life such as transportation, household and office tasks, as well as physical activities like walking, running, and cycling (18).

Physical fitness is defined by the World Health Organization (WHO) as the ability to successfully perform activities that involve muscle skills. In other words, physical fitness is the capacity of individuals to effectively carry out physical activities, whether these abilities are innate or acquired over time (1).

Physical fitness also encompasses the concepts of well-being, wellness, and health (9). As a critical determinant of health, physical fitness is considered essential for maintaining and improving health. Low levels of physical fitness are associated with an increased risk of cardiovascular diseases, diabetes, and musculoskeletal problems. Enhancing physical fitness helps to reduce these risks and contributes to the healthy functioning of the body (4,20).

The History of Physical Fitness

From a historical perspective, the relationship between physical activity and health extends back to 3000-1000 BCE. In ancient China, Huangdi, known as the Yellow Emperor, emphasized in the classic work "Yellow Emperor's Book of Internal Medicine" that harmony with nature is key to disease prevention, and that preventing diseases is fundamental for longevity (59). In later periods, many scholars, from Hippocrates to Galen, investigated the relationship between physical fitness, health, and work efficiency (51).

In the 5th-4th centuries BCE, in city-states such as Athens, Sparta, and others, it was emphasized that specific ideal criteria needed to be adhered to in order to maintain the physical health of both military personnel and civilians. However, during the same period, Hippocrates warned that excessive exertion of the body could lead to dangerous outcomes and disrupt the body's natural balance (19).

In more recent history, prior to 1913, physical fitness levels were evaluated using anthropometric measurements and dynamometer tests. By 1918, the importance of strength tests had increased, but it was realized that these tests alone were insufficient for assessing physical fitness comprehensively. In 1923, Schneider developed his eponymous test, and a modified version of this test began to be used by the medical units of the U.S. Army and Navy. In 1924, Collins and Howe critically evaluated physical fitness tests. They argued that physical fitness could not be measured by a single test and proposed the application of various test groups, including motor control tests, physiometric tests, and somatometric tests. In 1938, studies conducted by Wellesley College led to the emergence of the concept of "endurance," which is closely related to circulatory-respiratory condition, nutrition, and an individual's training level. In 1925, F.R. Rogers introduced the concepts of "strength scale" and "physical fitness scale" (37).

In the 1940s, the U.S. Air Force and Navy used physical fitness test batteries consisting solely of motor tests. Physical examinations conducted during World War II revealed that a dangerously high number of young individuals were physically unfit. During and after the war, efforts were made to develop tests to classify soldiers based on their physical fitness and to address their weaknesses. During these years, particularly in countries like the United States and Canada, the poor physical fitness levels of young people became a significant concern. During World War II and the Korean War, the primary reason for rejecting young men from military service was insufficient physical fitness levels. During these periods, the American Association for Health, Physical Education, and Recreation (AAHPER) reported that no single test could adequately determine physical fitness levels. They developed a comprehensive physical fitness test for young people that included pull-ups, sit-ups, shuttle run, standing long jump, 45-meter sprint, softball throw, and a 550-meter run (11).

In 1947, Cureton proposed a test battery that included motor, cardiovascular, respiratory, metabolic, and anthropometric measurement tests. Overall, it was understood that physical fitness could not be validly measured with a narrowly focused test battery and could not be reduced to a single test. Initially synonymous with strength, the concept of physical fitness underwent a transformation in the 1950s with the acceptance of the idea that cardiovascular measurements were more meaningful in determining physical fitness levels (37).

The most comprehensive and institutional step related to physical fitness was observed in the United States in 1953. Hans Krauss and Bonnie Pruden, in their article "Muscular Fitness and Health," revealed that with the increasing prosperity and ease of life, there was a rapid decline in the muscle strength of American adults and children. This article caught the attention of President Dwight D. Eisenhower, who invited the authors to the White House and organized a meeting with other experts. As a result of this meeting, the "President's Conference on Physical Fitness of American Youth" was held in 1956. President Eisenhower, a former military officer, placed great importance on the physical fitness levels of the youth, considered America's potential wartime force. He was also aware of the complaints from officers about the poor physical fitness of young recruits during World War II and the Korean War. Eisenhower ordered the establishment of the "President's Council on Physical Fitness and Sports" to raise public awareness and promote the development of physical fitness (51).

The primary aim of physical fitness development is to ensure that individuals are aware of their physical fitness levels not only during their educational periods but throughout their entire lives. It seeks to encourage lifelong engagement in physical activities, enable progress in various areas of development, and minimize the ailments caused by a sedentary lifestyle (25,47).

As a result of ongoing developments, various tools and methods are used to determine individuals' physical fitness levels. Data obtained from these measurements are compared with appropriate normative values, allowing for a concrete expression of individuals' physical fitness levels. This approach helps identify deficiencies and aims to improve physical fitness through suitable exercise programs (9).

Components of Physical Fitness

Physical fitness is examined in three main categories: health-related fitness, skill-related fitness, and physiological fitness (27).

Health-related fitness is a concept that enables the performance of daily activities without feeling fatigued and reduces the risk of hypokinetic diseases. The components of this type of fitness include cardiovascular fitness (CVF), muscular strength and endurance, flexibility, and body composition (33,40,54).

The components of skill-related fitness include agility, balance, reaction time, speed, and power. These components are directly related to success in performing motor skills (40).

The term physiological fitness is used particularly in the medical field to describe the effects of physical activity on biological systems and its role in disease prevention. The components of this type of fitness include metabolic fitness, morphological fitness (which refers to body composition), and bone integrity (27).

According to another classification, the components of physical fitness are outlined in seven distinct categories. In this classification, physical fitness includes aerobic power, aerobic endurance, muscular

strength, muscular endurance, flexibility, metabolic fitness, and balance/coordination/kinesthetic awareness. Although these components appear different from other classifications, they are fundamentally the same (5).

Various military authorities have provided definitions of physical fitness. For instance, the U.S. Army, in its Physical Fitness Training Manual, defines physical fitness as "the ability to perform physical work, training, and other activities efficiently, and to have enough energy to handle emergencies" (57). The Canadian Army defines physical fitness as "the energy and physical capability necessary to complete specific tasks, remain alert for sudden situations, and react swiftly; effectively counter stress and perform under challenging operational conditions" (7). The U.S. Military Academy, in a report, describes physical fitness as "the ability to perform daily duties energetically and dynamically, engage in recreational activities, and reserve energy for emergencies; the capability to counter stress, exhibit endurance, and withstand situations that would overwhelm someone without good physical fitness" (3,40).

Military Physical Readiness

Military physical readiness is defined as "the capacity to efficiently perform the physical tasks required by military duties and combat." This concept comprises components of physical fitness, health, and motivation (58).

The U.S. Marine Corps, in its 1988 document "Marine Corps Physical Training for Combat Readiness," emphasizes the importance of military physical readiness as follows (62):

Military physical deficiencies become evident in the initial stages of combat. This issue was recognized after the Civil War and has been repeatedly observed in every national threat situation.

a. Success in combat is directly proportional to the hours of training conducted under combat conditions. Losses and injuries in the initial phases of combat often result from inadequacies in coping with challenging terrain or climatic conditions. Sufficient preparation is essential to prevent these outcomes.

b. The first scientifically based physical conditioning doctrine was developed during World War II. As the war progressed, the positive effects of this program on soldiers became clearly evident.

c. Post-war periods have typically been times for discussing the sufferings and losses. Unfortunately, some commanders have viewed physical preparation as something only necessary during wartime. With this perspective, physical readiness was relegated to a secondary priority, reducing combat effectiveness. Soldiers sent to the Korean War reported that their low levels of physical readiness negatively impacted their combat effectiveness.

d. The hard-won military experiences have created an increasing awareness regarding the physical readiness of military personnel. Today, there is no longer a need to debate or emphasize the importance of physical fitness during combat or peacetime. Despite increasing modernization and mechanization, the factor that most significantly affects a soldier's chance of survival is their level of physical fitness.

e. Today, commanders are aware of the need for highly physically fit personnel and must create time for exercise for their personnel amidst the increasing workload due to daily tasks, maintenance, training, operations, and other time-consuming activities.

Physical Fitness for Armies

The primary objective of physical fitness tests in the world's militaries is to identify individuals who possess the physical fitness and readiness necessary to meet the physical demands of military duties, contribute to overall health, and best represent the armed forces in terms of image (39).

Physical fitness has always been one of the most crucial factors in winning battles for armies and has maintained its importance throughout history without losing its significance. Those who have won wars are those who were trained and ready (13). Although today’s operational conditions are technologically supported, the physical fitness level of personnel remains essential for the successful completion of missions (34).

An armed forces that will maintain a deterrent power for peace and participate in multinational forces organized by the UN, NATO, and other international organizations will undertake diverse and multi-

dimensional tasks such as disaster relief, embargo enforcement, the establishment of no-fly zones, refugee operations, search and rescue, peacekeeping, and peace enforcement. Regardless of the weapons, equipment, vehicles, and tools used in these missions, the primary effectiveness will be achieved through the quality of human resources (29).

Individual physical readiness forms the foundation of the military profession and a successful career. Physical activity is critical in maintaining physical fitness and readiness for military personnel. The daily duties that military personnel must perform require a high level of physical readiness (43).

The U.S. Army implements necessary measures to ensure that all military personnel, regardless of their rank, class, or duty, are combat-ready. Army personnel are expected to, among other duties, react swiftly in combat situations, cover distances on the battlefield, know close combat techniques, control and evacuate masses. All these tasks involve strenuous physical activities that require a high level of physical fitness (46).

Military personnel need to possess not only general endurance but also specialized endurance at a high level. Endurance gained through training specific to operational conditions, rather than just sports training, will be far more beneficial in terms of effectiveness. Although transportation by vehicles is preferred during peacetime for speed and convenience, war conditions and terrain obstacles often make such transportation challenging. There are numerous recent examples related to this issue (7,16,44).

The challenging nature conditions, one of the greatest adversaries of military personnel, must also be taken into account, and readiness for all situations is essential. In wars fought under harsh conditions, soldiers contend with two enemies: enemy forces and nature. Often, nature can be more formidable than enemy forces (13).

The physical readiness of military personnel can be achieved through well-planned training programs with progressively increasing difficulty levels. These programs should integrate physical training activities into the military training curriculum. A properly organized military physical fitness (PF) training program should be incorporated into the training schedules of units at every level. Military training prepares personnel, leaders, and units to fight under any conditions. The main objective of an army is to be combat-ready, becoming more agile, resilient, lethal, and capable of survival. Combat conditions require soldiers to possess attributes such as strength, endurance, mobility, flexibility, and coordination. Victory and a soldier's survival depend on these qualities. Combat conditions include marching long distances over rough terrain with weapons and equipment, engaging effectively in combat upon reaching the point of contact, swiftly operating tracked and motorized vehicles over rugged terrain, running and crawling long distances, jumping over obstacles, mounds, and ditches, lifting and carrying heavy objects, and enduring hours of combat without sleep. All these activities demand extraordinary physical conditioning (24).

Military administrations place great importance on physical appearance, which is perceived as an indicator of physical fitness level and influences the public's perception of the military for many psychosocial reasons. It is believed that physical appearance strengthens the sense of belonging and affects how a country's armed forces are perceived on the international stage. Additionally, it is known that physical appearance boosts self-confidence and positively impacts acceptance within the group (35).

The U.S. Department of Defense Physical Fitness Directive emphasizes that all military personnel must possess cardiovascular endurance and strength to be ready for potential combat situations. It also mandates that forces make adjustments suited to their specific needs to enhance combat effectiveness (58).

Recent examples show a clearer understanding of the sensitivity of senior personnel towards physical fitness and particularly physical readiness. In a speech in 1982, U.S. President Ronald Reagan stated (21):

"America's freedom depends on a strong defense. Our military must always be ready both physically and mentally; there should be no doubt about the nation's determination and ability to defend itself. Therefore, it is essential to better understand the importance of physical fitness. Despite today's modern weapon systems, it is the soldiers who are prepared to serve their country spiritually, mentally, and physically that will make the difference in future conflicts."

The research report prepared and published by Major Mark P. Hertling from the U.S. Armed Forces Academy (26) concludes with the following statements:

"The army must be strong. When watching an overweight officer or non-commissioned officer struggle to climb a set of stairs without getting winded, the real concern should be their ability to perform their assigned duties on the battlefield. If personnel tire during training while carrying a light backpack, their only fate will be death when advancing towards enemy lines with a fully loaded pack in combat. If personnel have not experienced grueling muscular fatigue during training, they will be unable to repeatedly lay signal cables where needed. If a non-commissioned officer cannot swim and is asked to lead their unit across a river, a leader must be prepared for personnel losses. If a tank gunner has never approached an exploding shell casing and does not know what to do, the superior performance of a multi-million dollar weapons system becomes meaningless. If we, as an army, do not subject ourselves to physical and emotional stress beyond two minutes of push-ups, sit-ups, and a 20-minute run around the barracks, our high technology and doctrine will be ineffective."

Regarding the necessity of maintaining peak physical fitness, D.M. Day stated the following (49):

"Your level of physical fitness should be such that you no longer need to think about it. Having a high level of physical fitness is critical not just for survival or excelling in any physical task, but because it enables you to serve as a commander or leader in combat. Your physical fitness must be excellent so that you can lead, think, plan, and complete your mission. Everything else is mere showmanship and therefore meaningless."

Physical Fitness Assessment Methods of Armies

United States Army

For U.S. Army personnel, physical fitness tests include assessments of aerobic fitness (2-mile run), body composition evaluation, and muscular strength (push-ups and sit-ups). Scoring tables and standards have been established for each age group and gender. However, personnel who declare a valid medical excuse may participate in one of the alternative tests instead of the 2-mile run. These alternative tests include a 400-meter swim, a 10-kilometer bicycle ergometer test, a 10-kilometer bicycle test, or a 4-kilometer walk test (50,57).

United States Navy

The United States Navy conducts physical fitness tests that include a 2,400-meter run for aerobic fitness, push-ups and sit-ups for muscular strength, a height-to-weight ratio for body composition, and a 450-meter swim for assessing strength characteristics. Personnel who are unable to participate in the run have the alternative option of an elliptical bike test. Personnel scoring below an average of 45 points on these tests are classified as "unsatisfactory" (15,50).

United States Air Force

In the United States Air Force, military personnel are subjected to body composition (BC), aerobic fitness, and muscular strength (MS) tests. The BC assessment is conducted by measuring waist circumference. For aerobic fitness, a 2,400-meter run test is administered, with a 1,600-meter walk test as an alternative. The MS assessment is determined by the number of correct push-up and sit-up repetitions performed in one minute. All Air Force personnel are expected to maintain a sufficient level of physical fitness at all times, or they may face consequences. Commanders are responsible for taking necessary measures to ensure that uniformed personnel do not undermine the military image (14).

United States Marine Corps

The physical readiness tests of the United States Marine Corps are conducted in three phases. All tests are performed in training attire, and there is no gender differentiation in the execution of the test items. The performance evaluation is determined as "pass/fail" (53,60,61).

The test items are as follows:

Approach to Point of Contact (800-meter run).

Ammunition Loading (Upper Body Strength and Endurance Test. In this test, a 15 kg (33 lbs) 5.56 mm ammunition box is lifted from shoulder height to above the head as many times as possible within a 2-minute duration).

Movement Under Fire (This test is a multi-stage exercise that includes various movements and tasks. The descriptions of these stages are provided below):

Stage One: From a prone position, the test includes a sprint, a 10-meter high crawl, a 15-meter low crawl, a zigzag run, and the grasping of a wounded personnel.

Stage Two: Dragging the wounded over a 10-meter S-shaped course, followed by a 60-meter carry using the fireman's carry technique.

Stage Three: A 50-meter sprint with ammunition boxes, a 25-meter zigzag run, grenade throwing, and completing 3 push-ups.

Stage Four: Rising from a prone position, picking up ammunition boxes, followed by a 25-meter zigzag run and a 50-meter sprint.

Chinese Army

Military personnel in the Chinese army are subjected to the following physical fitness tests: a 5000-meter run, a 3000-meter cross-country run with weapons and other equipment, a 400-meter obstacle run, an 800-meter breaststroke swim, a 100-meter sprint, horizontal pull-ups, 2 minutes of sit-ups, 2 minutes of push-ups, and grenade throwing (8).

German Armed Forces

Since 2010, the German Armed Forces have implemented a new physical fitness test. This test was developed using 82 female and 1,100 male subjects. The test allows for the evaluation of military personnel's physical fitness in five key categories. These categories include a 4x9 meter shuttle run to measure movement speed, sit-ups to assess the strength endurance of abdominal and hip flexor muscles, standing long jump to determine explosive power for the lower extremities, push-ups to measure muscular endurance for the upper extremities, and a 12-minute run to evaluate aerobic endurance (34).

Canadian Armed Forces (Combat Personnel)

The tests used for combat personnel in the Canadian Armed Forces consist of applications designed according to combat conditions. These tests are conducted in five stages (6,63).

The explanations for the tests are provided below in order:

Trench Digging: The energy expenditure during trench digging is approximately 400 kcal/hour, with a heart rate of 130-160 bpm. The workload corresponds to 70% of aerobic capacity. During this task, approximately 0.5 cubic meters of soil are removed, and the task is completed in under 10 minutes. The shortest times recorded are 2 minutes for men and 4 minutes for women. The average time for men under 35 is 4 minutes and 14 seconds, while for men over 35, it is 5 minutes and 36 seconds.

Loaded March: The distance covered in a loaded march ranges from 10 to 16 kilometers. During this task, the personnel carry equipment weighing 24.5 kg.

Casualty Evacuation: The rapid evacuation of an injured personnel from the battlefield to a safe area is of critical importance. The ability of one personnel to quickly rescue another from the combat zone is crucial for the safety of both the rescuer and the injured personnel. The designated distance for this task is approximately 100 meters, assuming that the weights of the personnel are equal.

Fuel Can Carrying: Refueling vehicles that run on gasoline requires carrying fuel cans to the vehicle and lifting them to a fuel tank cap approximately 1 meter high. The number of cans to be carried is determined by the amount of fuel needed for the refueling operation.

Loading/Unloading Combat Equipment: This task involves carrying ammunition boxes and lifting them to the height of a truck bed. Therefore, the ability to transport and load a specified number of ammunition boxes is included in the physical fitness tests for military personnel.

French Armed Forces

The French Armed Forces employ various tests to evaluate the physical fitness of their personnel. These tests include the Cooper test, a modified shuttle run test with increasing tempo each lap, the standard 20-meter shuttle run test, a 100-meter swim, a 10-meter underwater swim, a 5-meter rope climb, crunches, push-ups, and pull-ups (36).

Georgian Army

In the Georgian army, physical fitness assessment includes a 2400-meter run, push-up, and sit-up tests (42).

Swedish Army

A study by Wyss and colleagues (67) aimed to develop a new physical fitness test battery for the Swedish Army. Based on data from 12,862 subjects and subsequent statistical analyses, it was concluded that a battery consisting of endurance running, seated shot put, standing long jump, core strength test, and one-legged stance test was appropriate for measuring physical fitness.

Russian Army

The physical fitness tests used in the Russian army include a 3 km run with a rifle and equipment, pull-ups, a 5-meter rope climb without using legs, an obstacle course, throwing a rifle at a chest-height target 6 meters away, a 10 km march with equipment and backpack, and close combat training (55).

Australian Army

In 1995, the Australian Army made changes to its physical fitness programs by replacing the 400-meter run test with an 800-meter run test and the 5-kilometer run test with a 2,400-meter run test. Additionally, they incorporated a standardized loaded march and deep-water running test into their programs. Following these changes, a 40.8% reduction in health expenditures was recorded (65).

Israeli Army

The Israeli Army uses the Bar Or test, developed by Oded Bar Or, to assess the physical fitness levels of its personnel. This test battery is also used by the Israeli Police. The test battery includes push-ups, sit-ups, and a 2,000-meter run. The push-up and sit-up tests are conducted without a time limit, ending only when the individual can no longer continue the test or pauses the movement for 2 seconds (38).

Czech Army

In the Czech army, physical fitness assessment includes tests such as sit-ups, push-ups, a shuttle run (4x10 meters), grenade throwing, a coordination course, a 2,000-meter run, and a 300-meter swim (42).

UK Army

In the United Kingdom Armed Forces, physical fitness assessments are conducted through various tests. In the Navy, personnel undergo the Multistage Fitness Test or a 2,400-meter run test. The Army conducts 2,400-meter run, push-up, and sit-up tests. The Air Force administers the Multistage Fitness Test, push-up, and sit-up tests, while the Royal Air Force Regiment includes tests such as loaded marches, rapid walking, man dragging, and barrel carrying. Combat personnel are subjected to 800-meter runs, pull-ups, sit-ups, 5-kilometer fully loaded marches, swimming, and 2,400-meter run tests (30).

Austrian Army

In the Army, personnel undergo a 2,400-meter run and push-up test on an athletics track; for personnel over 35 years old, a modified pull-up test is administered. In the Special Forces, the tests include a 2,400-meter run, bicycle ergometer, inclined pull-ups, push-ups, and sit-ups (17).

Irish Army

Military personnel in the Irish Army are assessed for physical fitness through push-up, sit-up, and 2400-meter run tests (28).

Finnish Army

Military personnel assess their physical fitness through various tests, including a 12-minute run or ergometer test, sit-ups, push-ups, a 60-second squat test, grip strength test, body mass index (BMI), field test, shooting, and an annual choice among a 20 km walk, 25 km ski, or 80 km cycling test (31).

Latvian Army

In the Latvian army, physical fitness assessment includes push-ups, pull-ups, a 3,000-meter run, and an obstacle course test (42).

Turkish Armed Forces

Article 35 of Law No. 211 on the Internal Service of the Turkish Armed Forces states that "The duty of the Armed Forces is to defend the Turkish homeland against threats and dangers from abroad, to maintain and strengthen military power in a way that provides deterrence, to perform tasks assigned abroad by the decision of the Grand National Assembly of Turkey, and to assist in the maintenance of international peace" (52).

Article 86 of the Turkish Armed Forces Internal Service Regulation outlines the "Moral and spiritual qualities that every soldier must possess," and in subsection f of this article, it addresses the aspect of "Preparation for war" as follows:

"...to thoroughly learn how to use weapons and equipment in war, to have enough theoretical and practical knowledge and experience to make decisive and correct decisions and to act even during the difficult and stringent phases of war and even in the absence of commanders due to casualties, to condition the body to endure and withstand the inherent deprivations of war such as fatigue, sleeplessness, and, if necessary, hunger for long periods, to gain and continuously enhance the high capability that will ensure self-confidence in all these aspects, and to strive to increase these abilities at all times" (56).

In the Turkish Armed Forces, in accordance with existing legal regulations, physical fitness tests are conducted once a year. These tests consist of a 2-minute push-up test, a 2-minute sit-up test, and a 3,000-meter run (31).

Physical Fitness Research on Armies

A study conducted by Conway and Cronan (10) on 3,045 personnel in the United States Navy examined the effects of smoking and exercise on physical fitness. The results of the study revealed that smoking negatively impacts both muscular endurance and aerobic endurance in individuals who exercise and those who do not. However, smoking did not cause changes in muscle strength or body fat percentage.

In a study examining changes in physical fitness among doctors in the U.S. Army during their residency training, physical fitness tests were administered at the beginning of the residency and repeated three years later. The results of the study revealed a significant decrease in performance, with a significance level of $p<0.01$ (2).

An examination of the performance of personnel in the Swedish army from 1982 to 2005 revealed significant declines in performance due to an increasingly sedentary lifestyle. During this period, the distance covered in the Cooper test decreased by 4.1%, the time to climb a pole worsened by 19.8%, and the long jump distance decreased by 2.1% (66).

A study conducted on Canadian military personnel found a significant relationship between high body mass index (BMI) and waist circumference with performance in tasks such as evacuation, low and high crawling, sandbag carrying, VO2max, push-ups, and sit-ups ($p<0.05$) (22).

In a study conducted by Weiglein (64) involving military personnel from the Air Force, maxVO2 data obtained from a 1,600-meter walk, a 2,400-meter run, and treadmill tests were calculated and compared. The results indicated no significant differences between the tests; however, it was found that participants who performed at a lower level in terms of performance achieved better results in the 1,600-meter walk test.

Nindl (41) investigated the differences in performance of personnel under stress during military operations over a 72-hour period. As a result, he found a reduction of 7.3-15.0% in the overall work potential of the participants.

It was hypothesized that having strong respiratory muscles could enhance the endurance performance of German Special Forces personnel during intense physical activity. To test this hypothesis, a study conducted by Sperlich et al. (48) investigated the effects of increasing respiratory muscle strength using the "Ultrabreathe respiratory muscle trainer." The study found that enhancing respiratory muscle strength did not affect VO_2max development.

Similar to elite athletes, the physical fitness level required for U.S. Navy SEAL (Sea, Air, and Land Special Operations Force) personnel to successfully complete their missions is critical. Some of their tasks may involve extended submarine operations. In this context, the performance of SEAL personnel participating in a 33-day submarine mission was evaluated using the Cooper test. Upon return from the mission, a 7% decrease in distance covered and a 47% increase in recovery time were observed. Such a significant decline in fitness could negatively impact the personnel's combat readiness. Additionally, the limited movement space and insufficient sports facilities or equipment may adversely affect individuals' motivation to engage in regular physical activity (23).

A study conducted by Crawford et al. (12) demonstrated that U.S. Army personnel with lower body fat percentages exhibited higher aerobic and anaerobic performance compared to those with higher body fat percentages.

In a five-day study conducted by Knapik et al. (32), the effects of combat simulation on the performance of infantry soldiers were investigated. Military personnel were allowed four hours of sleep per day, with the remaining time dedicated to tasks simulating combat conditions. As a result, a decrease in performance compared to the initial level was observed. This reduction was notably evident in anaerobic capacity and upper body strength. However, no significant changes were found in other parameters.

The physical fitness levels of soldiers serving in the U.S. Air Force and the factors affecting these levels were examined. As a result, it was observed that women's physical fitness levels were negatively affected by obesity and insufficient aerobic exercise, while men's levels were adversely impacted by insufficient aerobic exercise, obesity, and tobacco use. As a result, it was determined that sedentary, smoking, and obese men had a 77% risk of having low physical fitness levels (45).

The studies mentioned above detail various factors affecting the physical fitness levels of soldiers and the impact of these factors on their performance in military operations.

DISCUSSION AND CONCLUSION

This study investigates the methods used to assess the physical fitness of military personnel serving in various countries' armed forces, establishing the physical fitness criteria necessary for maintaining soldiers' overall health and operational capabilities.

Within the scope of the research, physical fitness assessment criteria applied in the armed forces of 17 different countries were examined. These armies employ various tests to evaluate physical fitness. Through these tests, they aim to determine the endurance, muscle strength, and overall physical fitness of their soldiers. The physical fitness test criteria vary according to the operational requirements and needs of each army. However, it is observed that there is a common point in the physical fitness test criteria of all armies. This common point is to ensure that soldiers are psychologically and physically prepared for combat.

The Canadian and U.S. armies use comprehensive physical fitness test batteries. These tests evaluate endurance, strength, and aerobic capacity. On the other hand, Russia and China assess their military personnel in multiple aspects using detailed physical fitness test batteries, including swimming, pull-ups, running, and obstacle courses. Sweden, France, and Germany employ more specific test batteries to evaluate physical skills. The U.S. Army implements alternative tests for personnel who report health issues as an excuse, providing various options for maintaining physical fitness. The U.S. Marine Corps does not differentiate between genders in its physical fitness tests, ensuring that male and female personnel are evaluated based on the same criteria. The Australian Army, in addition to standard running tests, uses deep-water running and loaded march tests in their physical fitness assessments. Canada and the United Kingdom place great importance on maintaining the physical fitness levels necessary for operations. In this context, they implement tests appropriate to combat conditions to enhance the combat skills of their personnel. The Turkish Armed Forces

apply different test levels based on the age variable of the personnel, thereby supporting the maintenance of physical fitness in older personnel.

Physical fitness has been one of the most crucial factors in winning wars for armies. Additionally, it has maintained its importance without losing popularity over time. Continuous and regular physical activity among soldiers is critical for maintaining operational skills and combat readiness. In the current era, operational conditions are supported by technological advancements. However, despite this, the physical fitness level of personnel remains of great importance in the successful completion of missions.

In conclusion, it is recommended to use comprehensive and integrated test batteries (including strength, endurance, flexibility, and coordination) to thoroughly evaluate the physical fitness levels of military personnel. Additionally, implementing flexible and alternative test options for personnel who report health issues as an excuse, adapting physical fitness tests considering age and gender variables, and including continuous and regular training programs to maintain the physical fitness levels of personnel would be beneficial.

REFERENCES

1. Alpözgen AZ, Özdinçler AR. Fiziksel aktivite ve koruyucu etkileri: Derleme. Sağlık Bilimleri ve Meslekleri Dergisi. 2016;3(1):66-72.
2. Arora R. The Effects of Residency on Physical Fitness Among Military Physicians. Military Medicine. 2004;169(7):522-525.
3. Brown MJ. Fitness and Its Affects on the Military. US Army War College Strategy Research Project. Pennsylvania; 2005.
4. Bruce MJ. Physical activity, physical fitness and health: Leisure-time physical activity trends in Canada from 1981 to 1998 and the prospective prediction of health status from health-related physical fitness. National Library of Canada: Bibliothèque nationale du Canada, Ottawa; 2003.
5. Buckley JP. Exercise Physiology in Special Populations. Philadelphia: Elsevier; 2008.
6. Canadian Land Force Command. Army Fitness Manual (B- GL-382-001/PT-001). Ontario; 2005.
7. Chahal HPS. Army Physical Fitness Performance Standards Based on Body Composition, Muscular Strength and Endurance. Doctoral thesis. Alberta: University of Alberta; 1993.
8. Chen Z, Du J, Hu Y, et al. Weekly cumulative extracurricular core training time predicts cadet physical performance: A descriptive epidemiological study. Heliyon. 2023;9(4):e14756. doi:10.1016/j.heliyon.2023.e14756
9. Civil T. Sporun kavramsal temelleri-1. İstanbul: Efe Akademi; 2020.
10. Conway TL, Cronan TA. Smoking, Exercise, and Physical Fitness. Preventive Medicine. 1992;21(6):723-734.
11. Corroll VA. AAHPER Youth Fitness Test Items and Maximal Oxygen Intake. Doctoral thesis. Illinois: University of Illinois; 1967.
12. Crawford K, Fleishman K, Abt JP, et al. Less Body Fat Improves Physical and Physiological Performance in Army Soldiers. Military Medicine. 2011;176(1):35-43.
13. D'Eliscu F. A Manual In The Organization and Conduct of a Conditioning Program for Physical and Military Fitness and for Combat Training. Doctoral thesis. New York: New York University; 1944.
14. Department of the Air Force. Personnel Fitness Program (AFI 36-2905). United States Air Force Headquarters; 2010.
15. Department of the Navy. Physical Readiness Program (6110.1J). Office of the Chief of Naval Operations; 2011.
16. Eaton R. Prepare for Battle. The Army Doctrine and Training Bulletin. 1999;2(2):16-19.
17. Eisinger GC, Wittels P, Enne R, et al. Evidence-Based Job Analysis and Methodology to Determine Physical Requirements of Special Military Occupations. In: NATO. Optimizing Operational Physical Fitness (AC/323(HFM–080)TP/200). p. 6-1/6-64; 2009.
18. Ekelund U, Sjöström M, Yngve A, Nilsson A. Total daily energy expenditure and pattern of physical activity measured by minute-by-minute heart rate monitoring in 14–15 year old Swedish adolescents. European Journal of Clinical Nutrition. 2000;54(3):195-202.
19. Ergen E. Spor Hekimliği. Ankara: Milli Eğitim Basımevi; 1986.
20. Erikssen G. Physical fitness and changes in mortality: the survival of the fittest. Sports Medicine. 2001;31:571-576.
21. Fitness in the Military. Does the Joint Environment Dictate One DoD Test? http://www.scott.af.mil/news/story.asp?id=123112808; 2012.
22. Flanagan S. Fitness and Performance Classified According to Body Mass Index and Waist Circumference for Canadian Forces Personnel Aged 50–59 Years. Master's thesis. Ottawa: L'Université Canadienne; 2008.
23. Fothergill DM, Sims JR. Aerobic Performance of Special Operations Forces Personnel After a Prolonged Submarine Deployment. Ergonomics. 2000;43(10):1489-1500.
24. Headquarters Department of the US Army. Army Physical Readiness Training (TC 3-22.20). Washington; 2010.
25. Heper E, Sertkaya Ö, Koca C, Ertan H, Kale M, Terekli S. Spor bilimlerine giriş. Eşkişehir: Açık Öğretim Fakültesi Yayını; 2012.

26. Hertling MP. Physical Training for the Modern Battlefield: Are We Tough Enough? Capstone thesis. Kansas: U.S. Army Command and General Staff College; 1987.
27. Hoeger WW, Hoeger SA. Principles and Labs for Physical Fitness. 7th ed. Belmont: Wadsworth Cengage Learning; 2010.
28. Irish Defence Forces. Defence Forces Fitness Testing. https://www.military.ie/en/careers/faqs/defence-forces-fitness-testing/; 2024.
29. Isır T. Örgütlerde Personel Seçim Süreci: Bir Kamu Kuruluşundaki Yönetici Personelin Kişilik Özelliklerinin Tespit Edilerek Personel Seçim Sürecinin İyileştirilmesi Üzerine Bir Araştırma. Doctoral thesis. Adana: Çukurova University; 2006.
30. İngiliz Savunma Bakanlığı Web Sitesi. Fitness Training-A Sensible Guide to Preparing for Selection in the Gurkhas; 2012.
31. Kamuk YU. Türk Silahlı Kuvvetleri'nde fiziksel uygunluğun değerlendirilmesi. Doctoral thesis. Ankara: Gazi University; 2013.
32. Knapik J, Daniels W, Murphy M, et al. Physical Fitness and Infantry Operations. Massachusetts: U.S. Army Research Institute of Environmental Medicine; 1983.
33. Knapik JJ. The Validity of Self-Reported Physical Fitness Test Scores. Military Medicine. 2007;172(2):115-120.
34. Lison A, Pothoff T, Raida K, et al. Aussagekraft Sportmotorischer Testverfahren für die Streitkräfte. Wehrmedizinische Monatsschrift. 2011.
35. McLaughlin R, Wittert G. The Obesity Epidemic: Implications for Recruitment and Retention of Defence Force Personnel. Obesity Reviews. 2009;10:693-699.
36. Ministère de la Défense. Instruction Relative au Controle de la Condition Physique du Militaire (CCPM 126/DEF/EMA/EMP.3/NP). ÉTAT Major Des Armées, Paris; 2007.
37. Moore GC. An Analytical Study of Physical Fitness Test Variables. Doctoral thesis. Illinois: University of Illinois; 1955.
38. Moran DS. Gender Differences in Physical Fitness of Military Recruits During Army Basic Training. NATO AC/323(HFM-158/TP/237 Impacts of Gender Differences on Conducting Operational Activities RTO Meeting; 2008.
39. Naghii MR. The Importance of Body Weight and Weight Management for Military Personnel. Military Medicine. 2006;171:550-555.
40. Nande PJ, Vali SA. Fitness Evaluation Tests for Competitive Sports. Mumbai: Himalaya Publishing; 2010.
41. Nindl BC. Physical Performance Responses During 72 h of Military Operational Stress. Medicine & Science in Sports & Exercise. July 2002:1814-1822.
42. Plavina L. Characteristics of Physical Preparedness and Physical Fitness of the Military Officers and Soldiers. Papers on Anthropology. 2007;16:237-243.
43. Plavina L. Preparedness and Physical Fitness of Military Personnel. Papers on Anthropology. 2008;17:255-264.
44. Porter SC. The Soldier's Load. Infantry. May-June 1992:19-22.
45. Robbins AS, Chao SY, Fonseca VP, Snedecor MR, Knapik JJ. Predictors of Low Physical Fitness in a Cohort of Active-Duty U.S. Air Force Members. American Journal of Preventive Medicine. 2001;20(2):90-96.
46. Sackett PR, Mavor AS. Assessing Fitness for Military Enlistment: Physical Medical and Mental Health Standards. Washington: National Academies Press; 2006.
47. Sandıkçı MB. Sportif rekreasyonel faaliyetler ile sağlık açısından metaverse ve sanal gerçeklik teknolojisi. Beden Eğitimi Ve Spor Araştırmaları. 2022;65.
48. Sperlich B, Fricke H, Marees M, Linville JW, Mester J. Does Respiratory Muscle Training Increase Physical Performance? Military Medicine. 2009;174:977-982.
49. Stophel WC. The Marine Corps Physical Fitness Test: The Need to Replace It with a Combat Fitness Test. Virginia: United States Marine Corps Command and Staff College; 2008.
50. Strong GR. Descriptive Comparisons of United States Military Physical Fitness Programs. The Sport Journal. 1999;2(2).
51. Sturgeon J, Meer J. The First Fifty Years 1956–2006, The President's Council on Physical Fitness and Sports Revisits Its Roots and Charts Its Future. 2011.
52. T.C. Millî Savunma Bakanlığı Genelkurmay Başkanlığı. Görevi. https://www.tsk.tr/Sayfalar?viewName=Gorevi; 2024.
53. The Marine Corps Community Services. Introduction to the Corps Fitness Test; 2011.
54. The President's Council on Physical Fitness and Sports. PCPFS Research Digests. 2000.
55. The Russian System of Physical Training. https://www.dragondoor.com/articles/the-russian-system-of-physical-training/; 2007.
56. Türk Silahlı Kuvvetleri İç Hizmet Yönetmeliği. https://www.mevzuat.gov.tr/File/GeneratePdf?mevzuatNo=5905&mevzuatTur=KurumVeKurulusYonetmeligi&mevzuatTertip=5; 2024.
57. United States Army Headquarters. Physical Fitness Training FM 21–20. Washington; 1992.
58. US Department of Defense. DoD Physical Fitness and Body Fat Program Directive. Number 1308.1; 2004.
59. US Department of Health and Human Services. Physical Activity and Health: A Report of the Surgeon General. Atlanta: Department of Health and Human Services; 1996.

