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(CONTENTS)

2019 1(2)

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ORIGINAL RESEARCH

Is Vertical Jump Associated with Change of Direction Ability in Soccer Players? A Pilot Study

Abstract

The aim of this study was to evaluate the relationship between vertical jump and change of direction ability with different agility test performances of soccer players. Twenty-six male soccer players (age=9.4±0.5 years, height=138.8±8.7 cm, weight=31.1±5.6 kg, body mass index=16.0±2.0 kg.m-2) from U9-U10 age categories of a first division team in Turkish Professional Soccer League were tested for vertical jump (countermovement jump) and change of direction ability (CODA) with, Hexagon, 505 and Illinois agility tests. Relationship between these agility tests and vertical jump (VJ) were assessed by Spearman's rho correlation coefficient test. There was no significant relationship between VJ and any measure of CODA tests. In conclusion, it can be said that VJ is not associated with CODA performance of soccer players. Despite the fact that there have been many studies supporting these results in the literature, these cross-sectional relationships should be investigated longitudinally with the larger research groups for different age categories and sport-specific research design for different jumping directions.

Keyword: Change of direction ability, agility, vertical jump, soccer players.

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INTRODUCTION

Many diverse activities such as jogging, sprinting, and jumping performed by the players are basic movement patterns of many field sports such as handball, basketball, rugby and soccer. In this type of sports, players are required to accelerate, decelerate, and change of directions (COD) throughout the game in the reduced field (Sheppard & Young, 2006; Bloomfield, Polman, & O'Donoghue, 2007).

Recently, soccer has been characterized by dynamic movements of players during the game. In addition, there are unpredictable movement patterns that occur at different intensities during the competition. For this reason, players should be able to move different parts of their body quickly depending on the varying intensity of the game and be able to respond to these unexpected situations (Popowczak et al., 2019). Because of this reasons, acceleration at short distances, frequent stopping and repeated COD movements (forward, lateral, back and multi-directional movements) are the mostly important parameters that players continuously perform during the game (Gonçalves et al., 2015). These multi-direction and short-term rapid movements are essential in soccer and classically defined as agility (Zouhal et al., 2019). Because agility actions are thought to involve a combination of these movements (Brughelli et al., 2008; Meylan et al., 2009).

Agility is a very complex concept that requires interactions of physiological and biomechanical components (Simonek et al., 2016) and a great interest exists for developing field tests and specific training programs that can effectively measure agility. The majority of tests supported to assess agility are tests based on the change of direction speed [e.g., the T-test (Pauole et al., 2000), the Illinois agility test (Hastad & Lacy, 1994), the 505 test (Draper, 1985), the L-run test (Meir et al., 2001), and the zigzag test (Little & Williams, 2003)]. Because of number and direction of changes demanding by the test protocol, a wide variety of tests of change of direction performance exist that differ in terms of both test duration and complexity (Brughelli et al., 2008).

Moreover, various physical components such as leg strength, power, and reactive strength are also thought to be associated with the motor component of successful agility performance (Marković et al., 2007; Brughelli et al., 2008; Young & Farrow, 2006). It was predicted that a strong relation between jump performance and agility performance would be observed but the strongest association would be for the lateral jumps.

On the other hand, many researchers have investigated the relationship between jump capacity (vertical, lateral, and horizontal direction) and CODA in many sports. However, the results are contradictory (Salaj & Markovic, 2011; Wisløff et al., 2004). In fact, jumping and CODA could be considered as independent abilities (Salaj & Markovic, 2011).

The results from these studies illustrate the difficulty in identifying how performances on various field tests can be related to one another. Because of this reasons, the relationship between these two cross-sectional components was evaluated in the current pilot study in terms of selected different CODA tests mostly used for soccer players and countermovement jump for VJ performances.

METHOD

Experimental Approach to the Problem

In accordance with the information of the introduction above, the physical and physiological aspects of CODA components have been evaluated in many studies and it has

been observed that these studies are mostly discussed in terms of anthropometric features, reactive strength and leg power variables. In addition, the relationship between jumps applied to different directions and CODA performance were evaluated by numerous studies but it was seen that consistent and certain results could not be achieved.

Subjects

Twenty-six male soccer players (age=9.4±0.5 years, training age=2.7±0.8 years, height=138.8±8.7 cm, weight=31.1±5.6 kg, body mass index=16.0±2.0 kg.m-2) including fifteen U9 and eleven U10 age categories from a first division soccer club in Turkish Professional League participated in the study voluntarily. The athletes did not have any injuries that preventing maximal effort during performance testing. All participants received a written information form with explaining the potential risks, and benefits of participation of the study. Also, the study was conducted with the consent of the team to which they belonged and according to the Declaration of Helsinki (2013).

Data Collection

A standardized 10–15 min warm-up protocol that included jogging, shuffling, multi-directional movements, and dynamic stretching exercises was used. Testing was performed with three trials on artificial turf in the following order: countermovement jump, hexagon, 505 and Illinois agility test. Each test was performed three times with the minimum of three minutes of rest intervals between trials and approximately 6–7 minutes of rest intervals between tests to prevent fatigue and the best score was recorded.

Vertical Jump Height

Countermovement jump test was conducted to determine vertical jump height (VJH) using an electronic timing mat (Newtest Powertimer 300, Finland). This system determines flight time (sec), which is converted to jump height using the following equation: 9.81x (flight time)2/8. The participants keep their hands on hip for the entire movement to avoid any influence of arm swing.

Change of Direction Ability

In order to evaluate the relationship between VJH and Change of direction ability (CODA), different agility tests (Hexagon, 505 and Illinois) were selected. A photocell gate system (Newtest Powertimer 300, Finland) was used to record the time (sec) for 505 and Illinois agility tests.

The Hexagon Agility Test is performed as follows:

- The athlete stands in the middle of the hexagon, facing line A
- At all times throughout the test, the athlete is to face line A
- On the command "Go" the watch is started and the athlete jumps with both feet over line B and back to the middle, then over line C and so on
- When the athlete jumps over line A and back to the middle this counts as one circuit
- The athlete has to complete three circuits

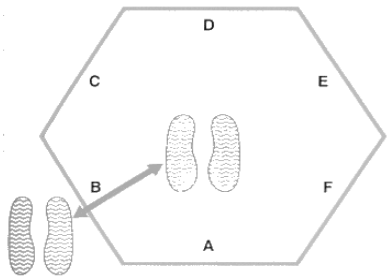

Figure 1. Schematic illustration of the hexagon agility test.

- On completion of three circuits, the time is recorded in seconds

The 505 Agility Test is performed as follows:

- The distance from A to B is 10m and from B to C is 5m
- The athlete runs from the start line (A) towards the 10m line (B)
- The athlete runs on to the 15m line (C), turns 180° and runs back towards the start line
- The test completes when the athlete passes through 10m line on his return.
- The time between start and finish line is recorded in seconds

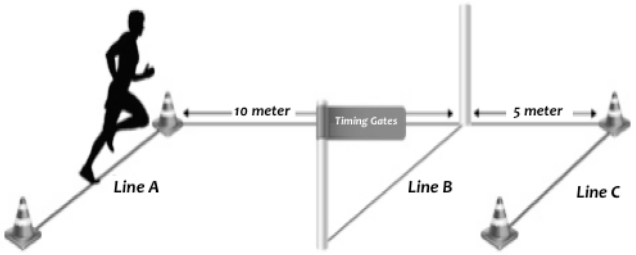

Figure 2: Schematic representation of the 505 agility test

The Illinois Agility Test is performed as follows:

- The length of the course is 10 meters and the width is 5 meters.
- Four cones are placed down the center an equal distance (3,3 meters) apart.
- The athlete lies face down on the floor at the start point
- On the "Go" command, the athlete gets up as quickly as possible and runs around the course in the direction indicated, without knocking the cones over, to the finish line.
- The time between start and finish line is recorded in seconds

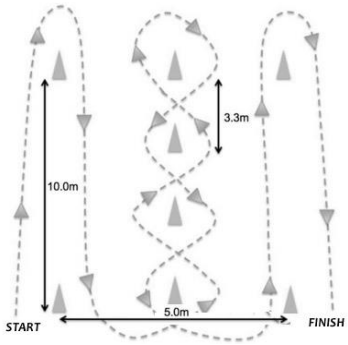

Figure 3. Schematic illustration of the Illinois agility test.

Statistical Analysis

All statistical analyses were performed using SPSS Version 22.0 (SPSS Inc., Chicago, IL, USA). The relationship between all variables was assessed by Spearman's rho correlation coefficient. An alpha level of p⊚0.05 was used for statistical significance.

FINDINGS

Mean and SD for physical characteristics of soccer players are presented in Table 1.

Table 1. Physical Characteristics of Soccer Players

	Min.	Max.	Mean ± SD
Age (years)	9.0	10.0	9.4 ± 0.5
Training age (years)	2.0	4.0	2.7± 0.8
Height (cm)	125.0	166.0	138.8 ± 8.7
Weight (kg)	23.0	41.0	31.1 ± 5.6
Body mass index ($kg.m^{-2}$)	13.2	21.8	16.0 ± 2.0

Mean, SD, and the correlations between VJ and CODA tests performances are presented in Table 2. VJH and different CODA tests performances (Hexagon, 505, and Illinois test) are 24.1±5.1 cm; 22.1±5.5 sec.; 3.0±0.3 sec.; 20.0±1.3 sec. respectively.

Table 2 also shows that there is not any correlation between VJ and Hexagon agility test (r=0.11; p>0.05), VJ and 505 agility test (r=-0.12; p>0.05), and VJ and Illinois agility test (r=-0.03; p>0.05) performances.

Table 2. Mean ± SD and Correlations between VJH and CODA

		Mean ± *SD*	**Correlation co-efficient (*r*)**			
		(n=26)	Hexagon	505	Illinois	VJ
CODA tests	Hexagon (s)	22.1 ± 5.5	_____			
	505 (s)	3.0 ± 0.3	0.19#	_____		
	Illinois (s)	20.0 ± 1.3	0.43*	0.03#	_____	
	VJH (cm)	24.1 ± 5.1	0.11#	-0.12#	-0.03#	_____

VJH= Vertical Jump Height; CODA= Change of Direction Ability
**p<0.05 # p>0.05*

DISCUSSION

The current study has been carried out to examine the relationship between VJH and various agility tests (hexagon, 505, and Illinois) performances in 9-10-year-old soccer players. According to the findings of the study, there is no significant correlation between VJH and these agility tests performances.

While there was a relation among jump tests, no relation was reported between jump and CODA performances according to the following studies. Henry et al. (2016) investigated the relationship between vertical, horizontal, and lateral jump performances and agility movement time on soccer players. They found that between each of the jumps were strong correlation but between the jumps and CODA the relationship were weak so, they have stated that other motor performance (skill, balance and coordination), cognitive and decision-making factors are more important. Similarly, Markovic et al. (2007) examined the relationship between VJ test and different agility tests performances (lateral stepping, 20-yard shuttle run and slalom run) on physical education students (age=21±2 years) and no relation was reported. Vescovi et al. (2008) researched the relationship between VJH and two agility tests performances (Illinois and pro agility) in three groups (high school soccer, college soccer, and college lacrosse between the ages of 15-20 years) and it was reported that there was a weak negative relationship. Meylan et al. (2009) stated that different jumps tests (single leg lateral, horizontal and vertical) are not sufficient to predict the sprint and CODA for physical education students. Nimphius et al. (2010) found that while there was a strong relation between relative strength and agility test performance and no relation between VJH and agility test performance of female softball players (age=18.1±1.6 years). Peterson et al. (2006) examined the 18-21 year old collegiate athletes and they reported a significant correlation between T-test and VJ in women but not in men. The relationship between horizantal and VJ test and CODA studied in soccer players (age=22.9±2.8 years) by Yanci et al. (2014). They found that horizantal jump and CODA has moderate correlation whereas VJ and CODA has not any correlation.

