T.C.
YEDİTEPE UNIVERSITY
INSTITUTE OF HEALTH SCIENCES
DEPARTMENT OF NUTRITION AND DIETETICS

TURKISH VALIDITY AND RELIABILITY OF THE NUTRITION KNOWLEDGE QUESTIONNAIRE FOR YOUNG AND ADULT ATHLETES (NUKYA-Q)

MASTER OF SCIENCE THESIS

MERVE SAFA AVAĞ

ISTANBUL, 2024

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SUPERVISOR

Asst. Prof. Dr. Gözde Dumlu Bilgin

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THESIS APPROVAL FORM

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Owner of the Thesis : MERVE SAFA AVAĞ

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This study have approved as a Master Thesis in regard to content and quality by the Jury.

Chair of the Jury:	Asst. Prof. Şaziye Ecem ÖRKÜ (Acibadem Mehmet Ali Aydinlar University, Faculty Of Health Sciences, Department of Nutrition and Dietetics)
Supervisor:	Asst. Prof. Dr. Gözde DUMLU BİLGİN (Yeditepe University Faculty of Health Sciences, Department of Nutrition and Dietetics)
Member/Examiner:	Assoc. Prof. Dr. İrem KAYA CEBİOĞLU (Yeditepe University Faculty of Health Sciences, Department of Nutrition and Dietetics)

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LIST OF SYMBOLS AND ABBREVIATIONS

AMPK	AMP-activated protein kinase
ACSM	American College of Sports Medicine
ADA	Academy of Nutrition and Dietetics
BAZ	BMI-for-age Z-scores
BCAA	Branched Chain Amino Acids
BMR	Basal Metabolic Rate
CHO	Carbohydrate
CLA	Conjugated Linoleic Acid
DC	Dietitians of Canada
FFM	Fat-Free Mass
GI	Glycemic Index
GLUT4	Glucose transporter type 4
HAZ	Height-for-age Z-scores
HEI	Healthy Eating Index
HO-1	Heme oxygenase-1
HSL	Hormone-Sensitive Lipase
ICC	Inter-class Correlation
IOC	International Olympic Committee
IU	International Unit
ISSN	International Society of Sports Nutrition
KR-20	Kuder Richardson-20
LEA	Low Energy Availability
LCHF	Low-Carb High-Fat
MPS	Muscle Protein Synthesis
NEAT	Non-Exercise Activity
NUKYA-Q	Nutrition Knowledge Questionnaire for Young and Adult Athletes

PDK4	Pyruvate dehydrogenase kinase 4
RDA	Recommended Dietary Allowance
RED-S	Relative Energy Deficiency in Sport
TEE	Total Energy Expenditure
TEF	Thermic Effect of Food
TEA	Thermic Effect of Activity
VO2max	Maximum Oxygen Consumption

ABSTRACT

Avağ, M.S. (2024). Turkish Validity and Reliability Study on the Evaluation of Validity and Reliability of the Nutrition Knowledge Questionnaire for Turkish Youth and Adult Athletes (NUKYA-Q). Yeditepe University Institute of Health Sciences, Department of Nutrition and Dietetics, Master's Thesis. Istanbul, 2024. The aim of this research is to accurately determine the validity and reliability of the Nutrition Information Questionnaire for Turkish Youth and Adult Athletes (NUKYA-Q) and to evaluate the relationship between athletes' nutritional knowledge level and diet quality. The research was conducted at Avcılar Football Academy with professional athletes playing in the A team and youth teams of Bulvarspor Club. A total of 236 professional athletes aged 13-30 participated in the research. A face-to-face survey was administered to determine individuals' general characteristics, eating habits, and sports nutrition knowledge. To determine nutritional status, 24-hour recall were taken. The diet quality of athletes was evaluated using the Healthy Eating Index-2020 (HEI-2020). NUKYA-Q was found to be reliable according to its high internal consistency value (Kuder Richardson-20=0.735) and test-retest intraclass correlation coefficient (r=0.971). The athletes' NUKYA-Q total score was 40.11±7.43 and correct response percentage 73.22±10.04%. A statistically significant difference was found between NUKYA-Q scores according to gender ($p<0.001$). Those who took sports nutrition lessons had significantly higher NUKYA-Q scores than those who did not ($p<0.001$). Athletes whose source of information about sports nutrition was a dietitian had significantly higher total and sub-section scores on NUKYA-Q compared to those who received information from coaches and other sources ($p<0.001$). There was a weak but statistically significant positive correlation between NUKYA-Q total score and HEI-2020 total score ($r=0.253$; $p<0.001$), as well as between NUKYA-Q total score and components such as whole fruit score ($r=0.249$, $p<0.001$), total vegetable score ($r=0.478$, $p<0.001$), and green and beans score score ($r=0.239$, $p<0.001$). NUKYA-Q was determined to be a valid and reliable tool for evaluating the nutritional knowledge of Turkish athletes. More research is needed to clarify the impact of nutrition knowledge on nutritional practices.

Keywords: Sports nutrition knowledge, diet quality, validity, reliability.

ÖZET

Avağ, M.S. (2024). Türk Genç ve Yetişkin Sporcular İçin Beslenme Bilgi Anketinin Geçerlilik ve Güvenilirliğinin Değerlendirilmesi (NUKYA-Q) Üzerine Türkçe Geçerlilik ve Güvenilirlik Çalışması. Yeditepe Üniversitesi Sağlık Bilimleri Enstitüsü, Beslenme ve Diyetetik Anabilim Dalı, Yüksek Lisans Tezi. İstanbul, 2024. Araştırmanın amacı, Türk genç ve yetişkin sporcular için Beslenme Bilgisi Anketi'nin (NUKYA-Q) geçerlilik ve güvenilirliğini doğru bir şekilde belirlemek ve sporcuların beslenme bilgi düzeyi ile diyet kalitesi arasındaki ilişkiyi değerlendirmektir. Araştırma, Bulvarspor Kulübü'nün A takımı ve genç takımlarında oynayan profesyonel sporcularla Avcılar Futbol Akademisi'nde gerçekleştirildi. Araştırmaya 13-30 yaşları arasında toplam 236 profesyonel sporcu katıldı. Katılımcıların genel özelliklerini, yeme alışkanlıklarını ve spor beslenmesi bilgilerini belirlemek amacıyla yüz yüze anket uygulandı. Beslenme durumunu belirlemek için 24 saatlik geri çağırma yöntemi kullanıldı. Sporcuların diyet kalitesi Sağlıklı Beslenme İndeksi-2020 (HEI-2020) kullanılarak değerlendirildi. NUKYA-Q, yüksek iç tutarlılık değeri (Kuder Richardson-20=0.735) ve test-tekrar test sınıf içi korelasyon katsayısı (r=0.971) ile güvenilir bulundu. Sporcuların NUKYA-Q toplam puanı 40.11±7.43 ve doğru yanıt oranı %73.22±10.04 olarak belirlendi. Cinsiyete göre NUKYA-Q puanları arasında istatistiksel olarak anlamlı bir fark bulundu ($p<0.001$). Spor beslenmesi dersi alanların NUKYA-Q puanları, almayanlara göre anlamlı derecede yüksekti ($p<0.001$). Spor beslenmesi hakkında bilgi kaynağı diyetisyen olan sporcuların, antrenörler ve diğer kaynaklardan bilgi alanlara göre NUKYA-Q toplam ve alt bölüm puanları anlamlı derecede daha yüksekti ($p<0.001$). NUKYA-Q toplam puanı ile HEI-2020 toplam puanı arasında zayıf ama istatistiksel olarak anlamlı pozitif bir korelasyon bulundu ($r=0.253$; $p<0.001$). Ayrıca, NUKYA-Q toplam puanı ile bileşenler olan tam meyve puanı ($r=0.249$, $p<0.001$), toplam sebze puanı ($r=0.478$, $p<0.001$) ve yeşil ve baklagiller puanı ($r=0.239$, $p<0.001$) arasında da zayıf ama istatistiksel olarak anlamlı pozitif bir korelasyon vardı. NUKYA-Q, Türk sporcularının beslenme bilgisini değerlendirmek için geçerli ve güvenilir bir araç olarak belirlendi. Beslenme bilgisinin beslenme uygulamaları üzerindeki etkisini netleştirmek için daha fazla araştırmaya ihtiyaç vardır..

Anahtar Kelimeler: Spor beslenme bilgisi, diyet kalitesi, geçerlilik, güvenilirlik

1. INTRODUCTION AND AIM

Nutrition is defined as the physiological process by which the body utilizes nutrients for the purposes of growth, sustaining life, ensuring its continuation, and maintaining overall health. Sports nutrition is a specialized field closely related to the study of human physiology in nutrition and exercise science (1). Dietary advice specific to athletes have been mentioned as ancient as 580 BC (2). Sports nutrition is a field of expertise in which nutrition and exercise science are combined (3). In summary, sports nutritionists optimize the dietary intake of athletes in order to promote performance increase in addition to the training and recovery period (4). Nutrition has important effects on sports performance and awareness of the effect of nutrition on performance is increasing (5, 6). Despite the increasing awareness, it is known that diets of athletes are generally insufficient in terms of nutrition, negative energy balance and micronutrient deficiencies are frequently observed (7).

Research in Europe, America, and Australia have evaluated the nutritional literacy of Athletes and (8-11) coaches (12, 13) across various sports disciplines and proficiency levels. A 2011 systematic review elucidated widespread misconceptions prevalent among athletes. These include the inaccurate notion that proteins constitute the principal energy source for muscle contraction, the erroneous belief in the energy-bestowing properties of vitamin and mineral supplements, and the unfounded necessity of protein, vitamin, and mineral supplements for optimizing peak performance (11). Likewise, research has shown that some misconceptions about the energy density of nutrients, the function of proteins, and the effectiveness of supplements are held by coaches (14).

In the discipline of sports nutrition, the Dietitians of Canada (DC), the Academy of Nutrition and Dietetics (ADA), and the American College of Sports Medicine (ACSM) provide internationally accepted guidelines regarding the exact time and amount of food, fluid, and supplement intake (15). In order for a sports dietitian to proficiently ascertain the level of nutritional knowledge

among athletes, offer personalized nutrition education to rectify specific deficiencies, and formulate strategies for augmenting nutritional literacy, it is imperative to systematically assess nutritional knowledge at distinct intervals. This practice not only facilitates the establishment of individualized performance augmentation objectives but also enables the delivery of efficacious recommendations and aids in the development of treatment

plans for eating disorders, thereby contributing significantly to the athlete's overall well-being and performance (11).

This study aimed to evaluate the Turkish validity and reliability of a 24-item questionnaire originally developed by Karla Vázquez-Espino and colleagues in Spain in 2020, known as "Nutrition Knowledge for Young And Adult Athletes Questionnaire (NUKYA-Q)". The secondary objective of the study is to assess Turkish athletes' knowledge of sports nutrition and their diet quality, as well as to evaluate the relationship between nutrition knowledge and diet quality.