60. US Department of the Navy. Marine Corps Physical Fitness Test and Body Composition Program Manual (MCO P6100.12). Washington; 2002.
61. US Department of the Navy. Marine Corps Physical Fitness Program (MCO P6100.13). Washington; 2008.
62. US Marine Corps. Marine Physical Readiness Training for Combat, MCRP 3-02A. Virginia; 1988.
63. Wayne LS. Task Related Aerobic and Anaerobic Physical Fitness Standards for the Canadian Army. Doctoral thesis. Alberta: University of Alberta; 1992.
64. Weiglein LH. The Validity of the One-Mile Walk Test as a Predictor of Aerobic Capacity in Air Force Males. Master's thesis. Illinois: Southern Illinois University; 2010.
65. Worden TE. A Comparison of the US Air Force Fitness Test and Sister Services' Combat-Oriented Fitness Tests. Master's thesis. Ohio: The Air Force Institute of Technology Air University; 2009.
66. Wyss T, Beuchat C, Zehr S, Mader U. Physical Performance in Young Men at Swiss Army Recruitment 1982 to 2005. 2011.
67. Wyss T, Marti B, Rossi S, Kohler U, Mader U. Assembling and Verification of a Fitness Test Battery for the Recruitment of the Swiss Army and Nation-wide Use. Schweizerische Gesellschaft für Sportmedizin. 2007;55(4):126-131.

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Examination of metaverse awareness levels of university students who have sports education

Kerim Ali AKGÜL [1A], Ali ERDOĞAN [2B], Erkan Faruk ŞİRİN [3C]

[1] *Sivas Cumhuriyet University, Faculty of Sport Sciences, Sivas, TÜRKİYE*
[2] *Karamanoğlu Mehmet Bey University, Faculty of Sport Sciences, Karaman, TÜRKİYE*
[3] *Selcuk University, Faculty of Sport Sciences, Konya, TÜRKİYE*

Address Correspondence to Ali ERDOGAN: e-mail: aerdogan@kmu.edu.tr

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A: Orcid ID: 0000-0002-4482-0591 B: Orcid ID: 0000-0001-8306-5683 C: Orcid ID: 0000-0002-6837-7758

Abstract

Being a thinking creature, human has made progress in almost every subject that his mind has reached. The word technology has also emerged as a result of this development. With the advancement of technology in today's digital age, systems that transmit human behaviors to the digital world have also developed rapidly. Metaverse is a good example that can be given to these systems and concepts lately. This technology, in which human movements are at the center, provides benefits in many different fields such as medicine, games, sports and art. In this context, it is important to include the Metaverse, a new technological phenomenon that will contribute to the development and technological progress of sports, in the field of sports, and to introduce and train all individuals in the sports community to the Metaverse. In this study, it was conducted to investigate the Metaverse knowledge, attitude and awareness level of the students studying at the Faculty of Sports Sciences in order to reveal the state of Metaverse knowledge and awareness of the students studying at the Faculty of Sports Sciences, which provides human resources to the field of sports, and to draw attention to the awareness of Metaverse technology. The sample of the study consists of 238 students studying at Sivas Cumhuriyet University, Faculty of Sport Sciences. As a result of our study, while a significant difference was found in various sub-dimensions according to the gender, income level and possession of crypto money, no significant difference was found according to the departments of the students. Conferences can be organised for students to have more information about the metaverse and to raise their awareness.

Keywords: Sports, technology, sports technology, metaverse.

Spor Eğitimi Alan Üniversite Öğrencilerinin Metaverse Farkindalik Düzeylerinin İncelenmesi

Özet

Düşünebilen bir canlı olan insan, aklının eriştiği hemen her konuda gelişme gerçekleştirmiştir. Teknoloji sözcüğüde da bu gelişmenin bir neticesi olarak ortaya çıkmıştır. Günümüz dijital çağımızda teknolojinin ilerlemesiyle birlikte insan davranışlarını dijital dünyaya ileten sistemler de hızla gelişim göstermiştir. Metaverse de son zamanlarda bu sistemlere ve kavramlara verilebilecek güzel bir örneği teşkil etmektedir. İnsan hareketlerin merkezde olduğu bu teknolojiden tıp, oyun, spor, sanat gibi birçok farklı alanda yarar sağlanılmaktadır. Bu bağlamda sporun geliştirilmesi ve teknolojik olarak ilerlemesine bir katkı sunacak yeni teknolojik olgu olan Metaverse spor alanına katmak ve spor camiası içindeki tüm bireylere Metaverse tanıtmak ve eğitim vermek önem arz etmektedir. Bu çalışmada spor alanına insan kaynağı sağlayan Spor Bilimleri Fakültesinde okuyan öğrencilerin Metaverse bilgisi ve farkındalığının ne durumda olduğunu ortaya koymak ve Metaverse teknolojisinin farkındalığına dikkat çekmek için spor bilimleri Fakültesi'nde öğrenim gören öğrencilerin Metaverse bilgi, tutum ve farkındalık düzeyini araştırmak amacıyla yapılmıştır. Çalışmanın örneklemini Sivas Cumhuriyet Üniversitesi Spor Bilimleri Fakültesi'nde öğrenim gören toplam 238 öğrenci oluşturmaktadır. Çalışmamızın sonucunda öğrencilerin cinsiyet, gelir düzeyleri ve kripto para sahip olma durumuna göre çeşitli alt boyutlarda anlamlı farklılık tespit edilirken, öğrencilerin bölümlerine göre herhangi bir anlamlı farklılık bulunamamıştır. Öğrencilerin metaverse hakkında daha fazla bilgi sahibi olmaları ve farkındalıklarının artırılması için konferanslar düzenlenebilir.

Anahtar Kelimeler: Spor, teknoloji, spor teknoloji, metaverse.

INTRODUCTION

Being a thinking creature, man has made progress in almost every subject his mind can reach. The word technology also emerged as a result of this development. Over time, the rapid spread of technologies in daily life has enabled many new concepts to be included in our lives (9). In today's digital age, with the advancement of technology, systems that transmit human behavior to the digital world have also developed rapidly. Metaverse has recently been a good example of these systems and concepts. This technology, which focuses on human behavior, provides benefits in many different fields such as games, medicine, sports and arts (18). The Metaverse, first described in author Neal Stephenson's 1992 novel "Snow Crash", has become a concept used to describe 3D (three-dimensional) VWs (virtual worlds) in which people interact with each other and their environment without being physically together (4). It is also defined as a world where economic, social and cultural activities that create value in the developing world take place (27). This concept, which provides realistic and precise images through the expansion of smartphones and internet networks and allows the real world to be moved to the virtual world by recreating the feeling of the real world (21), points to a world where the physical world and the digital world come together and also regardless of physical location, through their digital symbol avatars, people can gather in an environment and play games, socialize, work, watch sports events, shop and try on clothes, do sports, go to concerts, in short, continue their daily lives and spend their free time (33). In the Metaverse world, people can socialize, buy real estate, travel, do sports, design, and even realize all kinds of fiction, including university education (24).

Mark Zuckerberg, the founder of Facebook, stated that Facebook's vision will revolve around the project of building an extremely ambitious "Metaverse" and that its icons will turn into infinity signs, shifting everyone's attention to the Metaverse. As the concept of Metaverse partially takes place in our daily lives, it has become a subject that is discussed and studied, and this concept has become more interested and also questioned (10). Additionally, Mark Zuckerberg commented, "Our hope is that within the next decade, the Metaverse will reach billions of people, host hundreds of billions of dollars of digital commerce, and support the work of millions of creators and developers" (14). After Facebook, the concept of Metaverse began to take a strong, if not intense, place in many areas of our lives, from education to commerce, from sports to art, and continues to expand its area of influence every day (19). Recently, with the development of smartphones and VR devices, interaction between many different real and virtual objects has become possible and a new Metaverse world has begun to spread rapidly (21). The timeline of Metaverse development, which includes many key events from the emergence of the Internet and its first mention in the literature, to the first virtual world project with Second Life and the latest Metaverse projects of large technology companies such as Facebook and Microsoft, is given below.

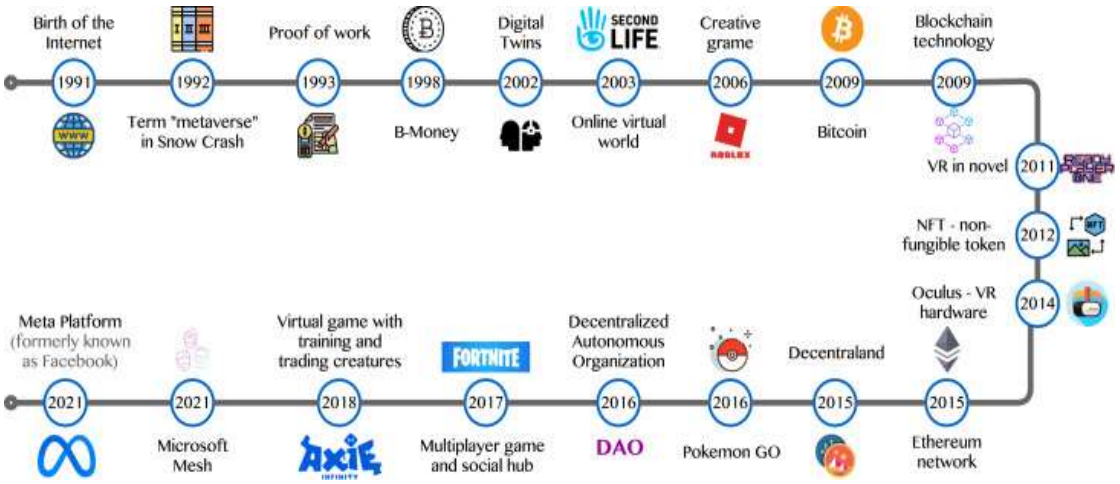

Figure 1: Metaverse progression timeline including key events from 1991 to 2021 (17).

Developments in the technological field show a strong interaction with sports as well as with every other field. While sports inspires many technological developments, it also benefits from developed technologies in many cases (33). In our daily lives, the reflections of technology attract attention at almost every point, from media equipment that provides access to sports to active and passive practitioners and audiences, statistics, analysis and artificial intelligence applications, training techniques and sports equipment (1). The concept of Metaverse, which emerged as a new technological development, has also been integrated into sports and has begun to take its place in sports fields. Metaverse has introduced many concepts within the sports phenomenon to the literature with the technological innovations it has brought. One of these is defined by Süleymanoğulları et al. (29) as "MetaSport" as a virtual universe in which the Metaverse infrastructure is created with the effect of technology and digitalization in order to achieve competitive competition, superiority, entertainment or perfection within the framework of certain rules in the field of sports.

From another perspective, it would not be wrong to use the concept of 'Metaversport' as the transfer of all kinds of physical conditions (Training, Sports management, sports organizations, competitions, etc.) within the phenomenon of sports to the virtual environment of the Metaverse created by technological developments.

Today, with digitalization gaining momentum, augmented reality training, which has been used by major sports clubs for a long time, has begun to become widespread around the world. After observing the benefits of these trainings, even clubs competing in national leagues have started to make their investments in this direction. These clubs also use technological equipment such as wearable technologies and simulations in their training. According to studies, fully immersive virtual reality training positively affects the motor performance and skill development of athletes. Even though sports clubs exist in different places and times offered by the Metaverse world, they have the opportunity to interact in the same virtual environment and evaluate technical and tactical training thanks to avatars. Providing young athletes with the opportunity in the Metaverse world to try movements, which need to be tried a lot and involve risks that may affect their development, thousands of times without any physical harm, creates a great opportunity for athletes (35).

Additionally, it may be possible to solve the difficult problems posed by online learning in sports science faculties by incorporating the Metaverse into physical education subjects. Virtual reality technology is a virtual reality system that allows sports activities, such as playing screen golf in the classroom, to be performed while watching a screen. In a situation where sports activities cannot be performed due to restrictions on outdoor activities, most students can enjoy sports activities in virtual reality as if they were playing football or baseball, and also allow users to experience the effects of real exercise in an augmented reality system in a virtual universe. As explained above, sports such as on-screen golf, baseball, tennis, badminton, table tennis, horseback riding and yoga etc. can be taught just like in the real physical education practice, thanks to Metaverse (34)

The most important feature of sports is that it is an area where "cultural dissemination" is the fastest and most effective (6). In this context, these opportunities are great chances not only for athletes and students, but also for sports spectators. With Metaverse, sports fans have the opportunity to go to Premier League matches without any hassle, for example, from their home or workplace in Turkey, and to watch any match from any angle they want with their friends living in another country. With the socialization effect of sports, people in the metasports world interact with international people and even offer the opportunity to make new friends from other countries. For example, the Milan-Fiorentina match in Serie A, one of Europe's important and major leagues, was broadcast live on the Metaverse within the Nemesis business. This excitement was experienced for the first time by users connecting from Southeast Asia and North Africa (31). In another example of the Metaverse in action for those who also want to practice the sport rather than watch it, a National Geographic VR subscription allows individuals to virtually ski among icebergs using Oculus VR hardware (15).

Governments must catch up with the rapid development of new technologies (30). We can say that these technological developments should then be included in areas such as education, training, health, economy, trism, and sports, etc., and thus support progress in these areas. Technological developments significantly increase their impact in sports fields as well as in different fields. As progress is made in Metaverse technology, the sports ecosystem will also reap the benefits. In addition, it is thought that with Metaverse, there will be a transformation in almost every field and 'value' functions of companies in the future, from entertainment services to sports services, from healthcare services to consumer products and even payments. In addition, new markets, resources and industries, as well as new types of skills, certifications and professions, will emerge in the future (16,13). In this context, it is important to add Metaverse, a new technological phenomenon that will contribute to the development and technological progress of sports, to the sports field and to introduce it to all individuals within the sports community and provide them with training. When the literature is examined, it is seen that most of the studies on Metaverse are compilation studies. It is thought that quantitative studies should be carried out and this deficiency should be eliminated. This study was conducted to reveal the level of Metaverse knowledge and awareness of students studying at the Faculty of Sports Sciences, which provides human resources to the field of sports, and to investigate the level of Metaverse knowledge, attitude and awareness of students studying at the Faculty of Sports Sciences in order to draw attention to the awareness of Metaverse technology.

METHOD

Research model

This study is descriptive in nature, one of the quantitative research approaches. Descriptive research is conducted to describe the current situation without making any intervention (12). In this study, which was carried out to determine the Metaverse knowledge, attitude and awareness level of students studying at the Faculty of Sports Sciences, the relational screening model, one of the research methods, was used. The relational screening model is a research method that provides the opportunity to see the existence and degree of change between two or more variables (20). With this model, while researching the current situations, the things and events that are the subject of the research are examined and defined under certain conditions (7,20).

Research group

The sample of the study consists of 126 (52.9%) female students and 112 (47.1%) male students studying at Sivas Cumhuriyet University Faculty of Sports Sciences in the academic year 2022-23. The distribution of participants according to departments consists of Physical Education Teaching 65 (27.3%), Coaching Education 61 (25.6%), and Sports Management department 112 (47.1%). According to the grade variable, the distribution is as follows: 1st Grade 44 (18.5%), 2nd Grade 55 (23.1%), 3rd Grade 59 (24.8%) and 4th Grade 80 (33.6%). See Table 1. Convenient sampling method was used to form the sample group and the data was obtained using the online survey form. Convenience sampling method means collecting data by easily reaching people in the study group of the research (7).

Table 1. Distribution of research participants according to their demographic characteristics

Characteristics	Variables	n	%
Gender	Male	112	47.1
	Female	126	52.9
Department	Physical education teacher	65	27.3
	Coach Education	61	25.6
	Sports Management	112	47.1
Grade	1st Grade	44	18.5
	2nd Grade	55	23.1
	3rd Grade	59	24.8
	4th Grade	80	33.6
Total		238	100.0

Data collection tools

Personal Information Form: This form, which was prepared to be compatible with the sub-objectives of the research, is a self-information form designed to determine the demographic information of the participants, including the variables "Grade", "Department", "Gender", "Income status".

Metaverse Scale: In this study, the "Metaverse Scale" developed by Süleymanoğulları et al., (29) was used. Metaverse Scale is a 5-point Likert type scale. The responses are scored as 1 = Strongly Disagree and 5 = Strongly Agree. There are no reverse coded items in the scale. As the scores on the scale increase, the participants' attitudes, knowledge and awareness levels regarding the word Metaverse also increase. As a result of the analyses carried out by the researchers, Cronbach's Alpha values for the scale and its sub-dimensions were found to be .813 for the total scale, .805 for the technology factor, .732 for the digitalization factor, .705 for the social factor and .713 for the lifestyle factor. The Cronbach Alpha value obtained for this study was found to be .91 for the total scale, .90 for the technology factor, .73 for the digitalization factor, .85 for the social factor and .69 for the lifestyle factor. According to Alpar (37), it can be stated that scale reliability is ensured.

Data analysis

SPSS 22 program was used to analyze the data obtained. After the data was transferred to the internet, missing data analysis, which is perceived as a general problem for research in social sciences, was first applied. It is because the modern and classical statistical methods used were developed with the assumption that the data set is not incomplete (3,25,28). No missing data was found in the missing data control carried out in this direction. Then, the normality and linearity assumptions of the resulting data set were evaluated. It was observed that there was a linear relationship in the resulting scatter diagram. Additionally, Skewness and Kurtosis values were observed by observing the significance result of the Shapiro-Wilk test to determine whether the distribution was normal or non-normal. The fact that these values for the measurement tools used in the research are between -1.5 and +1.5 indicates that the data has a normal distribution (38). Then, independent groups t-test was used to compare the Metaverse awareness of the research group according to gender, and one-way analysis of variance ANAVO was used to compare according to income levels, department and grade variables. The significance level was taken as $p<0.05$.

Ethical approval and institutional permission

For this research, it was decided that it was ethically appropriate in the decision numbered E-60263016-050.06.04-245459 and number 16 taken by Sivas Cumhuriyet University Scientific Research and Publication Ethics Board at its meeting dated 26.12.2022.

FINDINGS

Table 2. Descriptive statistics of participants' metaverse scale scores

Scale/Sub-Dimensions	n	Min	Max	Mean $\bar{X}$	Standard deviation (Sd)
Technology	238	1.00	5.00	3.45	0.046
Digitalization	238	1.00	5.00	3.48	0.046
Socialization	238	1.00	5.00	3.28	0.059
Lifestyle	238	1.00	5.00	3.45	0.048
Total	238	1.00	5.00	3.44	0.040

When Table 2 is examined, the mean score of the participants was determined as $\bar{X}$:3.44 for the total scale, $\bar{X}$:3.45 for the Technology sub-dimension, $\bar{X}$ 3.48 for the Digitalization sub-dimension, $\bar{X}$:3.28 for the socialization sub-dimension and $\bar{X}$:3.45 for the lifestyle sub-dimension.

Table 3. Comparison of METAVERSE scale and sub-dimension scores of participants according to gender

Scale	Gender	n	$\bar{X}$	Sd	t	P
Technology	Male	112	3.37	0.57	-1.423	0.09*
	Female	126	3.53	0.65		
Digitalization	Male	112	3.40	0.63	-1.680	0.12
	Female	126	3.55	0.76		
Socialization	Male	112	3.28	0.65	-1.540	0.97
	Female	126	3.28	0.80		
Lifestyle	Male	112	3.42	0.85	-0.037	0.50
	Female	126	3.48	0.98		
Total	Male	238	3.38	0.73	-0.663	0.15
	Female		3.49	0.74		

When Table 3 was examined, a significant difference was detected between the Metaverse scale and its sub-dimensions in the Technology sub-dimension according to the gender variable (t=-1.423; p<0.05). No significant difference was detected in the scale total score and socialization, digitalization and lifestyle sub-dimensions.

Table 4. Comparison of metaverse scale scores of participants according to their departments

		n	$\bar{X}$	Sd	F	p	Bonferroni
Scale Total	PET (a)	65	3.39	0.61	0.575	0.63	-
	COA(b)	61	3.51	0.75			
	SMD(c)	112	3.42	0.53			
Technology	PET (a)	65	3.45	0.67	0.721	0.48	-
	COA(b)	61	3.54	0.88			
	SMD(c)	112	3.41	0.62			
Digitalization	PET (a)	65	3.36	0.72	1.413	0.24	-
	COA(b)	61	3.57	0.82			
	SMD(c)	112	3.50	0.68			
Socialization	PET (a)	65	3.19	0.80	1.089	0.33	-
	COA(b)	61	3.42	1.04			
	SMD(c)	112	3.25	0.91			
Lifestyle	PET(a)	65	3.30	0.84	0.251	0.77	-
	COA(b)	61	3.43	0.67			
	SMD(c)	112	3.62	0.74			

PET= Physical Education Teaching; COA= Coaching; SMD= Sports Management

The scores of the students included in the research from the Metaverse scale were compared with the department variable in which they studied. It can be stated that the difference between the scores of the students who participated in the research in Table 5 and the Metaverse scale and its sub-dimensions according to the department they are studying in is not statistically significant.

Table 5. Comparison of participants according to their cryptocurrency usage situation with the metaverse scale

Scale/Sub-dimension	Cryptocurrency Usage Situation	$\bar{X}$	Sd	t	p
Metaverse Scale	Yes	3.91	0.54	6.99	0.00*
	No	3.31	0.57		
Technology	Yes	4.05	0.73	6.71	0.00*
	No	3.29	0.61		
Digitalization	Yes	4.00	0.73	7.01	0.00*
	No	3.34	0.61		
Socialization	Yes	3.81	0.88	4.83	0.00*
	No	3.13	0.88		
Lifestyle	Yes	3.57	0.70	1.30	0.19
	No	3.42	0.74		

* $p<0.05$

An independent t test was applied to compare the scores of the participants in the study on the Metaverse scale and Cryptocurrency usage. As a result of the test, it is seen that there is a significant difference in the participants' Metaverse scale total score and technology, digitalization and socialization sub-dimensions ($p <0.05$). It is seen that the averages of those who own crypto money are higher than those who do not own crypto money.

DISCUSSION AND CONCLUSION

When the international and national literature of the Metaverse concept is examined, it can be stated that its influence is undeniable today. It can be said that in the national literature, studies on Metaverse have been examined in many different fields, but Metaverse studies in the field of sports are generally few. For this reason, the study aimed to determine the attitude, awareness and knowledge levels of university students studying sports towards the concept of metaverse. In this regard, the information obtained by comparing the data obtained using the metaverse scale with the demographic characteristics of the participants will be evaluated in line with the literature below.

When the findings obtained as a result of the research are evaluated, it can be stated that the metaverse awareness of university students studying sports is high, according to the average score obtained from the metaverse scale and its sub-dimensions. In today's world, there is a technological transformation in communication and information technologies every ten years; It is mentioned that communication with computers in the 1990s, web in the 2000s, and mobile in the 2010s changed and that the main word of the paradigm of the 2020s is Metaverse (22). This result obtained is the age of information and technology, so people can access information in a short time. The fact that the concept of metaverse and metaverse is a concept that has come to the fore in the field of technology recently will explain the high metaverse awareness of university students. In addition, with the Covid-19 epidemic that has recently affected the whole world, the decision taken by the governments and the quarantine process of people have brought individuality to the fore, and as a result, people have turned to the internet environment to socialize. It can be stated that the individual who starts to spend more time than usual on the internet has an increased chance of encountering the word metaverse, which is one of the popular concepts of recent times, and as a result, metaverse knowledge and awareness has increased.

Lee (22) mentions that there is a technological transformation in communication and information technologies every decade in today's world such as communication with computers in the 1990s, the web in the 2000s, mobile in the 2010s, and that the main word of the paradigm of the 2020s is Metaverse. In this context, it is important to determine how aware the students of the faculty of sports sciences are about Metaverse technology in our study. Our study was carried out in line with this importance and the results obtained are as follows. In this study, where the Metaverse awareness of sports sciences faculty students was examined, a significant difference was detected between the Metaverse scale and its sub-dimensions in the Technology sub-dimension according to the gender variable ($t=-1.423$; $p<0.05$). Female students' technology

awareness was found to be higher than male students. No significant difference was detected in the scale's total score and socialization, digitalization and lifestyle sub-dimensions. Aslan and Görgen (5) concluded in their study titled "Teachers' awareness levels of teaching technologies and materials" that the awareness of female teachers is higher in percentage. In another study, Çakır and Ark (8) conducted a study titled "Examination of Metaverse Awareness of Faculty of Sports Sciences Students" and determined that there was a significant difference in favor of female students in the scale mean scores of the research group according to the gender variable. In general, we can say that the results of our study are parallel to the results of other studies.

When the Metaverse scale total score and sub-dimension scores of the participants were examined according to the income variable, a significant difference was detected between the total score, digitalization and technology sub-dimensions. As a result of the Benforonin test performed to determine the source of the difference, a significant difference was detected between the income level (10001 and above -5001 and 10000) and (5001 and 10000 -0-5000) and between the Technology sub-dimension and the Digitalization sub-dimension (10001 and above -5001 and 10000) and (5001 and 10000 -0-5000) according to the total score of the scale. It was determined that as the income level of the participating students increased, their Metaverse awareness also increased. In the study by Aksoy (2), it was found that, as a result of the analysis made according to the income variable, those with higher incomes had higher technology usage levels. Metaverse, which is a product of internet technology, requires certain technological hardware and products. Accessing this product and equipment requires a certain cost. Therefore, we can say that those with high income levels have a high level of awareness of technological products such as Metaverse.

According to the analysis results, where the Metaverse scale total score and sub-dimension scores of the participants were examined according to the department variable, no significant difference was found. Çakır et al. (8) could not find a significant difference in the mean scores of the students in their research group from the Metaverse awareness scale in terms of the department variable. We can say that there is no significant difference since there are no Metaverse-related courses in the course content of the students of the faculty of sports sciences and there are generally courses on the basic subjects of sports, and there is no situation that will affect the Metaverse awareness of the students according to their departments.

An independent t test was conducted to compare the scores of the participants on the Metaverse scale and their cryptocurrency usage. As a result of the test, it was determined that there was a significant difference in the participants' scores in the Metaverse scale total score and technology, digitalization and socialization sub-dimensions ($p<0.05$). It is seen that those who own crypto money have higher Metaverse awareness levels than those who do not own crypto money. In their study, Yurtsızoğlu and Akgül (36) found that there is a statistically significant difference in cryptocurrency perception and awareness level depending on the possession status. They concluded that those who own crypto money have a higher level of perception and awareness of crypto money. Today, there are 9351 cryptocurrencies, and 255 of these cryptocurrencies are associated with Metaverse (11). We can say that students investing in cryptocurrencies have a higher awareness of Metaverse as they are more likely to encounter cryptocurrencies related to Metaverse.

Nowadays, technologies such as Metaverse seem to be more prevalent in the field of sports. We encounter examples where Metaverse technology is used in training in many sports branches. This may make Metaverse technology important for the sports field. In this context, it is necessary to teach technologies such as Metaverse, which brings a different perspective to sports and contributes to sports, to the students of the faculty of sports sciences, which provides human resources in the field of sports, and to ensure that they are aware of technological innovations. Therefore, as a recommendation of our study, we can say that courses that introduce future technologies and make them aware of them should be included in the course contents of the Faculty of Sports Sciences. In addition, by informing the lecturers about the metaverse, using technologies such as metaverse technology in the course can increase the interest and awareness of the students.

REFERENCES

1. Ak MO. Spor yönetimi açisindan teknolojinin spora entegresi cybathlon örneği. Pearson journal, 2021; 6(16), 413-427.
2. Aksoy C. Teknoloji kullanım ölçeğinin geçerlilik ve güvenilirliğinin ölçülmesi: üniversite öğrencilerine yönelik bir araştırma. OPUS International Journal of Society Researches, 2018; 8(15), 1111-1131.
3. Allison PD. Missing data techniques for structural equation modeling. Journal of Abnormal Psychology, 2003; 4(1), 545-557.
4. Anderson J, Rainie L. The Metaverse in 2040. Pew Research Centre. 2022;
5. Aslan B, Görgen İ. Ortaokul Ve Lise Branş Öğretmenlerinin Öğretim Teknoloji Ve Materyallerine Farkındalık Düzeyleri. Turkish Studies (Elektronik), 2015; 10(11), 173-186.
6. Atasoy B, Kuter FÖ. Küreselleşme ve spor. Uludağ Üniversitesi Eğitim Fakültesi Dergisi, 2005; 18(1), 11-22.
7. Büyüköztürk Ş, Kılıç-Çakmak E, Akgün ÖE, Karadeniz Ş, Demirel F. Bilimsel araştırma yöntemleri (20. Baskı), Pegem Akademi, 2016; Ankara.
8. Çakır Z, Gönen M, Ceyhan MA. Spor Bilimleri Fakültesi Öğrencilerinin Metaverse Farkındalıklarının İncelenmesi. CBÜ Beden Eğitimi ve Spor Bilimleri Dergisi, 2022; 17(2), 406-418.
9. Çelik R. Metaverse Nedir? Kavramsal Değerlendirme ve Genel Bakış. Balkan ve Yakın Doğu Sosyal Bilimler Dergisi, 2022; 8(1), 67-74.
10. Çelikkol, Ş. (2022). Metaverse Dünyası'nın, Tüketici Satın Alma Davranışları Açısından Değerlendirilmesi. İstanbul Kent Üniversitesi İnsan ve Toplum Bilimleri Dergisi, 3(1), 64-75.
11. Coinmarketcap. Toplam kripto para sayısı. 29.08.2023 tarihinde https://coinmarketcap.com/tr/ adresinden alınmıştır.
12. Creswell JW. Educational research: planning, conducting, evaluating, quantitative and qualitative research (Fourth Edition). United State of America: Pearson Education Inc. 2012:
13. Erdoğan A, Yıldırım B. Covid 19 Sonrası Spor Bilimleri Fakültesi Öğrencilerinin Dijital Oyun Oynama Tutumlarının Belirlenmesi. Sportive, 2023; 6(2), 153-164. https://doi.org/10.53025/sportive.1248948
14. Euronews. Metaverse'ü tanıtan Facebook isim değişikliği yaptı, 'Meta' oldu. 15.05.2023 tarihinde https://tr.euronews.com/2021/10/28/Metaverse-u-tan-tan-facebook-isim-degisikligi-yapt-meta-oldu adresinden alındı.
15. Gursoy D, Malodia S, Dhir A. The Metaverse in the hospitality and tourism industry: An overview of current trends and future research directions. Journal of Hospitality Marketing & Management, 2022; 1-8.
16. Hollensen S, Kotler P, Opresnik MO. Metaverse – The New Marketing Universe. Journal of Business Strategy. 2022; 1-7.
17. Huynh-The T, Pham QV, Pham XQ, Nguyen TT, Han Z, Kim DS. Artificial intelligence for the Metaverse: A survey. Engineering Applications of Artificial Intelligence, 2023; 117, 105581.
18. Johnson L, Smith R, Willis H, Levine A, Haywood K. The 2011 Horizon Report, Texas: The New Media Consortium, 2011; Austin.
19. Kalkan N. Metaverse Evreninde Sporun Bugünü ve Geleceğine Yönelik Bir Derleme . Ulusal Spor Bilimleri Dergisi , 2021; 5 (2) , 163-174 . DOI: 10.30769/usbd.1027728
20. Karasar N. Bilimsel araştırma yöntemleri. Nobel Yayınları, Ankara, 2009:
21. Lee J. A study on the intention and experience of using the Metaverse. Jahr: Europski časopis za bioetiku, 2022; 13(1), 177-192.
22. Lee JY. A Study on Metaverse Hype for Sustainable Growth. International journal of advanced smart convergence, 2021; 10(3), 72-80
23. Lee JY. A study on Metaverse hype for sustainable growth. International journal of advanced smart convergence, 2021; 10(3), 72-80.
24. Narin NG. A content analysis of the Metaverse articles. Journal of Metaverse, 2021; 1(1), 17-24.
25. Osborne JW. Best practices in data cleaning. California: Sage Publication, Inc, 2013:
26. Park S, Kang YJ. A Study on the intentions of early users of Metaverse platforms using the Technology Acceptance Model. Journal of Digital Convergence, 2021; 19(10), 275-285.
27. Petrakou, A. Interacting through avatars: Virtual worlds as a context for online education. Comput. Educ. 2010; 54, 1020–1027. [Google Scholar] [CrossRef]
28. Pigott TD. A review of methods for missing data. Educational Resarch and Evaluation, 2001;7(1), 353-383.
29. Süleymanoğulları M Özdemir A, Bayraktar G, Vural M. Metaverse Ölçeği: Geçerlilik Ve Güvenilirlik Çalışması. Anatolia Sport Research, 2022; 3(1), 47-58.
30. Thomason, J. (2022). Metaverse, token economies, and non-communicable diseases. Global Health Journal.
31. Trt Haber. Metaverse'te ilk kez futbol maçı yayınlandı. 16.05.2023 tarihinde https://www.trthaber.com/haber/bilim-teknoloji/Metaversete-ilk-kez-futbol-maci-yayinlandi-677528.html adresinden alındı.
32. Türk GD, Bayrakcı S, Akçay E. Metaverse ve benlik sunumu . Turkish Online Journal of Design Art and Communication , 2022; 12 (2) , 316-333.

33. Yıldız AB, Doğu GA. Sporda Teknoloji Kullanımı: Bir Metafor Çalışması. Ahi Evran Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 2022; 8(1), 67-80.
34. Yu, J.E. (2022). Exploration of Educational Possibilities by Four Metaverse Types in Physical Education. Technologies, 10(5), 104.
35. Yücel İ. Tespitoloji. "Metalaşan Spor – Metaverse" 05. 09. 2022 tarihinde https://tespitoloji.com/teknoloji%CC%87/metala%C5%9Fam-spor-Metaverse/ adresinden alındı.
36. Yurtsızoğlu Z, Akgül KA. Spor Bilimleri Fakültesi Öğrencilerinin Kripto Para Algısı ve Farkındalık Düzeyi. Akdeniz Spor Bilimleri Dergisi, 2022; 5(3), 383-397.
37. Alpar, R. (2006). Spor bilimlerinde uygulamalı istatistik. Nobel yayınları.
38. Tabachnick, B.G., Fidell, L.S. (2013). Using multivariate statistics (6th ed.). Boston: Pearson.