Even though there are studies having similar findings with the current study in literature, there are also contrast studies. Alemdaroğlu (2012) examined the relationship between different jump tests (CMJ and SJ) and CODA in basketball players (age=25.1±17. years) and he found that CODA has moderate correlation with both jump tests. Köklü et al. (2014) reported that no correlation was found between VJ test and zigzag agility with the ball but the VJ was strongly correlated with the zigzag agility without the ball in young soccer

players (age=16.0±0.8 years). Sassi et. al (2009) found a relationship between VJ and agility test for the female group but not for the males. Swinton et al. (2014) conducted the study on rugby players (age=24.2±3.9 years) and reported a relationship between VJ test and CODA (5-0-5 agility test) performances. Conlon et al. (2013) performed the study on males and females from various sporting disciplines (soccer, swimming, gymnastics, tennis, squash, track and field, wrestling, weightlifting, karate, judo, diving, cycling, climbing, water skiing, table tennis or fencing) and found a significant relation between VJ test and agility test performances. They also reported that VJ velocity is the determinant of agility and sprint performances.

Barnes et al. (2007) conducted the study on female collegiate volleyball players and indicated that VJ test performance is a predictor of agility performance. Additionally, individuals with higher VJ performance have quicker agility times and performing vertical domain through training might improve the various type of agility performance. Erikoglu and Arslan (2016) performed the study on 14-year-old soccer players and found out a negative relationship between VJ and zigzag agility without ball test performance. Hermassi et Al. (2011) revealed that there was a significant correlation between VJ and agility test (agility T-test) performance by the study conducted with 17 year-old handball players. Chaouachi et al. (2012) investigated that the affecting variables of CODA vary according to the test characteristics for 19 year-old elite soccer players, and Brughelli et al. (2008) exposed that the differences found among studies may be due to both the populations evaluated and the different characteristics of the tests applied.

CONCLUSIONS

With the current knowledge of the literature, we can estimate that the relationship between VJ and agility tests is not clear yet. Moreover, the studies related to the subject may vary with sporting disciplines, gender, and training age of individuals.

As a result of the current study with 9-10-year-old soccer players, we determined no correlation between VJ and agility tests performance. In order to fully understand the relationship between VJ and agility performance, these cross-sectional relationships should be investigated longitudinally with the larger research groups for different age categories and sport-specific research design for different jumping directions.

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ORIGINAL RESEARCH

Heart Rate Variability Flow and Emotional Intelligence as Predictors of Novice Archers' Shooting Accuracy

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Abstract

We examined whether Heart Rate Variability (HRV), together with flow and trait emotional intelligence may predict variations in arrow shooting accuracy for novice archers. 30 novice archers ranging in age from 18 to 23 volunteered. Participants first completed the Schutte Emotional Intelligence Inventory. Then, participants' resting HRV was measured for 4 minutes. Afterwards, participants shot 10 arrows from 18 m to an 80 cm diameter target while their HRV was measured. Accuracy was determined in terms of radial distance (error) from the center of the target. In order to calculate an overall performance score, the median value of the 10 arrows was calculated for each participant. Results showed that HRV, certain flow dimensions, and trait emotional intelligence may have account for variations in novice archers' shooting accuracy. On the basis of the results obtained from the current study, we conclude that the determination of performance or shooting accuracy should be based on both physiological and psychological characteristics, in this case, HRV, flow, and emotional intelligence. This information might be beneficial for coaches, athletes, or other practitioners aiming to develop archers' performance.

Keyword: HRV, low to high frequency ratio, flow, emotional intelligence, archery.

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INTRODUCTION

In a psychomotor task in which performance is determined by the degree of precision, such as archery, psychological and physiological factors may collectively influence performance. Archery is one of the unique athletic disciplines requiring a high level of precision, which is closely related to individual differences in physiological activity and psychological characteristics. Therefore, determination of performance in archery should be based upon both physiological and psychological parameters.

In the present study, we recognized HRV as a physiological antecedent of performance in archery, which is an important marker of autonomic nervous system (ANS) activity modulation (Luft, Takase, & Darby, 2009). The ANS is modulated by two different well-balanced systems: the sympathetic nervous system (SNS), which is related to the fight or flight response; and the parasympathetic nervous system (PNS), which is associated with rest and the digestive system (Thayer & Lane, 2009). According to Massimo Pagani's HRV model (Malliani, Pagani, Lombardi, & Cerutti, 1991; Montano et al., 2009; Pagani et al., 1986), three components represent SNS, PNS, and the balance between SNS and PNS. Thus, high frequency (HF) power (0.15 to 0.40 Hz) is recognized as an indicator of cardiac parasympathetic tone. On the other hand, low frequency (LF) power (0.04 to 0.15) is accepted as a marker of cardiac sympathetic outflow. Sympathovagal tone is determined by the low to high frequency ratio (LF/HF) (Reyes del Paso, Langewitz, Mulder, van Roon, & Duschek, 2013). As HRV is recognized as a parameter with the potential to reflect attentional workload during sport (Abernethy, B., Maxwell, J. P., Masters, R. S., van der Kamp, J., & Jackson, 2007), it is of great importance to determine the role of HRV in archery performance. Despite a lack of evidence supporting the link between HRV and archery performance, previous results from other fields of psychology demonstrating the association between HRV and mental or attentional workload (Hansen, Johnsen, & Thayer, 2003) provide a theoretically sound basis to assume that HRV may potentially account for variations in archery performance, requiring high levels of mental and physical precision.

Another factor thought to be an antecedent of performance in archery is the experience of flow. The underlying logic for the study of flow experience in relation to archery performance is the fact that defining features of flow, such as reduced mental effort (Koehn, Morris, & Watt, 2013), total immersion in an activity (Bakker, 2008; Fullagar & Kelloway, 2009), and high concentration (Ullén et al., 2012), may lead to higher precision in archery. Another reason to study flow in relation to performance is the lack of research findings clarifying the flow-performance relationship. Previously, researchers have focused largely on factors affecting flow experience (Kaufman, Glass, & Arnkoff, 2009; Elbe, Strahler, Krustrup, Wikman, & Stelter, 2010). Thus, the issue of whether flow facilitates performance in an activity requiring an extreme level of concentration and precision remains unclear and deserves a careful examination in well-controlled experiments. Further, in the field of sport psychology, researchers have focused mainly on negative emotions as predictors of performance and simply ignored examining whether there is a relationship between positive emotions and performance. Therefore, there is a clear need to understand the link between performance in archery and flow, which represents positive emotional states associated with better performance.

Trait emotional intelligence might be another psychological individual difference that can lead to better athletic performance. "Trait emotional intelligence (or 'emotional self-efficacy') refers to a constellation of behavioral dispositions and self-perceptions concerning

one's ability to recognize, process, and utilize emotion-laden information" (Petrides, Frederickson, & Furnham, 2004, p. 278), and overlaps considerably with emotional skills thought to lead to better athletic performance, such as establishing and maintaining appropriate emotional conditions (Robazza, Bortoli, & Nougier, 2000). Moreover, previous research has shown that trait emotional intelligence is associated with athletes' HRV responses to mental stressors (Laborde, Brüll, Weber, & Anders, 2011), muscular performance under stress (Tok, Binboğa, Guven, Çatikkas, & Dane, 2013), and psychological skill use (Lane, Thelwell, Lowther, & Devonport, 2009). Therefore, there are theoretical reasons to suggest that trait emotional intelligence may be a psychological construct with the potential to explain variations in archery performance.

In the present study, we aimed to examine whether HRV, together with flow and emotional intelligence, may predict variations in archery performance. Such a multi-dimensional approach using techniques from different scientific branches may lead to a better understanding of the factors affecting performance in archery, which requires high levels of precision and concentration. In our study, the LF/HF ratio, as an indicator of stress, was expected to increase from baseline in the arrow shooting session due to the muscular, cognitive, and respiratory demands of archery. Moreover, we predicted that archers' performance would be associated with higher LF/HF ratios. Considering the requirements of better performance in archery, such as low psycho-physiological arousal, our prediction regarding the LF/HF ratio and shooting performance may seem contradictory. However, our sample consisted of novice archers, thus, the application of proper shooting techniques that require high levels of muscular and mental effort should lead to an increase in the LF/HF ratio. We also expected that flow and emotional intelligence, which may facilitate appropriate emotional conditions, should be related to better performance in archery.

METHOD

The Population and the Sample

Participants were 30 college students ranging in age from 18 to 23. None of the participants had previous experience in archery. However, they enrolled in an archery class to receive course credit. At the end of the 14-week course, individuals having a final exam grade higher than 70 were invited to take part in the study. Participants had no acute or chronic neuromuscular disease or psychiatric disorder and were required to abstain from the use of any medications that may affect nervous system functioning.

Data Collection Tool

In this study, two different measurement tools were adopted. These tools were "The State Flow Scale" and "The Schutte Emotional Intelligence Scale".

The State Flow Scale: The State Flow Scale, developed by Jackson and Eklund (2002) and adapted into Turkish by Aşçı, Çağlar, Eklund, Altıntaş, and Jackson (2007), was used to measure participants' flow experiences. The scale features 36 items that require a response using a five-point Likert-type scale. The State Flow Scale measures nine theorized dimensions of flow: challenge-skill balance, action-awareness merging, clear goals, unambiguous feedback, concentration on the task at hand, sense of control, loss of self-consciousness, time transformation, and autotelic experience.

The Schutte Emotional Intelligence Scale: The Schutte Emotional Intelligence Scale, developed by Schutte et al. (1998), revised by Austin, Saklofske, Huang, and McKenney

(2004), and adapted for the Turkish population by Tatar, Tok, and Saltukoglu (2011), was used to measure emotional intelligence. The scale contains 41 items and generates an overall EI score, as well as scores for three subscales: regulation of emotion, appraisal of emotion, and utilization of emotion. Regulation of emotion measures the extent to which people report being able to control their own and others' emotions; utilization of emotion measures the extent to which people report being able to use emotions in solving problems; and appraisal of emotions measures the extent to which people report being able to identify their own and others' emotions. Austin et al. (2004) provided evidence for the construct validity of the first two factors and the full scale's internal reliability.

Procedure

In the first stage of the experiment, participants first completed the Schutte Emotional Intelligence Inventory. Then, their resting HRV was measured for 4 minutes while sitting. In the next stage, participants shot 10 arrows in 4 minutes from 18 m to an 80-cm diameter target. The shooting task was self-paced, so participants decided when to shoot an arrow and how long to prepare to shoot. Based on a pilot study of five novice archers, we determined that participants were required to shoot an arrow in approximately 20–25 seconds. Participants were given additional arrows if they finished their shooting in less than 4 minutes. However, only the first 10 shots were taken into account. Lastly, participants completed the State Flow Scale. Performance was determined as the radial distance (error) from the center of the target, which was considered a measure of "accuracy"–the smaller the distance, the greater the accuracy. In order to calculate an overall performance score, the median value of the radial distance to the center was taken into account for each participant. All experimental procedures were approved by the local ethics committee and all data were collected in accordance with latest version of the Helsinki Declaration. All participants completed a form providing informed consent, as approved by the ethics committee.

