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THE ASSOCIATION BETWEEN SWIMMING EDUCATION-RELATED ANTHROPOMETRIC VARIABLES AND COMPETITIVE ANXIETY AMONG TURKISH ELITE STUDENT ATHLETES

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ABSTRACT

The objective of this study was to examine whether competitive state anxiety in elite student-athlete swimmers is associated with their years of sports experience and/or with the anthropometric measurements of the participants. The demographic data, including the gender, age, and years of sports experience of the student-athletes, were gathered using a self-report questionnaire. The Competitive State Anxiety Scale-2 (CSAI-2) was used to measure the student-athletes' feelings of competition anxiety. Anthropometric measures included height, weight, BMI, body fat percentage; muscle mass, as well as somatotype components. There were no statistically significant relationships between competition anxiety and sports experience and ectomorphy component values, regardless of gender ($p>.05$). Similarly, no significant relationship were observed between the competition anxiety scores of either male and female swimmers and height, weight, BMI, body fat percentage, muscle mass and mesomorphy or endomorphy component values. As a result, this study found that the competitive anxiety of elite student-athlete swimmers was not related to either their years of experience in sports or their anthropometric characteristics.

Keywords: Swimming education, student athlete, competitive anxiety, CSAI-2, anthropometry.

INTRODUCTION

The World Health Organization has reported that 264 million people around the world live with anxiety disorders (WHO, 2017), a statistic that reflects the prevalence of anxiety among individuals of all ages and from all walks of life. Anxiety is defined as an emotion consisting of unpleasant thoughts and feelings, possibly inducing physical changes, and may occur in response to a situation or stimulus perceived as threatening or dangerous (Raglin, 2004). Anxiety may also encompass feelings of boredom, a sense of insecurity, a state of excitement, or the possibility of danger emanating from the outside world, or indeed any situation deemed threatening (Hartocollis, 1972). In cases of anxiety, the individual is alert, and feels as if something bad is going to happen; accordingly, the individual may experience chest pain, palpitations, and/or shortness of breath, and feels worried or unable to deal with the perceived threat (DiTomasso, Freeman, Carvajal & Zahn, 2009). Based on research findings, anxiety has been divided into two types: “state anxiety” and “trait anxiety”. “State anxiety” is characterized by a temporary emotional state, subjective tension, and feelings of fear, whereas “trait anxiety” exists in the individual, and is the intensification and continuity of “state anxiety” (Spielberger et al., 1972).

Anxiety may adversely affect multiple aspects of an individual's life, including physical activity or sports. Although there are numerous psychological variables influencing athletic performance, anxiety is considered the one with the greatest impact (Ford, Ildefonso, Jones & Arvinen-Barrow, 2017). The negative effects of anxiety on sports performance present as reduced cognitive resources on the part of the athlete, narrowing of the visual field, decreased motivation, and/or contraction of opposing muscle groups, which may cause physical injury or impair coordination (Raglin, 2004). Although a certain level of anxiety is considered necessary for normal functioning, as anxiety levels increase beyond a certain point, athletic performance maybe negatively affected (Ford et al., 2017; Fullerton, 2010; House & Stark, 2002; Mottaghi, Atarodi & Rohani, 2013). Determining which factors will prevent athletes from succeeding in competitive environments is necessary to ensure optimal outcomes (Durand-Bush & Salmela, 2002; Hanton, Fletcher & Coughlan, 2005). Athletes' concerns regarding their own success (and that of their team, where applicable) may cause considerable anxiety, especially during competition season (National Collaborating Centre for Mental Health, 2013). Today, athletic performances are evaluated according to the criteria of excellence imposed not only by a sports' adjudicating body but also by society; thus, athletes are regularly exposed to a stressful environment and under external pressures inherent to the competitive nature of sports. While the expectations of coaches, teammates, families, and sponsors constitute an extra source of stress for athletes, such expectations also spur scientific research into improving performance by reducing anxiety levels (Mottaghi et al., 2013; Schaal et al., 2011; Weathington, Alexander & Rodebaugh, 2010). Anxiety is an integral part of the sports environment because a sport by its very nature is competitive, and the best performance wins. Although the competitive environment of sports may be anxiety-inducing for some athletes, it may be neutral for some, and even enjoyable for others (Raglin, 2004). Therefore, much research has been conducted on the subject of how anxiety affects performance in competitive sports environments (Ford et al., 2017). While high levels of anxiety

in sports have been shown to negatively affect performance, and may even lead some athletes to abandon competitive sports altogether, other studies have indicated that in some cases anxiety may actually improve performance (Eysenck, Derakshan, Santos & Calvo, 2007; Hanin, 2007; Kleine, 1990; Raglin, 2004).

