

Research

Nutritional Status, Diet Quality and Levels of Anxiety During Training and Match Day in Turkish Super League Male Water Polo Players

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This study was carried out to determine the relationship between the anxiety levels of the players playing in the Men's Water Polo Turkish First Division (known as Super League) teams at different periods and their nutritional status, and diet quality. The study was conducted among 60 players who professionally play water polo at different sports clubs. In order to determine the anxiety levels of the players at different time periods, the Sports Competition Anxiety Test (SCAT-A) was applied to the players on two different days. To evaluate the players' nutritional status, 2 days of food consumption were recorded, 1 day for training and the other for match day. The quality of the players' diet was evaluated using the Healthy Eating Index -2010. The players' anxiety (SCAT-A scores) on the match day was found to be higher than on the training day ($p < 0.05$). There was no statistically significant relationship between the players' anxiety levels on training and match days and the diet quality components nor total Healthy Eating Index (HEI-2010) scores on either day ($p > 0.05$). Further studies are needed to clarify the relationship between anxiety levels experienced by players at different times and nutritional status and diet quality

INTRODUCTION

Water polo is an aquatic team sport that requires endurance, strength, power, swimming speed, agility, tactical awareness, and specific technical skills. It also requires high energy production for explosive activities such as sprinting and jumping. Muscles receive contributions from aerobic and anaerobic systems to meet this requirement (Cox, Mujika, and Van Den Hoogenband 2014). Therefore, in order to meet these demands of exercise, players need to fuel their bodies adequately on a daily basis. This fueling process requires a specialized nutritional approach (Fink 2018). The goal is to provide adequate and optimal nutrition for the player, thus protecting their health and performance (Holway and Spriet 2011). The Academy of Nutrition and Dietetics (ADA), the Canadian Dietetic Association (DC) and the American College of Sports Medicine (ACSM) have international recommendations for the appropriate intake of nutrients, fluids, and supplements at appropriate times in sports nutrition (Potgieter 2013). Energy and carbohydrate requirements tend to be higher on match days than on weekly training days (Jenner et al. 2019).

Food choice is a multidimensional behavior that is influenced by a variety of factors, including psychological pa-

rameters (Yannakoulia et al. 2008). It is estimated that individuals make food choice decisions approximately 220 times a day (Birkenhead and Slater 2015). These choices are influenced by many external and internal factors. Although the influence of family, teachers, and coaches is great on the food preferences of the players, players' food preferences can also change for psychological, emotional, and behavioral reason (Birkenhead and Slater 2015). Anxiety is a common feeling that plays an important role in daily human life and can have negative consequences (Şekeroğlu 2017). Given that players in competitive sports must perform well under pressure, sporting events can be considered potentially threatening situations likely to elicit high anxiety levels (Fernández-Rodríguez, Rodríguez-Legorburu, and López-Ibor Alcocer 2017). Little is known about the relationship between psychological parameters such as anxiety, depression, perfectionism, and impulsivity and dietary characteristics such as macro- and micronutrient intake, food choices, and eating patterns (Yannakoulia et al. 2008). In a study investigating the relationship between exercise addiction, abnormal eating attitudes, anxiety and depression in professional female basketball players and amateur female players, the anxiety levels of women were tested with STAI and their eating attitudes were tested with EAT

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(Michou and Costarelli 2011). A positive relationship was found between anxiety levels and disordered eating attitudes (Spearman $\rho = 0.260$, $p < 0.01$) (Michou and Costarelli 2011). Some stressed players prefer a low-volume liquid meal supplement, and some others are unable to tolerate any food. Therefore team players tend to eat less these days due to game stress and/or travel and match schedules that change their normal eating habits (Holway and Spriet 2011). On the other hand, another study suggested that soccer players pay more attention to their diet on match day than their daily diet (Burke, Loucks, and Broad 2006).

The level of anxiety can affect the nutritional status of the players. Some studies have found relationships between nutritional habits, healthy eating behaviors, emotional eating and eating attitudes, and anxiety. While some studies have found relationships between nutritional habits and healthy eating behaviors, no studies in the literature directly examine the players' competition anxiety, nutritional status, and diet quality. Therefore, our study aimed to explore the relationship between changes in these players' anxiety levels and diet quality and quantity on training and match days, and to measure their nutritional status.