Data Analysis

To explore whether the LF/HF ratio differed between a resting state and during the shooting session, a Wilcoxon sign rank test was conducted. In order to examine the relationships between shooting accuracy and the LF/HF ratio recorded during arrow shooting, flow, and emotional intelligence, Spearman correlation coefficients were calculated. Lastly, stepwise regression analyses were carried out to determine whether predictor variables, LF/HF ratio, flow, and emotional intelligence, could predict significant amounts of variance in shooting accuracy.

FINDINGS

A Wilcoxon sign rank test showed that the LF/HF ratio differed significantly between resting (Mean Rank = 3.35) and during the shooting session (Mean Rank = 5.95, $z = 3.24$, $p = .001$). Spearman correlation coefficients were calculated to examine whether the LF/HF ratio, flow, and the trait emotional intelligence dimensions, as well as participants' overall scores were related to shooting accuracy (see Table 1). Among the emotional intelligence dimensions, only regulation of emotions ($r = -.40$, $p = .029$), appraisal of emotions ($r = -.38$, $p = .038$), and overall emotional intelligence ($r = -.54$, $p = .002$) scores were significantly related to shooting accuracy. The challenge-skill balance ($r = -.42$, $p = .023$) and clear goals ($r = -.44$, $p = .016$) dimensions of the flow scale were also significantly associated with shooting accuracy. Moreover, the LF/HF ratio was significantly correlated with shooting accuracy ($r = -.49$, $p = .006$).

Table 1. Relationship between HRV Trait Emotional Intelligence Flow and Shooting Accuracy

	Median	SD	Shooting Accuracy
LF/HF Ratio	6.27	3.5	**-.49****
Regulation of Emotions	48.03	5.49	**-.40***
Utilization of Emotions	21.03	3.78	-.29
Appraisal of Emotions	38.66	5.99	**-.38***
Challenge-Skill Balance	15.83	2.42	**-.42***
Action Awareness	12.93	4.20	.11
Clear Goals	17.43	2.26	**-.44***
Unambiguous Feedback	14.63	2.88	-.11
Total Concentration	16.56	1.75	-.14
Sense of Control	16.23	2.07	-.18
Loss of Self-Consciousness	14.43	3.87	.04
Transformation of Time	15.03	3.96	-.13
Autotelic Experience	18.46	1.79	-.21
EI Total	107.73	12.28	**-.54****
Flow Total	141.56	14.37	-.17

**p < .01; *p < .05

Based on the significant correlation coefficients observed in the former analyses we conducted a stepwise regression analyses to test whether the model consisting of LF/HF ratio; overall emotional intelligence score, as well as its regulation of emotions and appraisal of emotions dimensions; and the flow dimensions of challenge-skill balance and clear goals could significantly account for variations in archery performance. As can be seen in Table 2, in the resulting final model, only the LF/HF ratio, overall emotional intelligence score, and the challenge-skill balance dimension of flow were able to explain a significant amount of the variance in archery performance.

Table 2. Predictive Abilities of HRV Trait Emotional Intelligence and Flow for Shooting Accuracy

Independent variables	*B*	β	*t*	*r*	AdjR^2
Constant	44.43		6.20	.669	.38
LF/HF ratio	-.523	-.358	-2.39		
Challenge-skill balance	-.842	-.410	-2.62		
EI overall	-.116	-.279	-1.76		

DISCUSSION AND CONCLUSION

In the present study, we aimed to examine whether accuracy in arrow shooting may be predicted by HRV, flow, and emotional intelligence. As archery is a task that demands a high level of attention, we anticipated that the HRV parameters of the LF/HF ratio would be able to account for variations in arrow-shooting precision. Further, we also expected that flow and emotional intelligence could account for variations in arrow shooting accuracy, mainly due to the role of these two psychological qualities in creating appropriate emotional conditions for better performance.

As expected, the LF/HF ratio increased significantly from resting to shooting, which confirms arguments emphasizing the effect of mental or attentional load on HRV (Hansen et al., 2003). The data also confirmed our prediction regarding the relationship between the LF/HF ratio and shooting accuracy. The LF/HF ratio was inversely correlated to the median value of radial distances from the center of the target. In other words, the higher the LF/HF

ratio, the greater the accuracy in arrow shooting. Only one previous study, by Carrillo, Christodoulou, Koutedakis, and Flouris, (2011), reported an association between the LF/HF ratio and archery performance, which confirms the results observed in the present study. The fact that a higher LF/HF ratio or a lower level of sympathovagal balance may facilitate shooting accuracy can be considered logical, demonstrating the effect of mental load on HRV. In this respect, former studies have consistently shown that psychological (Petrowski, Herold, Joraschky, Mück-Weymann, & Siepmann, 2010), mental (Luft et al., 2009), and attentional (Park, Vasey, Van Bavel, & Thayer, 2013) loads may have a robust effect on HRV and performance.

However, readers should take into account several important issues when interpreting our results. First, the sample of the present study consisted of novice archers, who invest more physical and mental effort than do experienced archers. Thus, the LF/HF ratio of experienced archers may be lower. Therefore, in future studies, the link between HRV and shooting accuracy in archers should be studied with both novice and experienced archers. Attempts by archers to control their respiration rate should also be considered in regards to the LF/HF ratio and shooting accuracy, since they may have a vital effect on HRV. In a recent study, Neumann and Thomas, (2009) observed an increase in LF activity in elite golfers, but not in novice golfers. The researchers argued that increase in LF activity should stem from respiration rate rather than from ANS activity. Thus, researchers aiming to understand the link between HRV and shooting accuracy should consider the effect of respiration rate on HRV.

Our results provided only partial support for the predictions regarding flow and arrow shooting accuracy. Among the flow dimensions, only the challenge-skill balance and clear goals dimensions were found to be associated with a higher level of shooting accuracy. However, only challenge-skill balance emerged as a significant predictor in the final regression model. Interestingly, researchers in the field of sport psychology have focused on factors affecting the flow state rather than the flow-performance relationship (Koehn et al., 2013; Swann, Keegan, Piggott, & Crust, 2012). Only a few studies have examined the effect of flow on performance in terms of winning or losing (Bakker, Oerlemans, Demerouti, Slot, & Ali, 2011; Koehn, & Morris, 2012). Further, no previous study has examined whether performance in archery might be related to flow. Challenge-skill balance, which is a defining feature of flow experience, involves a perceived high level of skill, the ability to act, or a capacity to meet challenges (Flett, 2015), which may possibly play an important role in creating appropriate emotional conditions for a better performance. Consequently, the present study provides evidence for the argument that flow, especially the challenge-skill balance dimension, may have the ability to facilitate performance in archery.

Trait emotional intelligence was also found to be a significant predictor of shooting accuracy, which signifies that individuals with higher overall emotional intelligence scores were more precise in arrow shooting. The effect of trait emotional intelligence on individuals' appraisals of stress may provide an explanation for the observed relationship between emotional intelligence and shooting accuracy. Previously, individuals with high trait emotional intelligence have demonstrated a greater tendency to appraise stress as a challenge rather than as stress (Matthews et al., 2006; Mikolajczak & Luminet, 2008). Taken together, it can be argued that individuals who have higher emotional intelligence scores perceive the physical and psychological stress induced by arrow shooting as a challenge, which may in turn cause more accurate shooting performance. In addition, in a previous

study by Tok et al. (2013), trait emotional intelligence was found to be associated with better motor performance under stress.

On the basis of the results obtained from the current study, we conclude that the determination of performance or shooting accuracy should be based on both physiological and psychological characteristics, in this case, HRV, flow, and emotional intelligence. This information might be beneficial for coaches, athletes, or other practitioners aiming to develop archers' performance.

The present study includes several limitations. First, our sample consisted of only novice archers, which limits the generalizability of the results. The relationship between shooting accuracy and HRV may be different for experienced archers, who can execute the necessary psychomotor skills automatically. Moreover, it seems that the consideration of respiration activity may lead to a better understanding of the relationship between shooting accuracy and HRV.

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ORIGINAL RESEARCH

Scrutinizing the Changes in the Aggression of the Students of Faculty of Sports Sciences Studying at Different Departments

Abstract

The objective of this study is to examine the aggressive behaviors and proclivity of the students of Faculty of Sports Sciences of Selçuk University, studying at different departments. The study group is constituted by total 349 students, being 155 males and 194 females, studying at different departments of Faculty of Sports Sciences of Selçuk University. While the personal information form was used for the socio-demographic information, a 7-item likert-type Aggression Scale developed by Kiper (1984) was utilized to obtain the values of aggression. Following testing the homogeneousness and variances of the data, Independent Sample t Test was used in identifying the changes for the gender factor, One-Way Anova for multiple comparisons, and Tukey HSD test in determining the source of the difference. The Crombach Alpha value for this study was determined as 0,82. Statistical changes were observed in the aggression values depending on the gender and department factors ($p<0.05$). While no change was found in the destructive aggression category in view of the gender variable, it was determined that the average values of males were statistically higher than females in the categories of assertiveness, passivity, and overall aggression ($p<0.05$). It was found that the students of the coaching department have the highest average value in the entire aggression subcategories and that the changes are statistically significant ($p<0.05$). In the light of such findings, it is considered that the new functional model charged by the society on females and males will be effective in the changes found between the male and female students, along with the socio-cultural structure, social status, and roles. In addition, the reason for the changes depending on the department factor among the students can be considered as the fact that they are made subject to different recruitment criteria and examinations when being placed into departments, in addition to the differences of their sportive fields where they are studying. It is a noteworthy result that the aggression scores of the coaching students is high despite the fact that they take more practice-based classes. Regardless of its cause and source, sense of aggression must be considered as a sense and behavior that must be brought under control without reaching a dimension that inflicts damage on persons and the society.

Keyword: Aggression, sports, university student.

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INTRODUCTION

Intention is an important factor to determine whether a behaviour is aggressive or not. Freedman et al describes aggressive behaviour as an act that has the intention of hurting somebody. Target may not be the source of the aggressiveness but only the observable excuse (Lorenz 1968). If under control, aggresiveness is not an concerning issue to society. An act of aggressiveness full of purpose and intention is undoubtly destructive.

Emotions and behaviours like anger, stress, anxiety and aggressiveness are important for all ages and education levels. Especially, since university students are towards the end of their puberty and beginning of their profession and partner selection, it is a critical time to get their aggressive behaviours under control. Aggressive behaviour could be under a complicated structure that it is not possible to evaluate it isolated from the events it causes. Aggressiveness is not a pure act, emotions such as anger, hostility and outburst companies this behaviour (Gergen & Gergen, 1986). This may not be just towards individuals or society. Krech and Crutchfield (1980) has reported that it could be observed as aggression, rage, anger, financial damage to goods and people, offensiveness and destructive purposes. Aggressivness may not always result in violence. Partal and Kilcigil (2003) has described violence as the end point of aggressiveness but emphasized that aggressiveness does not have to involve violence.

Aggressiveness has the purpose or intention to hurt somebody physically or verbally, an act not carrying these properties cannot be described as aggressiveness (Atkinson et al, 2002). Cüceloğlu (2005) reports, aggressiveness might as well be towards the individual themselves rather than to an object, event, situation, individual or society. In literature there are different classifications and descriptions of aggressive emotion and act. Aggressiveness is evaluated under 3 main titles. Destructive, passive and bold. These 3 main titles could be summerized as follows. Destructive aggresiveness involves hostility. Passive aggresiveness is satisfying your aggressive emotions without angering the opposition. And being aggressive with the purpose of defending your own existence and rights with no intention of hurting anybody is defined as `bold` aggresiveness.

