*ORIGINAL RESEARCH*
*ORİJİNAL ARAŞTIRMA*

# The Effects of Nutritional Habits on Physical Fitness Parameters in Athletes

**ISSN: 2636-848X**

DOI: 10.46385/tsbd.782109

**Türk Spor Bilimleri Dergisi**
***Türk Spor Bil Derg***

Cilt 3, Sayı 2
Ekim 2020, 61-69

The Journal of Turkish Sport Sciences
*J Turk Sport Sci*

Volume 3, Issue 2
October 2020, 61-69

***Bedriye URAL*** [1]
***Emine ATICI*** [2]
***Gamze AYDIN*** [2]
***Laçin Naz TAŞCILAR*** [2]
***Burcu YEŞİLKAYA*** [2]
***Ahmet Cüneyt AKGÖL*** [2]
***Tülay ÇEVİK SALDIRAN*** [3]
***Mehmet ÖZKESKİN*** [4]

[1] Sağlık Bilimleri University
Faculty of Health Sciences
[2] İstanbul Okan University
Faculty of Health Sciences
[3] Bitlis Eren University
Faculty of Health Sciences
[4] Ege University
Faculty of Health Sciences

Sorumlu Yazar/Corresponding Author:
B. Ural
e-mail: gulerbedriye@gmail.com

*Geliş Tarihi: 18.08.2020*

*Kabul Tarihi: 26.10.2020*

## Abstract

Nutrition is one of the major component of sustainable energy, optimal body composition, improving physical fitness and maintaining good health status in athletes. The aim of the study is to investigate the effect of nutritional habits on physical fitness parameters of athletes playing in university teams in different sports branches. Height, body weight of the athletes were measured and body mass index (BMI) was calculated. 12 minute run test, 20 meter sprint test, slalom test, sit ups test, push up test, closed kinetic chain upper extremity stability test (CKCUET test), vertical jump test and hand grip strength test (right-left) were applied to the athletes. 72 athletes who participated in the study, 41.7% were female and 58.3% were male. It was found that the majority of athletes (60.0% for women; 66.7% for men) consumed 3-4 meals a day. While the majority of the athletes reported that they skipped meals, the most skipped meal was breakfast (p=0.05). It was observed that the group consuming 5 or more meals covered more distance in standing long jump and vertical jump tests. When the right and left hand grip strength examined, it was shown that the group who consumed 5 or more meals had better performance, but there was no statistically significant difference (p>0.05). As a result, athletes need different nutritional programs depending on factors such as gender, age, sport, training/competition time. A well-nourished athlete will have higher physical fitness and concentration ability and maximum efficiency of the training.

**Keywords:** Nutritional habits, physical fitness, athletes, anthropometry

# Sporcularda Beslenme Alışkanlıklarının Fiziksel Uygunluk Parametreleri Üzerine Etkileri

## Özet

Beslenme, sürdürülebilir enerjinin, optimal vücut kompozisyonunun, fiziksel performansı geliştirmenin ve sporcularda sağlık durumunu korumanın ana bileşenlerinden biridir. Araştırmanın amacı, farklı spor branşlarında üniversite takımlarında oynayan sporcuların beslenme alışkanlıklarının fiziksel uygunluk parametreleri üzerine etkisini araştırmaktır. Sporcuların boyları, vücut ağırlıkları ölçülüp, vücut kitle indeksleri (BKİ) hesaplanmıştır. 12 dakikalık koşu testi, 20 metre sprint testi, slalom testi, sit up testi, push up testi, üst ekstremite kapalı kinetik zincir stabilite testi (CKCUET testi), dikey atlama testi ve el kavrama gücü testi (sağ-sol) uygulandı. Çalışmaya katılan 72 sporcunun %41.7'si kadın, %58.3'ü erkekti. Sporcuların çoğunluğunun (kadınlarda %60.0; erkeklerde %66.7) günde 3-4 öğün yemek yediği tespit edildi. Sporcuların geneli öğün atladıklarını belirtirken en çok atlanan öğün kahvaltıydı (p = 0.05). Durarak uzun atlama ve vertikal sıçrama testlerinde 5 ve üzeri öğün tüketen grubun daha fazla mesafe katettikleri görülmüştür. Sağ ve sol el kavrama kuvveti incelendiğinde 5 ve daha fazla öğün tüketen grubun daha iyi performans gösterdiği, ancak istatistiksel olarak anlamlı bir fark olmadığı görüldü (p> 0.05). Sonuç olarak sporcuların cinsiyet, yaş, spor, antrenman/müsabaka süresi gibi faktörlere bağlı olarak farklı beslenme programlarına ihtiyaçları vardır. İyi beslenmiş bir sporcu daha yüksek fiziksel uygunluk ve konsantrasyon yeteneğine, antrenmanlarda maksimum verimliliğe sahip olabileceği söylenebilir.