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Sport and art

Elif Arzen DEMİREL İNAL [1A], Ramazan İNAL [2B]

[1] *Bitlis Eren University, Faculty of Fine Arts, Department of Graphic Arts, Bitlis, TÜRKİYE*
[2] *Bandırma Onyedı Eylül Universty, Faculty of Art, Design And Architecture, Graphic Desing Department, Bandırma, TÜRKİYE*

Address Correspondence to Elif Arzen DEMİREL İNAL e-mail: eademirel@beu.edu.tr

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A: Orcid ID: 0000-0001-8110-2938 B: Orcid ID: 0000-0003-3094-7847

Abstract

The purpose of this paper is to thoroughly examine the interactions between sports and the arts, highlighting how each domain influences and enriches the other. The need for a comprehensive review of the intersection between sports and the arts is increasing in the literature, as the synergy between these two fields can contribute to a better understanding of cultural and social dynamics. Such an examination provides innovative perspectives for professionals in both sports and the arts while also contributing to academic and cultural discourse. Sports and the arts are two interconnected phenomena that are performance-based, serve societal culture and humanity, and have seen increasing popularity and high engagement rates throughout history. The pursuit of excellence in both fields is represented through various forms and concepts such as movement, harmony, aesthetics, and synchronization, particularly by professionals. The strong relationship between sports and the arts is further highlighted in applications such as posters, sculptures, designs, paintings, and media, as well as in competitions and events. While sports and the arts have always complemented each other, their relationship remains a continually relevant topic of debate. Some argue that sports is fundamentally an art form, while others contend that they are distinct and independent concepts. Our primary focus is not on whether art is a sport or sport is an art, but rather on the relationship where sports and the arts intersect. This paper addresses the harmony, interaction, and contributions of sports and the arts to humanity as a review study. A thorough literature review was conducted, and findings were discussed in relation to similar publications and research. The results indicate that performing in both sports and the arts contributes to human development in physiological, psycho-social, and physical contexts, demonstrating a coherent and integrated relationship.

Keywords: Sport, art, graphic design, recreation.

Spor ve Sanat

Özet

Bu makalenin amacı, spor ve sanat arasındaki etkileşimleri derinlemesine inceleyerek her iki alanın birbirini nasıl etkilediğini ve zenginleştirdiğini ortaya koymaktır. Literatürde spor ve sanatın kesişim noktalarına dair kapsamlı bir

incelemeye olan ihtiyaç giderek artmaktadır; çünkü bu iki alanın birlikteliği, kültürel ve sosyal dinamikleri anlaşılmasına katkıda bulunacaktır. Bu tür bir inceleme, hem spor hem de sanat alanında çalışan profesyoneller için yenilikçi perspektifler sunarken, akademik ve kültürel çalışmalara da katkı sağlayacaktır. Spor ve sanat, her ikisi de performansa dayalı, toplum kültürüne ve insanlığa hizmet eden, tarih boyunca popülaritesi giderek artan ve tutulum oranı oldukça yüksek iki birleşik fenomendir. Her iki alanda da etkin olan mükemmelliyetçi arayış, özellikle profesyoneller tarafından hareket, uyum, estetik, senkron gibi farklı biçim ve kavramlarla temsil edilmektedir. Spor ve sanat adına gerçekleştirilen poster, heykel, tasarım, resim ve medya uygulamalarında, yarışma ya da müsabaka gibi organizasyonlarda spor ve sanat arasındaki güçlü ilişki daha dikkat çekici bir hal almıştır. Spor ve sanat her zaman el ele olmuş ve birbirini tamamlamıştır ancak bunun yanında sanat ve spor birlikteliği her dönem güncelliğini koruyan bir tartışma konusu olmaktan da çıkamamıştır. Bir kesim sporun tam anlamıyla bir sanat olduğunu savunurken aksini iddia eden hatta birbirinden bağımsız kavramlar olduklarını savunanlar da olmuştur. Bu noktada bizim savunucusu olduğumuz esas konunun sanatın bir spor olup olmadığı ya da sporun bir sanat olup olmadığından çok spor ve sanatın ortak paydada birleşen ilişkisidir. Makalede spor ve sanatın uyumu, birbirleri ile etkileşimi ve insanlığa olan katkıları derleme bir çalışma olarak ele alınmıştır. Araştırma için gerekli literatür taraması yapılmış, bulgular benzer yayın ve araştırmalar ile birlikte tartışılmıştır. Sonuç olarak, sporda ve sanatta performans sergilemenin fizyolojik, psiko-sosyal ve fiziksel bağlamda insan gelişimine katkı sağladığı ve bağdaşık bir bütünlük sergiledikleri görülmüştür.

Anahtar Kelimeler: Spor, sanat, grafik tasarım, rekreasyon.

INTRODUCTION

Human development is a process that begins with birth and completes its evolution with some changes over time. Some age-related changes affect the functionality of the body. Especially the growth and development period until the age of twenty is a serious reflection of the subsequent developmental periods. Therefore, being prone to sports and arts or engaging in sports or art-related practices will open the door to a healthy, fit, dynamic and productive future life.

Youth and childhood are very critical periods for societies in raising modern, yet strong, energetic, successful and healthy individuals who embrace their values. In this sense, the inclusion of art activities and sports training within the scope of "Positive Youth Development (PYD)" is seen as a very effective program. Positive Youth Development, from the perspective of life skills, refers to the process of equipping young people with the competencies necessary for leading a healthy and successful life both individually and socially. This approach focuses on enhancing youths' abilities to recognize and manage their emotions, strengthen social relationships, and improve problem-solving skills. Positive youth development aims to provide individuals with the life skills needed to realize their potential and live harmoniously within society (5). Sports and arts are ideal means to fulfill the feelings and expectations of youth such as proving themselves, developing self-confidence, being recognized and appreciated. Therefore, in order to raise athletes and artists, sports and arts need to be structured and presented to the society.

Human beings always strive to be physically, mentally and intellectually perfect. Today's modern people want to be distinguished by high intelligence, artistic talent and skill, combining in themselves whatever is different for development (4, 28).

The combined harmony of sports and art gave this privilege to the individual and was first seen in Ancient Greece during the Olympics (1, 21).

Plato, the leading supporter of approaching sports and art as a whole, discussed the basic abilities of the individual, the contributions of music to the development of wisdom and sports to the development of the body, and argues that these two should be developed in harmony. Plato, who stated that music and gymnastics, the two talents God gave to humans, are required for temperament, and wisdom is required for love, claimed that gymnastics without the art of music seems very crude and soulless. According to Plato, when music and sports are used together, spiritually and physically harmonious and ideal people grow up (32, 34).

Coubertin drew attention to the connection between sports and art and pointed out many times that these two are complementary to each other and need to be strengthened. He emphasised that "art is a close neighbour to sports, that sport should be seen as the source and cause of art" and that it is a necessity for

athletes and artists to be in alliance (33). The "Book of Five Rings" written by the great Japanese warrior Miyamoto Musashi described the strategy of a warrior. According to Musashi, a warrior must first have a developed sense of rhythm since a free movement can only be created with a good sense of rhythm. Dancing and using a wind or string instrument are important steps in setting the tempo in music. Rhythm is also associated with martial arts, archery, rifle shooting and horse riding. The important thing here is to analyse the rhythm in the background. Movements without rhythm lose their clarity (19, 34).

Козін О.В. explained sports as the embodiment of art and emphasised that the ability to perceive develops creative, unconventional thinking, thus there is a great connection between sports and art that requires mastery. He also explained that athletes who engage in different types of art to develop technical skills will benefit from this interest, and in this way they can improve concentration, creative skills and perception. Many modern athletes widely use musical accompaniment during training and are independently engaged in various types of art, especially drawing, singing, playing musical instruments (20).

Today, it is possible to see the integrated relationship between art and sports in almost all major sports organisations. Stage shows and creative festivals are combined with sports to create a more impressive visual feast. Many sports such as rhythmic gymnastics, figure skating and synchronised swimming are accompanied by music and choreography and presented with artistic visuals. Therefore, elegance, flexibility and aesthetics are important components of athlete performance (31, 30).

Lemus-Delgado (2021) discussed the similarities and differences between sports and art and stated that creativity and imagination are common in both fields (23). While art transforms sports organisations into a visual and aesthetic show, sports can be seen as a work of art on its own (22). In addition, the expressive power arising from this magnificent unity of art and sports offers the audience the opportunity to understand world cultures. Especially in international sports organisations, the effects of intercultural sharing arising from the integrated unity of sports and art are quite remarkable. Another issue other than physical harmony between sports and art is the sense of rhythm that human beings have had in their movements since their existence. Rhythmic sounds are sensory timers of movement and have strong physiological effects related to brain functions on time control, coordination, execution and sequencing of movement (36).

Rhythmic sounds can also reduce the response time of the muscle to stimuli by shortening the excitation time of spinal motor neurons through a number of connections (7). Rhythm, which forms the basis of music and movement education, is the basic harmony that exists not only in music and sports but also in calligraphy, dance, ceramics, sculpture, graphics, cinema and theatre, in short, in every field of visual, auditory and dramatic arts. When the application phase of movement in sports is combined with music, the harmony of aesthetics and elegance brings the visual to a different dimension (9).

Some statistics, on the other hand, have proved that young people with good appearance are much more successful in coping with the difficulties encountered in life than those who do not. It is accepted that physiologically and psychologically dynamic individuals with a strong musculoskeletal structure have a special protective shield against diseases (24). The American Heart Association has announced that obesity, high blood pressure, LDL (bad cholesterol), the risk of stroke and other cardiological diseases are more common in sedentary people (24). We have to accept that some professions enforce sedentary working lives. In this study conducting a comparative analysis of art and sports, we see that a painter is forced to maintain certain body positions for a long time in front of an easel, a musician at his instrument, a graphic designer at his computer, a ceramicist or a sculptor with his work in his hands.

We observe the effect of the separation of male and female gender for a number of reasons, especially in conservative segments throughout history. However, art and sports meet again at this point. Beyond biological differences, gender discrimination resulting from social impositions causes deep damages in arts and sports, and successful women remain behind the scenes. The concept of gender creates socio-cultural differences, and therefore the perspective on sports and art is seen as one of the factors that decreases the development levels of traditional societies. Fortunately, thanks to technological developments, the need for men's muscle power has been met by machines and women have become more visible in public institutions or organizations. However, in sport and the arts, women are not yet as visible as men. In societies where strong and patriarchal

mentality prevails, women are not encouraged enough to participate in sports and arts (10). When the literature on art and women is examined, it is noteworthy that modernist art historians, in particular, ignore women's art, associate women's works with crafts and remember them only in works that require manual dexterity, and gender inequality stands out as one of the common points in art, as in sports. Throughout history, women have been engaged in a feminist struggle due to the uncertainty of their role in art, protested in museums and art academies to show that they have equal rights and opened their own exhibitions, galleries and art schools (8).

Sports and arts have an integrative cultural structure in two separate structures that are owned by the society, but which are not disconnected from each other. Both cultures are dominated by the desire to improve and enrich society, to open up to the world and to act together with other societies regardless of religion, language and race. Neither art nor sport has a defined medium. Art may not always require a canvas, a stage or an instrument. Likewise, sports do not require a hall, a field, a ball or a bar. Sometimes a street or a road may be enough. This is how street art and street sports came into existence. Among the seven branches of art and most branches of sports, the streets are perhaps the most independent, courageous and effective medium with their closeness to the public. They can appear at any time, unexpectedly, and affect us in a remarkable, awareness-raising format. They may even constitute a stance against violence, the plague of our time, in societies. Streets are the barest places where cultures are experienced and exhibited. Therefore, by bringing sports and art to the streets, street culture can be eliminated from being a problem that we cannot overcome.

Like artists using urban space as a backdrop, people who engage in street sports can make the city more attractive by reintroducing freedom and fun. Like the graffiti artist, the street athlete maintains a passionate and fused relationship with urban space" (3). Streets generally exist and are used for transportation, but artists and urban athletes offer different alternatives and present them to us as more desirable and powerful spaces (11, 15). "Street Arts" and "Street Sports" have the ability to reverse the known images of cities.

Hughson, J., argued that the Olympic Games are cultural celebrations and therefore sports games should be accompanied by artworks and art performances. Considering that sports is inspired by art and art is inspired by sports, he stated that it is an excellent way to bring the connection between art and sports to the attention of the public at the Olympic Games (13).

Art is a form of culture in which emotional, intellectual and conscious actions are reflected in behaviour, and aesthetic creativity is dominant. Sports, like art, is an integral part of culture, dominated by aesthetics and creativity. Both are personal and collective. They can be recognised in some national symbols, but they are also international. This characteristic therefore makes them accessible and understandable to all nations of the world. Just like sports, art has the power to bring together and unite people from all over the world (8).

Physical activity and various sports, integral to human history, have significantly influenced the artistic designs in the architecture of sports facilities over time (14). Hughson (13) argued that humanity is in a continual quest for excellence in both sports and art. This interrelationship was further explored in a 2013 survey, which assessed how individuals perceive the relationship between art and sports. Out of 618 respondents who were asked whether they view skating more as an art or a sport, the results indicated that skating is seen as a combination of both disciplines (29). This study highlights the many commonalities between sports and art, particularly in their shared focus on performance.

The athlete's performance is usually accompanied by cheers from the fans. It has a wide audience due to the physical actions that contain competition and expect to be appreciated. The artist's performance is generally inspired by gymnastics and athletics sports, and is accompanied by models examining the human body. It can be accepted that sports and art are inseparable parts of a civilised culture which are embedded in the cultural memory through the contributions of artists, historians and poets. The athlete's performance is typically accompanied by cheers from the fans and attracts a broad audience due to its competitive physical actions, which are often intended to be appreciated and admired. Similarly, artistic performances, frequently inspired by gymnastics and athletic sports, are complemented by models that explore the aesthetics and dynamics of the human body. This interconnection suggests that sports and art are inseparable elements of a civilized culture, deeply embedded in cultural memory through the contributions of artists, historians, and

poets. As noted by Kleiner and Matz (2019), "Sports and the arts are integral to cultural development, reflecting and shaping societal values and aesthetics through their shared emphasis on performance and physical expression" (18).

Whether it is art or sports, live performances have a strong impact on the emotional behavior of individuals. Henry Dupont argued that emotions are not innate, but are formed later as a result of socialization and our interactions with other people, and are constructed as components of personality. Emotions are structures characterized by needs and values that change significantly during development (37). Therefore, it can be said that art and sports activities are great values for humanity and that we should make room for them in the center of life. Sports and art shows can meet emotional needs and sometimes create revolutions in individuals and societies with their existence. In these two areas that have no boundaries but are also different and offer a lifestyle and a culture to the society, the heroes of a show, a match or an exhibition can be actors, musicians, dancers, athletes, etc. who devote themselves to creating a world surrounded by beauty and sensitivity. Starting with their innate talents, artists/athletes aim to reach the masses by constantly renewing themselves (24).

Our brain, which refers to art when it comes to sports and to sports when it comes to art, has not been trained to provide this stimulus. The realization of this is the unity of art and sports, which is the subject of our study. Let's think of any dance. Each figure in it contributes not only to a healthy body but also to the development of a healthy soul. H. Sun conducted a study examining the effects of dance exercises on students' temperaments in terms of temperament and body shape, personal expression and self-confidence in sports (37). In addition, Q Lit supported that good posture and gait rhythm can be created through physical dance practice for adolescents (26). JiYoung conducted a three-month study on university students and found that exercise changes physical fitness, weight and psychological values, and argued that dance has positive effects on women's physical health (16).

XB Dong provided comprehensive physical dance training to over 200 physical education students, highlighting that dance can significantly enhance students' quality of life, self-esteem, self-confidence, and interpersonal skills (17). Similarly, JH Zhu noted that incorporating gymnastics training into physical dance instruction improves students' "aesthetic quality," alleviates negative emotions, and contributes positively to both physical and mental health (27). Further supporting these findings, J. Yao conducted a thorough bibliographic and analytical study on the role of sports dance in improving students' physiological well-being, athletic development, and physical appearance. Yao's research concluded that sports dance offers therapeutic benefits across these areas, demonstrating its positive impact on university students (38).

In a study conducted with children aged 9-12, T. Cheng analyzed statistical data (6) gathered from surveys and found that children who participated in sports dance showed significantly better physical health compared to their peers who did not engage in sports dance. Additionally, Cheng observed that these children demonstrated more optimistic and harmonious movement patterns, suggesting that sports dance positively influences both physical and emotional development.

METHOD

In this study, the synthesis method has played a crucial role. It involves the integration and amalgamation of information from a broad range of sources to develop a comprehensive understanding of the relationship between sports and art. By synthesizing various perspectives and findings, the study provides a holistic view of the intersection between these two fields. This approach not only consolidates existing knowledge but also uncovers new insights by highlighting connections that might not be apparent from individual studies (12). Through a meticulous analysis of the literature, the study aligns its objectives with a thorough examination of the topic. By presenting the relationship between sports and art as a compilation of existing knowledge, the study contributes to a deeper and more nuanced understanding of the interaction between these domains.

DISCUSSION AND CONCLUSION

As a result, there are few studies that examine sports and art together, and in parallel with these studies, it is seen that there is a close relationship between sports performance and art performance. It has been found that there is a common belief that art and sports have an effect on physical and mental health of individuals and that they have a greater effect on the mental health and that they have a significant effect on physical health by improving cardiovascular function, developing muscles and exhibiting strength and flexibility. Sport and the arts promote positive attitudes and health, and foster feelings of self-renewal and self-confidence. They create positive effects on interpersonal communication and understanding skills. Therefore, it is recommended that individuals engage in regular sports and artistic activities.

REFERENCES

1. Albizu I. (2017). The Impact Of Mathematics On Ballet: Between The Artistic Body And The Sporting Body. Bajo Palabra-Journal Of Philosophy. 2(16):93-102.
2. Altet X.B. (2002). Istoria Artei, Trad. Răzvan Junescu, Ed. Meridiane, Bucureşti. P. 40.
3. Ardenne, P. (2011). La Rue Est À Moi! Dans 100 Artistes Du Street Art. Paris: Édition La Martinière.
4. Визитей Н.Н. (1982). Спорт И Эстетическая Деятельность. - Кишенев: Штиинца
5. Catalano, R. F., Berglund, M. L., Ryan, J. A. M., Lonczak, H. S., & Hawkins, J. D. (2002). "Positive youth development in the United States: Research findings on evaluations of positive youth development programs." The Annals of the American Academy of Political and Social Science, 591(1), 98-124.
6. Cheng T. Spamer M. And Suhr R. (2018). "Sport Als &Erapie İm Klinischen Alltag," Nervenheilkunde, Vol. 38, No. 6, Pp. 424– 428.
7. De La Mothe, L. A., Blumell, S., Kajikawa, Y.& Hackett, T. A. (2006). Thalamicconnections Of The Auditory Cortex İn Marmoset Monkeys: Core And Medialbelt Regions. Journal Of Comparative Neurology, 72-96.
8. Eyigör, F., Korkmaz, F. D. (2013). 1960'dan Günümüze Plastik Sanatlar Alanında Feminist Yansımalar. http://Feyigorarttick.Blogspot.Com.Tr/2013/01/1960dangunumuze-Plastik-Sanatlar https://www.sportkon.com/ (Erişimtarihi:28.11.2022).
9. Gerek, Z. (2015). Beden Eğitimi Uygulamalarında Ritim Eğitimi. Erzurum: Atatürküniversitesi Yayınları. No.1079, S.14-15.
10. Gıulıanottı, R. (2005). Sport: A Critical Sociology. Polity Press, Cambridge.
11. Gwiazdzinski, L. (2003). Pour Une Ville En Mouvement. Le Mouvement, 23, 1–3
12. Hancock, D. R., & Algozzine, B. (2017). Doing Case Study Research: A Practical Guide for Beginning Researchers. Teachers College Press.
13. Hughson, J. (2010). Re-Uniting Sport And Art: The Potential Of Olympic Posters. Physical Culture And Sport, 50,60.
14. Ilić, S. (1994). Istorija Fizičke Kulture (Staro Doba İ Srednji Vek) [History Of Physical Culture (Old Century And Middle Ages)]. Belgrade: Faculty Of Physical Culture.
15. Jaccoud, C. (1998). Action Publique Et Nouvelles Pratiques Sportives: Roller Et Skate Dans Deux Villes Suisses. Paris: Ed. Cıes.
16. Jiyoung, K. Y. Jungeun, Hong A.And Lee S. (2017). "Finding The Position Of School Dance: A Review İn Accordance With Policy And Public Law Through The Stakeholder Analysis," Korean Journal Of Sport Pedagogy, Vol. 24, No. 2, P. 79.
17. Jung T. S., Jung, T. S. (2017). "Relations Among Tendency Of Perfectionism, Self-Management And Competition Anxiety Of The High School Students Majoring İn Dancing," Be Korean Journal Of Physical Education, Vol. 56, No. 5, Pp. 607–619.
18. Kleiner, F. S., & Matz, L. (2019). Gardner's Art Through the Ages: A Global History (16th ed.). Cengage Learning.
19. Kos, A.Wei, Y. Tomažič, S. & Umek, A. (2018). The Role Of Science And Technology İn Sport. Procedia Computer Science, 129, 489-495.
20. Козін, О. В. (2022). Єдність Спорту, Науки І Мистецтва: Аналітичний Огляд. Health-Savıng Technologıes, Rehabılıtatıon And Physıcal Therapy, 68.
21. Kreft L. (2014). The End Of Philosophy: Aesthetics And Philosophy Of Sport. Synthesis Philosophica. 29(2):347-59.
22. Krzysztofik, M., Trybulski, R., Trąbka, B., Perenc, D., Huszcz, K., Zajac, A., & Moraru, C. E. (2022). Theimpactof Resistance Exercise Range Of Motion On The Magnitude Of Upper-Body Post-Activation Performance Enhancement.Bmc Sports Science, Medicine And Rehabilitation, 14(1), 123.
23. Lemus-Delgado, D. (2021). International Sports Events And National İdentity: The Opening Ceremony Of Thetaipeiuniversiade. Sport İn Society, 24(7), 1093-1109.
24. Leşe, A. C., Minea, R. & Armencia, A. I. (2021). Performance İn Sports And Art. The Beginnings. Review Of Artistic Education, 21(1).
25. Leşe, A. C., & Minea, R. (2022). 2. Performance İn Sports And Art. The Beginnings. Review Of Artistic Education, (23), 137-141.

26. Lit And D. Byczkowska-Owczarek, (2019). "Performing On The Boundary Of Art And Sport: The Case Of Competitive Ballroom Dancers," Czech Sociological Review, Vol. 55, No. 3, Pp. 369–392.
27. Luiggi, M., & Griffet, J. (2019). Sport İnjury Prevalence And Risk By Level Of Play And Sports Played Among A Representative Population Of French Adolescents. A School-Based Study. Revue D'epidemiologie Et De Sante Publique, 67(6), 383-391.
28. Mcmahon M. (2016). The Other Industrial Art: Deleuze, Cinema, Affect And Sport. Deleuze Studies. 10(2):206-22.
29. Riffaud, T. Recours, R.& Gibout, C. (2015). Sports Et Arts De Rue: Être Citadins Autrement!. Loisir Et Société/Society And Leisure, 38(3), 423-435.
30. Sakibaev, K. Kozuev, K Atabaev, I. Alimbekova, A. & Argynbaeva, A. (2022). Somatotypological İndicatorsofphysical Development İn Residents Of Kyrgyzstan. Iranian Journal Of War And Public Health, 14(3), 279-285.
31. Smirnov, A. O. & Sadykova, T. I. (2021). The Organizational Principles Of Medical Support Of Ceremoniesofopening And Closing İnternational Sport Competitions. Problems Of Social Hygiene Of Public Healthandthehistory Of Medicine, 29(6), 1563-1565.
32. Stolyarov V. (1985). Sport As An Element Of Developing An Aesthetic Culture Among The Youth//"Review". Sport Science Periodical. International Council Of Sport Science And Physical Education, Pp. 36-41.
33. Stolyarov V. (1989). Paradoxes, Contradictions And Values Of The Modern Sport (Social And Philosophical Analysis). Paper Presented At The Jyvaskyla Congress: "Movement And Sport - A Challenge For Life- Long Leaning", June 17-22, Jyvaskyla, Finland.
34. Stolyarov V.I. (1990). Attitude Paradox Of The Population To The "Sport For All" And Ways Of İts Solution // Reports Of The National Scientific And Practical Conference "Physical Culture And Healthy Life Style". - Moscow, Pp. 92-105.
35. Sun H., Purser A. C. E. (2017). "Dancing Like A Girl: Physical Competence And Emotional Vulnerability İn Professional Contemporary Dance," Women İn Sport & Physical Activity Journal, Vol. 25, No. 2, Pp. 105–110.
36. Thaut, M. H. (2013). Rhythm, Music, And The Brain: Scientific Foundations And Clinicalapplications. New York: Routledge.
37. Thomas M. R. (2001). Recent Theories Of Human Development, Sage Publications Q.
38. Yao J. And Lee W. J. (2019). "A Study On The Dionysian Elements İn Break Dancing," Be Journal Of The Korean Society For The 10 Emergency Medicine International Philosophy Of Sport Dance & Martial Arts', Vol. 27, No. 3, Pp. 73–83.

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Examination of Self-Efficacy Levels of Physical Education Teachers and Trainer Candidates in Terms of Different Variables

Ertuğrul GENÇAY [1A]

[1] *İstanbul Yeni Yüzyıl University, Faculty of Sport Sciences, Recreation Department Istanbul, TÜRKİYE*
Address Correspondence to Ertuğrul GENCAY: e-mail: ertugrulgencay1@gmail.com

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A: Orcid ID: 0000-0001-9169-8843

Abstract

Self-efficacy belief is the belief of individuals in performing a particular job by relying on the knowledge, experience and skills needed for the job. In this study, it was aimed to examine the general self-efficacy of physical education and sports teacher candidates and coach candidates in terms of different variables. The sample of the study consists of 245 teacher and coach candidates, 124 female and 121 male, with an average age of 21.87±2.36 years, studying at Kahramanmaras Sutcu Imam University Faculty of Sport Sciences in the 2022-2023 academic year. The general self-efficacy scale developed by Magaletta and Oliver (13) and validated and reliable in Turkish by Yıldırım and İlhan (24) was used as a data collection tool. Obtained data were analyzed with Independent sample-t test and One-way Anova test. In terms of gender, candidates do not differ in their self-efficacy ($p>0.05$). It is understood that those who see their professional future as negative get a lower score than those who see their professional future as positive in the persistence-insistence sub-dimension, although their total self-efficacy and starting sub-dimension are higher ($p<0.05$). It is observed that physical education teacher and coach candidates differ in the starting sub-dimension of the self-efficacy scale according to their past athletic status ($p<0.05$). Accordingly, those who have 2 branches have higher scores in the starting dimension than those who have no branches. It was found that teacher and coach candidates differed in the sub-dimension of not giving up, trying to start and continuing-persistence of the self-efficacy scale in terms of departments ($p<0.05$). However, it was not found to be significant in terms of their total self-efficacy ($p>0.05$). As a result, it was found that the self-efficacy of physical education teacher and coach candidates did not differ in terms of gender. In terms of the departments studied, the self-efficacy scale of teacher and coach candidates; It was found that they differed in the sub-dimension of not giving up, starting and continuing effort. From this point of view, it can be said that having an athlete background in a certain sports branch at the stage of admission to the departments they study can contribute positively to their future professional life.

Keywords: Physical education and sports teacher, trainer, self-efficacy.

Beden Eğitimi Öğretmeni ve Antrenör Adaylarının Öz yeterlik Düzeylerinin Farklı Değişkenler Açısından İncelenmesi

Özet

Öz-yeterlik inancı, bireylerin belirli bir işi o iş için gerekli olan bilgi, deneyim ve becerilere güvenerek yerine getirebileceğine olan inancıdır. Bu çalışmada beden eğitimi ve spor öğretmen adayları ile antrenör adaylarının genel öz yeterliklerinin farklı değişkenler açısından incelenmesi amaçlanmıştır. Araştırmanın örneklemini 2022-2023 eğitim-öğretim yılında Kahramanmaraş Sütçü İmam Üniversitesi Spor Bilimleri Fakültesinde öğrenim gören, yaş ortalaması 21,87±2,36 yıl olan 124'ü kadın, 121'i erkek 245 öğretmen ve antrenör adayından oluşmaktadır. Veri toplama aracı olarak Magaletta ve Oliver (13) tarafından geliştirilen ve Yıldırım ve İlhan (24) tarafından Türkçe geçerlilik ve güvenilirliği yapılan genel öz-yeterlik ölçeği kullanılmıştır. Elde edilen veriler Independent sample-t testi ve One-way ANOVA testi ile analiz edildi. Cinsiyete göre adayların öz-yeterlik algıları farklılık göstermemektedir ($p>0,05$). Mesleki geleceğini olumsuz görenlerin, olumlu görenlere göre toplam öz yeterliliklerinin ve başlama alt boyutunun yüksek olmasına rağmen ($p<0.05$) sürdürme çabası-ısrar alt boyutunda mesleki geleceğini olumlu görenlere göre daha düşük puan aldıkları anlaşılmaktadır ($p<0.05$). Beden eğitimi öğretmeni ve antrenör adaylarının geçmişindeki sporculuk durumlarına göre, öz yeterlilik ölçeği başlama alt boyutunda farklılaştıkları görülmektedir ($p<0.05$). Buna göre 2 branşı olanlar, hiç branşı olmayanlara göre başlama boyutunda daha yüksek puana sahiptirler. Öğretmen ve antrenör adaylarının bölümlere göre öz yeterlilik ölçeğinin yılmama, başlama ve sürdürme çabası-ısrar alt boyutunda farklılaştıkları bulunmuştur ($p<0.05$). Ancak toplam öz yeterlilikleri açısından farklılaşma olmadığı bulunmuştur ($p>0.05$). Sonuç olarak beden eğitimi öğretmeni ve antrenör adaylarının öz yeterliklerinin cinsiyete göre farklılaşmadığı tespit edilmiştir. Öğretmen ve antrenör adaylarının bölümler açısından öz yeterlilik ölçeğinin yılmama, başlama ve sürdürme çabası-ısrar alt boyutunda farklılaştıkları, beden eğitimi öğretmeni ve antrenör adaylarının geçmişindeki sporculuk durumlarına göre öz yeterlilik ölçeği başlama alt boyutunda farklılaştıkları bulunmuştur ($p<0.05$). Bu açıdan bakıldığında öğrencilerin öğrenim gördükleri bölümlere kabul aşamasında belirli bir spor dalında sporcu geçmişine sahip olmalarının gelecekteki mesleki yaşamlarına olumlu katkı sağlayabileceği söylenebilir.

Anahtar Kelimeler: Beden eğitimi ve spor öğretmeni, antrenör, öz yeterlilik.

INTRODUCTION

Competence is the possession of professional knowledge, skills and attitudes needed to perform related duties in a profession. The fulfillment of the duties expected of the employee at the desired level is expressed as the acquisition of knowledge and skills that will perform a behavior (16). Self-efficacy belief is one of the most basic concepts of Bandura's social learning theory, and it is the belief of individuals in performing a particular job by relying on the knowledge, experience and skills needed for the job (5). Self-efficacy is the belief that by taking an active role on the actions taking place around the person, it will contribute to the process at the beginning and until the end (4). Self-efficacy refers to a person's knowledge and experience rather than abilities. The concept of self-efficacy includes elements such as internal motivation, which is formed as a result of the organization of the necessary knowledge and experience and the evaluation of the gains to be achieved together with the risk analysis while preparing an action plan (24). According to Bandura (5) the most important feature of those with high self-efficacy is; is that they quickly recover from their failures and persist in their actions without giving up. Self-efficacy is not about one's special abilities, but about one's judgments. Self-efficacy is a special case of what a person can do in a particular area. For example, a sprinter may be confident in sprint competitions but this to be not in long-distance running (25).

Belief in self-efficacy not only forms an important part of self-efficacy belief, it also affects people's motivation and behavior, but on the other hand, actions that will change people's lives. Bandura defines self-efficacy as the belief in one's own abilities to manage and program conditions to develop (4). Beliefs about self-efficacy do not generally reflect the person's capacity or abilities, but express their beliefs about their capacity under certain special circumstances (7). Self-efficacy makes a difference in the individual's belief in his own feelings and thoughts. When the sense of self-efficacy is low, this can create a feeling of stress, anxiety, depression, and desperation in the person (5).

A strong sense of efficacy in thinking increases the level of decision-making and facilitates cognitive activities and performance in different settings, including academic achievement. Self-efficacy can be effective when behavior is involved in determining the activities people will do.

Self-efficacy beliefs do not refer to someone's abilities or skills, but only to what the person believes they can do under certain circumstances, regardless of the abilities or skills they actually have. Thus, self-efficacy includes both a person's competencies and beliefs to be able to function successfully (5).

Conversely, it is stated that self-efficacy has a contextual quality rather thanageneral concept, because a person's self-efficacy may differ in different situations (3).

For example, a teacher who does not have sufficient self-efficacy in the science lesson may have sufficient and high self-efficacy in the language lesson (18). Many studies reveal that self-efficacy beliefs have a positive effect on teachers motivation and performance levels (1,2,6,11). Self-efficacy belief is much stronger than the individual's true competence in terms of its effect on individuals' emotional states and motivations (23).

As a result, according to this situation, there can be no possibility of an effective learning environment. With the increase of a teacher's job satisfaction, he will contribute to the learning levels of his students by doing his job in the most effective and productive way, and this depends on his self-efficacy belief (17). All these emphasize that self-efficacy is just as important in the process of self-actualization (22). Self-efficacy belief is determined by the following conditions: The four sources of information listed below in descending order: '1' active mastery experiences, '2' indirect experiences, '3' verbal persuasion, and '4' physiological and emotional states. Efficacy beliefs produce their effects through four processes: cognitive, motivational, emotional, and selective processes (3, 12).

Self-efficacy is a concept whose importance is increasingly understood in every field. In this sense, the present study aimed to examine the general self-efficacy of physical education and sports teacher candidates and coach candidates in terms of different variables.

From this point of view, answers to the following sub-problems were sought.

1. Are there any difference in general self-efficacy of physical education teacher and coach candidates according to their genders?

2. Are there any difference in general self-efficacy levels between physical education teacher and coach candidates?

3. Do the positive/negative perception of the professional future of physical education teacher and coach candidates affect their general self-efficacy levels?

4. Are the general self-efficacy of physical education teacher and trainer candidates affected by their past sports?

METHOD

Sample

The sample of the study consists of 245 teacher and coach candidates, 124 female and 121 male, with an average age of 21.87±2.36 years, studying at the Faculty of Sports Sciences at KSU in the 2022-2023 academic year. 245 people participated in the study on a voluntary basis. Before applying the scale, the participants were informed by the researcher to fill in the questionnaire. Answering the questionnaire took a total of 15 minutes. Study, KSU. It was applied by the Medical Research Ethics Committee (TAREK) with the decision dated 14.06.2022 and numbered 08, after obtaining the permission of the ethics committe.

Data Collection Tools

The general self-efficacy scale developed by Magaletta and Oliver (13) and validated in Turkish by Yıldırım and İlhan (24) was used in the study. The general self-efficacy scale is a scale that aims to determine the general self-efficacy level of the individual. In this study, the "How well does it describe you?" The likert-type format was used, in which the answers differing between "never" and "very good" answers can be given in a five-stage manner. Items 2, 4, 5, 6, 7, 10, 11, 12, 14, 16 and 17 in the scale are reverse scored. An increase in the score indicates an increase in self-efficacy belief. Scale; It consists of three sub-dimensions as "starting", "not giving up" and "continuing effort-insistence". While the internal consistency coefficient of the Turkish version of the scale was found to be 0.80, the internal consistency coefficient of the scale used in the current study was found to be 0.94.

Analysis of Data

The collected data were processed in the SPSS 21 Package program. Z values of skewness and kurtosis were examined to determine whether the obtained data showed a normal distribution. The Z value was found to be betwee-1.96 and +1.96 ($p < 0.05$) and the distribution was considered normal by the Tabachnick & Fidell (21). According to this; Independent Samples T Test was used for differences between independent and paired groups, and one-way analysis of variance (Anova) was used for comparisons of more than two groups. In statistical comparisons, their significance was interpreted according to $p<0.05$ values.

FINDINGS

Table 1. Classification of physical education teacher and coach candidates according to some socio-demographic characteristics

Variables		**f**	**%**
	Male	121	49,4
Gender	Female	124	50,6
	Total	245	100
	Teacher candidate	174	71
Section	Trainer candidate	71	29
	Total	245	100
	up to 19	35	14,3
Age	Between 20 -22	126	51,4
	23- And Above	84	34,3
	Total	245	100
	Positive	188	76,7
How do you see your professional future?	Negative	57	23,3
	Total	245	100
	No	102	41,6
Have you played any sports in the past?	Yes	102	58,3
	Total	245	100

Table 1 shows that 50.6% of the individuals participating in the research are women and 49.4% are men. 71% of the participants are from the teaching department and 29% from the coaching department. Those who see their professional future positively are 76.7%. those who see it negatively constitute 23.3%. Participants were asked; 58.3% of them answered yes, 41.6% of them no.

