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Original article

Assessment of nutrition status of Turkish elite young male soccer players in the pre-competition period

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Summary. *Background*: Follow up of the nutrition consumption of young soccer players is of great importance not only for their sport performance, but also for the protection of health, physical growth and development. *Aim*: The objective of this study was to evaluate the nutritional sufficiency status of elite young male athletes in the pre-competition period. *Methods*: Three-day food consumption and anthropometric measurements of the elite young athletes in the pre-competition period were recorded for 26 male voluntary athletes from a pro-professional soccer team based in Ankara Turkey. *Results*: The mean height of the athletes were calculated as 175.2±6.8 cm, weight 67.3±5.9 kg, body mass index (BMI) as 21.9±1.3 kg/m^2 and body fat percentage 6.2±1.7. It was determined that the athletes received an average of 3225±692 kcal energy daily whereas their mean energy expenditures per day were 3322±240 kcal. The ratios of energy received from carbohydrate, protein and fats were 53.6%, 16.2%, and 30.2%, respectively. Carbohydrate and protein consumption/day/kg body weight were 6.3±1.7 g and 1.9±0.5 g, respectively. It was determined that vitamin D consumption was inadequate for 92.3% of the athletes and calcium consumption was inadequate for 50% of the athletes. On the other hand, all of the athletes consumed vitamins B_2, B_6 and B_{12} as well as phosphorus, iron and zinc above recommended quantities. *Conclusions*: Nutrient consumption of young athletes at the beginning of their professional life must be monitored by a qualified dietitian and each athlete must have an individual dietary plan. Nutrition education must be arranged and the athletes' families must be included in these trainings.

Key words: Soccer players, male, food consumption, anthropometry

Introduction

Soccer is a sports branch which includes physical performance components such as agility, speed, strength, power, and endurance and has the highest popularity in the world (1). According to FIFA (2006), although soccer is a team game, it is necessary for players to have individual nutrition strategies (2). It is very important to design nutrition plans for the young (adolescent) soccer players because it positively affects their performance parameters, physical growth and development and results in reduced risks of injury (3). The nutritional needs of young soccer players are assessed in a similar manner as adult athletes. However, since growth and development have not yet been completed in younger athletes; they are expected to have greater energy and nutrient requirements (4).

Although studies performed on young soccer players, considered as endurance athletes, reported inadequate energy and nutrient intake (5,6), number of studies conducted in Turkey is rather limited. This study was planned to determine the food consumption and nutritional status of young soccer players (over the age of 15) playing in the soccer team of a pro-professional sports club. Due to the limited number of studies regarding nutritional status of adolescent athletes, especially soccer players in Turkey, it may be considered that the findings of this study will be useful for the sports clubs in Turkey.

Methods

Sample: A total of 26 athletes regularly playing in Ankaragucu pro-professional soccer (PAF) team volunteered to participate in this study. Approval of the Ethics Committee of Clinical Investigations in Ankara was obtained for this study (Decision number 2009/11-107 dated 11.11.2009).

Study Protocol: This study was planned to be conducted over three consecutive days in the pre-competition period. Considering the possibility that food habits might change on weekends or on days when there was no workout, the study was planned so that one of the three days fell on a resting day for the athletes. At the beginning of the study, a questionnaire consisting of questions regarding the demographic and personal information was completed by the participants. Volunteers having other obstacles for participating in the study (physical ailment or incompatibility) were excluded. The same day anthropometric measurements of the athletes were taken and recorded. For evaluation of food consumption status, 3-day food consumption (nutrition intake) records were conducted.

Data Collection Tools: Data collection tools comprised of three-day food consumption record form, weighing scale, stadiometer (height-measuring scale) and calipers.

Three-day food consumption registration form: During the 3 day study, all the foods and beverages consumed by the athletes were recorded in the food consumption registration form.

Weighing scale: The body weights of the athletes were measured with an electronic weighing scale sensitive up to 0.1 kg (Tanita BC 418MA, Tokyo, Japan).

Height-measuring scale: The heights of the athletes were measured with a stadiometer (Seca 220, Germany) sensitive up to 1 cm.

Caliper: The skin fold thicknesses (triceps, biceps, suprailiac, abdomen, midaxillary, pectoral, subscapular, thigh, calf, and suprapatella) of the athletes were measured with a caliper (Holtain, UK).