**Anahtar Kelimeler:** Beslenme alışkanlıkları, fiziksel fitnes, sporcu, antropometri

**To cite this article;** Ural, B., Atıcı, E., Aydın, G., Taşçılar, L.N., Yeşilkaya, B., Akgöl, A.C., Çevik-Saldıran, T., & Özkeskin, M. (2020) The effects of nutritional habits on physical fitness parameters in athletes. *The Journal of Turkish Sport Sciences*, *3*(2), 61-69.

This article was presented at the 5. International Eurasian Congress on Natural Nutrition Healthy Life and Sport in Ankara in 2019.

## INTRODUCTION

Technical skills, physical fitness, coordination, condition and motivation, and nutrition are important parameters for team sports which are depend on the type of sport. The main factors for achieving high performance in different sports are anatomical, functional, biomechanical and physiological adaptation of the sport. Athletes spend most of their time training to withstand the long-term physiological load that occurs during the match and the season, as well as to increase their efficiency. Nutritional interventions are also recommended to reduce the negative consequences of exercise-induced muscle damage.

Basketball, volleyball, and football are the common team sports that play. These sports branches have similar physical, physiological and motoric properties beside similar technical features. Team sports such as basketball, football, volleyball which are called intermittent sports, are the branches that both aerobic and anaerobic energy systems are used. Sportive performance can be described as the total effort made for success in the performance of an athletic task that needs to be done. Strength, speed, endurance, flexibility, reaction time, postural fitness, sport-specific characteristics should be evaluated according to the type of sport (Bayraktar and Kurtoglu, 2009; Karacabey 2013; Yarar et al., 2011).

Follow-up of athletes with a nutrition program is one of the main factors that increase their physical fitness efficiency (Yarar et al., 2011). It is important that athlete and coaches should have and use efficient information about nutrition in sports (Canbolat, 2016). Adequate and balanced nutrition is the intake of energy and nutrients such as; protein, carbohydrates, vitamins, and minerals in sufficient amounts (Parlak, 2008; American College of Sports Medicine et al., 2000).

Nutrition of an athlete affects body weight, body composition, recovery time, sport related physical fitness parameters and consequently overall health. Sports nutrition is necessary to meet the increasing energy requirement by training. There must be sufficient calorie and nutrient (carbohydrate, protein, fluid etc.) intake to provide the necessary energy and maintain positive energy sustainability. The energy that athlete needs vary depending on gender, age, height, weight, daily physical activities, sports branch and training periods (American College of Sports Medicine et al., 2000; TUBER, 2015; Ozdemir, 2010). Adequate fluid intake should be supplied along with a well-balanced nutrition program with macro and micronutrients. It has been shown that athletes improve overall physical fitness and provide competitive advantage through nutritional arrangements for training and competition periods. Giving athletes the required energy, nutrient, and fluid supports the adaptation and recovery process after training (Dinç et al., 2017; Ersoy, 2014).

### *Purpose of the Research*

Athletes may experience losing more body water and they press into muscle, joints and bones tissues than non-athletes (Tarnopolsky et al., 2005). Therefore, athletes need more energy and fluid to decompensate, especially during heavy training periods. In case of inadequate intake of energy with food consumption for a long time, the energy that athlete needs are supplied from the storage in the body. In this case, there is a decrease in muscle tissue along with weight loss and performance decreases with loss of strength and endurance (Kondrič et al., 2012; Sarper et al., 2016). It is required to increase the frequency and content of meals for athletes to meet their high energy needs compared to normal individuals. Nutrition is very important before, during and after the exercise especially for the athletes who are prepared for the competitions and who are training intensively (Kessinger, 2018). Athletes should be supported by three main meals (breakfast-lunch-dinner) with snacks according to their training periods. Body compositions such as body weight and body fat mass of the athletes who are followed up with a diet program is within the recommended levels. It is thought that an athletic-specific nutrition program which provides the necessary energy, liquid and nutrients is effective on the physical fitness parameters (American College of Sports Medicine et al., 2000; Gülgün and Hasbay, 2008). The aim of the study is to investigate the effect of nutritional habits on physical fitness parameters of athletes playing in university teams in different sports branches.