Alongside with aggressiveness, related concepts such as anger, hostility and violence should also be discussed. Not every aggressive act is violent but every violent act is aggressive. For example, a small kid hitting their friend during play time is not violence. Violence represents endpoints of aggressiveness. Injuring or killing could be given as examples to this. Anger is the underlying emotion behind aggressiveness. Hostility is the cognitive that leads to aggressiveness (Anderson & Bushman, 2002).

Since university involves the puberty it is an intensive time concerning emotions and behaviours. Enjoying violence and aggressive acts increases as a consequence of growing physical power and environmental circumstances (Yavuzer, 1992). Sports sciences faculties which helps sports industry with staff alongside with scientific support, serves variety of different professions likes of coaching, sports management, recreational and physical education. Behavioural acting disorders of our age are believed to be able to controlled under different scopes of studies. In this context we believe this study can be a help to future studies on this subject.

METHOD

Research Design

The objective of this study is to examine the aggressive behaviors and tendency of the students of Selçuk University, who study at different departments of sport sciences faculty. The study group consists of 155 male and 194 female students adding up to 349 total students. Who study at different departments of Selcuk Universities Sport Sciences Faculty.

Data Collection Tool

While the personal information form was used for the socio-demographic information, a 7-item likert-type Aggression Scale developed by Kiper (1984) was utilized to obtain the values of aggression. Participants were asked to select an option out of 7 options that were given. Options scaled from "it fits me very well" (+3 points) to "it does not fit me at all" (-3 points). Points differentiating from -3 to +3 were summed and for every sub scale the total was summed with +31 to get rid of negative points. For each sub scale a point between 1 to 61 was obtained. The Crombach Alpha value for this study was determined as 0.82.

Data Analysis

Variance and homogeneity of the obtained data were tested and for the statistical analysis independent Sample t test was used. One-way Anova and Tukey HSD tests were used as multi-comparison tests.

FINDINGS

Table 1. Aggressiveness Scores Depending on Sex

Gender	n	Destructive Aggressiveness		Bold Aggressiveness		Passive Aggressiveness		General Aggressiveness	
		x	SD	x	SD	x	SD	x	SD
Female	194	20.90	5.21	27.07	5.88	12.88	4.88	60.85	10.00
Male	155	20.43	5.84	31.06	6.93	13.15	4.74	64.64	12.50
Total	349	20.69	5.50	28.84	6.66	13.00	4.81	62.53	11.32
t		.794		-5.723		-.514		-3.069	
p		.422		.000*		.606		.002*	

* Significance value between groups (p<0.05).

As can be seen from table 1, Destructive and passive aggressiveness has no statistical significance between two groups while bold and general aggressiveness values are higher in male students (p<0.05).

Table 2. Aggressiveness Scores Depending on Department

Department	n	Destructive Aggressiveness		Bold Aggressiveness		Passive Aggressiveness		General Aggressiveness	
		x	SD	x	SD	x	SD	x	SD
Coaching	71	23.73	5.17 [a]	35.00	6,31 [a]	15,41	5,00 [a]	74,14	10,12 [a]
Sports Management	106	19.46	4.57 [b]	25.46	5,81 [b]	12,10	4,32 [b]	57,03	8,03 [c]
Recreation	49	19.55	7.16 [b]	27.00	6,14 [b]	11,10	3,03 [c]	57,65	11,15 [c]
Physical Education	123	20.45	5.05 [b]	28.94	5,15 [b]	13,14	5,15 [b]	62,52	9,38 [b]
F		10,601		41.171		10.528		52.329	
p		,000*		.000*		.000*		.000*	

*,ab= Significance value between groups (p<0.05).

As can be seen from table 2, all aggressiveness types has a statistically significant difference between faculties.

DISCUSSION AND CONCLUSION

In this study, which aimed to investigate the aggressive behaviour tendencies of students from different departmens there were no statisticly significant differences seen dependent on shelter, while there were differences dependent on gender and departmens. In literature there are a lot of studies reporting more male aggressiveness (Gönültaş & Atıcı, 2014; Halıcı & Baran, 2006; Eroğlu, 2009; Efilti, 2006), there are some that reports no difference between gender (Dervent, 2007; Ağlamaz, 2005). In this study there was no statisticly significant difference bon destructive and passive aggressiveness. Reason for this could be the changing roles and status of men and women dependent on the social structure. Socio cultural roles and different upbringing styles that Turkish society embraced through time could be the reason for higher aggressiveness in men.

Our study found that students of sports sciences faculty have a statisticly significant difference on aggressiveness dependent on faculty. It is normal that students of different school, faculty and area have different types and amplitudes of aggressivenes. In this study highest aggressiveness scores were obtained from coaching students. This result is thought to be caused by the difference of the licence program of coaching and also the uniquity of the program. Coaching department has a higher mean score of destructive aggressiveness and bold aggressiveness scores than other departments while others possess similar scores. Even though passive aggressiveness has a similar result, students of recreation department have the lowest scores. In terms of General aggressiveness while the coaching department has the highest scores, physical education, recreation and sports management follow it respectively. Ağlamaz (2005) reported that students have different aggressiveness points dependent on their Majors. Karataş (2008) showed, high school students have significant differences dependent on their choice of major. Kocatürk (1982) reports students who choose sports have higher aggressiveness scores than who choose education. Although they are in the same corporate constitition, sports sciences faculties have different licence programs, different staff and different environment. This situation is thought to be the causation of the difference observed in this study.

Having our emotions and behaviour under control is important for both ourselves and the society. There is a need to increase the number of studies investigating emotions like anger, stress, anxiety, aggressiveness of university students under different scopes and areas. It is believed that this study will be a light for the upcoming studies in this area.

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ORIGINAL RESEARCH

Acute Weight Training-Induced Testosterone Responses of Trained Males across Age Groups and Diets: A Pilot Study

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Abstract

Testosterone has been associated with health and athletic performance. However, it is also known to decrease with age. The rise of these age-related, non-communicable diseases affects economic growth. To develop natural, safe, and sustainable fitness and nutrition programs to keep the aging population healthy and fully functional, the present study explored exercise, diet, and age as possible factors affecting hormonal levels and responses. Twelve recreationally trained men from different age groups (20s to 70s) and diets (vegans and meat eaters) completed a 30-minute weight training protocol. Blood samples were taken before and after exercise to determine exercise-induced changes in total testosterone (TT) levels. Additional hormonal tests for cortisol (C) and testosterone-cortisol ratio (T/C) were conducted for outliers to guide future research. Pretest-posttest analysis showed a statistically significant increase in TT within subjects; $t(11)=-3.842$, $p=0.003$. Younger men (35 years old and below) had a significantly greater increase in TT compared to older men (40 years old and above); $X^2(1)=4.121$, $p=0.042$. Age was negatively correlated with TT increase ($r=-0.622$, $p=0.031$). Vegans showed higher estimated marginal mean TT levels in both pretest and posttest. In conclusion, a single session of 30-minute, moderate intensity, high-volume leg exercise can significantly increase blood serum TT in men across age groups and diets. Younger men tend to show greater increases in TT compared to older men. Further studies are needed to explore veganism as a more favorable diet for optimal testosterone levels.

Keyword: Acute testosterone response, weight training and testosterone, vegan diet and testosterone.

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INTRODUCTION

Background of the Study

Testosterone has been associated with muscle growth, strength, and various health measures, such as body composition (Rodriguez-Tolr, Torremadé, del Rio, di Gregorio & Miranda, 2013), bone density (Bouloux et al., 2013), brain function (Kocoglu et al., 2011), and immunity (Gold, Chalifoux, Giesser & Voskuhl, 2008). As a sex hormone, it is also linked with sexual drive and function (Gades et al., 2008). Recent studies on athletes also support the belief that testosterone plays an important role in athletic performance (Majumdar & Srividhya, 2010), recovery (Kargarfard, Amiri, Shaw, Shariat, & Shaw, 2018), fatigue (Bosco, Colli, Bonomi, Von Duvillard & Viru, 2000) and motivation (Crewther, Carruthers, Kilduff, Sanctuary & Cook, 2016). When it comes to fatigue and recovery, a low testosterone-cortisol ratio (T/C) is usually indicative of overtraining and catabolic status, while a high T/C marks anabolic status.

Unfortunately, testosterone levels in the body are known to decrease with age. Total testosterone (TT) levels fall at an average of 1.6% per year, while free and bioavailable levels fall by 2–3% per year among men (Feldman et al., 2002). Across age groups, clinically low testosterone levels (hypogonadism) was approximately 20% over age 60, 30% over age 70, and 50% over age 80 (Harman, Metter, Tobin, Pearson & Blackman, 2001). Furthermore, age-related hypogonadism is associated with erectile dysfunction, Type 2 diabetes, obesity, metabolic syndrome, osteoporosis, HIV, depression, cerebrovascular, and cardiovascular disease (Lunenfeld, Arver, Moncada, Rees & Schulte, 2012).

The World Health Organization estimates that around 1.5 billion of the world's population will be 65 years of age or older by 2050. In developing countries like the Philippines, the rise of these chronic, age-related, non-communicable diseases greatly affects economic growth (World Health Organization, 2011). Given the role of testosterone in health and the increase in older population, it is imperative to find safe and sustainable solutions to manage the natural decline of hormonal levels in aging men.

Review of Related Literature

Exercise Programming for Testosterone

There is a popular belief that resistance training can maintain health and virility by slowing down age-related decline in testosterone levels. Most studies on exercise programming for testosterone, however, involve young men.

Training volume. For instance, a study on young male recreational weightlifters found that a high-volume resistance training protocol for hypertrophy (10 sets of 10 repetitions, 75% 1RM, 2-minute rest periods, controlled movements) elicited significant elevations in salivary testosterone levels after a single session of exercise (Crewther, Cronin, Keogh & Cook, 2008). However, a study on college-aged men and women found that even a low-volume (2 sets, 90-second rest period) but high-speed resistance training protocol performed at maximal effort elicited significant increases in salivary testosterone after a single session of exercise (Caruso et al., 2012).

Rest period. In terms of rest period, a study on young male recreational weightlifters found that serum testosterone concentrations were significantly higher post-exercise in protocols with longer rest periods between sets (120 and 90 seconds) compared to one with a

shorter rest (60 seconds) after a single session of exercise (Rahimi, Qaderi, Faraji & Boroujerdi, 2010).

Speed of contraction. Another factor that greatly affects exercise-induced testosterone levels is the speed of muscle contraction. A study on young male recreational weightlifters found that lifting weights at maximal and submaximal movement velocities (70% of maximum velocity) both significantly increased serum testosterone levels after a single session of exercise, given equal training volumes (Smilios, Tsoukos, Zafeiridis, Spassis & Tokmakidis, 2014). This was supported by another study on young male competitive strength and powerlifters, which reported significant elevations in post-exercise salivary testosterone during the power training phases of different periodization programs (Bartolomei et al., 2016).

Muscle group. But perhaps the most important consideration in programing for higher testosterone levels is the muscle group involved. A hypertrophy protocol involving upper body exercises alone did not result in significant elevations in both total and free testosterone levels (Migiano et al., 2010; Simão et al., 2013). In contrast, doing leg exercises alone (squat and leg press) resulted in significant post-exercise elevations in salivary testosterone in trained men (Crewther, Cronin, Keogh & Cook, 2008).