Various self-reporting data collection tools have been developed to measure the anxiety levels of athletes in terms of negative reaction to competitive stress factors of sports, such as physical preparedness, level of the opposition, team camaraderie, the nature of the competition, and social assessment. One of these tools is the frequently-used State-Trait Anxiety Inventory (STAI), which was developed to determine an individual's state-trait anxiety level outside of the sports environment (Spielberger, Gorsuch, Lushene, Vagg & Jacobs, 1983). However, due to criticisms that STAI does not reveal anxiety related to the sports environment, various sports-specific tools for evaluating anxiety have been developed and used by researchers. One such tool focusing on how the athlete feels in the competitive environment is the Sport Competition Anxiety Test (SCAT; Martens, 1977). Another frequently used tool is the Competitive State Anxiety Inventory-2 (CSAI-2; Martens, Burton, Vealey, Bump & Smith, 1990). The CSAI-2 scale has been employed internationally to assess competition anxiety in sport psychology research (Bartholomeu, Montiel & Machado, 2014; Boudhiba, Moalla, Arfa & Kridis, 2015; Hashim & Zulkifli, 2010; Iosifidou & Doganis, 2001; Lundqvist & Hassmen, 2005).

In the literature, various factors affecting competition anxiety have been identified. Gender is one variable that significantly impacts the competition anxiety level of the athlete. Some studies have reported higher levels of competition anxiety in female athletes compared to men (Hussain, Khan & Ali, 2016; Parnabas & Mahamood, 2010; Wolf, Eys & Kleinert, 2013), while others have found that male athletes experience higher levels of competition anxiety (Arbinaga-Ibarzabal, 2013; Hagan, Pollmann & Schack, 2017). Still other studies have shown no difference between the anxiety levels of female and male athletes (Bazancir, Beydagi & Talu, 2018; Grossbard, Smith, Smoll & Cumming, 2009; Milavic, Jurko & Grgantov, 2013; Modrono & Guillen, 2011; Sharma, 2018).

Researchers have also examined the influence of the number of years of sports experience of athletes on competition anxiety. The results of these studies indicated that more experienced athletes are able to overcome stressful situations during competition by practicing certain mental skills and the acquisition and successful application of these skills increases with experience (Mellalieu, Hanton & O'Brien, 2004). In other words, sports experience was found to have a positive effect on reducing competitive anxiety. In addition to these findings, however, there are also studies showing that experience does not affect an athlete's level of competition anxiety. In one study conducted with wrestlers, there was no difference between experienced and less experienced athletes in terms of competition anxiety (Gould, Horn & Spreemann, 1983). Similarly, Gould, Petlichkoff, and Weinberg (1983) revealed that there was no significant difference in the competition anxiety levels of experienced and less experienced female high school volleyball players. In a study conducted with female gymnasts at the high school level, anxiety levels were not related to the years of experience of the athletes (Matheson & Mathes, 1991). Investigating the anxiety levels of elite female basketball players, Guillen

and Sanchez (2009) also reported that their competitive anxiety levels did not differ based on their athletic experience.

Few studies in the literature have investigated the relationship between athletes' physical and anthropometric characteristics and competition anxiety. In one such study, Zaccagni et al. (2019), examining the anthropometric, genetic, and psychological characteristics of female and male sprinters reported that the relationship between competition anxiety and anthropometric features varied depending on gender. They also found an inverse relationship between the leg lengths and competition concerns of female athletes: as the athletes' leg lengths increased, their anxiety levels decreased. In another study, Hreinsdottir (2019) examined the relationship between anthropometric measurements, physical fitness levels, and the psychological status of elite female basketball players. No significant relationship between anthropometric measurement values, physical fitness test results, and psychological factors, including anxiety were reported.