Collection of Data / Processing Method
Anthropometric Measurements

The skin fold thicknesses (triceps, biceps, suprailiac, abdomen, midaxiller, pectoral, subscapular, thigh, calf and suprapatella) were measured with the help of a caliper to calculate body fat percentages of the athletes. Each measurement was repeated three times and averages were taken (7-9). The weight and height scale were used to collected weight and height measurement. The weight, height, and BMI of the athletes were compared with age appropriate reference values (10).

The body fat percentage calculation= ((4.95/ body density) – 4.5) × 100

Body density = 1.112 – (0.00043499 x sum of skinfolds) + (0.00000055 x square of the sum of skinfold sites) – (0.00028826 x age)

Food Consumption and Energy Expenditure Measurements

Nutrition intakes of the athletes were monitored by the researcher for 3 days by means of the food consumption recording form. The daily energy expenditures of the athletes were calculated by Harris-Benedict equation and Physical Activity Level (PAL) values (10,11).

Analysis of Data

Three Day Food Consumption

The venue of meal consumption by the participants (home or outside) was determined from the questionnaire. In order to determine the amount of nutrients present in each portion of the meal consumed by the participants eating at home, exact amounts of all ingredients used for cooking the meal was recorded. The "Food and Nutrition Photo Catalogue: Measurements and Quantities" reference book was used to determine the amount of nutrients consumed at meals (12). For determination of the amount of nutrients included in each portion of the meal consumed by the participants eating outside, a reference book titled "Mass Nutrition Standard Cookbook for Established Institutions" was used (13). Data were entered into the Nutrition Information System (BEBIS-5) program and the average energy and nutrient intakes of the athletes for 3 days were calculated. Daily dietary energy and nutrient consumption sufficiency status of the athletes were compared with Dietary Guidelines For Turkey (2004) indicating the recommended amounts according to age and gender (14). Nutrient intake was clas-

sified as inadequate, adequate, and excessive intake. Food intake is sufficient if it meets 67% of the recommended amount, and if it is more than 33% it is defined as excessive intake. During the study, nutritional support and supplements usage of the athletes were questioned. However, since none of the participants used any nutritional supplements as per records, these products were excluded from the data.

Statistical Analysis

SPSS (Statistical Package for the Social Sciences) package program (version 15) was utilized for statistical analyses of the obtained data from the questionnaire which comprised of questions regarding demographic characteristics and the body composition of the experimental population, their nutrient and fluid intake as well as use of nutritional support products. Means ($\bar{X}$)and standard deviations (SD) were calculated where applicable.

Results

The average age of the participants was 16±1.2 years. The athletes had been playing soccer for 7 years on average and had been taking soccer training 6±0.6 times a week, 110±14.6 minutes on average. None of the athletes were diagnosed with any diseases as per examination by a physician. No medications were being used by the athletes.

Anthropometry

The average height was 175.2±6.8 cm, the average body weight was 67.3±5.9 kg and average body mass index (BMI) was 21.9±1.3 kg/m^2. The weight, height, and BMI of the athletes were found to be within the required range according to their age. Total skin fold thicknesses were measured as 51.6±9.8 mm and average body fat percentage was calculated as 6.2±1.7% according to skin fold thickness measurements (Table 1).

Food consumptions

The mean and standard deviation values of three-day energy and macro nutrient intakes of the athletes are given in Tables 2. It was observed that the athletes receive an average of 3225±692 kcal energy per day and the energy expenditures were 3322±240 kcal. The ratios of energy received from carbohydrate, protein, and fat were 53.6%, 16.2%, and 30.2%, respectively. The carbohydrate and protein consumption per weight of the athletes were 6.3±1.7 g/kg/day and 1.9±0.5 g/kg/day, respectively.

Table 1. Mean ($\bar{X}$) and standard deviation (SD) values of anthropometric measurements of athletes

Anthropometric measurements	±SD
Height (cm)	175.2±6.8
Weight (kg)	67.3±5.9
BMI (kg/m^2)	21.9±1.3
Total skin fold thickness (mm)	51.6±9.8
Body fat percentage (%)	6.2±1.7

The mean ($\bar{X}$) and standard deviation (SD) of the daily dietary micronutrient intake values of the athletes are shown in Table 3.