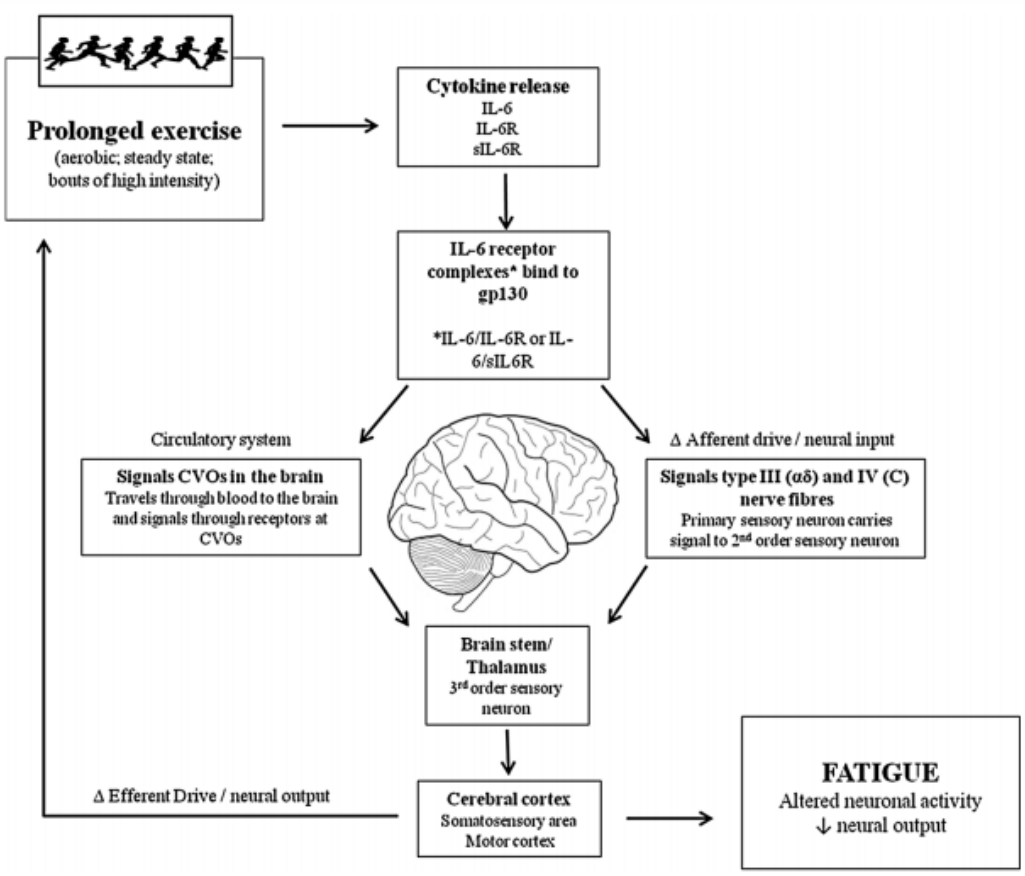

Figure 1. The Neuroinflammatory Model of fatigue in sport and exercise performance (Vargas & Marino, 2014).

Diet for Testosterone

Neuroinflammatory Model of fatigue. The negative effect of inflammation on exercise and sport performance has been well-studied (Kreher & Schwartz, 2012; Pyne, Hopkins,

Batterham, Gleeson & Fricker, 2005; Robson-Ansley, Blannin & Gleeson, 2007). A review on fatigue mechanisms discussed the role of the inflammatory system in sport and exercise performance (Vargas & Marino, 2014). In the Neuroinflammatory Model, fatigue during exercise can be likened to fatigue during disease, which is characterized by the release of inflammatory markers like cytokines. Specifically, increase in IL-6 and other inflammatory mediators may decrease efferent drive to the muscles, resulting to impaired performance. The same review concluded that exercise may help improve the overall inflammatory profile of people with diseases, as well as blunt the inflammatory response of healthy individuals.

Using the Neuroinflammatory Model of fatigue, a diet that reduces inflammation may lead to better sport and exercise performance, which can induce higher testosterone levels.

Indeed, vegan men have been found to have higher TT levels than that of vegetarians and meat eaters (Allen, Appleby, Davey & Key, 2000). The same study found that compared to vegetarians and meat eaters, vegan men had significantly lower levels of IGF-1 hormone, which has been linked to prostate cancer.

The largest study on vegan diet to date, known as "Adventist Health Study 2", also concluded that a vegan diet that excludes meat and other animal products conferred lower risk for all kinds of cancers studied, when compared to other dietary patterns (Tantamango-Bartley, Jaceldo-Siegl, Fan & Fraser, 2013). This supported an earlier meta-analysis which concluded that compared to meat eaters, non-meat eaters had a significantly lower incidence of all kinds of cancers studied (Huang, Yang, Zheng, Li, Wahlqvist & Li, 2012).

Meanwhile, the latest long-term study on older adults (aged 45-74) found that higher intake of plant protein was associated with lower total mortality (Budhathoki, Sawada & Iwasaki, 2019). The same study found that substituting animal protein with plant protein was associated with lower risk of death from cancer and heart disease.

There are three possible mechanisms by which a vegan diet may help improve health and athletic performance: 1) less inflammation due to higher intake of antioxidants; 2) less inflammation due to less intake of inflammatory compounds; and 3) longer length of chromosomal telomere.

Higher intake of antioxidants. It is now well-established that intense and prolonged exercise can result in oxidative damage to both proteins and lipids in contracting muscle cells (Powers & Jackson, 2008). Hence, a diet rich in antioxidants can be beneficial in sport and exercise performance.

Compared to an omnivore diet, a vegan diet was associated with higher levels of antioxidants and omega 3 that are known to decrease inflammation, which has been linked to a range of diseases, including cancer (Miles et al., 2019). Another study reported an inverse relationship between prostate cancer risk and dietary intake of flavonoids, which have antioxidant effects, from fruits and vegetables (Russo et al., 2018).

In an experimental study on female swimmers, supplementation with phytoestorgens, a compound found in plants, enhanced antioxidant enzymes after exercise, as well as modulated sex hormone plasma levels (Mestre-Alfaro et al., 2011). Another experimental study on male runners found that supplementation with an antioxidant drink containing vitamin C and E alleviated exercise-induced oxidative damage in lymphocytes, but without blocking the cellular adaptation to exercise. (Sureda et al., 2008).

Less intake of inflammatory compounds. Processed meat intake was inversely associated with telomere length, which reflects oxidative and inflammatory responses (Nettleton, Diez-Roux, Jenny, Fitzpatrick & Jacobs, 2008). The high heat-generated glycotoxins in animal products, including meat, egg yolk, dairy, and their derivatives, increase cell-oxidant stress and promote inflammation (Vlassara, Cai & Crandall, 2002). Based on studies like these, the World Health Organization has classified red meat and processed meat as carcinogenic (World Health Organization, 2015).

Longer telomere length. Telomeres, the protective ends of chromosomes, shorten with age and disease. Oxidative stress accelerates telomere shortening, while antioxidants decelerate it (Kurz, Decary, Hong, Trivier, Akhmedov & Erusalimsky, 2004; Von Zglinicki, 2002). Indeed, an experimental study found that age-dependent telomere shortening can be decelerated by suppressing oxidative stress through intake of Vitamin C (Furumoto, Inoue, Nagao, Hiyama, & Miwa, 1998), a micronutrient that has been found to be higher among vegans compared to the general population (Kristensen et al., 2015). In another study, consumption of plant-based foods like seeds, nuts, legumes, seaweeds, and coffee was associated with longer telomeres (Freitas-Simoes, Ros & Sala-Vila, 2016).

It is the goal of this study to compare testosterone levels of male vegans to that of meat eaters as an acute response to weight training. Also, men of different age groups (20s, 30s, 40s, 50s, 60s, and 70s) were included to explore age-related trends in exercise-induced hormonal responses.

Theoretical Framework

Based on the aforementioned studies on exercise, nutrition, and aging, the author formulated the following theoretical models.

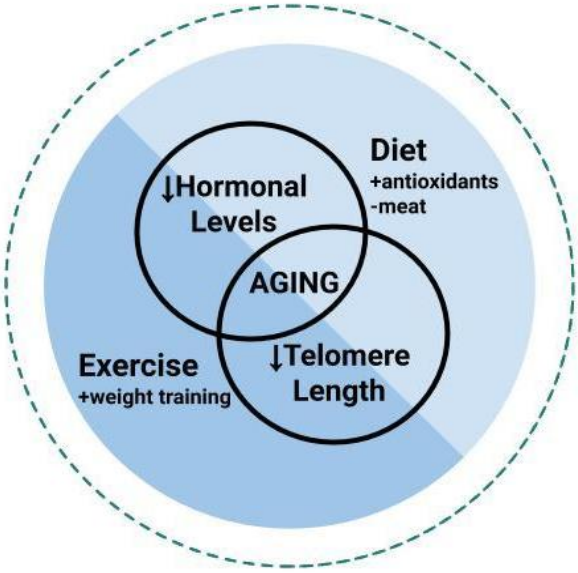

Figure 2. The author's general theoretical framework showing the two known measures of aging (telomere length and hormonal levels) and the two known lifestyle factors affecting them (diet and exercise). For diet, antioxidant intake is a favorable factor in slowing down aging, while meat intake is an aggravating factor for aging. For exercise, weight training is a favorable factor in slowing down aging.

METHOD

Design

Participants were randomly assigned to a training schedule between 11AM to 2PM. Lunchtime was chosen since cortisol levels have been found to peak in the morning, while testosterone levels do not vary significantly throughout the day among apparently healthy males (Hayes, Grace, Kilgore, Young & Baker, 2012). Vegans and non-vegans were tested together to minimize experimenter bias.

All participants followed a moderate-intensity hypertrophy protocol previously found to elicit significant elevations in testosterone levels: 10 total sets of 10RM, 75% 1RM, 2 minutes rest between sets (Crewther, Cronin, Keogh & Cook, 2008). A previous study on male seniors aged 65-70 also employed the said training protocol (Häkkinen, Kraemer, Pakarinen, Triplett-McBride, McBride & Häkkinen, 2002). Such moderate-intensity protocol was chosen over the high-speed, high-intensity training of Caruso et al. (2012) to ensure safety of older participants. Also, a study found that high-intensity training led to decreased testosterone levels (Abdollahzadeh & Ashrafizadeh, 2018).

One week before testing day, assessment of 10RM loads for each participant was done following guidelines of the American Council on Exercise (Jimenez, 2018). Participants were also requested to avoid cardiovascular endurance training and vigorous physical activity for 48 h, abstain from consuming substances known to affect performance (alcohol, caffeine, creatine, whey protein, pre-workout, etc.) for 24 h, and get quality sleep for at least 6 h the night before testing. They were also instructed to maintain their regular diet throughout the days leading to the study.

On testing day, blood samples were taken right before and right after exercise by the same medical technologist to minimize procedural variability. Participants were also asked to rate the difficulty of the exercise using the Borg Ratings of Perceived Exertion Scale.

Subjects

A total of 12 men consisting of six vegans and six meat eaters (mean age=39.92±15.05; mean BMI=24.51±0.92) who practiced resistance training regularly for recreational purposes during the time of study were included.

Inclusion Criteria

Inclusion criteria involved factors that are known to affect TT levels, such as: being apparently healthy, of normal weight, non-smoker, not on any medication or supplementation known to affect testosterone levels (testosterone boosters, Viagra, etc.), not on any supplementation known to affect performance (creatine, preworkout, etc.), never used anabolic steroids, not currently training for cardiovascular endurance, not currently active in any sport, not chronically sleep deprived, not chronically stressed, and not working in the night shift.