The hypotheses formulated for the study are as follows:

1. NUKYA-Q is valid for determining and assessing the level of nutrition knowledge in individuals engaging in exercise or sports
2. NUKYA-Q is reliable for determining and assessing the level of nutrition knowledge in individuals engaging in exercise or sports
3. Professional athletes show high scores on the NUKYA-Q
4. Professional athletes show high diet quality scores

2. LITERATURE REVIEW

2.1. Energy And Nutrient Requirements in Athletes

2.1.1. Energy Requirements of Athletes

Dietary planning that supports adequate energy intake is very important for athletes to improve their health, maximize training performance, and maintain body weight during periods of high-intensity or long-term training (16). Athletes' need for energy vary depending on their training and competition schedules. Training volume, intensity, and duration are some of the variables influencing energy requirements. The athletes' energy requirements are calculated based on their energy usage. The athlete's basal metabolic rate, the thermic effect of the meals consumed, and the thermic effect of the activities performed are all taken into account when calculating energy expenditure. Athletes' basal metabolic rates can be measured using a variety of formulas (e.g., Cunningham or Harris-Benedict), and the amount of energy expended and hence the amount of energy needed can be computed by multiplying this value by a physical activity factor appropriate for the athlete's level of activity (15).

Negative energy balance is the result of a long-term imbalance between energy intake and energy expenditure. In addition to weariness and immune system deterioration, this may cause fat-free mass (FFM), menstrual cycle disturbance, a decrease in bone mineral density, and fatigue (15, 17). The most recent definition, which was changed from the ‘female athlete trio' that previously solely applied to female, now also covers men athletes (18). Athletes participating in weight-focused sports, fighting, cycling, rowing, and running have all been identified as potential sports groups at risk for Low energy availability (LEA) (18). Athletes participating in individual and team sports emphasizing body composition as well as those competing in these sports disciplines are at risk for LEA (15). To accomplish their body composition goals, athletes prefer to consume insufficient amounts of energy over the long term. This circumstance has been categorically linked to a higher incidence of relative energy deficiency syndrome (RED-S) in athletes (18).

Table 2.1. RED-S in Athletes (19)

	PHYSIOLOGICAL	PSYCHOLOGICAL	PERFORMANCE EFFECTS
RED-S	Decreased muscle glycogen Stores	Depression	Decreased endurance performance
	Decreased muscle strength	Irritability	Decreased concentration and coordination
	Increased injury risk		Impaired judgement
	Decreased training adaption		

In studies examining diets focused on providing positive energy balance, energy excess supports the increase of FFM by stimulating the development of anabolic processes (19). Health authorities making sport-specific recommendations advocate adequate energy consumption to achieve overall health and athletic performance goals (15). Recently, new researches on the concept of periodic nutrition have been made in the literature in the field of sports nutrition. Periodic feeding is a term describing dietary advice that adjusts an athlete's dietary intake (DI) to training needs over time (i.e., during a training week) to promote training adaptations. Therefore, energy intakes should follow a periodic approach to ensure that energy intake matches the training process. Periodizing an athlete's energy intake can promote training adaptations and also help athletes optimize their body composition (20).

Total Energy Expenditure (TEE): Basal Metabolic Rate (BMR) + Thermic Effect of Food (TEF) + Thermic Effect of Activity (TEA)

TEA: Planned Exercise Expenditure + Non-Exercise Activity (NEAT) (15)

2.1.2. Nutrient Requirements of Athletes

2.1.2.1. Carbohydrate Requirements of Athletes

Carbohydrates play a fundamental role as the primary source of energy in the human body. Simple carbohydrates consist of either a single or two sugar molecules, whereas complex carbohydrates comprise multiple sugar units. Both types provide approximately 4 calories per gram. Since fiber remains undigested, it contributes less

effectively to energy provision. Carbohydrates stored in the body, predominantly in the form of glycogen within the muscles and liver, are rapidly utilized to fuel physical activity. It is imperative that athletes ensure adequate intake of carbohydrates, protein, and fat to optimize their training and performance. The necessity for optimal carbohydrate consumption becomes particularly apparent before, during, and after intense and high-volume training sessions and competitions. Numerous studies in the literature emphasize the correlation between carbohydrate consumption and athletic success, underscoring the importance for athletes to augment their dietary carbohydrate and protein intake. Athletes engaged in moderate to high volumes of training necessitate increased carbohydrate consumption to meet their daily requirements. Those undertaking intense exercise are generally advised to consume a diet containing 5-8 g/kg/day or 250-1200 g/day of carbohydrates to sustain muscle glycogen stores. It is suggested that athletes engaging in high-volume intense training may require 8-10 g/kg/day of carbohydrates to maintain optimal muscle glycogen levels (16).

The timing and type of carbohydrate intake are critical factors in enhancing and improving athletes' performances. Proper carbohydrate intake before, during, and after exercise is vital for maintaining energy levels, supporting muscle repair, and accelerating recovery. In this article, we will discuss the recommended strategies to optimize carbohydrate intake for athletes. Prior to exercise, adequate carbohydrate intake is essential to meet the body's energy demands. Generally, consuming 1-4 g/kg of carbohydrates 1-4 hours before exercise is recommended. Table 2.2 shows the carbohydrate requirements of athletes (15, 21, 22).

Table 2.2. CHO Requirements of Athletes (15, 21, 22)

Timing	**Goal**	**CHO Intake**
<1 Hour Before Exercise	Enhance performance during exercise	Carbohydrates that are easy to digest and meet the athlete’s preferred quality and quantity / Mouth rinse
1 – 4 Hours Before Exercise	Enhance performance during exercise	1-4 g/kg of carbohydrates (low-glycemic index)
During Exercise	Sustain energy levels and performance	**Strength and Team Sports**: 30-60 grams/hour **Endurance Sports**: Up to 90 grams/hour of carbohydrates

		depending on the duration (2:1 glucose:fructose ratio)
<8 Hours After Exercise - Recovery	Replenish glycogen stores	First 4 hours: 1–1.2 g/kg body weight (high-glycemic index)
>8 Hours After Exercise - Recovery	Maximize glycogen stores	Continue with the daily nutrition program to replenish muscle glycogen stores

2.1.2.2. Protein Requirements of Athletes

High-quality amino acids contribute to the body's net protein synthesis by activating intracellular signaling pathways (23). The required protein intake varies depending on the athlete's body composition and training goals, such as weight maintenance or muscle mass gain. As per established guidelines, athletes are recommended to consume between 1.2 and 2.0 grams of protein per kilogram of body weight daily, adjusting based on their daily body weight fluctuations (15, 24-26). In 2018, the International Society of Sports Nutrition (ISSN) emphasized the significance of consuming protein at a level exceeding 3 grams per kilogram of body weight (>3.0 g/kg/day) daily to preserve FMM, particularly in situations necessitating a hypocaloric diet (i.e., during energy deficit) (16). In a study conducted by Longland et al. and published in 2016, they underscored the significance of consuming high-protein diets (2.4 g/kg/day) to facilitate the augmentation of FFM amidst an energy deficit regime aimed at fat loss (27). In a recent study conducted by Longland et al., it was observed that participants adhering to a hypocaloric diet during a 4-week training period experienced a notable increase in lean mass when consuming high-protein diets compared to those receiving a standard protein intake (1.2 g/kg/day). This study underscores the pivotal role of protein consumption in individuals following a hypocaloric diet regimen. Moreover, the findings highlight the advantages of high protein intake (2.4 g/kg/day) during periods of high-intensity exercise, particularly in endeavors aimed at reducing fat mass and preserving lean mass, or when focusing on modifying body composition (27).

According to the recommendations of the ISSN, athletes seeking to enhance muscle protein synthesis (MPS) should meticulously consider the quantity, quality, and timing of protein intake during training (16). In addition to the necessity for a pragmatic

assessment, athletes' individual attributes, such as age, body weight, and athletic proficiency level, should be thoroughly examined to assist them in achieving the optimal protein intake goal (28). A total quantity ranging from 20 to 40 grams or a dosage of 0.2 to 0.55 grams per kilogram of body weight post-exercise is recommended to enhance muscle protein synthesis (16). Additionally, it is recommended to evenly distribute the daily protein intake, incorporating bolus protein consumption intervals throughout the day (every three to four hours) and before bedtime to optimize protein absorption (16).

Several studies comparing and analyzing the optimal dosage to enhance muscle protein synthesis in athletes participating in diverse sports have led to the establishment of a protein intake range of 20 to 40 grams (29, 30). In 2013, Areta et al. reported that a protein dosage of 20 grams could augment muscle protein synthesis even in the absence of exercise stimulation when distributed evenly throughout the day (e.g., across four meals) (29). In 2016, McNaughton et al. highlighted that a protein intake dose of 40 grams (whey protein) might be necessary to initiate muscle protein synthesis in older athletes following resistance training (30). According to the findings elucidated in this research, it was emphasized that the determination of an athlete's specific protein intake necessitates a meticulous consideration of various individual factors, encompassing age, expertise level, training regimen specificity, session duration, intensity, and frequency (29, 30).

The protein's quality is ascertained through its digestibility and amino acid composition (24). The necessary amino acids found in plant-based protein sources (beans, nuts, seeds, and tofu) as opposed to animal-based protein sources (meat, chicken, eggs, fish, and shellfish) and dairy products (milk, yogurt, cheese, etc.) determine the amino acid bioavailability of protein in meals varies in accordance with (28). After resistance training, consumption of dairy and animal protein sources have been associated to increased rates of muscle protein synthesis (28). The influence of soy, casein, and whey protein on muscle protein synthesis was examined in cohorts of healthy mens. The results showed that consumption of whey hydrolyzate protein resulted in higher rates of muscle protein synthesis than consumption of casein and soy protein (31). Isolated soy and casein protein digests more quickly and has a higher concentration of leucine amino acids than whey hydrolysate protein (31). For maximum muscle protein synthesis, a leucine dose of 700-3000 mg is recommended (28). Studies comparing the consumption of animal protein (such as whey) to that of plant-based protein sources (such as soy) showed slight increases

in blood levels when leucine and other branched-chain amino acids (leucine, isoleucine, and valine) were examined (31, 32). Animal protein sources and dairy-based protein sources provide a better protein source for athletes aiming to increase strength and power, increase lean mass and promote muscle protein synthesis (28). Protein intake of the athlete can be supported by using fast-release protein sources (for example, whey protein) to support the recovery of the athlete during intense training and competition periods (32).

Consuming protein and carbohydrates combined can accelerate recovery because it replenishes muscle glycogen stores and enhances markers of potential post-training muscle injury (32). Plans for the synthesis and recovery of muscle protein can be developed by concentrating on the time and quality of protein intake in addition to providing recommendations for each individual (28). In summary, meticulous planning that considers the individual characteristics of athletes, such as age, gender, training regimen, and performance objectives, is crucial. This planning should prioritize protein intake to facilitate muscle mass gain. Nonetheless, it is imperative to also factor in the overall energy intake to optimize performance outcomes (16, 28).