# METHODS

## Research Group

A total of 72 athletes in the sports club of Istanbul Okan University who have been doing exercise with the license for 2 years were included in the study. Athletes without physical and mental discomfort were players of basketball, volleyball, korfball and American football teams.

Table 1. Gender Variables of Athletes

| Variables | Frequancy | Percentage (%) |
|---|---|---|
| **Gender** | | |
| Female | 30 | 41.7 |
| Male | 42 | 58.3 |

## Data Collection Methods

### Nutritional Questionnaire

A questionnaire was applied to the athletes to determine frequency of meals they consumed, skipped meals, reasons for skipping meals, nutritional information and the source of nutritional information.

### Anthropometric Measurements

Measurements of body composition of athletes (height, weight, body mass index, lean body mass, fat percentage, total body water, basal metabolic rate, etc.) were measured with bioimpedance body analyzer. The height of the athletes was measured using the stadiometer (degree of accuracy was 0.01 cm) when they were in the anatomical posture position (the head was in the frontal plane, the overhead line was in the vertex point in the Frankfort plane) and the measurements were recorded in centimeters. The waist circumference of the athletes was calculated by measuring the lowest circumference in the middle of the iliac crest and the lowest rib. Hip circumference; the widest part of the hip is measured in tape measure and written in centimeters.

### Physical Fitness Tests

Aerobic power tests: The aerobic capacity of the athletes was evaluated by a 12-minute running test. The athletes were asked to run for 12 minutes in the marked area. The athletes were advised to take as much distance as possible during these 12 minutes. As soon as the run started, the stopwatch was started and the distance traveled at the end of 12 minutes were recorded. The maximum amount of oxygen consumption that a person can use during 12 minutes of running was calculated in ml/kg.min with the Cooper test formula (running distance during 12 minutes-505)/45) (Nilsson and Cardinale, 2015).

### Anaerobic Power Tests

***Vertical jump anaerobic power test:*** Vertical Jump Test was used for vertical plyometric force in athletes. The athletes extended as high as possible by standing up (give equal weight to both feet open at shoulder width) and this point was marked with chalk on the wall. This was the zero starting position and the athlete was asked to jump without flexing the knee, hip, and ankle, and that point was marked. The score was the vertical distance between the two points drawn in chalk. Anaerobic power was calculated in kg.m/s with the formula of '√4,9 x Body weight (kg) x vertical displacement (m) (Sattler et al., 2015).

***Standing long jump test:*** It was conducted to determine the functional strength, neuromuscular control and dynamic power of the lower extremity. The subjects were asked to jump as far as they could with their legs shoulder-width apart and parallel to each other from a starting point we determined. The distance left behind by the subjects after their jumps was measured and recorded. Each subject was given three jumps and their best jumps were considered (Güzel Atalay and Kafa, 2017).

***Agility test:*** Slalom test was applied to the athletes to test the versatile speed, agility and body control. There were 6 obstacles placed at 2 m intervals in the test area. The time of test was measured running at

maximum speed in the slalom pattern (forward and backward direction from the starting point) in this test area. The test area was 20 m long and the obstacles used as test material are 60 cm high and 80 cm wide (Güzel Atalay and Kafa, 2017).

***Speed tests:*** 20 Meter Sprint test was applied to athletes for speed test. In this test, the athletes were asked to complete the distance of 20 meters as soon as possible, the measurements were repeated twice and the best value was recorded (Karacabey, 2013).