Table 4 shows the nutritional sufficiency status of athletes in terms of micronutrient intakes in comparison to Dietary Guidelines For Turkey (2004) (14). It was determined that vitamin D consumption in 92.3% of the athletes and calcium consumption in 50% of the athletes were insufficient. All of the players consumed

Table 2. The average ($\bar{X}$) and standard deviation (SD) values of daily energy and macro nutrient intake values of the athletes

Energy and nutrient	±SD
Energy intake (kcal)	3225±692
Energy consumption (kcal)	3322±240
Carbohydrate (g)	418.2±90.3
Carbohydrate (g/kg/day)	6.3±1.7
Carbohydrate (%)*	53.6±6.5
Protein (g)	128.8±33.3
Protein (g/kg/day)	1.9±0.5
Protein (%)*	16.2±2.1
Total fat (g)	111.1±41.0
Total fat (%)*	30.2±6.4
Saturated fatty acids (%)*	14.1±4.1
Monounsaturated fatty acids (%)*	10.4±2.1
Polyunsaturated fatty acids (%)*	5.7±1.8
Cholesterol (mg)	397.0±168.5
Fiber (g)	25.6±7.0

* Daily received energy ratios

Table 3. Mean ($\bar{X}$) and standard deviation (SD) values of the micro-nutrient consumption values of the athletes

Vitamins / Minerals	±SD
A vitamin (µg RE)	1228.3±485.6
D vitamin (µg)	2.2±3.2
E vitamin (mg)	16.3±6.9
K vitamin (µg)	318.2±82.2
B_1 vitamin (mg)	1.3±0.3
B_2 vitamin (mg)	2.0±0.7
Niacin (mg)	21.9±7.6
B_6 vitamin (mg)	2.0±0.6
Folate (µg)	375.4±91.4
B_{12} vitamin (µg)	5.7±2.4
C vitamin (mg)	97.6±43.9
Calcium (mg)	1009.0±555.4
Magnesium (mg)	383.3±103.9
Phosphorus (mg)	1877.0±511.4
Iron (mg)	16.6±3.9
Zinc (mg)	17.6±4.6
Copper (mg)	2.5±0.7

Table 4. Assessment of sufficiency status of micro-nutrient consumption of the athletes according to Turkey-specific dietary guidelines

Micro-nutrient	**Insufficient**	**Sufficient**	**Over**
	n (%)	**n (%)**	**n (%)**
A vitamin (µg RE)	1(3.8)	14(53.8)	11(42.3)
D vitamin (µg)	24(92.3)	-	2(7.7)
E vitamin (mg)	3(11.5)	17(65.4)	6(23.1)
K vitamin (µg)	-	-	26(100)
B_1 vitamin (mg)	2(7.7)	19(73.1)	5(19.2)
B_2 vitamin (mg)	-	9(34.6)	17(65.4)
Niacin (mg)	1(3.8)	12(46.2)	13(50)
B_6 vitamin (mg)	-	10(38.5)	16(61.5)
Folate (µg)	2(7.7)	22(84.6)	2(7.7)
B_{12} vitamin (µg)	-	2(7.7)	24(92.3)
C vitamin (mg)	4(15.4)	12(46.2)	10(38.4)
Calcium (mg)	13(50)	12(46.2)	1(3.8)
Magnesium (mg)	2(7.7)	20(76.9)	4(15.4)
Phosphorus (mg)	-	9(34.6)	17(65.4)
Iron (mg)	-	8(30.8)	18(69.2)
Zinc (mg)	-	6(23.1)	20(76.9)
Copper (mg)	26(100)	-	-

vitamin B_2, vitamin B_6, vitamin B_{12}, phosphorus, iron, and zinc above the recommended quantities.

Discussion

Sufficient and balanced nutrition of the athletes is important for continuity of health, reduction of injuries, and sports performance. In particular, adequate and balanced nutrition of adolescent athletes, whose growth and development is not complete, is of great importance (4). However, the number of studies evaluating the nutritional status of athletes in the adolescence is very limited in the literature. This study which is planned and carried out in order to monitor nutrition and anthropometric measurement in elite male young athletes, exhibited inadequate nutritional status in terms of energy and some micro-nutrients as calcium and vitamin D. Considering that these group of athletes who will step into professionalism and carry the health and nutrition behaviors in their professional life, proper guidance and training in this area is of special significance.

Anthropometry

Soccer players show more homogeneous distribution in terms of body structure than other sport branches and are generally expected to be 178-183 cm in height and 68-78 kg in weight (15). Iglesias et al. (2008) conducted a study of 22 male soccer players aged 14-16 years. The athletes had a height of 178±0.9 cm, a weight of 62.8±8.7 kg and a BMI of 20.0±1.8 kg/m^2 (16). In this study, the height of the athletes was determined as 175.2±6.8 cm, weight 67.3±5.9 kg and BMI value 21.9±1.3 kg/m^2. The weight, height and BMI of the athletes were found to be in the required range according to their age.