METHOD

PARTICIPANTS

This study was carried out with four of the eight professional teams competing in the 1st League of the Turkish Water Polo Federation, who agreed to participate in the study between February and May 2020. Seventy-five players from these four sports clubs were reached. The research procedure was explained to the players. Five of these players refused to participate in the study. Six players were not included in the study because they were under the age of 18, and 5 players were excluded because they had a chronic disease. When the players who did not meet the criteria were excluded, 60 players between the ages of 18-34 were included in the study.

For this study, the 'Ethics Committee Approval' dated 09.01.2020 and numbered 2020-01/2 was obtained by the Clinical Research Ethics Committee of Acibadem Mehmet Ali Aydinlar University. Written informed consent was obtained from all participants.

2.2. PROCEDURE

EVALUATION OF NUTRITIONAL STATUS

MEASUREMENT OF FOOD AND NUTRIENT INTAKES

In order to measure the food consumption of the players and to evaluate the nutrient intake of the players, they were asked to keep 24-hour dietary records on one training day and one match day. The dietary record collected to assess players' food intake were evaluated using the "Computer-Aided Nutrition Program, Nutrition Information Systems (BEBİS)" computer program developed for Turkey. The players' average energy and nutrient intakes on the match day and the training day were evaluated separately.

MEASUREMENT OF ANTHROPOMETRIC MEASUREMENTS

Height (cm), body weight (kg) and body composition measurements of the players participating in the study were made by the researcher. Body weight and body composition measurements (body weight, body fat ratio and fat mass) of the players were made with the Bioelectric Impedance Analysis (Tanita 780 MA) device, wearing light clothes, with shoes and socks removed. Before BIA measurements were made, participants were required to meet the conditions (Gesell et al. 1938) below:

No heavy physical activity within 24 hours before the measurement,

Not drinking alcohol within 24 hours before the measurement,

Not having eaten within 2 hours before the measurement,

Not drinking water and going to the toilet immediately before the measurement,

No tea or coffee was consumed within 4 hours before the measurement.

ASSESSMENT OF DIET QUALITY

From these 24 hour dietary records, HEI-2010 was used to measure diet quality. HEI-2010 consist of a total 12 dietary components, 9 of which are to be encouraged and 3 of which must be consumed in limited quantities. Scores increase proportionally with increasing consumption of the former and decreased consumption of the latter. In HEI-2010, the total score obtained from the 12 components is a maximum 100, while the minimum score is 0. If the HEI-2010 score is above 80, the diet is classified as "good", between 51-80 as "need to be improved", and below 50 as 'poor'. The diet quality scores of the sample players on the match day and the training day were evaluated separately. The HEI-2010 includes 12 components, 9 of which assess adequacy of the diet, including 1) total fruit; 2) whole fruit; 3) total vegetables; 4) greens and beans; 5) whole grains; 6) dairy; 7) total protein foods; 8) seafood and plant proteins; and 9) FAs. The remaining 3, refined grains, sodium, and empty calories (i.e., energy from solid fats, alcohol, and added sugars), assess dietary components that should be consumed only in moderation.

ASSESSMENT OF ANXIETY LEVELS

To determine the anxiety levels of players at different periods the Competitive Anxiety Test in Sports-Adult Form (SCAT-A) was used. This test was adapted into Turkish by Korunç et al. (2005) was applied on a training day and again before a match.

The SCAT-A sports competition anxiety test consists of 15 questions, featuring a three-point Likert scale: rarely, sometimes, and often. While 10 test items relate to competition anxiety traits, 5 items consist of filler questions that are not included in the assessment. A number of items on the test are reverse questions and are evaluated a reverse manner. The total SCAT-A score ranges from 10 (low anxiety) to 30 (high anxiety).

Table 1. Anthropometric measurements of the water polo players

	Mean	Standard Deviation	Min-Max
Weight (kg)	86.59	11.7	68-131.7
Height (cm)	184.83	5.31	175-195
Fat Percentage (%)	13.12	5.00	4-25
Fat Mass (kg)	11.75	5.73	3-32
Fat-free Mass (kg)	74.77	7.49	62.9-99.6

STATISTICAL ANALYSIS

The Shapiro-Wilk test was used to check whether the variables fit the normal distribution. Variables that do not fit the normal distribution are shown with their median, minimum and maximum values. The Wilcoxon Ordinal Number Sign Test was used to analyze the differences between the two dependent groups. Relationships between variables were examined with the Spearman's Correlation Coefficient. Statistical analyses were performed with the IBM SPSS Statistics 22.0 program. The significance level was set as 0.05.

RESULTS

The mean age of the players was 21.9±4.16 years. [Table 1](#) gives their mean anthropometric measurements.