***Endurance tests:*** The endurance of the athletes were evaluated with sits up, push-up and Closed Kinetic Chain Upper Extremity Test (CKCUET) repeat numbers. Abdominal muscle strength was assessed by the sits up test, upper extremity muscular strength and endurance were evaluated by push-up and CKCUET test. In the sits up test, the athletes lied on the mat in a supine position with the knees flexed at 90°. The athletes were asked to cross the hands over the chest, flexing the trunk and raising himself/herself 90°. Each sits up started with a return to the ground. The athletes were asked to repeat this movement for 30 seconds and each correct movement was recorded as a number (Güzel Atalay and Kafa, 2017).

***Push up test:*** The athletes were positioned in the prone position on the mat with only the toes and hands were in contact with the ground. The athletes were asked to lower the entire trunk down until the elbows were flexed 90 ° and return to the initial position. The athletes were asked to repeat this movement for 60 seconds and each correct movement was recorded as a number (Güzel Atalay and Kafa, 2017).

***Closed kinetic chain upper extremity test (CKCUET):*** The athletes were in the push-up position and their hands were on a 90 cm horizontal line for the test. The athletes were told to touch the line next to the other hand and return to the starting position and repeat it with the other hand, respectively. Each touch of the hand on the opposite line starting point was counted as a number. Each touch done within 15 seconds was recorded as a number. Athletes done warm-up movements before the test. The measurements were repeated 3 times and the best value was recorded (Roush et al., 2007).

***Handgrip strength test:*** Handgrip strength was evaluated with JAMAR hand dynamometer (Sammons Preston, USA) measuring isometric muscle contraction for dominant and non-dominant hands. The measurement was recorded as the highest value in kilogram-force when the athletes were sitting in the shoulder adduction, elbow 90° flexed, the forearm and wrist were in the neutral position, and the athletes grasped the dynamometer and squeezed it with maximum force (Narin et al., 2009).

### Data Analysis

Athletes were evaluated in terms of anthropometric measurements, nutritional habits, and physical fitness parameters. The relevant percentage differences were used to evaluate the relationship between nutritioal habits and physical fitness parameters. The difference between the closing values of shares was determined as a percentage and presented in tables.

## RESULTS

The study was carried out 72 athletes; 41.7% of athletes were female and 58.3% were male. Demographic variables of the athletes according to gender are shown in Table 2.

When the mealtime consumption of the athletes examined, it was found that the majority (60.0% of women; 66.7% of men) consumed 3-4 meals a day. While the majority of the athletes reported that they skipped meals, breakfast was the most skipped meal. The main reason for skipping meals was the lack of time in 73.3% of female athletes and 66.7% of the male athletes. Other reasons for skipping meals are loss of appetite in women (13.3%) and forget eating in men (16.7%).

Table 2. Demographic Variables of Athletes

| Gender | Demographic variables | Minimum | Maximum | Mean±SD |
|---|---|---|---|---|
| **Female (41.7%)** | Weight (kg) | 44.4 | 96.2 | 60.91±12.19 |
| | Height (cm) | 157 | 180 | 167.83±5.92 |
| | BMI (kg/m$^2$) | 16.7 | 32.6 | 21.59±3.91 |
| | Waist Circumference (cm) | 62 | 105 | 72.7±10.83 |
| | Hip Circumference (cm) | 86 | 120 | 97.9±8.30 |
| | Lean Body Mass (kg) | 39.3 | 57.2 | 46.9±4.94 |
| | Body Fat Percentage (%) | 6.2 | 41.8 | 21.4±8.39 |
| **Male (58.3%)** | Weight (kg) | 55.8 | 119.6 | 79.78±13.34 |
| | Height (cm) | 170 | 198 | 182.57±6.67 |
| | BMI (kg/m$^2$) | 17.6 | 31.8 | 23.9±3.6 |
| | Waist Circumference (cm) | 67 | 104 | 83.46±8.41 |
| | Hip Circumference (cm) | 84 | 119 | 101.47±7.59 |
| | Lean Body Mass (kg) | 54 | 108.7 | 71.90±9.92 |
| | Body Fat Percentage (%) | 4.5 | 20.9 | 8.86±4.87 |

When the athletes' preferences were questioned, it was determined that they preferred snacks such as cakes, biscuits, chocolate and chips. Table 3 shows the nutritional habits of male and female athletes.