For vegan subjects, a minimum of one year of practicing a vegan diet was required to participate in the study. Only those who were vegans for ethical reasons (e.g. vegan for the animals, vegan for religion, etc.) for at least one year were included to ensure that they did not "cheat" on their vegan diet.

Sampling Method

Participants were recruited from different gyms and from online vegan and fitness groups where the researcher posted advertisements. They were asked to answer an online survey to determine if they were fit for the study. An online interview was also conducted by the author to supplement the said survey.

Ethical Considerations

Each subject signed a standard Physical Activity Readiness Questionnaire form, as well as an institutionally approved informed consent form to participate in the study. The current study was approved in advance by a panel of professors in the University of the Philippines College of Human Kinetics Graduate Studies Department.

Locale of the Study

The pilot study was done in an air-conditioned fitness gym in Quezon City, Philippines, from April 22-27, 2019. Room temperature was set at 20 degrees Celsius, while humidity was set at 42%, which were well within ACSM recommendations for exercise (Armstrong, Casa, Millard-Stafford, Morán, Pyne & Roberts, 2007; No & Kwak, 2016).

Instruments of the Study

1. Life Fitness Hammer Strength 45 Degree Linear Leg Press with Weights - exercise machine used for the leg press

2. Hammer Strength HD Athletic Power Rack with Standard Olympic Bar and Weights - exercise equipment used for the barbell back squat

3. iPhone 6s - used as timer and alarm for participants

Exercise Protocol

The protocol was the same for all subjects: Two compound leg exercises (Smith machine barbell back squat and supine leg press), each performed for five sets of 10RM (75% 1RM) with 2-minute rest periods between sets, and in controlled movements with 1.5 seconds concentric and 1.5 seconds eccentric movement (Crewther et al., 2008). The entire protocol, including warmup, lasted for approximately 30 minutes.

When participants felt fatigued and were unable to maintain 75% 1RM for 10 repetitions, the load was reduced to ensure five sets of 10 repetitions could still be completed.

Before starting the first set of exercises, subjects performed a standard warm-up consisting of five minutes of leg mobility drills, and two submaximal sets on the leg press machine (20 repetitions, 50% 1RM).

Participants were tested at the same air-conditioned gym with constant temperature (20 degrees Celsius) and humidity (42%) at the same time of day near lunchtime (11AM to 2PM) to avoid extreme hormonal levels that may be caused by diurnal variations. To minimize procedural variability, the same investigator/coach supervised all testing sessions and provided verbal encouragement during exercise.

Blood Tests

Blood samples were collected from the left antecubital fossa of the participants while they were seated before warm-up, and right after the last repetition of the last exercise. To

minimize procedural variability, the same medical technologist collected blood samples from the antecubital fossa of all participants. Whole blood was centrifuged (Hsiangtai, Taiwan) for 10 minutes, after which serum was aspirated, aliquoted, and analyzed for TT immediately (Cobas E 411, Roche Diagnostics, USA). Blood samples were stored in the laboratory for follow-up tests. One week after testing, additional hormonal tests for cortisol (C) and T/C were requested to explain the performance of outliers.

Subjects were instructed to have their normal, complete meals 2 h before testing. During the exercise protocol, they were allowed to drink water as needed.

Statistical Analyses

Data are presented in means ± standard deviation, and significance level was set at alpha 0.05. Prior to statistical analysis, dependent variables were tested for normality using Shapiro-Wilk test, and for homogeneity using Levene's test. Data showed normal distribution, but the assumption of homogeneity was violated for TT increase. Hence, non-parametric Kruskal-Wallis H was used to analyze between-group differences, while paired samples t-test was used to analyze within-subject differences in TT scores. Pearson correlation was used to explore relationships between variables.

RESULTS

Within Subjects

All subjects had normal baseline levels of TT pretest. Pretest (M=494.44, SD=177.27) and posttest (M=560.19, SD=203.05) statistical analysis showed a significant increase in TT scores within subjects; t(11)=-3.842, p=0.003. Participants rated the exercise protocol as "hard" (mean RPE=15.42±2.11).

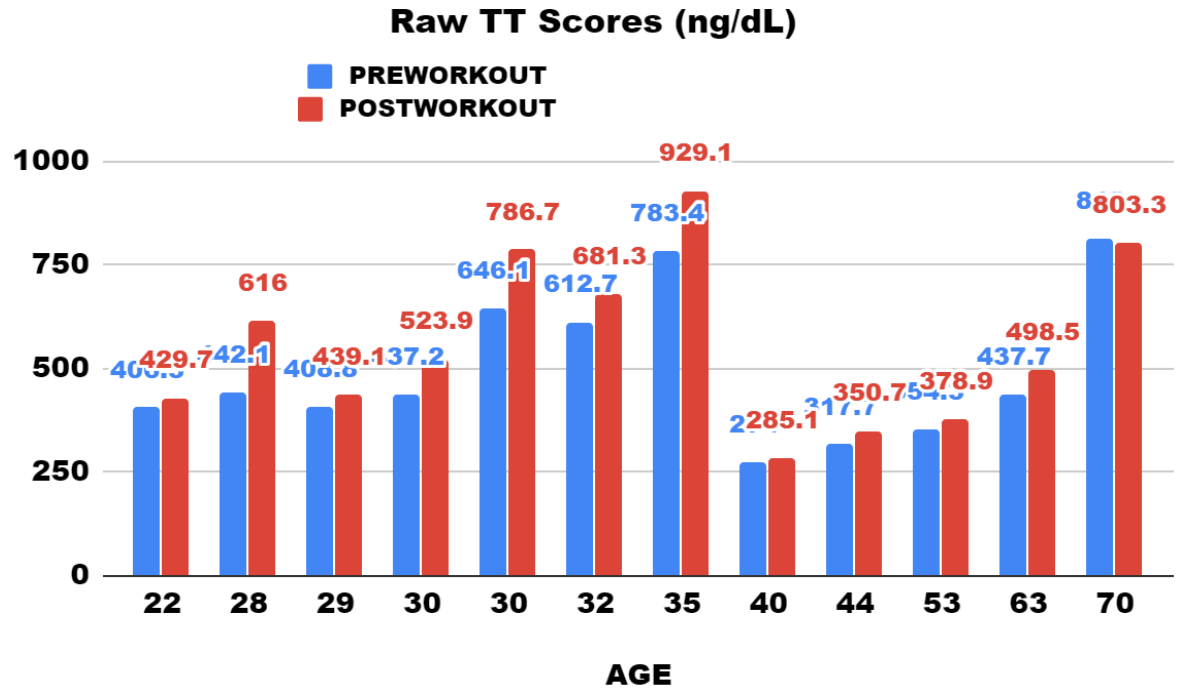

Figure 3. Raw TT scores of participants (N=12) according to age, with a statistically significant increase within subjects; t(11)=-3.842, p=0.003.

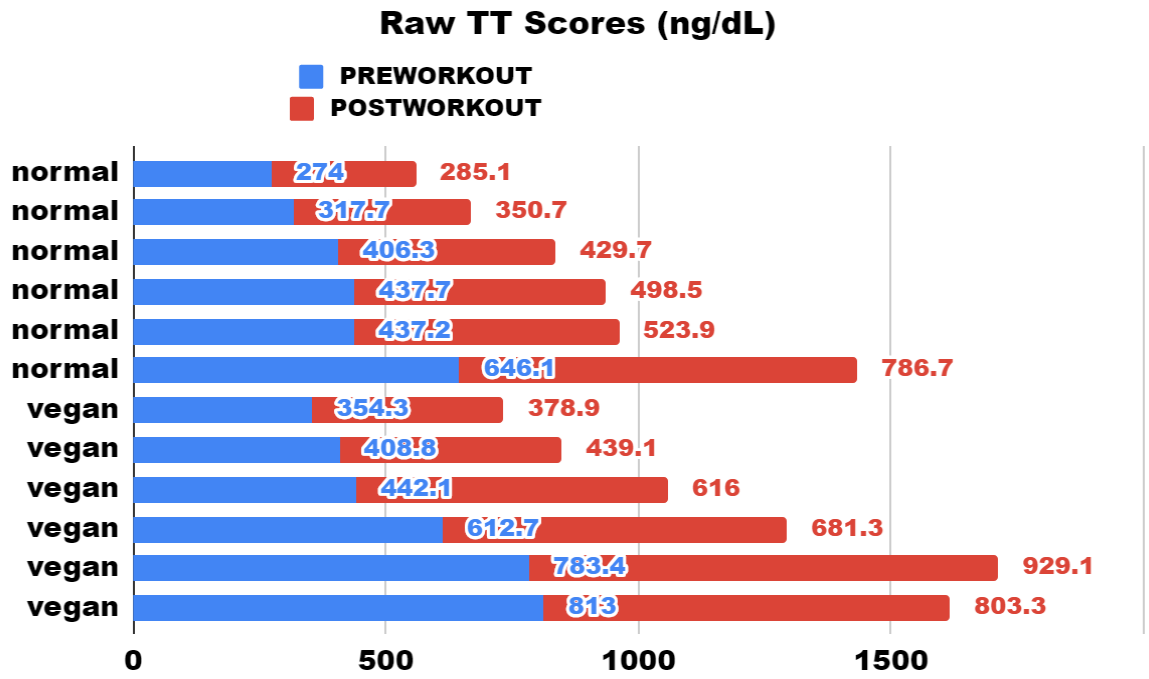

Figure 4. Raw TT scores of participants (N=12) according to diet.

Between Groups

Between-groups statistical analysis showed younger men (35 years old and below) had a significantly greater increase in TT scores compared to older men (40 years old and above); $X^2(1)=4.121$, $p=0.042$, with a mean rank pretest-posttest difference of 8.29 (N=7) for younger men and 4 (N=5) for older men. Age group was negatively correlated with TT increase ($r=-0.622$, $p=0.031$).

Vegans had higher estimated marginal mean TT levels in both pretest and posttest. Diet was almost correlated with percentage increase in TT ($p=0.054$).

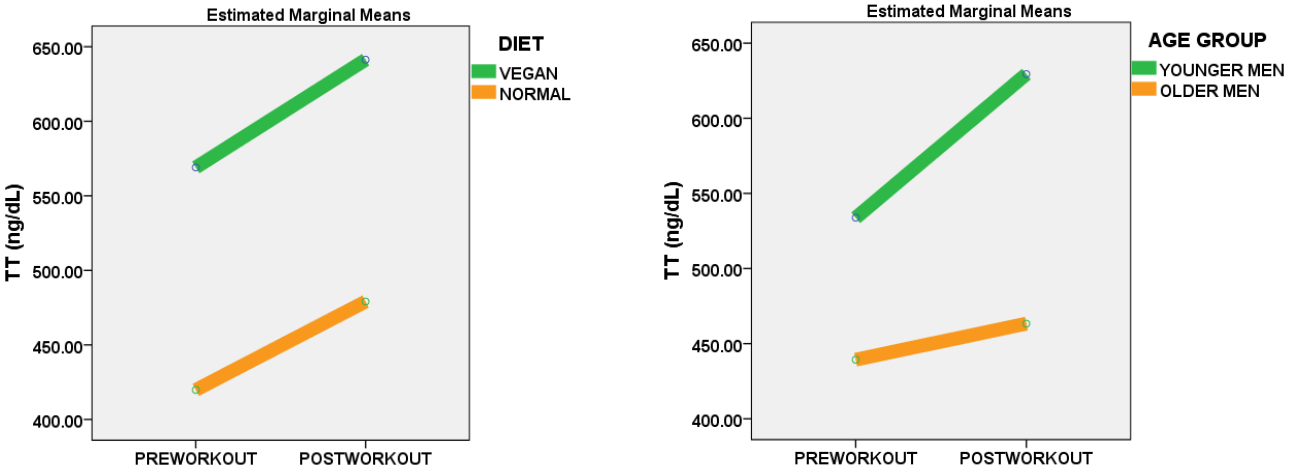

Figure 5. Estimated marginal means of TT responses of younger men (N=7) versus older men (N=5) with a statistically significant difference ($p<0.05$) between groups (left). Estimated marginal means of TT responses of vegans (N=6) versus meat eaters (N=6) with no statistically significant difference between groups (right)

Outliers

The outlier in the younger men's group (age=22) who had the least increase in TT (TTPRE=406.3 ng/dL, TTPOST=429.7 ng/dL) also exhibited an increase in C (CPRE=14900 ng/dL, CPOST=18470 ng/dL) and a decrease in T/C (T/CPRE=0.03 ng/dL, T/CPOST=0.02 ng/dL).