The skin fold thicknesses obtained with the help of caliper from different regions of the body were used to evaluate the body composition of the athletes. It has been suggested that the sum of 7 skin fold thicknesses (abdominal, biceps, thigh, calf, subscapular, supraspinal and triceps) determined by International Society For Advances in Kinanthropometry (ISAK, 2009) to be between 30-60 mm in male athletes. In the study done by Iglesias et al. (2008), the sum of skin fold

thickness was found to be at 49.3±9 mm (16). In this study, the sum of the skin fold thickness of the athletes was found to be at 51.6±9.8 mm. Although, the athletes' skinfold thickness measurements were in the normal range, it was close to the upper accepted limit of 60 mm.

Body fat percentages of adolescent athletes were reported to be lower than those of non-athletes (17, 18). Rico-Sanz et al. (1998) found that body fat percentage of athletes with a mean age of 17.0±2.0 years was approximately 7.6±1.1% (19). In the study done by Iglesias et al. (2008), the body fat percentage was found to be at 9.0±1.6% (16). In this study, body fat percentage was calculated as 6.2±1.7% according to skin fold thickness measurements. The results of the measurements regarding the skin fold thickness of the athletes were found to be within the acceptable values according to the age group and the sports branch of the athletes.

Food Consumption / Nutrition Intake

Irrespective of their sports activity status, factors such as being in the adolescence phase, social circle, personal taste, body image etc. affect young people's food choices (20-22). Young athletes need special attention for the protection and development of their nutritional status. Studies have shown that athletes fail to meet their energy needs in general. Furthermore, looking at the nutrient distribution of energy especially in endurance athletes as soccer players, percentage of energy received from carbohydrates are unable to meet the daily nutritional recommendations (5,6).

A study of the nutritional status of adolescent athletes in Brazil found that the amount of protein consumed by athletes was above the ACSM (American College Sports Medicine) recommendation and that carbohydrate consumption was inadequate for female athletes (6).

In a study done by Garcin et al. (2009) on 26 runners, 12 sprinter and 25 handball players, it was determined that the athletes' energy intake was 452±456 kcal lower than their energy expenditure and that the athletes could not meet their daily energy needs (5). In this study, it was seen that athletes consumed an average of 3224.9±691.7 kcal energy and spent 3322±240.4 kcal energy per day. It was determined that only 42.3% (11 people) met the daily energy expenditure. It was found that the difference between energy expenditure and intake was 586.6±401.6 kcal on average for athletes who could not meet their energy expenditure. In the sports center where the research was conducted, the absence of a dietitian who could plan the menus of the athletes and could provide nutrition education, could be the cause of inadequate diet and healthy nutritional practices among the athletes. There is a need for more training and information about energy and carbohydrate intake especially in this group of young endurance athletes.

Exercise performance in endurance sports, such as soccer, depends on the maintenance of blood glucose during exercise and muscle glycogen renewal after exercise, and high carbohydrate diet is recommended due to the long exercise periods. According to ACSM (2016) (11); a high carbohydrate diet, of 6-10 g/kg/day per weight is recommended. A study evaluating the nutritional status of soccer players in different age groups (14, 15, 16.6, 20.9 years) showed that the athletes› nutrient consumptions were lower than recommended levels and in particular the carbohydrate consumptions (44.6%) were inadequate (23). Iglesias et al. (2008) study showed that the percentage of energy intake from carbohydrates was 46% and that no athlete could go above 55% (16).

In the study done by Garcin et al. (2009), it was determined that the percentage of the athletes receiving energy from carbohydrates was 51.3±3.0% and their consumption was below the recommendations (5). In this study, it was determined that they consumed 6.3±1.7 g/day of carbohydrate per kg weight and that they met their daily carbohydrate requirements at just the lower margin of the acceptable level. According to the ACSM (2016) recommendations, 30-60 g/h carbohydrate consumption during 1-2.5 hours of endurance exercise positively affect the sport performance. In this study, it was determined that the athletes did not consume carbohydrates during exercise.