Table 2. T-test results of self-efficacy levels of physical education teacher and coach candidates in terms of gender

	Gender	**N**	$\overline{X}$	**Ss**	**t**	**df**	**p**
Do not give up	Male	121	3,2744	,19855	-,756	243	,450
	Female	124	3,2935	,19826			
Start	Male	121	1,7056	,41516	-,405	243	,686
	Female	124	1,7278	,44432			
Persistence-insistence	Male	121	4,2617	,43292	-,671	243	,503
	Female	124	4,2984	,42253			
Total self-efficacy	Male	121	2,6751	,15194	-1,198	243	,232
	Female	124	2,6991	,16125			

Table 2. It is seen that there is no significant difference between the general self-efficacy beliefs of male candidates and female candidates in terms of gender [$t(243)= 1.198$] ($p>0.05$).

Table 3. Self-efficacy independent sample t-test results according to the opinions of physical education teachers and coach candidates about their professional future

	How do you see your professional future?	N	$\overline{X}$	Ss	t	df	p
Do not give up	Negative	76	3,2895	,19213	,909	243	,364
	Positive	169	3,2817	,21764			
Start	Negative	76	1,5855	,40846	-3,996	243	,000*
	Positive	169	1,7759	,44368			
Persistence-insistence	Negative	76	4,4035	,42848	3,745	243	,000*
	Positive	169	4,2249	,37249			
Total self-efficacy	Negative	76	2,6464	,14807	-3,142	243	,002*
	Positive	169	2,7056	,17266			

In Table 3, it is understood that those who see their professional future as positive have higher self-efficacy and starting sub-dimension compared to those who see their professional future negatively ($p<0.05$), but those who see their professional future as positive get lower scores in the persistence sub-dimension ($p<0.05$). In this respect, persistence and persistence are important for a positive perception of the professional future.

Table 4. One Way Anova test results of physical education teachers and coach candidates in terms of departments

	Departments	N	$\overline{X}$	Ss	t	df	p
Do not give up	Teacher candidate	174	3,3057	,20021	2,713	243	,007*
	Trainer candidate	71	3,2310	,18407			
Start	Teacher candidate	174	1,6717	,39968	-2,606	243	,010*
	Trainer candidate	71	1,8275	,48013			
Persistence-insistence	Teacher candidate	174	4,3257	,41635	2,635	243	,009*
	Trainer candidate	71	4,1690	,43597			
Total self-efficacy	Teacher candidate	174	2,6800	,14148	-1,139	243	,256
	Trainer candidate	71	2,7051	,18933			

Table 4. It is seen that the self-efficacy scale of teacher and coach candidates differed in the sub-dimension of not giving up, trying to start and continuing-persistence ($p<0.05$). However, there was no significant difference in terms of total self-efficacy ($p>0.05$).

Table 5. One Way ANOVA test results according to the sportsmanship status of physical education teacher and coach candidates in their past

		Sum of Squares	Mean Squares	Sd	F	P	difference
Do not give up	Between groups	,165	2	,083	2,122	,122	
	Within groups	9,423	242	,039			
	Total	9,588	244				
Start	Between groups	1,407	2	,704	3,907	,021*	1-3
	Within groups	43,589	242	,180			
	Total	44,996	244				
Persistence-insistence	Between groups	1,046	2	,523	2,911	,056	
	Within groups	43,486	242	,180			
	Total	44,532	244				
Total self- efficacy	Between groups	,093	2	,047	1,910	,150	
	Within groups	5,911	242	,024			
	Total	6,004	244				

1-No 2-Yes, I was an athlete in 1 branch 3-Yes, I was an athlete in 2 branches

Table 5 shows that physical education teachers and coach candidates differ in the starting sub-dimension of the self-efficacy scale according to their past athletic status ($p<0.05$). According to this, those who have 2 branches have higher scores in the starting dimension than those who have no branches.

DISCUSSION AND CONCLUSION

In this section, the sub-problems organized for the purpose of the research were evaluated statistically, and the findings were interpreted and discussed, respectively.

1. Are there any difference in general self-efficacy of physical education teacher and coach candidates according to their genders?

In our study, no significant difference was found in the self-efficacy of physical education teacher and coach candidates in terms of gender ($p>0.05$). In many studies on the subject, similar results were found in terms of gender, Kangalgil M. (9), Sandıkçı and Öncü (19), Kahramanoğlu and Ay (7), Seçkin and Başbay (20), Koparan et al. (10), Seçkin and Başbay (20) attributed the decrease in social status differences between women and men, in coordination with the social and technological developments in the society, to the fact that women are more involved in their social and business lives. From this point of view, it shows that the concept of self-efficacy, which is defined as the individual's belief that he can influence the events that affect his life by exhibiting a certain level of motivation Bandura (4) is also valid for the self-efficacy of students studying in the field of sports sciences.

2. Are there any difference in general self-efficacy levels between physical education teacher and coach candidates?

It is seen that there is no significant difference in terms of self-efficacy of teacher and coach candidates according to their departments ($p>0.05$). Uysal (23) In his study, it was revealed that the general self-efficacy beliefs of pre-service teachers were not statistically significant to the department variables. In this respect, our study reveals similar results with the literature. However, in our study, it was observed that the general self-efficacy scale differed in the sub-dimension of not giving up, trying to start and continuing-persistence ($p<0.05$). Accordingly, pre-service teachers achieved higher values in the sub-dimension of not giving up and continuing-persistence, while pre-service coaches obtained higher values in the sub-dimension of starting. From this point of view, it can be said that physical education teacher candidates come to the fore in this aspect, since achieving success in a subject undoubtedly requires persistence and determination.

3. Are the general self-efficacy of physical education teacher and trainer candidates affected by their past sports?

In our study, it is seen that physical education teacher and coach candidates differ in the starting sub-dimension of the self-efficacy scale according to their past athletic status ($p<0.05$). In the study conducted by Seçkin & Başbay (20) it was found that doing regular sports affects self-efficacy belief. When both studies are evaluated together, it can be said that doing sports in the past will positively affect self-efficacy belief for both physical education teachers and coach candidates. From this point of view, it can be said that having an athlete background in a certain sports branch at the stage of admission to the physical education and sports school can contribute positively to his future professional life.

4. Do the positive/negative perception of the professional future of physical education teacher and coach candidates affect their general self-efficacy levels?

Although the total self-efficacy and starting sub-dimension of those who see their professional future as negative are higher ($p<0.05$), it is understood that those who see their professional future as positive have a lower score in the persistence sub-dimension than those who see their professional future as positive ($p<0.05$). According to Banadura (5) the most distinguishing feature of those with high self-efficacy is that they do not give up despite failures and carry out their actions with determination. Therefore, persistence and persistence are important in perceiving the professional future positively. Many studies on this subject also show that there is a positive relationship between professional future-career choice and self-efficacy (14).

As a result of the study, both physical education teachers and teachers who provide sports education such as coaching can create a curriculum that will provide students with health skills, create health awareness and increase their efficiency and productivity during the lesson (15). From this point of view; It can be thought

that increasing the self-efficacy levels of physical education teachers and trainers is important for students and athletes to progress at the desired level and to develop the behaviors, attitudes, skills and knowledge they will need.

REFERENCES

1. Bandura A, & Locke, EA, Negative self-efficacy and goal effects revisited. Journal of Applied Psychology, 2003; 88(1): 87-99.
2. Bandura A, Self-efficacy: toward a unifying theory of behavioural change. Psychological Review, 1977; 84(2), 191-215.
3. Bandura A. Social foundations of thought and action: A social cognitive theory. 1nd ed. Prentice-Hall, NJ: Englewood Cliffs , 1986: 123-125.
4. Bandura A. Self-efficacy. Encyclopedia of Human Behavior. 4 nd ed. Ramachaudran Academic Press, 1994: 234-235.
5. Bandura A. Self-efficacy: The exercise of control. 2 nd ed. W H Freeman/Times Books/ Henry Holt & Co. WH. Freeman and Company. 1997: 235-237.
6. Cho YJ & Shim SS, Predicting teachers' achievement goals for teaching: The role of perceived school goal structure and teachers' sense of efficacy. Teaching and Teacher Education, 2013; 32, 12–21.
7. Evers WJG, Brouwers A & Tomic W, Burnout and self-efficacy: A study on teachers' beliefs when implementing an innovative educational system in the Netherlands. British Journal of Educational Psychology, 2002; 72(2), 227–243.
8. Kahramanoglu R, & Ay Y, Analysis of Primary Teacher Candidates' Perceptions of Special Field Proficiency in Terms of Various Variables. International Journal of Turkish Literature, Culture and Education, 2013; 2(2), 285-301.
9. Kangalgil M, Examination of physical education teachers' participation in and possession of special field competencies. Journal of Sport Sciences, Hacettepe J. of Sport Sciences, 2014; 25(2), 94-103.
10. Koparan S, Ozturk F, & Korkmaz H, Examination of physical education teachers' self-efficacy and physical education teacher competence. National Physical Education and Sports Instructor. Congress 25-27 May, Van/Yyu Education Faculty Journal Special Issue, 2011;52-61.
11. Lee B, Cawthon S, & Dawson K, Elementary and secondary teacher self-efficacy for teaching and pedagogical conceptual change in a drama-based professional development program. Teaching and Teacher Education, 2013; 30(1), 84-98.
12. Maddux J E. Self-efficacy , adaptation, and adjustment: Theory, research, and application. 2nd ed. I J E M & J Lewis, Plenum Press. 1995:89-90.
13. Magaletta PR, OJ, Their Relations with Self-Efficacy, Optimism, and General Well-Being. Journal of Clinical Psychology, 1999; 55(5), 539-551.
14. Markham G, Balkin D, & Baron R, Inventors and New Venture Formation . Entrepreneurship Theory and Practice, 2002; 27(2), 149-165.
15. Martin JJ, & Kulinna PH, The development of a physical education teachers' physical activity self-efficacy instrument. Journal of Teaching in Physical Education, 2003; 22(2), 219-232.
16. MEB. Teaching competencies, general and special field competencies of the teaching profession. MEB Publications, 2008
17. Moè A, Pazzaglia F & Ronconi L, When being able is not enough. The combined value of positive affect and self-efficacy for job satisfaction in teaching. Teaching and Teacher Education, 2010; 26(5), 1145-1153.
18. Paraskeva F, Bouta H & Papagianni A, Individual characteristics and computer self-efficacy in secondary education teachers to integrate technology in educational practice. Computers and Education, 2008; 50(3), 1084-1091.
19. Sandıkçı M, & Öncü E, Determination and Comparison of Efficacy Perceptions and Attitudes of Teacher Candidates in Physical Education and Other Fields towards Teaching Profession. Pamukkale Journal of Sport Sciences, 2013; 4(1), 135-151.
20. Seçkin A & Başbay M, Examining the self-efficacy beliefs of physical education and sports teacher candidates regarding the teaching profession. International Periodical For The Languages, Literature and History of Turkish or Turkic, 2013; 8(8), 253-270.
21. Tabachnick BG ve Fidell, LS. Using Multivariate Statistics. 8nd ed. Pearson Education. 2013: 167-168.
22. Tsahannen-Moran M & Johnson D, Exploring literacy teachers' self-efficacy beliefs: Potential sources at play. Teaching and Teacher Education, 2011; 27, 751-761.
23. Uysal I, Examination of general self-efficacy beliefs of teacher candidates. Journal of Education and Training Research, 2013; 2(2), 217-226.
24. Yıldırım F & İlhan Ö, Validity and Reliability Study of the Turkish Form of the General Self-efficacy Scale. Turkish Journal of Psychiatry, 2010; 21(4), 301-308.
25. Zulkosky K, Self-Efficacy : A Concept Analysis. Journal Compilation, Wiley Periodicals, Inc., 2009; 44(2), 93-102.

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Exploring the Dynamics of Hamstring Strength in Volleyball: a Positional Perspective Through a Cross-sectional Lens

Cağlar SOYLU [1A], Emre ALTUNDAĞ [2B]

[1] *Health Sciences University, Gülhane Faculty of Physical Therapy and Rehabilitation, Ankara, TÜRKİYE*
[2] *Kütahya Dumlupınar University, Faculty of Sport Sciences, Kütahya, TÜRKİYE*

Address Correspondence to Çağlar SOYLU: e-mail:. caglar.soylu@sbu.edu.tr

Ethical Statement: It is declared that scientific and ethical principles have been followed while carrying out and writing this study and that all the sources used have been properly cited.

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A: Orcid ID: 0000-0002-1524-6295 B Orcid ID: 0000-0002-7010-5065

Abstract

No previous studies have examined the isolated eccentric hamstring strength according to the playing positions of volleyball players, but there are a few studies evaluating hamstring muscle strength based on playing positions. The aim of this study was to compare the eccentric hamstring muscle strength levels of elite volleyball players according to their playing positions. Elite volleyball players (n=31 female and n=32 male) aged between 18-35 who participated in the 2022-2023 Turkish Volleyball 1st League season and followed a similar training program were included in the study voluntarily. Sixty-three volleyball players were categorized as libero (n=5 female and n=6 male), middle player (n=8 female and n=8 male), opposite (n=4 female and n=6 male), setter (n=6 female and n=4 male), and spiker (n=7 female and n=9 male). Eccentric hamstring muscle strength was assessed during the Nordic Hamstring Exercise (NHE) using the IVMES H-Bord (IVMES, Ankara, Turkey) device. The comparison of the eccentric hamstring strength of the volleyball players according to their positions revealed no statistically significant difference between the maximum and mean eccentric hamstring muscle strengths and muscle strength differences for both female (F=0.403-5.331; p=0.255-0.982) and male (F=4.167-6.985; p=0.137-0.384) athletes. Additionally, there was no significant difference between male and female athletes in terms of mean and maximum eccentric hamstring muscle strength and muscle strength differences based on their positions (F=0.001-3.823; p=0.055-0.972). Our study found that the eccentric hamstring strength and bilateral strength difference percentages of both male and female volleyball players did not differ according to their positions. The fact that the eccentric hamstring strength levels of volleyball players did not differ according to positions in previous studies and in our study is thought to be related to the evolving structure of volleyball.

Keywords: Eccentric muscle strength, hamstring, playing position, volleyball.

Voleybolda Hamstring Gücü Dinamiklerinin Araştırılması: Kesitsel Bir Mercekten Konumsal Bir Perspektif

Özet

Bilgimiz dahilinde literatürde izole eksantrik hamstring kuvvetini voleybol oyuncularının oyun pozisyonlarına göre inceleyen bir çalışma bulunmamakla birlikte, hamstring kas kuvvetini oyun pozisyonlarına göre değerlendiren az sayıda çalışma bulunmaktadır. Bu araştırmanın amacı, elit voleybolcuların eksantrik hamstring kas kuvvetlerinin oyun pozisyonlarına göre karşılaştırmaktır. Araştırmaya, 2022-2023 Türkiye Voleybol 1. Lig sezonunda yer alan, benzer

antrenman programına alınan 18-35 yaş aralığında 63 (n=31 kadın ve n=32 erkek) elit voleybol sporcusu gönüllü katılmıştır. Sporcular libero (n= 5 kadın ve n=6 erkek), orta oyuncu (n=8 kadın ve n=8 erkek), pasör çaprazı (n= 4 kadın ve n=6 erkek), pasör (n= 6 kadın ve n=4 erkek) ve smaçör (n=7 kadın ve n=9 erkek) olarak kategorize edildi. Sporcuların eksantrik hamstring kas kuvvetleri Nordic Hamstring egzersizi (NHE) sırasında IVMES H-Bord (IVMES, Ankara, Türkiye) kullanılarak yapıldı. Voleybolcuların pozisyonlarına göre eksantrik hamstring kuvvetleri karşılaştırıldığında, hem kadın (F=0.403-5.331; p=0.255-0.982) hem de erkek (F=4.167-6.985; p=0.137-0.384) sporcuların maksimum ve ortalama eksantrik hamstring kas kuvvetleri ve kas kuvveti farklılıkları arasında istatistiksel olarak anlamlı bir fark bulunmamıştır. Ayrıca, kadın ve erkek sporcular arasında ortalama ve maksimum eksantrik hamstring kas kuvveti ve pozisyonlarına göre kas kuvveti farklılıkları açısından anlamlı bir fark bulunmamıştır (F=0.001-3.823; p=0.055-0.972). Çalışmamızda hem kadın hem erkek voleybol oyuncuların eksantrik hamstring kuvvetleri ve iki taraf arası kuvvet farklılık yüzdeleri mevkilere göre farklılık göstermediği bulundu. Geçmiş araştırmalarda ve araştırmamızda, voleybolcuların eksantrik hamstring kuvvet düzeylerinin mevkilere göre farklılık göstermemesi, voleybolun değişen yapısı ile ilgili olduğu düşünülmektedir.

Anahtar Kelimeler: Eksantrik kas kuvveti, hamstring, oyun pozisyonu, voleybol.

INTRODUCTION

Hamstrings are the muscle group with the highest injury rate and risk. Hamstring injuries constitute a significant portion of sports-related muscle injuries, accounting for 54.4% of such injuries (1). This high incidence rate underscores the vulnerability of the hamstring muscles, particularly in activities that involve high-intensity running and sudden accelerations or decelerations. The prevalence of hamstring injuries has a substantial impact on athletes, often causing them to be sidelined for extended periods and resulting in decreased performance across various sports disciplines. Hamstring muscle injuries (HMI) are especially common in running-based sports such as athletics, football, American and Australian football, and rugby (1, 2). The ramifications of these injuries extend beyond the athletic arena, contributing to increased labor force losses and heightened costs for both sedentary individuals and sports clubs. This highlights the broader economic and performance-related consequences of hamstring injuries, emphasizing the need for effective prevention and rehabilitation strategies (3). In order to prevent HMI, it is important to understand why they occur so that an appropriate approach targeting specific risk factors can be developed. Among the factors that lead to HMI are advanced age, history of hamstring injury, decreased eccentric hamstring muscle strength, imbalance in the ratio of hamstring muscle strength to quadriceps muscle strength, delay in hamstring reaction time leading to muscle fatigue, poor lumbopelvic stability, and impaired hamstring muscle architecture (3, 4).

Eccentric knee flexor muscle weakness is arguably the most frequently reported risk factor for HMI. Eccentric hamstring muscle strength deficits have been identified as a risk factor for recurrent HMI. This result suggests that weakness is a predisposing factor for both new and recurrent ACL. Therefore, the assessment of hamstring muscle eccentric strength at different stages of the season is considered a key strategy for the deliberate prevention of ACL (4, 5). The multidimensional role of hamstring strength in athletic performance is well understood and the direct contribution of hamstring strength to athletic skills such as sprinting and jumping has been demonstrated in several studies (6, 7). Hamstring strength also plays an important role in knee joint stabilisation and indirectly influences the qualities of agility manoeuvres such as acceleration, deceleration, changing direction and cutting (8). It has also been suggested that hamstring weakness increases the risk of ACL, which is a typical sports injury and occurs in sports such as athletics and volleyball that require high sprint speed and/or simultaneous excessive muscle tension (9). Low hamstring strength or inadequate activation is associated with non-contact anterior cruciate ligament (ACL) injuries, which are particularly high in team sports such as football and volleyball. In particular, as a synergist of the ACL, the lateral hamstring muscle spans two joints and provides secondary protection, especially at smaller joint angles (10).

Vertical jumping is a very important skill in volleyball and is important during blocking, attacking and passing (11, 12). A high level of knee muscle strength is required during the take-off and landing phases of the vertical jump, which requires high torque and power in concentric and eccentric movements of the knee extensor and flexor muscles (13). During a volleyball player's career, an increase in the intensity and frequency of training may lead to acute and chronic injuries and athletes may quit the sport (14). These events can be explained by strength imbalances between muscle groups or between dominant and non-dominant limbs, which predispose the joint to instability and ligament overload (15-17). Therefore, it is important to measure knee muscle strength and determine agonist-antagonist muscle imbalances in preparing training guidelines to reduce the risk of injury and increase muscle strength (13, 18, 19). In many prospective studies in the

literature, the effects of eccentric and concentric knee flexor muscle strength on hamstring injury rates have been investigated (3, 20-23). However, most of these studies have been performed on footballers and studies in volleyball players are insufficient. To the best of our knowledge, there is no study comparing eccentric hamstring muscle strength in volleyball players according to their positions. In addition, this study was hypothesised that there would be a difference in eccentric hamstring strength parameters between dominant and non-dominant side legs of volleyball players according to their positions. In this context, the aim of this study was to compare the eccentric hamstring muscle strength of elite volleyball players according to their playing positions.

METHOD

In the study, 63 (n=31 female and n=32 male) elite volleyball players between the ages of 18-35 (n=31 female and n=32 male) participated voluntarily in a similar training programme in the Turkish Volleyball 1st League season. The athletes were categorized into their playing positions based on their roles and responsibilities within their respective teams. The categorization was as follows: libero (n=5 females and n=6 males), middle player (n=8 females and n=8 males), opposite (passer cross, n=4 females and n=6 males), setter (passer, n=6 females and n=4 males), and spiker (n=7 females and n=9 males). These positions were determined by the specific functions each athlete performed during matches and training sessions. Liberos are defensive specialists responsible for receiving serves and playing in the back row. Middle players, or middle blockers, are primarily responsible for blocking and quick attacks at the net. Opposites, or passers cross, play a versatile role, often involved in both offensive and defensive plays. Setters, or passers, are responsible for setting up offensive plays by delivering accurate sets to attackers. Spikers, or outside hitters, are the primary attackers on the team, responsible for scoring points through powerful hits. This categorization ensured that each player's position was accurately represented according to their specialized skills and duties on the court. The required sample size was calculated using G*Power (G*Power, Ver.3.0.10, Universitat Kiel, Germany) programme with alpha= 0.05, beta=0.20 (Power 80%) and f=0.40 (effect size; f >0.10 small, >0.25 medium, >0.40 large) effect size and the number of participants was calculated as minimum 10 for each group (24, 25). The inclusion criteria were determined as being a professional volleyball athlete between the ages of 18-35 years, playing active and licensed sports for at least three years, not having any injury related to the lower extremity and hamstring in the last 3 months, not having any surgical operation in the lower extremity, and having regular participation in training during the study. Those who had any illness or injury that could affect performance in the last 6 months, those who had an injury that would keep them away from sports for more than 2 weeks in the last 3 months, and those who had Covid-19 in the last 6 months were not included.

Data Collection and Analysis

Sociodemographic data such as age, height, body weight, gender, dominant side, and years of sport were recorded. The dominant lower extremity was defined as the extremity in which the player takes the last step during jumping (26). It was found that 23.25% (n=10) of the athletes included in the study were left dominant and 76.25% (n=33) were right dominant. Body weight and body mass index were measured using a bioelectrical impedance analyser (Tanita 300 MA, Tanita Co., Tokyo-Japan) and height was measured using a stadiometer (SECA 213, Seca GmbH & Co. Kg, Hamburg, Germany). Eccentric hamstring muscle strength of the athletes was measured during Nordic hamstring exercise using iVMES H-BORD® [iVMES, Ankara, Turkey; Sampling Rate: 50 Hz (default) - 400 Hz, Capacity (per sensor): 1000 N / 100 kg, Safe Overload (per sensor): 1500 N / 150 kg, Maximum Overload (per sensor/2 sensors): 2000 N / 200 kg, Resolution: 1 N] measured with the device (Figure 1).

Figure 1: iVMES H-BORD®

Eccentric Hamstring Muscle Strength Measurement

Eccentric hamstring muscle strength of the athletes was measured during Nordic hamstring exercise (NHE) using IVMES H-Bord (IVMES, Ankara, Turkey) [Intraclass correlation coefficient (ICC)=0.90-097] (27). Before the test, NHE was performed at submaximal intensity with 1 set of 3 repetitions in order to understand and familiarise the movement. Nordic Hamstring exercise protocols were performed in eccentric mode with a maximum of 3 eccentric movements in 1 set. Rest was given for 2 minutes between each repetition. Each trial was recorded from the sagittal plane using a Canon XA35 camera at 50 Hz. The camera was placed on a stand fixed 3 m away from the participant and 0.5 m high (28). The angular changes required to determine the movement quality of each participant were calculated using reflective markers placed on the anatomical prominences of the greater trochanter, lateral femoral condyle and lateral malleolus, which have been reported in previous studies (9, 27). Measurements were performed with minimal clothing to prevent movement of the markers. Participants were placed in a kneeling position on the padded section of the device and each ankle was secured at the top of the lateral malleolus with separate supports. Participants were instructed to gradually lean forward from an upright position (90° knee flexion) at the slowest possible speed, maximally resisting the movement with both extremities, while keeping their trunk and hips in a neutral position with their hands on their chest. The NHE performance was completed at -30°-s-1 in accordance with previous studies (29, 30). If the participants were unable to meet the 30°-s-1 forward bending speed (as a result of video analyses), the NHE trials were repeated. The movement technique required participants to minimise hip flexion and lumbar lordosis throughout the repetitions to maintain a straight line from shoulder to knee. If participants showed a lack of control during landing or excessive hip movement during the repetition as a result of the video analyses, these repetitions were not included in the calculation. NHE trials in which hip flexion exceeded 20° at any time point and/or NHE trials with a mean forward bending velocity outside 20-40° s-1 were not included in the analyses. The values obtained from the device are maximum force, mean force and imbalance values within three repetitions for the right and left hamstring muscles, respectively.

Statistical Analysis

SPSS Version 26 (IBM SPSS® software, US) programme was used for statistical analysis of the data. The conformity of the data to normal distribution was evaluated visually and by Shapiro-Wilk test. Numerical variables were summarised as mean±standard deviation and categorical variables as frequency (percentage). In intergroup comparisons, one-way analysis of variance (ANOVA) was used for numerical variables and Pearson Chi-square test was used for categorical variables. The statistically significant level was set as $p < 0.05$.

Ethical Approval

Ethical approval for the study was obtained from the Non-Drug and Non-Medical Device Research Ethics Committee of KTO Karatay University on 31.03.2023, with the registration number 2023/006. Participants were informed about the purpose and content of the study, and a voluntary consent form was signed before the research procedure began. This study was conducted in accordance with the principles of the Declaration of Helsinki.

FINDINGS

Table 1. Data on the comparison of the physical characteristics of the participants according to their positions

		Libero (n=11)	Middle player (n=16)	Opposite (n=10)	Setter (n= 10)	Wing Spiker (n=16)	Test statistics	
		Mean±Sd	**Mean±Sd**	**Mean±Sd**	**Mean±Sd**	**Mean±Sd**	**F**	**p**
Age (years)	M	18.0±0.70	18.7±1.48	20.0±6.06	21.2±7.36	22.8±6.09	0.577	0.681
	F	23.0±3.87	22.1±4.77	19.2±2.62	20.0±4.42	20.3±7.04		
Height (m)	M	1.90±0.04	1.89±0.03	1.84±0.03	1.81±0.04	1.90±0.02	0.778	0.312
	F	1.88±0.03	1.89±0.01	1.86±0.02	1.82±0.03	1.88±0.02		
Weight (kg)	M	77.20±3.96	71.75±6.96	71.00±0.90	66.25±5.31	74.90±7.13	0.782	0.215
	F	73.2 ±5.83	76.85±3.13	68.75±3.59	65.16±4.79	70.28±5.93		
BMI (kg/m2)	M	21.32±0.20	19.95±1.55	20.87±0.75	20.09±1.10	20.53±1.73	0.378	0.789
	F	20.65±1.67	21.50±0.55	19.71±0.96	19.62±1.00	19.80±1.31		
Sport experience (years)	M	4.06±0.04	4.16±1.02	4.76±2.34	4.37±1.46	4.51±1.76	0.390	0.897
	F	3.86±1.11	4.44±0.97	4.53±1.87	4.41±1.51	4.22±1.64		
							X2	p
D-Side (n)	Right	8	13	10	7	15	6.831	0.145
	Left	3	3	0	3	1		
Gender (n)	M	6	8	6	4	9	1.367	0.850
	F	5	8	4	6	7		

Mean±Sd: Mean±Standard deviation / F: ANOVA test, X2 : Pearson Chi-square test, BMI: Body mass index, D: Dominant, M: Male, F: Female, m: meter, kg: kilogram

It was found that there was no significant difference in age, height, body weight, body mass index (BMI), years of sport and dominant extremity values of volleyball players according to their positions (Table.1).

Table 2: Hamstring strength comparison by player position

	Libero (n=11)	Middle player (n=16)	Opposite (n=10)	Setter (n= 10)	Wing Spiker (n=16)	Test statistics	
	Mean±Sd	Mean±Sd	Mean±Sd	Mean±Sd	Mean±Sd	F	p
Max HEcc D (N)	332.40±103.58	352.32±77.18	355.50±78.88	261.97±27.95	275.91±61.45	6.979	0.137
	244.38±63.55	275.34±58.92	264.21±38.88	261.03±48.30	314.27±49.44	3.490	0.479
F;p	3.201;0.111	0.851;0.373	0.485;0.506	1.532;0.251	0.064;0.804	0.173	0.679
Max HEcc ND (N)	331.04±106.13	321.96±78.29	339.70±65.36	256.05±26.45	265.09±65.96	6.985	0.137
	248.32±63.84	282.14±58.50	254.71±41.21	272.01±46.30	307.54±36.31	4.963	0.291
F;p	1.664;0.233	2.374;0.147	0.537;0.485	1.548;0.249	0.129;0.724	0.080	0.778
Mean HEcc D (N)	307.86±90.92	311.61±63.93	342.35±58.51	243.75±39.29	246.50±50.40	5.525	0.238
	224.46±66.43	268.90±43.04	239.26±50.21	240.46±37.13	304.90±49.56	5.331	0.255
F;p	0.009;0.926	1.890;0.192	0.614;0.456	0.890;0.373	1.415;0.252	0.001	0.972
Mean HEcc ND (N))	310.24±87.95	294.11±72.48	325.92±56.66	245.95±38.77	237.02±52.87	6.770	0.149
	220.02±74.15	257.44±39.54	236.05±52.11	257.71±52.54	280.65±41.91	3.229	0.520
F;p	1.074;0.330	2.919;0.111	1.378;0.274	0.938;0.361	0.024;0.878	0.044	0.835
Max difference (%)	8.84±0.08	11.30±1.93	14.21±1.44	4.90±0.72	11.56±3.24	4.167	0.384
	9.56±0.25	7.61±0.43	5.15±0.24	8.70±1.80	8.64±1.33	0.403	0.982
F;p	0.066;0.804	1.666;0.219	1.469;0.260	2.143;0.181	1.847;0.193	3.823	0.055
Mean difference (%)	7.72±0.67	10.23±1.63	13.58±1.86	3.75±0.30	9.97±1.98	4.670	0.323
	4.90±0.78	6.64±0.68	4.52±0.05	8.70±1.74	6.77±1.52	1.963	0.743
F;p	2.625;0.144	0.008;0.931	1.505;0.255	3.533;0.097	0.002;0.963	0.985	0.325

Max HEcc: Maximum eccentric hamstring strength, Mean HEcc: Average eccentric hamstring strength, D: Dominant side, ND: Non-dominant side, Max: Maximum, N: Newton, SD: Standard deviation, F: ANOVA test statistic, M: Male, F: Female, $p<0.05$

As a result of the comparison of the eccentric hamstring strength of the volleyball players according to the positions, it was determined that there was no statistically significant difference between the maximum and mean eccentric hamstring muscle strengths and muscle strength differences of both female (F=0.403-5.331;p=0.255-0.982) and male (F=4.167-6.985; p=0.137-0.384) athletes. In addition, there was no significant difference between male and female athletes in terms of mean and maximum eccentric hamstring muscle strength and muscle strength differences according to their positions (F=0.001-3.823; p=0.055-0.972) (Table 2).

DISCUSSION AND CONCLUSION

In this study, which aimed to compare the eccentric hamstring muscle strength levels of elite volleyball players according to their playing positions, it was found that there was no significant difference in terms of maximum and mean eccentric hamstring muscle strength of both male and female athletes according to their playing positions. To the best of our knowledge, no previous studies have examined the isolated eccentric hamstring strength of volleyball players based on their playing positions, although a few studies have evaluated hamstring muscle strength in relation to playing positions. Aka et al. (31) compared concentric quadriceps and hamstring isokinetic muscle strengths in volleyball players according to positions. As a result of the study, it was determined that there was no significant difference between the concentric quadriceps and hamstring muscle strengths of spikers, passers, and middle players at angular velocities of 60°s-1 and 180°s-1.

In contrast to this data, Küçükbaycan et al. (32) reported that there was no difference between the leg muscle strengths of spikers and middle players before the preparation period, but after the preparation period, the leg strengths of middle players were significantly higher than those of spikers in their study in which they compared the leg muscle strengths of female volleyball players before and after the preparation period according to their positions. Margues et al. (33) found that there were serious anthropometric and strength differences between the playing positions of male volleyball players and squat performance of passers was lower than other volleyball players. When the studies conducted in different sports branches were examined, Yılmaz et al. (34) stated that defenders had higher knee flexion and extension muscle strengths at an angular velocity of 60°sec-1 than forwards and midfielders in their study in which they compared isokinetic knee strengths according to positions in football players. Other studies comparing isokinetic knee strength in football players according to positions showed that defenders had higher strength ratios than forwards and midfielders (35,36). From this point of view, it was thought that the fact that defenders showed higher ratios at lower angular velocities compared to midfielders and forwards was the result of the fact that defenders had to move faster in the game to prevent opponent attacks and had to react instantaneously in defense. Tourny-Chollet et al. (36) reported that forwards had higher concentric hamstring muscle strength than center players. These differences were attributed to the higher forces produced by strikers at low and medium speeds during knee flexion. When the results of all these studies are analyzed, it is seen that there is no common opinion on strength comparisons between playing positions in existing studies, including our study. In addition, in these studies, comparisons were made according to concentric quadriceps and hamstring strengths. In our study, maximum and mean eccentric hamstring strength were evaluated. This focus on eccentric strength is a strength of our study and will serve as a reference for future research in this area. Because in the current literature, the strongest evidence among the risk factors of HFM is expressed as eccentric hamstring muscle strength weakness (3). Therefore, evaluating eccentric hamstring muscle strength is crucial in identifying injury risks in athletes and tailoring individual training programs according to their positions.

The practical implications of these findings are significant for training and injury prevention strategies. Coaches and sports scientists should consider incorporating regular assessments of eccentric hamstring strength into their training programs, regardless of the player's position. Such assessments can help in identifying potential weaknesses or imbalances that may predispose athletes to injury. Moreover, developing targeted strength and conditioning programs that address eccentric strength can be beneficial in enhancing overall performance and reducing injury risk. Given that no significant differences were found across positions, a uniform approach in training for eccentric hamstring strength may be effective.

This study presents several limitations that need to be acknowledged. Firstly, the sample size, while sufficient for initial exploration, may not capture the full variability within elite volleyball players' eccentric hamstring strength across different positions. Thus, results should be interpreted with caution when generalizing to broader populations. Secondly, the study exclusively focused on elite athletes from the Turkish Volleyball 1st League; therefore, findings may not directly apply to athletes from different competitive levels or leagues, potentially limiting the external validity of the study. Another limitation is the study's reliance on a single method (Nordic Hamstring exercise using the IVMES H-Bord device) for assessing eccentric hamstring muscle strength. While this method is widely accepted and provides valuable information, it does not encompass all aspects of hamstring function relevant to volleyball performance. Additionally, the study did not account for variables such as previous injury history or individual differences in training outside the team's program, which could influence eccentric hamstring strength. Moreover, the cross-sectional design limits the ability to infer causality or changes over time, hindering the understanding of how eccentric hamstring strength might evolve across a season or in response to specific training interventions. Lastly, the classification of players into positions, while necessary for the study's objectives, does not account for the fluidity of player roles and the multifaceted nature of volleyball, where players may perform tasks outside their primary positions.

Future research should consider longitudinal designs, larger and more diverse samples, and comprehensive assessments of hamstring function to build on the findings of this study. Exploring other dimensions of hamstring strength, such as concentric and isometric strengths, and their impact on performance and injury prevention in volleyball could provide a more holistic understanding of the muscle group’s role. Additionally, integrating various assessment methods and considering the influence of training

history and injury background could offer deeper insights into the development and maintenance of hamstring strength in volleyball players.

CONCLUSIONS

As a result of our study, we demonstrated that the grip strength of the dominant hand was higher with the bilateral grip compared to the unilateral grip, providing compelling evidence for the PNF irradiation principle. This finding is novel as it underscores the effectiveness of bilateral grip strength training, which has not been extensively explored in the current literature. Additionally, this information highlights the bilateral approach as a promising treatment option in training programs aimed at strengthening muscles and enhancing motor skills.