Table 3. Nutritional Habits of Athletes

| | | Female n (%) | Male n (%) | p |
|---|---|---|---|---|
| Meal frequency per day | 1-2 | 6 (20) | 7(19) | 0.75 |
| | 3-4 | 18 (60) | 28 (66.7) | |
| | 5 or more | 6 (20) | 6 (14.3) | |
| Skipping meal | Yes | 22 (73.3) | 30 (71.4) | 0.48 |
| | No | 8 (26.6) | 12 (28.6) | |
| Most common skipping meal | Breakfast | 11 (36.7) | 23 (54.8) | 0.05 |
| | Lunch | 4 (13.3) | 4 (9.5) | |
| | Mid-afternoon | 4 (13.3) | 9 (21.4) | |
| | Dinner | 4 (13.3) | 1 (2.4) | |
| | Night | 7 (23.3) | 5 (11.9) | |
| Reason for skipping meal | Lack of time | 22 (73.3) | 28 (66.7) | 0.51 |
| | Losing weight | 2 (6.7) | 1 (2.4) | |
| | Forgetting | 2 (6.7) | 7 (16.7) | |
| | Loss of appetite | 4 (13.3) | 6 (14.3) | |
| Most common snacks | Cake, biscuit, chocolate, chips | 16 (53.3) | 19 (45.2) | 0.41 |
| | Fruit, dried fruit | 11 (36.7) | 11 (26.2) | |
| | Milk, yogurt, ayran | 2 (6.7) | 5 (11.9) | |
| | Nuts | 1 (3.3) | 3 (7.1) | |
| | Sports products | 0 (0) | 4 (9.5) | |
| Total | | 30 (100) | 42 (100) | |

**n:** number of participants. Values are expressed as the number and percentage
**p:** Chi-Square test for between-sex comparison

Athletes were evaluated according to aerobic and anaerobic physical fitness parameters and the effect of meal consumption on these parameters was examined (Shown in Table 4). The athletes were grouped according to their consumption as 1-2 meals, 3-4 meals and 5 and more. The athletes who consumed 5 or more meals showed higher performance in twenty meter speed and slalom tests compared to other groups. Kruskal Wallis test was used to compare physical fitness parameters between groups and there was no statistically significant difference between standing long jump, vertical jump, slalom, twenty-meter speed, twelve-meter running, shuttle, push-up, CKCUET, right-handgrip and left-handgrip tests ($p > 0.05$).

Although not statistically significant it was observed that the group that consumed 5 or more meals covered more distance in standing long jump and vertical jump tests. It was found that the group consuming 1-2 meals was better in the shuttle test and the group consuming 3-4 meals was better in push-ups and CKCUET tests. When the grip strengths of the left and right hand were examined, it was shown that the performance of the group consuming 5 or more meals was better.

**Table 4.** Meal Consumption Frequency on Physical Fitness Parameters in Athletes

| | **Meal Consumption Frequency** | **Mean±SD** | **p** |
|---|---|---|---|
| Standing long jump test | 1-2 | 175.42±42.05 | 0.63 |
| | 3-4 | 185.13±45.41 | |
| | 5 and more | 191.42±33.63 | |
| Vertical jump test | 1-2 | 226.63±66.19 | 0.76 |
| | 3-4 | 239.86±51.03 | |
| | 5 and more | 249.97±77.25 | |
| Slalom test | 1-2 | 15.76±2.07 | 0.79 |
| | 3-4 | 15.71±1.86 | |
| | 5 and more | 15.27±1.88 | |
| Twenty-meter sprint test | 1-2 | 3.87±0.62 | 0.12 |
| | 3-4 | 3.86±0.63 | |
| | 5 and more | 3.78±0.39 | |
| 12 minute run test ($VO_{2max}$) | 1-2 | 27,92±6.81 | 0,75 |
| | 3-4 | 29,21±6.97 | |
| | 5 and more | 29,12±6.36 | |
| Shuttle test | 1-2 | 22.57±7.11 | 0.51 |
| | 3-4 | 24.50±8.18 | |
| | 5 and more | 24.08±8.92 | |
| Push-up test | 1-2 | 29.64±10.11 | 0.71 |
| | 3-4 | 27.97±13.56 | |
| | 5 and more | 27.50±16.32 | |
| CKCUET test | 1-2 | 20.35±5 | 1.06 |
| | 3-4 | 20.97±4.77 | |
| | 5 and more | 20.41±4.29 | |
| Handgrip Strength Test (Right) | 1-2 | 28.07±9.93 | 0.31 |
| | 3-4 | 27.69±11.49 | |
| | 5 and more | 33.75±14.03 | |
| Handgrip Strength Test (Left) | 1-2 | 29.21±9.95 | 0.40 |
| | 3-4 | 26.95±10.09 | |
| | 5 and more | 33.33±15.08 | |