As revealed by the literature review, research on the relationship between gender, athletic experience, anthropometric features, and competition anxiety, has not produced definitive results. Therefore, the objective of this study is to examine whether there is a relationship between sports experiences, selected anthropometric variables and competitive anxiety among elite student swimmers.

METHOD

Research Design

This quantitative study was conducted using a descriptive and correlational design. Correlational research is a non-experimental research where the researcher measures two or more variables and evaluates the statistical relationship between them with little or no effort to control external variables (Fraenkel, Wallen & Hyun, 2011).

Participants

The study participants included 161 competitive elite student-athlete swimmers (47% female, 53% male) who competed in the Turkish National Championship and regularly train at least 3 days per week. The average age of the female swimmers was 15.31 years ($SD= 1.43$) while that of the males was 15.96 years ($SD= 1.06$). Additional information on the study participants is presented in Table 1.

Table 1. Data on the Study Participants

	Gender			
	Female (n= 76)		Male (n = 85)	
	\bar{x}	SD	\bar{x}	SD
CSAI-2 score	64.13	5.94	62.68	4.37
Years of sports experience	8.43	2.93	8.71	2.56
Height	1.66	.06	1.75	.07
Weight	57.82	7.01	66.85	7.43
BMI	21.03	1.80	21.82	1.69
Body fat percentage	17.45	3.35	13.26	2.72
Muscle mass	38.84	4.82	40.49	4.98
Ectomorphy score	2.85	0.96	3.02	0.88
Mesomorphy score	2.84	0.89	3.43	1.75
Endomorphy score	3.42	0.63	2.62	0.65

Data Collection Instruments

A demographic information form was created and administered to collect data on age, sex, and years of sports experience. The study also involved measurements of anthropometric parameters including height, weight, body mass index (BMI), body fat percentage (%), and muscle mass, and ectomorphy, mesomorphy, and endomorphy component values.

The Competitive State Anxiety Scale-2 (CSAI-2) was used in the present study to assess the pre-competition anxiety levels of the student-athlete swimmers. The CSAI-2 (English version), originally developed by Martens et al. (1990), was translated into Turkish and validated by Koruç (1998). The CSAI-2 consists of a total of 27 items scored according to a 4-point Likert-type scale ranging from 1 (not at all) to 4 (very much). The total scores for the CSAI-2 were obtained from the sum of the scores of the 27 items and ranged from 27 to 108, with the higher scores indicating greater competitive anxiety. Martens et al. (1990) and Koruç (1998) reported a sufficiently high degree of internal consistency for the original and Turkish versions of the CSAI-2. The Cronbach's alpha coefficient for the current study was .87.

Data Collection Procedures

Prior to the start of the study, all of the trainers and potential student-athlete swimmers were informed regarding the objective and methods of the study as well as the measurements to be taken. All student-athlete swimmers read and signed the informed consent form before data collection was begun. Ethical approval for this research was granted by the Social and Humanities Ethics Committee of Van Yüzüncü Yıl University.

The student-athlete swimmers' body weights were measured using a scale (accurate to ± 100 g), height measurements were made using a Holtain brand stadiometer (accurate to ± 1 mm), and BMI was calculated by dividing the weight in kilograms by the square of the height in meters. In order to ensure accurate measurements, the student-athlete swimmers were in their bare feet for height measurements and wore their

swimsuits for weighing. Anthropometric measurements were carried out prior to competition and in accordance with the guidelines of the Anthropometric Standardization Reference Manual (ASRM) and International Biological Programme (IBP) (Weiner & Lourie 1969; Tanner et al., 1969). Skinfold thickness (biceps, triceps, subscapular, suprailiac, forearm, and thigh) were measured using a Holtain skinfold caliper, limb circumferences (biceps, forearm, thigh, and calf) were measured in cm with an inelastic measuring tape, and the diameter measurements (in mm) were taken using a Holtain anthropometer set. The anthropometric measurement results were entered into the Siri formula for body fat percentage and the Matiegka formula for body mass percentage (Rech, 2012; Cattrysse, 2002). In addition, the Heath-Carter method was used to determine the somatotype component values (Carter, Carter & Heath, 1990).