Given the novelty of our findings, further research is warranted to build on these results. Future studies should consider exploring the impact of bilateral grip strength training across different populations, including athletes from various sports, elderly individuals, and those undergoing rehabilitation. Additionally, investigating the long-term effects of bilateral versus unilateral training on muscle strength and motor skill development could provide deeper insights. Researchers should also examine other muscle groups and motor activities to determine if the benefits observed with bilateral grip strength training extend to other areas. Lastly, integrating different assessment methods and considering factors such as training history, injury background, and specific athletic demands could help in understanding the broader applicability and effectiveness of the bilateral approach.

Conflicts of interest and Funding

The authors declare no conflict of interest and funding.

REFERENCES

1. Eirale C, Farooq A, Smiley FA, Tol JL, Chalabi H. Epidemiology of football injuries in Asia: a prospective study in Qatar. J Sci Med Sport. 2013;16(2):113-117.
2. Orchard JW, Seward H, Orchard JJ. Results of 2 decades of injury surveillance and public release of data in the Australian Football League. Am J Sports Med. 2013;41(4):734-741.
3. Martin RL, Cibulka MT, Bolgla LA, Koc Jr TA, Loudon JK, Manske RC, et al. Hamstring Strain Injury in Athletes: Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability and Health From the Academy of Orthopaedic Physical Therapy and the American Academy of Sports Physical Therapy of the American Physical Therapy Association. J Orthop Sports Phys Ther. 2022;52(3):CPG1-CPG44.
4. Maniar N, Carmichael DS, Hickey JT, Timmins RG, San Jose AJ, Dickson J, et al. Incidence and prevalence of hamstring injuries in field-based team sports: a systematic review and meta-analysis of 5952 injuries from over 7 million exposure hours. Br J Sports Med. 2023;57(2):109-116.
5. Shield AJ, Bourne MN. Hamstring injury prevention practices in elite sport: evidence for eccentric strength vs. lumbo-pelvic training. Sports Med. 2018;48:513-524.
6. Váczi M, Fazekas G, Pilissy T, Cselkó A, Trzaskoma L, Sebesi B, et al. The effects of eccentric hamstring exercise training in young female handball players. Eur J Appl Physiol. 2022;122(4):955-964.
7. Markovic G, Sarabon N, Boban F, Zoric I, Jelcic M, Sos K, et al. Nordic hamstring strength of highly trained youth football players and its relation to sprint performance. J Strength Cond Res. 2020;34(3):800-807.
8. Greig M, Naylor J. The efficacy of angle-matched isokinetic knee flexor and extensor strength parameters in predicting agility test performance. Int J Sports Phys Ther. 2017;12(5):728.
9. Lee JW, Mok K-M, Chan HC, Yung PS, Chan K-M. Eccentric hamstring strength deficit and poor hamstring-to-quadriceps ratio are risk factors for hamstring strain injury in football: A prospective study of 146 professional players. J Sci Med Sport. 2018;21(8):789-793.
10. Zebis MK, Andersen LL, Bencke J, Kjær M, Aagaard P. Identification of athletes at future risk of anterior cruciate ligament ruptures by neuromuscular screening. Am J Sports Med. 2009;37(10):1967-1973.
11. Lidor R, Ziv G. Physical and physiological attributes of female volleyball players-a review. J Strength Cond Res. 2010;24(7):1963-1973.
12. Sattler T, Sekulic D, Hadzic V, Uljevic O, Dervisevic E. Vertical jumping tests in volleyball: reliability, validity, and playing-position specifics. J Strength Cond Res. 2012;26(6):1532-1538.
13. Dervišević E, Hadžić V. Quadriceps and hamstrings strength in team sports: Basketball, football and volleyball. Isokinet Exerc Sci. 2012;20(4):293-300.

14. Pelegrinelli ARM, Dela Bela LF, Silva MF, Rodrigues LCR, Batista JP, Jr., Guenka LC, et al. Velocity-specific knee strength between professional and under-17 female volleyball players. South Afr J Physiother. 2019;75(1):1-7.
15. Bamaç B, Çolak T, Özbek A, Çolak S, Cinel Y, Yenigün Ö. Isokınetıc performance ın elıte volleyball and basketball players. Kinesiology. 2008;40(2):182-188.
16. Coombs R, Garbutt G. Developments in the use of the hamstring/quadriceps ratio for the assessment of muscle balance. J Sports Sci Med. 2002;1(3):56-62.
17. Panni AS, Biedert RM, Maffulli N, Tartarone M, Romanini E. Overuse injuries of the extensor mechanism in athletes. Clin Sports Med. 2002;21(3):483-498.
18. Ardern CL, Pizzari T, Wollin MR, Webster KE. Hamstrings strength imbalance in professional football (soccer) players in Australia. J Strength Cond Res. 2015;29(4):997-1002.
19. Hadzic V, Sattler T, Markovic G, Veselko M, Dervisevic E. The isokinetic strength profile of quadriceps and hamstrings in elite volleyball players. Isokinet Exerc Sci. 2010;18(1):31-37.
20. Opar D, Williams M, Timmins R, Hickey J, Duhig S, Shield A. Eccentric hamstring strength and hamstring injury risk in Australian footballers. Med Sci Sports Exerc. 2015;47(4):857-865.
21. Timmins RG, Bourne MN, Shield AJ, Williams MD, Lorenzen C, Opar DA. Short biceps femoris fascicles and eccentric knee flexor weakness increase the risk of hamstring injury in elite football (soccer): a prospective cohort study. Br J Sports Med. 2016;50(24):1524-1535.
22. Bourne MN, Opar DA, Williams MD, Shield AJ. Eccentric knee flexor strength and risk of hamstring injuries in rugby union: a prospective study. Am J Sports Med. 2015;43(11):2663-2670.
23. Yeung SS, Suen AM, Yeung EW. A prospective cohort study of hamstring injuries in competitive sprinters: preseason muscle imbalance as a possible risk factor. Br J Sports Med. 2009;43(8):589-594.
24. Faul F, Erdfelder E, Lang AG, Buchner A. G* Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. Behav Res Methods. 2007;39(2):175-191.
25. Cohen J. Statistical power analysis Jbr the behavioral. Sciences. Hillsdale (NJ): Lawrence Erlbaum Associates. 1988;18:74.
26. Soylu Ç, Altundağ E, Akarçeşme C, Ün Yildirim N. The relationship between isokinetic knee flexion and extension muscle strength, jump performance, dynamic balance and injury risk in female volleyball players. Journal of Human Sport and Exercise. 2020;5(3):502-514.
27. Akarçeşme C, Cengizel E, Alvurdu S, et al. Reliability and validity of the new portable Nordic hamstring test device (IVMES H-Bord). Proc. Inst. Mech. Eng. Pt. P J. 2024;0(0).
28. Rhodes D, Jeffrey J, Maden-Wilkinson J, Reedy A, Morehead E, Kiely J, et al. The relationship between eccentric hamstring strength and dynamic stability in elite academy footballers. Sci Med Footb. 2021;5(1):48-54.
29. Opar DA, Piatkowski T, Williams MD, Shield AJ. A novel device using the Nordic hamstring exercise to assess eccentric knee flexor strength: a reliability and retrospective injury study. J Orthop Sports Phys Ther. 2013;43(9):636-640.
30. Wiesinger HP, Gressenbauer C, Kösters A, Scharinger M, Müller E. Device and method matter: A critical evaluation of eccentric hamstring muscle strength assessments. Scand J Med Sci Sports. 2020;30(2):217-226.
31. Hasan A, Aytar SH, Akarçeşme C, Aktuğ ZB. Is there a difference in isokinetic knee muscle strength between player positions in volleyball? Int J Sport Cult Sci. 8(4):302-309.
32. Küçükbaycan Ç, Yenigün N, Yenigün Ö, Dinçer Ö. Comparison of pre-season and post-season leg strength of volleyball players in the blocker and the spiker players. İstanbul Univ J Sport Sci. 2011;3(ÖS):137-140.
33. Marques MAC, González-Badillo JJ, Kluka DA. In-season resistance training for professional male volleyball players. Strength Cond J. 2006;28(6):16-27.
34. Yılmaz A, Kabadayı M, Bostancı Ö, Özdal M, Mayda M. Analysis of isokinetic knee strength in soccer players in terms of selected parameters. Phys Educ Students. 2019;23(4):209-216.
35. Meriç B, Aydın M, Çolak T, Çolak E, Son M. The comparison of knee isokinetic performances and anthropometric measurement of professional soccers who play different position. J Hum Sci. 2007;4(2).
36. Tourny-Chollet C, Leroy D, Léger H, Beuret-Blanquart F. Isokinetic knee muscle strength of soccer players according to their position. Isokinet Exerc Sci. 2000;8(4):187-194.
37. Bishop C, Turner A, Read P. Effects of inter-limb asymmetries on physical and sports performance: a systematic review. J Sports Sci. 2018;36(10):1135-1144.
38. Croisier JL, Ganteaume S, Binet J, Genty M, Ferret JM. Strength imbalances and prevention of hamstring injury in professional soccer players: a prospective study. Am J Sports Med. 2008;36(8):1469-1475.
39. Mokha M, Sprague PA, Gatens DR. Predicting Musculoskeletal Injury in National Collegiate Athletic Association Division II Athletes From Asymmetries and Individual-Test Versus Composite Functional Movement Screen Scores. J Athl Train. 2016;51(4):276-282.

40. Parkinson AO, Apps CL, Morris JG, Barnett CT, Lewis MGC. The Calculation, Thresholds and Reporting of Inter-Limb Strength Asymmetry: A Systematic Review. J Sports Sci Med. 2021;20(4):594-617.

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Examining the Relationship Between Exercise Dependence and Loneliness in Fitness Individuals

Recep CENGİZ[1A], Batuhan ER[2B]

[1] *Manisa Celal Bayar University, Faculty of Sport Sciences, Department of Recreation, Manisa, TÜRKİYE*
[1] *İstanbul Aydın University, Faculty of Sport Sciences, Department of Recreation, Istanbul, TÜRKİYE*

Address Correspondence to Batuhan ER e-mail: batuhaner32@hotmail.com

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A: Orcid ID: 0000-0003-4097-2237 B: Orcid ID: 0000-0002-4269-4149

Abstract

The aim of this study was to examine the relationship between exercise dependence and loneliness levels of fitness individuals. For this purpose, 300 individuals, 104 women and 196 men (Mean Age = 27.13 ± 9.866) who were fitness participants, were included in the study. The Exercise Dependence Scale-21, whose Turkish validity and reliability was provided by Yeltepe and Can İkizler (2007), and the UCLA Loneliness Scale-III, whose Turkish validity and reliability study was conducted by Durak and Durak (2010), were used as measurement tools in the study. Descriptive statistics, Pearson Correlation test and simple linear regression analyzes were used to analyze the data, using the SPSS 25 package program. When the results were examined, a negative relationship was found between exercise dependence sub-dimensions and total score and loneliness. Additionally, the loneliness variable was found to be a significant predictor of exercise dependence. As a result, it was concluded that the exercise dependence of the participating individuals was related to their loneliness levels and that their loneliness levels affected exercise dependence. It is possible to say that the loneliness levels of individuals participating in fitness interact with their exercise dependence.

Keywords: Exercise dependence, loneliness, fitness participants.

Fitness Yapan Bireylerin Egzersiz Bağımlılığı ve Yalnızlık İlişkisinin İncelenmesi

Özet

Bu çalışma fitness yapan bireylerin egzersiz bağımlılığı ve yalnızlık düzeylerinin incelenmesi amacıyla gerçekleştirilmiştir. Çalışmanın amacı doğrultusunda fitness katılımcısı 104 kadın ve 196 erkek (YaşOrt.= 27,13 ± 9,866) 300 birey araştırmaya dâhil edilmiştir. Çalışmada ölçüm araçları olarak Yeltepe ve Can İkizler (2007) tarafından Türkçe geçerlilik ve güvenilirliği sağlanan Egzersiz Bağımlılığı Ölçeği-21 ile Durak ve Durak (2010) tarafından Türkçe geçerlilik ve güvenilirlik çalışması gerçekleştirilen UCLA Yalnızlık Ölçeği-III kullanılmıştır. Verilerin analizinde SPSS 25 paket programından yararlanılarak, tanımlayıcı istatistikler, Pearson Korelasyon testi ve basit doğrusal regresyon analizleri kullanılmıştır. Elde edilen sonuçlar incelendiğinde egzersiz bağımlılığı alt boyutları ve toplam puanı ile yalnızlık arasında

negatif yönlü ilişki tespit edilmiştir. Ayrıca yalnızlık değişkeninin egzersiz bağımlılığının anlamlı bir yordayıcısı olduğu tespit edilmiştir. Sonuç olarak katılımcı bireylerin egzersiz bağımlılığının yalnızlık düzeyleri ile ilişkili olduğu ve yalnızlık düzeylerinin egzersiz bağımlılığını etkilediği sonucuna ulaşılmıştır. Fitness katılımı gösteren bireylerinin yalnızlık düzeylerinin egzersiz bağımlılıkları ile etkileşim içerisinde olduğunu söylemek mümkündür.

Anahtar Kelimeler: Egzersiz bağımlılığı, yalnızlık, fitness katılımcıları.

INTRODUCTION

Over-exercising can have negative effects on a person's mental and physical well-being. This condition is reflected in exercise dependence, which results from consistent engagement in moderate- to high-intensity exercise and manifests as the conversion of exercise into a compulsive habit (Hausenblas and Downs, 2002a). Excessive bodily desire while exercise is one way to describe exercise dependence. Despite the well-known negative effects of exercise, the persistence of activity, particularly in conditions like injury, and the negative emotions experienced if this is avoided, suggest a dependence on exercise (Vardar, 2012). The conceptual approach to exercise dependence includes behavioral factors such as exercise frequency, psychological factors such as pathological dependence, and physiological factors such as tolerance. For the definition of exercise dependence, Veal introduced a criterion based on the DSM-IV diagnostic criteria for substance dependence. It is stated that the presence of 3 or more of these criteria causes clinical impairment and distress. These criteria are as follows:

- ✓ Tolerance: It is defined as the need to perform a significantly increasing amount of exercise to achieve the desired effect, or the effect decreasing with continued use of the same amount of exercise.
- ✓ Withdrawal: It is manifested by symptoms that occur when not exercising, such as anxiety and fatigue, or by performing the same or similar amount of exercise to relieve or prevent these withdrawal symptoms.
- ✓ Intention Effects: Exercise is often performed in larger amounts or for a longer period of time than intended.
- ✓ Lack of Control: There is a persistent desire or unsuccessful effort to reduce or control exercise.
- ✓ Time: A lot of time is spent on activities required to exercise.
- ✓ Reductions in Other Activities: Give up or reduction of social, occupational, or recreational activities due to exercise.
- ✓ Continuance: Continuing to exercise despite the knowledge that there is a permanent or recurring physical or psychological problem that is caused or worsened by exercise (Hausenblas and Downs, 2002b).

Although some research in the literature (Özçelik et al., 2015; Pels and Kleinert, 2016; Hwang et al., 2019) suggests that engaging in sports, physical activity, or exercise can provide positive experiences that reduce feelings of loneliness, this study investigates the relationship between loneliness and exercise dependence.

Inadequate and unsatisfactory social experiences in social relations can affect individuals' lives to different extents. This situation can cause the individual to withdraw from society and feel lonely. Loneliness, which is known to cause many psychological crises and personality disorders, stands out as an emotion experienced intensely in society (Buluş, 1997). Loneliness refers to a sad and common experience, according to the conclusion obtained from many individual experiences (Perlman and Peplau, 1981). The state of loneliness is a particularly emotionally unpleasant experience. Individuals' perception that their social relationships do not meet their expectations emerges. The experience of loneliness stands out as an important indicator that a person has difficulty in social relationships, indicating the inadequacy of their relationships (Heinrich and Gullone, 2006).

It can be argued that engaging in various forms of exercise promotes mental health by easing the symptoms of stress, anxiety, and depression (Mikkelsen et al., 2017) and increases mental well-being by satisfying people's basic psychological needs (Öner, 2019). However, in addition to these contributions of exercise, individuals may experience loneliness due to the weakness of social life. It is also thought that the

negative emotional state created by the experience of loneliness may cause them to participate in exercise to the extent of dependence.

The idea that the increasing loneliness in individuals' lives, especially in line with the technological developments in recent years, may result in exercise dependence reflects the reason for conducting the research. The idea that the loneliness of individuals in fitness centers, which is one of the most common areas for participation in exercise today, may cause exercise dependence behavior constitutes the necessity and problem statement of this research. In this regard, the aim of the study is to examine the exercise dependence and loneliness levels of fitness individuals.

Problem Statement of the Research: Does the loneliness of fitness individuals have an effect on exercise dependence?

Hypotheses

H1: The loneliness of fitness individuals is related to exercise dependence.

H2: The loneliness of fitness individuals has an effect on exercise dependence.

METHOD

In the study, the relational survey model, one of the quantitative research methods, was used. The relational survey model is used to determine the relationship between two or more variables (Büyüköztürk et al., 2008).

Study Group

A total of 300 individuals, 104 women (34.7%) and 196 men (65.3%), with an average age of 27.13±9.866 years old, participating in fitness activities in gyms in Manisa province, participated in the study. It was determined that 64% of the participants do sports regularly, 69% have a good or very good income, and 50.7% have a sports background.

Table 1. Findings regarding the demographic information of the participants

	$\bar{X}$	**S.s**
Age	27.13	9.866
Gender	**N**	**%**
Female	104	34.7
Male	196	65.3
Regular Sport Participation	**N**	**%**
Yes	192	64.0
No	108	36.0
Income Status	**N**	**%**
Bad	93	31.0
Good	162	54.0
Very Good	45	15.0
Sports Backround	**N**	**%**
Yes	152	50.7
No	148	49.3

Data Collection Tools

Demographic information form, Exercise Dependence-21 Scale and UCLA-III Loneliness Scale were used as data collection tools in the study.

Demographic Information Form: The demographic information form created by the researchers to be used in the study includes variables such as age, gender, regular sports participation, income status and sports backround.

Exercise Dependence-21 Scale: Exercise Dependence-21 Scale was developed by Hausenblas and Downs (2002a). The Turkish validity and reliability study of the scale was conducted by Yeltepe and İkizler (2007). The scale consists of 21 items and has a 6-point Likert type structure: (1) never and (6) always. The scale

provides information about average scores regarding exercise dependence symptoms, asymptomatic-symptomatic and exercise dependence. The scale is based on 7 dependence criteria, and it has been stated that individuals who show 3 or more of these criteria can be classified as exercise depend. People with a score of 1-2 on the scale are considered asymptomatic, people with a score of 3–4 are considered symptomatic, and people with a score of 5–6 meet the criteria for addiction. The scale's criteria for dependency include: tolerance, withdrawal, intention effect, lack of control, time, reductions in other activities and continuance. The internal consistency coefficients of the scale in the current study were as follows: tolerance =.86, withdrawal =.79, intention effect=.84, lack of control =.84, time =.84, reductions in other activities =.82, continuance =.85, and α =.96 for the total score.

UCLA-III Loneliness Scale: Russell (1996) created the UCLA Loneliness Scale-III, and Durak and Durak (2010) studied the scale's reliability and validity in Turkey. With a 4-point Likert type structure of (1) never (4) always, the scale comprises a total of 20 items, 11 reverse and 9 straight. High scores from the scale indicate the level of loneliness. In the study, the internal consistency coefficient of the scale was determined as .70.

Collection of Data

Ethics committee permission was received for the study from Manisa Celal Bayar University Rectorate Social and Human Sciences Scientific Research and Publication Ethics Committee, dated 02.06.2023, number E—050.01.04-556222. Data collection was carried out face to face after the necessary information was given to the participants.

Analysis of Data

SPSS 26 licensed package program was used to analyze the data. Arithmetic mean, standard deviation, percentage and frequency values regarding the demographic information of the participants were extracted. As a result of the Skewness and Kurtosis tests, it was concluded that the data showed normal distribution. Subscale and total score averages of the Exercise Dependence-21 Scale and Cronbach Alpha reliability coefficients of the UCLA-III Loneliness Scale total score were examined and descriptive statistics were obtained. In the study, Pearson Correlation test was used for the relationship between participants' exercise dependence and loneliness levels, and Simple Linear Regression analysis was used to estimate exercise dependence according to the loneliness variable.

FINDINGS

The total score and subscale reliability coefficients of the Exercise Dependence-21 and UCLA-III Loneliness Scale used in the research are presented in the table. The reliability coefficients of the Exercise Dependence-21 Scale subscales are, respectively, tolerance α=.86, withdrawal α=.79, intention effect α=.84, lack of control α=.84, time α=.84, reductions in other activities α=.82, and continuance α=.85. The reliability coefficient for the Exercise Dependence-21 Scale total score was determined as α=96, and the reliability coefficient for the UCLA-III Loneliness Scale total score was determined as .70.

When Table 2 is examined, the sub-dimension and total score averages regarding the exercise dependence and loneliness levels of the study group are seen. Respectively, exercise dependence subscale mean scores were tolerance 3.4489; withdrawal 3.4100; intention effect 3.3289; lack of control 3.2856; time 3.4678; reductions in other activities 3.2133 and continuance 3.0333. In the study, the Exercise Dependence-21 Scale total score average was 3.3125 and the UCLA-III Loneliness Scale total score average was 2.7922.

Table 2. Exercise dependence levels of the study group

Gruplar	**N**	**%**
Asymptomatic	47	15.7
Symptomatic	165	55
Exercise Depend	88	29.3

When the results regarding the exercise dependence levels of the participating individuals in the research group were examined, it was determined that 15.7% (N = 47) were asymptomatic, 55% (N = 165) were symptomatic and 29.3% (N = 88) were in the dependent group.

Table 3. Pearson correlation test for exercise dependence and loneliness level

		EDS-21 Total	Withdrawal	Continuance	Tolerance	Lack of Control	Reductions in Other Activities	Time	Intention Effect
UCLA-III Total	r	-.299**	-.139*	-.325**	-.095	-.326**	-.330**	-.204**	-.309**
p<.05*									

When Table 3 was examined, it was determined that there was a low negative relationship between the participant individuals' total score regarding their loneliness levels and their exercise dependence total score (r=-.299, p=.000). In addition, the total score of the participant group regarding loneliness levels and the exercise dependence sub-dimensions continuance (r=-.325, p=.000), lack of control (r=-.326, p=.000), reductions of other activities (r=-.330, p=.000) moderate negative relationship is observed in the sub-dimensions and intention (r=-.309, p=.000). It was determined that there was a low level of negative correlation between the total score of the participants regarding their loneliness levels and the withdrawal (r=-.139, p=.016) and time (r=-.204, p=.000) sub-dimensions of exercise dependence.

Table 4. Simple linear regression analysis for the prediction of exercise dependence according to the loneliness variable

	B	Standart Error	β	t	p
UCLA- III Total	5.997	.500		12.004	
	-.961	.178	-.29	-5.417	**.000***
R= .299 R^2= .090 F= 29.342 p=.000					

When Table 4 is examined, according to the results of the simple linear regression analysis regarding the prediction of exercise dependence according to the loneliness variable, it is seen that the loneliness variable is a significant predictor of exercise dependence (R = .299, R2 = .090, F = 29.342, p = .000). It can be stated that 29.9% of the total variance in terms of exercise dependence is explained by the loneliness variable.

DISCUSSION AND CONCLUSION

This research was conducted to examine the exercise dependence and loneliness levels of fitness individuals. When the results are examined, it is seen that while a low level negative relationship is detected between exercise dependence and loneliness, the loneliness variable regarding the prediction of exercise dependence is a negative predictor and explains 29.9% of the exercise dependence of individuals who do fitness.

When the relevant literature is examined, Marques et al. (2018) estimate that the risk of exercise dependence varies according to personal characteristics, but is between 3% and 7% in the population of regular exercisers and university students, and between 6% and 9% in the athlete population. In this study, when the results regarding the exercise dependence levels of the participating individuals were examined, it was determined that 15.7% (N = 47) were asymptomatic, 55% (N = 165) were symptomatic, and 29.3% (N = 88) were in the dependent group. Pels and Kleinert (2016) found that physical activity and Hwang (2019) found that exercise reduced loneliness and directed individuals to socialize. However, Hawkley et al. (2009) found that loneliness reduces physical activity participation and causes inactivity. They stated that loneliness, especially in middle and older aged adults, is a risk factor that causes inactivity by reducing physical activity.

When studies on the relationship between loneliness and exercise dependence were examined, Güvendi and Abanoz (2019) examined the exercise dependence and loneliness situations of sports science faculty students and reported that no relationship was detected between exercise dependence and loneliness. When the results regarding the prediction of exercise dependence according to the loneliness variable were

examined, it was determined that the loneliness variable was a significant predictor of exercise dependence. Lukács et al. (2019) found in their study with amateur athletes that the level of loneliness was an important factor in predicting exercise dependence.

When the literature on exercise dependence was examined, Gadak and Pulur (2021) stated that individuals who exercise in fitness centers are in the exercise dependence group, while they stated that variables such as gender, age, monthly income level, profession, exercise frequency and reason for participating in exercise are not factors on exercise dependence. Kayhan et al. (2021) stated that, contrary to this situation, the group of their study on individuals exercising in fitness centers was not exercise dependent and that variables such as gender, age, income level and training frequency may be factors in exercise dependence. While Tekkurşun Demir and Namlı (2022) conducted a research on tennis players, they stated that age and income level may be factors in terms of exercise dependence, but gender is not a factor. Cicioğlu et al. (2019) stated that regular and intense exercise participation for a long time in groups such as elite athletes increases dependence. Aydın and Soyer (2023) also emphasized that the increasing level of exercise dependence may lead athletes and individuals to undesirable behaviors.

When the literature on loneliness was examined, Uzuner and Karagün (2014), while examining the loneliness levels of individuals who do sports for recreational purposes, emphasized that demographic variables do not affect the loneliness situation and that loneliness occurs in line with the structure of the person's own values. Serdar et al. (2018) concluded in their study that loneliness scores differ in terms of age.Özçelik et al. (2015) stated that sports participation can help reduce the feeling of loneliness. Siyahtaş and Donuk (2021) found a negative significant relationship between leisure satisfaction and loneliness, and stated that as the satisfaction university students get in their leisure increases, their loneliness will decrease. Uğurlu (2021) stated that the level of alienation may increase as the loneliness levels of university students increase. This result can also be interpreted as individuals who become lonely may be less likely to participate in any activity, including exercise.

The study found that there was a negative relationship between exercise dependence and loneliness. It is possible to say that loneliness has a negative effect on exercise dependence in fitness individuals. These results can be interpreted as exercise dependence decreases as the level of loneliness increases in fitness individuals. Nowadays, the increasing loneliness of individuals due to the effects of the social and psychological environment gives rise to different searches. The search for individual satisfaction and the drive for self-actualization can result in intense participation in activities. In this regard, it is thought that people's ability to achieve optimal social and psychological balance can reduce negative experiences such as loneliness and exercise dependence.

Disclosure statement

No potential conflict of interest was reported by the author(s).

REFERENCES

1. Aydın, G. & Soyer, F. Aktif Sporcuların Egzersiz Bağımlılığı Düzeyleri ve Performans Arttırıcılara Yönelik Tutumlarının İncelenmesi. Gazi Beden Eğitimi ve Spor Bilimleri Dergisi, 2023; 28(2), 135-141.
2. Buluş, M. Üniversite öğrencilerinde yalnızlık. Pamukkale Üniversitesi Eğitim Fakültesi Dergisi, 1997; 3(3), 82-90.
3. Büyüköztürk, Ş., Çakmak, E., Akgün, Ö. E., Karadeniz, Ş., & Demirel, F. Bilimsel araştırma yöntemleri. Ankara: Pegem Akademi, 2008.
4. Cicioğlu, H. İ., Demir, G. T., Bulğay, C. & Çetin, E. Elit düzeyde sporcular ile spor bilimleri fakültesi öğrencilerinin egzersiz bağımlılığı düzeyleri. Bağımlılık Dergisi, 2019; 20(1), 12-20.
5. Durak, M. & Senol-Durak, E. Psychometric qualities of the UCLA loneliness scale-version 3 as applied in a Turkish culture. Educational Gerontology, 2010; 36(10-11), 988-1007.
6. Gadak, A. & Pulur, A. Fitness merkezine giden bireylerin egzersiz bağımlılıklarının incelenmesi. Sportive, 2021; 4(2), 12-23.
7. Güvendi, B., & Abanoz, E. I. Examination of Exercise Dependency Levels and State of Loneliness in Students of Sports Sciences Faculty. International Journal of Higher Education, 2019; 8(4), 231-238.

8. Hausenblas, H. A., & Downs, D. S. How much is too much? The development and validation of the exercise dependence scale. Psychology and Health, 2002a; 17(4), 387-404.
9. Hausenblas, H. A., & Downs, D. S. Exercise dependence: a systematic review. Psychology of Sport and Exercise, 2002b; 3(2), 89–123.
10. Hawkley, L. C., Thisted, R. A., & Cacioppo, J. T. Loneliness predicts reduced physical activity: Cross-sectional & longitudinal analyses. Health Psychology, 2009; 28(3), 354–363.
11. Heinrich, L. M., & Gullone, E. The clinical significance of loneliness: A literature review. Clinical Psychology Review, 2006; 26(6), 695-718.
12. Hwang, J., Wang, L., Siever, J., Medico, T. D., & Jones, C. A. Loneliness and social isolation among older adults in a community exercise program: a qualitative study. Aging & Mental Health, 2019; 23(6), 736-742.
13. Kayhan, R. F., Kalkavan, A., & Terzi, E. Fitness salonlarında spor yapan bireylerin egzersiz bağımlılığı düzeyleri ve ilişkili değişkenler. Bağımlılık Dergisi, 2021; 22(3), 248-256.
14. Lukács, A., Sasvári, P., Varga, B., & Mayer, K. Exercise addiction and its related factors in amateur runners. Journal of behavioral addictions, 2019; 8(2), 343-349.
15. Marques, A., Peralta, M., Sarmento, H., Loureiro, V., Gouveia, É. R., & Gaspar de Matos, M. Prevalence of risk for exercise dependence: A systematic review. Sports Medicine, 2019; 49, 319-330.
16. Mikkelsen, K., Stojanovska, L., Polenakovic, M., Bosevski, M., & Apostolopoulos, V. Exercise and mental health. Maturitas, 2017; 106, 48-56.
17. Öner, Ç. Egzersiz katılımcılarının temel psikolojik ihtiyaçları ve mental iyi oluşlarının incelenmesi. Akdeniz Spor Bilimleri Dergisi, 2019; 2(2), 159-174.
18. Özçelik, İ. Y., İmamoğlu, O., Çekin, R., & Başpınar, S. G. Üniversite Öğrencilerinin Yalnizlik Düzeyleri Üzerine Sporun Etkisi. Spor ve Performans Araştırmaları Dergisi, 2015; 6(1), 12-18.
19. Pels, F., & Kleinert, J. Loneliness and physical activity: A systematic review. International Review of Sport and Exercise Psychology, 2016; 9(1), 231-260.
20. Perlman, D., & Peplau, L. A. Toward a social psychology of loneliness. Personal relationships, 1981; 3, 31-56.
21. Serdar, E., Harmandar Demirel, D., & Demirel, M. Üniversite Öğrencilerinin Facebook Kullanimi İle Yalnizlik Düzeylerinin İncelenmesi. Journal Of International Social Research, 2018; 11(60), 1402-1409.
22. Siyahtaş, A., & Donuk, B. Serbest zaman etkinliklerine katılan bireylerin yalnızlık düzeyleri ile doyum düzeylerinin incelenmesi. İnönü Üniversitesi Beden Eğitimi ve Spor Bilimleri Dergisi, 2021; 8(2), 1-18.
23. Tekkurşun Demir, G. & Namlı, S. Egzersiz Bağımlılığı: Tenis Oyuncuları Örneği. Uluslararası Egzersiz Psikolojisi Dergisi, 2022; 4(1), 1-7.
24. Uğurlu, A. Üniversite öğrencilerinin yalnızlık ve yabancılaşma düzeyleri arasındaki ilişkinin bazı değişkenlere göre incelenmesi. Akdeniz Spor Bilimleri Dergisi, 2021; 4(2), 308-319.
25. Uzuner, M. E. & Karagün, E. Rekreatif amaçlı spor yapan bireylerin yalnızlık düzeylerinin incelenmesi. Kocaeli Üniversitesi Sosyal Bilimler Dergisi, 2014; 27, 107-120.
26. Vardar, E. Egzersiz bağımlılığı. Arşiv Kaynak Tarama Dergisi, 2012; 21(3), 163-173.
27. Yeltepe, H., & İkizler, C. Egzersiz bağımlılığı ölçeği-21'in Türkçe geçerlilik ve güvenilirlik çalışması. Bağımlılık Dergisi, 2007; 8(1), 29-35.

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Examining The Relationship Between Perceived Physical and Cognitive Fatigue and Cognitive Flexibility in Sports Higher Education Institution Students

Ebru KARAKUŞ[1A], Gökhan İPEKOĞLU[2B], Kaan KARAKUŞ[1C], Hacı Ali ÇAKICI[1D]

[1] Ordu University, Faculty of Sport Sciences, Department of Sports Management, Ordu, TÜRKİYE
[2] Ordu University, Faculty of Sport Sciences, Department of Physical Education and Sport, Ordu, TÜRKİYE

Address Correspondence to Hacı Ali CAKICI: e-mail: cakicihaciali@gmail.com

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A: Orcid ID: 0000-0003-4157-2382 B: Orcid ID: 0000-0002-8530-0031 C: 0000-0002-1568-7816 D: 0000-0001-9439-1118

Abstract

The aim of this study is to examine the relationship between perceived physical and cognitive fatigue and cognitive flexibility among students of higher education institutions in sports. The study consists of a total of 224 participants, including 91 females and 133 males, determined through a random sampling method. In the study, the data collection instruments used were "Athlete Cognitive Flexibility Inventory" and "Perceived Physical and Cognitive Fatigue Scale." Skewness-Kurtosis test, independent samples t-test, one-way analysis of variance (ANOVA), and Pearson correlation analysis were used in the data analysis. All statistical analyses were conducted using SPSS 22.0 software. A significance level of $p<0.05$ was considered. When the study results were examined, no significant difference was found in the scale scores according to the variables of department, sport type, and sport level of the participants. Significant differences were found in the total scores of the Athlete Cognitive Flexibility Inventory, total scores of the Perceived Physical Fatigue Scale, and sub-dimension scores of the Perceived Physical Fatigue Scale according to the gender variable. Significant differences were found in the total scores and sub-dimension scores of the Perceived Physical and Cognitive Fatigue Scale and the control sub-dimension scores of the Athlete Cognitive Flexibility Inventory according to the age and sport age variables. As a result of the correlation analysis, a significant negative and moderate relationship was found between the two scales. According to these results, it is expected that as the perceived physical and cognitive fatigue levels increase, the level of cognitive flexibility decreases. Athletes who are physically and cognitively fatigued may have difficulty generating alternative solutions and may also experience a decrease in control skills. By providing training on stress management techniques to athlete students as part of the course, their skills in coping with stress, problem-solving, and increasing cognitive flexibility can be developed. Active recovery techniques such as light exercises, yoga, meditation, and massage can alleviate the effects of fatigue in athlete students.

Keywords: Cognitive flexibility, perceived physical fatigue, perceived cognitive flexibility.