**SD:** standard deviation. Values are expressed as the **Mean±SD**. *Kruskal Wallis test for between-group comparison

When asked how the nutritional information levels of the athletes participating in the study were questioned, 47.2% found it sufficient and 52.8% found it insufficient. The ways that athletes obtain nutritional information were trainers (48.6%), media (26.4), friends (15.3%) and dietitians (9.7%), respectively.

## DISCUSSION and CONCLUSION

Sports nutrition is one of the major component of sustainable energy, optimal body composition, improving physical fitness and maintaining good health status in athletes. It may be necessary to increase the frequency of meals to meet the increasing energy needs of athletes, especially during training intensively or competition period (American College of Sports Medicine et al., 2000; Gülgün and Hasbay, 2008). In this study, the effect of meal consumption on physical fitness parameters in athletes was investigated.

When the consumption of athletes was examined, it was found that the majority of the participants (60.0% in women; 66.7% in men) consumed 3-4 meals a day. It was found that the athletes skipped meals and the most skipped meal was breakfast. The main reason for skipping meals is the lack of time, followed by loss of appetite in women (13.3%) and forgetting to eat in men (16.7%). In a study conducted with American football players, the nutrition recommendations given to athletes was investigated. It was found that 82% of athletes consumed at least three meals and 48% had regular meals (every 3-5 hours) (Gacek, 2015). The study conducted with 115 volunteers who regularly do fitness and bodybuilding, it was found that the participants did not skip their main meals, 81.2% had breakfast, 92.2% had lunch and 97.4% had

dinner (Dinc et al., 2017). In a study of university students, it was found that the most skipped meal was lunch in boys and girls. When the number of meals was questioned, it was found that the majority of the boys consumed three meals and the majority of the girls consumed two meals (Ozdemir and Ozdilek, 2010). When amateur and professional footballers were questioned, it was determined that 91.7% of amateur footballers consume 3-4 meals per day, 86.7% of professional footballers consume 3-4 meals per day (Goral et al., 2010). It can be said that the players participating in the study have insufficient information on this subject since the athletes in such branches with high energy consumption should consume 5 or more meals to meet their energy requirements.

Ozdemir (2010) studied with elite basketball players, he found that athletes do not have sufficient nutritional knowledge. In this study, while 47.2% of the athletes find their nutritional knowledge sufficient, 52.8% of the athletes find it insufficient. The way of getting nutritional information was coaches (48.6%), media (26.4), friends (15.3%) and dietitians (9.7%), respectively.

In our study, athletes who consumed 5 or more meals were found to be more successful in physical fitness tests such as slalom, 20-meter sprint test, standing long jump, vertical jump, right-handgrip strength and left-handgrip strength test, but no significant relationship was found. Ferro et al. (2017) conducted a two-month nutrition program for athletes in the pre-competition period. The mean frequency of meals in the second month was slightly higher than the first month. The maximum speed of the 20-meter sprint test of the participants increased from 4.77 ± 0.31 m / s in the first month to 5.19 ± 0.23 m / s in the second month. The total duration of the 20 m sprint test was significantly higher in the first month than in the second month (Ferro et al., 2017). In our study, the lowest 20-meter sprint test duration was found in the group that consumed 5 or more meals (3.78 ± 0.39), the longest 20 meter sprint test duration was found in the group that consumed 1-2 meals (3.87 ± 0.62).

In a study investigating the effect of meal frequency on parameters such as fasting, body mass index, body composition, physical performance, it was found that meal frequency helped to activate fat loss, increase lean body mass and anaerobic power. However, it was reported that the effect of frequent meal consumption on performance in individuals doing exercise regularly compared to sedentary individuals may be due to improving body composition, stimulating anabolic activities of exercise and disintegrating the food taken in the body (La Bounty et al., 2011). In our study, anaerobic power tests were found to be better in those who consumed 5 or more meals compared to other groups.