2.1.2.3. Fat Requirements of Athletes

Adequate fat consumption is crucial for supporting the immune system's recovery and function in athletes, in addition to helping them meet their total energy needs (16). Anti-inflammatory lipids contribute in the healing process following exercise or competition and have a significant role in preventing illnesses and injuries in sports (33). Athletes should consume a moderate amount of fat (30% of total energy [TE]), taking into consideration their individual needs and training goals (16). Recently, there has been increased interest in the use of ketogenic diet and low-cho high-fat diets (LCHF), which are among the diet approaches that focus on their performance-enhancing effect (34). Low-carb, high-fat diets stimulate the transfer of triglycerides from adipose tissue via increasing the activity of hormone-sensitive lipase (HSL), which increases the use of endogenous and exogenous fat storage (16, 34).

Burke et al. (2017) found that LCHF diets were associated with higher oxygen cost, lower respiratory exchange rate, and reduced sports performance compared to periodically regulated high-carb diets (34). In 2020, Heikura et al. conducted a short-term ketogenic diet trial on professional athletes, and the results showed that bone modeling and bone health markers continued to be below reference values (35). Exercise intensity

causes a proportionate decrease in fat oxidation. Carbs and lipids supply the majority of the energy required for endurance training during contractions of the muscles (36). The main fuel used by athletes is fat, with the greatest amount of fat oxidation reached at roughly 47–52% of VO2max in untrained individuals and 59–64% of VO2max in endurance-trained athletes performing moderate exercise (37). Since glycogen provides as the athlete's main fuel source during exercise, higher training intensities result in higher glucose usage (38). The rate of fat oxidation is almost completely eliminated at a density of around 90% of VO2max (37).

2.1.2.4. Micronutrients Requirements of Athletes

The biochemical changes of the muscle tissue caused by the athlete's performance-enhancing trainings cause the muscle tissue to require certain nutrients at higher levels than usual. Athletes who engage in intense training, weight loss techniques that limit energy intake because of body composition goals, diet plans that are unbalanced in terms of nutrients, and diet plans that eliminate one or more food groups from their diets should all be prescribed specially designed supplementation programs. Athletes tend to be at risk for vitamin D, calcium, iron, and some antioxidant deficiencies (15).

Micronutrients support the immune system, protect bone health, stimulate energy production, keep body functions functioning effectively, and protect the body from oxidative stress (16, 26). Whether or not anemia develops, an athlete's success can be severely impacted by an iron shortage, which decreases muscle function, impacts training goals, and lowers athletic performance (39, 40). Additionally, in athletes who engage in intense training programs, sweat, urine, and feces may enhance iron losses (40, 41). Iron intake should be increased by the recommended dietary allowance (RDA) for athletes in the risk group, such as long-distance runners and vegetarians, who should also be monitored closely (40, 42). Treatment of iron deficiency anemia can take 3 to 6 months. It is important to initiate a dietary program intervention supplemented with an iron-rich diet prior to this development (39, 40). Supporting the consumption of heme iron and non-heme iron sources with sources rich in vitamin C can help athletes who are in the risk group for iron status or who develop anemia (e.g., low ferritin levels) avoid iron insufficiency without anemia (43). Primarily in the control of blood coagulation, nerve conduction, muscular contraction, and the growth, development, and repair of bone structure, calcium is a vital mineral. Bone mineral density is decreasing as a result of

inadequate caloric intake and poor calcium intake from the daily diet. The incidence of stress fractures and menstruation dysfunction increases as a consequence (15). Supplementation plan should be made after a detailed assessment of dietary intake. Calcium intake should be planned as 1500 mg/day and vitamin D 1500-2000 IU/day in order to optimize bone health in athletes in the risk group (18). For detailed recommendations on daily micronutrient intake for athletes based on guidelines from the IOC, ACSM, and ISSN, please refer to (Table 2.3.).

ISSN recommendations suggest that calcium and iron intakes of athletes not at risk of serious deficiency should be in line with normal population intakes (16). A significant number of athletes often consume micronutrient supplements unnecessarily, even when their dietary intake already meets their requirements. It is imperative for sports dietitians to closely monitor athletes, assess their dietary habits, and prescribe supplements only after a thorough clinical evaluation. This approach ensures that athletes do not self-assess their micronutrient status. Sports dietitians play a crucial role in safeguarding athletes against potential micronutrient deficiencies and enhancing their performance. This is achieved through the design of a nutritionally diverse diet plan, incorporating fortified foods from natural sources alongside supplements (15).

Table 2.3. Micronutrient Daily Intake Requirements for male and female Athletes (16, 26, 44)

Micronutrient	**Average Recommended Daily Intake for male**	**Average Recommended Daily Intake for female**
Vitamins		
Vitamin A	750 mcg	750 mcg
Vitamin D	15 mcg	15 mcg
Vitamin E	15 mg	15 mg
Vitamin C	82.5 mg	75 mg
Vitamin K	105 mcg	90 mcg
Vitamin B1 (Thiamin)	1.15 mg	1.1 mg
Vitamin B2 (Riboflavin)	1.2 mg	1.1 mg
Vitamin B3 (Niacin)	15 mg	14 mg
Vitamin B5 (Pantothenic Acid)	5 mg	5 mg

Vitamin B6	1.5 mg	1.3 mg
Vitamin B7 (Biotin)	30 mcg	30 mcg
Vitamin B9 (Folate)	400 mcg	400 mcg
Vitamin B12	2.4 mcg	2.4 mcg
Minerals		
Calcium	1,100 mg	1,000 mg
Iron	8 mg	18 mg
Magnesium	410 mg	360 mg
Phosphorus	700 mg	700 mg
Potassium	4,700 mg	4,700 mg
Zinc	9 mg	8 mg
Iodine	150 mcg	150 mcg
Selenium	55 mcg	55 mcg

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2.2. Comprehensive Nutritional Strategies for Athletes

2.2.1. Nutrition Timing

2.2.1.1. Pre-exercise

Optimal pre-match nutrition includes a high-carbohydrate intake of 6-8 g/kg body weight daily, and a 1-3 g/kg meal 3-4 hours before kick-off to replenish glycogen (45). The pre-match meal should be easy to digest, prioritizing comfort over strict guidelines (46). Research indicates that high carbohydrate intake can delay fatigue and enhance performance, with benefits for technical skills like dribbling (47, 48). Players should also aim to start the match well-hydrated by consuming 5-7 mL/kg of fluids in the 2-4 hours before kick-off, allowing time for excess fluid excretion and aiming for pale yellow urine (49, 50).

2.2.1.2. During Exercise

Adequate CHO and fluid intake are crucial nutritional considerations during a match. Consuming 30-60 g of CHO per hour or 60 g before each half is recommended. Players should target ~30-60 g of CHO after warm-up and during halftime (45, 51). CHO can enhance technical skills, though effects on other measures vary. Elite players average 32 g/hour, influenced by regulations and gastrointestinal concerns (52). Sports drinks

minimize discomfort. Breaks allow increased CHO and fluid intake, especially in heat (45). CHO mouth rinsing may enhance intermittent exercise when consumption is limited. Swallowing the drink after 5 seconds allows central and muscle fuel effects (45, 53). Sweat rates vary widely, with lower rates in females. Sweat rates among male athletes during training sessions and competitive matches have been documented to range between 0.5 to 2.5 L/hour (45, 54). Hypohydration impairs performance through cardiovascular strain, cognition, and skills (45, 55, 56). Adequate fluids should prevent a deficit exceeding 2-3% of pre-exercise body weight (57). Personalized nutrition strategies are essential.

2.2.1.3. Recovery from Exercise

Rapid replenishment of CHO stores is crucial post-match (58). One of the primary objectives is the rapid replenishment of CHO stores. Post-match meals and snacks should aim to achieve a CHO intake of approximately 1-4 g/kg BM/hour for 1-4 hours (59). Players should consume sports foods and fluids to address electrolyte and hydration deficits (45). Maintaining a daily CHO intake ranging from 6-8 g/kg BM over the 24 hours following a match (MD +1) is crucial for ongoing glycogen replenishment. This intake should be maintained for up to 48-72 hours post-match, especially during congested fixture schedules (45). Targeted protein intake of 20-25 g at meals and 30-60 g of casein before bed optimizes repair and adaptation (60, 61). While protein enhances synthesis, the effects on muscle function are limited. Large doses of antioxidants are discouraged due to potential interference with adaptive processes (62).

2.2.2. Fluid Requirements of Athletes

The maintenance of body water homeostasis is coordinated by the human brain through a complex and dynamic neuroendocrine network. When the compensatory responses necessary to maintain this balance are minimal, a state of hydration ensues (50). Deviations from this balance can result in states of increased or decreased total body water, referred to as hyperhydration and hypohydration, respectively. Maintaining fluid intake or achieving mild hyperhydration is critical for athletes, as even moderate levels of hypohydration have been shown to impair athletic performance (57). Total body water, comprising 50-65% of body weight, fluctuates and is influenced by age, sex, and body composition. It is divided between intracellular (~67%) and extracellular compartments (~33%), including interstitial fluid and plasma. These volumes are part of a dynamic

equilibrium, complicating hydration assessment. A simple method to monitor body water during exercise is measuring acute changes in total body mass to estimate water loss and assess hypohydration. Other post-exercise hydration assessment methods include evaluating urine color, specific gravity, volume, osmolality, and thirst sensation (63). The main recommendations from existing consensus documents regarding fluid intake schedules are summarized in (Table 2.4.).

Importantly, athletes are typically advised to refrain from fluid deficits exceeding 2% of total body mass loss (BML) during exercise, as per the latest position statements and guidelines. While contingent upon environmental factors, a BML of 2-3% may compromise cognitive function and aerobic exercise performance, whereas reductions of 3-5% BML have been demonstrated to impair technical skills and performance in anaerobic and high-intensity exercises (64). To mitigate potential performance impairments, athletes are advised to follow hydration plans designed to optimize their pre-exercise hydration status and mitigate fluid losses during and after exercise, thereby minimizing the degree of hypohydration. Consequently, the amount of fluid ingested before, during, and after exercise should be tailored based on exercise demands, athlete characteristics, and environmental conditions.

