



# Adolescent Football Players' Nutritional Knowledge Levels, Nutritional Status, and Nutritional Habits During the COVID-19 Pandemic

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## Abstract

**Objectives:** This study was conducted to evaluate the nutritional knowledge levels, habits, nutritional status, and changing nutritional habits during the pandemic period of adolescent football players aged 14–18 years who play football in a football academy.

**Methods:** 89 male football players (62 middle-adolescents and 27 late-adolescents) participated in the study. Information about general characteristics, health, nutritional habits, and knowledge level of the athletes were obtained by a questionnaire method applied by face-to-face interview. Height and weight measurements were taken by researcher. Three-day food records were taken, and dietary nutrient intakes were calculated with a software program and the data were statistically evaluated.

**Results:** The majority of the athletes do not skip meals. When those who skipped meals were analyzed, it was found that the majority skipped the midday meal. As a reason, they stated that it coincided with the training time. According to the rate of correct answers to the questions in the nutrition knowledge level section, the success rate of the middle adolescent group was 81%, and 75% of the late adolescent group. The majority of the athletes did not change their eating habits during the pandemic period. Dietary intake of energy, carbohydrate, fiber, calcium, iron, potassium, zinc, and Vitamin B1 of the athletes were lower than recommendations, protein intake was sufficient, and fat, sodium, and phosphorus intakes were higher than recommendations. The percentages of the recommended intakes of nutrients in the eighteen age group were found to be lower than the other age groups.

**Conclusion:** Athletes generally have fat-weighted diets, and dietary intakes were insufficient in terms of some important nutrients required for growth, development, and sports performance.

**Keywords:** Adolescent, dietary habits, eating behavior, nutritional status, sports.

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Adolescence is a period covering the age range of 10–19 years in which cognitive and social maturation takes place in addition to rapid physical growth. In this period, as the age increases, the adolescent approaches the physical structure of adulthood and cognitive and social development increases.<sup>[1]</sup> As the rate of growth

and development increases, nutrient requirements also increase.<sup>[2]</sup> Unhealthy and inadequate eating habits are seen in adolescents. They have high-fat and high-calorie diets due to increased consumption of foods such as ready meals, fast food, and carbonated drinks.<sup>[3,4]</sup> These wrong eating habits may adversely affect the growth and

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development, physical, and mental health of adolescents.

<sup>[2]</sup> In adolescent athletes, energy and nutrient requirements have increased with the effect of both sports, and growth and development. Adequate and balanced nutrition is very important to increase sports performance, and to ensure healthy growth and development in adolescents.<sup>[5]</sup>

The postponement or cancellation of sports competitions during the pandemic affected athletes physically and psychologically. Athletes' sports performances and eating habits were affected.<sup>[6]</sup> The tendency to eat high-calorie, high-fat, and high-carbohydrate diets has increased.

<sup>[7]</sup> Such unhealthy eating habits negatively affect the immune system health, sports performance, growth, and development of adolescent athletes.<sup>[1]</sup> Adequate and balanced nutrition, rich in antioxidant vitamins and minerals and omega-3 is very important for the growth and development, immune system, and sports performance of adolescent athletes, especially during this period.<sup>[6]</sup>

The aim of this study was to determine the nutritional habits and nutritional knowledge level of adolescent football players, to determine possible changes in nutritional habits during the pandemic period, and to determine whether the nutrient intake of athletes during the pandemic period is adequate. At the same time, this study was planned to determine whether the difference in the cognitive and social development of adolescent football players in middle and late adolescence affects their nutritional behaviors, nutritional knowledge level, nutritional habits, and food intake during the pandemic period and to compare these nutritional parameters between the two age groups.

## Materials and Methods

### Universe and Sample

The universe of this descriptive and cross-sectional study consists of 100 youth football players between the ages of 14–18 who were in Yilport Samsunspor Football Academy in April and May 2021. The sample of the study consists of youth football players who voluntarily accepted to participate in the study by themselves and their parents. The sample number was calculated to be at least 80 with 95% confidence interval and 5% margin of error and random sampling method was selected. Athletes with communication barriers, athletes with any chronic disease diagnosed by a doctor that may affect their food choices diagnosed by a doctor were not included in the study. As a result, this study was conducted with 89 youth football players aged 14–18 years playing football in the academy. The athletes were evaluated in two groups as mid-adolescent athletes (MAS: 14 –<17 years) and late-adolescent athletes (LAS: 17–18 years).

### Questionnaire Form

The questionnaire form used in this study, which was conducted by face-to-face interview method, consists of four different sections and 68 questions.

### General Characteristics

In this section, questions such as age (years), height (cm), body weight (kg), education, living place, diseases, years of playing football, and training frequency were included in the study.

### Eating Habits

In this section, the number of meals and skipping meals of the participants were questioned. In addition, fluid intake and nutritional habits during training and match times were also questioned.

An open-ended question was asked about the foods that are thought to increase performance by the athlete. The answers given by the athletes were evaluated and classified as "Energizing foods (honey, butter, cream, peanut butter, tahini, and molasses), Oil seeds (walnuts, hazelnuts), Protein-containing foods (meat, milk, and eggs), Nutritional supplements (caffeine, omega 3, and multi-vitamin), Vegetables and fruits, and Carbohydrate."