Spor Yükseköğretim Kurumu Öğrencilerinde Algılanan Fiziksel ve Bilişsel Yorgunluk ile Bilişsel Esneklik Arasındaki İlişkinin İncelenmesi

Özet

Bu çalışmanın amacı, spor yükseköğretim kurumu öğrencilerinde algılanan fiziksel ve bilişsel yorgunluk ile bilişsel esneklik arasındaki ilişkinin incelenmesidir. Çalışma, tesadüfi örneklem yöntemi ile belirlenen 91 kadın ve 133 erkek toplam 224 katılımcıdan oluşmaktadır. Çalışmada veri toplama aracı olarak "Sporcu Bilişsel Esneklik Envanteri" ve "Algılanan Fiziksel ve Bilişsel Yorgunluk Ölçeği" kullanılmıştır. Verilerin analizinde Skewness– Kurtosis testi, bağımsız örneklem t-testi, tek yönlü varyans analizi (ANOVA) ve Pearson korelasyon analizi kullanılmıştır. Tüm istatistiki analizler SPSS 22.0 programı ile yapılmıştır. Anlamlılık değeri $p<0.05$ olarak kabul edilmiştir. Çalışma sonuçları incelendiğinde katılımcıların bölüm, spor türü ve spor düzeyi değişkenlerine göre ölçek puanlarında anlamlı farklılık saptanmamıştır. Cinsiyet değişkenine göre sporcu bilişsel esneklik envanteri toplam puan, algılanan fiziksel yorgunluk ölçeği toplam puan ve algılanan fiziksel yorgunluk alt boyut puanlarında anlamlı farklılık saptanmıştır. Yaş ve spor yaşı değişkenine göre algılanan fiziksel ve bilişsel yorgunluk ölçeği toplam puan ve alt boyut puanları ile sporcu bilişsel esneklik envanteri kontrol alt boyutu puanlarında anlamlı farklılık saptanmıştır. Korelasyon analizi sonucunda iki ölçek arasında negatif yönde ve orta düzeyde anlamlı ilişki tespit edilmiştir. Bu sonuçlara göre algılanan fiziksel ve bilişsel yorgunluk düzeyinin artmasıyla bilişsel esneklik düzeyinin azalması beklenmektedir. Fiziksel ve bilişsel olarak yorgun olan sporcular, alternatif çözümler üretmekte zorlanabilir ve kontrol becerilerinde de azalma yaşayabilir. Sporcu öğrencilere ders kapsamında stres yönetimi tekniklerine yönelik eğitim verilerek, stresle başa çıkma, problem çözme ve bilişsel esnekliği artırma becerileri geliştirilebilir. Hafif egzersizler, yoga, meditasyon ve masaj gibi aktif iyileşme teknikleri, sporcu öğrencilerde yorgunluğun etkilerini hafifletebilir.

Anahtar Kelimeler: Bilişsel esneklik, algılanan fiziksel yorgunluk, algılanan bilişsel esneklik.

INTRODUCTION

In sports success, many factors such as optimism, pessimism, discipline, concentration, ambition, and discipline are influential. However, it is stated that the level of physical and cognitive fatigue is also an important factor for sports success (35). Fatigue is a phenomenon that reduces the desire to act and decreases performance (31). Perceived fatigue is often different from fatigue resulting from instantaneous exercise, activity, or competition (13). Perceived fatigue is described as a feeling of exhaustion that causes the slowing down of cognitive and physical functions in an athlete (19). Fatigue, which significantly affects an athlete's performance (37), is classified into physical and cognitive fatigue (7, 28). Physical fatigue is a process that reduces an individual's physical endurance, hinders participation in activities, and leads to deconditioning (26). This physical process is also characterized as fatigue that occurs with the cessation of movements (13). Cognitive fatigue, on the other hand, is a psychological state that arises from the mind being intense after prolonged physical activities (18). After prolonged mental activities, cognitive fatigue can manifest with problems such as lack of energy, loss of motivation, reaction issues, and memory difficulties (8). In other words, both physical fatigue and cognitive fatigue negatively affect an athlete's performance. Indeed, perceived physical and cognitive fatigue can weaken the body and create a decline in perception (35). At this point, an athlete's ability to make effective decisions under stress and quickly adapt to the game can be achieved with a high level of cognitive flexibility (39).

Cognitive flexibility is defined as "the tendency of the mind to change perception concerning different environmental conditions" (16). Asıcı and Ekiz (4) expressed cognitive flexibility as "the ability of an individual to change their thoughts and their approach to responsibilities." Stevens (32) defined cognitive flexibility as "adapting to different changing situations and having many perspectives towards the solution." Similarly, cognitive flexibility is mentioned as "the ability to think about various concepts and factors" (17) and "the ability to adapt to change" (12). Individuals with this mental skill can find new ways by changing difficult thoughts with more compatible ones. Thus, individuals can manage events more easily under pressure (39). In other words, an individual with a high level of cognitive flexibility recognizes, evaluates, and shapes their attitude accordingly. An individual with a low level of cognitive flexibility may give dysfunctional responses to situations they encounter (11). In the sports environment, the concept of cognitive flexibility emerges when athletes are anxious, and their attention focus weakens (38). Especially in combat sports, athletes encounter many situations where they need to make sudden decisions. Therefore, the effectiveness of the decisions made by athletes is associated with a high level of cognitive flexibility (23). At this point, the level of fatigue can cause the athlete to fail to react correctly (19). In light of all this information, it is thought that examining the relationship between perceived physical and cognitive fatigue and cognitive flexibility in students of sports

higher education institutions will contribute to the literature. As a result, the fact that no research has been found on the subject of the current study highlights its originality. Additionally, it contributes to the mental development of athletes. In this direction, examining the relationship between perceived physical and cognitive fatigue and cognitive flexibility in students of sports higher education institutions constitutes the aim of this study.

METHOD

Research design

In the research, a relational survey model, which is one of the quantitative research methods and has a descriptive quality, was used. The relational survey method is a statistical procedure used in quantitative research methods to determine the relationship between two or more variables (9).

Population and sample

The population of the research consists of university students studying in the field of sports sciences in Turkey. The sample group consists of 224 undergraduate students, including 133 males and 91 females, within the Faculty of Sport Sciences of Ordu University. In determining the sample size of the research, Büyüköztürk (9)'s statement of "at least 30 units in correlation studies" and "the number of units should be equal to the number of items X Likert scale options" in data collection tools consisting of Likert-type options was taken into account. In this sense, for the Athlete Cognitive Flexibility Inventory, 5x20=100 and for the Perceived Physical and Cognitive Fatigue Scale, 5x19=95, a total of 100+95=195 minimum participants should be reached. In this research, 224 participants were reached.

Data collection tools

Personal Information Form: The personal information form prepared by the researchers includes variables such as gender, age, department, sport type, sport level, and sport age.

Athlete Cognitive Flexibility Inventory (ACFI): The Cognitive Flexibility Inventory, developed by Dennis and Wal (12), was adapted into Turkish by Sapmaz and Doğan (30). The validity and reliability study of the Cognitive Flexibility Inventory in a sports environment was conducted by Yarayan et al. (39). The inventory consists of 20 items and 2 sub-dimensions. The sub-dimensions are alternatives (1,3,5,6,8,10,12,13,14,16,18,19,20) and control (2,4,7,9,11,15,17). The inventory includes reverse items (2,4,7,9,11,17). The items of the 5-point Likert-type inventory are specified as "1=Not at all suitable...5=Completely suitable". The inventory can be evaluated based on the total score. High scores on the inventory indicate a high level of cognitive flexibility. The Cronbach Alpha values of the inventory are .91 for the alternatives sub-dimension, .84 for the control sub-dimension, and .87 for the overall inventory (39). In this research, the Cronbach Alpha values were found to be .90 for the alternatives sub-dimension, .85 for the control sub-dimension, and .89 for the overall inventory.

Perceived Physical and Cognitive Fatigue Scale (PPCFS): The scale, developed by Tekkurşun Demir et al. (35), consists of 19 items and 2 sub-dimensions. The sub-dimensions are perceived physical fatigue (1,2,3,4,5,6,7,8) and perceived cognitive fatigue (9,10,11,12,13,14,15,16,17,18,19). PPCFS is a five-point Likert-type scale. Accordingly, the items measuring the perceived physical and cognitive fatigue levels of the athletes are evaluated as "1=Strongly disagree...5=Strongly agree". The lowest score that can be obtained from the scale is 19, and the highest score is 95. The Cronbach Alpha coefficient of the scale was determined as .95 for the perceived physical fatigue sub-dimension, .97 for the perceived cognitive fatigue sub-dimension, and .97 for the overall scale (35). In this research, the Cronbach Alpha values were found to be .90 for the perceived physical fatigue sub-dimension, .94 for the perceived cognitive fatigue sub-dimension, and .95 for the overall scale.

Data were obtained from the sample group of the study through the personal information form, the Perceived Physical and Cognitive Fatigue Scale, and the Athlete Cognitive Flexibility Inventory. The implementation of the scales was carried out using a random sampling method. The random sampling method is known as the probability of each individual in the population being selected at the same level (36). Data access was provided through WhatsApp and Google Drive.

Ethical approval of the research

Ethical approval for the study was obtained with decision number 2024-94 from the Ethics Committee for Social and Human Sciences Research of Ordu University. Permission to use the scales was obtained from the authors via email. The study was based on the principle of voluntariness.

Data analysis

In the normality analysis of the data obtained from the participants, Skewness and Kurtosis values were examined, and it was seen that the data were between -2 and +2. Data being between -2 and +2 is assumed to be normally distributed (14). In the study, parametric tests such as the Student's t-Test for paired comparisons, One-Way Analysis of Variance (ANOVA) for comparisons of three or more categories, and Tukey's multiple comparison test were applied. Pearson's correlation analysis was used to determine the relationship between the Perceived Physical and Cognitive Fatigue Scale and the Athlete Cognitive Flexibility Inventory. Differences at the significance level of 0.05 in the study were considered significant. All analyses were performed using the SPSS 21.0 statistical software package.

Table 1. The average values, internal consistency coefficients, and skewness-kurtosis values of the responses given by the participants to the scale items

Scales	Average	S.D.	Skewness	Kurtosis	Internal Consistency Coefficient	Evaluation
PCPF Scale Total	53,71	16,70	-0,087	-0,561	0,95	Reliable
ACEI Scale Total	73,93	10,53	0,258	-0,210	0,89	Reliable

PCPF: Perceived Physical and Cognitive Fatigue Scale, ACEI: Athlete Cognitive Flexibility Inventory

FINDINGS

Table 2. Demographic Information of Participants

Variable	Category	n	%
Gender	Female	91	40.6
	Male	133	59.4
Age	18-20	100	44.6
	21-23	84	37.5
	24 and above	40	17.9
Department	Teaching	86	38.4
	Management	138	61,6
Sport Type	Individual Sports	112	50.0
	Team Sports	112	50.0
Sports Level	Amateur	187	83.5
	Professional	37	16.5
Sport Experience	1-4 years	100	48.2
	5-9 years	84	32.1
	10 years and above	40	19.6
Total		224	100

Table 3. Comparison of Perceived Physical and Cognitive Fatigue Scale and Athlete Cognitive Flexibility Inventory Scores by Gender

Scales and Subdimensions	Gender	n	$\bar{x}$	sd	t	p
PPF	Female	91	24,51	6,833	2,161	**,032***
	Male	133	22,40	7,406		
PCF	Female	91	31,84	10,23	1,600	,111
	Male	133	29,50	11,10		
PCPF Scale Total	Female	91	56,36	15,67	2,007	**,046***
	Male	133	51,90	17,19		
Alternatives	Female	91	49,31	7,091	-1,395	,165
	Male	133	50,72	7,595		
Control	Female	91	23,00	5,448	-1,757	,080
	Male	133	24,32	5,595		
ACEI Scale Total	Female	91	72,31	9,525	-1,969	**,050***
	Male	133	75,04	11,06		

*p<0.05, PCPF: Perceived Physical and Cognitive Fatigue Scale, PPF: Perceived Physical Fatigue, PCF: Perceived Cognitive Fatigue, ACEI: Athlete Cognitive Flexibility Inventory

In Table 3, a significant difference in favor of female participants was found between the total scores of the Perceived Physical and Cognitive Fatigue Scale and the subdimension scores of perceived physical fatigue by gender (p<0.05). A significant difference in favor of male participants was found in the total score of the Athlete Cognitive Flexibility Inventory by gender (p<0.05).

Tablo 4. Comparison of scores on the perceived physical and cognitive fatigue scale and the athlete cognitive flexibility inventory based on participants' age variable

Scales and Subdimensions	Age	n	$\bar{x}$	sd	f	p
PPF	18-20	100	21,95b	6,864	3,222	**,042***
	21-23	84	24,59a	7,533		
	24 and above	40	23,75ab	7,120		
PCF	18-20	100	28,66b	10,07	4,870	**,009***
	21-23	84	33,30a	11,67		
	24 and above	40	28,95b	9,505		
PCPF Scale Total	18-20	100	50,61b	15,45	4,588	**,011***
	21-23	84	57,90a	17,89		
	24 and above	40	52,70b	15,62		
Alternatives	18-20	100	48,94	7,748	2,800	,063
	21-23	84	50,75	7,075		
	24 and above	40	51,92	6,877		
Control	18-20	100	24,05ab	5,770	4,350	**,014***
	21-23	84	22,59b	5,229		
	24 and above	40	25,62a	5,241		
ACEI Scale Total	18-20	100	72,99	11,13	2,940	,055
	21-23	84	73,34	9,632		
	24 and above	40	77,55	10,28		

*p<0.05, a,b letters indicate differences between groups in the same column. PCPF: Perceived Physical and Cognitive Fatigue Scale, PPF: Perceived Physical Fatigue, PCF: Perceived Cognitive Fatigue, ACEI: Athlete Cognitive Flexibility Inventory

In Table 4, significant differences were found in favor of the 21-23 age group in the total scores and subdimension scores of the Perceived Physical and Cognitive Fatigue Scale by age (p<0.05). Significant differences in favor of the 24 years and above age group were found in the control subdimension scores of the Athlete Cognitive Flexibility Inventory by age (p<0.05).

Table 5. Comparison of perceived physical and cognitive fatigue scale and athlete cognitive flexibility inventory scores by department

Scales and Subdimensions	Department	n	$\bar{x}$	sd	t	p
PPF	Teaching	86	22,94	7,060	-,524	,601
	Management	138	23,46	7,365		
PCF	Teaching	86	30,65	10,26	,214	,831
	Management	138	30,33	11,15		
PCPF Scale Total	Teaching	86	53,59	15,36	-,089	,929
	Management	138	53,79	17,53		
Alternatives	Teaching	86	49,09	7,433	-1,695	,091
	Management	138	50,81	7,346		
Control	Teaching	86	24,12	5,107	,726	,469
	Management	138	23,57	5,835		
ACEI Scale Total	Teaching	86	73,22	10,35	-,803	,423
	Management	138	74,38	10,65		

*p<0.05, PCPF: Perceived Physical and Cognitive Fatigue Scale, PPF: Perceived Physical Fatigue, PCF: Perceived Cognitive Fatigue, ACEI: Athlete Cognitive Flexibility Inventory

In Table 5, no significant differences were found between the total scores and subdimension scores of the Perceived Physical and Cognitive Fatigue Scale by department (p>0.05). No significant differences were found between the total scores and subdimension scores of the Athlete Cognitive Flexibility Inventory by department (p>0.05).

Table 6. Comparison of perceived physical and cognitive fatigue scale and athlete cognitive flexibility inventory scores by sport type

Scales and Subdimensions	Sport Type	n	$\bar{x}$	sd	t	p
PPF	Individual Sports	112	23,16	6,978	,847	,847
	Team Sports	112	23,35	7,519		
PCF	Individual Sports	112	30,44	10,49	-,012	,990
	Team Sports	112	30,46	11,13		
PCPF Scale Total	Individual Sports	112	53,61	16,14	-,092	,927
	Team Sports	112	53,82	17,31		
Alternatives	Individual Sports	112	49,50	7,099	-1,319	,189
	Team Sports	112	50,80	7,686		
Control	Individual Sports	112	23,58	5,469	-,528	,598
	Team Sports	112	23,98	5,671		
ACEI Scale Total	Individual Sports	112	73,08	10,25	-1,207	,229
	Team Sports	112	74,78	10,78		

*p<0.05, PCPF: Perceived Physical and Cognitive Fatigue Scale, PPF: Perceived Physical Fatigue, PCF: Perceived Cognitive Fatigue, ACEI: Athlete Cognitive Flexibility Inventory

In Table 6, no significant differences were found between the total scores and subdimension scores of the Perceived Physical and Cognitive Fatigue Scale by sport type (p>0.05). No significant differences were found between the total scores and subdimension scores of the Athlete Cognitive Flexibility Inventory by sport type (p>0.05).

Table 7. Comparison of perceived physical and cognitive fatigue scale and athlete cognitive flexibility inventory scores by sport level

Scales and Subdimensions	Sport Level	n	$\bar{x}$	sd	t	p
PPF	Amateur	187	23,41	7,318	,714	,476
	Professional	37	22,48	6,862		
PCF	Amateur	187	30,14	10,60	-,969	,334
	Professional	37	32,02	11,72		
PCPF Scale Total	Amateur	187	53,56	16,79	-,316	,752
	Professional	37	54,51	16,43		
Alternatives	Amateur	187	50,13	7,136	-,058	,954
	Professional	37	50,21	8,778		
Control	Amateur	187	23,72	5,511	-,353	,725
	Professional	37	24,08	5,884		
ACEI Scale Total	Amateur	187	73,86	10,26	-,227	,821
	Professional	37	74,29	11,93		

* p<0.05, PCPF: Perceived Physical and Cognitive Fatigue Scale, PPF: Perceived Physical Fatigue, PCF: Perceived Cognitive Fatigue, ACEI: Athlete Cognitive Flexibility Inventory

In Table 7, no significant differences were found between the total scores and subdimension scores of the Perceived Physical and Cognitive Fatigue Scale by sport level (p>0.05). No significant differences were found between the total scores and subdimension scores of the Athlete Cognitive Flexibility Inventory by sport level (p>0.05).

Table 8. Comparison of perceived physical and cognitive fatigue scale and athlete cognitive flexibility inventory scores by sport experience

Scales and Subdimensions	Sport Experience	n	$\bar{x}$	ss	f	p
PPF	1-4	100	21,95b	6,864	3,222	**,042***
	5-9	84	24,59a	7,533		
	10 years and above	40	23,75ab	7,120		
PCF	1-4	100	28,66b	10,07	4,870	**,009***
	5-9	84	33,30a	11,67		
	10 years and above	40	28,95b	9,505		
PCPF Scale Total	1-4	100	50,61b	15,45	4,588	**,011***
	5-9	84	57,90a	17,89		
	10 years and above	40	52,70b	15,62		
Alternatives	1-4	100	48,94	7,748	2,800	,063
	5-9	84	50,75	7,075		
	10 years and above	40	51,92	6,877		
Control	1-4	100	24,05ab	5,770	4,350	**,014***
	5-9	84	22,59b	5,229		
	10 years and above	40	25,62a	5,241		
ACEI Scale Total	1-4	100	72,99b	11,13	2,940	,055
	5-9	84	73,34b	9,632		
	10 years and above	40	77,55a	10,28		

*p<0.05, a,b letters indicate differences between groups in the same column. PCPF: Perceived Physical and Cognitive Fatigue Scale, PPF: Perceived Physical Fatigue, PCF: Perceived Cognitive Fatigue, ACEI: Athlete Cognitive Flexibility Inventory

In Table 8, significant differences were found in favor of the 5-9 years and 10 years and above sport experience groups in the total scores and perceived physical fatigue subdimension scores of the Perceived

Physical and Cognitive Fatigue Scale by sport experience ($p<0.05$). No significant differences were found between the total scores and subdimension scores of the Athlete Cognitive Flexibility Inventory by sport experience ($p>0.05$).

Table 9. Relationship between participants' perceived physical and cognitive fatigue scale scores and athlete cognitive flexibility inventory scores

		PPF	PCF	PCPF Total
Alternatives	r	-,117	-,253	-,214
	p	,079	**,001***	**,001***
Control	r	-,441	-,538	-,539
	p	**,001***	**,001***	**,001***
SBEE Toplam	r	-,315	-,462	-,435
	p	**,001***	**,001***	**,001***

*p<0.05, PCPF: Perceived Physical and Cognitive Fatigue Scale, PPF: Perceived Physical Fatigue, PCF: Perceived Cognitive Fatigue, ACEI: Athlete Cognitive Flexibility Inventory

Table 9 presents the correlation results between the perceived physical and cognitive fatigue scores of the participants and the scores of the athlete cognitive flexibility inventory. According to the results; a negative and moderate level significant relationship was found between the total score of perceived physical and cognitive fatigue and the total score of the athlete cognitive flexibility inventory ($r=-.435$, $p<0.05$). A negative and low level significant relationship was found between the total score of perceived physical and cognitive fatigue and the scores of the alternative sub-dimensions ($r=-.214$); a negative and moderate level significant relationship was found between the control sub-dimension ($r=-.539$) ($p<0.05$). A negative and moderate level significant relationship was found between the sub-dimension of perceived physical fatigue and the total score and control scores of the athlete cognitive flexibility inventory ($r=-.315$, $r=-.441$) ($p<0.05$). A negative and moderate level significant relationship was found between the sub-dimension of perceived cognitive fatigue and the total score and control scores of the athlete cognitive flexibility inventory ($r=-.462$, $r=-.538$); a negative and low level significant relationship was found between the scores of the alternative sub-dimensions ($r=-.253$) ($p<0.05$).

DISCUSSION AND CONCLUSION

This study was conducted to examine the relationship between perceived physical and cognitive fatigue and cognitive flexibility among students in sports higher education institutions. Additionally, differences in perceived physical and cognitive fatigue and cognitive flexibility were assessed according to variables such as gender, age, department, type of sport, level of sport, and sport age. No significant differences were found in scale scores based on department, type of sport, and level of sport variables. Significant differences were found in total scores of the athlete cognitive flexibility inventory, perceived physical fatigue scale, and perceived physical fatigue sub-dimension scores according to gender. Significant differences were also found in total scores and sub-dimension scores of the physical fatigue scale and control sub-dimension scores of the athlete cognitive flexibility inventory according to age and sport age variables. As a result of the correlation analysis, a significant negative and moderate relationship was found between the total scores of perceived physical and cognitive fatigue and the total scores of the athlete cognitive flexibility inventory. The literature review revealed that studies on perceived physical and cognitive fatigue are very limited. In this context, the results of this study were discussed and interpreted in light of the findings of the closest studies in the literature in terms of meaning.

In the study, a significant difference was found in favor of female athletes in the total scores of the perceived physical and cognitive fatigue scale and perceived physical fatigue scores according to gender. Accordingly, it can be said that the level of perceived fatigue is higher in female participants compared to male participants. The results obtained can be associated with the differences in physical capacities and recovery rates between male and female participants. Higher levels of emotional and psychological stress in female athletes may translate this stress into perceived fatigue. Additionally, physiological differences, hormonal changes, and psychological factors may affect the fatigue levels of female athletes. No studies in the literature

have been found that include the perceived physical and cognitive fatigue scale and the gender variable. When examining studies related to perceived physical and cognitive fatigue, it was determined that male participants had higher fatigue scores compared to female participants in the study conducted by öcal and göncü (27), and that the results do not align with the findings of this study. The differences between the findings can be associated with the data collection tools and study groups.

In the study, a significant difference was found in favor of male participants in the total scores of the athlete cognitive flexibility inventory according to gender. Accordingly, it appears that the cognitive flexibility level of male participants is higher than that of female participants. It is thought that differences in sports branches, training techniques, and strategies may have influenced these results. In other words, there may be differences in training and coaching programs for male and female athletes. Male athletes may be working with more varied and challenging training techniques that develop cognitive flexibility. These long-term and intensive experiences may enhance the cognitive flexibility of male participants. When examining studies in the literature that include the cognitive flexibility and gender variable, it has been determined that male participants have higher cognitive flexibility scores compared to female participants in studies conducted by Güler (15), Kara (21), and Asıcı and İkiz (4), and that the results are similar to the findings of this study. In contrast, studies by Yılmaz et al. (41), Yılmaz et al. (42), Karadağ (22), and Atalı (5) found no significant differences in cognitive flexibility scores according to gender, and the results do not align with the findings of this study. The differences between the findings can be explained by the use of different inventories or scales to measure cognitive flexibility, different cultural contexts, and variations in the intensity, duration, and type of sports training.

In the study, a significant difference was found in favor of the 21-23 age group in the total scores and sub-dimension scores of the perceived physical and cognitive fatigue scale according to age. When evaluated for the total score of the perceived physical and cognitive fatigue scale and the perceived cognitive fatigue sub-dimension, the 21-23 age group had higher averages compared to the 18-20 and 24 and older age groups. Specifically, the 21-23 age group had higher averages in the perceived cognitive fatigue sub-dimension compared to the 18-20 age group. According to the results obtained, it can be said that the 21-23 age group is in a period where their academic life and sports activities are intense. In other words, participants face various situations such as exams, projects, training sessions, and matches. Therefore, it is thought that students in the 21-23 age group may feel more physical and cognitive fatigue. The higher average in the perceived cognitive fatigue sub-dimension for the 21-23 age group compared to the 18-20 age group can be explained by the fact that the 21-23 age group is generally in the final years of their undergraduate education. Indeed, student-athletes may be involved in various activities such as graduation projects, thesis work, and intensive course schedules. Additionally, factors such as graduation anxiety, job search concerns, and future plans may increase cognitive fatigue. A literature review revealed no studies that included the perceived physical and cognitive fatigue scale and the age variable. When examining studies that are presumed to be related to perceived physical and cognitive fatigue, it was determined in the study by Taşpınar (34) that there were no significant differences in exhaustion scores according to the age variable, and that the results do not align with the findings of this study. The differences between the findings can be explained by data collection tools, the time factor, and study groups.

In the study, no significant differences were found in the total scores and alternatives sub-dimension scores of the athlete cognitive flexibility inventory according to the age variable. However, a significant difference was found in the control sub-dimension scores in favor of the 24 years and older age group. Accordingly, it was observed that participants aged 24 and older had higher control scores compared to the 21-23 age group. These results indicate that age does not have a significant impact on general cognitive flexibility and the ability to generate alternatives, but it does have an effect on the ability to exert control. It is thought that participants aged 24 and older have gained more experience in their sports careers in areas such as stress management, decision-making under pressure, and emotion regulation. Indeed, these experiences may positively influence participants' cognitive control abilities. When examining studies in the literature that include the cognitive flexibility and age variable, a significant difference in control scores according to age was identified in the study by Güler (15). In the study conducted by Kaya (23), no significant differences were found in the cognitive flexibility scores of participants, and it was found that the results are similar to the findings of the current research. In contrast, studies by Yılmaz et al. (41) and Akçakaya (1) found no significant

differences in control scores according to age, and it was observed that the findings do not align with the findings of the current research. The differences between the findings are thought to be due to the data collection tools, the distribution of age groups, and the timing of the studies.

In the study, no significant differences were found in the total scores and sub-dimension scores of the perceived physical and cognitive fatigue scale according to the department variable. Accordingly, it appears that the department variable is not a determinant of the perceived levels of physical and cognitive fatigue. This result can be associated with the fact that students in teaching and management departments generally participate in similar educational content and activities. Indeed, students in sports higher education institutions mostly take similar theoretical and practical courses during their undergraduate education processes. In this sense, the level of fatigue they perceive related to sports activities may be similar. No studies were found in the literature that include the perceived physical and cognitive fatigue scale and the department variable. When examining studies that are presumed to be related to perceived physical and cognitive fatigue, it was determined in the study by Yılmaz et al. (43) that there were no significant differences in burnout scores in sports according to the department variable, and it can be said that their results support the findings of the current research.

In the study, no significant differences were found in the total scores and sub-dimension scores of the athlete cognitive flexibility inventory according to the department variable. Accordingly, it appears that the department variable does not have a determining effect on cognitive flexibility scores. Students in sports higher education institutions may be subjected to similar course contents and educational methods. These similar educational experiences may create similar effects on cognitive flexibility. Both management and teaching department students may focus on developing skills that require cognitive flexibility, such as career goals, teamwork, leadership, and problem-solving, inherent to the nature of sports. When examining studies in the literature that include the cognitive flexibility and department variable, no significant differences in cognitive flexibility scores were found according to the department variable in the studies conducted by Yılmaz et al. (41) and Tabak (33), and it can be said that the findings are similar to the findings of this research.

In the study, no significant differences were found in the total scores and sub-dimension scores of the perceived physical and cognitive fatigue scale according to the type of sport variable. Accordingly, it can be said that the type of sport variable is not a determinant of perceived levels of physical and cognitive fatigue. This result can be associated with the unique challenges of both individual and team sports. Indeed, each sport discipline has its own psychological and physical difficulties. For example, individual sports generally focus on personal motivation, concentration, and individual performance, while team sports place more emphasis on cooperation, communication, and team dynamics. Therefore, the level of perceived fatigue may be similar for participants involved in both types of sports. No studies were found in the literature that include the perceived physical and cognitive fatigue scale and the type of sport variable. When examining studies that are presumed to be related to perceived physical and cognitive fatigue, it was determined in the study by Yılmaz et al. (43) that there were no significant differences in burnout inventory scores according to individual and team sports, and it is thought that the results are parallel to the findings of the current research.

In the study, no significant differences were found in the total scores and sub-dimension scores of the athlete cognitive flexibility inventory according to the type of sport variable. Accordingly, it appears that the type of sport variable does not have a determining effect on cognitive flexibility scores. Cognitive flexibility requires athletes to adapt to various situations and quickly change their strategies during training and competitions. The necessity for athletes to adapt to different situations encountered during training may similarly develop their cognitive flexibility. In other words, athletes involved in both individual and team sports need to quickly change their strategies and tactics. When examining studies in the literature that include the cognitive flexibility and type of sport variable, no significant differences in cognitive flexibility scores according to the type of sport were found in the studies conducted by Yılmaz et al. (42) and Kaya (23). Similarly, studies by Akyol (2), Karadağ (22), and Bayer (6) found that the type of sport was not a determinant of cognitive flexibility scores, and it can be said that the findings support the results of the current research.

In the study, no significant differences were found in the total scores and sub-dimension scores of the perceived physical and cognitive fatigue scale according to the sport level variable. Accordingly, it can be inferred that the sport level is not a determinant of perceived levels of physical and cognitive fatigue. In other

words, the perceived levels of physical and cognitive fatigue in amateur and professional athletes are similar in nature. This result can be associated with the fact that professional athletes are accustomed to physical and cognitive intensity throughout their sports careers. Additionally, the lower sustainability of sports careers in amateur athletes compared to professional athletes may affect their perceptions of fatigue levels. The fact that amateur and professional athletes participate in similar theoretical and practical courses in sports higher education institutions can also be considered as another factor in obtaining these results. A literature review revealed no studies that include the perceived physical and cognitive fatigue scale and the sport level variable. When examining studies presumed to be related to perceived physical and cognitive fatigue, it was found in the study by Saatoğlu Akıllı and Karagün (29) that there were no significant differences in burnout scores between amateur and professional participants, and it was observed that the results support the findings of this study.

In the study, no significant differences were found in the total scores and sub-dimension scores of the Athlete Cognitive Flexibility Inventory based on the sport level variable. Accordingly, it can be concluded that the sport level variable does not have a determining effect on cognitive flexibility scores. Both amateur and professional athletes can undergo general mental and physical adaptation processes associated with sports. Amateur athletes, upon gaining sufficient experience in a specific sports discipline and developing various cognitive and strategic skills during this process, can reach similar levels of cognitive flexibility as professional athletes. A review of the literature on cognitive flexibility and the sport level variable shows that Yılmaz et al. (42) found significant differences in cognitive flexibility scores among athletes based on their sport level. The difference in findings may be due to participants' specific sports disciplines and the sporting experiences related to those disciplines.

In the study, significant differences were found in the total scores and sub-dimension scores of the Perceived Physical and Cognitive Fatigue Scale based on the age of sports participation. When evaluated, participants who have been engaged in sports for 5-9 years were found to have higher averages compared to those who have been involved in sports for 1-4 years and 10 years or more, both in terms of the total perceived physical and cognitive fatigue scale and the perceived cognitive fatigue sub-dimension scores. Specifically, for the perceived physical fatigue sub-dimension, it was observed that participants engaging in sports for 5-9 years had higher averages compared to those engaging in sports for 1-4 years. According to these results, it can be said that individuals engaged in sports for 5-9 years may feel more physically and mentally fatigued due to the cumulative effect of long-term sports participation. This situation can be associated with participants being in an age range where they can achieve their peak athletic performance. Athletes may strive for maximum effort especially during their undergraduate education process to achieve sporting success. Therefore, they may be involved in a rigorous process both physically and cognitively. Consequently, athletes may operate under more stress, which can increase their sense of fatigue. There were no studies found in the literature that specifically included the Perceived Physical and Cognitive Fatigue Scale and sports age as variables. When examining studies related to perceived physical and cognitive fatigue, Yılmaz et al. (43) and Koçyiğit and Pepe (25) did not find significant differences in exhaustion inventory scores in sports according to sports age, which contrasts with the findings of this study. The difference between findings can be explained by differences in data collection tools, sample groups, socio-cultural characteristics, types of sports, and experiences.

In the study, no significant differences were found in the total scores and alternative subscale scores of the Sports Cognitive Flexibility Inventory based on sports age variable. However, significant differences favoring participants engaging in sports for 10 years or more were identified in the control subscale scores based on sports age. Accordingly, participants who had been involved in sports for 10 years or more were observed to have higher control scores compared to those who had been involved for 5-9 years. These results indicate that sports age does not have a significant impact on general cognitive flexibility and alternative generation skills, but it does affect the ability to control. Participants engaged in sports for a longer period, particularly showing higher scores in the control subscale, suggest that experience plays an important role in developing control abilities. It is believed that athletes who have been engaged in sports for 10 years or more encounter more stressful situations, make strategic decisions, and develop their control skills during this process. This process is expected to contribute to athletes' ability to adapt to sudden changes and unexpected

situations over time, thereby enhancing their flexibility and adaptation skills. Additionally, it can be said that long-term training and education processes play a significant role in the development of these skills.

When examining studies that include cognitive flexibility and sports age as variables in the literature, Kaya (23), Akyol and Taşkıran (3), and Bayer (6) found no significant differences in cognitive flexibility total scores based on years in sports, which aligns with the findings of the current study. However, Karadağ (22) found significant differences favoring participants with 11 years or more of sports experience in cognitive flexibility total scores. Similarly, Kara, M. (20) identified significant differences in cognitive flexibility total scores based on sports experience, which do not parallel the findings of this study. The differences among findings can be attributed to variations in the distribution of years in sports, types of sports disciplines, and socio-cultural characteristics.

In the study, a negative and moderate significant relationship was found between the total score of perceived physical and cognitive fatigue and the total score of athlete cognitive flexibility inventory. Additionally, a negative and low significant relationship was identified between the total score of perceived physical and cognitive fatigue and the scores of alternative subscales, and a negative and moderate significant relationship with the control subscale. Furthermore, a negative and moderate significant relationship was detected between the physical fatigue subscale and the total score and control scores of athlete cognitive flexibility inventory. Similarly, a negative and moderate significant relationship was observed between the cognitive fatigue subscale and the total score and control scores of athlete cognitive flexibility inventory, and a negative and low significant relationship with the alternative subscales. Based on these results, it can be concluded that perceived physical and cognitive fatigue negatively affect cognitive flexibility. Similarly, it can be stated that athletes tend to lose their mental flexibility when they are fatigued, which could adversely impact their performance. When athletes are physically and cognitively fatigued, their ability to cope with stress, make strategic decisions, and adapt to unexpected situations may decrease. Additionally, when athletes are fatigued, they may struggle to generate creative and alternative solutions and may experience a decline in their control skills. In summary, athletes who are physically and cognitively fatigued may find it difficult to generate alternative solutions and may experience a decrease in their control skills. Some students in sports universities may be amateur or professional athletes, while others may not engage in sports due to reasons such as injury. Therefore, theoretical and practical courses in higher education institutions may be perceived as fatigue for amateur athletes or non-athletes. Professional athletes, in addition to their individual activities related to their current sports discipline, also participate in theoretical and practical courses at higher education institutions. In other words, professional athletes are under intense pressure due to their training programs and educational processes. Therefore, physical and cognitive activities can be perceived as fatigue in participants. A literature review related to perceived physical and cognitive fatigue and athlete cognitive flexibility supports the findings of the current study. Yennurajalingam and Bruera (40) conducted a study indicating that psychological fatigue negatively affects cognitive activities such as attention and focus and emphasizes the need for athletes to recover physically and cognitively as soon as possible. Effective recovery not only ensures sustainability in athletes but also helps them resist negative conditions such as exhaustion and depression (24). In this sense, some suggestions can be given to minimize the negative effects of perceived physical and cognitive fatigue on cognitive flexibility in student athletes:

Athlete students can develop stress management techniques during classes, enhancing their coping with stress, problem-solving, and cognitive flexibility skills.

Light exercises, yoga, meditation, and massage, among other active recovery techniques, can alleviate the effects of fatigue in athlete students and provide mental relaxation.

Collaboration with sports psychologists can help athletes identify and manage symptoms of cognitive fatigue.

Games and brain exercises that promote strategic thinking can assist athletes in enhancing their cognitive flexibility and creative thinking abilities.

The use of wearable technologies to monitor athletes' fatigue levels and physical performance can aid in optimizing training programs.