Table 2.4. Athlete hydration plan recommendations from consensus documents

Institution	Pre-Exercise	During Exercise	Post-Exercise
ACSM (2007)	Consume 5–10 mL/kg of body weight 2–4 hours prior to exercise (to achieve clear urine)	Drink 0.4–0.8 L/hour during exercise to replenish sweat losses and limit Body Mass Loss (BML) to less than 2%	Drink approximately 1.5 L/kg of BML at a moderate pace following exercise
NATA (2017)	Adjust individual fluid intake plans for maintaining euhydration or achieving less than 2% hyperhydration (only under medical supervision or for endurance activities with restricted fluid availability)	Consume sufficient fluids during exercise to approximate sweat losses and restrict BML to less than 2%	Drink fluids up to 150% of estimated fluid losses within 4 hours post-exercise
SDA (2020)	Adapt fluid intake strategies according to fluid balance and expected substance and fluid requirements	Tailor fluid intake plans based on real-time assessments	Consume up to 150% of BML to promptly reverse moderate-severe fluid deficits post-exercise
IOC (2022)	Implement adequate fluid intake strategies before exercising in hot conditions to achieve BML less than 1–2%, urine specific gravity less than 1.020, and/or plasma osmolality less than 290 mmol/kg	Apply fluid intake plans during activity to minimize losses without increasing body weight	Consume fluids to rapidly restore fluid balance after exercise

There are various recommendations regarding the optimal type, timing, and quantity of beverages for athlete hydration plans. During physical activity, it is essential

to replenish any fluid losses incurred. However, this can present a challenge as the volume of fluid lost often surpasses the gastric emptying rate (1 L/hour). Enhancing gastric emptying can be achieved by incorporating carbohydrates at a concentration of 4 – 8% and sodium at a rate of 0.5 – 0.7 g/kg (or 10 – 25 mmol/L). Common recommendations include consuming 400 – 600 ml of fluid prior to exercise and replacing 120 – 150% of fluid lost during exercise within two to six hours post-activity. Traditionally, athletes were advised to consume 150 – 350 ml of fluid every 15 – 20 minutes during exercise. However, current recommendations advocate for personalized hydration plans tailored to individual fluid losses in similar environmental conditions (65).

2.3. Nutritional Knowledge Evaulation

Numerous studies have endeavored to evaluate nutritional acumen across a spectrum of demographic cohorts, commencing with adolescents (66), adults (67-71), coaches (9-13, 62), and athletes (8, 9, 70, 72, 73). These studies utilize a variety of methodologies, including the development of bespoke surveys or adaptations of existing instruments, featuring formats ranging from true/false statements to multiple-choice questions. However, the methodological heterogeneity presents obstacles to direct comparisons and meta-analytical synthesis, thereby complicating the interpretation of findings and the determination of precise levels of knowledge (74).

When assessing the level of nutritional knowledge, it is essential that the questionnaire employed adheres to specific criteria. The questionnaire should encompass items that assess both factual knowledge, such as identifying sources of carbohydrates, and practical knowledge, including planning, preparation, and procurement of a diet rich in carbohydrates. To ensure accurate measurement, evaluation, and comparison of nutritional knowledge, it is imperative to utilize valid and reliable questionnaires (67). To ensure validity and reliability, specific statistical analyses, known as psychometric criteria, must be performed. These criteria comprise content validity, construct validity, and reliability. Content validity necessitates comprehensive coverage of all facets within the measured construct. For instance, in the domain of sports nutrition, ensuring content validity entails including questionnaire items that address various topics pertinent to sports nutrition, such as hydration, periodization, and macronutriens-micronutrients. Construct validity and reliability are established through methods like known-group

validity, involving diverse groups with differing levels of nutritional knowledge, and test-retest reliability, respectively (75).

In recent years, Calella and colleagues have spearheaded the creation of specialized questionnaires designed to evaluate the nutritional knowledge of adolescent and young adult athletes in Italy (67), while De Souza and colleagues have developed questionnaires specifically for German adolescent athletes (76). Trakman and colleagues developed a sports nutrition knowledge questionnaire composed of six sub-sections (weight control, macronutrients, micronutrients, sports nutrition, supplements, and alcohol), utilizing a distinctive approach known as Rasch analysis (77). Similarly, Furber and colleagues conducted a study wherein they devised an 85-item questionnaire aimed at assessing both general and sports-specific nutritional knowledge, which was subsequently distributed among participants residing in the United Kingdom. Following the removal of 23 questions through a systematic process, the resultant 62-item questionnaire exhibited robust internal consistency and reliability, garnering commendable scores in these aspects (7)

Numerous studies have examined the correlation between nutrition knowledge and several factors, including gender, participation in nutrition courses or receiving guidance from dietitians, sporting experience, type of sport, skill level, and self-care habits. These investigations have consistently shown that there is no significant disparity in nutritional knowledge based on gender. However, athletes who have engaged in nutrition courses or received counseling from dietitians exhibit markedly higher levels of nutritional knowledge compared to their counterparts who have not undergone such education (14, 78, 79).

It has been found that some misconceptions prevail among athletes, such as the belief that "proteins are the main fuel for muscle contraction," "vitamin and mineral supplements provide energy," and "protein, vitamin, and mineral supplements are essential for high performance" (11). In a study, it was found that rugby players were often unaware of current recommendations regarding carbohydrate intake; however, they obtained high scores in the subgroups of the questionnaire related to "dietary recommendations," "food groups," and "food choices" (73). Studies have shown that athletes acquire nutrition knowledge and seek to enhance their knowledge through various sources such as coaches, dietitians, television, and the internet (8).

2.4. Diet Quality Assesment

The Healthy Eating Index (HEI), first developed by the United States Department of Agriculture (USDA) in 1995 and subsequently updated every five years, is utilized in epidemiological studies, population surveillance, assessment of nutritional environments, and evaluation of the relationship between diet cost and diet quality. Diet quality indices allow for the assessment of whether a diet is diverse, sufficient, and balanced (80, 81).

There are studies evaluating diet quality in athletes using various indices (82-85). In Australia, Blair et al. developed a specific diet quality index for high-performance athletes (26 men, 43 female, aged 16-71) across 30 different sports (86). The impact of athletes' diet quality on performance has been determined. Both significantly exceeding or insufficiently meeting dietary requirements negatively affect an athlete's performance (87). A statistically weak but positively significant relationship was found between the general nutritional knowledge and the total diet quality score and vegetables component score of Australian professional athletes (37 male, 64 female) ($r=0.261$, $p=0.008$) (74). In another study, the diet quality of university athletes was evaluated with the HEI-2005. Accordingly, the average HEI score was 51.2 ± 8.8; It has been stated that the diets of athletes are insufficient in vegetables, fruits and fiber, and their sodium and fat intake is high (88).

3. MATERIALS AND METHODS

3.1. Participants

The study protocol was approvedby the Yeditepe University Ethics Board and Commission (approval no: *E.83321821-805.02.03-67*) (see Appendix-1). The sample size was calculated using a non-probability sampling method, in accordance with the literature recommendation that "the sample size in scale studies should be 5-10 times the number of items in the scale" (89), resulting in a determination of 240 individuals. However, 4 individuals were excluded, and the study was completed with 236 participants, consisting of 185 male athletes and 51 female athletes.

After obtaining collaboration approval from Bulvarspor Football and Club and Avcılar Football Academy, these clubs were selected because they provided access and agreed to participate in the study (see Appendix 10 - Appendix 11). The clubs offered a variety of sports disciplines, including 182 football players, 33 basketball players, 11 athletes from athletics, and 10 participants from American football. Participants aged 13 and above, or their guardians in the case of those under 18, received both verbal and written information about the purpose and procedures of the study. Inclusion criteria were set for participants aged 13 and above, residing within the Istanbul province, who had signed the informed consent form (consent was obtained from guardians for those under 18 and directly from participants aged 18 and above (Appendix 7 - Appendix 8)), and who had sufficient cognitive capacity to understand and respond to the survey questions. Exclusion criteria included participants under the age of 13, pregnant and breastfeeding participants, those who had not signed the informed consent form, those residing outside the Istanbul province, participants who exercised or played sports less than three days a week or not at all, and those with any eating disorders. The aforementioned questionnaire was administered between January 2023 and December 2023.

3.2. General Plan of The Research

Initially, permission to use the NUKYA-Q was obtained (see Appendix 2). The translation of the NUKYA-Q was meticulously conducted to harmonize with the cultural nuances and linguistic idiosyncrasies prevalent among the Turkish population. This translation endeavor was undertaken by a team comprised of three faculty members from the esteemed Department of Nutrition and Dietetics at Yeditepe University, alongside a proficient research assistant affiliated with the Faculty of Dentistry at Bahçeşehir

University. Following a stringent validation process aimed at ensuring linguistic precision and cultural relevance, the questionnaire underwent a pilot study involving 30 athletes, meticulously coordinated by the principal researcher. Throughout the pilot study, the feedback solicited from participants was thoroughly analyzed to verify the questionnaire's alignment with the specific needs and cognitive capacities of the target population. Consequently, no further modifications were deemed necessary, thereby corroborating the clarity and comprehensibility of the translated questionnaire.

Participants filled out comprehensive face-to-face questionnaire forms, which included a data collection form (see Appendix-3) for demographic characteristics. Additional forms encompassed inquiries about general dietary habits, utilization of the adapted NUKYA-Q in Turkish (see Appendix 4), and retrospective assessments of 24-hour dietary recall (see Appendix 5) and 24-hour retrospective physical activity record (Appendix 6). However, it is noteworthy that the retrospective physical activity records obtained from athletes were deemed unsuitable for evaluation due to the inclusion of performance tests and isokinetic assessments, which deviated from the standard training regimen. Additionally, logistical constraints prevented the assessment of dietary frequency questionnaires during the pilot study. For the purpose of assessing test-retest reliability, the NUKYA-Q was administered once again to a cohort comprising 30 voluntary individuals after a two-week interval. The evaluation of athletes' dietary quality utilized the HEI-2020 metric, ensuring a comprehensive appraisal of nutritional intake patterns within the studied cohort. The assessment process was designed to meticulously capture the dietary habits and nutritional status of the participants, providing valuable insights into their overall diet quality. Permission to use the HEI was initially obtained (see Appendix-7).

3.3. Statistical Analysis and Data Evaluation

Data obtained from the research were statistically analyzed using IBM Statistical Package for the Social Sciences (SPSS) 23.0 program. The distribution of numerical data was evaluated using the Kolmogorov-Smirnov test. The t-test was used to assess the significance of the difference between two means in normally distributed data, while the Mann-Whitney U test was employed for non-normally distributed data. The significance test for differences among more than two means was evaluated using ANOVA for normally distributed data and Kruskal- Wallis for non-normally distributed data. The chi-

square and Fisher's exact tests were used for the evaluation of qualitative data. Correlation calculations between numerical variables were performed using Pearson correlation test when parametric test assumptions were met, and Spearman correlation test when parametric test assumptions were not met. Correlation coefficient (r) values were interpreted as follows: 0.00-0.19 indicates no relationship, 0.20-0.39 indicates a weak relationship, 0.40-0.69 indicates a moderate relationship, 0.70-0.89 indicates a strong relationship, and 0.90-1.00 indicates a very strong relationship. The obtained data were presented as count (N), percentage (%), mean ($\bar{x}$), standard deviation (SD), median (M), minimum-maximum values.