[Table 2](#) indicates the energy and macronutrient intake of players on training and match days. There was a statistically significant difference between the total energy, protein (g/kg) consumption, total protein consumption, animal protein consumption, plant protein consumption, carbohydrates consumption (g/kg), consumption of fat(g), fiber, soluble fiber, and insoluble fiber received by the players participating in the study on the training day and on the match day ($p<0.05$).

The total energy, protein (g/kg), total protein, animal protein, plant protein, fat(g), fiber, soluble fiber, and insoluble fiber consumption amounts were higher on training day compared to match day ($p<0.05$).

As shown in [Table 3](#), the average anxiety score of the players on the training day was 13.46±3.21 points, and the average on the match day was higher ($p<0.05$) at 19.36±3.14 points. The anxiety scores of players on a match day are higher than the training day.

[Table 4](#) compares the quantity of selected types of foods and nutrients consumed as well as the overall diet quality (HEI-2010 score) on the training vs match day. Consumption of total fruit, whole fruit, total vegetable, whole grain, milk and dairy products group, total protein foods, and total healthy eating index score was higher on the training than the match day ($p<0.05$). The number of refined grains consumed on the match day was higher than on the train-

ing day ($p<0.05$). The amounts of other dietary quality components consumed did not differ ($p>0.05$).

[Table 5](#) compared diet quality on training vs match days. On the training day, 45% ($n=27$) of the players had diet quality that needed to be improved, and 55% ($n=33$) had poor diet quality. On the match day, 10% ($n=6$) of the players had a diet quality that needed to be improved, and 90% ($n=54$) had a poor diet quality. None of the players were found to have had a good quality diet on either training or match days.

DISCUSSION

This study was conducted to examine the nutritional status of water polo players and the relationship between the anxiety levels and diet quality on training days compared to match days. We found that they had higher anxiety levels on match day compared to the training day. In addition, although the energy requirement increases on match days, their energy and macronutrient intakes were at a statistically lower levels on the match day compared to the training day.

There are a limited number of studies in the literature examining the nutritional intake of water polo players compared to other team sports (Farajian et al. 2004). The nutrition and energy requirements of players vary considerably according to training periods (preparation, pre-season, competition, etc.) and training, match, and rest days within a certain training period, and players often have difficulty meeting their increasing energy needs. One systematic review found that although the energy needs of endurance players during the competition period increased considerably compared to the preparation period, their energy intake was similar during the two periods (Jenner et al. 2019). Therefore, a more serious energy deficit tends to be experienced during the competition period (Tavares et al. 2018). However, among football players, daily energy intake was reported as 2782 ± 293 kcal on the match day and 2270 ± 535 kcal on the non-match day by Metz et al. (2015) and 3789 ± 532 kcal on match day compared to 2956 ± 374 kcal on training day by (Anderson et al. 2017). The present study found that the total amount of energy received by the players on the training day was higher than on the match day ($p<0.05$).

Ensuring adequate intake of macronutrients while meeting the increasing energy needs of players is an important factor for improving performance (Kerksick et al. 2018). In football players, the daily amount of carbohydrates consumed on a match day was found to be higher than on a training day (Metz et al. 2015; Anderson et al. 2017; Ksi 2020; Martínez and Sánchez 2013). In the present study, only the intake of refined grains was statistically greater on the match day.

Daily carbohydrate intakes of water polo players during training and competition have been stated to be 4-8 g/kg/d (Cox and et al. 2014). In this study, the players consumed an average of 2.66±0.83 g on the training day and 2.53 (0.9-5.1) g on the match day, which remained below the recommended levels. In another study which found simi-

Table 2. Comparison of Water Polo Players' Training and Match Day Energy and Macronutrient Intakes

