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Research Article

Comparison of Acute Effects of Classical Massage and Connective Tissue Massage on Lower Extremity Blood Flow Changes[1]

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Abstract

This study aimed to compare the immediate effects of connective tissue massage and classical massage on lower extremity blood circulation in healthy adults, and to better understand the mechanism of connective tissue massage. Twenty healthy participants underwent a 40-minute classical massage on the left lower limb. One week later, the same individuals received a connective tissue massage. Using color Doppler ultrasound, the diameter, flow velocity, and blood volume of the popliteal and posterior tibial arteries were measured before and after each session. Both massage methods led to significant increases in blood flow velocity, vessel diameter, and blood volume ($p<0.05$). However, connective tissue massage was more effective than classical massage in increasing the flow velocity and volume in the popliteal artery, as well as the diameter and volume in the posterior tibial artery ($p<0.05$). There was no significant difference between the two techniques regarding the diameter of the popliteal artery and the flow velocity of the posterior tibial artery ($p>0.05$). Overall, while both methods improved circulation, connective tissue massage produced greater improvements in peripheral blood volume, suggesting it may be more beneficial when enhanced vascular response is desired.

Keywords: Blood Circulation, Connective Tissue, Doppler Color Ultrasonography, Lower Extremity Massage.

Klasik Masaj ve Konnektif Doku Masajı Uygulamalarının Alt Ekstremite Kan Akış Değişiklikleri Üzerine Olan Akut Etkilerinin Karşılaştırılması

Öz

Bu çalışma, sağlıklı yetişkinlerde konnektif doku masajı ile klasik masajın alt ekstremite kan dolaşımı üzerindeki anlık etkilerini karşılaştırmayı ve konnektif doku masajının etki mekanizmasını daha iyi anlamayı amaçlamıştır. Yirmi sağlıklı katılımcıya sol alt ekstremiteye 40 dakikalık klasik masaj uygulanmıştır. Bir hafta sonra aynı bireylere konnektif doku masajı yapılmıştır. Popliteal ve posterior tibial arterlerin çapı, kan akış hızı ve kan hacmi her uygulamadan önce ve sonra olmak üzere renkli Doppler ultrason ile ölçülmüştür. Her iki masaj yöntemi de kan akış hızı, damar çapı ve kan hacminde anlamlı artış sağlamıştır ($p<0,05$). Ancak, konnektif doku masajı popliteal arterdeki akış hızı ve hacim ile posterior tibial arterdeki çap ve hacmi klasik masaja göre daha fazla artırmıştır ($p<0,05$). Popliteal arter çapı ile posterior tibial arter akış hızı açısından iki yöntem arasında anlamlı bir fark bulunmamıştır ($p>0,05$). Genel olarak her iki masaj yöntemi de dolaşımı artırsa da, konnektif doku masajı periferik kan hacmini artırmada daha etkilidir. Bu bulgular, terapötik hedeflere göre uygun masaj tekniğinin seçilmesinde klinisyenlere yol gösterebilir.

***Anahtar Kelimeler*:** Kan Dolaşımı, Konnektif Doku, Doppler Renkli Ultrasonografi, Alt Ekstremite Masajı

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INTRODUCTION

Manual therapy, which includes a wide variety of techniques such as soft tissue mobilizations, massage, myofascial release, joint mobilizations or manipulations, and nerve mobilizations, is defined as a touch-based conservative treatment approach used to assess and treat various symptoms and conditions (Clar et al., 2014; Roura et al., 2021). Among these techniques, massage is an ancient practice that has been utilized for thousands of years for health and wellness purposes (Rodrigues et al., 2020). Many massage techniques used in clinical settings are advantageous due to their affordability, accessibility, and safety (Er & Yüksel, 2023).

Massage therapy has the potential to enhance local and peripheral blood flow and volume, deliver oxygenated blood to muscles, and promote muscle relaxation (Portillo-Soto et al., 2014; Supa'at et al., 2013 ; Walaszek, 2015;). Although it has been reported that massage can increase blood volume and improve circulation, findings in the literature are inconsistent (Portillo-Soto et al., 2014; Roura et al., 2021; Supa'at et al., 2013; Goats, 1994; Shoemaker et al., 1997). Some studies have even shown that massage does not produce significant changes in blood flow (Shoemaker et al., 1997; Hinds et al., 2004; Tiidus & Shoemaker, 1995).

Classical massage (CM), also known as Swedish massage, is widely applied in clinical settings and primarily targets dermal, subcutaneous, and muscular tissues. This technique can cause vasodilation through blood vessel expansion. Connective tissue massage (CTM), on the other hand, is a reflex therapy technique aimed at balancing sympathetic and parasympathetic components of the autonomic nervous system by stimulating autonomic nerve pathways through connective tissue manipulation (Akbaş et al., 2019; Holey & Dixon, 2014; Yuan et al., 2015). CTM differs from CM in both its physiological effects and application technique. Evidence is growing for its influence on autonomic function (Holey et al., 2011; Toprak Celenay et al., 2023). Although not fully conclusive, studies on CTM's physiological impact suggest it modulates autonomic nervous activity, particularly in cardiovascular parameters such as blood pressure and flow (Bartsch et al., 2021; Holey & Dixon, 2014; Holey & Dixon, 2018).

Because of their effects on circulation, both massages are widely used in clinical practice for therapeutic purposes. However, it is not known which form is more effective on blood flow. The aim of this study is to investigate the acute effects of two different manipulative methods, CTM and CM, on hemodynamic changes in the lower extremities in healthy individuals and to compare the two techniques in terms of superiority.

METHOD

Participants

According to the power analysis based on patient and healthy control group data in a previous study (Taşpınar, 2010) in which the effectiveness of Matrix Rhythm Therapy in increasing peripheral blood circulation compared to Classical Massage was evaluated, α error 0.05, β error 0.15 (power: 0.85), the required minimum sample size was calculated as 20 for each group.

Twenty healthy volunteers, 8 female and 12 male, aged between 19 and 37 who signed the Informed Consent Form in Istanbul Erenköy Physical Therapy and Rehabilitation Hospital between November 2017 and December 2018 were enrolled in this study. Approval for the study was obtained from the Erenköy Mental Health and Neurology Training and Research Hospital Clinical Research Ethics Committee (number, 27; date, 06.11.2017).

Individuals who had a history of allergies, neurological or orthopedic disease, smokers, active athletes, those who were receiving medical treatment (eg vasodilator drugs), having regular massage interventions,

individuals who had a circulation problem, and those who had a musculoskeletal injury at least one month before the study were excluded from the study. Changes in the popliteal artery and posterior tibial artery's diameter, blood flow velocity, and amount of blood volume were measured with a linear probe using a color doppler ultrasound device (MedisonSonoAce X8) before and after the intervention in all individuals who participated in the study. All measurements were performed by a radiologist blinded to massage treatments. Flow rate measurements were evaluated at room temperature (22°C) and at 30-60°C doppler angle (Figure 1). Popliteal artery evaluation was made from the popliteal fossa between the medial and lateral heads of gastrocnemius muscles. Posterior tibial artery evaluation was performed on the ankle behind the medial malleol. The Doppler insonation angle was kept between 30-60 degrees during the velocity measurements (Hwang, 2017).

Figure 1. Measurements with color Doppler ultrasonography.

Measurements of the popliteal artery and posterior tibial artery were included in the evaluations, and the diameters were measured from the anterior-posterior cross-section. Maximum systolic volume was measured in order to assess the blood volume and the amount of blood volume was calculated and recorded by taking into account the mean value of three measurements in order to prevent measurement error.

The participants were asked to rest in the bed for 15 minutes before the massage intervention and measurements.

Intervention

All patients who were included in the study were given CM therapy, their measurements were repeated after the therapy, and then one week later they were given CTM therapy and re-evaluated.

Before CM intervention, patients were first laid on their back and a pillow was placed under the extremity on which massage was to be performed. CM was applied on the quadriceps, biceps femoris, tensor fascia latae, semimembranosus, semitendinosus, tibialis anterior, peroneus brevis and longus, gastrocnemius, the soleus muscles, and the adductor muscles of the thigh. Typical CM techniques were used during the intervention, such as stroking with the palms (effleurage), friction with the palms, kneading (petrissage), percussion (tapotement) and vibration (Kassolik et al., 2013). Stroking was applied as 50-60 times and kneading 30 times per minute. Kneading was applied with circular movements with fingertips. During the massage, hand-skin contact was not interrupted. Applied in accordance with body

contours with palms and fingers. The intervention was continued for 40 minutes.

CTM intervention was applied firstly on the primary region, i.e. the sacral region, and then continued to the quadriceps, biceps femoris, tensor fascia latae, semimembranosus, semitendinosus, tibialis anterior, peroneus brevis and longus, gastrocnemius, the soleus muscles, and the adductor muscles of the thigh. The intervention commenced with a series of short strokes over the sacrum, lumbar spine and posterolateral pelvis, which were developed into longer paravertebral and subcostal strokes. It was then completed by applying strokes to the front of the thigh, the back of the thigh, and the knee and calf, respectively. During the intervention, traction was created between the middle fingers of both hands and the cutaneous tissues (Yüksel et al., 2013). The intervention was conducted with long and short pulling strokes for 40 minutes. CM and CTM interventions were performed by the same physiotherapist who has 8 years of experience in massage.

Data Analysis

The data obtained in the study was analyzed using the SPSS 20.0 package software. Descriptive data were presented with minimum-maximum and mean ± standard deviation values. Data was not normally distributed and therefore, nonparametric statistical methods were selected. The Wilcoxon Signed Rank Test was used in order to determine the effectiveness of the methods employed in the study. The Mann Whitney U Test was used in order to analyze the differences between the measured values before and after the interventions. The significance level was set as $p<0.05$ for all analyzes

RESULTS

20 healthy volunteers, eight females (40%) and 12 (60%) males, were included in the study. The age, height, body weight and body mass index findings of the participants were presented in (Table 1).

Comparison of the sonographic measurements of Group 1 (CTM) and Group 2 (CM) before the therapy revealed that there was no significant difference between the groups in terms of blood vessel diameter (D), amount of blood volume (BV) and mean blood flow velocity (MBFV) ($p>0.05$) (Table 2).

Table 1. Demographic Characteristics of the Participants.

Variables	n	Minimum	Maximum	Mean
Age (year)	20	19	37	23.75 ± 2.12
Height (cm)	20	157	190	167.77 ± 7.4
Body weight (kg)	20	54	90	62.5 ± 3.53
BMI (kg/m2)	20	19.91	26.02	23.68 ± 0.92

BMI: Body Mass Index.

According to the comparison of sonographic values obtained from the popliteal artery and posterior tibial artery before and after CM, blood vessel diameter, blood volume velocity and amount of blood volume exhibited an increase that was statistically significant ($p<0.05$) (Table 2). According to the comparison of sonographic values obtained from the popliteal artery and posterior tibial artery before and after CTM, blood vessel diameter, blood flow velocity and amount of blood volume exhibited an increase that was statistically significant ($p<0.05$) (Table 2).

Table 2. Comparison of Sonographic Values Before and After Massage Interventions (N=20).

Classical Massage Intervention (n=20)		Before Mean±SD	After Mean±SD	*p*
Popliteal artery	Diameter of vessel (mm)	4.7±0.39	5.1±0.44	< 0.001*
	Velocity blood mean (cm/sec)	52.3±11.1	56.7±10.2	0.005*
	Blood volume (ml/min)	998±202	1134±297	0.003*
Posterior tibial artery	Diameter of vessel (mm)	3.91±0.51	4.1±0.47	0.003*
	Velocity blood mean (cm/sec)	40.33±9.76	44.21±8.43	0.004*
	Blood volume (ml/min)	744±152	820±197	0.002*
Connective Tissue Massage Intervention (n=20)		**Before Mean±SD**	**After Mean±SD**	***p***
Popliteal artery	Diameter of vessel (mm)	4.88±0.29	5.3±0.39	< 0.001*
	Velocity blood mean (cm/sec)	53.6±10.66	62.7±15.6	< 0.001*
	Blood volume (ml/min)	1040±232.2	1302±331.3	< 0.001*
Posterior tibial artery	Diameter of vessel (mm)	3.7±0,44	4±0.74	< 0.001*
	Velocity blood mean (cm/sec)	43.66±7.88	51.7±9.77	< 0.001*
	Blood volume (ml/min)	501.1±145	643.3±332	< 0.001*

SD: Standard Deviation. *: Statistically Significant Difference ($p < 0.05$)

It was found that the intervention of the CTM method resulted in a higher increase in the amount of blood volume per minute through the popliteal artery and posterior tibial artery in comparison to the CM method ($p<0.05$) (Table 3).

It was observed that the increase in the diameter of the cross-sectional area of the popliteal artery was higher after CTM intervention compared to CM. However, this increase was not statistically significant ($p>0.05$). The increase in the diameter of the posterior tibial artery was also higher in the CTM group, and this increase was statistically significant ($p<0.05$) (Table 3).

The increase in blood flow velocity through the popliteal artery was higher after CTM intervention compared to CM and the difference was statistically significant ($p<0.05$). Comparing the differences in blood flow velocity through the posterior tibial artery, the CTM group exhibited a higher increase, but it was not statistically significant ($p>0.05$) (Table 3).

Table 3. Comparison of Change Values of Hemodynamic Parameters Before and After Intervention

Vessels	Parameters	CTM (n=20) Difference (Δ)±SD	CM (n=20) Difference(Δ)±SD	*p*
Popliteal artery	Diameter of vessel (mm)	0.42±0.17	0.38±0.14	0.282
	Velocity blood mean (cm/sec)	9.1±2.4	4.4±1.3	0.009*
	Blood volume (ml/min)	262.4±103.8	136±63.8	0.014*
Posterior tibial artery	Diameter of vessel (mm)	0.3±0.12	0.19±0.1	0.03*
	Velocity blood mean (cm/sec)	8.04±2.2	3.92±1	0.22
	Blood volume (ml/min)	142±80.7	76±40.3	0.017*

SD: Standard Deviation, CTM: Connective Tissue Massage, CM: Classical Massage. *: Statistically Significant Difference ($p < 0.05$)

DISCUSSION and CONCLUSION

There is increasing interest in the use of manipulative soft tissue techniques and in studies investigating the comparative effectiveness of treatment methods applied for

similar purposes but involving different mechanisms of action. In the present study, the acute changes in lower extremity blood flow following the application of connective tissue massage (CTM) and classical massage (CM) were evaluated. As anticipated, both massage techniques resulted in increased blood flow to the lower limbs. Among the two, CTM was found to be superior to CM in enhancing blood volume in the lower extremities, increasing the diameter of the posterior tibial artery, and improving blood flow in the popliteal artery.

Previous studies have widely reported that superficial blood vessels dilate and blood flow velocity increases after massage therapy (Goats, 1994; Portillo-Soto et al., 2014; Supa'at et al., 2013; Walaszek, 2015). Indicators such as localized skin redness or, more objectively, elevated blood flow measured via Doppler ultrasonography, reinforce this assertion. Taspinar et al. (2013) investigated the effects of matrix rhythm therapy and CM on blood flow in 15 healthy participants using color Doppler ultrasound. According to measurements taken from the posterior tibial and popliteal arteries, both treatments enhanced blood volume, vessel diameter, and flow velocity; however, matrix rhythm therapy yielded a greater increase compared to CM. The literature generally supports the notion that massage improves circulation, a view further validated by our current findings, which showed CTM to be more effective than CM.

Conversely, several studies have reported that massage may not significantly influence blood flow (Hinds et al., 2004; Shoemaker et al., 1997; Tiidus & Shoemaker, 1995). Shoemaker et al. (1997), using Doppler ultrasound, observed that blood flow remained unaffected regardless of massage dosage or intensity. Similarly, Hinds et al. (2004) found no significant difference in hemodynamic parameters between the CM and control groups after exercise. Our study discusses these contradictory findings in light of our own data regarding the circulatory effects of massage therapy.

Massage-induced vasodilation may be mediated by several physiological mechanisms. The literature highlights the roles of somatosensory stimulation, mechanical pressure, nitric oxide (an endothelium-derived relaxing factor), prostacyclin, various local metabolic substances, and altered blood gas concentrations (decreased O_2 or increased CO_2) in promoting vascular smooth muscle relaxation (Baratchi et al., 2017; Espí-López et al., 2020; Franklin et al., 2014; Karemaker, 2017; Korthuis, 2011; Nelson, 2015; Sato-Suzuki et al., 2019; Toprak Celenay et al., 2023; Yamamoto et al., 2018;). Somatosensory input combined with improved muscle compliance and the mechanical compression generated during massage pulses contribute to increased blood flow (Espí-López et al., 2020; Nelson, 2015). The best-established mechanism of massage therapy involves mechanical pressure-induced vasodilation leading to enhanced local perfusion (Franklin et al., 2014; Goats, 1994; Supa'at et al., 2013;). Franklin et al. (2014) also demonstrated that a single 30-minute massage improved brachial artery endothelial function for up to 48 hours, a phenomenon known as "conducted vasodilation," wherein vasodilation in distal vascular regions rapidly spreads throughout the vascular network (Franklin et al., 2014; Nelson, 2015). Similar mechanisms may have contributed to the blood flow improvements observed in our study. These explanatory models are more frequently cited in the context of CM, although our results suggest that CTM may engage similar or additional mechanisms.

To our knowledge, no prior study has directly compared the effects of CM and CTM on blood volume. Nevertheless, a study by Bakar et al. (2014) partially supports our findings. They examined pressure pain threshold and muscle relaxation using electroneuromyography in 45 women with chronic neck pain following one session of CM and CTM. CM was effective in reducing pain, while CTM showed greater effects on muscle relaxation, which the authors attributed to enhanced peripheral circulation and increased blood volume. CTM is considered a manipulative reflex therapy that stimulates distal autonomic nerve endings via mechanical traction on connective tissue.

Although its mechanism of action is not fully elucidated, CTM is thought to influence the balance between the sympathetic and parasympathetic branches of the autonomic nervous system (Holey & Dixon, 2014).

Blood vessels, except for a few specialized types, are densely innervated by the sympathetic nervous system (Karemaker, 2017). Elevated blood flow velocity due to increased sympathetic tone has been linked to vascular remodeling (Kontos et al., 2017). Previous research has demonstrated that massage therapy can affect autonomic function, often enhancing parasympathetic activity (Akbaş et al., 2019; Holey & Dixon, 2014 Roura et al., 2021). CTM in particular is known to reduce sympathetic activity and activate vasodilator reflexes by mechanically stimulating connective tissue and associated cell populations (Akbaş et al. 2019; Toprak Celenay et al., 2023) reported that CTM significantly reduced blood pressure in healthy young women, suggesting diminished sympathetic output. These findings align with our current results, where CTM was more effective than CM in enhancing lower extremity blood volume. This effect may be attributed to the reflex pathways activated by CTM rather than direct physiological mechanisms. Additionally, the sequence in which the massages were applied—CM preceding CTM—may have created a synergistic advantage for CTM. However, autonomic effects induced by manual therapy vary depending on treatment site, applied technique, and the selected measurement approach. Currently, there is no definitive evidence clarifying the specificity of autonomic outcomes based on body region or technique (Roura et al., 2021).

This study has several limitations. The relatively small sample size and the absence of long-term follow-up reduce the generalizability of the findings. The lack of a control group is another limiting factor. Additionally, the one-week interval between the two massage sessions might have allowed the effects of CM to influence the response to CTM. Future studies should incorporate a longer washout period, include a control group, and use a larger sample to validate these findings and explore long-term effects.

In conclusion, this study demonstrated that both classical massage and connective tissue massage significantly increased lower extremity blood flow, as measured by color Doppler ultrasound. CTM was more effective than CM in enhancing blood volume, vessel diameter, and blood flow velocity. Given that improving circulation is a key objective in musculoskeletal rehabilitation, both massage modalities can be incorporated into treatment programs. The results also provide guidance for clinicians when selecting soft tissue techniques based on therapeutic goals.

Author's Statement of Contribution to the Article

Idea/Concept: İsmail Palalı, Özlem Altındağ; Article design: İsmail Palalı, Özlem Altındağ; Consulting: Özlem Altındağ; Data Collection and Processing: İsmail Palalı; Analysis/Comment: İsmail Palalı, Özlem Altındağ; Literature review: İsmail Palalı; Article writing: İsmail Palalı; Critical Analysis: Özlem Altındağ; Source/Material: İsmail Palalı, Özlem Altındağ; Article Submission Corresponding Author: İsmail Palalı

Conflict of Interest

The authors have no conflict of interest to declare.

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Ethics Committee Approval

This study is in line with the Declaration of Helsinki. Approval for the study was obtained from the Erenköy Mental Health and Neurology Training and Research Hospital Clinical Research Ethics Committee (number, 27; date, 06.11.2017).

Peer Review

After the blind review process, it was found suitable for publication and accepted.

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Research Article

An Examination of Volleyball's Impact on Lateralization and Motor Performance Based on the Proprioceptive Task in Female Children Aged 12 to 16[1]

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Abstract

Athletes from different sports may show varying motor performance based on their sport's demands and individual talents. Volleyball, emphasizing perceptual-motor skills like reaction time and eye-hand coordination, can enhance players' physical capacities. Comparing volleyball players with same-age sedentary individuals is important to understand the sport's potential effects. In this context, the present study examined the motor performance of female volleyball players aged 12–16 and compared it with that of sedentary girls in the same age group during a proprioception-based reaching task. In addition, a comparative evaluation of the performance between the dominant and non-dominant arms was conducted to assess lateralization. Speed, reaction time, accuracy, and linearity in a proprioceptive reaching task were analyzed via 2x2 mixed-model ANOVA to compare group (volleyball vs. sedentary) and hand effects in 30 female volleyball players and 30 sedentary girls. The results indicated that volleyball players performed significantly better than sedentary individuals in terms of reaction time and movement linearity. These motor performance parameters may offer valuable insights for talent identification and player development in sports.

Keywords: Lateralization, Motor performance, Proprioception, Volleyball.

Voleybolun 12–16 Yaş Grubu Kız Çocuklarında Lateralizasyon ve Proprioseptif Göreve Dayalı Motor Performans Üzerine Etkisinin İncelenmesi

Öz

Farklı spor dallarındaki sporcular, sporun gereksinimleri ve bireysel yeteneklerine bağlı olarak motor performans açısından farklılıklar gösterebilir. Reaksiyon zamanı ve el-göz koordinasyonu gibi algısal-motor becerilere vurgu yapan voleybol, oyuncuların fiziksel kapasitelerini geliştirebilir. Aynı yaş grubundaki voleybolcular ile sedanter bireylerin karşılaştırılması, bu sporun potansiyel etkilerini anlamak açısından önemlidir. Bu bağlamda, mevcut araştırmada 12–16 yaş aralığındaki kadın voleybolcuların motor performansları incelenmiş ve aynı yaş grubundaki sedanter kızlarla propriosepsiyona dayalı bir uzanma görevi sırasında karşılaştırması yapılmıştır. Ayrıca, lateralizasyonu değerlendirmek amacıyla baskın ve baskın olmayan kollar arasındaki performans da karşılaştırmalı olarak değerlendirilmiştir. Proprioseptif bir uzanma görevinde hız, reaksiyon zamanı, doğruluk ve doğrusallık ölçümleri 2x2 karma model ANOVA ile analiz edilerek grup (voleybol vs. sedanter) ve el etkileri karşılaştırılmıştır (30 kadın voleybolcu ve 30 sedanter kız). Sonuçlar, voleybolcuların reaksiyon zamanı ve hareket doğrusallığı açısından sedanter bireylerden anlamlı derecede daha iyi performans sergilediğini

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göstermiştir. Bu motor performans parametreleri, sporda yetenek seçimi ve oyuncu gelişimi açısından değerli bilgiler sağlayabilmektedir.

Anahtar Kelimeler: Lateralizasyon, Motor Performans, Propriosepsiyon, Voleybol.

INTRODUCTION

Volleyball is a dynamic and fast-paced sport that demands high levels of coordination, agility, and control. The sport involves continuous movement, rapid decision-making, and repetitive interactions with the ball—skills that heavily rely on effective neuromuscular functioning. Volleyball players must frequently perform actions such as jumping, setting, spiking, and serving, all of which require precise control of body position and movement. Notably, these skills are executed not only with visual input but also through sensory systems like proprioception, which enables athletes to respond to fast-changing game situations with accuracy and fluidity (Almeida and Soares, 2003; Golmoghani, 2009; Achilleopoulos et al., 2022). The bilateral nature of volleyball skills—especially in tasks such as setting, which require the coordinated use of both arms—suggests that the sport may influence the motor performance of both dominant and non-dominant limbs, thus playing a role in lateralization.