Protein consumption is seen as a key nutrient for success in all sports (11). The daily protein requirement of the athlete varies according to endurance and power training. The recommended protein intake for endurance athletes is determined as 1.2-1.4 g/kg/day (24). In a study conducted by Iglesias et al. (2008) found that

the athletes› protein consumption was 1.8 g/kg/day and 15% of the energy was obtained from protein (16). In a study of protein consumption of 11 soccer players aged 15 years (25), it was found that daily protein consumption was 1.57 g/kg per weight and this amount provided a positive nitrogen balance. In this study, it was determined that the ratio of energy received from protein was 16.2% and the athletes consumed 1.9±0.5 g/day protein per weight. It was determined that the athletes' diets were well above the recommended protein consumption quantities for endurance athletes. The protein sources in the athletes' diets were high quality protein resources as cheese, meat, and eggs. Along with the thought that excessive protein intake will cause more muscle and power production, protein intake of the athletes has also increased as a result of a shift towards nutrients that are protein sources.

Fat, especially saturated fatty acids and cholesterol consumption are increasing due to the fact that athletes consume more protein and increase their meat consumption (26). In long-term exercises, the fats are used as fuel. The ACSM (2016) recommendation for fat consumption is 20-35% of energy supplied from fat. The studies show that the athletes› daily ratio of energy intake supplied from fat is over 30 (5,16).

In Iglesias et al. (2008) study, it was determined that the ratio of athletes› diets supplied by fat is 38% and that cholesterol intake was 343 mg/day (16). In a study conducted to determine the nutritional status of soccer players, it was found that the adolescent athletes whose average age was 15 years had a ratio of 29.1% energy intake from fat (25). In this study, it was determined that the athletes› energy intake from fat was 30.2±6.4% and the fatty acid distribution was as follows: saturated fat 14.1%, monounsaturated fatty acid 10.4% and polyunsaturated fatty acid 5.7%. Although it is suggested that the athletes› daily saturated fat consumption must be 8% of energy intake and the cholesterol intake must be less than 300 mg; in this study, saturated fat and cholesterol consumptions were 14.1% and 397.0±168.5 mg respectively. The reason behind unbalanced fatty acid distribution was due to the fact that athletes consumed a lot of eggs, cheese, and meat, but not fish.

Presently there is no recommendation about daily fiber consumption for athletes, but in Dietary Guidelines for Turkey (2004) (14), fiber consumption of approximately 25 g/day is recommended for this age group and gender. In a study done by Schenkel et al., it was determined that daily fiber consumption of male soccer players (average age at 15.3±31.2) was 14.4 ± 0.38 g (20). In this study, it was determined that the athletes› daily fiber consumption was 25.6 g, which was consistent with the fiber recommendation. It was thought that the athletes› daily consumption of vegetables-fruits (562.5±256.5 g), legumes (14.9±13.3 g), and oily seeds (4.1±16.2 g) were sufficient to meet their daily fiber needs.

Studies on the micro-nutrient intake of the athletes have shown that adolescent athletes do not sufficiently consume micronutrient contents such as calcium, magnesium, iron, zinc and vitamin D (20, 27-29). Garcin et al. (2009) conducted a study; it was found that athletes› vitamin D, vitamin E and magnesium consumptions were below the RDA for France (5). In a study done by Rico-Sanz et al. on elite soccer players, it was concluded that their calcium consumptions were inadequate after assessing their nutrition status (19). In this study, it was seen that 50% of the athletes consumed calcium inadequately when their micro nutrient requirements are compared with Dietary guidelines for Turkey (2004) values recommended fort his age group and gender.

While athletes are recommended to consume 450 g of milk and 30 g of cheese per day according to their ages and gender in Dietary Guidelines for Turkey (2004), it was determined in this study that athletes consumed 259.7±181.7 g of milk and 82.5 ± 105.3 g of cheese per day and therefore could not meet their daily calcium requirements. In the study, 92.3% of the athletes were found to have inadequate vitamin D in their diets. However, soccer being an open-air sport, they would benefit from sun rays which are the main source of vitamin D.

Conclusion

As a conclusion, the nutritional status of the athletes should be determined at regular intervals. Education of coaches, trainers, team workers, athletes, and athletes' families are an important part of the nutrition training protocol. The first aspect of nutrition education for athletes by sports dietitians must be the correct choice of nutrients in the diet. Even though

soccer players meet their energy needs, carbohydrate consumption and some micronutrient intakes are often inadequate.

The dietary intake studies for athletes should be done during their stay in the training camps. The weakness of this study is that the athletes remained at home during the study period and that some of the information provided by the participants was not observable and depended on the athlete's self-claim.

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