### Nutrition Knowledge Level

The questions in this section were formed by the researchers by evaluating similar studies in the literature<sup>[8,9]</sup> that examined the nutritional knowledge levels and habits of amateur and professional football players. There are 16 questions in this section, including 5 questions with options and 11 multiple choice questions (True, False, Undecided). Since a validity and reliability questionnaire was not used to evaluate the level of knowledge in our study, the number of questions answered correctly by the athletes was calculated as a percentage and a success rate (%) was found.<sup>[10,11]</sup>

### The Changes in Eating Habits during the Pandemic Period

The questions in this section were created by the researcher by evaluating the literature examining the changes in the eating habits of adults and athletes during the pandemic period.<sup>[12]</sup> There are 22 questions with options in this section.

### Dietary Intake

Three-day food consumption records were taken to determine the food consumption of the athletes. The researcher explained to the athletes how to take 3-day food consumption records and then the food consumption records of the athletes were checked and evaluated by the researcher to prevent any possible missing, error, etc. Food consumption records were taken on 3 consecutive days,

one of which was at the end of the week. Energy, macro and micronutrient intakes from the recorded food consumption were analyzed with a software, Computer Assisted Nutrition Programme Nutrition Information Systems Package Program 8.2.<sup>[13]</sup> Since there is no specific nutritional guideline for adolescent football players, dietary intakes were compared with the recommended safe intake levels according to age and sex in the Turkish Nutrition Guide 2015 (TUBER)<sup>[14]</sup> and expressed as percentages of meeting nutrient requirements.

### **Anthropometric Measurements**

The height (cm) and body weight (kg) measurements of the athletes were taken by the researcher. Body mass index (BMI) ( $\text{kg}/\text{m}^2$ ) was calculated by dividing body weight (in kilograms) by the square of height (in meters). The percentile data of the World Health Organization were used in the evaluation of anthropometric measurements.<sup>[15]</sup>

Height for age percentiles:  $<3^{\text{rd}}$  percentile (stunted),  $\geq 3$ .– $<15^{\text{th}}$  percentile (short),  $\geq 15$ .– $<85^{\text{th}}$  percentile (normal),  $\geq 85$ .– $<97^{\text{th}}$  percentile (tall),  $\geq 97^{\text{th}}$  percentile (very tall); BMI for age percentiles:  $<3^{\text{rd}}$  percentile (very underweight),  $\geq 3$ .– $<15^{\text{th}}$  percentile (underweight),  $\geq 15$ .– $<85^{\text{th}}$  percentile (normal), and  $\geq 85$ .– $<97^{\text{th}}$  percentile (overweight).

### **Ethical Approval**

For this research, ethics committee approval dated February 10, 2021, and numbered 2021/02 was obtained from Bahçeşehir University Scientific Research and Publication Ethics Committee. The parents of the athletes participating in the study were informed verbally and in writing, and written consent was obtained from the parents with the "Parent Information and Consent Form" indicating that they agreed to participate in the study. This study was derived from a master's thesis.

### **Statistical Analysis**

IBM SPSS Statistics 27 (IBM Corp, 2020) package program was used for statistical analysis. Descriptive statistics for demographic and nutritional characteristics of the participants were presented as mean, standard deviation, median, minimum and maximum for numerical variables; qualitative data were presented as number (n) and percentage (%). Kolmogorov–Smirnov and Shapiro–Wilk tests and histogram graphs were used to determine the normality of the distribution. Chi-square test was used for pairwise comparisons between categorical variables and Fisher's exact test was used when the Chi-square condition was not met. Since the normal distribution condition was met for numerical variables, independent samples t-test was used for comparisons of two group means, one-way ANOVA was used for comparisons of more than two group means and Welch

statistics was used when the condition of homogeneity of group variances was not met. Post hoc tests were used to determine the source of the significant difference in ANOVA; Tukey test was applied when the homogeneity assumption was fulfilled, and Games-Howell test was applied when the homogeneity assumption was not fulfilled. In the study,  $p < 0.05$  was accepted for statistical significance level.

## **Results**

### **General Characteristics**

Among the adolescent footballers in the study, 62 were in middle adolescence (14, 15, and 16 age groups) and 27 were in late adolescence (17 and 18 age groups). The mean age of the athletes was  $15.82 \pm 1.34$  years (MAS:  $15.06 \pm 0.77$  years, and LAS:  $17.56 \pm 0.51$  years). General and anthropometric characteristics of the athletes are given in Table 1. The majority of athletes had BMI and height for age within the normal range. Sports age, weekly training frequency, and daily training duration were higher in LAS than in MAS ( $p < 0.05$ ).

The meal habits and nutritional behaviors of the athletes and the nutritional beliefs on performance are shown in Table 2. It was found that the majority of athletes consumed 3 main meals and most of them consumed two snacks. No significant difference was found in the number of main and snack meals in both groups. LAS mostly skipped meals, and the main reason for skipping meals in both groups was that the meal coincided with the training time. While 45.2% of MAS thought that there are foods that improve performance, 51.8% of LAS stated that they had no idea. Most of the athletes believe that protein-containing foods and bananas have a positive effect on performance.