Encouraging athlete students to participate in programs focused on adequate rest, balanced nutrition, and cognitive flexibility can be beneficial.

REFERENCES

1. Akçakaya F. Antrenörlerin empatik eğilim ve bilişsel esneklik düzeylerinin incelenmesi. Journal of Health Sciences/Erciyes Üniversitesi Sağlık Bilimleri Dergisi, 2021; 30(1).
2. Akyol G. Spor Bilimleri Fakülteleri Öğrencilerinde Akademik Güdülenmenin Yordayıcısı Olarak Üstbiliş ve Bilişsel Esneklik. Doktora Tezi. Çorum: Hitit Üniversitesi, Sağlık Bilimleri Enstitüsü; 2024.
3. Akyol G, Taşkıran C. Elit Düzey Güreşçilerin Bilişsel Esneklik Düzeyleri ve Stresle Başa Çıkma Stratejileri. Gazi Beden Eğitimi ve Spor Bilimleri Dergisi, 2023; 28(4): 267-275.
4. Asıcı E, İkiz F. Mutluluğa giden bir yol: Bilişsel esneklik. Mehmet Akif Ersoy Üniversitesi Eğitim Fakültesi Dergisi, 2015; 1(35): 191-211.
5. Atalı M. Elit düzey kadın erkek buz hokeyi sporcularının mental dayanıklılık ve bilişsel esneklik düzeylerinin incelenmesi. Doktora Tezi. Bursa: Bursa Uludağ Üniversitesi; 2022.
6. Bayer E. Bireysel ve Takım Sporcularının Zihinsel Dayanıklılık ve Bilişsel Esneklik Durumlarının İncelenmesi. Yüksek Lisans Tezi. Mardin: Mardin Artuklu Üniversitesi Lisansüstü Eğitim Enstitüsü Beden Eğitimi ve Spor Ana Bilim Dalı; 2023.
7. Bogdanis GC. Effects of physical activity and inactivity on muscle fatigue. Frontiers in physiology, 2012; 3: 142. https://doi.org/10.3389/fphys.2012.00142
8. Boksem MA, Tops M. Mental fatigue: costs and benefits. Brain Research Reviews, 2008; 59(1): 125-139.
9. Büyüköztürk Ş. Veri analizi el kitabı: İstatistik, araştırma deseni, SPSS uygulamaları ve yorum. Pegem Akademi, 2008:167-182.
10. Büyüköztürk Ş, Kılıç Çakmak E, Akgün ÖE, Karadeniz Ş, Demirel F. Bilimsel Araştırma Yöntemleri. 14. baskı. Ankara: Pegem Yayınları, 2008.
11. Canas JJ, Fajardo I, Salmeron L. Cognitive flexibility. International Encyclopedia of Ergonomics and Human Factors. 2006; 1(3): 297-301.
12. Dennis JP, Vander Wal JS. The cognitive flexibility inventory: Instrument development and estimates of reliability and validity. Cognitive therapy and research, 2010; 34: 241-253.
13. Finsterer J, Mahjoub SZ. Fatigue in healthy and diseased individuals. American Journal of Hospice And Palliative Medicine, 2014; 31(5): 562-575.
14. George D, Mallery M. SPSS for Windows Step by Step: A Simple Guide and Reference, 17.0 Update. 10th ed. Boston: Pearson, 2010.
15. Güler S. Geleneksel ve e-sporcuların bilişsel esneklik düzeylerinin incelenmesi. Yüksek Lisans Tezi. Balıkesir: Balıkesir Üniversitesi Sağlık Bilimleri Enstitüsü; 2023.
16. Gülüm İV, Dağ İ. Tekrarlayıcı Düşünme Ölçeği ve Bilişsel Esneklik Envanterinin Türkçeye Uyarlanması, Geçerliliği ve Güvenirliği. Anadolu Psikiyatri Dergisi, 2012;1 3(3): 216-223.
17. Hirt ER, Devers EE, McCrea SM. I want to be creative: exploring the role of hedonic contingency theory in the positive mood-cognitive flexibility link. Journal of Personality And Social Psychology, 2008; 94(2): 214-230.
18. Job RS, Dalziel J. Defining fatigue as a condition of the organism and distinguishing it from habituation, adaptation, and boredom. In Stress, Workload, and Fatigue. CRC Press, 2001: 466-476. https://doi.org/10.1201/b12791
19. Jones CM, Griffiths PC, Mellalieu SD. Training load and fatigue marker associations with injury and illness: a systematic review of longitudinal studies. Sports Medicine, 2017 ;47(5): 943-974.
20. Kara M. Karate branşındaki sporcuların karar verme stilleri ile bilişsel esneklik düzeyi. Yüksek Lisans Tezi. Sakarya: Sakarya Uygulamalı Bilimler Üniversitesi Lisansüstü Eğitim Enstitüsü; 2020.
21. Kara NŞ. Spor yapan ve yapmayan bireylerde yaşamın anlamı, affetme esnekliği, bilişsel esneklik ile psikolojik belirtilerin çeşitli değişkenler açısından incelenmesi. Doktora Tezi. Sakarya: Sakarya Uygulamalı Bilimler Üniversitesi Lisansüstü Eğitim Enstitüsü; 2020.
22. Karadağ CC. Bireysel ve takım sporcularında bilişsel esneklik, sportif öz güven ve spora özgü başarı motivasyonunun incelenmesi. Yüksek Lisans Tezi. Aksaray: Aksaray Üniversitesi Sosyal Bilimler Enstitüsü; 2023.
23. Kaya H. Bireysel ve takım elit sporcularda zihinsel antrenman düzeyleri ve bilişsel esneklik durumlarının incelenmesi. Yüksek Lisans Tezi. Erzurum: Atatürk Üniversitesi Kış Sporları ve Spor Bilimleri Enstitüsü; 2022.
24. Kellmann M, Bertollo M, Bosquet L, Brink M, Coutts AJ, Duffield R, Erlacher D, Halson SL, Heckstеden A, Heidari J, Kallus KW, Meeusen R, Mujika I, Robazza C, Skorski S, Venter R, Beckmann J. Recovery and performance in sport: consensus statement. International Journal of Sports Physiology and Performance. 2018; 13(2): 240-245.
25. Koçyiğit B, Pepe O. Triatlon sporcularında tükenmişlik düzeylerinin incelenmesi. Uluslararası Bozok Spor Bilimleri Dergisi, 2022; 3(2): 95-101.
26. Miller NL, Matsangas P, Shattuck LG. Fatigue and its effect on performance in military environments. In: Performance Under Stress. CRC Press, 2018: 247-266. https://doi.org/10.1201/9781315599946

27. Öcal T, Göncü BS. Sporda mücadele ve tehdit algısı ile Brunel ruh hali arasındaki ilişki. Akdeniz Spor Bilimleri Dergisi, 2023; 6(1-Cumhuriyet'in 100. Yılı Özel Sayısı): 215-224.
28. Penner IK, Raselli C, Stöcklin M, Opwis K, Kappos L, Calabrese P. The Fatigue Scale for Motor and Cognitive Functions (FSMC): validation of a new instrument to assess multiple sclerosis-related fatigue. Multiple Sclerosis Journal, 2009; 15(12): 1509-1517.
29. Saatoğlu Akıllı M, Karagün E. Spor kulübü yöneticilerinin tükenmişlik düzeylerinin incelenmesi. Beden Eğitimi ve Spor Bilimleri Dergisi, 2014; 8(1): 49-59.
30. Sapmaz F, Doğan T. Assessment of cognitive flexibility: reliability and validity studies of Turkish version of the Cognitive Flexibility Inventory. Ankara University Journal Of Faculty of Educational Sciences (JFES), 2013; 46(1): 143-162.
31. Scott DL, Khoshaba B, Choy EH, Kingsley G. Limited correlation between the Health Assessment Questionnaire (HAQ) and EuroQol in rheumatoid arthritis: questionable validity of deriving quality adjusted life years from HAQ. Annals of The Rheumatic Diseases, 2007; 66(11): 1534-1537.
32. Stevens AD. Social problem-solving and cognitive flexibility: relations to social skills and problem behavior of at-risk young children. Doctoral dissertation. Seattle: Seattle Pacific University; 2009.
33. Tabak O. Spor Bilimleri Öğrencilerinin Bilişsel Esneklik ve İstihdam Edilebilirlik İlişkisi. Yüksek Lisans Tezi. İstanbul: İstanbul Gedik Üniversitesi Lisansüstü Eğitim Enstitüsü Beden Eğitimi ve Spor Bilimleri Ana Bilim Dalı; 2023.
34. Taşpınar HA. Farklı liglerde oynayan futbolcuların ruh halleri ile motivasyonları arasında ilişkinin incelenmesi. Yüksek Lisans Tezi. Balıkesir: Balıkesir Üniversitesi Sağlık Bilimleri Enstitüsü; 2019.
35. Tekkurşun Demir G, Cicioğlu Hİ, Yarayan YE. Algılanan Fiziksel ve Bilişsel Yorgunluk Ölçeği'nin Geliştirilmesi (Afbyö): Geçerlik ve güvenirlik çalışması. Akdeniz Spor Bilimleri Dergisi, 2023; 6(3): 715-726.
36. Ural A, Kılıç İ. Bilimsel Araştırma Süreci ve SPSS ile Veri Analizi. 2. baskı. Ankara: Detay Yayıncılık, 2006.
37. Weinberg RS, Gould D. Foundations of Sport and Exercise Psychology. 7th ed. Human Kinetics, 2019.
38. Williams AM, Elliott D. Anxiety, expertise, and visual search strategy in karate. Journal of Sport And Exercise Psychology, 1999; 21(4): 362-375.
39. Yarayan YE, Turhan MÖ, Demir GT. Bilişsel Esneklik Envanterinin Sporcular İçin Uyarlanması: Geçerlik ve güvenirlik çalışması. Gaziantep Üniversitesi Spor Bilimleri Dergisi, 2023; 8(3): 221-240.
40. Yennurajalingam S, Bruera E. Palliative management of fatigue at the close of life; it feels like my body is just worn out. JAMA, 2007; 297(3): 295-304.
41. Yılmaz A, İnce G, Kırımoğlu H. Beden Eğitimi ve Çocuk Gelişimi Öğrencilerinin Bilişsel Esneklik ve Kaynaştırma Eğitimine Bakış Açıları. Trakya Eğitim Dergisi, 2020; 10(1): 207-220.
42. Yılmaz BH, Yetim D, Özdemir M, Üzer Y, Gül E. Sporcularda ruminasyon ile bilişsel esneklik arasındaki ilişki. Yalova Üniversitesi Spor Bilimleri Dergisi, 2024; 3(1): 127-139.
43. Yılmaz B, Kara M, Selvi H. Aktif spor yapan spor bilimleri öğrencilerinin sporda tükenmişlik ve sporcu öz şefkat düzeyleri arasındaki ilişkinin incelenmesi. Gümüşhane Üniversitesi Sağlık Bilimleri Dergisi, 2023; 12(3): 1346-1357.

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The Effect of Dominant Leg on Change of Direction Performance in Young Female Football Players

Ayşenur Turgut KAYMAKÇI [1A], Ertuğrul GELEN [1B], Volkan SERT [1C]

[1] *Sakarya Uygulamalı Bilimler University, Faculty of Sport Sciences, Department of Coaching Education, Department of Sport and Health, Konya, TÜRKİYE*
Address Correspondence to Ayşenur Turgut KAYMAKCI: e-mail: aysenurturgut@subu.edu.tr

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A: Orcid ID: 0000-0003-0537-6018 B: Orcid ID: 0000-0001-7817-7007 C: Orcid ID: 0000-0001-7399-7516

Abstract

Over the last two decades, women's soccer has become increasingly established and recognised. The demands of women's soccer have increased significantly, with a significant development in terms of quantity, including improved fitness performances and a greater number of matches and players throughout the season. Movements in women's soccer consist of a large number of directional changes. In this study, the effect of dominant leg on Change of Direction (COD) performance in young female soccer players was investigated.Twenty (mean±SD age17.1±1.56 years, body weight:55.7±4.94kg, height:1.61±0.05 meter) young female soccer players participated in the study. The players performed change of direction tests at different angles (45°-90°-135°-180°) on a 10-meter track, knee flexion (KFRS) and extension isometric strength tests (KERS), and asymmetric depth jump tests (ADJ). Athletes performed all tests with both the dominant leg (DL) and non-dominant leg (NDL). In the analysis of the data, Parametric Dependent Samples T-test statistical analysis was used to determine the differences between DL and NDL performances, and correlation analysis was performed to examine the relationships between the tests.It was observed that COD performance of female soccer players with DL (5-10m P=0.000-0.009, t=2.924-4.802, ES:0.44-0.59 and, 0-10m P=0.000-0.030 t=2.351-6.757, ES:0.33-0.59) were better than the NDL. DL's KERS (Extension= 6.4%kg, t=4.947) and KFRS (Flexion=12.7% kg, t=4.406 ES:0.77-0.82), ADJ contact time (CT) (CT=-16.4% (ms), t=-22.601) and flight time (FT) (FT= %17,6 (ms), t=22.931 ES:0.64-0.75) tests showed better performance than NDL's. Significant relationship was found between DL KFRS and DL's 45 degrees (5-10m r=,715**, 0-10mr =,520* P<0.05), 135 degrees (5-10m r=,562**, 0-10m r=,533*, P<0.05), and 180 degrees (5-10 m r=,687**, 0-10m r =,622 ** P<0.05) COD values. Significant relationship was found between DL KERS and DL's 45 degrees (5-10m r=,566**; 0-10m r=,502* P <0.05) and 180 degrees (5-10m r=,495*, P<0.05) COD values.When the findings were examined, it was determined that change of direction performance with dominant leg was better than with non-dominant leg in female soccer players. This is thought to be due to the DL's ability to generate more isometric strength during COD.

Keywords: Change of direction, dominant leg, women's soccer, performance, strength asymmetry.

Genç Kadin Futbol Oyuncularinda Baskin Bacağin Yön Değiştirme Performansina Etkisi

Özet

Son yirmi yılda, kadın futbolu, giderek kendine daha fazla yer bulmakta ve tanınmaktadır. Gelişmiş kondisyon performansları ile sezon boyunca daha fazla sayıda maç ve oyuncuyu içeren nicelik açısından önemli bir gelişme gösteren

kadın futbolunun talepleri önemli ölçüde artmıştır. Kadın futbolunda hareketler çok sayıda yön değiştirmeden oluşmaktadır. Bu çalışmada, genç kadın futbolcularda baskın bacağın yön değiştirme (COD) performansına etkisi incelenmektir.Çalışmaya 20 (mean ± SD age 17.1 ± 1.56 years, body weight: 55.7 ± 4.94 kg, height: 1.61 ± 0.05 m) genç kadın futbolcu katılmıştır. Oyuncular 10 metrelik parkurda ve farklı açılarda (45° -90° -135° ve 180°) yön değiştirme testi, diz fleksiyon ve ekstansiyon izometrik kuvvet testi ve asimetrik derinlik sıçraması testi gerçekleştirmişlerdir. Sporcular hem baskın bacak (DL) hem de baskın olmayan bacak (NDL) ile tüm testleri uygulamıştır. Verilerin analizinde baskın bacak ve baskın olmayan bacak performansları arasındaki farkları belirlemek amacıyla Parametrik Bağımlı Örnekler T-testi istatistiksel analizi ve testler arasındaki ilişkileri incelemek için de korelasyon analizi yapılmıştır.Kadın futbolcuların baskın bacaklarının (5-10m P=0.000-0.009, t=2.924-4.802, ES:0.44-0.59 and, 0-10m P=0.000-0.030 t=2.351-6.757, ES:0.33-0.59) COD performansının baskın olmayan bacaklarına göre daha iyi olduğu gözlendi. DL'nin diz ekstansiyon bağıl gücü (KERS) ve diz fleksiyon bağıl gücü (KFRS) (P=0.00 Ekstansiyon=6.4 %kg, t=4.947 and Fleksiyon=12.7% kg, t=4.406 ES:0.77-0.82)., asimetrik sıçrama temas süresi (CT) (CT = -16.4% (ms), t=-22.601) ve havada kalma süresi (FT) (FT=%17,6 (ms), t=22.931 ES:0.64-0.75) testleri NDL'lerden daha iyi performans gösterdi. DL KFRS ile DL'nin 45 derece (5-10m r =,715**, 0-10m r=,520*, P<0.05), 135 derece (5-10m r=,562**, 0-10m r=,533*, P<0.05) ve 180 (5-10m r=,687**, 0-10m r =,622** P<0.05) derece yön değiştirme performansları arasında anlamlı ilişki bulunmuştur. DL KERS ile DL'nin 45 derece (5-10m r=,566**, 0-10m r=,502* P<0.05) ve 180 derece (5-10m r=,495*, P<0.05) COD performansları arasında anlamlı ilişki bulunmuştur.Bulgular incelendiğinde kadın futbolcularda baskın bacak ile yön değiştirme performansının baskın olmayan bacağa göre daha iyi olduğu belirlendi. Bunun, baskın bacağın yön değiştirme sırasında daha fazla izometrik güç üretme yeteneğinden kaynaklandığı düşünülmektedir.

Anahtar Kelimeler: Yön değiştirme, baskın bacak, kadın futbolu, performans, kuvvet asimetrisi.

INTRODUCTION

Interest in soccer has increased in recent years and has become one of the most popular sport in the world played in different age groups at all levels (4, 14, 24). Women's soccer has more than 26 million players worldwide (14). Considering these numbers, it is seen that women's soccer is developing and requires further research.

Soccer is a multi-task sport and it involves different abilities such as sprints, jumps and shootings, dual tackles, and change of direction (COD) movements (9). Elite-level female soccer players may cover 335 m distance with a maximum speed in a single bout and cover 1.53-1,68 km distances with high speeds during a ~ 10 km match (7). They perform the numbers of 1,300 speed and direction changes within this distance, and the COD includes a majority of the activities (5) . On the other hand, young female soccer players perform 28% less high-speed running and 24% shorter distance sprinting than elite female soccer players (18). These movements mostly consist of short high-speed runs, jumps, dual tackle and COD (19). Some physical abilities such as strength, power, speed, and agility gain importance as a requirement of women's soccer, which are high-skill requering activities (10). Especially, the asymmetric strength difference between leg muscle strength is an important factor affecting COD performance (15, 23). In some studies, it has been found that the possibility of injury to the non-dominant leg during unilateral dynamic movements in female soccer players is higher than that of the dominant leg (11, 12, 21, 22). The decrease in the ratio of asymmetry between legs may improve the COD performance while reducing the risk of injury (1, 2).

Considering the studies examining the effect of leg muscle strength on COD performance, Thomas et al. (25) found a low correlation value between isometric mid-thigh pull strength and COD performance. A recent study also showed the same result, De Marco et al. (8) found no significant correlation between IMTPr performance and COD deficit. Additionally, Young et al. (28) found a low correlation value between isometric leg strength and reactive power output during drop jump and COD performance in different directions. Rouissi et al. (23) observed better COD performance and maximal isometric voluntary contraction of the knee extensors/flexors with the dominant leg. Although we can see in the literature that a high relationship between dominant leg and the COD performance, in almost all studies, there were either no significant correlation values between leg strength and COD performances, or values that could not be considered significant were found (16, 23).

The fact that there are few studies on agility, dominant leg strength and asymmetry for young female soccer players and the current studies do not give clear information indicate the deficiency in this area. This deficiency seems worth examining, considering the small differences in achieving success today and how big the factors affecting performance are. Therefore, this study was conducted to examine the effects of young

female soccer players' dominant legs on COD performance. And we hypothesize that the COD performance of young female soccer players with their dominant legs will be better.

METHOD

Experimental Approach to the Problem

In this study, which was carried out to examine the effects of young female soccer players on their COD performance with their dominant legs, the direction change test in different angles (45 °, 90 °, 135 °, 180 °), isometric strength test (knee extension and flexion) was used for determining leg relative strength, and asymmetric depth jump test was used to determine the asymmetry between the legs, and the measurements were respectively evaluated.

Subjects

The research group of this study consisted of 20 (mean ± SD age 17.1 ± 1.56 years, body weight: 55.7 ± 4.94 kg, height: 1.61 ± 0.05 m) young women player who play in women soccer team from Turkish 3rd Women's League. The sample size was determined using the proportionate sample size calculation. This formula indicated that 16 players would be sufficient to complete the study with a 95% confidence interval (5% margin of error) (29). The criterion of the particapation to the study was to have at least 3 years of experience and competing actively in last 12 months. Athletes with any injury or recent injury were excluded from the study. Before the study, the participants were informed about the tests. A signed voluntary consent form was obtained from all participants. The study approved by the Sakarya University of Applied Sciences ethics committee. In every phase of the study, the Helsinki declaration was followed.

Procedures

The tests of the study COD, vertical jump and isometric force tests were conducted in 3 non-consecutive sessions with 48 hours intervals. Change of direction tests were carried out in the first practice session, isometric force tests in the second practice session, and jump tests in the third practice session. All measurements of the athletes were taken between 15:00 and 17:00 in the afternoon. The athletes were familiar with the tests due to the nature of soccer and their training and isometric strength training. Nevertheless, a familiarization session was held one week before the tests. All test measurements were carried out during the break period of the Women's 3rd League.

Change of direction tests

To determine the COD performances of female soccer players , the method reported by Rouissi et al. (23) was used (Figure 1). A general warm-up including 5 minutes of running and 10 minutes of dynamic stretching was performed before the female soccer players COD tests, and warm-up was performed on both the dominant leg and the non-dominant leg directions at all angles (23). The subject's dominant leg was determined based on Waterloo Footedness Questionnaire-Revised (WFQ-R) (13).

The COD performance started with the athlete standing 0,5 meter behind the first photocell door and waiting for staggered stance and starting as soon as she felt ready. During the 10-meter running performance, the direction was changed by using the thrust of the dominant or non-dominant leg at the angles determined (45o - 90o - 135o - 180o) at the 5th meter and the last 5 meters were performed with a straight run at maximum performance.

Each angles of the test, 2 trials were performed, 2 minutes rest was given between trials and the best trial was used for analysis. Strong verbal support was given to the participants throughout the trials to ensure maximum effort.

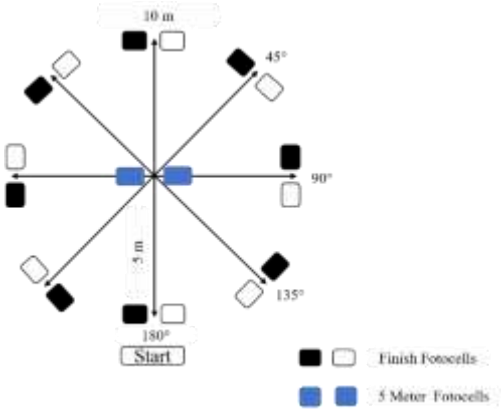

Figure 1. Different Angles of Change of Direction Test Track (Rouıssı et al., 2016)

Maximal knee isometric voluntary contraction tests

Before the knee isometric voluntary contraction test, after 10 minutes of running on the treadmill in the fitness center at 6 km/h, players warmed up with 30% of 1RM of their leg extension and seated leg curl (Diesel Fitness, USA) for 10 repetitions, 2 sets and after one-minute rest, they performed 40% of 1RM for 8 repetitions 2 sets. Knee voluntary isometric contractions of the players were measured by connecting the dynamometer to the leg extension and seated leg curl machines (Diesel Fitness, USA). A modified leg dynamometer (Takei Scientific Instruments Co., Japan) was used for this measurement (Figure 2). The isometric strength value was obtained with the power produced by connecting the gauge part of the dynamometer to the belt of the weight part of the machine. Dominant and non-dominant knee extension was measured first, and then dominant and non-dominant knee flexion was measured. All measurements were taken at a 90-degree knee angle. The athletes were asked to perform the test without lifting their bodies in the air while sitting and with the hands firmly on the handles next to the seat. Each test was done 2 times and the best performance was used for analysis.

Figure 2. Modified Leg Isometric Force Test Setup

Asymmetric Depth Jump Test

For the warm-up before asymmetric depth jump test, 5 minutes of jogging and 10 minutes of dynamic stretching exercises were followed by asymmetric depth jump (rigth-left single leg) trials and warm-up was done. After warm-up, the asymmetric depth jump test was performed first with the dominant leg and then with the non-dominant leg.

The players were standing on a 30 cm high box. The players then jumped unilaterally from the box to the ground and jumped vertically as high as possible immediately after contacted with the ground and landed on the ground with the foot on which she jumped and returned to the ground (28). The hands were fixed on the hips throughout the test. The players repeated this test 2 times and rested for 2 minutes between repetitions. The best value was used for analysis.

To record the jump, a smartphone camera used which placed on tripod facing the participant (in the frontal plane) at ~1.5 m from the box, and zooming in on the feet of the participant. The videos were then analyzed with the application named "Myjump 2" in the Appstore to determine the contact and flight time for each leg during the jump of the players. The validity and reliability study of the "Myjump 2" application was previously carried out by Bishop et. all., (3).

Statistical analyses

Descriptive statistics of all data are presented as mean ± SD. Shapiro-Wilk test used to determine the normality distrubution of data. For the reliability controls of the data, intraclass correlation coefficient (ICC), coefficient of variation (CV), standard error of measurement (SEM) were performed. Parametric Dependent Samples T-test statistical analyzes were performed to determine the difference between dominant leg and non-dominant leg performances, since the data showed normal distribution. The effect sizes (ES) of the data were calculated using Cohen's d (6). Cohen's d accepted d = <0.2 a 'small' effect size, from 0.2 to 0.8 a 'moderate' effect size and> 0.8 a 'large' effect size (25). Relationships between variables were evaluated using Pearson's correlation test. Statistical significance was set at P<0.05. All data were analyzed using SPSS 22.0 (SPSS Inc., Chicago, IL, version. 22.0).

FINDINGS

The analysis results of the data collected from the subjects are given below. ICC, SEM and CV values for all measurements showed moderate reliability: (ICC range: 0.50-0.99; SEM range: 0.00–9.05 and CV% range: 1.15–1.38). The effect sizes were observed to be moderate (ES: 0.6-0.82).

When DL and NDL COD performances were compared for 0-5 meters at all angles (45° -90° -135° -180°), it was observed that there was no statistically significant difference (P = 0.364-0.898 t=-.930-0.921 ES: -0.14-0.14), and when compared at 5-10 and 0-10 meters, a statistically significant difference was observed in favor of DL (5-10 P= 0.000-0.009, t=2.924-4.802, ES: 0.44-0.59 and, 0-10 P = 0.000-0.030 t= 2.351-6.757,ES: 0.33-0.59, respectively) (Table 1).

Comparing DL and NDL's relative isometric strength of knee flexion and extension, a significant difference was found in favor of DL in both flexion and extension (P = 0.00 Extension = 6.4% kg, t=4.947 and Flexion = 12.7% kg, t=4.406 ES: 0.77-0.82, respectively).

When DL and NDL's contact times (CT) and flight times (FT) were compared, a significant difference was found in favor of DL in both CT and FT (P = 0.00 Contact Time = -16.4% (ms), t=-22.601, Flight Time =%17,6 (ms), t=22.931 ES: 0.64-0.75, respectively) (Table 1).

When the relationship analysis between different tests was examined, a significant relationship was found between DL KFRS and DL's 45 degrees COD values (5-10 meters r =, 715 **; 0-10 meters r =, 520 * P <0.05). A significant relationship was found between DL KFRS and DL's 135 degrees COD values (5-10 meters r =, 562 **; 0-10 meters r =, 533 * P <0.05). A significant relationship was found between DL KFRS and DL's 180 degrees COD values (5-10 meters r =, 687 ** 0-10 meters r =, 622 ** P <0.05). A significant relationship was found between DL KERS and DL's 45 degrees COD values (5-10 meters r =, 566 **; 0-10 meters r =, 502 * P <0.05). A significant relationship was found between DL KERS and DL's 180 degrees COD values (5-10 meters r =, 495 *, P <0.05) (Table 2).

Comparing DL and NDL's all angles' COD performances and CT and FT of asymmetric jump, significant relationships were found between DL FT vs. DL's 45 degrees (5-10 meters r = -, 555 *), 90 degrees (0-10 meters r = -, 456 *), 180 degrees (5-10 meters r = -, 512 *, 0-10 meters r = -, 533 *) COD performances (P <0.05) (Table 2).

Table 1. Performance test results of all participants

	Distance (meter)	DL	NDL	Asymmetry %	ES	P
COD 45° (sec.)	0-5	1.25 ± 0.08	1.27 ± 0.06	1.6	0.14	0.509
	5-10	1.08 ± 0.12	1.19 ± 0.10	10.1	0.44	0.009
	10	2.37 ± 0.15	2.47 ± 0.13	7.3	0.33	0.027
COD 90° (sec.)	0-5	1.29 ± 0.29	1.35 ± 0.08	4.4	0.13	0.369
	5-10	1.41 ± 0.11	1.59 ± 0.16	12.7	0.54	0.001
	10	2.79 ± 0.12	2.97 ± 0.16	6.4	0.44	0.001
COD 135° (sec.)	0-5	1.46 ± 0.13	1.42 ± 0.14	2.7	0.14	0.364
	5-10	1.65 ± 0.15	1.91 ± 0.20	15.7	0.59	0.001
	10	3.16 ± 0.18	3.36 ± 0.16	6.3	0.50	0.001
COD 180° (sec.)	0-5	1.33 ± 0.10	1.33 ± 0.06	0	0.06	0.898
	5-10	2.10 ± 0.22	2.30 ± 0.16	9.5	0.46	0.007
	10	3.46 ± 0.27	3.65 ± 0.20	5.4	0.37	0.030
KFRS (Kg)		27.7 ± 2.3	23.3 ± 2.8	12.7	0.82	0.001
KERS (Kg)		48.5 ± 5.3	45.5 ± 5.7	6.4	0.77	0.001
JUMPCont (ms)		274.4 ± 25.6	319.5 ± 28.0	16.4	0.64	0.001
JUMPFligth (ms)		329.1 ± 24.0	271.1 ± 25.7	17.6	0.75	0.001

DL: dominant leg; NDL: non-dominant leg; COD: Change of Direction (45o - 90 o - 135 o - 180 o); KFRS: Knee Flexion Relative Strenght; KERS: Knee Extension Relative Strenght; JUMPCont: Asymmetric Depth Jump Contact Time; Jump Fligth: Asymmetric Depth Jump Fligth Time; ES:Effect Size; (Sec.): Second; (ms): Milisecond

Table 2. Relationship values between change of direction tests at all angles and isometric strength and asymmetric depth jump performance

	Distance	KERS (Kg)		KFRS (Kg)		JUMPCont (ms)		JUMPFligth (ms)	
	(meter)	DL	NDL	DL	NDL	DL	NDL	DL	NDL
DL 45° COD (Sec)	0-5	-.300	-.164	-.016	.126	.220	.276	-.046	-.256
	5-10	-.566**	-.121	-.715**	-.047	.079	-.036	-.555*	-.537*
	10	-.502*	-.121	-.520*	.033	.166	.156	-.317	-.460*
DL 90° COD (Sec)	0-5	-.044	.051	-.035	.274	-.057	-.147	-.247	-.369
	5-10	-.122	-.044	-.120	-.217	-.033	-.191	-.358	-.473*
	10	-.008	-.160	-.026	.157	-.140	-.219	-.456*	-.532*
DL 135° COD (Sec)	0-5	-.130	-.366	-.209	-.105	.059	-.028	-.183	-.256
	5-10	-.368	.058	-.562**	-.036	-.021	-.024	-.286	.147
	10	-.434	-.301	-.533*	-.046	-.153	-.156	-.358	.103
DL 180° COD (Sec)	0-5	-.146	-.099	-.374	.203	-.107	-.236	-.281	-.368
	5-10	-.495*	-.346	-.687**	.000	-.023	-.195	-.512*	-.608**
	10	-.288	-.296	-.622**	.184	-.104	-.307	-.533*	-.548*
NDL 45° COD (Sec)	0-5	-.198	-.443	-.202	-.087	-.342	-.459*	-.420	-.190
	5-10	-.229	-.257	-.117	-.276	.043	-.100	-.263	-.399
	10	-.326	-.348	-.200	-.300	-.092	-.214	-.394	-.389
NDL 90° COD (Sec)	0-5	-.243	.109	-.152	-.150	.124	0.57	-.460*	-.428
	5-10	-.056	-.537*	-.151	.046	-.394	-.461*	.206	.134
	10	-.439	-.524*	-.446*	-.170	-.174	-.302	-.287	-.379
NDL 135° COD (Sec)	0-5	-.108	-.113	-.165	-.099	-.002	-.111	-.512	-.281
	5-10	-.134	-.515*	-.388	.210	-.314	-.481*	.066	.032
	10	-.280	-.498*	-.476*	.011	-.256	-.511*	-.226	-.186
NDL 180° COD (Sec)	0-5	-.255	-.359	-.524*	-.395	.182	-.014	-.650**	-.232
	5-10	.057	-.457*	-.197	.052	-.421	-.436	.113	.154
	10	-.095	-.509*	-.450*	-.294	-.109	-.257	-.330	-.136

DL: Dominant Leg; NDL: Non-Dominant Leg; COD: Change of Direction (45o - 90 o - 135 o - 180 o); KFRS: Knee Flexion Relative Strenght; KERS: Knee Extension Relative Strenght; JUMPCont: Asymmetric Depth Jump Contact Time; Jump Fligth: Asymmetric Depth Jump Fligth Time; Sec.: Second; ms: Milisecond

DISCUSSION AND CONCLUSION

The aim of this study was to examine the effect of dominant leg on COD performance at certain angles (45°-90°-135°-180°) in young female soccer players. The general results of the study conducted for this purpose showed that the COD performances performed with the dominant leg were better at 5-10 meters and 0-10 meters compared to the non-dominant legs. In Knee Extension Relative Strength and Knee Flexion Relative Strength, Asymmetric Depth Jump Tests Contact Time and Flight Time the dominant leg values performed better than the non-dominant leg. There was no overall significant relationship between COD performances and Knee Extension Relative Strength and Knee Flexion Relative Strength, Asymmetric Depth Jump Tests Contact Time, and Flight Time.

The study conducted by Rouissi et al. (23) tested the 45°-90°-135°-180° COD performance of the dominant and non-dominant leg using two different maneuvers in elite young soccer players found that the dominant leg performance was better. As a result of the study, it was predicted that the stronger leg would exhibit a better COD performance. The current study showed similar results. It was found that dominant leg performance was better in all directions and again, DL Knee Extension Relative Strength and Knee Flexion Relative Strength values were better than NDL. Similarly, Lehance et. al., (15) reported that DL is stronger than NDL in young elite soccer players . Based on these results, it can be said that the COD performance of the leg with a greater isometric strength will be better. It is thought that the reason for the high isometric force generation of DL is that the ground reaction force and propulsion. DL has more thrust than NDL, and this can be shown as one of the important factors affecting strength generation. Indeed, in Wong et al. (27)'s study, the difference between the preferred leg in some soccer-related movements and the non-preferred leg was examined and it was observed that the pressure of the preferred leg was more than the non-preferred leg in 115 of the 120 data. Specifically, higher ground reaction force was found in the preferred leg during the propulsion phase in each of the four movements, while higher pressure was found in the non-preferred leg during the landing phase. They attributed this to the preferred leg being stronger. This suggests that the preferred leg plays a role for higher strength of motion (27).

Since leg muscle quality is an important determinant in COD performance (4), the relationship between leg strength and COD performance was investigated in this study. For this purpose, when comparing the Knee Extension Relative Strength and Knee Flexion Relative Strength values with the COD performance, a statistically significant (r = -0.495 * - 0.715 **) relationship values were found between the DL Knee Extension Relative Strength and Knee Flexion Relative Strength values in some aspects. However, we cannot get a clear result with these values, both because there is no difference in all directions and because there are not very high correlation values. Young et al. (28), in their study to examine the relationship between muscle strength and COD performance, they compared their 8-meter straight sprint and their performance in different directions with the reactive muscle strength of a single leg depth jump. They concluded that the relationship between leg reactive muscle strength and speed performance during COD was moderate. They assumed that this might be because the movements were performed similarly. Considering the results obtained in this study, we can say that COD performed with the stronger leg will show better results, since the performances of COD with the dominant leg knee extension relative strength and knee flexion relative strength are better than the non-dominant leg.