Meanwhile, the outlier in the older men's group (age=70) showed a decrease in both TT (TTPRE=813 ng/dL, TTPOST=803.3 ng/dL) and C (CPRE=71500 ng/dL, CPOST=58700 ng/dL), and an increase in T/C (T/CPRE=.11 ng/dL, T/CPOST=.14 ng/dL).

CONCLUSION AND DISCUSSION

The aim of this pilot study was to explore how men of different age groups and diets respond to a 30-minute, moderate-intensity weight training session designed to elicit maximal TT. To the author's knowledge, this is the first of its kind to compare meat eaters and vegans in terms of acute testosterone response to weight training.

It was observed that 11 out of 12 participants showed an increase in TT following weight training, and this was statistically significant within subjects; $t(11)=-3.842$, $p=0.003$. This supports several studies that found a single bout of high-volume hypertrophy scheme to be effective in increasing testosterone levels (Linnamo, Pakarinen, Komi, Kraemer & Hakkinen, 2005; Crewther et al., 2008).

To make sense of the performance of outliers, follow-up hormonal tests for C and T/C were done. Being the "stress hormone", C has long been used as an indicator of fatigue and catabolic nature of exercise. Hence, higher C would lead to a lower T/C which has been correlated with overtraining (Kargarfard, Amiri, Shaw, Shariat, & Shaw, 2018). Conversely, a higher T/C ratio indicates anabolic status and has been correlated with athletic performance (Majumdar & Srividhya, 2010).

Interestingly, the outlier in the young men's group (age=22) who exhibited the least TT increase also lifted the heaviest total weight and rated the protocol as "extremely hard" (RPE=19). The subject, a fitness coach and recreational powerlifter, reported a weight training experience of 10 years, and a lifting frequency of five times a week. Indeed, follow-up tests revealed that he had a corresponding increase in C and a decrease in T/C postworkout. It can be inferred that the minimal change in TT was mediated by fatigue.

A similar study on exercise-induced hormonal responses mentioned that across different protocols, total exercise stress may induce increases in C (Smilios, Tsoukos, Zafeiridis, Spassis & Tokmakidis, 2014). This provides an interesting take on the popular opinion of pushing one's limits during exercise. When the goal is increase in testosterone levels, it may help to keep the exercise intensity at moderate levels.

Meanwhile, the outlier in the older men's group and the oldest participant (age=70) who did not show an increase in TT was found to have a corresponding increase in both C and T/C. As his T/C ratio still increased, fatigue is less likely to be a cause of the decrease in TT. However, he rated the protocol as "very hard" (RPE=18). The subject, a retired senior, reported a weight training experience of one year and a lifting frequency of three times a week. However, he admitted that he rarely performs leg exercises.

In a similar study among older men (60-75 years old), acute increases in serum TT were not observed following the same resistance training protocol (Smith machine squat, 5 x

10RM, 2 minutes rest between sets) before the participants underwent a 24-week strength training program. However, after the 24-week training program, the same participants showed significant acute increases in TT (Häkkinen et al., 2002). It seems that training status mediates acute hormonal responses to exercise.

When it comes to diet, vegan men had consistently higher estimated marginal mean TT scores in both pretest and posttest compared to meat eaters. Diet was only almost significantly correlated with percentage increase in TT ($p=0.054$). A previous study found that a vegan diet was associated with higher TT levels compared to vegetarian and omnivore diets (Allen et al., 2000). Perhaps a significant result would have been achieved with a larger sample size.

In conclusion, a single session of 30-minute, moderate intensity, high-volume leg exercise can significantly increase blood serum TT across age groups and diets. Younger men tend to show greater increases in TT compared to older men. Further studies are needed to explore veganism as a more favorable diet for optimal testosterone levels.

Limitations

The current paper is a pilot study aimed at exploring various factors that can guide future studies. Hence, sample size was limited, and tests for C and T/C levels were done for the outliers only. Also, there was no control group, making the study more descriptive than experimental.

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ORIGINAL RESEARCH

Investigation of Sport High School Student's Attitudes Towards School

Abstract

Attitudes are the performative step of potential behaviors. They can give prior knowledge about behaviors to be exhibited in the future. Thus, they can be essential in providing foresight on testing the attitudes. It is important to know the sports students' attitude levels regarding the schools which provide education towards sports. In this research, it is aimed to examine the sports high school students' attitude regarding school. Research participants; 394 students who are studying at Sivas and Çorum Sports High Schools and are stated according to the convenience sampling method. Personal information form and "Attitude Regarding School Scale" which is developed by Adıgüzel (2012) are used to collect data. Besides, "t-test" and "one way ANOVA" tests are used to detect whether the difference between the attitudes according to the sportsmen's country, gender, class level they study, school preferance state and family wealth are important. Research significance level is accepted as $p<0.05$. As a result, significant difference is detected at these extents: only trust sub-dimension according to gender factor; value and adaption sub-dimensions according to class level factor; trust, value and adaption sub-dimensions according to school preferance state factor; value sub-dimension according to grade repetition factor; love and value sub-dimensions according to family wealth factor. From this point of view, attitude regarding school can be changed positively by organizing intramural and extrascholastic social activities with male and female students from different levels and from those who have negative or positive attitudes regarding school, or by providing activities for spending more time together.

Keyword: Sports, high school, school, attitude, student.

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INTRODUCTION

The school is a very important institution for communities where everyone can learn about the integrity and ease of life (Krishnamurti, 1994). It is very important how the students perceive the "school", where a significant part of human life passes while directing the human being (Arslan, 2006). The experiences of the students until their arrival in the school environment, the sensations they receive from their environment, the lives they observe in their family, friends and social circles affect their expectations and perspectives and attitudes towards the school and their future. All these factors can be classified as physiological, psychological, emotional, social, physical conditions, and can also be called as learning variables. These variables affect students' attitudes towards school positively or negatively (Gelişli, 2010).

Attitudes that are reported to have significant effects on students' educational attainment are defined as the tendency of the individual to react to this situation in a certain way according to Oppenheim (1994). The attitude towards the school reflects how well the students feel at school and their good and bad opinions about the school (Stern, 2012; Uyan 2012). Considering that students' attitudes towards school have a significant effect on educational outcomes, it is possible to give positive attitudes towards the school and to shape the attitudes towards the school by only determining the attitudes of the students towards the school (Slee, 1992). Developing a positive attitude towards school will contribute to the increase of students' school success. Accordingly, it is very important for the students to adopt, love and see the school as their own home in order to have a positive attitude towards the school. A positive school environment means a positive impact on student academic achievement (Alıcı, 2013). The school is an important place and an important turning point in terms of both academic and social development of individuals. In addition, thanks to their positive attitudes towards the school, students can achieve the deserved and desired achievements, and their positive attitudes can influence their important decisions about their future educational field (Gürbüz & Kışoğlu, 2007). In this respect, it is important how the students' attitudes towards school are reflected in sports high schools where sports education is given. Attitudes are the pragmatic steps of possible behaviors. They can give preliminary information about future behavior. Therefore, measurement of attitudes may be important in terms of providing foresight for the situations to be encountered. Determining the attitudes of students attending sports high schools increases the importance of the research in terms of their contribution to the literature.

METHOD

The Model of the Research

Descriptive scanning model, which is one of the quantitative research methods, was used in the study. An existing situation is tried to be described as it is in the research model (Karasar, 2009). The survey model is a model that can be used without affecting the existing processes in the institutions of the research sample during the study. An advantage of the screening model is that it can be used without disturbing the existing order in the research institution and without administrative difficulties for the personnel of the institution (Kaptan, 1999).

Participants

The population of the study consisted of students of sports high schools in Turkey. There are a total of 17 554 sports high school students in Turkey according to the Ministry of

Education 2019 data. The sample of the study included 394 sports high school students considering Krejcie and Morgan's (1970) sample determination table. The participants of the study were determined by the convenience (appropriate) sampling method among the students studying in Sivas and Çorum sports high schools. The demographic characteristics of the students participating in the research are given in Table 1.

Table 1: Personal Information of the Students Participating in the Research

Personal Information	**Variables**	**f**	**%**
Province	Sivas	237	60.2
	Çorum	157	39.8
Gender	Female	138	35
	Male	256	65
Class of study	9th grade	101	25.6
	10th grade	101	25.6
	11th grade	94	23.9
	12th grade	98	24.9
School preference	I preferred	376	95.4
	My family preferred	12	3.0
	I couldn't score another school	6	1.6
Repetition status	Yes	23	5.8
	No	371	94.2
Family welfare status	Middle	152	38.6
	Good	163	41.4
	Very good	79	20.0
Total		394	100

According to Table 1, the participants of the study consisted of 394 high school students. 237 (60,2%) of these students were from Sivas Sports High School and 157 (39,8%) students were Çorum Sports High School. 138 (35%) of the participants were females and 256 (65%) of the participants were males. 101 (25,6%) of the participants were in the 9th grade, 101 (25,6%) of the participants were in the 10th grade, 94 of the participants (23,9%) were in the 11th grade and 98(24,9%) of them were in the 12th grade. 376 (95.4%) of the students who participated in the study stated that they preferred the school themselves, 12 (3.0%) stated that their parents made the preference, and 6 (1.6%) stated that their score was not enough for another school. 23 (5.8%) of the students who participated in the research stated that they did grade repetition and 371 (94.2%) said they did not repeat the grade. 152 (38.6%) of the participants evaluated their welfare status as moderate, the welfare of 163 (41.4%) students were good and the welfare of 79 (20.0%) students were very good.

Data Collection

Personal information form and School Attitude Scale were used as data collection tools. The School Attitude Scale developed by Adıgüzel (2012) consists of 21 items and four sub-dimensions. There are 14 positive and 7 negative items in the dimensions of Trust, Love, Value and Harmony. The Cronbach's Alpha value for the total of the scale was .86. The higher the total score, the more positive the attitude towards the school and the lower the negative. Data collection tools were applied to the participants person to person. In order to collect the data, necessary permissions were obtained from the official institutions and parents of the students under the age of 18 with the Parental Permit Certificate. The data of the study were collected in the spring semester of the 2018-2019 academic years.

Statistical Analysis of Data

SPSS 22 program was used for statistical analysis of the obtained data. Kolmogorov-Smirnov test was used to determine whether the data showed normal distribution. When the skewness and kurtosis values were examined, it was found that the data showed normal distribution. Independent Sample T-Test and One Way ANOVA tests were used to determine whether the scale scores differed between the groups in the demographic data of the participants. LSD test from Post-Hoc tests was used for binary comparisons. Significance level was accepted as $p < 0.05$. The demographic data of the individuals were determined by frequency analysis.