### **The Level of Nutrition Knowledge**

The answers given by the athletes for the nutrition knowledge level questions are given in Tables 3 and 4. The athletes gave mostly correct answers to the questions about meals. Considering the correct answer rates of both groups, the success of MAS was 81%, while the success of LAS was 75%. The athletes gave mostly correct answers to the questions about recognizing high carbohydrate and high protein foods. The majority of MAS gave the correct answer to the glycemic index question, but the majority of LAS stated that they did not have knowledge on this subject ( $p < 0.05$ ) (Table 3). All of the athletes thought that there is a relationship between adequate and balanced nutrition and sports success and that water consumption is important for performance. The majority of the athletes (MAS: 61.3%, LAS: 48.2%) think that excessive consumption of protein does not cause muscle increase but increases performance; excessive consumption of carbohydrate causes fat storage

**Table 1.** Athletes general and anthropometric features

General features	Middle adolescent (n=62) Mean±SD		Late adolescent (n=27) Mean±SD		p
	n	%	n	%	
Sport age (years)	6.0±1.9		8.7±1.8		<0.001
Weekly training duration (day)	3.5±0.9		4.8±1.0		<0.001
Daily training duration (hour)	1.7±0.3		1.9±0.4		0.011
BMI (kg/m <sup>2</sup> )	20.5±1.7		22±1.3		
BMI by age					
Underweight	2	3.2	0	–	1.000 <sup>b</sup>
Normal	58	93.6	27	100	
Overweight	2	3.2	0	–	
Height by age					
Stunted	1	1.6	0	0	0.748 <sup>b</sup>
Short	4	6.4	1	3.7	
Normal	46	74.2	24	88.9	
Tall	8	13.0	2	7.4	
Very tall	3	4.8	0	0	
Education					
Primary	10	16.1	1	3.7	0.009 <sup>b</sup>
High school	52	83.9	23	85.2	
University	0	0	3	11.1	
Living place					
With family	51	82.3	19	70.4	0.208 <sup>a</sup>
Facility	11	17.7	8	29.6	

<sup>a</sup>: Independent groups t-test, <sup>b</sup>: Fisher exact Chi-square analysis (p<0.05). SD: Standard deviation, BMI: Body mass index.

but also causes muscle increase. Most of the athletes (MAS: 82.3% and LAS: 85.2%) think that vitamins are also needed for energy during exercise, and the need for antioxidant vitamins and minerals may increase in athletes. Most of the athletes (MAS: 66.1% and LAS: 59.3%) think that water loss decreases performance in athletes and that only water loss occurs with sweating (MAS: 42% and LAS: 48.2%) (Table 4).

### The Changes in Eating Habits during the Pandemic Period

The changes in eating habits and body weight of the athletes during the pandemic period are given in Table 5. The majority of the athletes stated that their eating habits did not change during the pandemic period. On the other hand, when the possible changes were asked separately, it is seen that the number of meals, night eating, and water consumption increased in the majority of athletes. In addition, the majority of the athletes stated that they started to eat a carbohydrate-based diet. When MAS and LAS were compared, statistically significant differences

were found between the changes in carbohydrate, fat, meat, chicken, and fish consumption (p<0.05). The majority of the athletes stated that they started to eat protein and vitamin-based diet; their consumption of fast food, ready meals, frozen food did not increase, but their consumption of snacks, bread, and desserts increased and they started to prepare more meals at home. The majority of the athletes increased their consumption of milk and yoghurt (MAS: 83.9% and LAS: 63.0%), egg (MAS: 85.5% and LAS: 66.7%), meat, chicken and fish (MAS: 90.3% and LAS: 63.0%), vegetables and fruits (MAS: 80.6% and LAS: 66.7%), and oil seeds such as hazelnuts, walnuts, and almonds (MAS: 72.6% and LAS: 66.7%).

### Dietary Intakes

The average daily energy and nutrient intakes of the athletes are given in Table 6 and the percentages of meeting these nutrient requirements are given in Table 7. In general, each age group had lower carbohydrate intake and higher fat intake. Protein intake was adequate in all age groups and

**Table 2.** Athletes' eating behaviors and the nutritional beliefs on performance

Eating behaviors	Middle adolescent (n=62)		Late adolescent (n=27)		p
	n	%	n	%	
Number of main meals					0.235*
2	15	24.2	3	11.1	
3	45	72.6	24	88.9	
4	2	3.2	0	0	
Number of snack meals					0.926*
None	1	1.6	1	3.7	
1	24	38.7	11	40.7	
2	30	48.4	12	44.4	
3	7	11.3	3	11.1	
Skipping meals					<b>0.025</b>
Yes	13	21	9	33.3	
No	33	53.2	6	22.2	
Sometimes	16	25.8	12	44.4	
Skipped meals					0.355*
Breakfast	2	7	3	14.3	
Lunch	16	55	11	52.4	
Dinner	10	35	4	19	
Snacks	1	3	3	14.3	
Reasons for skipping meals					0.937*
Lack of time	5	17.2	4	19	
Lack of appetite	4	13.8	4	19	
Lack of food	2	7	0	0	
Coinciding with training time	9	31	8	38.2	
Desire to lose weight	1	3.5	1	4.8	
Lack of habit	7	24	4	19	
Financial impossibility	1	3.5	0	0	
Nutritional Beliefs					
Believes that there is a food improve performance					<b>0.007</b>
Yes	28	45.2	6	22.2	
No	22	35.5	7	26	
No idea	12	19.3	14	51.8	
Foods considered by the athlete improve performance**					0.870
Energy giver foods (honey, butter, milk cream, peanut butter, tahini, molasses)	7	25.0	1	16.7	
Oily seeds (walnuts, hazelnuts )	4	14.3	0	0	
Protein-containing foods (meat, milk, and egg)	10	35.7	2	33.3	
Dietary supplements ( caffeine, omega3, multi-vitamin)	2	7.1	0	0	
Vegetables and fruits	4	14.3	0	0	
Carbohydrate	2	7.1	1	16.7	
Banana	9	32.1	2	33.3	