The repetitive and structured movements inherent in volleyball training are expected to contribute to the development of proprioceptive abilities (Yoon, Ha, Ko and Kim, 2022). This makes volleyball an ideal context in which to explore how athletic training affects proprioception and related motor functions, particularly during adolescence when these abilities are still developing. Understanding how young athletes adapt to training stimuli can shed light on the developmental pathways of motor control and coordination.

Proprioception enables accurate movement by providing spatial position information between the brain and various parts of the body, as well as in relation to the external environment (Sherrington, 1906). In addition to offering a sense of joint position, the proprioceptive sensory system gathers data on motion and muscle tension (Schacter, Gilbert and Wegner, 2010). This information is essential for the coordination of body movements, especially when combined with the visual system, which translates environmental input into precise motor actions (Batista, Buneo, Snyder and Andersen, 1999). Together, proprioception and visuomotor coordination support balance, postural control, and quick responses to external stimuli—critical elements in both sports and daily life (Guskiewicz and Perrin, 1996; Tyldesley and Grieve, 1996).

In sports contexts, proprioceptive feedback is particularly valuable in ensuring correct body positioning, executing accurate movements, and maintaining coordination under pressure (Han, Anson, Waddington and Adams 2014a; Hang et al., 2014b). Volleyball players, for instance, rely on proprioception to time their movements, stabilize their posture, and adjust quickly to ball trajectories—all of which influence performance outcomes.

Another key concept related to motor control is lateralization, which refers to functional differences between the left and right sides of the body (Sainburg, 2016; Wang and Sainburg, 2006). Since volleyball skills such as setting and serving require the coordinated use of both limbs, the sport may influence the development of lateralization during adolescence. Examining how volleyball training affects lateralization and motor performance, in comparison to peers who do not engage in sports, provides valuable insight into how training impacts sensorimotor development.

The primary objective of this study is to investigate performance differences during a proprioception-based test between volleyball players and sedentary individuals. Additionally, the study examines motor performance differences between these two groups in terms of lateralization (dominant vs. non-dominant arm use). Within this framework, the study aims to compare motor

performance parameters such as movement speed, accuracy, linearity, and reaction time between the volleyball and sedentary groups.

The focus of this research is to identify potential differences in proprioception skills between volleyball players and sedentary individuals and to assess how these differences impact motor performance. Parameters such as movement speed, accuracy, linearity, and reaction time allow for a detailed analysis of motor abilities in both groups. This comparative analysis will help reveal the specialized motor skills developed by volleyball players due to the specific demands of their sport and will shed light on how the 12–16 age group is affected by these skills. The findings can be used to develop specific training strategies for performance enhancement and to support proprioceptive abilities in aging individuals.

METHOD

Study Group

This study was conducted with female participants aged between 12 and 16 years. The study included two groups: one group consisted of sedentary female students, and the other group included female volleyball players of the same age range. Participation was based on voluntary consent. To determine the sample size, a G*Power power analysis test was conducted. Based on the analysis, with a 95% confidence level (1-α), 95% power (1-β), and an effect size of d = 0.5, the total sample size was calculated to be 36 for a repeated measures mixed model ANOVA. However, a total of 60 participants were recruited for this study, with 30 in the volleyball group (M_{age} = 14.1 ± 1.12 years old) and 30 in the sedentary group (M_{age} = 14.16 ± 1.08 years old). The volleyball group, consisting of 30 players, engaged in regular volleyball training three times per week. Participants in the volleyball group had a minimum of two years of volleyball experience.

Data Collection Tools

The data collection process was carried out at the laboratory of the Faculty of Sports Sciences at Nevşehir Hacı Bektaş Veli University. Measurements focused on predetermined parameters to assess participants' motor performance. These parameters included movement speed, accuracy, linearity, and reaction time. The assessments were conducted using the KineReach system (Figure 1, experimental setup) during reaching movements. Participants' hand dominance was determined using the Edinburgh Handedness Inventory, which objectively identifies right or left hand preference. All participants in the study reported being right-handed and scored above 90% on the Edinburgh Handedness Inventory, confirming right-hand dominance. The instruments used in this study were selected and standardized to ensure validity and reliability.

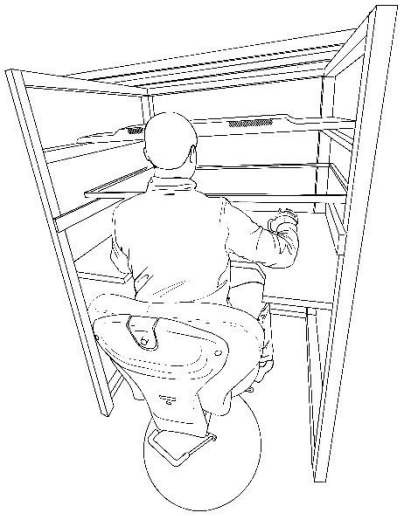

Figure 1. Experimental Setup

Data Collection

To measure proprioception, an experimental setup based on electromagnetic sensors (TrackSTAR, Ascension Technology, USA) was used, as shown in Figure 1, to assess reaching movements. Participants were seated

on height-adjustable chairs, and sensors were placed on the tips of their index fingers. The setup ensured that their head level was aligned with a mirror placed in front of them. Measurements were taken using both dominant and non-dominant arms.

In the experimental setup, a starting point and multiple target positions were displayed via a mirror located below a horizontally placed 55" screen (Figure 2). Participants were asked to reach for the targets with the cursor corresponding to the position of their index finger, even though they could not see their arms. Once the cursor left the starting point, it disappeared from the screen, requiring participants to rely solely on proprioceptive input to complete the reaching task. These movements were recorded in real-time at a sampling rate of 100 Hz. Data collection was conducted using custom software developed in the MATLAB environment (Akpınar, 2015, 2016).

In the test, a white starting point with a radius of 1.5 cm and one of three randomly selected targets (3 cm in diameter, with a 1 cm blue center and a grey border) were shown on the mirror display (Figure 2). The starting point was positioned 30 cm from the sternum and 20 cm to the left or right, depending on the arm being used. While the system resembled an interactive gaming interface in real-time, the reaching movements were recorded only in two dimensions.

Procedure

Parental consent was obtained via a "Informed Consent Form" based on approval from the Ethics Committee of Nevşehir Hacı Bektaş Veli University and the Nevşehir Provincial Directorate of National Education (Approval No: 2022.10.99). The rights and privacy of the participants were respected, and all procedures were conducted in accordance with ethical guidelines. Data were collected during the 2022–2023 academic years.

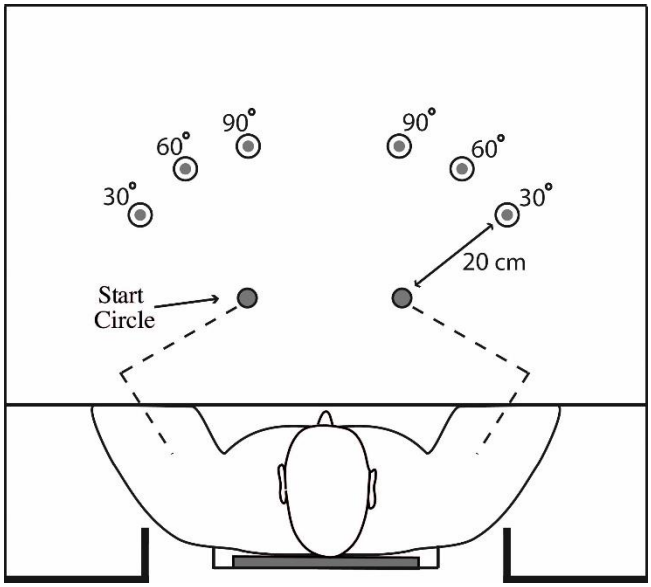

Figure 2. Experimental design, distribution of the targets

Data Analysis

Raw data obtained from the KineReach system were analyzed using custom MATLAB software, from which values for movement speed, accuracy, linearity, and reaction time were extracted. Movement speed was measured as the peak amplitude of the velocity profile. Accuracy was as sessed using the final position error (FPE), calculated as the Euclidean distance between the center of the target and the final 2D position of the index fingertip, represented by the cursor. Linearity was evaluated using the hand path linearity deviation (HPLD), defined as the ratio of the minor to the major axis of the index finger's movement trajectory. The major axis was determined as the greatest distance between any two points along the hand path, while the minor axis was the maximum perpendicular distance from any point on the hand path to this major axis. Reaction time (RT) was defined as the time interval between the appearance of the target on the screen and the initiation of movement toward that target (Akpinar, 2015).

For the statistical analysis of motor performance data, the JMP Pro statistical software was used. A 2x2 mixed model ANOVA was performed for each variable,

with "group" (sedentary vs. volleyball) and "arm" (right vs. left) as factors in repeated measures.

The level of statistical significance for each motor performance parameter in the reaching test was set at $p < .05$. This threshold was used to determine whether observed differences were statistically significant. The aim was to identify performance differences between the groups and variability related to hand dominance.

RESULTS

Motor performance in terms of movement speed during the reaching movements without visual feedback was measured in sedentary individuals and volleyball players. Since the speed-accuracy trade-off (Coker, 2017) can affect movement performance, it was first examined whether there was a statistically significant difference between the dominant and non-dominant arm performances of the groups in terms of movement speed.

In this model, groups (sedentary vs. volleyball) were treated as the between-subjects factor, and arms (right vs. left) as the within-subjects factor. According to the statistical analysis results, the group × arm interaction was not statistically significant, $F(1, 116) = 0.36$, $p > .05$, $\eta^2 = .003$. Additionally, the group effect was also not statistically significant, $F(1, 116) = 0.17$, $p > .05$, $\eta^2 = .002$. Finally, no statistically significant difference was found between the arms as a within-subject factor, $F(1, 116) = 0.37$, $p > .05$, $\eta^2 = .003$.

The reaction time parameter was examined during reaching movements without visual feedback in both sedentary and volleyball participant groups. Whether there was a significant difference between right and left arm performances in terms of reaction time was also analyzed. The findings are presented in Figures 3 and 4. As before, the group (sedentary vs. volleyball) was treated as a between-subjects factor, and arms (right vs. left) as a within-subjects factor.

The statistical analysis showed that the group × arm interaction was not statistically significant, $F(1, 116) = 0.10$, $p > .05$, $\eta^2 = .001$. Similarly, no significant difference was found between the arms, $F(1, 116) = 0.004$, $p > .05$, $\eta^2 = .001$. However, a statistically significant group effect was observed, $F(1, 116) = 3.93$, $p < .05$, $\eta^2 = .08$ (Volleyball group: $M = 0.387 \pm 0.04$ sec; Sedentary group: $M = 0.407 \pm 0.06$ sec).

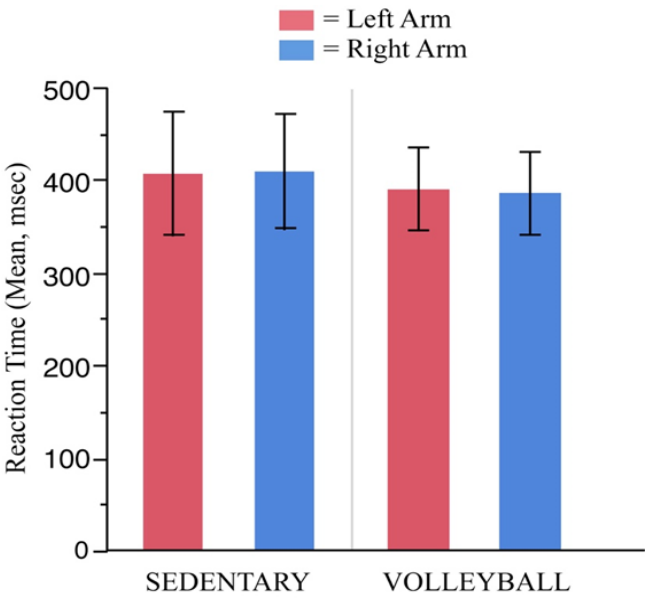

Figure 3. Average reaction time values (msec) of the right and left arms of the participants in the volleyball and sedentary groups

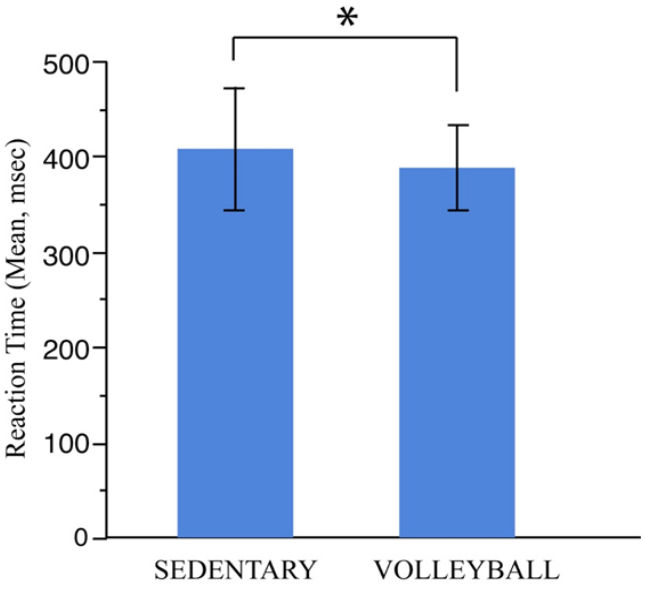

Figure 4. Average reaction time values (msec) of participants in the volleyball and sedentary groups

Linearity, defined as the ability to perform movement along a specific path without deviation, was evaluated during reaching tasks performed without visual feedback. The results are presented in Figures 5 and 6. Groups (sedentary vs. volleyball) were the between-subjects factor, and arms (right vs. left) the within-subjects factor. Statistical analysis revealed that the group × arm interaction was not significant, $F(1, 116) = 2.31$, $p > .05$, $\eta^2 = .02$. No significant difference was found between arms either, $F(1, 116) = 1.39$, $p > .05$, $\eta^2 = .01$. However, a significant group effect was found, $F(1, 116) = 4.20$, $p < .05$, $\eta^2 = .10$ (Volleyball group: $M = 0.054 \pm 0.012$; Sedentary group: $M = 0.060 \pm 0.022$).

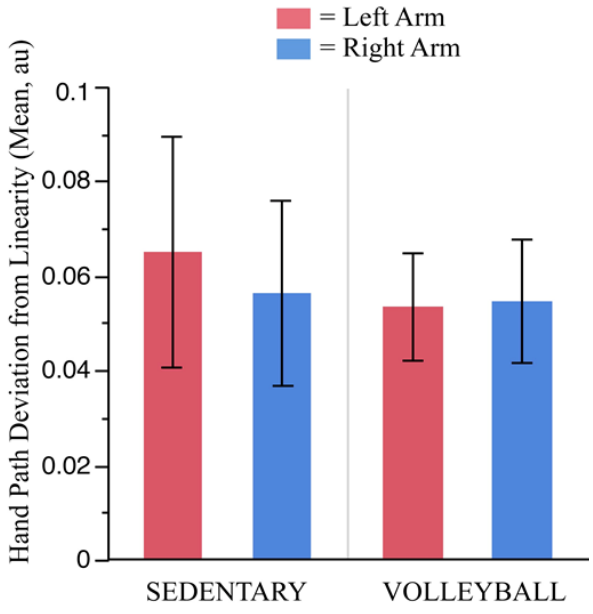

Figure 5. Average hand path deviation from linearity (au) of the right and left arms of the participants in the volleyball and sedentary groups

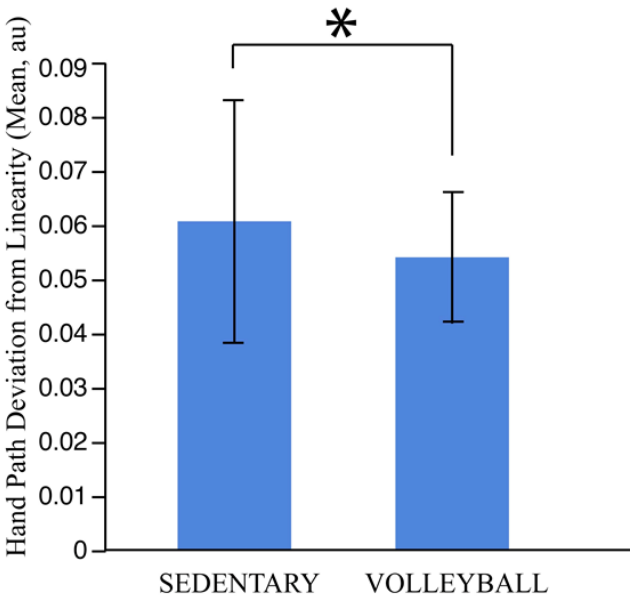

Figure 6. Average hand path deviation from linearity (au) of participants in the volleyball and sedentary groups

The accuracy parameter was measured during reaching movements without visual information in sedentary and volleyball groups. The group (sedentary vs. volleyball) was considered a between-subjects factor, and arms (right vs. left) as a within-subjects factor. The related data are presented in Figure 7. Statistical analysis revealed that the group × arm interaction was not significant, $F(1, 116) = 1.42$, $p > .05$, $\eta^2 = .003$. The group effect was also not significant, $F(1, 116) = 0.37$, $p > .05$, $\eta^2 = .001$. Likewise, no significant difference was found between arms, $F(1, 116) = 0.36$, $p > .05$, $\eta^2 = .001$

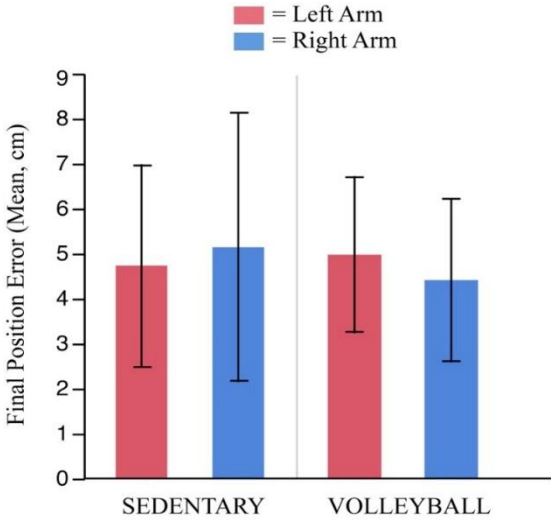

Figure 7. Average final position error (cm) of the right and left arms of the participants in the volleyball and sedentary groups

DISCUSSION and CONCLUSION

This study investigated the differences in motor performance associated with lateralization between sedentary individuals and volleyball players. A reaching test conducted using proprioceptive feedback assessed motor parameters such as movement speed, accuracy, linearity, and reaction time, revealing significant differences between the groups. The literature suggests that proprioception and motor performance improve with age and engagement in sports. The current findings indicate that repetitive motor activities, such as volleyball, may enhance motor control by reducing lateralization (Goble, Noble and Brown, 2006; Vaeyens, Lenoir, Williams and Philippaerts, 2007).

The analyses revealed no statistically significant difference in speed between the groups. This finding suggests that both groups performed the reaching movements at similar movement speeds, and that the movement speed parameter is relatively independent of an individual's sports background. Additionally, no significant differences were found between the dominant and non-dominant arms, indicating that lateralization does not significantly affect this motor parameter. Similarly, interaction effects between group and arm were not statistically significant (Goble and Brown, 2008; Sainburg, 2002).

Participants were instructed to perform the reaching movement in approximately one second, aligning with the "speed-accuracy trade-off" (Fitts, 1954) principle often emphasized in the motor control literature. As Plamondon and Alimi (1997) noted in their kinematic model of human movement, increased speed tends to negatively impact accuracy. Likewise, studies by Standage, Blohm, and Dorris (2014) have shown that faster movements lead to decreased accuracy. In our study, the uniform movement speed among participants allowed for an unbiased evaluation of the accuracy parameter.

In conclusion, these results suggest that engaging in regular athletic activity such as volleyball does not provide a distinct advantage in speed performance during reaching movements performed without visual input. Speed appears to function as a fundamental capacity within motor control processes. Moreover, lateralization did not significantly influence movement speed performance, as no significant differences were observed between the right and left arm trials. These findings underscore the importance of carefully evaluating group and arm-related differences in studies where movement speed is the dependent variable.

In the reaching test performed in response to an auditory cue, significant differences were found between volleyball players and sedentary participants in terms of reaction time. The results indicated that volleyball players had significantly shorter reaction times compared to sedentary individuals. This supports the idea that sports requiring rapid decision-making and execution—such as volleyball—positively impact reaction time. Regular training and sports participation appear to enhance this component of motor performance.

With regard to lateralization, no significant differences were found in reaction times between the dominant and non-dominant arms. Similarly, no significant interaction effects

between group and arm were observed. These findings suggest that reaction time is more strongly associated with athletic performance level than with arm dominance.

These results are consistent with previous studies. Gürsoy, Akarsu and Hazar (2017) found that athletes had significantly shorter reaction times with the right arm compared to sedentary individuals, although the left arm showed no such difference. Similarly, Şenol et al. (2020) reported that individuals participating in specific sports exhibited better visual and auditory reaction times than sedentary individuals. Supporting this, a study by Mroczek, Kawczyński and Chmura, (2013) observed that elite volleyball players demonstrated faster reaction times during a game, indicating enhanced motor control. Reigal et al. (2019) also found that children engaged in regular physical activity had superior reaction times.

In summary, the current study supports the conclusion that reaction time is a motor skill that can be developed through regular athletic training rather than being determined by individual factors such as hand preference. Sports like volleyball, which require high levels of attention, speed, and coordination, appear to foster this skill, providing players with an advantage in the timing of motor responses. The findings align with existing literature, further confirming the positive effects of physical activity on reaction time.

In this study, the linearity parameter—defined as the ability to perform a movement along a straight path—was analyzed in volleyball players and sedentary individuals. The findings revealed that volleyball players performed the reaching task more efficiently in terms of linearly than sedentary participants, and this difference was statistically significant. This suggests that regular physical activity and volleyball may positively influence movement smoothness and control.

Similar results have been reported in the literature. Akpınar (2016) found that professional female basketball players performed better than sedentary individuals in both accuracy and linearity, and that the right arm exhibited more linear movement than the left. In the present study, only the between-group difference was statistically significant, with volleyball players exhibiting more linear movements. This may be attributed to factors such as age, sports history, and the lack of visual feedback in the test.

Due to the nature of volleyball, coordinated use of both arms—especially during skills such as overhead and forearm passing—is essential. Consequently, a lower level of lateralization can be expected among volleyball players. Supporting this, Stöckel and Weigelt (2012) emphasized that athletes who can use both sides of their body effectively may achieve better sports performance.

The superior performance observed in volleyball players may also be related to neurophysiological adaptations. Li and Smith (2021) highlighted that the athlete's brain exhibits enhanced adaptability to environmental conditions, contributing to improved motor preparation, decision-making, and execution. Thus, the more linear movements observed in volleyball players in this study reinforce the positive impact of sports on motor control.

In this study, the accuracy parameter was defined as the ability to reach the target during the reaching task. Unlike linearity, this parameter emphasizes the ability to precisely hit the target rather than the coordination of movement. The analyses showed no statistically significant differences in accuracy between the volleyball and sedentary groups or between the dominant and non-dominant arms. Although volleyball players demonstrated slightly higher average accuracy, the difference was not statistically significant, suggesting that volleyball does not have a definitive effect on accuracy.

The similarity in accuracy scores between both arms indicates that lateralization does not significantly influence this parameter. This result implies that both groups achieved similar target-hitting success rates with each arm. The findings may be related to the nature of the test, which required participants to rely on proprioception rather than visual input.

Additionally, the participants' age range (12–16 years) may have contributed to the absence of significant group differences.

Previous studies have reported varying results. For instance, Akpınar (2016) found that basketball players aged 18–29 outperformed sedentary individuals in terms of accuracy. Similarly, Akpınar, Sainburg, Kirazcı and Przybyla (2015) reported that elite fencers demonstrated higher accuracy than sedentary controls with both arms, suggesting that physical activity may enhance target precision. In the current study, the lack of significant differences in accuracy may be due to the younger age group and absence of visual cues during the task.

Volleyball players showed advantages in reaction time and linearity, while sedentary individuals displayed more pronounced lateralization. This can be explained by volleyball's requirement for coordinated use of both arms. The superior reaction times and more linear movements observed in volleyball players reflect more efficient motor control and coordination. The proprioceptive sense and motor performance parameters were generally more favorable among volleyball players. Furthermore, participation in sports appears to reduce lateralization, minimizing differences between limbs. The ability of volleyball players to automatically adjust their bodies to the ball's motion and game requirements may contribute to the development of their proprioceptive awareness.