Data Analysis

Because the variables investigated were not normally distributed, nonparametric statistical analysis was employed. The Mann-Whitney U test was applied to determine whether the mean values for the study variables (CSAI-2 score; years of sports experience; height; weight; BMI; body fat percentage; muscle mass; ectomorphy; mesomorphy; endomorphy scores) differed significantly between the female and male student-athlete swimmers. Spearman correlation was also applied to detect relationships between the CSAI-2 scores and the other study variables (years of sports experience; height; weight; BMI; body fat percentage; muscle mass; ectomorphy; mesomorphy; endomorphy scores).

FINDINGS (RESULTS)

No significant differences in CSAI-2 scores ($U= 2785.50, p>.05$), years of sports experience ($U= 2305.00, p>.05$) and ectomorphy measures ($U= 2863.00, p>.05$) between female and male student-athlete swimmers were found. There were, however, significant differences between the two genders with respect to height ($U= 953.00, p<.05$), weight ($U= 1167.00, p<.05$), BMI ($U= 2416.00, p<.05$), body fat percentage ($U= 993.00, p<.05$), muscle mass ($U= 2185.50, p<.05$), mesomorphy ($U= 2385.50, p<.05$), and endomorphy component values ($U= 1188.50, p<.05$). The results of the comparisons are shown in detail in Table 2.

Table 2. Comparison of Female and Male Student-Athlete Swimmers in Terms of the Study Variables

	Female		Male		U	z	p
	Mean Rank	Med.	Mean Rank	Med.			
CSAI-2 score	86.85	64.13	75.77	62.68	2785.50	-1.51	.13
Years of sports experience	75.38	8.00	86.03	9.00	2305.00	-2.96	.14
Height	51.04	1.65	107.79	1.74	953.00	-7.72	.001
Weight	53.86	57.35	105.27	66.30	1167.00	-6.99	.001
BMI	70.29	21.20	90.58	21.90	2416.00	-2.76	.01
Body fat percentage	110.43	17.00	54.68	12.80	993.00	-7.58	.001
Muscle mass	67.26	34.40	93.29	41.50	2185.50	-3.54	.001
Ectomorphy score	76.17	2.90	85.32	3.00	2863.00	-1.24	.21
Mesomorphy score	69.89	2.90	90.94	3.30	2385.50	-2.86	.004
Endomorphy score	107.86	3.50	56.98	2.50	1188.50	-6.92	.001

Since the differences between the female and male student-athlete swimmers with regard to CSAI-2 scores, years of sports experience, and ectomorph component values were not statistically significant, the female and male data were not separated when examining the relationships between CSAI-2 scores and years of sports experience and ectomorphy component values. There were no significant correlations between CSAI-2 scores and years of sports experience ($r_s(161) = .08, p < .05$) or ectomorphy component values ($r_s(161) = -.05, p < .05$). Spearman's rank-order correlation tests between CSAI-2 and the other study variables were performed separately for the female and male student-athlete swimmers since the Mann-Whitney U test results found significant differences between the females and males in terms of height, weight, BMI, body fat percentage, muscle mass, and mesomorphy and endomorphy component values. The results of the Spearman's rank-order correlation analysis indicated no statistically significant correlations between CSAI-2 scores and height ($r_{s_{female}}(76) = -.02, p = .89; r_{s_{male}}(85) = -.06, p = .60$), weight ($r_{s_{female}}(76) = .02, p = .86; r_{s_{male}}(85) = .03, p = .79$), BMI ($r_{s_{female}}(76) = .01, p = .94; r_{s_{male}}(85) = .08, p = .49$), body fat percentage ($r_{s_{female}}(76) = .13, p = .28; r_{s_{male}}(85) = .14, p = .20$), muscle mass ($r_{s_{female}}(76) = .09, p = .44; r_{s_{male}}(85) = -.10, p = .39$), mesomorphy ($r_{s_{female}}(76) = .07, p = .55; r_{s_{male}}(85) = .13, p = .23$), or endomorphy component values ($r_{s_{female}}(76) = .18, p = .13; r_{s_{male}}(85) = .09, p = .43$). Table 3 presents the Spearman's correlation coefficients between the variables considered in the study.