P value has been analyzed with Pearson Chi-square test. \*: Fisher Exact Chi-square analysis, \*\*: Multiple reply has been given (p<0.05).

the amounts of energy, carbohydrate (percentage), dietary fiber, calcium, iron, potassium, zinc, Vitamin B1, folate, and water were lower than need. The percentage of fulfillment of the needs of the 18-year-old group is lower than the

other age groups. In athletes, protein (g) intake increased with increasing age, except for 18 years of age. It was found that energy (kcal/kg), protein (g/kg), and B6 intakes were different between ages (p=0.043, p=0.014, p=0.013).

**Table 3.** Distribution of athletes' answers to nutrition knowledge level questions

Nutrition knowledge level questions	Middle adolescent (n=62)		Late adolescent (n=27)		p*
	n	%	n	%	
How many main meals should a footballer have a day?					0.099*
≥3 <sup>a</sup>	50	80.6	26	96.3	
<3	12	19.4	1	3.7	
Which of the following meals is more appropriate as the last meal before a match?					0.575*
Easy digestible, fiber free, and low fatty <sup>a</sup>	56	90.4	25	92.6	
High fat, and energy	3	4.8	0	0	
Vegetable dishes, and fruit	3	4.8	2	7.4	
Which foods have the highest carbohydrate content?***					0.194**
Bread, rice, bulgur, pasta <sup>a</sup>	56	90.3	26	96.3	
Legumes	16	25.8	4	14.8	
Meat, chicken, fishes, egg	4	6.4	3	11.1	
Oily seeds such as hazelnuts, walnuts, almonds etc.	4	6.4	2	7.4	
Milk, yoghurt, buttermilk, kefir	4	6.4	0	0	
Vegetables	6	9.7	0	0	
Fruits	7	11.3	0	0	
Don't know	1	1.6	1	3.7	
Which foods have the highest protein content?***					0.876**
Meat, chicken, fishes, egg <sup>a</sup>	58	95	25	92.6	
Bread, rice, bulgur, pasta	0	0	0	0	
Legumes	5	8.2	1	3.7	
Oily seeds such as hazelnuts, walnuts, almonds etc.	5	8.2	1	3.7	
Milk, yoghurt, buttermilk, kefir	10	16.4	5	18.5	
Vegetables	3	5	1	3.7	
Fruits	2	3.3	0	0	
Don't know	0	0	0	0	
Which foods have the highest glycemic index?***					0.003*
Sweets, desserts <sup>a</sup>	22	35.5	4	15	
Bread, rice, bulgur, pasta	17	27.4	3	11.1	
Oat	7	11.3	7	26	
Milk, yoghurt	13	21	1	3.7	
Don't know	20	32.3	15	55.6	

<sup>a</sup>: True answer. \*: Chi-square test, \*\*: Fisher exact Chi-square analysis, \*\*\*: Multiple reply has been given (p<0.05).

## Discussion

In this cross-sectional study, which was planned to determine the nutritional habits and nutritional knowledge level of adolescent football players, to determine effect of the pandemic period on diet, it was determined that the most skipped meal by the athletes was lunch, the reason for this was the overlap with the training time, LAS skipped more meals, and MAS had more ideas about the relationship between nutrition and performance. The success of the athletes in the nutrition questions was 81% in MAS and 75% in LAS. The athletes stated that the pandemic period and quarantine did not change their eating habits, but in

detailed questions, they also stated that the number of meals, eating at night, water consumption, vitamin-based diet, snack consumption, milk, yoghurt, egg, vegetables, fruits, oil seed group, and dessert consumption increased during this period. In this period, both an increase and constancy in body weight were reported. It was determined that the athletes were under-nourished in terms of energy and carbohydrate and over-nourished in terms of fat. In general, it was observed that the 18 age group had different dietary intakes compared to other ages.

In studies conducted with adolescent athletes, most of the athletes provided the recommended number of meals, but