FINDINGS

Independent samples T-Test was used in order to determine the differences of the attitudes of the participants towards school according to gender.

Table 2. Evaluation of School Attitudes by Gender

Lower dimension	Gender	n	$\bar{x}$	ss	t	p
Confidence	Female	138	16.19	3.66	2.26	.024*
	Male	256	15.36	3.41	2.21	
Love	Female	138	14.85	3.17	0.40	.684
	Male	256	14.71	3.21	0.40	
Value	Female	138	15.10	3.73	0.61	.541
	Male	256	14.85	3.96	0.62	
Harmony	Female	138	9.93	3.51	1.24	.213
	Male	256	9.48	3.30	1.22	

*p < .05

When Table 2 was examined, it was observed that there was a significant difference ($p < 0.05$) between the gender and the sub-dimensions of the students, while there was no significant difference in the other dimensions ($p > 0.05$). The mean attitude scores of female students in the trust dimension (16.19) were higher than male students (15.36). An analysis of variance was performed to determine the differences between the attitudes of the participants towards the school level.

Table 3. Evaluation of School Attitudes According to Class Level

Sub- dimension	Grade	n	$\bar{x}$	ss	f	p	LSD
Confidence	9th grade	101	15.53	3.45	1.623	.184	-
	10th grade	101	15.62	3.28			
	11th grade	94	15.17	2.77			
	12th grade	98	16.27	4.34			
Love	9th grade	101	15.18	2.76	.969	.407	-
	10th grade	101	14.43	3.21			
	11th grade	94	14.69	3.40			
	12th grade	98	14.72	3.36			
Value	9th grade	101	16.27	3.73	7.333	.000*	11<10<12<9
	10th grade	101	14.51	3.77			
	11th grade	94	13.82	3.36			
	12th grade	98	15.08	4.22			
Harmony	9th grade	101	11.27	2.89	14.646	.000*	11<12<10<9
	10th grade	101	9.50	3.08			
	11th grade	94	8.26	2.85			
	12th grade	98	9.43	3.92			

*p < .05

When Table 3 is examined, it is seen that there is a significant difference between the students' grade levels and sub-dimensions scores in the Value and Adaptation sub-dimensions, while there is no significant difference in the other sub-dimensions (p>0.05). LSD test was applied to determine the level of significant differences in the Value and Harmony sub-dimensions. When we compare the sub-dimensions in binary, Value sub-dimension shows differences between 9th grade and 10th grade, between 9th grade and 11th grade, between 9th grade and 12th grade, and between 11th grade and 12th grade, but at the other grade levels no difference is seen. When we examine the sub-dimension, there are significant differences between 9th grade and 10th grade, between 9th grade and 11th grade, between 9th grade and 12th grade, between 10th grade and 11th grade, and between 11th and 12th grade. There are no significant differences in other grade levels. The difference is in favor of 9th grade.

Variance Analysis was conducted to determine the differences between the attitudes of the participants towards the school preference.

Table 4. Evaluation of School Attitude According to School Preference

Sub-dimension	O.T.D	n	$\bar{x}$	ss	f	p	LSD
Confidence	I Prefer	376	15.72	3.39	14.755	.000*	My Score Was Not Enough for Another School <I Prefer <My Family Preferred
	My Family Preferred	12	16.98	3.43			
	I Didn't Score Another School	6	8.36	4.36			
Love	I Prefer	376	14.78	3.14	3.503	.031*	My Score Was Not Enough for Another School <I Prefer <My Family Preferred
	My Family Preferred	12	15.66	4.45			
	I Didn't Score Another School	6	11.58	2.26			
Value	I Prefer	376	15.06	3.76	11.380	.000*	My Score Was Not Enough for Another School <My Family Preferred<I Prefer
	My Family Preferred	12	14.88	4.06			
	I Didn't Score Another School	6	7.63	4.32			
Harmony	I Prefer	376	9.66	3.33	8.800	.000*	My Score Was Not Enough for Another School <I Prefer <My Family Preferred
	My Family Preferred	12	11.52	3.50			
	I Didn't Score Another School	6	4.62	0.91			

*p < .05

When Table 4 is examined, it is seen that there is a significant difference between the preference of these schools and the scores of their sub-dimensions in all sub-dimensions (p>0.05). The LSD test is used to compare the differing sub-dimensions. When we compare the sub-dimensions in pairs, there are differences between the Trust, Love and Harmony sub-dimensions, I preferred and I did not have enough scores for another school sub-dimensions, My parents preferred and I did not have enough scores for another school sub-dimensions. There is no difference between the other situations. The differences were in favor of the situation that my family preferred. In the value sub-dimension, there are significant differences between I preferred and my parents preferred, I preferred and I did not have enough points for another school, My family preferred and I did not have enough points for another school sub-dimensions. There is no difference between the other situations. The differences were in favor of the case I preferred.

An independent sample T-test was used to determine the differences in the attitudes of the participants towards the school according to class level.

Table 5. Evaluation of School Attitudes According to Repetition Status

Sub-dimension	S.T.Y.D	n	$\bar{x}$	ss	t	p
Confidence	Yes	23	15.89	3.63	0.34	.734
	No	371	15.64	3.52	0.33	
Love	Yes	23	15.54	3.93	1.20	.228
	No	371	14.71	3.14	0.99	
Value	Yes	23	13.37	3.33	2.00	.046*
	No	371	15.03	3.89	2.29	
Harmony	Yes	23	9.10	3.69	-.78	.435
	No	371	9.67	3.36	-.72	

*p < .05

When Table 5 is examined, it is seen that there is a significant difference in Value dimension between students' repetition status and sub-dimensions scores, while there is no significant difference in other dimensions (p>0.05). The significant difference in the value sub-dimension was in favor of those who did not repeat the grade.

Variance Analysis was conducted to determine the differences between the attitudes of the participants towards school according to their family welfare status.

Table 6. Evaluation of School Welfare According to Family Welfare Status

Sub- dimension	A.R.D	n	$\bar{x}$	ss	f	p	LSD
Confidence	Medium	152	15.47	3.50	.342	.710	
	Good	163	15.72	3.45			
	Very good	79	15.85	3.72			
Love	Medium	152	14.41	3.64	4.264	.015*	Medium<Good<Very Good
	Good	163	14.64	2.98			
	Very good	79	15.67	2.44			
Value	Medium	152	14.07	4.00	6.372	.002*	Medium<Very Good<Good
	Good	163	15.50	3.77			
	Very good	79	15.45	3.58			
Harmony	Medium	152	9.43	3.38	1.470	.231	
	Good	163	9.56	3.40			
	Very good	79	10.21	3.30			

*p < .05

When Table 6 is examined, there is a significant difference between the scores of the families' welfare status and sub-dimensions of the students in the Love and Value sub-dimensions, while there is no significant difference between the other sub-dimensions (p>0.05). LSD test is used to compare the scores in the Love and Value subscales dually. When the sub-dimensions are compared in binary, there is a significant difference between the level of moderate welfare in the Love sub-dimension and the level of very good welfare, and between good welfare and very good welfare. There is no significant difference between other family welfare states. In the value sub-dimension, there is a significant difference between the middle welfare and good welfare status and between the middle welfare and very good welfare status, but there is no significant difference between other family welfare states. Differences are found to be in favor of moderate welfare status.

DISCUSSION AND CONCLUSION

In this study, students' attitudes towards school were evaluated in terms of various variables. When the attitudes of the students towards the school were taken into consideration, it was seen that the attitudes of the students were moderate.

In this study, it was determined that female students' attitudes towards school were higher than male students. According to Eichorn and Adams (1995), male students have more school attitude difficulties than female students. This is due to the fact that male students need a higher level of independence than girls in adolescence, which makes them slightly lower in attitude. There are similar studies in the literature with research findings (Berberoğlu & Balcı, 1994; Ramey, Lanzi, Phillips & Ramey 1998; Sözbilir, Akıllı & Ozan, 2010; Adıgüzel & Karadaş, 2013; Nergiz, 2018). On the other hand, results that are not similar to the findings of the research (Gülcemal, 2019; Çetin, 2017) are also included.

When the attitudes according to grade level were examined, it was seen that the attitudes of 9th grade students towards school were higher than the other grade levels. The reason for this situation may be that as the class level increases, boredom from the school and the deterioration of the attitude with the departure from school due to the increase in school problems. There are similar studies in the literature with research finding. (Gülcemal, 2019; Berberoğlu & Balcı, 1994; Balcı, 2001; Mokk & Flyyn, 2002; Durmuş, 2010; Alıcı, 2013; Nergis, 2018). Similar studies were also found according to the grade level variable. On the other hand, results that are not similar to the findings of the research (Gün, 2018; Çetin, 2017) are also included.

When the attitude according to school preference was examined, it was found that there was a significant difference between the scores of the sub-dimensions. The reason for this situation is that students make a decision in line with their own wishes and when this decision is supported by their family, it is thought that they will adapt to their environment more quickly. In the study conducted by Çetin (2017), it was found that there was a significant difference between school preferences and attitudes towards school, while there was no significant difference between school preferences and sub-dimensions. There have been other studies which do not show similarity in terms of school preference (Durmuş 2010; Adıgüzel & Karadaş, 2013).

According to the results of the research, it was determined that there was a significant difference between the scores of the repeating status and sub-dimensions. The reason for this situation is that the students who repeat the class can see themselves as unsuccessful and worthless, and as a result of this, it is thought that they have difficulty in adapting to their environment. When the literature was reviewed, no similar studies were found. Durmuş (2010), on the other hand, found no significant difference between students' adaptation to school according to the repetition variable. In the study conducted by Çetin (2017), it was observed that there was no significant difference between students' repetition status and scores of the school adaptation sub-dimensions.

According to the results of the study, there was a significant difference between family welfare status and scores of love and value sub-dimensions, but not significant differences in other sub-dimensions. There are studies showing that low level of family welfare is associated with school problems, adjustment disorder, emotional difficulties and disruptive behavior disorders (Işıklar, Bilgin & Bilgin, 2015). It is thought that due to these economic problems, students have difficulty adapting to their environment. There are similar studies

in the literature with research findings. (Gülcemal, 2019; Özdemir, 2012) On the other hand, it is possible to come across results that do not resemble the research findings (Adıgüzel & Karadaş, 2013; Çetin, 2017).

CONCLUSIONS AND RECOMMENDATIONS

As a result, there is a significant difference between gender and attitudes towards school. Female students have higher attitudes towards school. There is a difference between class levels and attitudes towards school. This difference is in favor of the students in the lower classes. There is a difference between school preference and school orientation. Students who choose themselves and those who choose these schools have higher school attendance. There is a difference between repetition and attitudes towards school. Students who do not repeat grade have higher attitudes towards school. There is a difference between family welfare and attitudes towards school. Students with good family welfare status have higher adaptation.

Various activities and interviews can be conducted to improve male students' attitudes towards school. It is recommended that the stimulants that reduce male students' adjustment to school relationships should be investigated in wide-ranging studies. Seminars and social and cultural organizations can be organized with the common participation of the classes in order to reduce differences in attitudes towards the school. In particular, events and activities can be organized to increase the attitudes of 11th and 12th grade students towards school. Information and awareness-raising activities for students and parents can be carried out by experts or guidance counsellors about what kind of problems can be caused by school repeatability problems. In order to increase the adaptation of the students to the school, it may be considered to involve them in the decision-making process in the activities to be done in the school. The same study can be done with a larger sample and the results can be gained in the literature. An experimental study on school attitudes can be used to investigate differences in students.

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