Engaging in sports at a young age has a positive impact on proprioception and motor performance. These findings demonstrate that sports not only improve physical health but also contribute positively to balance, hand-eye coordination, proprioception, and motor skills. Using such performance parameters during talent selection may help evaluate players' in-game abilities more accurately, offering substantial benefits for optimizing both individual and team performance. Considering players' physical and technical attributes alongside factors such as reaction speed and coordination may provide a strategic approach to talent identification and player development. Integrating these parameters into training programs could lead to more effective and efficient long-term player development.

Author's Statement of Contribution to the Article

Idea/Concept: Emre Burak Gürlek, Selçuk Akpınar; Article design: Emre Burak Gürlek, Selçuk Akpınar; Consulting: Selçuk Akpınar; Data Collection and Processing: Emre Burak Gürlek; Analysis/Comment: Emre Burak Gürlek, Selçuk Akpınar; Literature review: Emre Burak Gürlek; Article writing: Emre Burak Gürlek; Critical Analysis: Selçuk Akpınar; Source/Material: Emre Burak Gürlek, Selçuk Akpınar; Article Submission Corresponding Author: Selçuk Akpınar

Conflict of Interest

The authors have no conflict of interest to declare.

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Ethics Committee Approval

This study is in line with the Declaration of Helsinki. Parental consent was obtained via a "Informed Consent Form" based on approval from the Ethics Committee of Nevşehir Hacı Bektaş Veli University and the Nevşehir Provincial Directorate of National Education (Approval No: 2022.10.99).

Peer Review

After the blind review process, it was found suitable for publication and accepted.

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Research Article

Examination of Leisure Crafting and Intrinsic Leisure Motivation of Sports Science Students[1]

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Abstract

This study investigates the levels of leisure crafting and intrinsic leisure motivation among sports science students based on demographic variables and examines the relationship between these two concepts. The sample consists of 310 voluntary students (177 male, 133 female) from the Faculty of Sports Sciences at Afyon Kocatepe University. Data were collected using the Leisure Crafting Scale, the Intrinsic Leisure Motivation Scale, and a demographic questionnaire. Descriptive statistics, Independent Samples t-Test, One-Way ANOVA, and Pearson Correlation tests were employed in the analysis. Results showed that male students reported higher leisure crafting levels, while intrinsic leisure motivation did not differ significantly by gender. Although class level and department had no overall impact on leisure crafting, recreation students scored significantly higher than students from other departments. Significant differences were also observed in certain sub-dimensions regarding paternal education and income levels. Additionally, positive correlations were found between specific sub-dimensions of intrinsic leisure motivation and leisure crafting. Overall, the findings highlight a meaningful link between intrinsically motivated leisure and proactive engagement in leisure activities, suggesting that such involvement can support self-exploration and personal development during university years.

Keywords: Intrinsic Leisure Motivation, Leisure, Leisure Crafting

Spor Bilimleri Öğrencilerinin Boş Zaman Becerikliliği ve İçsel Boş Zaman Motivasyonlarının İncelenmesi

Öz

Bu çalışmanın amacı, spor bilimleri öğrencilerinin bazı demografik değişkenlere göre boş zaman becerikliliği ve içsel boş zaman motivasyon düzeylerini incelemek ayrıca bu iki kavram arasındaki ilişkiyi araştırmaktır. Bu bağlamda, Afyon Kocatepe Üniversitesi Spor Bilimleri Fakültesi'nde öğrenim gören 177 erkek ve 133 kadın olmak üzere toplam 310 birey gönüllü katılım sağlamıştır. Çalışmada veri toplama aracı olarak "boş zaman becerikliliği" ve "içsel boş zaman motivasyonu" ölçekleri ile demografik değişkenlerden oluşan bir anket formu kullanılmıştır. Verilerin analizinde, betimsel istatistik yöntemleri, Independent Samples t-Testi, tek yönlü Varyans Analizi (ANOVA) ve Pearson Korelasyon testleri uygulanmıştır. Araştırma bulguları, erkek

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öğrencilerin boş zaman becerikliliğinin daha yüksek olduğunu, ancak içsel boş zaman motivasyonu açısından cinsiyetler arasında anlamlı bir fark bulunmadığını ortaya koymuştur. Sınıf düzeyi ve bölüm değişkenleri genel olarak boş zaman becerikliliği üzerinde anlamlı bir etki göstermemekle birlikte, rekreasyon bölümü öğrencilerinin bu alanda diğer bölümlere kıyasla istatistiksel olarak anlamlı düzeyde daha yüksek beceriklilik sergilediği belirlenmiştir. Ayrıca ölçekler ile baba eğitim durumu ve gelir düzeyi değişkenleri açısından da bazı alt boyutlara göre anlamlı farklılıklar tespit edilmiştir. Son olarak içsel boş zaman motivasyonu ölçeğine ait bazı alt boyutlar ile boş zaman becerikliliği arasında anlamlı ve pozitif yönlü ilişki ortaya çıkmıştır. Sonuç olarak, bu çalışma spor bilimleri öğrencilerinin boş zaman becerikliliği ile içsel boş zaman motivasyonu arasındaki ilişkiyi ortaya koyarak, bu sürecin üniversite yaşamı boyunca bireyin kendini keşfetmesine ve kişisel gelişimine nasıl katkı sağladığına dair değerli içgörüler sunmaktadır. Bulgular, içsel motivasyonla yürütülen boş zaman etkinliklerinin, genç bireylerin belirli alanlarda beceri geliştirmelerinde destekleyici bir rol oynayabileceğini göstermektedir.

Anahtar Kelimeler: İçsel Boş Zaman Motivasyonu, Boş Zaman, Boş Zaman Becerikliliği

INTRODUCTION

In the contemporary world, leisure time has become an essential component of personal balance, offering not only rest but also opportunities for growth and self-expression. Individuals increasingly use their free time to support their mental well-being, develop new skills, and foster social connection.

Research shows that the dynamics of work pace, educational life, and social responsibilities significantly shape how people engage in leisure activities (Yayla & Çetiner, 2019). Effective use of leisure time has been linked to improved well-being and overall life satisfaction (Sirgy et al., 2017). In this context, two key concepts—leisure crafting and intrinsic leisure motivation—emerge as crucial for making leisure time both productive and meaningful.

Leisure crafting refers to the individual's ability to plan their leisure time, choose meaningful activities, and sustain engagement in these activities (Petrou & Bakker, 2016). This skill is critical for making leisure time both efficient and fulfilling. On the other hand, intrinsic leisure motivation is a key element that shapes individuals' attitudes and behaviors toward leisure activities (Ryan & Deci, 2000). According to Self-Determination Theory (Ryan & Deci, 2000), intrinsic motivation arises when individuals engage in an activity with a sense of volition and psychological freedom. This theory identifies autonomy, competence, and relatedness as the three basic psychological needs that foster intrinsic motivation. In this context, leisure crafting can be interpreted as a proactive behavior that satisfies these needs, particularly autonomy and competence, thus reinforcing intrinsic leisure motivation. In addition to Self-Determination Theory, other motivation theories such as the Expectancy-Value Theory (Eccles & Wigfield, 2002) emphasize individuals' expectations of success and the value they place on activities as determinants of motivation. Within leisure contexts, this aligns with how individuals assess the personal relevance and enjoyment of an activity before committing to it. The integration of psychological (e.g., Ryan & Deci, 2000) and sociological theories (e.g., Stebbins, 2001) provides a more comprehensive framework for understanding how individuals engage in leisure crafting. While psychological theories explain internal mechanisms such as need satisfaction and self-regulation, sociological frameworks contextualize these behaviors within broader social structures, educational backgrounds, and cultural expectations. In this regard, leisure crafting and intrinsic motivation form a synergistic partnership that focuses on individuals' potential to make their leisure time purposeful and rewarding.

Leisure crafting encompasses an active and deliberate effort toward achieving personal goals during one's leisure time (Petrou & Bakker, 2016). It includes seeking opportunities for self-development, forming new social relationships, and engaging with others (Fritz & Sonnentag, 2005). This concept suggests that leisure is not solely about passive rest or entertainment, but also involves participation in activities that foster

learning, social connection, and psychological renewal (Petrou & Bakker, 2016). Individuals who renew themselves through leisure crafting can manage their physical and mental energy more effectively, which in turn generates more positive outcomes (Ni et al., 2022).

Leisure crafting helps individuals offset resource losses—such as time, work-related stress, or burnout—by creating new resources, enhancing social support, and enriching existing ones (Hmieleski & Cole, 2021). This aligns closely with the concept of the "gain spiral of resources," a key component of the Conservation of Resources (COR) Theory. Developed by Hobfoll (1989), COR Theory posits that individuals strive to conserve, maintain, and increase their physical, cognitive, emotional, and social resources. This effort becomes particularly pronounced in situations where current resources are threatened or where there is potential to gain new ones. As a stress theory, COR focuses on how people protect and replenish their resources. Accordingly, leisure crafting can be seen as a comprehensive and effective strategy for preserving, gaining, and optimizing personal resources.

While individuals develop themselves through leisure crafting, their underlying motivation for engaging in such activities also plays a crucial role. This highlights the concept of intrinsic leisure motivation. According to Ryan and Deci (2000), motivation involves perceiving a situation as a personal challenge and striving to overcome it through self-initiated effort. This process is inherently self-directed and occurs in the absence of external rewards. Intrinsic motivation refers to the internal drivers of participation in leisure activities, encompassing both psychological mechanisms such as autonomy and competence, and sociological influences including social identity and cultural context (Chen & Pang, 2012). It is characterized by spontaneous interest, decision-making, and positive mood while pursuing personally meaningful goals (Orbegoso, 2016). How individuals spend their leisure time reflects not only their activities but also the significance those activities bring to their lives (Manfredo et al., 1996). Intrinsic motivation especially covers activities done for inner satisfaction and enjoyment (White, 1959). This form of motivation means engaging in an activity for the pleasure and fulfillment it provides (Deci & Ryan, 2013). From this perspective, intrinsic motivation illuminates how individuals explore their potential and add depth to their lives.

Leisure crafting and intrinsic leisure motivation stand out as two fundamental constructs that enhance quality of life, support psychological recovery, and optimize resource management. However, empirical research exploring the direction, strength, and contextual dynamics of the relationship between these two variables remains limited. In this regard, the present study aims to examine the relationship between leisure crafting and intrinsic leisure motivation, while also analyzing the role of relevant demographic variables, thereby contributing to the literature. Demographic factors such as age, gender, and education level are included in the study based on the assumption that these characteristics may influence individuals' leisure preferences, motivations, and capacities for leisure crafting. Understanding these effects will provide a more nuanced interpretation of how personal background shapes leisure-related behaviors. The findings are expected to inform the development of strategies that help individuals utilize their leisure time more effectively and meaningfully. Thus, the study offers both theoretical insights and practical implications for future applications. To provide a clearer analytical direction and align with the theoretical framework, the following hypotheses were developed to guide the study:

H1: There is a significant relationship between intrinsic leisure motivation and leisure crafting among sports science students.

H2: There are significant differences in intrinsic leisure motivation according to certain demographic variables (e.g., income level, academic department).

H3: There are significant differences in leisure crafting according to certain

demographic variables (e.g., gender, academic department, parental education).

These hypotheses aim to explore not only the interrelation between the main psychological constructs but also how individual characteristics might shape students' leisure-related behaviors.

METHODS

This section presents the research model, details regarding the study group, data collection instruments, the data collection process, and the procedures for data analysis.

Research Model

This study employed a quantitative research approach, utilizing both causal-comparative and correlational survey models (Karasar, 2007) to examine the intrinsic leisure motivation and leisure crafting skills of students in the field of sport sciences. Data were collected through a questionnaire technique.

Participants

This study was conducted with students from the Faculty of Sport Sciences at Afyon Kocatepe University. The study group consisted of a total of 310 students who voluntarily agreed to participate. Participants were selected through convenience sampling due to its practicality and accessibility in educational settings; however, this non-probability method may limit the generalizability of the findings. Nevertheless, considering that student admission processes (e.g., special talent exams) and curricular structures across sport sciences faculties in Turkey are largely standardized, the findings may provide indicative insights at a national level.

To evaluate the adequacy of the sample size for the statistical analyses conducted, a post-hoc power analysis was performed using G*Power 3.1.9.7 software. Based on the tests applied in the study—including independent samples t-tests, one-way ANOVA, and Pearson correlation analysis—a power calculation was conducted using an alpha level of .05, a medium effect size (f = 0.25), and a sample size of 310 participants. The resulting statistical power (1 – β) was calculated to be above 99.9%. This result confirms that the sample size was sufficient for the analyses performed and supports the reliability of the study's results.

The study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval was granted by the Social and Human Sciences Scientific Research and Publication Ethics Committee of Afyon Kocatepe University (Decision No: 2024/385, dated 20.11.2024). The questionnaire, which served as the data collection tool, was administered face-to-face. The survey took approximately 6 minutes to complete, and the data obtained were analyzed in accordance with the principle of anonymity.

Basic demographic characteristics of the participants, including gender, class level, academic department, and parental education, are presented in Table 1 to provide a clearer profile of the sample.

Data Collection

In this research, the "Personal Information Form," the "Intrinsic Leisure Motivation Scale," and the "Leisure Crafting Scale" were used as data collection instruments. The personal information form included questions related to gender, grade level, department, income status, and parental education levels. The data were collected between November 25, 2024, and December 13, 2024.

Intrinsic Leisure Motivation Scale

To assess participants' intrinsic leisure motivation, the "Intrinsic Leisure Motivation Scale," originally developed by Weissinger and Bandalos (1995) and adapted into Turkish by Özdemir, Durhan, and Karaküçük (2020), was utilized. The scale consists of five subdimensions and 23 items. Özdemir et al. (2020) stated that the scale is valid and effective in explaining the psychological and sociological factors underlying participation in leisure activities.

The scale is structured using a 5-point Likert-type rating system, with response options ranging from "1 = Strongly Disagree" to "5 = Strongly Agree." The subdimensions of the scale are as follows: Challenge (items 1–8), Self-Determination (items 9–14),

Commitment (items 15–17), Identification (items 18–20), and Amotivation (items 21–23). The items in the Amotivation subdimension were reverse coded and carefully recoded prior to analysis. All data entries were double-checked to ensure scoring accuracy and internal consistency.

In the Turkish adaptation study, the Cronbach's alpha reliability coefficients for the subdimensions were reported as .85 for Challenge, .85 for Self-Determination, .75 for Commitment, .71 for Identification, and .70 for Amotivation. The overall Cronbach's alpha coefficient of the scale was .91. In the current study, the Cronbach's alpha coefficients for the subdimensions were calculated as .825, .741, .735, .748, and .685 respectively, with an overall reliability coefficient of .891.

Leisure Crafting Scale

This scale, which reflects a proactive effort to achieve personal goals during leisure time, was developed by Petrou and Bakker (2016) and adapted into Turkish by Sürücü and Ertan (2022). The scale is unidimensional and consists of 9 items. In the adaptation study, the Cronbach's alpha reliability coefficient was reported as .845. The scale is based on a 5-point Likert-type system with response options ranging from "1 = Strongly Disagree" to "5 = Strongly Agree." In the current study, the Cronbach's alpha reliability coefficient for the scale was calculated as .855.

Both scales had previously undergone comprehensive psychometric evaluations, including confirmatory factor analyses during their Turkish adaptation processes, which supported their structural validity. Therefore, the present study did not reassess the factor structures but relied on these well-established and validated frameworks.

Data Analysis

The collected data were entered into SPSS software for statistical analysis. During data entry, percentage and frequency distributions were examined to identify potential coding errors; any inaccuracies were reviewed and corrected when necessary. To assess the normality of the data distribution, skewness and kurtosis values were evaluated. According to George and Mallery (2003), values between -2 and +2 are considered acceptable indicators of a normal distribution. In this study, all variables were found to fall within this range, supporting the assumption of normality.

Descriptive statistics, including percentages, frequencies, and means, were calculated to summarize participants' demographic characteristics and average scale scores. Independent samples t-tests were used to examine differences in intrinsic leisure motivation and leisure crafting scores by gender. One-way ANOVA was conducted for variables with more than two groups (e.g., grade level, academic department, income level, and parental education). When ANOVA results indicated significant differences, Tukey's HSD post hoc test was employed to identify the source of the group differences. Finally, Pearson correlation analysis was conducted to assess the relationships between intrinsic leisure motivation and leisure crafting.

RESULTS

Table 1. Descriptive Statistics of Sport Sciences Faculty Students' Demographic Characteristics, Leisure Crafting, and Intrinsic Leisure Motivation

Variables	Groups	Frequency	%	ILMS	LCS
				x̄±ss	x̄±ss
Gender	Male	177	57,1	3,816±0,891	4,234±0,719
	Female	133	42,9	3,684±0,789	4,045±0,655
Grade Level	1	89	28,7	3,724±0,866	4,134±0,718
	2	86	27,7	3,616±0,938	4,168±0,709
	3	41	13,2	3,865±0,698	4,073±0,712
	4	94	30,3	3,877±0,798	4,191±0,068
Department	Physical Education and Sports Teaching	82	26,5	3,774±0,096	4,109±0,689
	Coaching Education	126	40,6	3,678±0,075	4,063±0,721
	Recreation	102	32,9	3,848±0,830	4,299±0,657
İncome	Low	51	16,5	3,745±0,902	4,176±0,712
	Medium	155	50,0	3,677±0,834	4,077±0,707
	High	104	33,5	3,889±0,838	4,254±0,668
Father's Education Level	Primary School	88	28,4	3,812±0,868	4,090±0,748
	Middle School	64	20,6	3,671±0,724	3,984±0,684
	High School	119	38,4	3,760±0,927	4,176±0,656
	University	39	12,6	3,782±0,767	4,500±0,617
Mother's Education Level	Primary School	139	44,8	3,643±0,870	4,039±0,766
	Middle School	61	19,7	3,811±0,817	4,147±0,614
	High School	85	27,4	3,847±0,845	4,282±0,599
	University	25	8,1	3,980±0,850	4,360±0,714

ILMS=Intrinsic Leisure Motivation Scale, LCS=Leisure Crafting Scale

As shown in Table 1, 57.1% (n=177) of the students participating in the study were male, while 42.9% (n=133) were female. Regarding class distribution, 30.3% (n=94) of the students were in their fourth year. In terms of academic department, 40.6% (n=126) were enrolled in the Coaching Education program. Additionally, 50.0% (n=155) of the students reported having a medium income level. Concerning parental education levels, 38.4% (n=119) of the fathers had completed high school, while 44.8% (n=139) of the mothers had completed primary school. The table also presents the mean scale scores for each demographic variable.

Table 2. Differences in Leisure Crafting and Intrinsic Leisure Motivation Total Scores and Subdimensions According to Gender among Sport Sciences Faculty Students

Variables	Gender	n	x̄	Sd	*t*	*p*
Leisure Crafting	Male	177	4,23	0,71	2,38	0,018*
	Female	133	4,04	0,65		
Intrinsic Leisure Motivation	Male	177	3,81	0,89	1,35	0,176
	Female	133	3,68	0,78		
Challenge/ Competence	Male	177	3,49	1,14	1,37	0,171
	Female	133	3,31	1,06		
Self-Determination	Male	177	3,93	0,76	0,93	0,350
	Female	133	3,85	0,72		
Commitment	Male	177	3,96	0,80	1,47	0,142
	Female	133	3,83	0,70		

Identification	Male	177	3,84	0,84	2,44	0,015*
	Female	133	3,60	0,83		
Amotivation	Male	177	3,49	1,14	1,37	0,171
	Female	133	3,31	1,06		

**p<0,05*

As shown in Table 2, a statistically significant difference was found in the Leisure Crafting mean scores and the Identification subdimension of Intrinsic Leisure Motivation according to gender among students of the Faculty of Sport Sciences (p<.05).

Table 3. Differences in Leisure Crafting and Intrinsic Leisure Motivation Total Scores and Subdimensions According to Grade Level among Sport Sciences Faculty Students

Variables	Grade Level	n	x̄	Sd	F	*p*	*Difference*
Leisure Crafting	1	89	4,13	0,71	0,307	0,821	-
	2	86	4,16	0,70			
	3	41	4,07	0,71			
	4	94	4,19	0,66			
Intrinsic Leisure Motivation	1	89	3,72	0,86	1,691	0,168	-
	2	86	3,61	0,93			
	3	41	3,86	0,69			
	4	94	3,87	0,79			
Challenge/ Competence	1	89	4,02	0,81	1,512	0,210	-
	2	86	3,80	0,72			
	3	41	4,01	0,58			
	4	94	3,96	0,68			
Self-Determination	1	89	3,91	0,81	0,048	0,986	-
	2	86	3,87	0,76			
	3	41	3,90	0,67			
	4	94	3,91	0,71			
Commitment	1	89	3,98	0,85	1,807	0,146	-
	2	86	3,78	0,78			
	3	41	3,79	0,65			
	4	94	3,99	0,67			
Identification	1	89	3,84	0,88	2,925	0,034*	4 < 2
	2	86	3,54	0,79			
	3	41	3,64	0,88			
	4	94	3,86	0,82			
Amotivation	1	89	3,29	1,19	3,465	0,017*	4 < 2
	2	86	3,19	1,12			
	3	41	3,65	0,90			
	4	94	3,63	1,04			

**p<0,05*

As shown in Table 3, no statistically significant differences were found in the total scores of Leisure Crafting and Intrinsic Leisure Motivation according to students' grade level. However, significant differences were observed among grade levels in the Identification subdimension (p = .034) and the Amotivation subdimension (p = .017). Post hoc comparisons using Tukey's HSD test indicated that students in the fourth year scored significantly higher in Identification and lower in Amotivation compared to second-year students (4>2). No significant differences were found in the remaining subdimension (p<.05).

Table 4. Differences in Leisure Crafting and Intrinsic Leisure Motivation Total Scores and Subdimensions According to Academic Department among Sport Sciences Faculty Students.

Variables	Department	n	x̄	Sd	F	*p*	*Difference*
Leisure Crafting	Physical Education and Sports Teaching$_1$	82	4,10	0,68	3,486	0,032*	2<1,3
	Coaching Education$_2$	126	4,06	0,72			
	Recreation $_3$	102	4,29	0,65			
Intrinsic Leisure Motivation	Physical Education and Sports Teachin $_1$	82	3,77	0,87	1,138	0,322	-
	Coaching Education$_2$	126	3,67	0,84			
	Recreation $_3$	102	3,84	0,84			
Challenge/ Competence	Physical Education and Sports Teachin $_1$	82	3,77	0,87	1,138	0,322	-
	Coaching Education$_2$	126	3,67	0,84			
	Recreation $_3$	102	3,84	0,84			
Self-Determination	Physical Education and Sports Teaching$_1$	82	3,89	0,73	1,789	0,169	-
	Coaching Education$_2$	126	3,82	0,77			
	Recreation $_3$	102	4,00	0,72			
Commitment	Physical Education and Sports Teaching$_1$	82	3,93	0,72	0,483	0,617	-
	Coaching Education$_2$	126	3,85	0,81			
	Recreation $_3$	102	3,95	0,73			
Identification	Physical Education and Sports Teaching$_1$	82	3,70	0,78	4,692	0,010*	2<1<3
	Coaching Education$_2$	126	3,60	0,94			
	Recreation $_3$	102	3,94	0,72			
Amotivation	Physical Education and Sports Teaching$_1$	82	3,39	1,12	3,691	0,026*	2<1<3
	Coaching Education$_2$	126	3,25	1,14			
	Recreation $_3$	102	3,64	1,01			

**p<0,05*

As shown in Table 4, statistically significant differences were found among departments in students' total Leisure Crafting scores, as well as in the Identification and Amotivation subdimensions (p = .01). However, no significant differences were observed in the total Intrinsic Leisure Motivation scores or in the other subdimensions (p>.05).