**Table 4.** Distribution of athletes' answers to multiple choice nutrition knowledge level questions

Questions	Middle adolescent (n=62)		Late adolescent (n=27)		p
	n	%	n	%	
There is a relationship between adequate and balanced nutrition and sports success					
True <sup>a</sup>	62	100	27	100	**
Excess weight affects performance negatively					
True <sup>a</sup>	58	93.6	25	92.6	0.620*
Indecisive	2	3.2	2	7.4	
False	2	3.2	0	0	
Water consumption is important for performance					
True <sup>a</sup>	62	100	27	100	**
Excessive consumption of protein causes muscle increase					
True	9	14.5	5	18.5	0.511
Indecisive	15	24.2	9	33.3	
False <sup>a</sup>	38	61.3	13	48.2	
Excess carbohydrate consumption causes fat storage					
True <sup>a</sup>	46	74.2	17	63	0.285*
Indecisive	15	24.2	8	29.6	
False	1	1.6	2	7.4	
Excess protein consumption increases performance					
True	23	37.1	12	44.4	0.646
Indecisive	22	35.5	10	37	
False <sup>a</sup>	17	27.4	5	18.6	
Excess carbohydrate consumption causes muscle growth					
True	33	53.2	13	48.2	0.904
Indecisive	19	30.7	9	33.3	
False <sup>a</sup>	10	16.1	5	18.5	
Vitamins are also needed for energy formation during exercise					
True <sup>a</sup>	51	82.3	23	85.2	0.169*
Indecisive	5	8	4	14.8	
False	6	9.7	0	0	
Athletes need antioxidant vitamins more than normal individuals					
True <sup>a</sup>	47	75.8	20	74	0.854*
Indecisive	14	22.6	7	26	
False	1	1.6	0	0	
In athletes, only water loss occurs with sweating					
True	26	42	13	48.2	0.492
Indecisive	17	27.4	9	33.3	
False <sup>a</sup>	19	30.6	5	18.5	
Water loss in athletes decreases performance					
True <sup>a</sup>	41	66.1	16	59.3	0.065
Indecisive	11	17.8	10	37	
False	10	16.1	1	3.7	
Percentage of correct answers (success %)	81		75		

<sup>a</sup> Correct answer. P-value has been analyzed with Chi square. \*: Fisher exact chi-square analysis, \*\*: Since all answers were the same, p-value could not be calculated (p<0.05).

meal skipping behavior is also common.<sup>[16,17]</sup> In our study, the meal usually skipped was lunch, whereas in other studies it was breakfast. As a reason, athletes stated that they did not

have enough time and habits.<sup>[18-20]</sup> In these studies, most of the athletes stated that the reason for skipping meals was lack of time and also lack of appetite. It should be kept in

**Table 5.** Responses of athletes about changing eating behaviors and body weight during the pandemic period

Questions	Answers	Middle adolescent (n=62)		Late adolescent (n=27)		p
		n	%	n	%	
Has your diet changed during the pandemic?	Yes	30	48.4	9	33.4	0.084*
	No	31	50.0	15	55.5	
	No Idea	1	1.6	3	11.1	
Reason for changing diet during the pandemic? (mid- adolescent n=30 and late- adolescent n=9)	To increase immunity	5	16.7	1	11.1	0.480*
	Psychological reason	6	20.0	1	11.1	
	Lack of exercise	3	10.0	0	0.0	
	Feeling more hungry	16	53.3	6	66.7	
	Does not know what to do for diet in pandemic	–	0.0	1	11.1	
Detailed questioning of dietary pattern The number of meals increased	Yes	34	54.8	14	51.9	0.958
	Indecisive	7	11.3	3	11.1	
	No	21	33.9	10	37.0	
Night eating behavior increased	Yes	39	62.9	14	51.9	0.145
	Indecisive	2	3.2	4	14.8	
	No	21	33.9	9	33.3	
Water consumption increased	Yes	49	79.0	18	66.7	0.292
	Indecisive	6	9.7	6	22.2	
	No	7	11.3	3	11.1	
Started to a carbohydrate-rich diet	Yes	27	43.5	7	25.9	<b>0.009</b>
	Indecisive	14	22.6	15	55.6	
	No	21	33.9	5	18.5	
Started to a protein-rich diet	Yes	44	71.0	13	48.2	0.108
	Indecisive	13	21.0	11	40.7	
	No	5	8.0	3	11.1	
Started to a fat-rich diet	Yes	20	32.3	5	18.5	<b>0.033</b>
	Indecisive	13	21.0	13	48.2	
	No	29	46.7	9	33.3	
Started to a vitamin-rich diet	Yes	40	64.5	13	48.2	0.155
	Indecisive	13	21.0	11	40.7	
	No	9	14.5	3	11.1	
Fast food consumption increased	Yes	17	27.4	6	22.2	0.549
	Indecisive	16	25.8	5	18.5	
	No	29	46.8	16	59.3	
Consumption of ready meals increased	Yes	18	29.0	8	29.6	0.760
	Indecisive	10	16.1	6	22.2	
	No	34	54.9	13	48.2	
Frozen food consumption increased	Yes	11	17.7	4	14.8	0.564
	Indecisive	12	19.4	8	29.6	
	No	39	62.9	15	55.6	
Snack consumption increased	Yes	37	59.7	11	40.8	0.224
	Indecisive	9	14.5	7	25.9	
	No	16	25.8	9	33.3	
Started to prepare more meals at home	Yes	34	54.8	12	44.5	0.487
	Indecisive	8	12.9	6	22.2	
	No	20	32.3	9	33.3	