In determining internal consistency, the Kuder-Richardson-20 (KR-20) coefficient was utilized, while the consistency (reliability) of results through test-retest was evaluated using the Intra-Class Correlation Coefficient (ICC)-R1. The assessment of R1-ICC values is as follows: 0.95-1.00 is considered excellent, 0.85-0.94 is high, 0.70-0.84 is moderate, and 0.00-0.69 is unacceptable. For the Kuder-Richardson-20 coefficient, a value of $\alpha>0.60$ is deemed acceptable. Concurrent validity was assessed using the significance test (t-test) for the difference between two means with known group validity. Results were considered significant at a confidence level of 95% when the p-value was below 0.05.

3.4. Data Collection

The survey form was administered face-to-face to the individuals participating in the study (see Appendix 4). Two weeks later, the Turkish-adapted NUKYA-Q section was re-administered to only a part of the sample (n=30) for test-retest purposes.

3.4.1. Participant Characteristics

This section encompassed the comprehensive exploration of demographic attributes including age, marital status, educational attainment, and experiences relevant to sports nutrition among all participants. Moreover, specific inquiries were made regarding the particular sports discipline in which athletes were engaged, their weekly exercise durations, and the onset ages of their involvement in sports.

3.4.2. Anthropometric Measurements

The anthropometric data including height and body weight of athletes were meticulously acquired from documented records with their explicit permissions. The computation of individuals' body mass index (BMI) values ensued by dividing the body weight (in kilograms) by the square of height (in meters).

3.4.3. 24-Hour Dietary Recall

Individuals' dietary intake was recorded using a 24-Hour dietary recall form. The quantities of consumed foods were determined utilizing the Meal and Food Photography Catalog. Nutrient analyses were conducted using the Nutrition Information System (BEBIS) version 9.

3.4.4. NUKYA-Q

In this study, the NUKYA-Q (90), developed by Karla Vázquez-Espino and colleagues in Spain in 2020 to evaluate the nutrition knowledge of individuals involved in sports, will be utilized. The NUKYA-Q has been previously employed in diverse cohorts within Spain, encompassing athletes from four elite/sub-elite sports disciplines of Barcelona Football Club (FCB) - football, wheelchair hockey, indoor football or futsal, and basketball - along with sports technical personnel including coaches, physical trainers, physiotherapists, and doctors (91). It has also been administered to athletes at Malaysian universities (92). The original questionnaire consists of four sub-sections: "macronutrients," "micronutrients," "hydration," and "periodization," comprising 24 questions and 59 items in total. Each correct response earned 1 point, unanswered questions received 0 points, and incorrect answers incurred a penalty of -1 point. Additionally, a transformation is planned to be applied to convert the raw score (ranging from 0 to 59) to a scale between 0 and 100.

To adapt the original English questionnaire for assessing the nutrition knowledge of Turkish athletes, the translation process was conducted by four faculty members proficient in English. Three of these faculty members were active English instructors at Yeditepe University, and one was an active English instructor at Bahçeşehir University. The process began with an initial translation of the original questionnaire into Turkish by an English instructor at Yeditepe University. The translated questionnaire was then back-translated into English by the instructor at Bahçeşehir University to ensure accuracy.

Following this, the back-translated English version was again translated into Turkish using the standard back-translation method by the English instructors at Yeditepe University. The researcher and their advisor reviewed both the back-translated items and the original scale to finalize the questionnaire. To ensure translation validity, culturally appropriate equivalents for non-consumed foods in the Turkish population were incorporated based on expert opinions and current recommendations. For instance, "beans" were translated as "baklagiller," and "nuts" were translated as "sert kabuklu yemişler." Additionally, the option regarding the carbohydrate percentage of sports drinks (4-6%) was validated against current data, considering that the primary purpose of sports drinks is hydration rather than carbohydrate loading. To avoid the risks of excessive sugar intake and digestive discomfort associated with high concentrations, the range of 4-6% was deemed appropriate. This thorough process ensured that the adapted questionnaire was both culturally relevant and linguistically accurate, providing a comprehensive tool for effectively assessing the nutrition knowledge of Turkish athletes.

The NUKYA Questionnaire was administered to the target group of athletes via a pilot study, resulting in the development of its final version specifically tailored to athletes. Given that the questionnaire items encompassed domains relevant to sports nutrition, including macro-nutrients, micro-nutrients, hydration, and timing of nutrition, content validity was not reassessed, and only the initially mentioned alterations were deemed appropriate. Questions 1-8, 10, 16-20 were assigned scores, where each correct response earned 1 point, unanswered questions received 0 points, and incorrect answers incurred a penalty of -1 point. For multiple-choice questions with a single correct answer (questions: 9, 11-15), a correct response was rewarded with 1 point for the entire question. Conversely, an incorrect response to the entire question resulted in a deduction of -1 point, while unanswered questions were scored as 0 points.

Test-retest reliability and internal consistency of the entire NUKYA-Q and its sub-sections were assessed for questionnaire reliability. The test-retest method was applied to a subset of the sample (n=30) after an optimal interval of 2 weeks to minimize recall bias and substantial changes in responses. As a result of the test-retest method, no item was found to be entirely incongruous with the questionnaire. Therefore, no modifications were deemed necessary to the original questionnaire format, and the nutritional knowledge levels of athletes were assessed using the NUKYA-Q, comprising a total of 59 items.

3.4.5. Health Eating Index

HEI-2020 comprises a total of 13 components, of which 9 are adequacy components and 4 are components that should be consumed in limited amounts. The adequacy components include "total fruits," "whole fruits," "total vegetables," "dark green leafy vegetables and legumes," "whole grains," "dairy," "total protein foods," and "seafood and plant proteins." Increased consumption of these components proportionally increases the HEI score. The components to be consumed in limited amounts are "fatty acids," "refined grains," "sodium," "added sugars," and "saturated fats." Decreasing consumption of these components is recommended, and a proportional increase in the HEI score occurs with decreased consumption. The Healthy Eating Index score, evaluated over a total of 100 points, is categorized as "poor" when below 50, "needs improvement" between 51 and 80, and "good" when above 80. HEI-2020 scores for athletes' nutritional practices were calculated from 24-hour Dietary Recal. Subsequently, the relationship between HEI-2020 scores and NUKYA-Q scores was evaluated for the assessment of athletes' nutritional practices (93).

Table 3.1. HEI-2020 & HEI–2015[1] Components & Scoring Standards (80, 93)

Component	Maximum Points	Standard for Maximum Score	Standard for Minimum Score
Adequacy			
Total Fruits[2]	5	≥ 0.8 cup / 192 g equivalents per 1,000 kcal	No Fruits
Whole Fruits[3]	5	≥ 0.4 / 96 g equivalents per 1,000 kcal	No Whole Fruits
Total Vegetables[4]	5	≥ 1.1 / 264 g cup equivalents per 1,000 kcal	No Vegetables
Greens and Beans[4]	5	≥ 0.2 cup / 48 g equivalents per 1,000 kcal	No Dark Green Vegetables or Legumes
Whole Grains	10	≥ 1.5 oz / 42 g equivalents per 1,000 kcal	No Whole Grains
Dairy[5]	5	≥ 1.3 cup / 312 g equivalents per 1,000 kcal	No Dairy
Total Protein Foods[6]	5	≥ 2.5 oz / 70 g equivalents per 1,000 kcal	No Protein Foods
Seafood and Plant Proteins[6,7]	5	≥ 0.8 oz / 22,4 g equivalents per 1,000 kcal	No Seafood or Plant Proteins
Fatty Acids[7]	10	(PUFAs + MUFAs) / SFAs ≥ 2.5	(PUFAs + MUFAs) / SFAs ≤ 1.2
Moderation			
Refined Grains	10	≤ 1.8 oz / 50,4 g equivalents per 1,000 kcal	≥ 4.3 oz / 120,4 equivalents per 1,000 kcal
Sodium	10	≤ 1.1 g per 1,000 kcal	≥ 2.0 g per 1,000 kcal
Added Sugars	10	≤ 6.5% of energy	≥ 26% of energy
Saturated Fats	10	≤ 8% of energy	≥ 16% of energy

1: The HEI-2020 components and scoring standards are the same as the HEI-2015. Intakes between the minimum and maximum standards are scored proportionately. The total HEI score is the sum of the adequacy components (i.e. foods to eat more of for good health) and moderation components (i.e. foods to limit for good health).
2: Includes 100% fruit juice.
3: Includes all forms except juice.
4: Includes beans, peas, and lentils
5: Includes all milk products, such as fluid milk, yogurt, and cheese, and fortified soy beverages.
6: Includes seafood, nuts, seeds, soy products (other than beverages), and beans, peas, and lentils.
7: Ratio of poly- and monounsaturated fatty acids (PUFAs and MUFAs) to saturated fatty acids (SFAs).

4. RESULTS

According to these data, the demographic characteristics of individuals were compared by gender, and the differences were analyzed and reported.

The demographic data, including age, sex, marital status, and educational status, are presented in Table 4.1 The average age of male participants was 20.28±4.25 years, while the average age of female athletes was 20.43±3.11 years. No statistically significant relationships were found between gender and either educational attainment or marital status ($p>0.05$).

Table 4.1. Demographic Variables

	Male (n=185)		**Female (n=51)**		**Overall (n=236)**			
	n	**%**	**n**	**%**	**n**	**%**	χ^2	**p**
Age (years) ($\bar{x}$±SS)	20.28±4.25		20.43±3.11		20.31±4.02		t=0.236	0.814
Educational Status								
Student	105	56.8	29	56.9	134	56.8	0.000	0.989
Graduate	80	43.2	22	43.1	102	43.2		
Marital Status								
Married	2	1.1	0	0.0	2	0.8	0.556	0.456
Single	183	98.9	51	100.0	234	99.2		

Table 4.2 compares the anthropometric characteristics of individuals by gender, with an analysis of the differences.

The height-for-age Z-scores, BMI-for-age Z-scores, and BMI values of individuals under 18 years old and individuals aged 18 and above are compared between male and female subjects, and the differences are analyzed and reported. A statistically significant relationship was found between the BMI-for-age Z-scores and gender among individuals under 18 years old ($p<0.05$). The proportion of individuals with a normal BMI was 83% among males and 50% among females. No statistically significant differences were found in the height-for-age Z-scores and BMI values between male and female subjects aged 18 and above ($p>0.05$).