Table 5. Differences in Leisure Crafting and Intrinsic Leisure Motivation Total Scores and Subdimensions According to Income Level among Sport Sciences Faculty Students

Variables	Income	n	x̄	Sd	F	*p*	*Difference*
Leisure Crafting	Low	51	4,17	0,71	2,059	0,129	-
	Medium	155	4,07	0,70			
	High	104	4,25	0,66			
Intrinsic Leisure Motivation	Low	51	3,74	0,90	1,956	0,143	-
	Medium	155	3,67	0,83			
	High	104	3,88	0,83			
Challenge/ Competence	Low	51	3,94	0,82	2,456	0,087	-
	Medium	155	3,86	0,71			
	High	104	4,06	0,67			
Self-	Low	51	3,55	0,82	10,21	0,000*	1 < 2 < 3

Determination	Medium	155	3,87	0,73			
	High	104	4,11	0,66			
Commitment	Low	51	3,68	0,86	4,504	0,012*	1 < 2 < 3
	Medium	155	3,87	0,72			
	High	104	4,06	0,74			
Identification	Low	51	3,60	0,90	2,054	0,130	-
	Medium	155	3,69	0,78			
	High	104	3,87	0,90			
Amotivation	Low	51	3,46	1,01	0,294	0,745	-
	Medium	155	3,37	1,02			
	High	104	3,47	1,27			

**p<0,05*

As shown in Table 5, no statistically significant differences were found in the total scores of Leisure Crafting and Intrinsic Leisure Motivation according to students' income levels (p<.05). However, in the Self-Determination subdimension of the Intrinsic Leisure Motivation Scale, students with higher income levels scored significantly higher (p=.000). Additionally, a statistically significant difference was found in the Commitment subdimension based on income level (p=.012). No significant differences were observed in the remaining subdimensions of the Intrinsic Leisure Motivation Scale (p<.05).

Table 6. Differences in Leisure Crafting and Intrinsic Leisure Motivation Total Scores and Subdimensions According to Father's Educational Background among Sport Sciences Faculty Students

Variables	Father's Education Level	n	x̄	Sd	F	*p*	*Difference*
Leisure Crafting	Primary School$_1$	88	4,09	0,74	4,91	0,002*	1<2 <3<4
	Middle School$_2$	64	3,98	0,68			
	High School$_3$	119	4,17	0,65			
	University$_4$	39	4,50	0,61			
Intrinsic Leisure Motivation	Primary School$_1$	88	3,81	0,09	0,791	0,791	-
	Middle School$_2$	64	3,67	0,09			
	High School$_3$	119	3,76	0,08			
	University$_4$	39	3,78	0,12			
Challenge/ Competence	Primary School$_1$	88	3,92	0,80	1,178	0,318	-
	Middle School$_2$	64	3,81	0,72			
	High School$_3$	119	4,00	0,67			
	University$_4$	39	4,03	0,71			
Self-Determination	Primary School$_1$	88	3,74	0,75	1,962	0,120	-
	Middle School$_2$	64	3,92	0,72			
	High School$_3$	119	3,98	0,70			
	University$_4$	39	3,97	0,88			
Commitment	Primary School$_1$	88	3,83	0,81	2,755	0,43	-
	Middle School$_2$	64	3,87	0,67			
	High School$_3$	119	3,87	0,76			
	University$_4$	39	4,23	0,73			
Identification	Primary School$_1$	88	3,69	0,87	0,383	0,766	-
	Middle School$_2$	64	3,69	0,81			
	High School$_3$	119	3,76	0,79			
	University$_4$	39	3,84	1,00			
Amotivation	Primary School$_1$	88	3,61	1,01	1,564	0,198	-

	Middle School$_2$	64	3,35	1,05
	High School$_3$	119	3,38	1,13
	University$_4$	39	3,19	1,29

**p<0,05*

As shown in Table 6, a statistically significant difference was found in the total scores of the Leisure Crafting Scale according to father's educational background, with students whose fathers held a university degree scoring higher (p=002). No statistically significant differences were observed in the total Intrinsic Leisure Motivation scores or in any of its subdimensions (p<.05).

Table 7. Differences in Leisure Crafting and Intrinsic Leisure Motivation Total Scores and Subdimensions According to Mother's Educational Background among Sport Sciences Faculty Students

Variables	Mother's Education Level	n	x̄	Sd	F	*p*	*Difference*
Leisure Crafting	Primary School$_1$	139	4,03	0,76	2,989	0,031	-
	Middle School$_2$	61	4,14	0,61			
	High School$_3$	85	4,28	0,59			
	University$_4$	25	4,36	0,71			
Intrinsic Leisure Motivation	Primary School$_1$	139	3,64	0,87	1,297	0,146	-
	Middle School$_2$	61	3,81	0,81			
	High School$_3$	85	3,84	0,84			
	University$_4$	25	3,98	0,78			
Challenge/ Competence	Primary School$_1$	139	3,88	0,80	1,362	0,255	-
	Middle School$_2$	61	3,87	0,66			
	High School$_3$	85	4,07	0,60			
	University$_4$	25	4,00	0,72			
Self-Determination	Primary School$_1$	139	3,80	0,76	1,578	0,195	-
	Middle School$_2$	61	3,95	0,64			
	High School$_3$	85	3,96	0,76			
	University$_4$	25	4,10	0,82			
Commitment	Primary School$_1$	139	3,86	0,80	0,899	0,442	-
	Middle School$_2$	61	3,84	0,71			
	High School$_3$	85	3,98	0,72			
	University$_4$	25	4,06	0,75			
Identification	Primary School$_1$	139	3,67	0,90	0,540	0,655	-
	Middle School$_2$	61	3,79	0,76			
	High School$_3$	85	3,78	0,85			
	University$_4$	25	3,82	0,67			
Amotivation	Primary School$_1$	139	3,41	1,06	3,670	0,571	-
	Middle School$_2$	61	3,53	1,08			
	High School$_3$	85	3,42	1,17			
	University$_4$	25	3,16	1,18			

****p<0,05***

As shown in Table 7, no statistically significant differences were found in students' total Leisure Crafting scores, total Intrinsic Leisure Motivation scores, or any of its subdimensions according to mother's educational background (p<.05).

Table 8. Correlation Between Intrinsic Leisure Motivation and Leisure Crafting

Intrinsic Leisure Motivation	Pearson's r	Leisure Crafting
Challenge/ Competence	r	.530**
Self-Determination	r	.443**
Commitment	r	.400**
Identification	r	.363**
Amotivation	r	.096

As shown in Table 8, significant positive correlations were observed between Leisure Crafting and the subdimensions of the Intrinsic Leisure Motivation Scale, including Challenge/Competence (r=.530**), Self-Determination (r=.443**), Commitment (r=.400**), and Identification (r=.363**). These results suggest that students with higher levels of intrinsic motivation tend to engage more proactively in leisure crafting activities. Notably, no significant relationship was found between Amotivation and Leisure Crafting (r=.096, non-significant), indicating that the absence of motivation does not contribute meaningfully to the structuring of leisure time. Overall, the coefficients reflect moderate to strong relationships, supporting the theoretical assumption that intrinsic motivation plays a key role in shaping how individuals structure and invest in their leisure experiences.

DISCUSSION and CONCLUSION

This study examined the intrinsic leisure motivation and leisure crafting of sport sciences students in relation to various demographic variables, while also exploring the relationship between these two constructs.

In terms of gender, a statistically significant difference was found between male and female students in total leisure crafting scores (Table 2). The higher scores among male students may suggest that they are more effective in utilizing their leisure time and managing leisure-related activities. In contrast, no significant difference was found in the total intrinsic leisure motivation scores. This suggests that gender does not have a distinct effect on intrinsic motivation. Although not directly in the context of intrinsic leisure motivation, a meta-analysis conducted by Yarım and Ada (2021) also concluded that gender does not significantly influence general motivation. Similarly, in a study by Dinç et al. (2019) examining university students' meanings of leisure, no significant findings were reported regarding the intrinsic leisure motivation variable, despite significant results in other subdimensions. These findings support the notion that intrinsic leisure motivation is independent of gender, aligning with previous research.

Regarding the grade level variable, no statistically significant differences were observed in total leisure crafting or intrinsic leisure motivation scores (Table 3). However, differences were found in the Identification and Amotivation subdimensions. Notably, fourth-year students scored higher, which may reflect the influence of accumulated academic knowledge and experience on motivation. Nevertheless, the absence of consistent differences suggests that grade level may have a limited effect on these constructs. It is possible that leisure crafting and intrinsic motivation develop at earlier stages and remain relatively stable throughout university years. According to Sivan and Siu (2021), university students have opportunities to explore various domains, participate in extracurricular activities, and engage with diverse peer groups throughout their academic journey. This process helps them better understand themselves and discover genuine interests and passions, enabling them to structure their leisure time more consciously and meaningfully. Hill (2013) also found that higher identification scores among fourth-year students may align with the identity development process during university. As students approach graduation, they may increasingly feel the need to define

themselves beyond academic roles, which in turn encourages engagement in leisure activities aligned with their evolving self-concept.

Furthermore, although no statistically significant difference was found between departments in terms of intrinsic leisure motivation and leisure crafting (Table 4), an evaluation of the mean scores revealed that students in the recreation department had higher leisure crafting scores compared to other departments. This finding may suggest that students in the recreation department possess stronger leisure management skills due to their professional orientation. The absence of significant differences in intrinsic leisure motivation scores between departments indicates that department-based differences may influence leisure crafting more directly. According to Silverman (1995), the curriculum of recreation departments covers topics such as time management, planning, and resource allocation for leisure activities. This specialized education may help students acquire practical skills that enhance leisure crafting, independent of their intrinsic motivation levels. In another study, Sessoms (2000) examined whether students in recreation departments were provided with greater opportunities to participate in diverse leisure activities. Exposure to a broader range of activities, along with guidance from faculty members and experienced peers, can contribute to students' abilities to effectively identify, plan, and sustain leisure engagements. Additionally, a study by Gou et al. (2022) found that higher income levels may provide more flexibility in work arrangements, allowing individuals to better integrate leisure into their lives. This leads to a greater sense of perceived control over leisure, which can influence their self-determination.

Regarding income level, no significant differences were found in leisure crafting or intrinsic leisure motivation (Table 5). However, students with higher income levels scored significantly higher in the Self-Determination subdimension, suggesting that socioeconomic status may influence personal awareness and self-regulatory capacities. The study by Okun and Morris (2003) emphasizes that socioeconomic status may intersect with social support networks. Individuals with higher income may have access to broader social environments and resources that facilitate leisure participation, which in turn positively affects their leisure crafting skills.

Father's educational background was found to significantly influence leisure crafting (Tables 6 and 7). Students whose fathers had attained a university degree reported higher leisure crafting scores. Although no statistically significant difference was found in relation to mother's education level, students with more highly educated mothers tended to have relatively higher scores. These findings highlight the influence of parental education levels on leisure behavior. According to Chesley and Flood (2017), the availability of leisure time that can be used for continued education is highly valuable. Higher parental education may be associated with an emphasis on lifelong learning and intellectual curiosity. These values may be transmitted to children, encouraging them to seek out new experiences and pursue knowledge beyond formal educational settings.

Finally, the study revealed important findings regarding the influence of different dimensions of intrinsic motivation on leisure crafting. Specifically, the dimensions of Challenge, Self-Determination, and Commitment were found to enhance individuals' capacity to make effective and meaningful use of their leisure time. These results suggest that the ability to cope with challenges, act autonomously, and feel committed is a significant determinant of leisure crafting. This aligns with previous findings showing that leisure crafting behaviors are strengthened when individuals perceive a clear structure of time and engage in goal-directed leisure activities (Tsaur, Yen, & Chen, 2021). In contrast, the Identification dimension appeared to have a more limited effect on leisure crafting. This may indicate that identification with activities contributes more to the motivational foundation rather than directly enhancing crafting behaviors. These findings underscore the importance of developing specific dimensions of intrinsic leisure motivation in order to improve how individuals engage with their leisure.

Supporting this, Xue et al. (2022) demonstrated that when college students engaged in leisure crafting regularly, especially in forms aligned with personal motivation, their well-being improved significantly over time. Particularly, supporting autonomy and the ability to cope with challenges may have a positive impact on leisure crafting. This aligns with the broader understanding that leisure crafting not only enhances individual well-being but also contributes to deeper forms of personal and professional integration, such as job embeddedness, as demonstrated by Teng and Chen (2025). Their study revealed that leisure crafting can play a significant mediating role in strengthening individuals' psychological connection to their work and life environments.

Overall, the results of the study highlight a strong and meaningful relationship between intrinsic leisure motivation and leisure crafting. The findings provided valuable insights in line with the purpose of the study and contributed to expanding the existing body of literature. Whereas previous studies often focused on variables associated with intrinsic motivation and leisure crafting separately, this study has brought their direct relationship into focus. Additionally, the analysis of these variables in comparison to demographic factors addresses a gap in the current literature. In conclusion, this study reveals the relationship between leisure crafting and intrinsic leisure motivation among sports science students, offering valuable insights into how this process contributes to self-discovery and personal development during university life. As a result of this study, engaging in intrinsically motivated leisure activities can play a supportive role in helping young individuals develop skills in specific areas.

This study has several limitations. Firstly, the research was conducted exclusively with students from a single university's Faculty of Sport Sciences, which limits the generalizability of the findings. The demographic and socioeconomic diversity of the participants was limited, potentially affecting the external validity of the study. In addition, the study relied solely on self-report measurement instruments, which may introduce response biases and limit the objectivity of the findings. The exclusive use of quantitative methods also restricted the depth of contextual and experiential insights that could have been captured through qualitative approaches.

Future research should consider collecting data from multiple universities and more diverse populations to enhance generalizability. Moreover, longitudinal research designs could be employed to explore the long-term effects of leisure crafting and intrinsic motivation. Qualitative approaches and in-depth interviews could provide more detailed insights into individuals' leisure experiences. Lastly, the influence of environmental and societal factors on these relationships should be examined in greater depth.

Beyond future research, the findings offer practical implications for university settings. For instance, campus-based leisure programs may be designed to enhance students' intrinsic motivation and leisure crafting abilities. Student support services and counseling units could also incorporate leisure planning and motivational skill-building into personal development workshops.

Author's Statement of Contribution to the Article

Idea/Concept: Halime Dinç, Yusuf Can Özdemir; Article design: Halime Dinç, Yusuf Can Özdemir; Consulting: Rıfat Yağmur; Data Collection and Processing: Halime Dinç, Burak Olur, Dürdane Sicimli; Analysis/Comment: Halime Dinç; Literature review: Halime Dinç, Yusuf Can Özdemir; Article writing: Halime Dinç; Critical Analysis: Rıfat Yağmur; Source/Material: Burak Olur, Dürdane Sicimli; Article Submission Corresponding Author: Halime Dinç

Conflict of Interest

The authors have no conflict of interest to declare.

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Ethics Committee Approval

The study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval was granted by the Social and Human Sciences Scientific Research and Publication Ethics Committee of Afyon Kocatepe University (Decision No: 2024/385, dated 20.11.2024).

Peer Review

After the blind review process, it was found suitable for publication and accepted.

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Research Article

Investigation of the Relationship Between Time Management and Work Life Balance of Academicians Working in the Faculty of Sport Sciences

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Abstract

The aim of this study is to examine the relationship between time management and work-life balance of academicians working in Faculties of Sport Sciences. In the quantitative research method, data were collected with Work-Life Balance and Time Management Scales from 117 participants selected by maximum diversity sampling method. Normally distributed data were analyzed using descriptive statistics, t-test, MANOVA and Pearson correlation tests. As a result of the research, it was determined that academicians' work negatively affects their lives, their time planning is poor, there is a negative relationship between the number of scientific publications and time attitudes, and according to the title, lecturers' time planning is better than research assistants (P<0.05). There was no statistically significant (P>0.05) relationship between the participants' managerial position, marital status and course load variables and time management and work-life balance. Time planning trainings and flexible working hours are recommended for academicians to improve their time management skills.

Keywords: Academician, Time Management, Work Life Balance

Spor Bilimleri Fakültesinde Görevli Akademisyenlerin Zaman Yönetimleri ve İş Yaşam Dengeleri Arasındaki İlişkinin İncelenmesi

Öz

Bu çalışmanın amacı, Spor Bilimleri Fakültelerinde görev yapan akademisyenlerin zaman yönetimi ve iş-yaşam dengesi arasındaki ilişkiyi incelemektir. Nicel araştırma yönteminde maksimum çeşitlilik örnekleme yöntemi ile seçilen 117 katılımcıdan İş-Yaşam Dengesi ve Zaman Yönetimi Ölçekleri ile veri toplanmıştır. Normal dağılım gösteren veriler betimsel istatistikler, t-testi, MANOVA ve Pearson korelasyon testleri kullanılarak analiz edilmiştir. Araştırma sonucunda akademisyenlerin çalışmalarının yaşamlarını olumsuz etkilediği, zaman planlamalarının zayıf olduğu, bilimsel yayın sayısı ile zaman tutumları arasında negatif bir ilişki olduğu ve öğretim görevlilerinin zaman planlamalarının araştırma görevlilerine göre daha iyi olduğu tespit edilmiştir (P<0,05). Katılımcıların yöneticilik pozisyonu, medeni durum ve ders yükü değişkenleri ile zaman yönetimi ve iş-yaşam dengesi arasında istatistiksel olarak anlamlı (P>0,05) bir ilişki bulunmamıştır. Akademisyenlerin zaman yönetimi becerilerini geliştirmeleri için zaman planlama eğitimleri ve esnek çalışma saatleri önerilmektedir.

Anahtar Kelimeler: Akademisyen, İş Yaşam Dengesi, Zaman Yönetimi

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INTRODUCTION

Academicians, in their efforts to fulfill their professional responsibilities and pursue personal development, organize their daily lives within the dual structure of work and private life. Work-life balance refers to an individual's effective distribution of time and energy between work and personal life to achieve satisfaction and well-being in both areas (Greenhaus and Beutell, 1985). Urbanization has led to radical transformations in individuals' work lives and social relationships. This transformation has created significant pressures between the work environment and personal life, especially within the academic community. For example, Jacobs and Winslow (2004) revealed that academicians in American universities struggled to achieve work-life balance due to increasing workload and family demands. In Turkey, university campuses are generally located in city centers, and while these modern cities offer advanced facilities and opportunities to employees, they also bring problems such as stress and time management (Toker, 2016). Work-life balance should be managed effectively to prevent work-related demands from negatively affecting personal life and to protect an individual's physical, mental, and emotional health (Kossek and Lambert, 2005). For instance, Greenhaus, Collins, and Shaw (2003) demonstrated that achieving work-life balance increased employees' job satisfaction and quality of life.

In the twenty-first century, technological advancements are creating complex effects on work-life balance and time management. Time management refers to the process of increasing efficiency and productivity by planning and prioritizing tasks (Claessens, Van Eerde, Rutte, and Roe, 2007). While digital communication tools and new media facilitate academicians' work processes, the expectation of constant accessibility limits their personal time (Turkle, 2011). Elements such as email, online meetings, and social media make it difficult to disconnect from work, leading to work continuing outside working hours and complicating time management (Demir, 2020; Derks and Bakker, 2014). For example, Derks, van Mierlo, and Schmitz (2015), in a study conducted in the Netherlands, stated that smartphone use increased work-home conflict and negatively affected academicians' post-work recovery processes. This situation can negatively impact work-life balance, leading to problems such as stress, burnout, and tension in family relationships (Allen, Herst, Bruck, and Sutton, 2000). Establishing work-life balance becomes even more complex for academicians with a demanding work pace, where educational and teaching activities are carried out simultaneously with academic studies. In this context, work-life balance stands out as a factor that directly affects not only individual well-being but also academic productivity and institutional success (Grzywacz and Carlson, 2007). For example, Karatepe and Tekinkus (2006) showed that work-life balance issues among employees in the service sector in Turkey affected job performance and intention to leave; these findings suggest similar effects could exist for academicians.

Time, as a limited and irreversible resource, is a fundamental element in organizing individuals' lives. Academicians can enhance their professional success and maintain their personal well-being by preserving work-life balance through effective time management strategies (Claessens et al., 2007). For example, Macan, Shahani, Dipboye, and Phillips (1990) revealed that time management behaviors reduced job stress and increased job satisfaction. However, achieving this balance requires academicians to possess advanced organizational skills across a wide range of tasks, from lesson planning to research processes, field studies, and administrative duties (Peeters and Rutte, 2005). Workload refers to the volume and intensity of professional duties such as teaching and research; managerial duties refer to non-teaching responsibilities such as committee work, report preparation, and institutional management (Bezuidenhout and Cilliers, 2010). These factors are significant variables that directly affect time management and work-life balance. For instance, Houston, Meyer, and Paewai (2006), in a study

conducted on teachers, found that high workload negatively affected work-life balance and increased the risk of burnout; this situation can also be valid for academicians. Similarly, Bezuidenhout and Cilliers (2010), in a study on academicians, stated that managerial duties placed a significant burden on time management and complicated work-life balance. Effective time planning necessitates a strategic approach that clarifies academicians' goals and increases productivity (Covey, 1989). Furthermore, work-life balance is not only related to the effective use of time but also to establishing healthy boundaries between work and personal life. These boundaries allow academicians to reduce stress caused by workload and achieve greater satisfaction and happiness in their personal lives (Clark, 2000). For academicians working in a dynamic field like sports sciences, achieving this balance directly impacts both individual and institutional success. For example, Türkmen (2021) reported that Sports Sciences academicians faced special difficulties in time management due to intensive field studies and workload, and this situation affected their work-life balance.

Demographic characteristics have a significant impact on work-life balance and time management. For example, Tausig and Fenwick (2001) stated that gender and family status affected the perception of work-life balance and that female academicians generally undertook more family responsibilities. Similarly, Cinamon and Rich (2005), in a study conducted on educators, revealed that demographic factors such as age and marital status shaped time management strategies and the perception of work-life balance. Such studies emphasize that academicians' work-life balance and time management practices should be addressed in the context of individual differences.

In this context, this study was conducted to examine the relationship between time management and work-life balance among academicians working in Sports Sciences Faculties. From this point, time management and work-life balance variables were examined considering academicians' demographic characteristics such as marital status, gender, workload, and managerial duties.

Research Model

Spor This study, which examines the relationship between time management and work-life balance among academic staff working in the Faculty of Sports Sciences, utilized a general survey approach and a relational survey model, which are quantitative research methods. In the general survey model, a survey is conducted on an entire universe or a sample group taken from it to reach a general judgment about the universe, which consists of a large number of elements. The relational survey model, on the other hand, aims to determine the existence or difference of co-variation between at least two or more variables (Karasar, 2011).

Population and Sample

The study population for this research also constituted the sample group. This sample group consisted of 117 participants (Research Assistant, Lecturer, Asst. Prof. Dr., Assoc. Prof. Dr., Prof. Dr.) working in Sports Sciences faculties, selected entirely on a voluntary basis using the maximum variation sampling method, which is a non-random purposive sampling method (Büyüköztürk et al., 2018).

Data Collection Tool

The survey technique was used as the data collection method in the research. For this purpose, the first section of the scale used to collect data on participants' demographic characteristics (marital status, managerial duty, course load, title, total number of publications) consisted of 5 questions. The second section used the "Work-Life Balance Scale," which was adapted into Turkish and whose validity and reliability studies were conducted by Ekinci and Sabancı (2021), consisting of 17 questions and 4 sub-dimensions: "Negative effect of life on work (YIOSE), Negative effect of work on life (IYOSE), Positive effect of life on work (YIOLE), Positive effect of work on life (IYOLE)." The scale was scored on a 5-point Likert type, with 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, and 5=strongly agree. The total reliability coefficient of the scale for this study was determined as α=0.77.

To collect data on time management, the "Time

Management Scale," adapted into Turkish and validated by Alay and Koçak (2002), consisting of 27 questions and 3 sub-dimensions: "Time Planning, Time Attitudes, Time Wasters," was used. The scale was scored on a 5-point Likert type, with 1=Never, 2=Rarely, 3=Sometimes, 4=Often, and 5=Always. The total reliability coefficient of the scale for this study was determined as α=0.90.

Data Collection

Data were collected online from voluntary participants using Google Forms between January 1, 2023, and March 15, 2025. The scale was administered via email addresses and social media platforms.

Data Analysis

To test whether the collected data related to dependent variables showed a normal distribution, 5 main parameters (Histogram, Coefficient of Variation, Skewness/Kurtosis, Detrended Test, and Normality Test) were analyzed. According to the literature, at least 3 of these 5 parameters should show a normal distribution (Büyüköztürk, 2023). From this point, to determine normal distribution, skewness and kurtosis values (skewness and kurtosis/Standard error=+- 1.96) were first examined, and it was found that these values were between (+1.96 and-1.96) in all sub-dimensions. Then, the coefficient of variation of the sub-dimensions was calculated using the formula (Standard Deviation / Mean x 100 = Coefficient of Variation), and it was determined that the Coefficient of Variation was <30% of the Standard Deviation in all dimensions. In the detrended normal Q-Q plot, another test measuring the normality of the data, it was determined that the unit values of the variables clustered just above the line, thus confirming that the data collected for this research showed a normal distribution.

RESULTS

This section presents the statistical analyses related to the data collected in line with the research objective. The findings are detailed with tables and explanations.