	Training Day		Match Day		Test Value	P*
	Mean±SD	Median (Min-Max)	Mean±SD	Median (Min-Max)		
Energy (kcal)	2470.1±448.7	2489.4(1260.5-3712.2)	2175±401.87	2170(1402.1-3941.6)	-4.3	<0.001
Protein (g/kg/d)	1.611	1.525 (0.7-3.2)	1.61±0.47	1.291 (0.7-2.3)	4.01	<0.001
Protein (g/d)	137.9±39.2	139.1(65.3-250.1)	110.2±30.8	106.7(57.5-181.3)	-4.69	<0.001
Animal protein (g)	98.7±35.7	97.5(41.5-215.6)	77.2±30.3	73.8(13.6-141.7)	-3.82	<0.001
Plant protein (g)	39.22±14.2	38.5(11.4-70.9)	32.9±10.5	32.5(10.3-67)	-2.82	0.005
Fat (g)	108.5±28.6	114.45(48.3-197.3)	93±24.5	92.4(45.2-147.6)	-3.47	0.001
Fat (%)	38.9±6.7	40(24-54)	38.11±8.2	38.5(21-60)	-0.88	.375
Cholesterol (mg)	609.4±269.2	677.3(124.5-1080.6)	525.8±255.7	596.9(101-1031.6)	-1.8	0.064
Carbonhydrates (g/kg/d)	2.66±0.83	2.62(0.8-5.7)	2.53±0.77	2.53(0.9-5.1)	0.86	0.392
Carbonhydrates (g/d)	228.3±68.7	224.1(71.9-415.2)	217.3±66.3	208.5(79.3-490.4)	-0.73	0.462
Dietary Fiber (g)	27.4±9.8	25.8(7.7-53.7)	20.9±8	20.3(9.46-57.8)	-3.87	<0.001
Water Soluble Fiber (g)	9.3±4.1	8.8(2.3-23.5)	7.1±2.7	6.8(2.4-16.2)	-3.43	0.001
Water Insoluble Fiber (g)	16.5±5.8	15.6(5.4-30.3)	13.3±5.6	12.7(4.9-39.9)	-3.72	<0.001

***Bold values: p<0.05, Wilcoxon Ordinal Number Sign Test**

Table 3. Comparison of Water Polo Players' Training and Match Day Anxiety Scores

Anxiety Level	Mean±SD	Median (Min-Max)	Test Value	p
Training Day	13.46±3.21	13(10-23)	-6.749	<0.001
Match Day	19.36±3.14	19(12-28)		

p<0.05, Wilcoxon Ordinal Number Sign Test

Table 4. Quantities of types of foods and selected nutrients consumed and overall measurement of diet quality on Training vs Match days

	Training Day		Match Day		Test Value	p ^a
	Mean±SD	Median (Min-Maks)	Mean±SD	Median (Min-Maks)		
Total Fruit (g)	146.91±112.1	150(0-480)	85.33±78.34	100(0-300)	-3.532	<0.001
Whole Fruit (g)	121.75±98.81	137.5(0-425)	67.66±68.97	60(0-240)	-3.758	<0.001
Total Vegetables (g)	99±104.16	100(0-400)	38.16±73.86	0(0-320)	-3.696	<0.001
Greens and Beans (g)	5.25±28.81	0(-0180)	5.33±29.88	0(0-200)	0.001	1
Whole Grain (g)	105.58±89.82	140(0-300)	63.16±82.45	0(0-300)	-2.854	0.004
Dairy (g)	260.61±158.55	255(0-520)	213.25±149.56	200(0-600)	-2.129	0.033
Total Protein Foods (g)	136.51±37.13	136.9(65.3-240)	110.13±30.85	106.7(57.5-181)	-4.669	<0.001
Seafood and Plant Proteins (g)	10.18±13.74	0(0-52)	6.12±14.99	0(0-80)	-1.932	0.053
Fatty Acids (g)	0.73±0.74	0.63(0.1-6)	0.58±0.35	0.55(0.1-1.6)	-1.344	0.179
Refined Grains (g)	289.71±131.43	300(0-550)	336.38±101.59	350(130-550)	-1.974	0.048
Sodium (g)	3.68±1.5	3.4(1.4-7)	3.42±1.42	3.1(1.1-8.4)	-1.571	0.116
Empty Calories (g)	19.62±6.19	18(10-42)	21±6.8	20.03(11.2-50)	-1.452	0.147
Total HEI-2010 score ^b	47.67±11.06	47.9(21.9-68.4)	38.55±8.85	37.5(17.6-54.8)	-4.8	<0.001

^a*p*<0.05, Wilcoxon Ordinal Number Sign Test

^bA measurement of diet quality. See methods section for explanation.

Table 5. Distribution of Training and Matchday Diet Quality Levels of Water Polo Players

	Training Day		Match Day	
	Frequency	%	Frequency	%
Poor	33	55.0	54	90.0
Needs Improvement	27	45.0	6	10.0
Good	-	-	-	-

lar results with this study, the macronutrient consumption and energy intake of team players were insufficient to meet their needs (Jenner et al. 2019). In that study, most players reported consuming diets excessively high in protein and fat at the expense of carbohydrates.