Sports nutrition in all terms such as meal frequency, timing, amounts of macro/ micronutrients and fluid, is one of the main factors associated with the physical fitness parameters of athletes. In our study; it was found that many physical fitness test results were better in the group that the frequency of meal consumption was higher (5 meals per day or more). In a study, twelve healthy male athletes had a 33% calorie restriction compared to their normal diet. As a result of calorie restriction, athletes' body weight, body fat tissue, lean body tissue, body, arm, and leg weights significantly decreased. Also, athletes' performance and energy efficiency increased. However, it has been shown that calorie restriction reduces daily micronutrient intake and therefore it may cause vitamin & mineral deficiency (Pons et al., 2018). Lack of vitamins and minerals which found in co-enzymes and cofactors in many vital metabolic pathways such as energy production may decrease the performance of the athlete and increase the risk of disability (Gülgün and Hasbay, 2008).

The timing of the energy intake and macronutrients contributes recovery and tissue repair, increases muscle protein synthesis and can improve moods after high volume or intense workouts. Prolonged (>60 min.) and high intensity (>70% VO2max) exercises stimulate energy and fluid requirement in the body. Increasing the frequency of meal consumption may affect hunger appetite and satiety positively. There are studies showing the beneficial effects of meal frequency according to exercise program on weight loss / body composition, better physical fitness, muscle recovery, especially in athletes (Tarnopolsky et al., 2005; Kerksick et al., 2008; White et al., 2008).

Each athlete needs different diet programs related to factors such as gender, age, sports branches or duration of training. Athletes with a good nutritional knowledge are successful to follow adequate and balanced diet before, during and after the competition. Well-nourished athletes may have better physical fitness, concentration ability and ideal body composition, compared to malnourished athletes. Also, these athletes might have lower rate of illness, injury and shorter recovery time.

As a conclusion, a well-nourished athlete will have higher physical fitness and concentration ability and maximum efficiency of the training. So sport nutrition is an issue that examines "exercise-nutrition" interaction in the field of nutrition science and the importance of sports nutrition is increasing with the recent studies. Taking into consideration all the points, educating of athletes on sports nutrition and following athletes with an appropriate personal diet program can be effective in improving physical fitness parameters and efficiency of the training.

## REFERENCES

American College of Sports Medicine, American Dietetic Association, and Dietitians of Canada. (2000). American College of Sports Medicine & American Dietetic Association joint position statement: nutrition and athletic performance. *Medicine and Science in Sports and Exercise. 32*(12), 2130.

Bayraktar, B., Kurtoğlu, M. (2009). Performance in sports, effective factors, evaluation and increase. *Clinical development. 22*(1), 16-24.

Canbolat, E., Çakiroğlu F. P. (2016). Vücut geliştirme ve fitness salonlarında çalışan antrenörlerin beslenme bilgi düzeylerinin saptanması. *CBÜ Beden Egitimi ve Spor Bilimleri Dergisi. 11*(2), 83-91.

Dinç, N., Gökmen, M. H. and Ergin, E. (2017). Examination of nutrition habits of individuals exercising regularly. *National Journal of Sport Sciences. 1*(1), 43-53.

Dinç, N., Gökmen, M. H. and Ergin, E. (2017). Investigating the dietary habits of the individuals who regularly exercise. *National Journal of Sport Sciences. 1*(1), 43-53.

Ersoy, G. (2014). *Importance of hydration of liquid support for active people and athletes.* 7punto Design Printing.

Ferro, A., Garrido, G., Villacieros, J., Pérez, J., and Grams, L. (2017). Nutritional habits and performance in male elite wheelchair basketball players during a precompetitive period. *Adapted Physical Activity Quarterly. 34*(3), 295-310.

Gacek, M. (2015). Association between self-efficacy and dietary behaviours of American football players in the Polish Clubs in the light of dietary recommendations for athletes. *Roczniki Państwowego Zakładu Higieny. 66*(4).

Göral, K., Saygın, Ö., and Karacabey, K. (2010). Amateur and professional football player to investigate the level of nutritional knowledge. *International Journal of Human Sciences. 7*(1).