Table 1. Descriptive Statistics - Percentage and Frequency Distribution

Variables		f	%
Marital Status	Married	82	70,1
	Single	35	29,9
Managerial Duty	Yes	36	30,8
	No	81	69,2
Title	Res. Ass.	24	20,5
	Lecturer	17	14,5
	Asst. Prof.	36	30,8
	Assoc. Prof.	23	19,7
	Prof. Dr.	17	14,5
Total		117	100

When Table 1 is examined, it is seen that out of a total of 117 participants, 70.1% are married, 29.9% are single, 30.8% have managerial duties, and 69.2% do not.

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Table 2. Arithmetic mean and standard deviation of work-life balance and time management scale sub-dimensions.

Scales	Sub-dimensions	N	x̄	Ss
Work-life balance	Negative effect of work on life	117	3,37	0,84
	Negative effect of life on work	117	2,65	0,85
	Positive effect of work on life	117	3,11	0,87
	Positive effect of life on work	117	3,31	0,85
Time management	Time planning	117	2,46	0,63
	Time attitudes	117	2,70	0,48
	Time wasters	117	2,75	0,83

When Table 2 is examined, it is seen that among the work-life balance scale dimensions, the "negative effect of work on life" dimension (x̄=3.37) has the highest mean, while in the time management scale, the "time wasters" dimension has a higher mean (x̄=2.75) than other dimensions.

Table 3. Relationship between course load and number of publications and work-life balance and time management scale sub-dimensions.

Correlation		IYOSE	YIOSE	IYOLE	YIOLE	Time planning	Time attitudes	Time wasters
Course load	r	-0,05	-0,14	-0,01	-0,02	0,09	0,02	-0,04
	p	0,54	0,13	0,83	0,75	0,32	0,77	0,60
Pub. count	r	0,08	-0,12	0,00	0,03	-0,06	**-0,23***	0,08
	P	0,37	0,16	0,94	0,70	0,51	0,01	0,32

*p<0,05

When Table 3 is examined, while no significant relationship was found between course load and work-life balance and time management scale sub-dimensions, a moderate negative significant relationship (r= -0.23, p<0.05) was found between participants' publication count variable and the time attitudes dimension.

Table 4. Comparison of marital status variable with work-life balance and time management scale sub-dimensions.

Scales	Sub-dimensions	Marital status	n	x̄	Ss	t	p
Work-life balance	Negative effect of work on life	Married Single	82 35	3,46 3,17	0,79 0,92	1,72	0,08
	Negative effect of life on work	Married Single	82 35	2,71 2,51	0,81 0,92	1,12	0,26
	Positive effect of work on life	Married Single	82 35	3,04 3,26	0,84 0,93	-1,25	0,21
	Positive effect of life on work	Married Single	82 35	3,30 3,35	0,84 0,89	-2,27	0,78
Zaman yönetimi	Time planning	Married Single	82 35	2,49 2,39	0,59 0,70	0,762	0,44
	Time attitudes	Married Single	82 35	2,71 2,66	0,45 0,54	0,58	0,56
	Time wasters	Married Single	82 35	2,75 2,77	0,85 0,80	-0,12	0,90

*p<0,05

When Table 4 is examined, no statistically significant difference was found in the t-test conducted to compare the marital status variable with the work-life balance and time management scale sub-dimensions (p>0.05).

When Table 5 is examined, no statistically significant difference was found between participants' managerial duty variable and the work-life balance and time management scale sub-dimensions (p>0.05)

Table 5. Comparison of managerial duty with work-life balance and time management scale sub-dimensions.

Scales	Sub-dimensions	Managerial duty	n	x̄	Ss	t	p
Work-life balance	Negative effect of work on life	Yes No	36 81	3,46 3,33	0,88 0,83	0,72	0,47
	Negative effect of life on work	Yes No	36 81	2,51 2,71	0,86 0,84	-1,14	0,25
	Positive effect of work on life	Yes No	36 81	3,19 3,07	1,02 0,80	0,68	0,49
	Positive effect of life on work	Yes No	36 81	3,29 3,32	0,95 0,81	-0,19	0,84
Time management	Time planning	Yes No	36 81	2,39 2,49	0,67 0,61	-0,84	0,40
	Time attitudes	Yes No	36 81	2,62 2,73	0,50 0,46	-1,10	0,27
	Time wasters	Yes No	36 81	2,63 2,81	0,82 0,84	-1,07	0,28

*p<0,05

Table 6. Difference between title and work-life balance and time management scale sub-dimensions.

MANOVA	Sub-dimensions	Title	x̄	S	Sd	F	p	η2	Tukey
Work-life balance	Negative effect of work on life	Res. Asst.	3,40	1,02	4-112	0,67	0,61	0,02	
		Lecturer	3,14	0,89					
		Asst. Prof.	3,52	0,82					
		Assoc. Prof.	3,27	0,67					
		Prof. Dr.	3,40	,078					
	Negative effect of life on work	Res. Asst.	2,58	0,90	4-112	1,73	0,14	0,05	
		Lecturer	2,92	0,97					
		Asst. Prof.	2,83	0,85					
		Assoc. Prof.	2,37	0,74					
		Prof. Dr.	2,47	0,68					
	Positive effect of work on life	Res. Asst.	3,05	1,11	4-112	0,22	0,92	0,00	
		Lecturer	3,27	0,80					
		Asst. Prof.	3,07	0,84					
		Assoc. Prof.	3,05	0,72					
		Prof. Dr.	3,17	0,89					
	Positive effect of life on work	Res. Asst.	3,37	1,01	4-112	0,48	0,74	0,01	
		Lecturer	3,39	0,66					
		Asst. Prof.	3,15	0,89					
		Assoc. Prof.	3,36	0,61					
		Prof. Dr.	3,45	0,99					
Time management	Time planning	Res. Asst.	2,17	0,55	4-112	3,15	0,01**	0,10	Res. Asst. < Lecturer
		Lecturer	2,78	0,66					
		Asst. Prof.	2,53	0,66					
		Assoc. Prof.	2,56	0,52					
		Prof. Dr.	2,28	0,58					
	Time attitudes	Res. Asst.	2,61	0,52	4-112	1,96	0,10	0,06	
		Lecturer	2,90	0,44					
		Asst. Prof.	2,76	0,46					
		Assoc. Prof.	2,68	0,53					
		Prof. Dr.	2,49	0,34					
	Time wasters	Res. Asst.	2,89	0,81	4-112	1,38	0,24	0,04	
		Lecturer	2,50	0,85					
		Asst. Prof.	2,93	0,88					
		Assoc. Prof.	2,53	0,79					
		Prof. Dr.	2,75	0,74					

*p<0,05

When Table 6 is examined, a statistically significant difference was found between the participants' title variable and the time planning sub-dimension of the time management scale (F(4,112)=3.15; p<.01, η2=0.10), specifically between research assistants and lecturers. According to this difference, lecturers are able to plan their time better.

DISCUSSION and CONCLUSION

This study examined the demographic characteristics of 117 academicians who participated in the research. It was observed that 70.1% were married and 30.8% held managerial positions (Table 1). The distribution of titles ranged broadly from research assistants to professors, consistent with the maximum variation sampling method

and enhancing the sample's representativeness of the population (Büyüköztürk et al., 2018). The impact of independent variables such as title, course load, marital status, managerial duties, and number of publications on work-life balance and time management was limited within the scope of this study.

Participants reported a high mean for the "negative effect of work on life" dimension and a low mean for the "negative effect of life on work" dimension in the work-life balance scale (Table 2). This finding indicates that academicians' responsibilities in their professional lives more significantly impact their personal lives. A possible reason for this could be that academicians in the field of sports sciences juggle numerous social responsibilities (e.g., recreational activities, school team work, community engagement) in addition to their teaching, education, and academic duties. Gerçek, Hatay, and Dündar (2015) noted that work intensity can suppress an individual's social and personal spheres, which aligns with our study's finding of a high "negative effect of work on life." Literature suggests that flexible working hours can help mitigate the negative impact of work on personal life (Aycan and Eskin, 2005). To counteract these negative effects, improving elements like professional satisfaction and personal development would positively reflect on academicians' personal lives. For instance, Eby, Casper, Lockwood, Bordeaux, and Brinley (2010) stated that the positive aspects of work-life balance contribute to employees' quality of life by increasing job satisfaction.

Regarding the time management scale, the "time wasters" dimension had a high mean, while "time planning" had a low mean (Table 2). This suggests that participants might spend more time on personal tasks at work, or engage in detrimental habits like smoking, excessive socializing with colleagues, and digital addiction, leading to procrastination and various time management difficulties. Given the demanding work pace of academic staff, it's crucial for them to avoid elements that lead to time loss at work and to develop a strategic time management plan. According to Mackenzie (1989), effective time management relies on strategic planning. The low time planning observed in academicians in this study could be attributed to participants not sufficiently implementing such strategies. Yeşil (2009) emphasized that effective time use enhances an individual's quality of life and that the prevalence of time wasters in the workplace negatively affects work-life balance. This is particularly true for sports sciences academicians, who face additional time management challenges due to field studies and heavy course loads (Türkmen and Özcan, 2023). Therefore, the high incidence of time wasters highlights the need for more training and support for academicians to optimize their work processes.

While no significant relationship was found between course load and work-life balance or time management sub-dimensions, a moderate negative relationship was observed between the number of publications and "time attitudes" (Table 3). This finding suggests that as academicians' publication count increases, their attitudes towards insufficient time are negatively affected. Kapız (2002) emphasized that excessive workload negatively influences individuals' time attitudes. These results imply that the obligation to publish for career advancement negatively impacts academicians' time attitudes and can disrupt their work-life balance. This situation indicates that the pressure to publish not only affects academicians' perception of time but also negatively impacts their overall job satisfaction and quality of life. Poelmans and Caligiuri (2008) noted that academic productivity pressure, especially publication-focused performance evaluations, complicates employees' work-life balance and increases stress levels. In this context, academic institutions balancing publication expectations and offering flexible work arrangements could improve academicians' time attitudes.

No statistically significant difference was found between participants' marital status and work-life balance or time management sub-dimensions. However, evaluating the arithmetic means of responses, married individuals seemed to have a worse work-life balance than single individuals, though they didn't report time management problems (Table 4). These results suggest that academicians' marital status doesn't play a defining role in this context. There are

conflicting findings in the literature; for instance, Aycan and Eskin (2005) stated that spouse support positively influenced work-life balance in married individuals, while Greenhaus and Beutell (1985) argued that family responsibilities could increase work-life conflict. The lack of effect of marital status in this study might stem from the unique dynamics of the sample group or the general pressures of academic life. It's plausible that while family responsibilities might challenge work-life balance for married academicians, this effect could be mitigated by high levels of family support within the sample or excellent personal coping strategies. Duxbury and Higgins (2001) highlighted that family support and flexible work arrangements play a crucial role in reducing work-life conflict for married individuals. Therefore, academic institutions developing family-friendly policies could improve the work-life balance of married academicians.

While no significant difference was found between participants' managerial duty and work-life balance or time management sub-dimensions, examining the arithmetic means suggests that academicians with managerial duties had a better work-life balance than those without, but they experienced problems with time management (Table 5). This result implies that managerial duty and additional responsibilities don't have a distinct impact on time management or work-life balance. Özcanlı and İlgün (2008) also found that managers faced challenges with time management in their study. Considering that managerial duties in academia often manifest as administrative burdens, their impact on time management might be limited. Lambert, Waxman, and Haley-Lock (2006) stated that the effect of managerial duties on time management depends on the individual's organizational skills and institutional support mechanisms. In this regard, academic institutions providing time management training and support systems for managers could mitigate the potential negative effects of these roles.

A significant difference was found in the "time planning" sub-dimension between research assistants and lecturers in favor of lecturers, when considering the participants' title variable (Table 6). This significant difference clearly demonstrates the impact of professional experience and responsibilities on time management. Özcanlı and İlgün (2008) stated that time management develops with experience. No significant difference was found among other sub-dimensions based on title, indicating that the perception of work-life balance and time management is experienced similarly regardless of title. This finding supports the idea that professional experience plays a critical role in developing time management skills. Kinman and Jones (2008) noted that academic staff's time management skills improved with career progression, but the perception of work-life balance remained similar regardless of title difference. Therefore, developing time management training programs, especially for new academicians, could be effective in addressing time planning deficiencies in this group.

To briefly summarize the relationship between time management and work-life balance specifically for academic staff in Sports Sciences Faculties: it can be said that while the negative effect of work on life is high, and the intensity of academic staff's work life pressurizes their personal lives, the balance is not entirely lost due to a moderately positive perception of the positive effect of work on life and life on work. From a time management perspective, the dominance of time wasters and low time planning emerged as areas where academic staff need to improve to use their time efficiently. While course load did not have a significant impact on work-life balance and time management, the negative influence of scientific publication count on time attitudes suggests that the pressure for academic productivity may complicate time perception. The weakness of research assistants in the time planning dimension, according to their title, emphasizes the importance of professional experience.

In conclusion, it's recommended that academic staff develop their time management skills to achieve work-life balance. Training programs focused on time planning and flexible working hours arrangements could positively impact this balance. In this context, academic institutions organizing mentorship programs and time management workshops, especially

for new academicians, could enhance both individual well-being and institutional productivity. Additionally, implementing institutional policies that support work-life balance, such as flexible working hours and family-friendly practices, on a broader scale is recommended. Kossek, Baltes, and Matthews (2014) stated that institutional support mechanisms play a critical role in improving work-life balance and reducing the risk of burnout among employees.

Author's Contribution Statement to the Article

Idea/Concept: M. Emir Orak, Hanifi Üzüm, Ünal Karlı; Article design: M. Emir Orak, Hanifi Üzüm, Ünal Karlı; Consulting: Hanifi Üzüm, Ünal Karlı; Data Collection and Processing: M. Emir Orak; Analysis/Comment: Hanifi Üzüm; Literature review: M. Emir Orak, Hanifi Üzüm; Article writing: M. Emir Orak, Hanifi Üzüm; Critical Analysis: Ünal Karlı; Source/Material: M. Emir Orak, Hanifi Üzüm; Article Submission Corresponding Author: M. Emir Orak

Conflict of Interest

The authors have no conflict of interest to declare.

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Ethical Approval

This study is in compliance with the Declaration of Helsinki. A report with meeting and decision date 30/01/2022-01 was obtained from Bolu Abant İzzet Baysal University Social Sciences Human Research Ethics Committee.

Peer Review

The article was found suitable for publication and accepted after the blind peer-review process.

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Review

The Future of Technology at Mega Sports Events

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Abstract

Mega sporting events, such as the World Cup and the Olympics, are international events where the host country and city change. Technological developments at these events are used in various fields, including wearable devices, line technologies, and advanced analytical applications. These developments improve athlete performance, fan participation, and managerial efficiency. This study examined the technologies used in mega sporting events from historical and contemporary perspectives, as well as made predictions about future technologies. The study was conducted as a review. First, the technologies used in mega sporting events were examined within the scope of the research. Information was collected by reviewing academic publications, event reports, company websites, news sites, and event videos. The study concluded that the technologies used in mega sports events fall into five main categories: athlete performance and health technologies; refereeing and decision support systems; fan experience and interaction technologies; organizational and infrastructure technologies; and education, preparation, and analysis technologies. It is believed that this categorization can be used in future research.

Keywords: Future, Mega Events, Sports, Technology

Mega Spor Etkinliklerinde Teknolojinin Geleceği

Öz

Mega spor organizasyonları, katılımın uluslararası seviyede olduğu fakat organizasyonun düzenlendiği ülke ve şehirlerin değiştiği Dünya Kupası veya Olimpiyatlar gibi organizasyonlardır. Bu organizasyonlarda yaşanan teknolojik gelişmeler sporcu performansı, taraftar katılımı ve yönetimsel verimliliğin arttırılmasının yanında giyilebilir cihazlar, çizgi teknolojileri, gelişmiş analitik uygulamalar gibi farklı alanlarda kullanılmaktadır. Bu araştırma, mega spor organizasyonlarında kullanılan teknolojilerin geçmiş ve bugün perspektifinden inceleyerek gelecekte kullanılabilecek teknolojilere yönelik tahminler oluşturmak amacıyla gerçekleştirilmiştir. Araştırma derleme makale türünde gerçekleştirilmiştir. Araştırma kapsamında ilk olarak mega spor organizasyonlarında kullanılan teknolojiler incelenmiştir. Bu teknolojiler incelenirken öncelikle yayınlanmış akademik yayınlar, ardından organizasyon raporları, web siteleri, teknolojileri üreten firmanın web siteleri haber siteleri ve organizasyonlara ait videolar incelenerek bilgiler derlenmiştir. Araştırma sonucunda mega spor organizasyonlarında kullanılan teknolojiler; sporcu performans ve sağlık teknolojileri, hakemlik ve karar destek sistemleri, taraftar deneyimi ve etkileşim teknolojileri, organizasyonel ve alt yapı teknolojileri ve eğitim, hazırlık ve analiz teknolojileri olmak üzere beş başlık altıda sınıflandırılabileceği ve bu şekliyle gelecek araştırmalarda kullanılabileceği düşünülmektedir.

Anahtar Kelimeler: Gelecek, Mega Etkinlikler, Spor, Teknoloji

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INTRODUCTION

The sports industry, which has seen significant developments over the past century, has become not only a source of entertainment but also a powerful economic force. Historically, sports, which were initially limited to local events, became global with the advent of television (Holden et al., 2019; Mencarini et al., 2022; Wang et al., 2022). Over time, the rise of cable television, sports networks, and the increasing use of the internet have further fueled this growth. Technological developments around the world have been integrated into the sports industry, improving athlete performance, fan participation, and managerial efficiency, as well as taking many different forms, from wearable devices and line technologies to advanced analytical applications (Ramkumar et al., 2021). Finally, with the integration of artificial intelligence, one of the greatest technological developments of the 21st century, the sports industry has entered a major transformation process. With the use of artificial intelligence, machine learning has enabled significant improvements in athlete performance, injury prevention, and game strategy (Dindorf et al., 2022).

The rapid advancement of technology has brought about significant changes in the sports industry. As a result of these changes, GPS systems, wearable technologies, video analysis software, and AI-powered applications have provided athletes, coaches, managers, and fans with different experiences. These technologies enable the real-time tracking of athletes' movements and the use of the data obtained to create training programmes, game strategies, and detailed analyses of performance and injuries (Carling et al., 2012; Franks, 2004; Hughes and Şimşek and Devecioğlu, 2019).

All developments in the sports sector are of utmost importance in terms of contributing to the development of mega sports events, finding application areas, and introducing them to large audiences. In this regard, the technologies used in sports events show various innovations with each new event, both for coaches, media workers, and spectators in the sports venues and for spectators watching from their screens (Şimşek and Devecioğlu, 2019).

Mega sports events are events such as the World Cup or the Olympics, where participation is at an international level but the country and city hosting the event change. While these events cover a specific short time frame, they have long-term effects on the country and city hosting the event (Preuss, 2009).

According to Müller (2015), it is possible to examine a sporting event as a mega-event from two different perspectives. From the first perspective, the duration and scale of the event are important in terms of its internal characteristics. The internal characteristics in question include the total spectator capacity of sports facilities, the number of employees and volunteers working for the event, the sports disciplines, the number of facilities to be built, renovated, or expanded for the event, and the number of athletes, coaches, administrators, and spectators participating in the event. The second perspective focuses on the external characteristics contributed by the country or city hosting the event. From this perspective, the external characteristics include the number of countries and broadcasters that will broadcast the sporting events live, sponsorship opportunities and numbers, investments in infrastructure such as transportation, accommodation, and communication, sports heritage plans and strategies, and the impact on the host country and city.

As a result of all the evaluations made, mega sports organizations are defined as limited-term, one-time, or repeatable events that showcase the vision, culture, and strategies of cities and countries through their candidacy and that leave a lasting impact on the country or city through planned sports heritage strategies, with investments made in various areas for the purpose of promoting the country and city through sustainable finance and financial programmes (Gold and Gold, 2011; Hiller, 2000; Mills and Rosentraub, 2013; Müller, 2015; Roche, 2000). Countries hosting mega sports events have different motivations. The most important motivational

factors include economic, political, social, and cultural reasons (Baum and Lockstone, 2007).

This article aims to examine fast-developing technologies such as artificial intelligence, biometric systems, digital twins and immersive audience interaction platforms for future technologies for mega sports organizations. By analysing the current trends and examining the systems applied in mega sports organizations in the past and present, it creates predictions for future applications and brings them to the attention of organisation managers, academicians, rule makers and technology developers. A literature review was first conducted for the research data. First, published articles were examined, followed by reports on mega sporting events (PubMed, ScienceDirect, Human Kinetics, Google Akademik, Web of Science), websites of brands related to the events' Technologies, and news site publications. The literature review for the scope of the research was conducted between 1 November 2024 and 1 May 2025. Finally, the authors evaluated and interpreted the findings in terms of future perspectives. Furthermore, this research is significant because it contributes to the existing literature and future research in this field.

Sports Technologies Used in Mega Sports Events

This section of the study examines the technologies used in mega sporting events, from past events to those in the present day. These technologies are categorised and explained with examples.

Wearable technologies

Wearable technologies allow athletes to simultaneously monitor various data, such as heart rate, pulse, sleep, and body temperature. Examining wearable technologies from this perspective reveals that the process began with the invention of eyeglasses in the 13th century and has undergone major evolution, leading to the augmented reality (AR) and virtual reality (VR) glasses used today. Wearable technologies come in various forms, including smart bracelets, shoes, glasses, watches, clothing, head-mounted displays, and virtual reality glasses. At major sports events, Intel Curie Module technology was used at the 2016 Rio and 2020 Tokyo Olympics to analyse athletes' movements, enhance performance analysis, and improve the viewer experience. Electronic Performance and Tracking Systems (EPTS) were used at the 2018 and 2022 Fédération Internationale de Football Association (FIFA) World Cups (Mannai, 2025; Pan et al., 2024). At the 2024 Paris Olympics, smartwatches, biometric sensor-equipped clothing, and wristbands were used to collect data on heart rate, sleep quality, exercise load, and stress levels. These data were then analysed using artificial intelligence (Mooney, 2024).

Artificial intelligence supported performance analyses

AI-supported performance analysis is the process of predicting athletes' fatigue, injury risk and performance values by using big data analysis and artificial intelligence algorithms. At the Tokyo 2020 Olympics, Intel 3D Athlete Tracking (AI + Image Processing) technology was used in the movement analysis of sprinters and gymnasts and was used for technical analysis and referee support systems in the organisation (International Olympic Committee [IOC], 2019). At the FIFA 2022 Qatar World Cup, Connected Ball and AI Video Analytics technology were used for offside detection and analysing passing lanes, tracking players and the ball, and tactical analysis (Federation Internationale de Football Association [FIFA], 2022).

Video analysis and ımage recognition systems

Video analysis and image recognition systems enable the automatic analysis of athletes' positions, movements and performance through video images. The Hawk-Eye system is an image recognition technology used especially in sports such as tennis, cricket and soccer. This technology is used to track the movement of the ball on the field. It is used in many different sports organizations such as the FIFA World Cup, Wimbledon and World

Cricket Championship. 3D video analysis systems are technologies used to analyse player movements, strategic changes and in-match data in a 3D environment. These technologies are used as an effective analysis tool in players' training. These technologies are used in organizations such as the Olympics, FIFA World Cup, NBA (National Basketball Association) and Formula 1 (Iguma et al., 2020; Sheppard, 2006). Object recognition systems are used to identify moving objects. These technologies are especially used in sports such as football and basketball to track the movements of the ball and players, as well as to analyse different angles of matches. These technologies are used in organizations such as the Olympics, FIFA World Cup, NBA, tennis, hockey and Formula 1. Ball tracking systems are a technology used especially in tracking the movements of the ball. With this technology, it is used to accurately determine the speed, path and location of the ball in sports such as soccer, tennis and cricket (Kamble, 2019).

Biomechanical and physiological test systems

Biomechanical and Physiological Testing Systems are used to optimize the performance of athletes, reduce the risk of injury and perform training in scientific ways. Using these systems, it is effective to analyze the movement mechanics and physiological capacities of athletes. 3D motion analysis systems were used by the United Kingdom Institute of Sport at the 2012 London Olympics to evaluate the performance of athletes before the games. Examples of these technologies include Electronic Performance and Monitoring Systems (EPES) and Semi-Automated Offside Technology (Moeslund et al., 2006). Accelerometers and Gyroscopes are among the wearable sports technologies that are increasingly used in developing sports technologies. Using these sensors, it is possible to analyze athletes' movement speed, direction, acceleration, rotational movements and posture in real time. These systems are used for athlete performance and load monitoring, technical analysis and injury prevention. Examples of these technologies are the IMU (Inertial Measurement Unit) sensors developed by Catapult and STATSports, which include accelerometers, gyroscopes and magnetometers (Chambers and Gabbett, 2009).