Table 3. Spearman's Correlation Coefficients Between the Study Variables

Study variables	CSAI-2 score (N= 161)	
Years of sports experience	.08	
Ectomorphy score	-.05	
	CSAI-2 score	
	Female (n= 76)	Male (n= 85)
Height	-.02	-.06
Weight	.02	.03
BMI	.01	.08
Body fat percentage	.13	.14
Muscle mass	.09	-.10
Mesomorphy score	.07	.13
Endomorphy score	.18	.09

DISCUSSION

The present study revealed no significant difference between the CSAI-2 scores of male and female student-athlete swimmers. This finding is, to some extent, consistent with results published in previous studies. The literature is not without discrepancies, however; some studies have reported that the pre-competition anxiety levels of men were higher than those of women, while other studies found the exact opposite (Kurimay, Pope-Rhodus & Kondric, 2017; Stenling, Hassmen & Holmström, 2014). Considering the aforementioned research findings, we cannot yet make a definitive statement regarding gender differences with respect to pre-competition anxiety. In one study with results similar to our own, Kolayis and Sari (2011) compared various psychological parameters of male and female judoists who participated in the Senior Turkish Judo

Championship; they found no difference between the two groups in terms of competitive anxiety. Modrono and Guillen (2011), in their study on professional and amateur windsurfers, also detected no significant difference in competitive anxiety levels between men and women. Similarly, Hussain, Zaman, and Idris (2014) examined the pre-competition anxiety levels of college athletes between the ages of 16-27 in various branches of sport and found no difference between the two genders. In the present study, male and female student-athlete swimmers are thought to present with similarly moderate anxiety levels because they compete at the same high level. Both female and male athletes train hard in their sports until they reach a competitive stage, and hence anxiety levels are believed to be similar due to their comparable training schedules (Modrono & Guillen, 2011).

The results of this study revealed no significant relationship between the student-athlete swimmers' competitive anxiety levels and years of sports experience. There are, however, some studies in the literature indicating the existence of a relationship between competitive anxiety and years of sports experience (Hanton, Neil, Mellalieu & Fletcher, 2008; Matheson & Mathes, 1991). These studies have reported that athletes with fewer years of experience have more problems with self-confidence and higher competitive anxiety levels (Fernandes, Nunes, Raposo & Fernandes, 2014; Guillen & Sanchez, 2009). The reason for the lack of a relationship between competitive anxiety and years of sports experience in the present study may be due to the fact that these student-athlete swimmers participate in top-level competitions, in which all participating athletes have achieved similar skill levels (Mellalieu, Hanton & O'Brien, 2004). Researchers examining the competitive anxiety levels of players on the Turkish women's national volleyball team found no relationship between these elite players' competition anxiety and years of sports experience (Başoğlu & Şekeroğlu, 2016). A study by Aşçı and Gökmen (1995) investigated the relationship between Turkish women handball players' competition anxiety, success, sports experience, and athletic competence. The researchers determined that there was no significant relationship between the athletes' competition anxiety and sports experience.

The data gathered in the current study also demonstrated that no relationship existed between the anthropometric measurements (height, weight, BMI, body fat percentage, muscle mass and mesomorphy, endomorphy, and ectomorphy component values) and the competitive anxiety levels of the female and male student-athlete swimmers. These findings are consistent with those of earlier studies. In one such study, Oliveira Silva, Silva, Cunha, and Foster (2018) examined the relationships between various physical fitness parameters (heart rate variability, BMI, body fat, aerobic capacity) and competitive anxiety levels of cyclists. Based on their findings, the authors concluded that some of the physical fitness parameters (BMI, body fat) did not correlate with the participants' anxiety levels. In another study, Hreinsdottir (2019) analyzed the physical fitness and psychological factors of elite female basketball players, a sport requiring both physical and mental endurance, and determined that there was no significant relationship between the variables. Another group of researchers examined the physical, physiological, and psychological determinants of rock climbing ability; they also found no relationship between competitive anxiety and the ability levels of male and female rock climbers (MacKenzie, Monaghan, Masson, Werner, Caprez, Johnson & Kemi, 2019). In another recent study, Zaccagni et