Table 4.2. Anthropometric Measurements

	Male		Female		Total			
	n	**%**	**n**	**%**	**n**	**%**	χ^2	**p**
13-18 Years Old (n=53)								
Height-for-Age Z-Score (HAZ)								
Normal (≥-2SD to <+2SD)	26	55.3	2	33.3	28	52.8	5,241	0,073
Stunted (<-2SD)	15	31.9	1	16.7	16	30.2		
Severely Stunted (<-3SD)	6	12.8	3	50.0	9	17.0		
BMI-for-Age Z-Score (BAZ)								
Underweight (<-2SD)	2	4.3	0	0.0	2	3.8	10,310	0,016
Normal (≥-2SD to <+1SD)	39	83.0	3	50.0	42	79.2		
Overweight (>+1SD)	6	12.8	2	33.3	8	15.1		
Obesity (>+2SD)	0	0.0	1	16.7	1	1.9		
≥18 -30 Years old (n=183)								
BMI								
Underweight	4	2.9	1	2.2	5	2.7	4,390	0,222
Normal weight	115	83.3	33	73.3	148	80.9		
Overweight	17	12.3	11	24.4	28	15.3		
Obesity	2	1.4	0	0.0	2	1.1		

As presented in Table 4.3 sports nutrition and nutrition knowledge evaluation rates are compared between male and female athletes.

All participants reported that a nutritionist was available where they engaged in sports. Among male participants, 65.4% stated that they learned about sports nutrition information from their coach, whereas 52.9% of female athletes reported the same. The difference between genders regarding the source of information about sports nutrition was statistically significant ($p<0.001$). However, there was no statistically significant difference between genders in terms of the person giving advice on sports nutrition and the evaluation of nutritional information ($p>0.05$).

Table 4.3. Nutritional Practices and Sports Nutrition Information Sources Among male and female athletes

	Male (n=185)		Female (n=51)		Overall (n=236)			
	n	**%**	**n**	**%**	**n**	**%**	χ^2	**p**
Is there a sports nutrition advisor where you work/exercise?								
Yes	185	100.0	51	100.0	236	100.0	*	*
If Yes, who is the advisor?								
Coach	183	98.9	51	100.0	234	99.2	0.556	0.456
Other	2	1.1	0	0.0	2	0.8		
How do you rate your overall nutrition knowledge?								
Very Good	15	8.1	3	5.9	18	7.6	1.417	0.702
Good	64	34.6	22	43.1	86	36.4		
Average	96	51.9	24	47.1	120	50.8		
Poor	10	5.4	2	3.9	12	5.1		
What are your top 3 sources of sports nutrition information?								
Coach	121	65.4	27	52.9	148	62.7	25.739	**<0.001**
Dietitian	22	11.9	21	41.2	43	18.2		
Other	42	22.7	3	5.9	45	19.1		

Table 4.4 presents the results of the item-total correlation analysis for the NUKYA-Q.

Table 4.4. Reliability Statistics for All Items NUKYA-Q

Items	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
1.1 Chicken	39.15	54.530	.178	.715
1.2 Honey	39.36	55.081	-.008	.722
1.3 Beans	39.23	54.654	.191	.717
1.4 Bread	39.35	56.032	-.125	.728
1.5 Jam	39.30	53.392	.254	.711
1.6 Butter	39.40	52.607	.309	.708
1.7 Breakfast Cereal	39.52	52.702	.261	.710
1.8 Rice	39.22	56.005	-.161	.724
1.9 Candies	39.39	52.944	.258	.710
2. Should an athlete who wants to lose weight completely eliminate carbohydrates from his diet?	39.15	54.655	.151	.716
3. Are carbohydrates stored in the muscle as glycogen?	39.27	53.960	.195	.714
4. Does the muscle use protein as the main source of energy during exercise?	39.34	54.582	.061	.719
5.1 Chicken	39.11	55.378	-.113	.719
5.2 Beans	39.28	53.715	.235	.712
5.3 Fruit	39.42	53.113	.237	.711
5.4 Margarine/butter	39.50	52.787	.240	.711
5.5 Breakfast cereal	39.73	50.420	.424	.699
5.6 Nuts	39.59	52.898	.220	.712
6. Do fats play an important role in the body?	39.43	53.063	.279	.710
7. Do saturated and unsaturated fats have the same effect on health?	39.55	51.755	.432	.703
8.1 Chicken	39.41	52.047	.330	.706
8.2 Nuts	39.35	53.189	.241	.711
8.3 Avocado	39.36	52.843	.324	.708
8.4 Fish and seafood	39.71	53.876	.105	.718
8.5 Cheeses	39.51	54.200	.079	.719
8.6 Sausage	39.56	55.387	-.054	.726
8.7 Breakfast cereal	39.57	52.578	.242	.711
8.8 Lettuce	39.55	53.585	.177	.714
8.9 Olive oil / Sunflower oil	39.18	54.675	.144	.716

9. How many servings of fruit and vegetables are recommended per day? A serving is a piece of fruit or a bowl of salad or vegetables (Choose an option).	39.81	51.528	.330	.705
10.a If you lose 2% of your body weight (for example, 1.5 kg if you weigh 75 kg) due to dehydration, your athletic performance will decrease.	39.44	52.307	.269	.709
10.b For good hydration during sports training, you have to wait until you are thirsty to drink.	39.53	55.033	-.021	.725
10.c For complete rehydration after exercise, you need to drink a volume of liquid greater than the volume of water lost during exercise (which we know by weighing your weight before and after your workout).	39.93	56.722	-.173	.737
10.d Fruit juice is a suitable liquid to drink during in the training and the middle of the match	40.00	56.498	-.173	.731
10.e Energy drinks such as "Red Bull" are recommended for athletes to consume during exercise	39.86	55.301	-.049	.727
11. What do you think is the most suitable urine color before you start training? (Choose an option)	39.71	52.165	.354	.706
12. What is the best way to replace the water that is lost through sweating during intense or prolonged exercise? (Choose an option)	39.73	52.990	.158	.716
13. The percentage of carbohydrates in an isotonic sports drink should be: (Choose an option)	39.75	51.507	.324	.706
14. When is the best time to eat and drink to initiate recovery after exercise or competition? (Choose an option)	39.14	55.009	.057	.718
15. The most important nutrient(s) to consume after training are: (Choose an option)	39.33	53.235	.263	.711

16. Should the last main meal (breakfast, lunch, or dinner) be eaten at least 3-4 hours before a competition/exercise?	39.25	55.612	-.084	.723
17. Can the human body get most of its vitamin D from sunlight? (Choose an option)	39.13	54.770	.162	.716
18. Are vitamins and minerals a good source of energy? (Choose an option)	39.83	47.886	.611	.685
19.1 Avocado	39.43	52.952	.283	.710
19.2 Meat	39.19	54.521	.132	.716
19.3 Fish	39.25	54.461	.107	.717
19.4 Beans	39.21	53.493	.281	.711
19.5 Spinach	39.21	53.569	.276	.711
19.6 Nuts	39.23	53.890	.216	.713
19.7 Bread	39.69	52.497	.284	.709
19.8 Butter	39.53	52.548	.303	.708
20.1 Fruit	39.48	54.540	.059	.719
20.2 Meat	39.14	55.051	.060	.717
20.3 Almond	39.18	54.771	.101	.717
20.4 Milk	39.38	53.777	.166	.714
20.5 Spinach	39.36	53.047	.258	.710
20.6 Cheese	39.40	53.619	.192	.713
20.7 Bread	39.45	53.100	.213	.712
20.8 Butter	39.33	53.781	.197	.713

Table 4.6 presents the internal consistency (KR-20 coefficient) and test-retest intraclass reliability coefficients (R1-ICC) of the NUKYA-Q and its sub-sections. After removing non-functional items, the internal consistency value of the NUKYA-Q was determined to be 0.735. The ICC analysis results indicate an excellent correlation of 0.971 among individuals where the NUKYA-Q was re-administered after two weeks.

Table 4.5. KR-20 and R1-ICC of the NUKYA-Q and its Sub-sections

		Test-Retest (R_1-ICC)
	Internal Consistency (KR-20)	Athletes (n=30)
Total	0.735	0.971

Table 4.6. Distribution of responses to the statements in the macronutrients section of the NUKYA-Q.

	-1		0		1	
	N	%	N	%	N	%
1.1 Chicken	3	1.3	4	1.7	229	97.0
1.2 Honey	8	3.4	42	17.8	186	78.8
1.3 Beans	3	1.3	22	9.3	211	89.4
1.4 Bread	20	8.5	16	6.8	200	84.7
1.5 Jam	6	2.5	32	13.6	198	83.9
1.6 Butter	9	3.8	50	21.2	177	75.0
1.7 Breakfast Cereal	12	5.1	73	30.9	151	64.0
1.8 Rica	3	1.3	21	8.9	212	89.8
1.9 Candies	11	4.7	43	18.2	182	77.1
2. Should an athlete who wants to lose weight completely eliminate carbohydrates from his diet?	3	1.3	3	1.3	230	97.5
3. Are carbohydrates stored in the muscle as glycogen?	3	1.3	32	13.6	201	85.2
4. Does the muscle use protein as the main source of energy during exercise?	8	3.4	38	16.1	190	80.5
5.1 Chicken	0	0.0	1	0.4	235	99.6
5.2 Beans	3	1.3	33	14.0	200	84.7
5.3 Fruit	9	3.8	56	23.7	171	72.5
5.4 Margarine/butter	15	6.4	63	26.7	158	66.9
5.5 Breakfast cereal	33	14.0	80	33.9	123	52.1
5.6 Nuts	16	6.8	82	34.7	138	58.5
6. Do fats play an important role in the body?	2	0.8	72	30.5	162	68.6
7. Do saturated and unsaturated fats have the same effect on health?	3	1.3	97	41.1	136	57.6
8.1 Chicken	18	7.6	34	14.4	184	78.0
8.2 Nuts	10	4.2	36	15.3	190	80.5
8.3 Avocado	4	1.7	50	21.2	182	77.1
8.4 Fish and seafood	20	8.5	101	42.8	115	48.7
8.5 Cheeses	15	6.4	65	27.5	156	66.1
8.6 Sausage	17	7.2	73	30.9	146	61.9
8.7 Breakfast cereal	20	8.5	68	28.8	148	62.7
8.8 Lettuce	5	2.1	94	39.8	137	58.1
8.9 Olive oil / Sunflower oil	0	0.0	16	6.8	220	93.2

Table 4.7. Distribution of responses to the statements in the micronutrients section of the NUKYA-Q.

	-1		0		1	
	N	%	N	%	N	%
9. How many servings of fruit and vegetables are recommended per day? A serving is a piece of fruit or a bowl of salad or vegetables (Choose an option).	31	13.1	102	43.2	103	43.6
17. Can the human body get most of its vitamin D from sunlight? (Choose an option)	2	0.8	1	0.4	233	98.7
18. Are vitamins and minerals a good source of energy? (Choose an option)	51	21.6	68	28.8	117	49.6
19.1 Avocado	4	1.7	67	28.4	165	69.9
19.2 Meat	4	1.7	11	4.7	221	93.6
19.3 Fish	8	3.4	17	7.2	211	89.4
19.4 Beans	8	3.4	7	3.0	221	93.6
19.5 Spinach	7	3.0	9	3.8	220	93.2
19.6 Nuts	5	2.1	19	8.1	212	89.8
19.7 Bread	12	5.1	112	47.5	112	47.5
19.8 Butter	7	3.0	85	36.0	144	61.0
20.1 Fruit	5	2.1	77	32.6	154	65.3
20.2 Meat	1	0.4	6	2.5	229	97.0
20.3 Almond	3	1.3	11	4.7	222	94.1
20.4 Milk	7	3.0	50	21.2	179	75.8
20.5 Spinach	10	4.2	38	16.1	188	79.7
20.6 Cheese	5	2.1	58	24.6	173	73.3
20.7 Bread	14	5.9	53	22.5	169	71.6
20.8 Butter	3	1.3	47	19.9	186	78.8

Table 4.8. Distribution of responses to the statements in the hydration section of the NUKYA-Q.