Gülgün, E. and Hasbay, A. (2008). Sports nutrition. Turkish Republic Ministry of Health. Available from: https://sbu.saglik.gov.tr/Ekutuphane/kitaplar/A%203.pdf

Güzel Atalay, N., and Kafa, N. (2017). *Sports Health.* Evaluation in sport-physical fitness assessment methods. Ankara: Hipokrat Kitabevi. 56-64.

Karacabey, K. (2013). Sport performance and agility tests. *Journal of Human Sciences. 10*(1), 1693-1704.

Kerksick, C., Harvey, T., Stout, J., Campbell, B., Wilborn, C., Kreider, R., et al. (2008). International Society of Sports Nutrition position stand: nutrient timing. *Journal of the International Society of Sports Nutrition.5*(1),17.

Kessinger, T. K. (2018). Nutritional recovery considerations for intermittent exercise and sport. *Strategies. 31*(6), 26-33.

Kondrič, M., Uljević, O., Gabrilo, G., Kontić, D., & Sekulić, D. (2012). General anthropometric and specific physical fitness profile of high-level junior water polo players. *Journal of humankinetics. 32*, 157-165.

La Bounty, P. M, Campbell, B.I., Wilson, J., Galvan, E., Berardi, J., Kleiner, S.M. et al. (2011). International society of sports nutrition position stand: meal frequency. *Journal of the International Society of Sports Nutrition. 8*(1), 4.

Narin. S., Demirbüken, İ., Özyürek, S., Eraslan, U. (2009). Relationship of the grip and pinch strength of the dominant hand with anthropometric measurements of forearm. *DEU the Journal Of Medical Faculty*. 23(2), 81-85.

Nilsson, J. and Cardinale, D. (2015). Aerobic and anaerobic test performance among elite male football players in different team positions. *LASE Journal of Sport Science. 6*(2), 73-92.

Nutrition Guide to Turkey (TUBER). (2015). Turkish Republic Ministry of Health. Publication no:1031. Ankara, Turkey.

Özdemir, G. (2010). Nutrition according to sports branch. *Spormetre Journal of Physical Education and Sports Sciences*. *8*(1), 1-6.

Özdemir, G. and Özdilek, Ç. (2010). Nutrition habits of the students who do active sports at kutahya dumlupinar university physical education and sports college. *Dumlupinar University Journal of Social Sciences:* 26.

Parlak, N. (2008). *Investigation of the knowledge and habits of athletes between the ages of 15 and 18 engaged in active sports in Konya.* Selçuk University Health Sciences Institute. PhD Thesis. Konya, Turkey.

Pons, V., Riera, J., Capó, X., Martorell, M., Sureda, A., Tur, J. A. et al. (2018). Calorie restriction regime enhances physical performance of trained athletes. *Journal of the International Society of Sports Nutrition*. *15*(1), 12.

Roush, J., Kitamura, J. and Waits, M. C. (2007). Reference values fort he closed kinetic chain upper extremity stability test (ckcuest) for collegiate baseball players. *North American Journal Of Sports Physcal Therapy*. *2*(3), 159-163.

Sarper Kahveci, M., Hergüner, G., and Albayrak, C. (2016). Determining whether the symptoms of female athletic triad in badminton female league athlete sand national team exist and the knowledge levels of them on female athletic triad. *Journal of Human Sciences*. *13*(2), 3643-3653.

Sattler, T., Hadžic, V., Derviševic, E., Markovic, G. (2015). Vertical jump performance of professional male and female volleyball players: Effects of playing position and competition level. *The Journal of Strength & Conditioning Research. 29*(6), 1486-1493.

Tarnopolsky, M. A., Gibala, M., Jeukendrup, A. E. and Phillips, S. M. (2005). Nutritional needs of elite endurance athletes. Part I: Carbohydrate and fluid requirements. *European Journal of Sport Science*. *5*(1), 3-14.

White, J. P., Wilson, J. M., Austin, K. G., Greer, B. K., St John, N., and Panton, L. B. (2008). Effect of carbohydrate-protein supplement timing on acute exercise-induced muscle damage. *Journal of the International Society of Sports Nutrition*. *5*(1), 5.

Yarar, H., Gökdemir, K., Eroğlu, H., and Özdemir, G. (2011). Evaluation of knowledge for diet and dietary habits of elite athletes. *Selçuk University Journal of Physical Education And Sport Science. 13*(3), 368-371.