Video analysis software is a technology that enables major changes in both individual and team sports. Thanks to these software, technical and tactical performances of athletes or teams are analyzed through images. In the Olympics, programs such as Dartfish, SportsCode and SiliconCoach were used in branches such as gymnastics, diving, swimming and athletics, and software such as NAC Sport, Dartfish and Longomatch were used in tactical analysis especially in team sports. In the World Cups, SAP and Dartfish were used to analyze rival teams, Technical Study Group (TSG), FIFA officially Enhanced Football Intelligence (EFI), FIFA Player App and FIFA Insight System provided video-supported analysis during and after the match (Carling et al., 2012). Pressure Analysis Systems are used to measure athletes' sole pressure, balance, ground contact time and load distribution. Using these systems, it is an important area in the performance development of athletes, injury prevention, rehabilitation follow-up and technical corrections. Devices such as Bosu platforms and Pedar Pressure Plate have been used to analyze the pressure points and balance of athletes on the ground, and platforms of Kistler and Tekscan brands have been used to measure parameters such as gait analysis and pressure distribution analysis, step pressure, foot contact with the ground and balance shifts in runners and track and field branches (Razak et al., 2012).

Physiological testing systems are highly advanced and comprehensive technologies used to reduce the risk of injury in athletes and to ensure maximum efficiency. Maximal oxygen consumption (VO2 max) test systems are used to measure the maximal oxygen consumption capacity of athletes and are important in determining the levels of endurance sports (Holder, 2024). Heart rate monitors and HRV (heart rate variability) analysis are technologies used to monitor athletes' training levels, fatigue and recovery processes. Monitoring the performance of athletes with these technologies is important

for the management of training and the development of recovery processes. These technologies were first used at the 2012 London Olympics. In the 2022 Qatar FIFA World Cup, these technologies went one step further and were used to monitor the stress levels and recovery of athletes before, during and after the match (IOC, 2013). Body composition analysis is an important tool used in the examination of values such as fat ratio, muscle mass, water ratio and bone density of athletes and in the optimization of their physical and performance. Along with this analysis, it is used to determine the endurance, strength and performance of athletes. These systems have been used in the Olympics, World Cups and Olympic preparation camps (Ackland et al., 2012; Silva et al., 2013).

Heat and perspiration analysis are technological methods used to analyze athletes' body temperature, hydration levels, electrolyte loss and heat-induced performance degradation. It plays an important role in optimizing both heat-related health problems and performance of athletes in mega sports organizations held in hot and humid climates (Plakias, 2024). Blood gas and respiration analysis are used to measure physiological parameters such as oxygen utilization, carbon dioxide excretion, acid-base balance, blood pH and muscle metabolism and metabolic efficiency levels of athletes. These analyses allow athletes to obtain important information on aerobic capacity, lactate threshold, hypoxia tolerance, training adaptation and performance optimization (Migliaccio et al., 2023).

Athlete health and rehabilitation technologies

Athlete health and rehabilitation technologies are advanced technological tools and methods used to improve athletes' performance and injury and post-injury processes. Injury prevention and risk analysis technologies are technological systems used to protect athletes' health, improve their performance and reduce injuries. In the 2020 Tokyo Olympics, one of the first Olympics where these technological analyses were used, movement analysis of athletes was performed using artificial intelligence and machine learning, data such as muscle activity, balance, and stress levels of athletes were monitored using wearable sensors, and high-speed cameras and motion analysis systems were used to analyse risky movements in gymnastics and track and field branches (Soligard et al., 2023). Performance and health tracking systems are technological systems that enable athletes to maximise their performance while at the same time protecting their health. Using the Electronic Performance and Tracking System, players on the field were constantly monitored with three cameras, and instant data was accessed on tablets. Values such as respiration, heart rate and body temperature of athletes were obtained using smart jerseys, and fatigue score calculations were performed (The Government of Japan [GOJ], 2021). Orthopaedic and supportive technologies consist of technological products and systems such as orthoses, compression products, bionic supports, special insole systems and 3D-printed prosthesis solutions used to minimise the performance and injury risks of athletes. In the 2022 Qatar World Cup, carbon fibre protectors such as rib protection, wrist splints and knee braces for players with fragile bone structures and personal orthoses were used with 3D printers. Insoles with pressure sensors were used, and data such as muscle tension, joint angle and humidity/temperature were obtained with smart support bandages. Sprain-proof support technologies were used with advanced protection systems that provide special structures such as athletes' wrists inverted. Psychological health and neuro-rehabilitation technologies are technological systems used in athletes' performance, endurance, stress management and injury recovery phases, both in physical development and mental recovery and endurance (Mira et al., 2022). For example, at the 2020 Tokyo Olympics, athletes' mental levels, such as stress, anxiety, focus, etc., were analysed with neurofeedback systems, and training sessions were created for competition stress, lack of self-confidence and mental rehearsals with virtual reality therapies (IOC, 2021).

Video assistant referee (VAR) system

The video assistant referee (VAR) system is used in sports such as soccer to review referees' decisions and correct incorrect decisions. Replaying a position ensures that critical decisions such as goals, penalties, and red cards are made correctly. Referees review their decisions using feedback from assistant referees in the VAR room. The system uses footage from multiple cameras to identify and correct potential incorrect decisions (International Football Association Board [IFAB], 2025; FIFA, 2023a). The VAR system was first used at the 2018 World Cup in Russia (FIFA, 2023) and was integrated with semi-automatic offside technology at the 2022 World Cup in Qatar (FIFA, 2023a).

Rapid video review

The Rapid Video Review (RVR) system is a technology that allows referees and officials to replay key moments and review decisions quickly during a game. It is used in sports such as football, basketball, and tennis to evaluate athlete or team objections. It enables referees to verify their decisions during the game. The system was first used as part of the Video Assistant Referee (VAR) system during the 2018 FIFA World Cup in Russia. In the 2022 FIFA World Cup in Qatar, the semi-automatic offside system was used in combination with VAR and goal-line technology (Teixeira da Silva et al., 2024).

Goal detection

It is a technological system consisting of components such as sensors, cameras, lasers or radars that allow the location of a target, such as an arrow, bullet or ball, on a target board, field or line to be determined millimetrically. At the 2004 Athens Olympics, the system started to be used, especially in shooting and archery branches, and was standardised after the 2008 Beijing Olympics. At the 2012 London Olympics, the Hawk-Eye System was used for the first time in tennis (Uzor et al., 2023).

Artificial intelligence and machine learning

In order to improve referees' decisions, machine learning algorithms use data from past matches to help referees improve their decision-making processes. In the 2018 Russia World Cup, artificial intelligence (AI) and video analytics along with VAR, and in the 2022 Qatar World Cup, semi-automated offside technology and advanced AI-based video analytics were used (Rathi, 2020).

Simulation based referee training systems

Training systems created to improve the decision-making abilities of referees are systems that create simulations from data obtained from past matches and teach referees their decisions in such situations (van Beimen et al., 2023). Virtual training applications were used in the taekwondo discipline at the 2020 Tokyo Olympics (World Taekwondo Federation [WTF], 2020). For the 2024 Paris Olympics, an AI-based training program has been added that is personalised for referees IOC, 2024).

In-stadium experience technologies

These are technological solutions used with in-stadium experience technologies to ensure attendee satisfaction, increase revenues and digitalise the event. Smart ticketing and contactless entry systems enable participants to enter securely and contactlessly by using QR (quick-response), NFC (Near Field Communication) and facial recognition systems, etc. For example, face recognition entry systems and mobile ticketing were used in the 2022 Qatar World Cup. The experiences of the fans are enhanced by providing content, ordering, live statistics, etc., tailored to the seat numbers of the participants by personalising with mobile applications. For the 2020 European Cup, the UEFA (Union of European Football Associations) Euro 2020 App, which provides special content for fans, was used to enhance the user experience. With augmented reality and virtual reality technologies, participants can see player statistics, etc., with the glasses they use and have the opportunity to experience the match from different angles. At the 2020 Tokyo Olympics, a virtual

reality-supported match experience was offered. Thanks to uninterrupted internet such as Wi-Fi and 5G infrastructure in the stadium, social media sharing, live broadcasts and fast data consumption become possible. At the 2020 Tokyo Olympics, the use of 5G networks started, and AR and VR were used in broadcast technologies with 5G-supported remote monitoring systems due to the fact that the games were played without spectators. At the 2022 Beijing Winter Olympics, unmanned logistics robots and facial recognition systems supported by 5G took place. In the experience areas, interaction areas were created for fans, such as shooting simulations, photo booths and meeting athletes with hologram technology. By using smart seats and screens, fans can access options such as touch screens, charging areas and live broadcasts from their seats. At the 2022 Beijing Olympics, some special areas had heating, sensors, and adjustable seats, while the screens on the seats enabled multiple camera angles, information about athletes, scores, analysis, and food and beverage ordering (Glebova et al, 2023; Teal, 2024). Smart ticketing and NFC/RFID (Radio Frequency Identification) based access systems have sped up visitor traffic and are used to manage the exhibition area. Sensors integrated with the Internet of Things (IoT) system in the facilities have increased operational efficiency by monitoring environmental parameters, such as energy consumption, occupancy rates, and waste accumulation, in real time. Additionally, emergency evacuation plans have been simulated using digital twin models for early intervention planning (Andhale et al., 2020; Chowdhury et al., 2016).

Digital and virtual interaction technologies

Digital and virtual interaction technologies are among the technological solutions used to involve fans in activities in the digital world. Technologies such as augmented reality and virtual reality, virtual stadiums, social media integrations and finally, fan token and blockchain technologies are used. With augmented reality and virtual reality technologies, fans are used in areas such as viewing statistics from the stands, social media content production with augmented reality filters and virtual souvenir photo corners. It has also been used in games such as virtual stadium viewing with virtual reality glasses, virtual locker room tours and penalty kicks with augmented reality. In the UEFA 2020 European Cup, augmented reality glasses were used to view the information of the players from the stands. At the 2020 Tokyo Olympics, matches were watched 360 degrees with virtual reality glasses, and at the 2018 Russia World Cup, the BBC's VR application was used to watch the matches from different angles. With social media integrations, there are areas of use, such as Instagram filters of the teams that fans can apply, participating in live comments, voting, hashtag campaigns and live videos. In the 2022 Qatar World Cup, 5 billion social media interactions were recorded, and in the 2020 Tokyo Olympics, 3.5 billion people followed the games on digital platforms. Over forty augmented reality filters have been developed by Instagram. In addition, many hashtags (#WorldCupDance, #Tokyo2020, #Qatar2022) were used in mega organizations. Virtual stadium technologies include content such as 360-degree camera systems of matches, virtual stands created with 3D modelling, real-time statistics panels and individual experiences such as seat selections. At the 2020 Tokyo Olympics, some competitions could be watched virtually with augmented reality technologies. At the 2022 Beijing Olympics, a virtual Olympic city was established, and with the Virtual Fan Fest experience implemented at the 2022 Qatar World Cup, people were able to watch matches, dance and chat in a three-dimensional environment. Fan tokens and blockchain technologies, along with crypto-based assets, have been used to interact with clubs and participate in decisions such as participating in surveys, digital uniforms, collectibles, and player and goal music selections. In the 2020 European Championship, fan tokens were used for the first time in an international tournament with the partnership with Socios (Avcı et al., 2023; Goebert and Greenhalgh, 2020; Pickman, 2023; Union of European Football Associations [UEFA], 2025).

Data and personalization technologies

With data and personalisation technologies, artificial intelligence, wearable devices and real-time data systems are being used in mega sports organizations to enhance the performance of athletes and enrich fan experiences. The 2022 Qatar World Cup featured an AI-powered data analysis application that allows each player on the field to be tracked 50 times per second from 29 different points, the FIFA Player App, an AI offside system and personalised fan applications. At the 2020 Tokyo and 2024 Paris Olympics, technological processes such as facial recognition and biometric access systems for athletes and officials, offering special content by analysing the analysis of users' preferences through artificial intelligence-based personalisation, and instant broadcasting of athletes' performances using wearable devices (Dudek et al., 2025; Lloyd-Smith, 2024).

Gamification and interactive experiences

In order to increase the fan experience in mega sports organizations, gamification and interactive experiences are used to reach large audiences on both physical and digital platforms by ensuring the active participation of the audience in the events. At the 2022 Qatar World Cup, the Hayya Fan App application was used to enrich the fan experience, enabling them to participate by earning points through virtual quizzes, score predictions and daily tasks. With the Fantasy game organized in the UEFA Champions League, fans were included in the event, allowing users to create virtual teams and collect points based on real match performance (UEFA, 2024).

Digital management systems

These are the technological systems used in the planning of mega sports organizations, audience experience, etc., to make the organizations more efficient, safe and interactive. With organisation and logistics management, the human and material resources that participate in mega sports organizations are brought together in a coordinated manner, and outputs are obtained from them. In this way, a smooth process is tried to be created with the effective use of the organisation's resources (Glebova et al., 2023). At the 2024 Paris Olympics, centralised information and interaction were provided between athletes, coaches, commentators, fans and organisation partners. At the 2024 European Football Championships, the use of digital management systems ensured the smooth running of the organisation and enabled fans to participate more in the events and personalise their experience (IOC, 2024; UEFA, 2024a). In mega sports organizations, broadcasting and media management using digital management systems are used to deliver events to audiences all over the world. The 2020 Tokyo Olympics marked a turning point in terms of digital transformation in broadcasting. In this Olympics, the OBS Cloud platform was developed in cooperation with Olympic Broadcasting Services (OBS) and Alibaba Cloud, and the content production and distribution processes of broadcasters were realised on a cloud-based basis. In this way, broadcasters were able to access content remotely and set up their own content production systems on the platform. For the 2024 Paris Olympics, the third version of the OBS Cloud platform (OBS Cloud 3.0) was used. Thanks to this platform, broadcasters' content production and distribution processes have become more efficient with artificial intelligence-supported cloud technologies. In addition, with virtual production tools and remote access, publishing operations have become more flexible and effective (Alibaba Cloud, 2021; Laemle, 2024). Artificial intelligence and automation technologies are used to improve broadcast quality, ensure efficiency and further enrich the audience experience. At the 2024 Paris Olympics, the Olympic Broadcasting Services (OBS) produced more than 11,000 hours of content with the use of AI technologies. These technologies were used in processes such as real-time statistics, personalised advertisements and automatic display of key moments (IOC, 2024d). In addition, 360-degree replays with Alibaba, AI-supported data explanations with Omega and fast highlights with Intel were created through collaborations (Bevir, 2024).

Smart stadiums and facilities

Smart stadiums and facilities consist of high-speed internet connections, 4K and 360-degree camera broadcasting systems, virtual reality and augmented reality (Cha, 2020). At the 2020 Tokyo Olympics, the smart city concept was integrated into stadiums, where live statistics and replays were provided to spectators with 5G and high-speed connectivity, athletes and officials were transported by autonomous vehicles, and robots were used for food service and welcoming (IOC, 2022a). At the 2022 Beijing Olympics, the movements of athletes were analysed and detailed performance data were obtained with AI-powered performance analysis, and high-quality broadcasting and data transmission were achieved with 5G and Internet of Things integration in the stadiums (IOC, 2022; Sampedro, 2023). At the 2024 Paris Olympics, crowd movements were monitored instantaneously with artificial intelligence-supported crowd management systems, and security was ensured through predictive analysis. It also supported crowd guidance systems with sensors placed in the stadiums and was built with energy efficiency using innovative recycled materials, such as Adidas Arena (IOC, 2024b). Paris 2024 has gone down in history as the first Olympics to broadcast live in 8K resolution. In collaboration with OBS and Intel, global live broadcasts were made with 50 Mbps bandwidth and an average delay of 400 ms (Olympic Broadcasting Services [OBS], 2024).

Energy management systems

These are technological systems that enable the effective use of renewable energy resources with fixed and mobile energy storage systems in order to optimise energy consumption and reduce carbon footprint in mega sports organizations. At the 2020 Tokyo Olympics, ISO 20121 certification standards have been set. Some of the energy needs were met through the use of renewable resources such as solar energy and biomass, and efficiency was achieved through smart meters and Internet of Things technologies. At the 2022 Beijing Olympics, with the carbon neutrality target, all facilities were operated with 100% renewable electricity, 800 hydrogen-fuelled vehicles were used for transportation and ISO 20121 standards were adopted (IOC, 2020). At the 2024 Paris Olympics, similar systems were used to reduce the carbon footprint by 54.6% compared to previous Olympics (IOC, 2024a). Prior to the 2022 Qatar World Cup, it activated the first large-scale solar power plant with a capacity of 800 MW, directed the air produced by large solar-powered absorption chillers into the stadium, and achieved high standards in environmental sustainability by obtaining Global Sustainability Assessment System (GSAS) certification (Méndez and Biçer, 2020; FIFA, 2022a).

Security systems

Advanced security systems are used in mega sports organizations to ensure the safety of participants and spectators. Along with these systems, technologies such as facial recognition, drone surveillance, smart access control systems and crowd management are significantly effective in the smooth management of these organizations. At the 2020 Tokyo Olympics, security was increased by speeding up identity verification processes using facial recognition technologies in all event areas, autonomous security robots were used, and approximately 450 million cyber attacks were prevented (Government Technology, 2021). At the 2022 Beijing Olympics, integrated surveillance systems were used in the event venues, ensuring border security and high levels of electronic surveillance (Ji et al., 2022). At the 2024 Paris Olympics, approximately 300 AI-powered security cameras were used to detect potential threats between spectators and athletes, and cybersecurity measures were strengthened and training was provided (Laanstra-Corn and Sewell, 2024; Popek, 2024). Facial recognition systems were not used in Paris 2024. Instead, AI-powered, algorithmic video analysis systems were used to monitor for behavioral anomalies (crowd movement, abandoned items, suspicious behavior, etc.) and generate alarms. These systems were tested with approximately 480 cameras in

accordance with France's “Loi JO 2024” law, which was passed in 2023 (Garzon Valenzuela, 2024;).

Training technologies

Educational technologies help participants learn their tasks and gain hands-on experience by using online training platforms and virtual simulations to ensure the best preparation of athletes, coaches, referees, organisational staff and volunteers. Training technologies include virtual and augmented reality as well as wearable technologies. At the 2020 Tokyo Olympics, the Yoi Don! training programme was used to increase students' interest in the Olympics, and Intel VR training systems were used to train managers who will take part in the competitions (Association of National Olympic Committees [ANOC], 2017). At the 2024 Paris Olympics, AI-supported training tools aimed to enable volunteers to fulfil their tasks more effectively (IOC, 2024e).

Preparation technologies

Using preparation technologies, athletes used digital tools and software in processes such as event planning, logistics management and time management. In addition, with the use of virtual and augmented reality technologies, it has enabled the event areas to be experienced beforehand and possible problems to be simulated. In this respect, it is effective in increasing organisational efficiency and preventing possible disruptions. At the 2018 PyeongChang Olympics, Samsung used clothes equipped with sensors that transmit body position data for Dutch speed skaters to determine the appropriate posture positions of the athletes. In addition, VR systems developed by STRIVR for US skiers allowed them to virtually experience the race tracks (Avcı, 2023; Cossich, 2023; Pickman, 2023; Zhao, 2023). At the 2020 Tokyo Olympics, the 3DAT technology developed by Intel was used to analyse performance with artificial intelligence and computers (Centre for European Studies of Technology [CEST], 2024; IOC, 2019).

Analysis technologies

Analysis technologies are used to monitor and analyse the performance of athletes before and during organizations. These systems are used to analyze competitions in depth and to identify details that may be overlooked during the game. At the same time, it is often used to identify the mistakes or positive aspects of athletes in training and competition. One of these technologies, artificial intelligence and machine learning, is used to make important evaluations in terms of injury predictions, performance and skill levels of athletes. These previously mentioned technologies were used in the 2022 Qatar World Cup and the 2024 Paris Olympics. Big data and sports analytics technologies will be used to analyse and improve the performance of athletes; they are used to monitor their physical condition, training efficiency and fatigue levels, while coaches are used to create appropriate training programmes and to analyse the tactics of teams and opponents during matches. It was first used at the 2012 London Olympics (FIFA, 2022). At the 2022 Qatar World Cup, AI-powered video surveillance systems were used for analysis, and at the 2024 Paris Olympics, organisers used data analytics for game planning and optimising operations. With the use of wearable technologies, it has been frequently preferred to monitor athletes' physical performances simultaneously. Smart watches, one of these technologies, have been used to determine heart rate, sleep hours and stress levels. The data obtained from these devices are directly related to athletes' injuries, health data monitoring and performance analytics (Laursen, 2024). At the 2014 World Cup, smartwatches were integrated into the GoalControl system used to verify referees' goal decisions. At the 2020 Tokyo Olympics, multi-sensor wearables were used to determine athletes' heart rate, body temperature and muscle activity (Avcı et al., 2023). In the 2024 Paris Olympics, GPS vests were used to collect data such as speed, distance and direction of players in sports such as football, volleyball and basketball, and smart glasses and sensor clothing were used to evaluate the technical performances of athletes in sports such as swimming and to determine technical errors (IOC, 2024c).

Future Sports Technologies in Mega Sports Events

The ideas put forward for the technologies to be used in mega sports organizations in the future will be based primarily on the technologies used today, as well as the ideas of some companies producing products and services for sports technologies and the technologies planned to be used in organizations.

In the future, research is being conducted to predetermine the characteristics of athletes, such as endurance, strength and injury susceptibility. Its use for training or performance prediction in research for this process has only recently begun. It is thought that these applications will come to an important point in the future in detecting musculoskeletal injuries of athletes and personalising training programmes. With the development of robotic exoskeletons and treatment devices, robotic rehabilitation technologies have been shown to provide rapid improvements in muscle strength, balance and endurance in clinical trials, and these technologies are expected to develop further. With virtual reality training, athletes' tactical decision-making, reflex and stress management skills will be further improved by simulating realistic scenarios in a safe environment.

In terms of performance monitoring and analysis, wearable sensors will be distributed to all athletes in the future, and training programmes can be personalised by obtaining simultaneous data on heartbeat, GPS, muscle activity and artificial intelligence-based analysis. Biometric scans and AI systems can be used for health monitoring and injury prevention. Advanced therapy centres can take part in the rehabilitation and rapid recovery processes of athletes. Athletes' hospital stays can be reduced with robotic walking devices, hyperbaric oxygen therapy and customised physical therapy programmes. In the future, health screening can be done even underwater using artificial intelligence in water sports. Considering that developments in athlete performance and health technologies are becoming more widespread every day, it is thought that technological developments such as wearable sensors, artificial intelligence and augmented and virtual reality systems will be used much more in mega sports organizations in areas such as protection of athlete health, prevention of injuries and performance enhancement.

It is thought that artificial intelligence-supported fully automatic decision systems will be used in football in the future. With the developed ball sensors, it can be used to automatically draw offensive and penalty area lines in the future. With artificial intelligence, positions can be detected by video analysis, and images and statistics can be delivered to referees using devices such as referee glasses or augmented reality. In athletics, with the use of fully automated systems and artificial intelligence, positions can be analysed and rule violations can be identified. Augmented reality glasses can be used to provide referees with information such as instant pace information, differences between athletes and shooting statistics. Injustices can be reduced by instantly displaying the distance of the shot with data sensors. With the further development of sensors located in the starting blocks in water sports, the body weight distribution of athletes can be monitored so that violations such as getting up early or pulling a helper by hand can be detected. With augmented reality technologies, decision support with virtual lines placed on the field, match statistics, rule summaries, and instant synchronised and telescopic views of the referee with glasses can be provided. In the future, the rules can be tracked with sensors placed in balls, rackets or sneakers. A transparent and secure process can be ensured with the use of blockchain technologies in recording referee decisions. Robotic or fully automated referee applications can be used in mega sports organizations in the future.