**Table 5 (cont.).** Responses of athletes about changing eating behaviors and body weight during the pandemic period

Questions	Answers	Middle adolescent (n=62)		Late adolescent (n=27)		p
		n	%	n	%	
Bread consumption increased	Yes	30	48.4	10	37.0	0.132
	Indecisive	6	9.7	7	25.9	
	No	26	41.9	10	37.1	
Consumption of milk and yoghurt group increased	Yes	52	83.9	17	63.0	0.052*
	Indecisive	3	4.8	5	18.5	
	No	7	11.3	5	18.5	
Egg consumption increased	Yes	53	85.5	18	66.7	0.078*
	Indecisive	4	6.4	6	22.2	
	No	5	8.1	3	11.1	
Consumption of meat, chicken and fish increased	Yes	56	90.3	17	63.0	<b>0.002*</b>
	Indecisive	4	6.5	9	33.3	
	No	2	3.2	1	3.7	
Consumption of vegetables and fruits increased	Yes	50	80.6	18	66.7	0.199
	Indecisive	6	9.7	7	25.9	
	No	6	9.7	2	7.4	
Consumption of oilseeds such as hazelnuts, walnuts and almonds increased	Yes	45	72.6	18	66.7	0.817
	Indecisive	10	16.1	6	22.2	
	No	7	11.3	3	11.1	
Dessert consumption increased	Yes	28	45.2	14	51.8	0.823
	Indecisive	17	27.4	6	22.2	
	No	17	27.4	7	26.0	
Body weight increased	Yes	21	33.9	10	37.1	0.890
	Indecisive	17	27.4	8	29.6	
	No	24	38.7	9	33.3	

P-value was calculated with Pearson chi-square analysis. \*: Fisher exact chi-square analysis (p<0.05).

mind that this group of athletes is also at school age, and for this reason, training program as well as school program may be an obstacle in planning meal times. In our study, the first reason was the overlap with the training time, and then the reasons such as lack of habit and feeling of satiety were listed. These differences may also be due to the different training plans of the athletes. In addition, as the age increases, footballers train more intensively and the number and duration of training increases.<sup>[21]</sup> It is of great importance to plan training and meal times in a way that does not cause any deficiency for adolescent athletes who are in the growth and development phase.

In this study, when the correct answer rates of both groups to the questions determining the level of nutritional knowledge were analyzed, the success rate of MAS was 81%, while the success rate of LAS was 75%. In two different studies conducted with adolescent footballers in Ireland, in which the same scale was used, the success rate was found to be 59.6% and 45.6% and it was stated that the nutritional knowledge level of the

participants was low in these studies.<sup>[22,23]</sup> In another study, the success level of nutritional knowledge of adolescent football players was found to be 54.6%, and the success levels in other studies using the same scale varied between 36.9% and 77.6%.<sup>[10,11,24]</sup> Reasons such as the fact that our study is more recent than similar studies in the literature and the increased interest in nutrition content focused on increasing immunity in social media and visual media during the pandemic period may be effective in our higher success rate. In general, the reason for the low level of nutritional knowledge of adolescent athletes may be that athletes focus on learning football skills and are less interested in nutrition. The level of nutritional knowledge of the sources from which athletes learn may also be an important factor.

The results of the related literature, in parallel with the results of our study, show that the rate of correct answers to nutritional knowledge questions in MAS is higher than in LAS and the rate of correct answers decreases with increasing age.<sup>[10,23,25]</sup> In fact, cognitive level, comprehension, and awareness

**Table 6.** Athletes daily energy, macro and micro nutrients, and water intakes

Age	14 (n=16) Mean±SD Min-max	15 (n=26) Mean±SD Min-max	16 (n=20) Mean±SD Min-max	17 (n=12) Mean±SD Min-max	18 (n=15) Mean±SD Min-max	p*
Energy (kcal)	1635±508 817–2659	1789±355 1199–2513	1808±339 1229–2460	1869±511 881–2846	1620±424 1126–2776	0.377
Energy (kcal/kg)	30±9 16–48	29±7 17–45	26±5 18–38.5	28±8 11–43	23±6 13–37	<b>0.043</b>
Carbohydrate (g)	133±37 75–173	148±43 78–257	124±44 54–228	143±53 60–224	123±41 59–190	0.263
Carbohydrate (% energy)	34±5 26–49	34±9 19–53	28±7 16–42	31±7 17–43	32±10 16–49	0.060
Fat (% energy)	49±6 34–58	49±8 34–62	54±7 43–68	51±6 41–61	53±11 34–73	0.107*
Protein (g)	66±20 36–107	74±18 45–123	79±19 47–111.8	82±28 41–139	61±16 38–94	<b>0.020</b>
Protein (% energy)	17±1 13–19	17±3 12–22	18±3 11–25	18±6 12–36	16±3 10–20	0.164
Protein (g/kg)	1.2±0.4 0.7–2.0	1.2±0.3 0.7–1.9	1.0±0.3 0.7–1.6	1.2±0.5 0.5–2.3	0.9±0.2 0.6–1.3	<b>0.014</b>
Fiber (g)	18±6 8–31	19±8 8–38	15±5 6–26	19±9 5–39	15±7 5–26	0.177
Calcium (mg)	788±316 301–1468	851±308 274–1599	848±276 386–1386	710.4±261 300–1196	634±261 204–1366	0.137
Iron (mg)	9±3 4–14	10±4 5–26	9±3 6–17	11±4 4–19	8±2 5–12	0.161
Magnesium (mg)	265±75 158–396	281±104 153–567	259±60 157–387	308±125 108–525	208±72 108–349	0.058
Phosphorus (mg)	1239±396 642–1959	1352±455 754–2720	1273±270 836–1734	1354±500 558–2213	1024±342 693–1998	0.127
Potassium (g)	2.0±0.5 1.5–3.0	2.0±0.8 1.0–4.0	2.0±0.6 1.0–3.5	2.0±1.0 1.0–4.0	2.0±0.7 0.8–3.0	0.087
Sodium (g)	8±10 1–35	7±11 1–53	4±4 1–19	14±23 1–80	4±4 1–21	0.265
Zinc (mg)	9.5±3.0 5–18	10.5±2.6 6–17	11.6±3.6 7–21	11.0±3.0 6–18	8.6±2.5 6–14	0.055
Vitamin A (mcg)	982±315 481–1646	1095±356 458–1791	1173±437 650–2430	1273±560 652–2639	1085±379 540–2125	0.399
Vitamin E (mcg)	156±10 4–34	13±5 6–23	14±6 5–29	15±10 4–38	13±7 4–27	0.863
Vitamin C (mg)	94±44 45–178	72±45 7–179	75±40 6–163	107±69 23–280	69.5±50 1–210	0.172
B1 (mg)	1.0±0.2 0.5–1	0.9±0.3 0.5–2	0.8±0.2 0.5–1	1.0±0.3 0.3–1.6	0.7±0.3 0.3–1.2	0.112
B2 (mg)	1.5±0.3 1–2	1.7±0.4 1–2.5	1.7±0.5 1–2.7	1.7±0.5 0.8–2.4	1.3±0.4 0.7–2.3	0.078
B6 (mg)	1.4±0.3 0.8–2	1.3±0.4 0.7–2	1.5±0.4 0.7–2	1.7±0.5 1–2	1±0.3 0.5–1.7	<b>0.013</b>
Folate (mcg)	261±65 150–380	266±80 140–492	268±82 164–505.5	310±113 146.5–493	254±70 137–402	0.450
Water (ml)	959±169 668–1302	934±261 582–1457	893±241.5 517–1303	1041±364 529–1623	767±258 365–1188	0.084