	-1		0		1	
	N	%	N	%	N	%
10.a If you lose 2% of your body weight (for example, 1.5 kg if you weigh 75 kg) due to dehydration, your athletic performance will decrease.	24	10.2	29	12.3	183	77.5
10.b For good hydration during sports training, you have to wait until you are thirsty to drink.	24	10.2	52	22.0	160	67.8
10.c For complete rehydration after exercise, you need to drink a volume of liquid greater than the volume of water lost during exercise (which we know by weighing your weight before and after your workout).	58	24.6	77	32.6	101	42.8
10.d Fruit juice is a suitable liquid to drink during in the training and the middle of the match	34	14.4	143	60.6	59	25.0
10.e Energy drinks such as "Red Bull" are recommended for athletes to consume during exercise	34	14.4	110	46.6	92	39.0
11. What do you think is the most suitable urine color before you start training? (Choose an option)	7	3.0	127	53.8	102	43.2
12. What is the best way to replace the water that is lost through sweating during intense or prolonged exercise? (Choose an option)	38	16.1	70	29.7	128	54.2
13. The percentage of carbohydrates in an isotonic sports drink should be: (Choose an option)	31	13.1	89	37.7	116	49.2

Table 4.9. Distribution of responses to the statements in the periodization section of the NUKYA-Q.

	-1		0		1	
	N	%	N	%	N	%
14. When is the best time to eat and drink to initiate recovery after exercise or competition? (Choose an option)	3	1.3	2	0.8	231	97.9
15. The most important nutrient(s) to consume after training are: (Choose an option)	6	2.5	40	16.9	190	80.5
16. Should the last main meal (breakfast, lunch, or dinner) be eaten at least 3-4 hours before a competition/exercise?	4	1.7	26	11.0	206	87.3

Table 4.10 compares regular sports activity and participation rates across different sports branches between male and female athletes.

Among men, 99.5% engage in sports regularly, while this rate is 100% for female, resulting in an overall rate of 99.6%. In terms of sports branches, 82.2% of men are interested in football, compared to 58.8% of female, with an overall participation rate of 77.1%. The difference in sports branch participation between genders was found to be statistically significant ($p<0.05$). The average monthly sports duration for men is 109.69±44.73 hours, while for female it is 91.76±39.06 hours. A statistically significant difference was found between exercise duration and gender ($p<0.05$).

Table 4.10. Comparison of Exercise Habits and Sport Branches Between in male and female athletes

	Male (n=185)		**Female (n=51)**		**Overall (n=236)**			
	n	**%**	**n**	**%**	**n**	**%**	χ^2	**p**
Regular Exercise Status								
Yes	184	99.5	51	100.0	235	99.6	0.277	0.599
No	1	0.5	0	0.0	1	0.4		
Sport Branch								
Football	152	82.2	30	58.8	182	77.1	13.951	**0.003**
Basketball	22	11.9	11	21.6	33	14.0		
Athletics	6	3.2	5	9.8	11	4.7		
American Football	5	2.7	5	9.8	10	4.2		
Duration of Exercise (months) ($\bar{x}$±SS)	109.69±44.73		91.76±39.06		105.81±44.11		t=2.600	**0.010**

Table 4.11 compares meal skipping status and nutritional assessment rates between male and female athletes. While 68.6% of male athletes sometimes skip meals, this rate is 86.3% for female, resulting in an overall rate of 72.5% among all participants.

Additionally, 45.6% of men reported skipping lunch, while 40.4% of female stated they skipped breakfast. The difference between gender and meal skipping status, as well as skipped meals, was found to be statistically significant ($p<0.05$).

However, there was no statistically significant difference between gender in terms of thinking about eating healthy and nutritional evaluation ($p>0.05$).

Table 4.11. Comparison of general eating habits in male and female athletes

	Male (n=185)		**Female (n=51)**		**Overall (n=236)**			
	n	**%**	**n**	**%**	**n**	**%**	**χ^2**	**p**
Number of Meals per Day ($\bar{x}$±SD), Median (Min-Max)	2.91±0.29	3 (2-3)	2.96±0.20	3 (2-3)	2.92±0.27	3 (2-3)	U=1.222	0.222
Skipping Main Meals								
Yes	20	10.8	3	5.9	23	9.7	6.332	**0.042**
No	38	20.5	4	7.8	42	17.8		
Sometimes	127	68.6	44	86.3	171	72.5		
Which Meal								
Morning	40	27.2	19	40.4	59	30.4	8.808	**0.012**
Noon	67	45.6	10	21.3	77	39.7		
Evening	40	27.2	18	38.3	58	29.9		
Do You Consider Yourself to Eat Healthy?								
Yes	164	88.6	49	96.1	213	90.3	2.509	0.113
No	21	11.4	2	3.9	23	9.7		
Nutrition Assessment								
Very good	13	7.0	1	2.0	14	5.9	2.674	0.445
Good	46	24.9	16	31.4	62	26.3		
Fair	115	62.2	32	62.7	147	62.3		
Poor	11	5.9	2	3.9	13	5.5		

Table 4.12 compares the rates of supplement use and the types of nutritional supplements used between male and female athletes.

Significantly, while 63.8% of male respondents disclosed non-utilization of supplements, a notably higher proportion of female athletes, accounting for 68.6%, reported supplement intake.

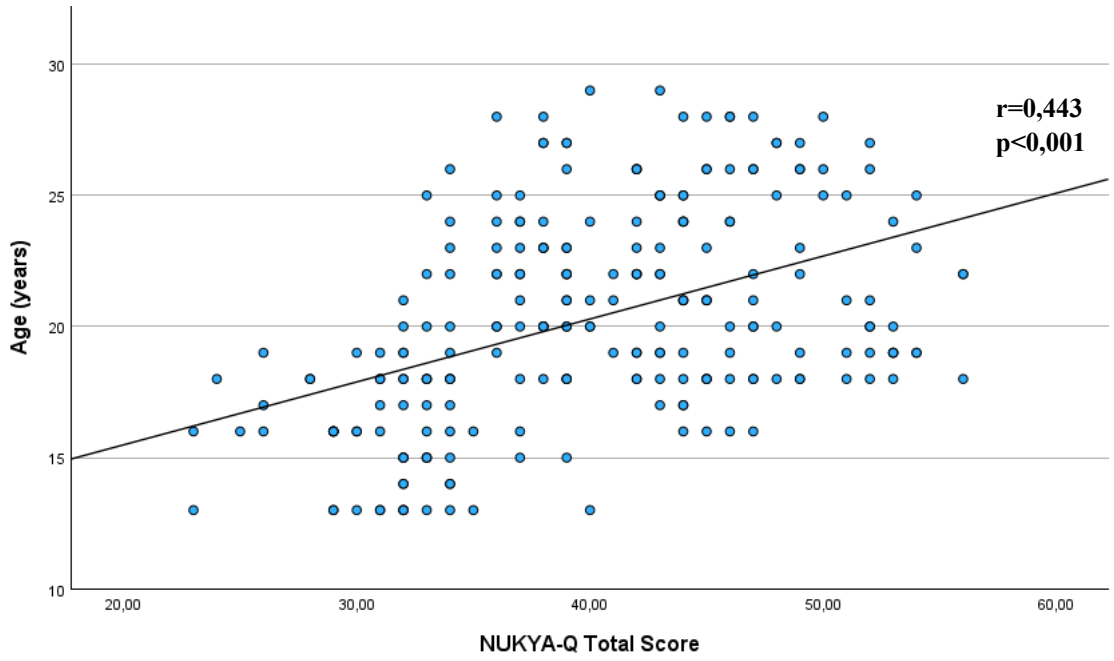
The difference in supplement use between genders was found to be statistically significant ($p<0.001$), with female's supplement use rate significantly higher. Regarding the type of nutritional supplement used, the difference in protein powder use between genders was found to be statistically significant ($p<0.05$).

No statistically significant difference was detected between the use of glutamine, l-carnitine, Conjugated Linoleic Acid (CLA), Branched Chain Amino Acids (BCAA), creatine, multivitamin, weight/volume, omega-3, and other types of nutritional supplements and gender ($p>0.05$).

Table 4.12. Comparison of dietary supplement use between male and female athletes

	Male (n=185)		**Female (n=51)**		**Overall (n=236)**			
	n	**%**	**n**	**%**	**n**	**%**	χ^2	**p**
Do you use any dietary supplements?								
Yes	67	36.2	35	68.6	102	43.2	17.114	**<0.001**
No	118	63.8	16	31.4	134	56.8		
If YES, please provide the name(s) (brand name(s)) of the dietary supplement(s) you use.								
Protein Powder	31	16.8	16	31.4	47	19.9	5.355	**0.021**
Glutamine	2	1.1	0	0.0	2	0.8	0.556	0.456
L-carnitine	1	0.5	0	0.0	1	0.4	0.277	0.599
CLA	3	1.6	1	2.0	4	1.7	0.028	0.868
BCAA	7	3.8	4	7.8	11	4.7	1.482	0.223
Creatine	8	4.3	3	5.9	11	4.7	0.218	0.640
Multi Vitamin	14	7.6	3	5.9	17	7.2	0.170	0.680
Weight/Volume Gainer	3	1.6	1	2.0	4	1.7	0.028	0.868
Omega-3	14	7.6	3	5.9	17	7.2	0.170	0.680
Other	7	3.8	2	3.9	9	3.8	0.002	0.964

A moderate positive relationship was found between age and the total score of the NUKYA-Q ($r=0.443$; $p<0.001$). As age increases, the total score on the NUKYA-Q scale also increases.



Figures 4.1. Scatter plot analysis of the correlation between the NUKYA-Q score and Age

Table 4.13 presents the statistics for the NUKYA-Q and its sub-sections. The mean total score for the NUKYA-Q is 40.11 with a standard deviation of 7.43. The minimum and maximum scores are 23 and 56, respectively.