It seems likely that there will be some changes in terms of fan experience and interaction technologies in the future. The use of wearable devices to measure fans' biometric data in real time and include them in events, and the inclusion of the obtained data in social media posts and stadium shows, may be important in terms of strengthening fan loyalty. In addition, with the use of

systems such as facial recognition, it is thought that the usage areas of developments such as stadium entrances and contactless payments will increase. By using artificial intelligence, big data and algorithms, special content can be offered for fans. It is also thought that the use of chatbots will increase. Metaverse and virtual stadium experiences will improve the processes of watching the match from different angles and with friends in different parts of the world. 360-degree virtual stadium interactions will develop using augmented and virtual reality lenses. In the distant future, using Neuralink-like systems, the match can be watched mentally, and even mental activities such as camera angle, data display and goal warning can be performed using mental commands. Special artificial intelligence avatars can be defined for fans. Fans' pulse, sweating and excitement can be analysed using smartwatches or implants. Special camera angles, sound effects and personalised music can be used in moments of high emotional intensity. With quantum internet technologies, streaming delays can be reduced to near zero. By using holographic replicas, processes that can be played in stadiums in different parts of the world will develop. Hybrid Olympics could emerge. By using emotional simulations, sounds such as wind, stadium sounds, etc., can be physically felt, and the feeling of being there at that moment can be experienced. With the use of holographic projection systems, matches can be watched as 3D holograms.

In terms of event management and logistics, artificial intelligence-supported systems can be used in material procurement and transportation processes, and the tracking of materials can be done further through sensors with Internet of Things technology. In the future, smart wristbands or facial recognition systems can be used for everyone attending mega sports organizations, and biometric doors are expected to become widespread for access to VIP areas. Wireless sensors will increase in stadiums and facilities, and robotic security dogs and patrol drone systems will be integrated with camera systems. Artificial intelligence-supported content production, multi-channel broadcasting and user control technologies will be implemented.

Green energy solutions, environmentally friendly building designs and circular economy principles will be further developed in organizations. The modular design and construction of new stadiums and facilities and their relocation to other regions after the event, the use of foldable stands, disassembled renewable energy panels and water recycling systems will increase and even become standardised. 6G networks planned for use after 2030 will enable worldwide satellite connectivity and holographic communication.

Image processing and machine learning will increase automated processes in referee decisions. In addition, it is thought that AI-supported assistant coaches who can give strategic suggestions during the match will become widespread. Artificial intelligence-supported sensors and bioelectronic applications can be used to monitor the health and performance data of athletes, and new types of eyewear devices can be used to allow the audience to see the data of the athlete they are looking at.

With the development of artificial intelligence, in the future, deep learning-based video analysis will reach higher resolutions, player and ball tracking can be done more accurately, customised training for athletes with health data, and artificial intelligence coaches can be used by processing data in training and matches with cloud and 5G technologies. In the future, it is thought that devices that can track values such as blood sugar or lactate, as well as detect hydration and fatigue levels by measuring sweat analysis, electrolyte and metabolite levels by using online sensors and biotextile products in blood in biometric analyses, will become widespread. In the future, hybrid trainings can be realised with the development of the concept of mixed reality (XR) and the process of users experiencing the virtual and real worlds uninterruptedly. With virtual and augmented reality applications, it is thought that training can be shared live from anywhere in the world, virtual gyms can be collaborated in, and distance learning and even virtual competitions can be organised through metaverse-based simulations. Using 5G and Wi-Fi 6 connections, the data obtained with

video and sensors during training sessions will be processed instantly and made universally accessible using cloud-based services. In the future, it is thought that data-based individual performance management will be at the forefront in training, preparation and analysis technologies for mega sports organizations. The creation of digital twins of athletes can be used to test training scenarios of these twins in a virtual environment and to create the most efficient training strategies. The increase in the computational capabilities of artificial intelligence technologies will enable technologies such as automated coaching assistants and biomechanical analysis robots to assist in training and in matches.

DISCUSSION and CONCLUSION

This research evaluated the technologies that will be used at future mega sports events. First, the technologies used in mega sports events were examined within the scope of the research. Information was collected by reviewing news sites, event websites, technology company websites, event reports, and event videos. This study evaluated mega sports events from the perspectives of their past, present, and future and observed that changes have occurred in parallel with technological development in these events. All processes carried out before, during, and after mega sports events were examined, as well as the technologies involved from the perspectives of all stakeholders, including participants, sponsors, and fans. These were examined under five main headings. It is undeniable that these technologies significantly impact record-breaking, experience enhancement, and error minimisation in sports.

The research conducted has resulted in the classification of the technologies used in mega sporting events. According to this classification, they fall into one of the following five categories: Athlete Performance and Health Technologies; Refereeing and Decision Support Systems; Fan Experience and Interaction Technologies; Organisational and Infrastructure Technologies and Training, Preparation and Analysis Technologies.

Examining athlete performance and health technologies reveals significant developments, including the use of the LZR swimsuit at the 2008 Beijing Olympics. Athlete information tracking systems were used at the 2016 Rio Olympics. The 2020 Tokyo Olympics featured 3D systems, athlete tracking systems, and some artificial intelligence applications. At the 2024 Paris Olympics, artificial intelligence-supported performance and injury tracking using wearable sensors began to be used. Each Olympics has taken a step forward from the previous one, with an increase in the scope of technological applications. These technological advances in monitoring athletes' performance and health make it possible to prevent injuries and guide the physical and mental rehabilitation of athletes in adverse situations. These technologies will prevent athletes from experiencing irreversible health problems in the future.

Examining referee decisions and support systems, for example, reveals that goal-line technology was first used in the 2012 World Cup in Japan, VAR was first used in the 2018 World Cup in Russia, and sensor-equipped balls and artificial intelligence–supported systems were first used alongside VAR in the 2022 World Cup in Qatar. Implemented to enhance referees' ability to make accurate and fair decisions, these systems have been further developed in each subsequent tournament. In the future, advancements in artificial intelligence within these systems will make it easier to detect rule violations and prevent referee errors.

In terms of fan experience, the 2004 Athens Olympics used cable TV, the 2016 Rio Olympics used 4K Ultra HD broadcasts, and the 2020 Tokyo Olympics used 8K broadcasting, AR glasses, interactive seats, smart screens, and real-time 5G data communication. Additionally, as mobile technologies and social media applications have developed, so have the entertainment tools fans use, such as apps. From this perspective, it is clear that fan experiences are becoming more diverse at every major event

to enhance the experience. The process began with television broadcasts, the first development to influence the growth and globalisation of mega sports events. Now, technological developments such as streaming broadcasts and 5G internet have taken over. In the future, processes such as holograms, quantum computers, and internet or mental match viewing will evolve. The rapid development of sports technologies and the resulting changes will increasingly emphasise their importance within the sports industry. Technological systems and changes aimed at enhancing fan experiences and interactions, whether at home or at physical events, will play a significant role in helping participants enjoy themselves and create memorable experiences.

Significant advances have been made in the areas of organisation and infrastructure, particularly with regard to the internet and mobile devices. Additionally, major technological developments have occurred in areas such as security and energy Management Systems and smart sports facilities. Technologies used in previous Olympics include the visual systems used in the 2000 Sydney Olympics; technological recycling; facial recognition technology; robot technology; autonomous vehicles; and recyclable cardboard beds in the 2020 Tokyo Olympics, as well as smart stadium technologies, interactive seats, smart screens, and 5G internet in the 2024 Paris Olympics. These technological developments facilitate the smooth running of mega sporting events before, during, and after the event. In the future, technological developments in organisation and infrastructure will enable significant strides in event management and increased security systems with artificial intelligence applications, as well as the implementation of carbon-neutral events.

Video analysis software, wearable technologies, augmented reality, GPS, virtual reality, and image processing systems are used to examine training, preparation, and analysis technologies for mega sporting events. Technological developments in this area began with stopwatches and progressed to video analysis systems and, later, real-time data analysis. Off-field wearable devices were developed for the first time in the 2004 Athens Olympics. Live measurements were provided on the field in the 2008 Beijing Olympics. Artificial intelligence and sensors were used in the 2020 Tokyo Olympics. In the 2024 Paris Olympics, artificial intelligence-supported analyses were used in conjunction with 3D motion analysis systems, GPS, and accelerometer systems. In the future, hybrid systems will be used to prepare athletes, coaches, referees, organisational staff, and volunteers in terms of education, preparation, and analysis technologies. Additionally, data obtained from analyses of athletes, referees, and coaches will frequently be used to determine training, performance, and technical errors.

Clearly, the organisation of mega sporting events transcends the digital age in terms of social, economic, environmental, and technological developments. Future technological developments will mirror the evolution of these events. Examining past mega sports events reveals that the sports technologies employed have developed in tandem with global technological advancements and been integrated into sports. This integration is anticipated to be applied in vastly different fields in the future, significantly contributing to the growth of the sports industry.

This research is a compilation study on technologies used in mega sporting events and those that may be used in the future. As a result of this research, future studies can examine the economic impacts of technologies used in mega sports events, the role of technological developments in terms of sustainability and sports heritage, the role of technology in social perception and participation, the transformation brought about by digital transformation in mega sports events, the impact of technology on Olympic values from the perspective of athletes, and finally, the role of technology in terms of climate change and environmental factors.

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YAYIN İLKELERİ, YAZIM KURALLARI VE ETİK KURALLAR

Amaç ve Kapsam

Türkiye Spor Bilimleri Dergisi (TUSBİD), özgün araştırma ve derleme makaleler yayınlayan, açık erişim politikasını benimseyen, disiplinler arası süreli bir yayındır. Okuyucu ve araştırmacılara spor bilimleri alanındaki yenilikleri, uygulamaları ve güncel bilgileri paylaşarak yeni bilimsel araştırmaları teşvik eder.

Dergi; Beden Eğitimi ve Spor Bilimlerinin çeşitli yönleri; Beden Eğitimi ve Spor, Hareket ve Antrenman Bilimleri, Egzersiz Fizyolojisi, Spor Anatomisi, Biyomekanik ve Kinesiyoloji, Sporda Beslenme, Spor Felsefesi, Spor Sosyolojisi, Egzersiz ve Spor Psikolojisi, Spor Sağlık Bilimleri, Spor Yönetimi Bilimleri, Rekreasyon, Spor Turizmi ve diğer disiplinler arası konular üzerine özenle hazırlanmış makaleleri kabul eder. Türkiye Spor Bilimleri Dergisi, 2017 yılında yayın hayatına başlamış olup yılda 2 kez (Haziran, Aralık) yayımlanan Uluslararası Hakemli bir dergidir. Derginin dili Türkçe ve İngilizcedir.

Genel Kurallar

1. Türkiye Spor Bilimleri Dergisi'nin yayın dili Türkçe ve İngilizce'dir.

2. Dergide yayımlanacak çalışmaların daha önce hiçbir yayın organında yayımlanmamış, yayın hakkının verilmemiş ya da aynı anda birden çok dergiye yayımlanması amacıyla gönderilmemiş olması gerekir.

3. Yazarlar, dergiye gönderilen makalenin Helsinki Bildirgesi'nde insan ve hayvan çalışmaları için önerilen ilkelere uygun olduğunu kabul eder. Bu konuda tüm sorumluluk yazar(lar)a aittir.

4. Makalelerin etik ve yasal sorumluluğu yazar(lar)a aittir. Yazarların, ulusal ve uluslararası etik kurallara uyması ve insanlar veya hayvanlar üzerinde yapılan araştırmalar için ilgili etik kurullardan izin alması gereklidir.

5. Bilimsel toplantılarda sunulan bildiri, poster ya da özetlerin makale haline dönüştürülmesi durumunda, başlık sayfasında belirtilmelidir.

6. Çalışma bir kurum/kuruluş tarafından desteklenmişse ya da bir doktora/yüksek lisans tezinden hazırlanmışsa, başlık sayfasında belirtilmelidir.

7. Makaleler yayımlanmak üzere dergiye gönderildikten sonra, yazar isimleri çıkarılamaz, yeni isim eklenemez ve yazar sıralaması, tüm yazarların yazılı onayı olmaksızın değiştirilemez.

8. Gönderilen çalışmanın intihal raporu (http://www.ithenticate.com) ek dosya olarak yüklenmelidir. Rapor, yazar(lar) tarafından imzalanmalıdır. Alıntılar hariç benzerlik oranı %15'i geçmemelidir.

9. Yazarların isimleri ve kurumlarıyla ilgili bilgiler ana metinde verilmemelidir. Bu tür detaylar başlık sayfasında belirtilmelidir.

10. Makalenizi yazarken, yazım kurallarına uygun olarak hazırlanmış örnek dosyayı kullanabilirsiniz. Yazım şablonuna uygun olarak sunulmayan çalışmalar dikkate alınmayacaktır. Örnek makale şablonu için aşağıdaki dosyaya tıklayınız.

Makale İle Birlikte Gönderilmesi Gereken Dosyalar

1. Başlık Sayfası: Çalışmanın Türkçe ve İngilizce başlığı, yazar isimleri ve kurumları, çıkar çatışması beyanı, Destek ve Teşekkür Beyanı, Etik Kurul Beyanı, Yazar Katkı Beyanının yer aldığı başlık sayfası doldurulmalı, imzalı olarak yüklenmelidir.

2. İntihal Raporu (Makaleler, alınan karar gereği 2017 itibari ile intihal (IThenticate, Turnitin, vb) raporu ile birlikte değerlendirilmeye alınmaktadır.) Intihal raporu eklenmediği takdirde editör kurulu IThenticate yazılımında intihal olup olmadığını kontrol ederek makaleyi direk red edme hakkına sahiptir.

2. **Telif Hakkı Devir Fromu** Makalelerin telif hakkı devri, dergi internet sayfasında sunulan form doldurulup imzalanmak suretiyle alınır. Form imzalandıktan sonra tarayıcıdan geçirilerek sisteme PDF olarak yüklenmelidir. Bu formu göndermeyen yazarların yayınları basılamaz.

Yazım Kuralları

Makaleniz; örnek makale dosyası üzerinde aşağıdaki yazım kurallarına uygun olarak yazılmış olmalıdır. Örnek makale dosyası için lütfen tıklayınız.

1. Çalışma: **Özet/Abstract, GİRİŞ, YÖNTEM, BULGULAR, TARTIŞMA ve SONUÇ, TEŞEKKÜR** (gerekirse **), KAYNAKLAR** şeklinde düzenlenmeli ve her bölüm başlığı bold, büyük harf ve 12 punto yazılmalıdır.

2. Çalışmanın başlığı İlk Harfleri büyük, bold ve 14 punto yazılmalıdır.

3. Çalışma, Türkçe ise, başlıktan sonra gelen yazar isim/isimlerinden sonra Türkçe, özet, anahtar kelimeler daha sonra sırasıyla çalışmanın adının İngilizce başlığı, İngilizce Özet/Abstract ve "Key Words" yazılmalıdır.

4. Özet/Abstract 150-200 kelime arasında olmalıdır. Anahtar kelimeler/Key Words en az 3, en fazla 5 kelimeden oluşmalıdır. ***Anahtar kelimeler/Key Words*** başlığı 10 punto, bold ve italik yazılmalıdır. Anahtar kelimeler virgül (,) işareti ile birbirinden ayrılmalı, ilk harfleri büyük harfle yazılmalıdır. Giriş ile anahtar kelimeler arasına 1 satır boşluk bırakılmalıdır.

5. Yazı Microsoft Word yazılım programı ile Times New Roman ile 2,5 cm'lik kenar boşlukları bırakılarak ve 15 sayfayı geçmeyecek şekilde yazılmalıdır. Çalışmanın Özet (Abstract) metni 10 punto ve 1 aralık; Çalışmanın Metni 11 punto 1 aralık; kaynakça metni 10 punto 1 aralık yazılmalıdır.

6. Tablo, grafikler ve istatistik raporlama APA stile göre hazırlanmalıdır. Tablo yazı karekteri 10 punto tek aralık yazılmalıdır.

7. Şekil, grafik, fotoğraf vb. "Şekil" sayısal değerler ise "Tablo" olarak belirtilmelidir. Şekil adları ilgili grafiğin altına, tablo adları ise ilgili sayısal değerin üzerine yazılmalıdır. Resim, grafik ve benzerlerinin ayrı bir dosya hâlinde ve jpg formatında kaydedilmesi baskı kalitesi açısından gereklidir.

8. **Makale yazarken metin içi alıntı ve kaynakçada gösterim aşağıdaki kurallar doğrultusunda olmalıdır.**

1. Doğrudan alıntı

Bir kaynaktan doğrudan alıntı yaparken metin içi göndermede her zaman yazar, yıl ve sayfa numarası bilgilerine, eğer doğrudan alıntı 40 kelimeden az ise bu alıntı metinde çift tırnak içinde verilir.

Örnek

Bandura (1997) öz-yeterliği "bireyin, belli bir performansı göstermek için gerekli etkinlikleri organize edip, başarılı olarak yapma kapasitesi hakkında kendine ilişkin yargısı" (s.65) olarak tanımlamaktadır.

Eğer doğrudan alıntı 40 ve daha fazla kelimeden oluşuyorsa bu alıntıya yeni bir satırda sol taraftan yarım inç (1,25 cm) içeriden yazarak başlanır. Alıntı yapılan kısımda ikinci bir paragraf yer alacaksa ilk satırı yarım inç daha içeriden başlamalıdır.

Örnek

Betimleme yöntemi, Kaptan (1995) tarafından şu biçimde tanımlanmıştır:

"Olayların, objelerin, varlıkların, kurumların, grupların ve çeşitli alanların ne olduğunu betimlemeye, açıklamaya çalışan incelemelerdir. Bunlar nedir? sorusuna cevap bulmaya yöneliktir. Bununla mevcut durumlar, koşullar, özellikler aynen ortaya konmaya çalışılır. Betimleme araştırmaları, mevcut olayların daha önceki olay ve koşullarla ilişkilerini de dikkate alarak, durumlar arasındaki etkileşimi açıklamayı hedefler" (s. 59).

2. **Tek yazarlı eserlere göndermeler yazarın soyadını ve tarih bilgisini içerir. Örnek;**

Künye

Yıldırım, İ. (2015). A study on physical education teachers: The correlation between self-efficacy and job satisfaction. *Education, 135*(4), 477-485.

Gönderme (Yıldırım, 2015)

3. **İki yazarlı bir çalışma için her göndermede iki yazarın soyadı da yer almalıdır**. Örnek;

Künye

Öğüt, E. E., ve Şahin, M. Y. (2017). Amatör Spor Kulüplerinin Sorunları: Açımlayıcı Bir Araştırma. *Spor Bilimleri Dergisi, 28*(2), 49-68.

Gönderme (Öğüt ve Şahin, 2017)

4. **Üç, dört ve beş yazarlı çalışmalara gönderme yapılırken sadece metin içindeki ilk göndermede tüm yazarların soyadları verilir**. Diğer göndermeler için ilk yazarın soyadının yanına ve diğerleri ifadesi eklenmelidir. İngilizce yazılan makalelerde üç, dört ya da beş yazarlı yayınlara gönderme yapılırken ve diğerleri yerine et al. İfadesi kullanılmalıdır. Örnek;

İlk gönderme (Çayır, Nazlı ve Köse, 2011),

İkinci ve sonraki göndermeler (Çayır vd., 2011)

Künyeler

Çayır, A., Nazlı, A. ve Köse, S. K. (2011). Beslenme ve diyet kliniğine başvuranlarda obezite durumu ve etkili faktörlerin belirlenmesi. *Ankara Üniversitesi Tıp Fakültesi Mecmuası, 64*(01), 013-019.

5. Altı ve daha fazla yazarı olan çalışmalara gönderme yapılırken sadece ilk yazarın soyadı belirtilir. Örnek;

Gönderme

(Yıldırım vd., 2016).

Künye

Yıldırım, İ., Işık, Ö., Ersöz, G., Büyükkök, M., Zengin, G., ve Özel, Ö. (2016). Düzenli fiziksel aktivite yapan bireylerde depresyon ve yeme tutum ve davranışları ilişkisi. *Journal of Human Sciences, 13*(2), 3590-3599.

6. **Yazar olarak bir grup/tüzel kişi (dernekler, şirketler, devlet kurumları ve diğer çalışma grupları gibi) ifade ediliyorsa bu gruba ilişkin ad bilgisi metin içindeki göndermede oldukça açık ve anlaşılır biçimde verilmelidir**. Grup adı bazı durumlarda kısaltılabilir. ilk kullanımda hem açık hali hem kısaltma hali kullanılıp, sonraki kullanımlarda ise sadece kısaltma kullanılabilir. Örnek;

Gönderme cümlenin sonunda yapılıyorsa

İlk gönderme

(Türkiye Bilimsel ve Teknolojik Araştırma Kurumu [TÜBİTAK], 2013)

İkinci ve sonraki göndermeler

(TÜBİTAK, 2013)

Gönderme cümle içerisinde yapılıyorsa

İlk gönderme,

Türkiye Bilimsel ve Teknolojik Araştırma Kurumu (TÜBİTAK, 2013)

İkinci ve sonraki göndermeler

TÜBİTAK (2013)

7. Aynı parantez içerisinde birden çok gönderme yapılması

Aynı parantez içerisinde yapılan çoklu göndermeler ilk yazarın soyadına göre alfabetik sırada olmalı ve noktalı virgül ile ayrılmalıdır.

Örnek

(Akçay ve Doğan, 2013; Derman, 2003; Yıldırım, 2017)

8.**Aynı yazara ait farklı çalışmalar aynı parantezde verilecekse**, geçmişten güncele yıl sırası takip edilir ve yazar soyadı göndermenin en başına bir kez yazılır.

Örnek

(Yıldırım, 2015, 2017)

9. **Aynı yazar ya da aynı ad sırasındaki yazar grubuna ait aynı yılda yapılmış çalışmalar a, b, c harfleri ile birbirinden ayrılır**.

Örnek

(Yıldırım, 2015a, 2015b)

10. **Kaynaklar bölümü Yeni bir sayfadan başlamalıdır**. Metin içinde belirtilen tüm kaynaklar 'Kaynaklar' listesi içinde yer almalıdır. Kaynaklar bölümünde kaynaklar alfabetik sıra ile verilmelidir. Birden fazla yazarlı Türkçe ve yabancı kaynaklar için son yazarın soyadından önce 've' yazılmalıdır.

11. Kaynaklar başlık dahil 10 punto ile tek satır aralığında hiç boşluk bırakmadan alfabetik sıralı yazılmalıdır. Paragraf girintisi asılı 1,25 cm'dir. Her kaynakçanın bu metinde gösterildiği şekilde ikinci ve daha sonraki satırlar içe 1.25 cm girintili olacak şekilde hazırlanmalıdır.

Kitaplar

Sevim, S. (2002). *Basketbolda Kondisyon Antrenmanı*. Ankara: Nobel Yayın Dağıtım.

Dergiler

Yildirim, I. (2015). Associations among dehydration, testosterone and stress hormones in terms of body weight loss before competition. *The American journal of the medical sciences, 350*(2), 103-108.

Tezler

Şinoforoğlu, T. (2007). *Akut ve düzenli antrenmanın hentbolcülerde oksidatif stres üzerine etkisi*. Yayımlanmamış doktora tezi, Gazi Ü. Sağlık Bilimleri Enstitüsü, Ankara.

Bildiriler

Balçıkanlı, G. S.. (2010). Lisans derslerinde sosyal iletişim ağlarının kullanımı üzerine öğrenci görüşleri. 11. *Uluslararası Spor Bilimleri Kongresine Sunulmuş Bildiri*.

Editörlü kitaplar

Güçlü, N. (2000). İletişim. İçinde: L. Küçükahmet (Ed.), *Sınıf Yönetimi*. Ankara: Nobel Yayın Dağıtım.

El Kitapları

Özgüven, İ. E. (1992). HKE *Hacettepe kişilik envanteri el kitabı* (İkinci revizyon) Ankara: Odak Ofset.

Çeviri kitaplar

Hellman, H. (2001). *Büyük çekişmeler: Bilim tarihinden seçilmiş on tartışma* (Çev. Füsun Baytok). Ankara: TÜBİTAK.

Anonim

The Chicago manual of style: Fourteenth edition. (1993). Chicago: The University of Chicago Press.

Gazete Makalesi

Ekşi, O. (2002, 03, 23). İstenen bu muydu? Hürriyet Gazetesi. 21.

Kurum yayınları

Devlet Planlama Teşkilatı. (2000). *Uzun vadeli strateji ve sekizinci beş yıllık kalkınma planı 2001-2005*. Ankara: DPT.