\*: Welch statistics (p&lt;0.05).

**Table 7.** The percentages of dietary recommendation intakes

Age Percentages	14 (n=16) Mean±SD Min-max	15 (n=26) Mean±SD Min-max	16 (n=20) Mean±SD Min-max	17 (n=12) Mean±SD Min-max	18 (n=15) Mean±SD Min-max	p*
Energy (kcal)	58±18 29–95	60±12 40–84	60±11 41–82	58±16 275–89	50.6±13 35–87	0.280
Carbohydrate (g)	102±28 58–133	114±33 60–198	95±34 42–1755	110±40 46–172	95±31 455–146	0.263
Carbohydrates (% energy)	65±10 49–93	65±16 36–101	53±14 30–80	59±13 32–82	60±18 30–93	0.060
Fat (% energy)	178±20 123–211	177±28 123–225	197±25 156–247	184±21 149–222	192±40 124–265	0.107
Protein (g)	146±44 80–237	148±37 90–247	148±35 88–209	147±49 74–248	114±30 72–177	0.063
Protein (% energy)	120±11 93–136	117±18 83–152	125±23 76–172	127±41 83–248	104±20 67–133	0.068
Protein (g/kg)	111±32 66–175	109±30 64–169	104±26 69–150	113±43 48–214	82±23 54–129	0.052
Fiber (g)	97±33 43–161	92±39 37–182	72±25 30–123	93±45 26–185	61±27 20–105	<b>0.012</b>
Calcium (mg)	68±27 26–128	74±27 24–139	74±24 34–120.5	62±23 26–104	63±26 20–137	0.514
Iron (mg)	83±27 39–130	90±38 50–235	85±24 58–152	99±35 40–178	71±20 45–110	0.161
Magnesium (mg)	88±25 53–132	94±35 51–189	86±20 52–129	103±41 36–175	59±20 31–100	<b>0.001</b>
Phosphorus (mg)	194±62 100–306	211±71 118–425	199±42 131–271	211±78 87–346	186±62 126–363	0.725
Potassium (g)	48±10 33–65	47±17 22–81	45±14 26–74	52±17 22–81	36±14 16–66	0.087
Sodium (g)	543±652 95–2369	451±731 105–3559	259±253 109–1300	909±1558 101–5316	274±310 87–1376	0.264
Zinc (mg)	89±32 46–165	74±18 42–119	82±26 50–148	77±22 44–126	61±17 42–97	<b>0.020</b>
Vitamin A (mcg)	164±53 80–274	146±47 61–239	156±58 86–324	169.7±75 87–352	145±50.5 72–283	0.657
Vitamin E (mcg)	122±77 32–265	102±42 46–181	108±50 40–225	118±82 30–292	100±58 34–212	0.788
Vitamin C (mg)	134±63 64–255	72±45.5 7–179	75±40.4 6–163	107±69 23–280	63±46 2–191	<b>0.001</b>
B1 (mg)	72±20 37–114	72±27 39–151	63.5±18 37–94	78±30 28–136	56.6±21 29–102	0.112
B2 (mg)	118±27 70–176	129±35 72–196	131±40 69–207	129±35 59–187	101±28 57–178	0.078
B6 (mg)	109±29 65–169	104±34 57–163	113±33 52–172	132±39 67–188	87±26.5 39–134	<b>0.013</b>
Folate (mcg)	96±24 55–140	80±24 42–149	8±25 49–153	94±34 44–149	77±21 41–122	0.113
Water (mL)	38±6 27–52	37±10 23–58	36±10 20–52	42±14 21–65	31±10 15–47	0.084