The speed of COD is important in a variety of sports, but little is known about how muscle stiffness and asymmetries affect COD. Maloney et al. (17) used muscle stiffness and asymmetry to understand the determinants of COD performance. Eighteen men performed depth jump, right and left direction change with one leg. They found that faster athletes exhibited greater muscle stiffness and less asymmetry during depth jump. This result showed that muscle stiffness and depth jump height asymmetry are strong determinants of COD (17). On the other hand, in this study, a relationship was observed between the flight time asymmetry of the dominant leg and their DL COD performances (Table 2.). The main reason for this is that the dominant leg values show better results for both parameters when looking at contact time and flight time in jump performance (Table 1). In the literature, Nariman et al. (20) conducted a study to examine the different power outputs between dominant and non-dominant legs, and as a result found that the contact time and flight time of the dominant leg were better than the time of the non-dominant leg. In another study, Webb and Lander (26) obtained a low (r = -0.19) relationship value between the two in their study, where they compared the L direction change test and the vertical jump test. Based on the results, we can interpret that the better contact

time and flight time the better the COD performance with the leg. However, this difference between the legs may increase the risk of injury or cause worse performance with the weak leg. These results show that the difference between legs should be reduced not only to improve performance but also to minimize the risk of injury.

In this research, when looking at knee extension relative strength and knee flexion relative strength, we can see that DL values produce higher isometric strength than NDL values (Table 1.). When looking at the relationship between leg isometric strength values and COD performances, significant relationships are seen (Table 2). Thomas et al. (25) examined the relationship between the one leg isometric mid-thigh pull test and COD performance and found a nonsignificant relationship ($r = -0.01$-0.03; $p > 0.05$) between the two. Considering the difference of the tests performed, it may be an idea for future studies to make a research on which test will be more appropriate with a COD. There is no limitation in this study.

Conclusion

In previous studies to examine the relationship between isometric leg strength and COD performance, isometric leg strength was evaluated and compared bilaterally rather than unilaterally (DL). In this study, they were evaluated unilaterally, and young female soccer players performed better with their dominant legs after changing direction during COD. The relationships between DJ performance and COD were examined, but there was no study examining the relationship between unilateral (DL) DJ and COD (DL). As with the DJ, the contact time increases during a sudden maneuver during COD. In the asymmetric depth jump test conducted in the study, the flight times and the contact times also showed a better result in dominant leg performances. It is an important detail that each of the tests is measured and analyzed unilaterally (DL), as in current study, to examine whether there is a relationship between these two. In addition, the possible increase in leg relative strength will positively affect COD performance. In current study, if it is taken into account that the dominant leg produces a greater isometric force in the relative strength test, the stronger the dominant leg explains the asymmetric difference in both the COD test and the jump test. Decreasing the difference between legs will give better results in COD performances with both legs. Since a relatively poor performance of the non-dominant leg will also create a negative consequence for possible necessary situations, it would be good to reduce the difference between the legs to the lowest possible level. The first aim of the trainers and conditioners in this regard should be to make practices and trainings that will close this difference.

REFERENCES

1. Augustsson, J., Thomeé, R., & Karlsson, J. (2004). Ability of a new hop test to determine functional deficits after anterior cruciate ligament reconstruction. Knee Surgery, Sports Traumatology, Arthroscopy, 12(5), 350–356.
2. Barber, S. D., Noyes, F. R., Mangine, R., & DeMaio, M. (1992). Rehabilitation after ACL reconstruction: function testing. In Orthopedics, Vol. 15, Issue 8, pp. 969–974.
3. Bishop, C., Perez-Higueras Rubio, M., Gullon, I. L., Maloney, S., & Balsalobre-Fernandez, C. (2022). Jump and change of direction speed asymmetry using smartphone apps: Between-session consistency and associations with physical performance. Journal of Strength and Conditioning Research, 36(4), 927–934.
4. Castillo-Rodríguez, A., Fernández-García, J. C., Chinchilla-Minguet, J. L., & Carnero, E. Á. (2012). Relationship between muscular strength and sprints with changes of direction. The Journal of Strength & Conditioning Research, 26(3), 725–732.
5. Chaouachi, A., Manzi, V., Chaalali, A., Wong, D. P., Chamari, K., & Castagna, C. (2012). Determinants analysis of change-of-direction ability in elite football players. The Journal of Strength & Conditioning Research, 26(10), 2667–2676.
6. Cohen, J. (2013). Statistical power analysis for the behavioral sciences. Routledge.
7. Datson, N., Hulton, A., Andersson, H., Lewis, T., Weston, M., Drust, B., & Gregson, W. (2014). Applied physiology of female football: an update. Sports Medicine, 44(9), 1225–1240.
8. De Marco, K., Lyons, M., Joyce, C., & Conlon, J. A. (2023). The relationship between relative lower-body strength, sprint and change of direction ability in elite youth female soccer athletes. International Journal of Sports Science & Coaching, 17479541231180329.
9. Di Salvo, V., Baron, R., González-Haro, C., Gormasz, C., Pigozzi, F., & Bachl, N. (2010). Sprinting analysis of elite football players during European Champions League and UEFA Cup matches. Journal of Sports Sciences, 28(14), 1489–1494.
10. Emmonds, S., Nicholson, G., Begg, C., Jones, B., & Bissas, A. (2019). Importance of physical qualities for speed and change of direction ability in elite female football players. The Journal of Strength & Conditioning Research, 33(6), 1669–1677.
11. Fort-Vanmeerhaeghe, A., Gual, G., Romero-Rodriguez, D., & Unnitha, V. (2016). Lower limb neuromuscular asymmetry in volleyball and basketball players. Journal of Human Kinetics, 50(1), 135–143.

12. Hewit, J. K., Cronin, J. B., & Hume, P. A. (2012). Asymmetry in multi-directional jumping tasks. Physical Therapy in Sport, 13(4), 238–242.
13. Kapreli, E., Athanasopoulos, S., Stavridis, I., Billis, E., & Strimpakos, N. (2015). Waterloo Footedness Questionnaire (WFQ-R): cross-cultural adaptation and psychometric properties of Greek version. Physiotherapy, 101, e721.
14. Kunz, M. (2007). Big count: 265 million playing football. Fifa Magazine, 10-15.
15. Lehance, C., Binet, J., Bury, T., & Croisier, J.-L. (2009). Muscular strength, functional performances and injury risk in professional and junior elite football players. Scandinavian Journal of Medicine & Science in Sports, 19(2), 243–251.
16. Madruga-Parera, M., Bishop, C., Beato, M., Fort-Vanmeerhaeghe, A., Gonzalo-Skok, O., & Romero-Rodríguez, D. (2021). Relationship between interlimb asymmetries and speed and change of direction speed in youth handball players. The Journal of Strength & Conditioning Research, 35(12), 3482–3490.
17. Maloney, S. J., Richards, J., Nixon, D. G. D., Harvey, L. J., & Fletcher, I. M. (2017). Do stiffness and asymmetries predict change of direction performance? Journal of Sports Sciences, 35(6), 547–556.
18. Mohr, M., Krustrup, P., Andersson, H., Kirkendal, D., & Bangsbo, J. (2008). Match activities of elite women football players at different performance levels. The Journal of Strength & Conditioning Research, 22(2), 341–349.
19. Mujika, I., Santisteban, J., Impellizzeri, F. M., & Castagna, C. (2009). Fitness determinants of success in men's and women's football. Journal of Sports Sciences, 27(2), 107–114.
20. Nariman, E., Elnemr, A., Abdellatif, A., Elnemr, O., Shawky, W., & Hazzaa, W. E. (n.d.). A Comparıson of Power Performance Varıables in Sıngle Leg Jump Between Domınant and Non-Domınant Legs For Young Men.
21. Paterno, M. V, Ford, K. R., Myer, G. D., Heyl, R., & Hewett, T. E. (2007). Limb asymmetries in landing and jumping 2 years following anterior cruciate ligament reconstruction. Clinical Journal of Sport Medicine, 17(4), 258–262.
22. Paterno, M. V, Schmitt, L. C., Ford, K. R., Rauh, M. J., Myer, G. D., Huang, B., & Hewett, T. E. (2010). Biomechanical measures during landing and postural stability predict second anterior cruciate ligament injury after anterior cruciate ligament reconstruction and return to sport. The American Journal of Sports Medicine, 38(10), 1968–1978.
23. Rouissi, M., Chtara, M., Owen, A., Chaalali, A., Chaouachi, A., Gabbett, T., & Chamari, K. (2016). Effect of leg dominance on change of direction ability amongst young elite football players. Journal of Sports Sciences, 34(6), 542–548.
24. Stølen, T., Chamari, K., Castagna, C., & Wisløff, U. (2005). Physiology of football. Sports Medicine, 35(6), 501–536.
25. Thomas, C., Dos'Santos, T., Comfort, P., & Jones, P. A. (2018). Relationships between unilateral muscle strength qualities and change of direction in adolescent team-sport athletes. Sports, 6(3), 83.
26. Webb, P., & Lander, J. (1983). An economical fitness testing battery for high school and college rugby teams. Sports Coach, 7(3), 44–46.
27. Wong, P., Chamari, K., Chaouachi, A., Wisløff, U., & Hong, Y. (2007). Difference in plantar pressure between the preferred and non-preferred feet in four football-related movements. British Journal of Sports Medicine, 41(2), 84–92.
28. Young, W. B., James, R., & Montgomery, I. (2002). Is muscle power related to running speed with changes of direction? Journal of Sports Medicine and Physical Fitness, 42(3), 282–288.
29. Newbold, P., Carlson, W. L., & Thorne, B. M. (2013). Statistics for business and economics. Pearson.

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Effect of Psychological Fragility on Motivation in Sports

Yunus Emre BÜYÜKBASMACI [1A], Murat ERDOĞDU [2B], Enes Buğra ÖZ [3C]

[1] *Karamanoğlu Mehmet bey University, School of Applied Sciences, Department of Recreation Management, Karaman, TÜRKİYE*
[2] *Selcuk University, Faculty of Sport Sciences, Department of Sport Management, Konya, TÜRKİYE*
[3] *Akdeniz University, Faculty of Sport Sciences, Institute of Social Sciences, Antalya, TÜRKİYE*

Address Correspondence to Yunus Emre BÜYÜKBASMACI: e-mail: emrebasmaci70@gmail.com

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A: Orcid ID: 0000-0003-1090-3273 B: Orcid ID: 0000-0002-5324-2236 C: 0000-0002-3369-7751

Abstract

The aim of this study is to analysis the effect of psychological fragility on motivation in sports. The "Psychological Fragility Scale" and the "Motivation in Sports Scale-II" were used as data collection tools in the study. The "Psychological Fragility Scale" was developed by Sinclair and Wallston (32), and adapted to Turkish by Akın and Eker (2). The "Motivation Scale in Sports-II" is based on Pelletier et al. (27), developed by, It was adapted into Turkish by Yildiz et al.(38). The samples of the study were determined by using the "Objective (Monographic) and Theoretical Sample Selection Technique", one of the non-probability (judicial) sample selection techniques. Scales were performed by giving the necessary time to the athletes accompanied by a trainer before training. A total of 216 athletes were participated in the research. SPSS package programs were used in the analysis of the obtained data. Normality test was performed in order to test the hypotheses established before the study, descriptive statistical analysis, correlation analysis and regression analysis were performed respectively. At the end of the study, a moderate of negative relationship (-,60) was determined between the level of psychological decrepitude and the level of motivation in sports. It has been found that as athletes' psychological fragility perception scores increase, there is a decrease in motivation skills scores in sports.

Keywords: Sports, athletes, psychological fragility, motivation in sports.

Psikolojik Kırılganlığın Sporda Güdülenmeye Etkisi

Özet

Bu çalışmanın amacı, psikolojik kırılganlığın sporda güdülenmeye etkisini yordamaktır. Çalışmada veri toplama aracı olarak, "Psikolojik Kırılganlık Ölçeği" ile "Sporda Güdülenme Ölçeği-II" kullanılmıştır. "Psikolojik Kırılganlık Ölçeği" Sinclair ve Wallston (1999), tarafından geliştirilmiş Akın ve Eker (2011), tarafından Türkçe'ye uyarlanmıştır. "Sporda Güdülenme Ölçeği-II" ise Pelletier ve ark. (2013), tarafından geliştirilmiş, Yıldız ve arkadaşları (2019), tarafından Türkçe'ye uyarlanmıştır. Çalışmanın örneklemleri, olasılıkdışı (yargısal) örneklem seçim tekniklerinden "Amaçsal (Monografik) ve Teorik Örneklem Seçim Tekniği" kullanılarak belirlenmiştir. Ölçekler sporculara antrenman öncesi antrenör eşliğinde gerekli süreler tanınarak gerçekleştirilmiştir. Araştırmada toplam 216 sporcu yer almıştır. Elde edilen verilerin analizinde SPSS programından yararlanılmıştır. Çalışma öncesinde kurulan hipotezleri test etmek amacıyla il olarak normallik testi gerçekleştirilmiştir. Normallik testi sonrasında sırasıyla tanımlayıcı istatistik analizi, korelasyon analizi ve regresyon analizi gerçekleştirilmiştir. Araştırmanın sonunda, psikolojik kırılganlık düzeyi ile sporda güdülenme düzeyi arasında olumsuz yönde çok yüksek düzeyde (-,989) bir ilişki belirlenmiştir. Sporcuların psikolojik kırılganlık algı puanları yükseldikçe, sporda güdülenme becerileri puanlarında bir azalma olduğu tespit edilmiştir.

Anahtar Kelimeler: Spor, sporcu, psikolojik kırılganlık, sporda güdülenme.

INTRODUCTION

The act of being offended has been expressed by the Turkish Language Institution as "getting offended, offended, hurt against someone" (1). Psychological fragility, on the other hand, is defined as psychological frustration behaviors that occur in individuals who are in search of success with external approval. Psychological fragility reveals a sense of fragility to the capricious behavior of other people or the difficulties of life (7). This situation can cause negativity in a person's social life and against their goals. In addition, psychological fragility can also negatively affect people's subjective well-being by lowering their hope and excitement levels (30). Factors that cause psychological fragility include stressful events, life experiences, social status, social environment structure, age, gender, marital status, socio-economic status, traumatic experiences, family structure, etc. (23; 35; 36). If Summarized; psychological fragility is considered as a natural consequence of being human (39).

We can define why individuals do sports despite the risk of injury and injury by the phenomenon of motivation in sports (10). Motivation in sports, which is one of the most important building blocks of sporting success, is influenced by the nature of sports, sports branch and at the same time athlete personality traits. At the same time, athletes who receive support from their social environment are advantageous in terms of motivation. On the other hand, individuals who do not have problems with motivation in sports try to reveal their performance in the best way by enjoying sports (19). In addition, the sense of motivation gives the athlete readiness behavior. While some athletes see training as a very enjoyable tool, some athletes see it as a boring and challenging process. The factors that cause these two different motivations are due to the direction, stability and intensity of motivation (34). Some researchers have considered the phenomenon of motivation in sports with three different concepts in their studies: participant-centered, situation-centered and interactional-centered view (4). If the personality structure, needs and goals of the athlete and his coach contain a participant-centered view, the situation the athlete is in, a situational view, both a participatory and a situational view, it is expressed as an interactionist view (4,5; 37).

Psychological fragility drags athletes to the center of obscurity, while motivation in sports is a harbinger of success. Do individuals who experience psychological fragility have problems with motivation in sports? What kind of difficulties do individuals experiencing psychological fragility experience in terms of motivation in sports? What are the solutions to psychological fragility and motivation problems in sports? This study was conducted to look for answers to similar questions. In this athlete-centered study, psychological fragility and motivation issues in sports were analyzed by synthesizing them into sports.

Psychological Fragility

Psychological fragility refers to the cognitions that occur as a result of external approval and success seeking (32). The search for external approval with the meanings attached to success can make people take on a more fragile structure than individuals without expectations. In this context, it is stated that the psychological fragility levels of individuals who need environmental approval to a high degree will be higher (30). It is stated that the phenomenon of psychological fragility can be affected by social structures (29). Human beings have felt the need for approval from their surroundings throughout life. While this behavior is positive when approved by their environment, it can cause psychological fragility by affecting the intellectual strength of individuals when it is not approved (17). In individuals who experience psychological fragility, situations of isolation from life and self-blame occur (3). Sinclair and Wallston (32) stated that psychological fragility may be affected by shame, addiction, cognitive patterns, perfectionism and dysfunctionality along with genetic factors. It is accepted that the changes that may occur in self-esteem affect the level of psychological fragility. While an individual who has lost his self-esteem becomes sensitive to the negative situations he faces, it also leads to an increase in the level of psychological fragility. On the contrary, in the opposite cases, the cognitive perceptions of individuals with high self-esteem are well-structured and the level of fragility is quite low (9).

Motivation in Sports

The concept of motivation is included among the basic elements of exercise and sports psychology. It has a very important position in achieving the success of sports actions. Motivation in sports is the first degree factor in behaviors such as setting any sports goal, taking action for the goal, ensuring the continuation of movement or terminating movement (18). The process of transformation of motivation into behavior is shown in figure 1. (6).

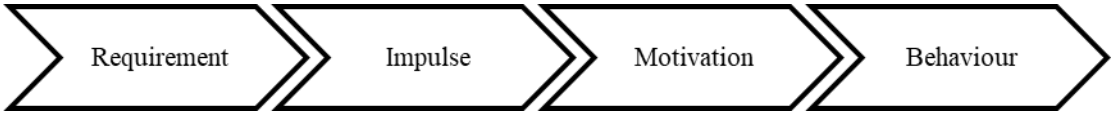

Figure 1. Transformation of Motivation into Behavior

It is a matter of noble importance for athletes to gain a sense of motivation and behavior in order to be successful. The reason is that athletes who do not experience enough motivational behavior can be met with a reaction by their viewers, social environment and internal emotional states. The state of achieving success in sports never happens without motivation(Doğan, 2022).. Motivation and success are a common concept in interaction with each other. For this reason, the motivation levels of athletes have become the criterion of sporting success. In summary; athletes who cannot be motivated, who cannot focus, who cannot motivate themselves should not be expected to show success (22).

METHOD

The research is a study in relational survey model to examine how much perceived fragility perception variable predict motivation in sport levels in athletes. The method of this study is a "relational model" study prepared using the "questionnaire" technique, one of the quantitative research methods.

Model of the Research

In this section, the model diagram of the research is given.

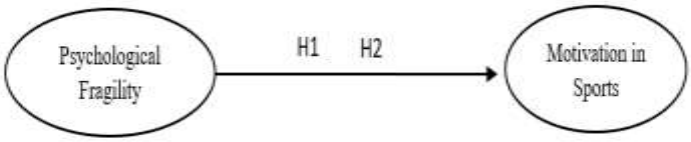

Figure 2. Model of the Research

Hypotheses of the Research

1. H^0: There is no significant relationship between the level of " Psychological Fragility" and the perceptions of "motivation in sports".

1. H^1: There is a significant relationship between the level of " Psychological Fragility" and the perceptions of "motivation in sports".

2. H^0: The level of "psychological vulnerability" has no effect on the perception of "motivation in sports".

2. H^1: The level of "psychological vulnerability" has an effect on the perception of "motivation in sports".

Problem Sentences and Subproblems of the Research

1: Does the level of "psychological vulnerability" have an impact on the perception of "motivation in sports"?

1.1; Is there a positive effect of the level of "psychological vulnerability" in sports on the perception of "motivation in sports"?

Universe and Sampling

The universe of this study consists of amateur age group athletes from Istanbul province. The sample is composed of Bakırköyspor, İfaspor, Bahçelievlerspor athletes determined by the "Objective (Monographic) and Theoretical Sample Selection Technique".

Data Collection Tools

This study was prepared by using the "Psychological Fragility Scale" and the "Motivation in Sports Scale-II".

Psychological Fragility Scale

The "Psychological Fragility Scale" was developed by Sinclair and Wallston (32). Its adaptation into Turkish was carried out by Akın and Eker (2). The scale consists of one dimension and 6 questions. The scale is of 5-point Likert type. The cronbach alpha reliability coefficient of the scale was determined as 0.75.

Scale of Motivation in Sports-II

The Motivation Scale in Sports-II was developed by Pelletier et al. 27). The adaptation study into Turkish was implemented by Öcal and Sakallı (25). The scale is of 7-point likert type. Scale consists of 18 questions. The 6 sub-dimensions of the scale are identity, internal motivation, assimilation, inward impulse, external regulation, lack of motivation. Cronbach alpha "coefficient" of the scale was determined as 0.82.

Statistical Analysis

In the analysis of the data, descriptive statistical methods frequency (n), percentage (%), arithmetic mean (X) and standard deviation (SD) were used for personal informationIn the study, first of all, the normality and linearity of the data sets were evaluated to determine whether the data were suitable for simple linear regression analysis. The existence of extreme values that make normality (multivariate) and linearity assumptions difficult was examined according to mahalanobis distance (13.82) and cook's (Cook'<1) values. In addition, the kurtosis, skewness values, scatter and histogram graphs of the data sets were also examined. In addition to meeting the linearity and normality conditions of the data sets, it was seen that the sample size was sufficient considering the number of predicting variables. For the condition that there is no high correlation coefficient between the predictor variables, which is another assumption of the simple linear regression analysis, the binary correlation coefficients between the predictor variables, VIF and CI values were examined.

It was determined that there was no correlation value above .80, which can be defined as multicollinearity among the predictive variables, the VIF value was less than 10 and the CI value was less than 30. Finally, the Durbin-Watson value was checked to examine the condition of errors being independent; It has been seen that the value is between 1-3 .

Working Group

The study group of this study consisted of a total of 216 athletes, including 68 Bakırköyspor U15/A, U16, U17/B, U18, U-17/A athletes, 89 Bahçelievlerspor U13, U14, U15/B, U16 athlete, 59 İfaspor U14 T.Ş. Grup, U17/A, U18, athletes in the football branch. The surveys were conducted by allowing the athletes of all three sports clubs the necessary time before training accompanied by a coach. The study sample was limited to Bakırköyspor, Bahçelievlerspor, İfaspor athletes as a result of the limitations of the study. Since the sample filling out the questionnaires randomly could not be determined, all data were assumed to be correct answers. In order to solve the hypotheses established before the study, 2 different scale questions were posed to the samples.

FINDINGS

Table 1. Normality test findings

Psychological Fragility	Skewness	*836*	*,168*
	Kurtosis	-1,137	,334
Motivation in Sports	Skewness	-,183	,122
	Kurtosis	-1,357	,334

Normality analysis was performed before the analyses were performed between the scales. It was assumed that the variables with skewness and kurtosis values between -2 and +2 showed normal distribution (16). Accordingly, it was found that the values of Psychological Fragility and Motivation in Sports showed a normal distribution, and it was decided to use the parametric test method in the analysis of the data.

Table 2. Descriptive statistical findings

	N	**Mean**	**Std. Deviation**
Psychological Fragility	216	23,314	3,69058
Motivation in Sports	216	30,158	8,21511

In Table 2, when the descriptive statistical findings showing the perceptions of psychological fragility and motivation in sports were examined, psychological fragility (x=23.314±3.690) was determined as (x=30,158±8,215) motivation in sports.

Table 3. Correlation Analysis Showing the Relationship Between Psychological Fragility and Perceptions of Motivation İn Sports

		Motivation in Sports
Psychological Fragility	Pearson Correlation	-,608**
	P	**,000**

In Table 3, as a result of the correlation analysis, a negative, at a moderate level relationship was determined between psychological fragility and perceptions of motivation in sports.

Table 4. Regression analysis between psychological fragility and perceptions of motivation in sports

Model	**R**	**R Square**	**Adjusted R Square**		**Std. Error of the Estimate**	
1	,608a	,369	,366		2,187	
Anova						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**P**
1 Regression		599,384	1	599,384	125,250	,000b
Residual		1024,024	214	4,786		
Coefficients						
Model		**Unstandardized Coefficients**	**Standardized Coefficients**		**t**	**P**
		B	Std. Error	Beta		
1 (Constant)		-25.778	,859		-30,026	,000
Psychological Fragility		1,121	,100	,608	11,192	,000

In Table 4, as a result of the regression analysis, a statistically significant predictable was found between psychological fragility and perceptions of motivation in sports.

DISCUSSION AND CONCLUSION

When descriptive statistical findings showing the psychological fragility and motivation perceptions of the athletes in the study were examined, psychological fragility (x=23,314±3,690) and motivation in sports (x=30,158±8,215) were determined as.

As a result of the correlation analysis performed, a moderate of negative relationship was determined between psychological vulnerability and perceptions of motivation in sports. As the psychological vulnerability levels of athletes increase, the motivation levels in sports decrease. Psychological vulnerability can be expressed as a state of sadness, unhappiness and pessimism, inability to enjoy events and phenomena in social life, and mental depression, which has become permanent in a way similar to depression. Motivation in sports, on the other hand, evokes empowerment. Given the meaning of the concept of psychological vulnerability, it is not surprising that there is a negative relationship between motivation and psychological vulnerability in sports, which evokes empowerment in sports. Because while psychological fragility drags athletes to the center of obscurity, motivation in sports is a harbinger of success.

When the literature was examined; Kasil's (20) study examined the relationship between burnout perceptions and sport-specific success motivation perceptions in athletes who received curling and skiing training, and a significant negative relationship was observed between athletes' burnout levels and sport-specific success motivations. While psychological vulnerability and burnout perceptions show similarities to each other, sport motivation perceptions and sport-specific success motivation perceptions show similarities. From this point of view, Kasil's (20) study also supports our study. In Demirci's (12) study conducted to compare the levels of motivation and depression perception of students who continue their education and training life at the faculty of sports sciences and the faculty of education, the results of a meaningful low-level relationship between motivation and depression levels were obtained. Özden's (26), a similar study, examined the relationship between academic motivation and depression levels of students receiving online education in his study, and observed a negative, moderate and significant relationship between depression and academic motivation variables. In Karharman's (2019) study, the effect of positive perception levels of elite mountain running athletes on success motivation was examined, and a positively low and significant relationship was observed between positive perception levels of elite mountain running athletes and success motivation. Positive perception is the opposite emotional state of psychological vulnerability. Therefore, in order to support this study, the correlation coefficient should indicate positive results. The motivation for success is directly proportional to the motivation in sports. From this point of view, it would not be wrong to note that Karharman's (2019) study also shows results that support this study. Again, in the Crimean study (2020), the psychological well-being and psychological vulnerability perceptions of women members of life and sports centers were examined and a meaningful negative relationship was found between the psychological well-being of the samples and psychological vulnerability perceptions. According to the findings of Kırım's (21) study, it would be correct to state that the psychological vulnerability levels of women decrease as the level of psychological well-being perception increases. When the similarity of the subjects is taken into account, the results supporting this study have emerged. Demir (11) examined the relationship between motivation Deceleration, anger levels and aggression in elite level boxing athletes in his study, and it was found that not being motivated in sports has a significantly positive and low-strength effect on anger and aggression perceptions in sports. Demir's (11) study also found results that support this study, and it was concluded that anger and aggression levels in sports also increase as perceptions of lack of motivation increase. Because; psychological vulnerability and perceptions of aggression and anger in sports show similarities. Mental toughness, on the other hand, is the opposite of psychological vulnerability. Eser (15) conducted an investigation of the relationship between the success motivation and mental endurance of athletes competing in the amputee Turkish super league in the football branch in his study and reached the results that the relationship is at a meaningful moderate level in a positive direction. In summary; As in many studies, Eser's (2022) study also reached results that support this study. Another study, Akdeniz (1), examined the correlation between physical education and sports teachers' perceptions of learned strength and psychological vulnerability in his study, and a significant level of negative low-power relationship was observed between learned strength and psychological Deciency perceptions.

When the studies carried out in the literature are examined, it has been observed that the results supporting this study are generally obtained. As a result, it is clearly evident in both this study and literature

studies that the perception of psychological vulnerability negatively affects the perception of motivation in sports. As a result of the study; Depending on psychological vulnerability, when considering the solutions to the problems of inability to be motivated in sports, the psychological vulnerability levels of athletes should be determined and the topic of motivation in sports should be turned into an advantage.

REFERENCES

1. Akdeniz H. Beden eğitimi öğretmenlerinin öğrenilmiş ve güçlülük psikolojik kırılganlık düzeyleri arasındaki ilişkinin incelenmesi. Doktora Tezi, Sakarya Üniversitesi Eğitim Bilimleri Enstitüsü, Sakarya. 2018.
2. Akın A, Eker H. Turkish version of the psychological vulnerability scale: a study of validity and reliability. Germany 32th International Conference of the Stress and Anxiety Research Society. 2011.
3. Akın U. The predictive role of the self-compassion on psychological vulnerability in Turkish university students. International Journal of Social Science and Education, 2014; 4(3), 693-701.
4. Altıntaş A. Sporcuların zihinsel dayanıklılıklarının belirlenmesinde optimal performans duygu durumu, güdülenme düzeyi ve hedef yöneliminin rolü. Doktora tezi, Ankara Üniversitesi Sağlık Bilimleri Enstitüsü, Ankara. 2015.
5. Anshel MH. Sport psychology: from theory to practice. Arizona: Gorsuch Scarisbrick 3st ed. Scottsdale, 1997.
6. Baymur FB. Genel psikoloji. İstanbul: İnkılap-Aka Kitabevi. 1976.
7. Bilici H. Duygusal zeka, psikolojik kırılganlık ve yaşam doyumu ilişkisinde kısa semptomların aracı rolü. Yüksek Lisans Tezi. Trabzon Üniversitesi Lisansüstü Eğitim Enstitüsü. Trabzon. 2020.
8. Caz Ç, Kayhan RF, Bardakçı S. Spor yaralanması kaygı ölçeği'nin türkçeye uyarlanması: geçerlik ve güvenirlik çalışması, Spor Hekimliği Dergisi, 2019; 54(1): 52-63.
9. Crocker J. Contingencies of self-worth: ımplications for self-regulation and psychological vulnerability, Self and Identity, 2002; 1:2, 143-149.
10. Çelik A. Spor kulüp yöneticilerinin çatışmayı yönetme stratejilerinin mükemmeliyetçilik özellikleri ve motivasyon düzeyleriyle ilişkisi. Doktora Tezi. Gazi Üniversitesi Sağlık Bilimleri Enstitüsü, Ankara. 2011.
11. Demir Ş. Elit düzey boksörlerin sporda güdülenme, saldırganlık ve öfke düzeyleri arasındaki ilişkinin incelenmesi. Yüksek Lisans Tezi. Bartın Üniversitesi Lisansüstü Eğitim Enstitüsü, Bartın. 2020.
12. Demirci R. Eğitim fakültesi ve spor bilimleri fakültesi öğrencilerinin depresyon ve motivasyon bilgi düzeylerinin karşılaştırılması.; Yüksek Lisans Tezi. Uşak Üniversitesi Sosyal Bilimleri Enstitüsü, Uşak. 2017.
13. Doğan C. Profesyonel futbolcularda duygusal zekâ ile motivasyon ilişkisinde kişilik tipinin aracı rolü. Yüksek Lisans Tezi, Çanakkale Onsekiz Mart Üniversitesi Lisansüstü Eğitim Enstitüsü. Çanakkale. 2022.
14. Doğan O. Spor psikolojisi. Ankara: Detay Yayıncılık. 2015.
15. Eser H. Türkiye ampute futbol süper ligi'nde oynayan sporcuların zihinsel dayanıklılık ve başarı motivasyonu arasındaki ilişkinin incelenmesi. Yüksek Lisans Tezi. Fırat Üniversitesi Sağlık Bilimleri Enstitüsü, Elazığ. 2022.
16. George D, Mallery M. SPSS for windows step by step: a simple guide and reference, 17.0 update. Boston: Pearson. 2010; 10.
17. Güder E. Romantik ilişki yaşayan bireylerde çocukluk çağı travmaları, psikolojik kırılganlık ve ilişki doyumu arasındaki ilişkinin incelenmesi. Yüksek Lisans Tezi. Yakın Doğu Üniversitesi Lisansüstü Eğitim Enstitüsü, Lefkoşa. 2022.
18. Hardy L, Jones G, Gould D. Understanding psychological preparation for sport: theory and practice of elite performers. Chichester, West Sussex: John Wiley ve Sons. 1997.
19. Hosseınalıpour F. Üniversiteli sporcu öğrencilerin, sporda motivasyon düzeyleri ve stresle başa çıkma yöntemlerinin incelenmesi. Yüksek Lisans Tezi. Gazi Üniversitesi Eğitim Bilimleri Enstitüsü, Ankara. 2015.
20. Kasil Ç. Kayak ve curling eğitimi alan sporcu bireylerin tükenmişlik durumları ile spora özgü başarı motivasyon düzeylerinin incelenmesi. Yüksek Lisans Tezi. Trabzon Üniversitesi, Lisansüstü Eğitim Enstitüsü, Trabzon. 2023.
21. Kırım G. Spor ve yaşam merkezlerine üye olan kadınların psikolojik iyi oluş ve psikolojik kırılganlık düzeylerinin incelenmesi. Yüksek Lisans Tezi. Sivas Cumhuriyet Üniversitesi Sağlık Bilimleri Enstitüsü. Sivas. 2020.
22. Koçel T. İşletme yöneticiliği. İstanbul: Beta Yayınları. 2003.
23. Mechanıc D, Tanner JL. Vulnerable people, groups, and populations: societal view. Health Aff Airs, 2007; 26 (5), 1220- 1230.
24. Mimaroğlu R. Vücut geliştirme ve fitness merkezlerinde spor yapan erkek bireylerin spora güdülenmesi (diyarbakır ili örneği). Yüksek Lisans Tezi. Fırat Üniversitesi Sağlık Bilimleri Enstitüsü, Elazığ. 2021.
25. Öcal K, Sakallı D. Turkish adaptation of the sport motivation scale II (SMS-II): Procedures of validity and reliability. International Journal of Sport Exercise and Training Sciences-IJSETS, 2018; 4(1), 39-48.
26. Özden E. Online eğitim alan öğrencilerin akademik motivasyon ve depresyon düzeyleri arasındaki ilişkinin incelenmesi. Yüksek Lisans Tezi. Doğu Akdeniz Üniversitesi, Lisansüstü Eğitim Öğretim ve Araştırma Enstitüsü, Gazimağusa, Kuzey Kıbrıs. 2022.

27. Pelletier LG, Rocchi MA, Vallerand RJ, Validation of the revised sport motivation scale (SMS-II). Psychol Sport Exerc. 2013; (14):329-41.
28. Rex CC, Metzler JN. Development of the sport injury anxiety scale. Meas PhysEduc Exerc Sci. 2016; 20(3): 14658.
29. Sarıçalı M, Satıcı SA. Bilinçli farkındalık ile psikolojik kırılganlık ilişkisinde utangaçlığın aracı rolü. Hitit Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 2017; 10(1), 655- 670.
30. Satıcı SA. Psychological vulnerability, resilience, and subjective wellbeing: the mediating role of hope. Personality And Individual Differences, 2016; 10(2), 68-73.
31. Satıcı SA, Kayıs AR, Akın A. Predictive role of authenticity on psychological vulnerability in Turkish university students. Psychological Reports: Mentaland Physicalhealth, 2013; 112(2), 519-528.
32. Sınclaır VG, Wallston KA. The development and validation of the Psychological Vulnerability Scale. Cognitive Therapy and Research, 1999; 23(2), 119- 129.
33. Sipahi Z. Genç futbolculara uygulanan on haftalık bilinçli farkındalık eğitim programının sporda güdülenme ve bilinçli farkındalık üzerindeki etkisi. Yüksek Lisans Tezi, Marmara Üniversitesi Sağlık Bilimleri Enstitüsü. İstanbul. 2021.
34. Taştan Z. Sporda güdülenme, öz yeterlik ve spora yönelik tutum arasındaki ilişkinin modellenmesi. Yüksek Lisans Tezi. Mersin Üniversitesi Eğitim Bilimleri Enstitüsü, Mersin. 2020.
35. Thoits PA. Life stress, social support, and psychological vulnerability: epidemiological considerations. Journal of Community Psychology, 1982; 10, 341-362.
36. Wang CE. Depression and cognitive vulnerability. Unpublished doctoral disseertation, Univer.of Tromsø, Norway. 2006.
37. Weinberg RS, Gould D. Foundations of sport and exercise psychology. Human Kinetics Publishers. 1995.
38. Yıldız A, Altıntaş A, Elmas S, Aşcı FH. Sporda güdülenme ölçeği-ıı'nin psikometrik özelliklerinin incelenmesi. Spor Hekimliği Dergisi, 2019; 54(1): 33-44.
39. Zubin J, Spring B. Vulnerability: A new view of schizophrenia. Journal of Abnormal Psychology, 1977; 86(2), 103-126.