DOI numarası olan elektronik kaynaklar

Chan, H. F., Guillot, M., Page, L. ve Torgler, B. (2015). The inner quality of an article: Will time tell?. Scientometrics, 104, s. 19-41. doi:10.1007/s11192-015-1581-y

DOI numarası olmayan elektronik kaynaklar

Al, U. ve Soydal, İ. (2014). Kütüphan-e Türkiye Projesi: Halk kütüphanesi kullanım araştırması. Türk Kütüphaneciliği, 28, 288-307. Erişim adresi: http://www.tk.org.tr/index.php/TK

Web sitesi

Hacettepe Üniversitesi. (2017, 10 Aralık). Misyon, vizyon ve değerler. Erişim adresi: http://hacettepe.edu.tr/hakkinda/misyonvizyondegerler

Gönderme (“Hacettepe Üniversitesi”, 2017)

Etik İlkeler ve Yayın Politikası

Yayın Etiği

Türkiye Spor Bilimleri Dergisi (TUSBİD), özgün araştırma ve derleme makaleler yayınlayan, açık erişim politikasını benimseyen, disiplinler arası süreli bir yayındır. Okuyucu ve araştırmacılara spor bilimleri alanındaki yenilikleri, uygulamaları ve güncel bilgileri paylaşarak yeni bilimsel araştırmaları teşvik eder. Türkiye Spor Bilimleri Dergisi'ne gönderilen makalelerin daha önce başka bir yerde yayımlanmamış veya yayımlanmak üzere gönderilmemiş olması gerekir. Türkiye Spor Bilimleri Dergisi'ne gönderilen çalışmaların etik ve bilimsel standartlara uygun olması gerekmektedir. Yayımlanan makalelerin bilimsel, etik ve hukuki sorumlulukları yazar(lar)a ait olup editör, editörler kurulu ve yayın kurulu üyelerinin görüşlerini yansıtmaz. Türkiye Spor Bilimleri Dergisi, Committee on Publication Ethics (COPE), Directory of Open Access Journals (DOAJ) ve Open Access Scholarly Publishers Association (OASPA) tarafından yayınlanan Uluslararası Etik Yayıncılık İlkeleri'ni benimsemiştir. Ayrıca, Türkiye Spor Bilimleri Dergisi yer aldığı TÜBİTAK ULAKBİM çatısı altında DergiPark'ın belirlediği yayın ilkelerini uygular. Bu ilkeler dikkate alınarak hazırlanan yönerge aşağıda sunulmuştur:

Yayıncı'nın Etik Sorumlulukları

Türkiye Spor Bilimleri Dergisi, 2017 yılından bu yana, editör kurulu yönetiminde Spor Bilimleri alanında yayın yapan bir dergidir. Dergi, bilimsel eserlerin etik ilkeler doğrultusunda yayınlanması gerektiğini düşünmekte olup, kar amacı gütmemektedir.

• Yayıncı, elinde bulundurduğu iletişim gücünü hiçbir bireysel çıkar gözetmeden kullanmak ve hedef kitlesini doğru yönlendirmekle yükümlüdür.

• Bünyesinde yayınlanan her çalışmanın mülkiyet ve telif hakkını korur ve yayınlanmış her ürünün arşivlenmesi görevini üstlenir.

• Yayıncı derginin web sayfasında derginin açık, elektronik ve ücretsiz erişimini sağlar.

• Yayıncı, editoryal bağımsızlığı garanti eder, hakem değerlendirme sürecine saygı gösterir ve editoryal kararlara dahil olmayı reddeder.

• Yayıncı, cilt ve sayıları zamanında yayınlamayı garanti eder.

• Yayıncı, bilimsel çalışmanın bütünlüğünü korumayı garanti eder.

• Yayıncı, editörler ve üçüncü taraflar arasındaki ilişki kurallarını her türlü sözleşmede belirtir, fikri mülkiyet ve telif haklarını korur, gizliliğe saygı gösterir ve editoryal bağımsızlığı destekler.

Kişiler etik olmayan bir durumla karşılaştıklarında yayıncıyla iletişime geçmekten çekinmemelidir.

Türkiye Spor Bilimleri Dergisi Editör Kurulunun Sorumlulukları

Türkiye Spor Bilimleri Dergisi'ne başvurusu yapılan her makaleden, hatta yayımlanmasından sonraki tüm süreçlerinden Türkiye Spor Bilimleri Dergisi Editörler Kurulu sorumludur ve Editörler Kurulu bu sorumluluğunu bilir. Bu sorumluluk, dergiyle ilgili konularda verilen kararlarda yalnızca kamu yararını düşünerek; kişisel kazancı düşünmeden, bağımsız olarak karar vermeyi gerektirir. Yayıncı ve Editörler Kurulu arasındaki ilişki bağımsızlık ilkesine dayanır, editörlerin alacağı tüm kararlar yayıncıdan ve diğer kişi ve kuruluşlardan bağımsızdır.

• Editör Kurulu, Dergiyi sürekli geliştirmeye, yayın niteliğini yükseltmeye çaba gösterir.

• Türkiye Spor Bilimleri Dergisi editörleri, derginin yayın politikalarının uygulanmasından ve yürütülmesinden sorumludur.

• Derginin benimsemiş olduğu Çift kör hakemlik ve değerlendirme süreci politikalarını uygulamak, hakemlerin kimlik bilgilerini gizli tutmak, her makalenin yansız ve süresi içinde değerlendirilmesini sağlamak.

• Türkiye Spor Bilimleri Dergisi editörleri, makalelerin ilgili araştırma alanlarında uzmanlığı olan hakemlere atanmasından sorumludur.

• Türkiye Spor Bilimleri Dergisi editörleri, gönderilen makalenin editöryel incelemesini yazarın cinsiyeti, yaşı, cinsel yönelimi, ırkı, vatandaşlığı, etnik kökeni, dini, siyasi görüşü ve kurumsal bağlılığına bakmaksızın tamamen bilimsel liyakatine göre gerçekleştirir.

• Türkiye Spor Bilimleri Dergisi editörleri, yayın kurulu üyeleri ve editör yardımcıları, gönderilen makale ile ilgili bilgileri, sorumlu yazar ve yayıncı dışında hiç kimseye açıklayamaz.

• Türkiye Spor Bilimleri Dergisi editörleri, makalelerin hakem değerlendirme sürecinden sorumludur ve hakemlerin ve yayın kurulu üyelerinin yorumlarına dayanarak hangi makalelerin yayınlanacağına dair son kararı verir.

• Türkiye Spor Bilimleri Dergisi Editörler Kurulu, Türkiye Spor Bilimleri Dergisi'nde yayınlanmış makale yazarlarının telif hakkını korur.

• Editör ve Editör Kurulu, makalelerde insan ve hayvan haklarının korunmasına özen göstermeli, etik kurul onayı olmadığında makaleyi reddetmelidir.

• Türkiye Spor Bilimleri Dergisi editörleri, hakemlerin ve editoryal suiistimallerin takibinden sorumludur. Gönderilen veya yayınlanan makalelerle ilgili etik şikayetler sunulduğunda, Türkiye Spor Bilimleri Dergisi editörleri derginin politikaları doğrultusunda önlemler almalıdır.

Hakemlerin Sorumlulukları

Türkiye Spor Bilimleri Dergisi makale değerlendirme sürecinde çift yönlü kör hakemlik ilkesi uygulamaktadır. Hakemler yazarlarla doğrudan iletişim kuramaz, makale değerlendirme formları ve metin üzerinde düzeltme istemlerini Dergi Park yönetim sistemi üzerinden editör ve/veya editör kurulu aracılığı ile yazar(lar)a iletilir. Hakemlerin etik sorumlulukları:

• Hakemler yalnızca uzmanlık alanları ile ilgili makalelerin değerlendirilmesini kabul etmelidir.

• Bütün makaleleri, makalenin içeriğini temel alarak, yazarın cinsiyet, ırk, etnik köken, din, vatandaşlık veya siyasi değerlerine bakmaksızın adil şekilde değerlendirmelidirler.

• Hakemler, yazarlarla çıkar çatışması-çıkar birliği olması durumunda makaleyi değerlendirmeyi reddetmeli ve editörü bilgilendirmelidir.

• Hakemler, makaleleri değerlendirirken akademik ve yapıcı bir dil kullanmalı, hakaret içeren kişisel yorumlardan kaçınmalıdır.

• Hakemler değerlendirmeyi kabul ettikleri makalelerle ilgili görüşlerini kendilerine verilen süre içerisinde editör ve editör kuruluna iletmelidir.

• Makaleyle ilgili tüm bilgileri gizli tutmalıdırlar.

Türkiye Spor Bilimleri Dergisi hakemleri, gönderilen makaleler için aşağıdaki dört kararı belirtebilir:

• Yayın için Kabul Et

• Revizyon Gerekli (Küçük revizyonlarla kabul: Revizyonlar editörler tarafından kontrol edilir)

• İnceleme için yeniden gönderin (Büyük revizyonlar: İkinci tur için gözden geçirilecektir)

• Reddet (Yayınlanması tavsiye edilmez)

Hakemlerin kararlarına göre üçüncü veya dördüncü hakem atanabilir. Böyle bir durumda, aynı inceleme süreci gerçekleştirilecektir.

Yazarların Etik Sorumlulukları

Yazarlar, akademik yayıncılık sürecinde önemli bir role sahiptir ve etik kurallara ve yayın politikalarına sıkı bir şekilde uyarak bilimsel bilginin doğruluğunu ve bütünlüğünü sağlamalıdırlar. Yazarların sorumlulukları şunları içerir:

• Yazarlar, eserlerinin kendilerine ait olduğunu ve orijinal olduğunu garanti etmelidirler. Daha önce başka bir yerde yayınlanmamış ve sadece Türkiye Spor Bilimleri Dergisine gönderilmiş olmalıdır.

• Yazarlar makalelerini aynı anda sadece bir dergiye göndermelidir. Yazarlar, aynı makaleyi aynı anda birden fazla dergiye göndermenin etik olmayan bir yayıncılık davranışı oluşturduğunu ve kabul edilemez olduğunu bilmelidir.

• Yazarlar, yayıncının yayınlanan makaleleri dağıtmak için tüm telif haklarını koşulsuz ve süresiz olarak elinde tuttuğunu onaylamalıdır.

• Başka kaynaklardan alınan materyaller (kendi yayınlanmış yazıları da dahil olmak üzere) açıkça belirtilmeli ve uygun izinler alınmalıdır.

• Yazar(lar), makale yazımı sırasında yararlandıkları kaynaklara etik ilkeler doğrultusunda uygun atıf tekniklerle atıf yapmalıdır.

• Yazarlar, eserlerinin başkalarının haklarını, özellikle gizlilik ve fikri mülkiyet haklarını ihlal etmediğinden emin olmalıdırlar.

• Yazarlar, sundukları verilerin doğru olduğunu ve manipüle edilmediğini garanti etmelidirler.

• Yazarlar, mevcut veya muhtemel çıkar çatışmalarını makalelerini gönderirken açıkça belirtmelidirler.

• Yazar(lar), etik kurul kararı gerektiren deney, anket, ölçek, görüşme, gözlem, odak grup çalışması gibi nicel ya da nitel yöntemlerle veri toplamayı gerektiren araştırmalar için etik kurul onayı aldığını; etik kurul adı, karar tarihi ve sayısı aday makalenin ilk-son sayfasında ve yöntem bölümünde belirtmeli, etik kurul kararını gösteren belgeyi makalenin başvurusuyla birlikte sisteme yüklemelidir.

• Araştırma insan ve hayvan denekler üzerinde gerçekleştirilmiş ise araştırmanın uluslararası bildiriler, kılavuzlar vb., uygun gerçekleştirildiği bildirilmelidir (Helsinki Deklearasyonu).

• Yazarlar, eserlerindeki hataları veya yanlışlıkları fark ettiklerinde, yayınlanmış olsun veya olmasın, derhal editöre bildirmelidir.

• Değerlendirme sürecinde yazar(lar)dan makalelerine ilişkin bilgi ya da ham veri istenmesi durumunda istenilen bilgileri Editörlere sunmalıdırlar.

• Yazarlar, makalenin yazarlık durumlarını doğru bir şekilde ifade etmelidirler. Makaleye katkı sağlamayan kişilerin adı, yazar olarak yazılmamalı, yayımlanmak üzere başvurusu yapılan bir makalenin yazar sırasını değiştirme, yazar çıkartma, yazar ekleme önerilmemelidir. Makale sisteme yüklenme aşamasında yazar isimleri sorumlu yazar tarafından yüklenmektedir. Dergi Editör Kurulu sistemsel değişiklik yapmamaktadır.

ARAŞTIRMA ETİĞİ

Türkiye Spor Bilimleri Dergisi, insan ve hayvan haklarının korunması kapsamında ulusal ve uluslararası etik kural ve ilkelere tam uygunluk prensibini benimsemiştir. Makalelerin etik kurallara uygunluğu yazarların sorumluluğundadır.

• Araştırma ekibi ve katılımcılar, araştırmanın amacı, yöntemleri ve öngörülen olası kullanımları; araştırmaya katılımın gerektirdikleri ve varsa riskleri hakkında tam olarak bilgilendirilmelidir.

• Araştırma katılımcıları gönüllü olarak araştırmada yer almalı, herhangi bir zorlama altında olmamalıdırlar.

• Araştırma ekibi ve katılımcılar, araştırmanın amacı, yöntemleri ve öngörülen olası kullanımları; araştırmaya katılımın gerektirdikleri ve varsa riskleri hakkında tam olarak bilgilendirilmelidir.

• Katılımcıların zarar görmesinden kaçınılmalıdır. Araştırma, katılımcıları riske sokmayacak şekilde planlanmalıdır.

• Araştırma bağımsızlığıyla ilgili açık ve net olunmalı; çıkar çatışması varsa belirtilmelidir.

• Deneysel çalışmalarda, araştırmaya katılmaya karar veren katılımcıların yazılı bilgilendirilmiş onayı alınmalıdır. Çocukların ve vesayet altındakilerin veya tasdiklenmiş akıl hastalığı bulunanların yasal vasisinin onayı alınmalıdır.

• Çalışma herhangi bir kurum ya da kuruluşta gerçekleştirilecekse bu kurum ya da kuruluştan çalışma yapılacağına dair onay alınmalıdır.

• İnsan öğesi bulunan çalışmalarda, "yöntem" bölümünde katılımcılardan "bilgilendirilmiş onam" alındığının ve çalışmanın yapıldığı kurumdan etik kurul onayı alındığı belirtilmesi gerekir.

Türkiye Spor Bilimleri Dergisi'nde değerlendirmeye alınan makalelerde, aşağıda belirtilen maddeler uyarınca söz konusu araştırmalar için Etik Kurul Onayı gerekmektedir:

• Anket, mülakat, odak grup çalışması, gözlem, deney, görüşme teknikleri kullanılarak katılımcılardan veri toplanmasını gerektiren nitel ya da nicel yaklaşımlarla yürütülen her türlü araştırmalar,

• İnsan ve hayvanların (materyal/veriler dahil) deneysel ya da diğer bilimsel amaçlarla kullanılması,

• İnsanlar üzerinde yapılan klinik araştırmalar,

• Hayvanlar üzerinde yapılan araştırmalar (Deney hayvanları Fare, Sıçan vb…),

• Kişisel verilerin korunması kanunu gereğince retrospektif çalışmalar.

Bilimsel Araştırma ve Yayın Etiğine Aykırı Diğer Eylemler

Yükseköğretim Kurumları Bilimsel Araştırma ve Yayın Etiği Yönergesine uyulmalıdır.

Bilimsel araştırma ve yayın etiğine aykırı eylemler şunlardır:

İntihal: Başkalarının özgün fikirlerini, metotlarını, verilerini veya eserlerini bilimsel kurallara uygun biçimde atıf yapmadan kısmen veya tamamen kendi eseri gibi göstermek,

• **Sahtecilik:** Bilimsel araştırmalarda gerçekte var olmayan veya tahrif edilmiş verileri kullanmak,

• **Çarpıtma:** Araştırma kayıtları veya elde edilen verileri tahrif etmek, araştırmada kullanılmayan cihaz veya materyalleri kullanılmış gibi göstermek, destek alınan kişi ve kuruluşların çıkarları doğrultusunda araştırma sonuçlarını tahrif etmek veya şekillendirmek,

• **Tekrar yayım:** Mükerrer yayınlarını akademik atama ve yükselmelerde ayrı yayınlar olarak sunmak,

• **Dilimleme:** Bir araştırmanın sonuçlarını, araştırmanın bütünlüğünü bozacak şekilde ve uygun olmayan biçimde parçalara ayırıp birden fazla sayıda yayımlayarak bu yayınları akademik atama ve yükselmelerde ayrı yayınlar olarak sunmak,

• **Haksız yazarlık:** Aktif katkısı olmayan kişileri yazarlar arasına dâhil etmek veya olan kişileri dâhil etmemek, yazar sıralamasını gerekçesiz ve uygun olmayan bir biçimde değiştirmek, aktif katkısı olanların isimlerini sonraki baskılarda eserden çıkartmak, aktif katkısı olmadığı halde nüfuzunu kullanarak ismini yazarlar arasına dâhil ettirmek,

Araştırma Yönetim Planı ve Hassas Grupların Dahil Edilmesi

Riskli gruplarla yapılan araştırmaların WMA Helsinki Bildirgesi Madde 19. ve 20. hükümlerine uygun olarak yürütülmüş olması ve yasal otorite tarafından etik kurul kararıyla onaylanmış olması gereklidir.

Koruyucu Tedbirler: Hassas grupları içeren çalışmalarda, katılımcıların haklarını korumak için özel koruyucu tedbirler alınmalıdır. Bu tedbirler, katılımcıların fiziksel ve duygusal refahlarını sağlamaya yönelik olmalıdır.

Onam Prosedürleri: Katılımcıların onamı, araştırmanın doğası ve katılımcının durumuna uygun bir şekilde alınmalıdır. Özellikle, reşit olmayan katılımcılar veya yetenekleri sınırlı olan kişiler için, ebeveynler, yasal vasiler veya uygun bir yetkili kişi tarafından onay alınmalıdır.

Bilgilendirilmiş Onam: Katılımcılara araştırmanın amacı, prosedürleri, potansiyel riskler ve faydalar gibi bilgileri içeren kapsamlı bir bilgilendirilmiş onam süreci sağlanmalıdır. Katılımcılar, araştırmaya katılmadan önce tüm bilgilere tamamen erişebilmelidir.

Gizlilik: Hassas gruplardan gelen katılımcıların gizliliği ve mahremiyeti özenle korunmalıdır. Katılımcıların kişisel bilgileri, gizli tutulmalı ve sadece araştırmada gerektiği kadar kullanılmalıdır.

Zorunlu Raporlama: Araştırmacılar, herhangi bir şüpheli kötüye kullanım, istismar veya ihmal durumunu ilgili yetkililere rapor etmekle yükümlüdür. Bu raporlama, katılımcıların güvenliğini ve refahını sağlamak için hayati öneme sahiptir.

Etik İnceleme Kurulu İzinleri: Hassas grupları içeren araştırmalar için etik inceleme kurullarından gerekli izinlerin alınması gerekmektedir. Bu izinler, araştırmanın etik standartlara uygunluğunu ve katılımcıların haklarını korumayı sağlar.

Bilimsel Kalite: Riskli gruplarla yapılan araştırmaların bilimsel kalitesinin Helsinki Bildirgesi, ICH ve İnsan Hakları ve Biyotıp sözleşmesi standartlarına uygunluğunun sağlanmış olması esastır.

Toplumsal Fayda: Araştırmaya katılan gönüllülerin çıkarının toplumsal ve bilimsel faydanın önünde olması temel kriterdir. Riskli gruplarla yapılan araştırmaların toplumsal fayda sağlaması beklenir.

İntihal Politikası

Gönderilen çalışmanın benzerlik oranı %15 veya altında olması gerekmektedir. Benzerlik raporu " http://www.ithenticate.com " üzerinden alınmaktadır. Çalışma "Tezden (Yüksek Lisans/Doktora)" üretilmişse Başlık Sayfası Forumunda belirtilmelidir. Ayrıca "kongrelerde sunulmuş bildirilerin" genişletilmiş hali de gönderilirken Başlık Sayfası Formunda belirtilmelidir. Makale metni içerisinde blok benzerlik kesinlikle kabul edilmeyecektir.

Telif Hakkı Politikası

Yayımlanmak üzere kabul edilen çalışmaların her türlü yayın hakkı dergiyi yayımlayan kuruma aittir. Bununla beraber dergide yayımlanan çalışmalar, ticari olmamak, uygun bir şekilde atıf vermek ve yukarıda belirtilen lisanslama koşullarına uymak kaydı ile kullanılabilir, kopyalanabilir, çoğaltılabilir ve uyarlanabilir. Yayımlanan çalışmalarda yer alan düşünce ve öneriler tümüyle yazarların sorumluluğundadır. Dergide yayımlanan yazılar için telif hakkı ödenmez. Yazar(lar) aşağıdaki hususları kabul eder:

• Sunulan eserin, yazar(lar)ın orijinal çalışması olduğunu ve intihal yapmadıklarını,

• Tüm yazarların bu çalışmaya asli olarak katılmış olduklarını ve bu çalışma için her türlü sorumluluğu aldıklarını,

• Tüm yazarların sunulan eserin son halini gördüklerini ve onayladıklarını,

• Eserin başka bir yerde basılmadığını veya basılmak için sunulmadığını,

• Eserde bulunan metnin, şekillerin ve dokümanların diğer şahıslara ait olan Telif Haklarını ihlal etmediğini kabul ve taahhüt ederler.

Bu Telif Hakkı Anlaşması Formu tüm yazarlar tarafından imzalanmalıdır/onaylanmalıdır.

Çıkar Çatışmaları

• Yazarlar başvuru sırasında herhangi bir (kurumsal, finansal, kişisel ve akademik) çıkar çatışması varsa beyan etmelidir.

• Hakemler makaleyi değerlendirmelerini önleyen herhangi bir (kurumsal, finansal, kişisel ve akademik) çıkar çatışması olması durumunda dergi editörünü bilgilendirmeli ve makale sürecinden çekilmelidir.

• Dergimiz makale değerlendirme sürecinde çıkar çatışmalarının önlenmesi adına hakem ve yazarların aynı kurumda görev almıyor olmalarına dikkat eder.

• Kurul üyelerimiz (Editör, Yayın kurulu üyesi vb.) tarafından dergimize gönderilen makalelerin değerlendirme sürecinde çıkar çatışmalarının önlenmesi adına ilgili makalenin süreci tamamlanana kadar yazarların dergimizdeki rolleri askıya alınır ve süreci görmemeleri sağlanır.

• Dergimiz editörleri, kendisinin veya aile üyeleri tarafından yazılmış makalelerle ilgili kararlarda yer almazlar.

Şikâyet Ve İtiraz Politikası

Editörler; yazar, hakem veya okuyuculardan gelen şikâyetleri dikkatlice inceleyerek aydınlatıcı ve açıklayıcı bir şekilde yanıt vermekle yükümlüdür. Yayınlanan herhangi bir materyalle ilgili şikayetler, yalnızca ilk yayın tarihinden itibaren 2 ay içinde kabul edilecektir. Herhangi bir şikayet ve/veya itiraz olması durumunda yazarların şikayetlerini gerekçeleri ile birlikte tsbdergisi@gmail.com e-posta adresi üzerinden editörlüğe iletmeleri gerekmektedir.

Açık Erişim Politikası

Türkiye Spor Bilimleri Dergisi açık erişimli bir dergidir. Açık Erişim, yayınların çevrimiçi olarak herkese ücretsiz olarak ve yeniden kullanımla ilgili birkaç kısıtlamayla erişilebilir olmasıdır. Araştırmanın sınırsız bir şekilde yayılması özellikle yazarlar, okuyucular ve fon sağlayanlar için önemlidir. Dergi, tüm kullanıcılara makalelerin tam metinlerini okuma, indirme, kopyalama, dağıtma, yazdırma, arama veya bağlantı verme, dizine eklemek için tarama, veri olarak yazılıma aktarma veya başka herhangi bir yasal amaç için kullanma izni verir. Yalnız şu şartlara uyulmalıdır:

• Atıf: Uygun referans vermeli, lisansa bağlantı sağlamalı ve değişiklik yapıldıysa bilgi vermelisiniz. Bunları uygun bir şekilde yerine getirebilirsiniz fakat bu, lisans sahibinin sizi ve kullanım şeklinizi onayladığını göstermez.

• Gayri Ticari: Bu materyali ticari amaçlarla kullanamazsınız.

• Ek sınırlamalar yoktur: Lisansın sağladığı izinlerin kullanımını kanunen kısıtlayacak yasal koşullar ya da teknolojik önlemler uygulayamazsınız.

Ücret Politikası

Hiçbir ad altında yazar veya kurumundan ücret alınmaz. Dergimiz açık erişimli bir dergidir, dergi için herhangi bir ücret talep edilmez. Dergiye gönderilen ya da yayın için kabul edilen makaleler için hiçbir ad altında işleme ücreti ya da gönderim ücreti alınmaz. Dergimiz yayın politikaları gereği sponsorluk ve reklam kabul etmemektedir. Dergimizin tüm giderleri yayıncı tarafından karşılanmaktadır.