al. (2019) investigated whether there is a relationship between the performance of sprinters and their anthropometric, genetic, and psychological characteristics; the researchers found that the relationship between anthropometric and psychological features was gender-specific. Researchers have also demonstrated an inverse correlation between the performance of sprinters and leg length, the anteroposterior distance from the heel to the first metatarsal head, and competitive state anxiety (Zaccagni et al., 2019). Proceeding from the theory that shooting requires muscle control and endurance, Arumugam and Shaju (2019) aimed to determine whether there is a relationship between anxiety, muscle strength, and muscle stability of athletes who have been shooting at least one year, but found no significant relationship found between these variables. Martinez-Rodriguez and Roche (2017) compared the body weights and competitive anxiety levels of university athletes, who comprised two different nutrition groups, and reported that the competitive anxiety levels of athletes who lost weight and experienced an improvement in body composition were lower compared to the group that did not show any improvement in terms of fat mass. Turkish researchers examined the relationship between competitive anxiety levels and exam performance of Maritime Faculty students who took a physical proficiency exam, finding no statistically significant relationship between the students' BMI and competitive anxiety levels (Çakır, Kalkavan, Işık & Kayhan, 2019). Conversely, in their study with Turkish female handball players, Aşçı and Gökmen (1995) reported a statistically significant relationship between competition anxiety and perceived athletic competence, as athletes who were confident in their athletic competence exhibited low levels of competition anxiety. The researchers also revealed that the level of competition anxiety of the athletes with high perceived athletic competence was higher than that of athletes with a low perception of their athletic competence. One reason that the findings obtained by Aşçı and Gökmen (1995) are not in line with the results of our study may be that their study considered the perception of athletic competence, which is by definition subjective, rather than examining physical characteristics based on actual objective measurements. Studies investigating the relationship between anthropometric measurements and the performances of swimmers have revealed that anthropometric properties significantly affect performance in swimming, but not in young athletes (Morais, Garrido, Marques, Silva, Marinho & Barbosa, 2013). The fact that the young student-athlete swimmers (aged approximately 15-16 years) in this study believed that anthropometric parameters would not affect their performance may explain why there was no significant relationship between their competitive anxiety levels and anthropometric characteristics.

CONCLUSION

In conclusion, the results of this study, which was designed based on the hypothesis that improved physical characteristics would reduce competitive anxiety among female and male student-athlete swimmers, indicated that no correlation existed between competition anxiety and anthropometric measures (height, weight, BMI, body fat percentage, muscle mass, and mesomorphy, ectomorphy, and endomorphy component values). Among the limited number of studies on this subject, the findings obtained have been inconclusive and thus the issue remains unsettled. From this perspective, our research findings constitute a useful contribution to the literature, especially as regards competitive elite student-athlete swimmer samples. In review studies,

researchers have investigated whether factors such as gender, age, and experience were related to competitive anxiety (Rocha & Osorio, 2018).

RECOMMENDATIONS

We recommend that future studies focus more on the relationships between various anthropometric parameters and competitive anxiety in order to clarify this issue. Future studies should also address the relationship between competitive anxiety and the anthropometric measurements of student-athletes in other sports, with sufficient variation in the physical characteristics of the athletes to ensure a robust analysis.

The present study is not without limitations. The principal limitation was that the participants were never advised of the values of their anthropometric measurements, and thus possessed no information as to whether they were physically superior, mediocre, or inferior relative to the other swimmers. Another limitation was that the anthropometric features of the participating swimmers exhibited minimal variation, as the participants were generally well-developed due to their many years of sports experience.

ETHICAL DECLARATION

“In this article, journal writing rules, publishing principles, research and publishing ethics rules, journal ethics rules are followed. Responsibility belongs to the author for any violations related to the article.”

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