Negative protein balance among players reduces tolerance to training and leads to muscle loss, injuries, and diseases (Phillips, Chevalier, and Leidy 2016). Studies of football players have found the protein intake (Metz et

al. 2015; Anderson et al. 2017) and percentage of energy from protein to be similar on training days and match days (Martínez and Sánchez 2013; Bettonviel et al. 2016).

Maintaining energy balance, replenishing intramuscular triacylglycerol stores and adequate consumption of essential fatty acids are of great importance for players. The American College of Sports Medicine (ACSM) reports that when fat consumption is less than 20% of the energy intake, it negatively affects sports performance and that fat-soluble

vitamins and essential fatty acids have an important place in the nutrition of players (Medicine, American College of Sports 2016). In a study conducted in Spain, when fat consumption was evaluated, its contribution to energy intake was found to be 30.7% on the training day and 28.2% on the match day (Martínez and Sánchez 2013). Metz et al. found that the fat consumption of football players did not differ between days (Metz et al. 2015). In the present study, fat intakes were found to be 37.7±9.27% and 40.7±9.15% of energy intake, respectively, on training and match days, above the recommended intakes. However, the amount of dietary fat consumed on the training day was 108.5±28.6 g, which was higher than on the match day (93±24.6 g) ($p<0.05$). High body fat levels in water polo give the players a physical advantage because water polo is a sport that involves one-on-one combat. Therefore, while taking into account the current recommendations, suggestions specific to the players should be created by taking into account the individual morphological characteristics of the players (Idrizović, Milošević, and Pavlović 2013).

There are few studies in the literature in which diet quality scores (HEIs) are used to evaluate the diet quality of players. Similar to the present study, Padovani and Juzwiak (2015) found that neither male nor female players had good HEI scores and mean HEI scores on the training day were 47.7±11.1, and on the matchday 38.6±8.9. In a study conducted with 138 university players, the average HEI score of the players was found to be 51±8% (Webber et al. 2015). Similar to the results of this study, players' alcohol, sugar, and sodium consumption were found to be high, and their vegetable and fiber consumption was found to be low.

A study of 540 football players found anxiety scores to be lower than this study, with a SCAT-A average of 16.8 ± 2.1 (Mottaghi, Atarodi, and Rohani 2013). However, among badminton players, mean anxiety scores were found to be 20.75±3.44, similar to the present study (Khan et al. 2011).

Unlike in the present study, no difference was found between days in a study of 36 American football players (Allie, Larson, and Debeliso 2018). However, most studies report higher anxiety on match day. Among students studying physical education, the training day anxiety score was found to be 18.9±3.3 and the matchday anxiety score of 21.9±3.9 (Aslam et al. 2015).

Some studies, not on players, but on healthy individuals, have examined relationships between nutritional habits, healthy eating behaviors, emotional eating, eating attitudes, and anxiety. A study involving 252 university students in Spain found a direct relationship between trait anxiety and adherence to the Mediterranean diet (Marchena, Bernabéu, and Iglesias 2020). In another study with university students, anxiety and depression symptoms were associated with decreased calorie intake and increased sugar consumption (Keck et al. 2020). Yannakouli et al.

found a linear relationship between sweet consumption and red meat consumption of women with high anxiety levels, while a negative relationship was found between anxiety levels of male players and their consumption of legumes/cereals (Yannakouli et al. 2008). A study of 1183 Australian adults found lower adherence to the Mediterranean diet with increased trait anxiety (Crichton et al. 2013). A linear relationship was found between the change in anxiety levels of the players in this study and the amount of animal protein consumed. ($p<0.05$).

CONCLUSION

In line with the information we obtained from the literature and the data we obtained from our study, it is possible to say that anxiety can be encountered frequently in players, typically higher on a match day than on training days. Despite these results, the fact that the study only worked with male water polo players, only worked with A-team level players, did not include players doing sports in different sports branches, was small in the population, and did not examine other factors that could affect anxiety levels may have limited the result of the study. For this reason, more comprehensive studies should be carried out with the participation of male and female players from different sports branches and different age groups in future studies.

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CONFLICTS OF INTEREST

None of the authors has any conflict of interest to declare.

ETHICS APPROVAL

The protocol of the study was approved by the Ethical Committee of the Acibadem Mehmet Ali Aydinlar University

AUTHORS' CONTRIBUTIONS

Gulsah Evren and Duygu Saglam contributed to the design and implementation of the research, to the analysis of the results and to the writing of the manuscript.

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