\*: Welch statistics (p&lt;0.05).

increase with increasing age in adolescents; therefore, it is expected that late adolescents would have higher rates of correct answers to the questions due to both their football experience and their age and therefore higher cognitive level. These results did not meet our expectation because the rate of correct answers to the nutrition knowledge level questions of the athletes did not increase with increasing age, on the contrary, it decreased. The reason for this may be that the search for identity and future anxiety are higher in late adolescence than in middle adolescence, and therefore their interests are self-realization and academic activities in these fields rather than sports, performance and therefore nutrition. At the same time, adolescents may not have been able to answer the questions properly due to these concerns. Therefore, the 18-year-old age group should be followed up with a separate focus in terms of nutrition.

Nutritional beliefs may also affect nutritional behavior and knowledge levels. Nutritional beliefs of athletes should also be well understood. Most of the athletes thought that there is a special food that improves performance and these foods are protein-containing foods.<sup>[26,27]</sup> However, in a study conducted with adolescent football players, most of the athletes thought that the food that increased performance was multivitamin cereal.<sup>[17]</sup> In our study, most of the athletes believed that protein-containing foods and bananas affected performance.

In this study, athletes stated that the pandemic period and quarantine did not change their eating habits. This result was also obtained in similar studies conducted with adolescent football players.<sup>[28,29]</sup> In our study, it was found that the majority of the athletes did not increase their consumption of ready meals, frozen foods, and fast food, but their consumption of snacks and the frequency meal preparation at home increased. In another study conducted with adolescent football players, the frequency of preparing and eating food at home increased too.<sup>[12]</sup> In another study, ready-to-eat food consumption of athletes did not increase.<sup>[29]</sup> In the pandemic, it was observed that ordering ready-to-eat meals was avoided with the concern of virus transmission. In this current study, athletes stated that their consumption of bread, milk, yoghurt, egg, meat, chicken, fish, vegetables, fruits, and desserts increased. Similarly, it has been reported that vegetable and fruit consumption increased,<sup>[29]</sup> dessert, bread, snacks, and fruit consumption increased, but vegetable consumption decreased.<sup>[28]</sup>

In this current study, in which dietary intakes were analyzed, carbohydrate intake of athletes was found to be lower than it should be, fat intake was found to be higher than it should be, and it was observed that they were fed predominantly with fat. In other studies, athletes were found to have a

fat-dominant diet.<sup>[30-32]</sup> Similar to our study, energy and carbohydrate intake was low, protein intake was sufficient and fat intake was high in studies conducted with adolescent athletes.<sup>[16,19,33]</sup> Also in other studies, similar to our study, calcium, iron, zinc, potassium, and Vitamins B intakes were found to be low.<sup>[19,20,24]</sup> In addition, similar to the present study, sodium and phosphorus intakes of athletes were found to be much higher than the recommended levels.<sup>[19,33]</sup> In our study, the fact that the percentage of macro and micronutrient intakes were lower in the 18-year-old age group compared to the other age groups may be related to the fact that this group was stressed and anxious during the year of preparation for the university exam and therefore paid less attention to their nutritional status. In the literature, similar to our study, it was observed that the general nutrient intake of athletes was lower than it should be.<sup>[24,32]</sup> Since low intake of micronutrients such as calcium, iron, and zinc may adversely affect growth, development, sports performance, and general health, it is very important for adolescent athletes to meet the increased nutrient requirements of sports, growth, and development in every age group.

This study has several limitations and strengths. Due to the cross-sectional nature of this study, a cause and effect relationship cannot be established. The single-center nature of the study makes the study results not generalizable to the general population. On the other hand, this single-center study is a strength in terms of generating homogeneous data from the participants. So far, this is the first study to examine adolescent Turkish football players according to their adolescence period during the pandemic.

## Conclusion

It was determined that adolescent football players mostly skipped lunch due to training time and their nutritional knowledge level decreased towards the age of 18. In a special period such as the pandemic, it is seen that nutritional behaviors and body weights differ, and it has been determined that these athletes, who are in the growth and development phase, are not fed in accordance with the recommendations. However, it cannot be said that these deficiencies are caused by the pandemic alone. The adolescent period, which is determined as a growth period, should be evaluated as separate ages in itself, and especially 18-year-old athletes should be followed up separately. It is seen that the nutrient intake of adolescent football players who are at risk for inadequate and unbalanced nutrition is inadequate and needs to be improved. It is thought that athletes can gain healthier eating habits and their nutritional status can be improved and nutritional quality can be increased by the nutritionist's regular follow-up.

## Disclosures

**Ethics Committee Approval:** The study was approved by the Bahçeşehir University Scientific Research and Publication Ethics Committee (no: 2021/02, date: 10/02/2021).

**Authorship Contributions:** Concept – A.A.; Design – A.A., Y.S.; Supervision – Y.S.; Funding – A.A.; Materials – A.A.; Data collection and/or processing – A.A.; Data analysis and/or interpretation – Y.S., A.A.; Literature search – Y.S., A.A.; Writing – Y.S., A.A.; Critical review – Y.S.

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