Table 4.13. Statistics of NUKYA-Q and its Sub-sections

	$\bar{x}$±SD	Min-Max value	Correct response %	Skewness	Kurtosis
Macronutrients	20.72±4.02	10-29	75.51±11.13	-0.201	-0.297
Micronutrients	13.86±3.27	3-19	77.14±13.50	-0.324	-0.099
Hydration	2.93±1.56	1-7	49.84±13.42	0.168	-0.520
Periodization	2.60±0.61	1-3	88.56±16.45	-1.260	0.535
Total	**40.11±7.43**	**23-56**	**73.22±10.04**	**0.056**	**-0.731**

$\bar{x}$±SD=mean± standard deviation

Table 4.14 presents the analysis results of the NUKYA-Q scale and its sub-sections, highlighting the differences between genders.

A statistically significant difference was observed between macronutrient knowledge and gender ($p<0.001$). The mean score of female athletes (M=22.75, SD=3.09) in the macronutrient section was significantly higher than that of male participants (M=20.16, SD=4.07).

Similarly, a statistically significant difference was found between micronutrient knowledge and gender ($p<0.001$). Female athletes scored significantly higher (M=15.53, SD=2.72) compared to male participants (M=13.41, SD=3.27).

In the hydration sub-section, the difference between genders was also statistically significant ($p<0.001$). Female athletes had a higher mean score (M=3.55, SD=1.76) than their men counterparts (M=2.76, SD=1.46).

In the periodization sub-section, the difference between genders was also statistically significant ($p<0.05$). Female athletes had a higher mean score (M=2.82, SD=0.39) than their male athletes (M=2.54, SD=0.64).

Overall, the total score of the NUKYA-Q scale revealed a statistically significant gender difference ($p<0.001$). Female athletes had a significantly higher total mean score (M=44.65, SD=6.23) compared to male athletes (M=38.86, SD=7.26).

Table 4.14. Total and sub-section scores of the NUKYA-Q based on gender

	Gender	**n**	**$\bar{x}$±SD**	**Correct response %**	**t**	**p**
Macronutrients	Male	185	20.16±4.07	73.98±11.14	4.214	**<0.001**
	Female	51	22.75±3.09	81.07±9.24		
Micronutrients	Male	185	13.41±3.27	75.42±13.19	4.249	**<0.001**
	Female	51	15.53±2.72	83.38±12.87		
Hydration	Male	185	2.76±1.46	48.24±12.51	3.283	**<0.001**
	Female	51	3.55±1.76	55.64±15.07		
Periodization	Male	185	2.54±0.64	87.03±17.02	2.998	**0.003**
	Female	51	2.82±0.39	94.12±12.83		
Total	Male	185	38.86±7.26	71.62±9.69	5.186	**<0.001**
	Female	51	44.65±6.23	79.03±9.16		

Table 4.15 presents the analysis results regarding the differences between the NUKYA-Q and its sub-sections in relation to supplement use.

A statistically significant difference was observed between macronutrient knowledge and supplement use ($p<0.001$). The mean score for individuals using supplements ($M=22.09$, $SD=3.86$) in the macronutrient section was significantly higher than that of individuals not using supplements ($M=19.84$, $SD=3.88$).

Similarly, a statistically significant difference was found between micronutrient knowledge and supplement use ($p<0.001$). The mean score for individuals using supplements ($M=14.97$, $SD=3.18$) in the micronutrient section was significantly higher than that of individuals not using supplements ($M=13.16$, $SD=3.14$).

Regarding hydration knowledge, a statistically significant difference was found in relation to supplement use ($p<0.001$). The mean score for individuals using supplements ($M=3.58$, $SD=1.48$) in the hydration section was significantly higher than that of individuals not using supplements ($M=2.51$, $SD=1.46$).

Overall, the total NUKYA-Q score revealed a statistically significant difference in relation to supplement use ($p<0.001$). The total mean score for individuals using supplements ($M=43.27$, $SD=7.11$) was significantly higher than that of individuals not using supplements ($M=38.09$, $SD=6.94$).

Table 4.15. Total and sub-section scores of the NUKYA-Q based on whether athletes use supplements

	Athletes use supplements	**n**	**$\bar{x}$±SD**	**Correct response %**	**t**	**p**
Macronutrients	Yes	92	22.09±3.86	79.69±10.90	4.343	**<0.001**
	No	144	19.84±3.88	72.84±10.48		
Micronutrients	Yes	92	14.97±3.18	81.35±13.02	4.288	**<0.001**
	No	144	13.16±3.14	74.45±13.14		
Hydration	Yes	92	3.58±1.48	55.71±12.49	5.410	**<0.001**
	No	144	2.51±1.46	46.09±12.67		
Periodization	Yes	92	2.64±0.53	88.41±16.71	0.801	0.424
	No	144	2.58±0.65	88.66±16.33		
Total	Yes	92	43.27±7.11	77.41±9.45	5.542	**<0.001**
	No	144	38.09±6.94	70.54±9.50		

Table 4.16 presents the analysis results regarding the differences in scores on the NUKYA-Q and its sub-sections, based on whether individuals have taken courses on sports nutrition.

A statistically significant difference was found between taking courses on sports nutrition and scores related to macronutrients ($p<0.001$). The average macronutrient score of individuals who took courses on sports nutrition ($M=22.80$, $SD=3.58$) was significantly higher than those who did not take such courses ($M=18.86$, $SD=3.45$).

Similarly, a statistically significant difference was observed between taking courses on sports nutrition and scores related to micronutrients ($p<0.001$). The average micronutrient score of individuals who took courses on sports nutrition ($M=15.57$, $SD=2.93$) was significantly higher than those who did not take such courses ($M=12.33$, $SD=2.76$).

In terms of hydration, a statistically significant difference was detected ($p<0.001$). The average hydration score of individuals who took sports nutrition lessons ($M=3.43$, $SD=1.57$) was significantly higher than those who did not take such courses ($M=2.48$, $SD=1.41$).

Overall, a statistically significant difference was found between the total NUKYA-Q score and the status of taking courses on sports nutrition ($p<0.001$). The total mean score on the NUKYA-Q scale for individuals who took courses on sports nutrition ($M=44.47$, $SD=6.41$) was significantly lower than for those who did not take such courses ($M=36.24$, $SD=6.02$).

Table 4.16. Total scores and sub-section scores of the NUKYA-Q based on whether the athletes have taken nutrition lessons.

	Sports nutrition lessons	n	$\bar{x}$±SD	Correct response %	t	p
Macronutrients	Yes	111	22.80±3.58	81.89±9.39	8.597	**<0.001**
	No	125	18.86±3.45	69.85±9.38		
Micronutrients	Yes	111	15.59±2.93	84.97±11.37	8.812	**<0.001**
	No	125	12.33±2.76	70.19±11.26		
Hydration	Yes	111	3.43±1.57	55.07±13.84	4.916	**<0.001**
	No	125	2.48±1.41	45.20±11.20		
Periodization	Yes	111	2.64±0.57	89.19±16.31	0.905	0.367
	No	125	2.57±0.64	88.00±16.61		
Total	Yes	111	44.47±6.41	79.62±8.00	10.169	**<0.001**
	No	125	36.24±6.02	67.54±8.07		

Table 4.17 presents the analysis results regarding the differences in scores on the NUKYA-Q and its sub-sections, based on the source of information about sports nutrition.

A statistically significant difference was found between the source of information about macronutrients and sports nutrition ($p<0.001$). The average macronutrient score of individuals who received information from a dietitian (M=25.16, SD=2.60) was higher than those who received information from a trainer (M=19.84, SD=3.81) and other sources (M=19.33, SD=2.76). According to the Tamhane test results, individuals who received information about sports nutrition from coaches and other sources scored significantly lower than those who received information from a dietitian.

Similarly, a statistically significant difference was observed between the source of information about micronutrients and sports nutrition ($p<0.001$). The average micronutrient score of individuals who received information from a dietitian (M=17.00, SD=2.20) was higher than those who received information from a trainer (M=13.40, SD=3.04) and other sources (M=12.40, SD=3.04). The Tamhane test results indicated that individuals who received information about sports nutrition from coaches and other sources scored significantly lower than those who received information from a dietitian.

For hydration, a statistically significant difference was also found between the sources of information about sports nutrition ($p<0.001$). The average hydration score of individuals who received information from a dietitian (M=4.35, SD=1.33) was higher than those who received information from a trainer (M=2.53, SD=1.39) and other sources (M=2.89, SD=1.53). According to the Tamhane test results, individuals who received information about sports nutrition from coaches and other sources scored significantly lower than those who received information from a dietitian.

For periodization, a statistically significant difference was also found between the sources of information about sports nutrition ($p<0.05$). The average periodization score of individuals who received information from a dietitian (M=2.81, SD=0.45) was higher than those who received information from a trainer (M=2.57, SD=0.58) and other sources (M=2.49, SD=0.76). According to the Tamhane test results, individuals who received information about sports nutrition from coaches and other sources scored significantly lower than those who received information from a dietitian.

Overall, a statistically significant difference was found between the total NUKYA-Q score and the source of information about sports nutrition ($p<0.001$). The total mean score on the NUKYA-Q scale for individuals who received information from a dietitian (M=49.33, SD=4.71) was higher than those who received information from a trainer (M=38.34, SD=6.46) and other sources (M=37.11, SD=5.65).

The Tamhane test results showed that individuals who received information about sports nutrition from coaches and other sources scored significantly lower than those who received information from a dietitian.

Table 4.17. NUKYA-Q and its sub-sections, based on the source of information about sports nutrition.

	The source of information about sports nutrition	n	$\bar{x}$±SD	Correct response %	F	p	Difference
Macronutrients	Coach	148	19.84±3.81	72.88±10.20	44,438	**<0,001**	**1<2**
	Dietitian	43	25.16±2.60	88.45±8.07			**3<2**
	Other (athlete, teammate, school, television, scientific article)	45	19.33±2.76	71.80±7.14			
Micronutrients	Coach	148	13.40±3.04	74.75±12.38	32,669	**<0,001**	**1<2**
	Dietitian	43	17.00±2.20	89.96±10.94			**3<2**
	Other (athlete, teammate, school, television, scientific article)	45	12.40±3.04	72.75±12.10			
Hydration	Coach	148	2.53±1.39	45.52±11.01	28,084	**<0,001**	**1<2**
	Dietitian	43	4.35±1.33	63.95±11.32			**3<2**
	Other (athlete, teammate, school, television, scientific article)	45	2.89±1.53	50.56±13.31			
Periodization	Coach	148	2.57±0.58	87.16±16.73	3,637	**0,028**	**1<2**
	Dietitian	43	2.81±0.45	93.80±15.01			**3<2**
	Other (athlete, teammate, school, television, scientific article)	45	2.49±0.76	88.15±16.14			
Total	Coach	148	38.34±6.46	70.50±8.56	62,130	**<0,001**	**1<2**
	Dietitian	43	49.33±4.71	85.89±7.27			**3<2**

Other (athlete, teammate, school, television, scientific article)	45	37.11±5.65	70.06±7.14

Table 4.18 provides a comprehensive comparison of daily energy and macronutrient intakes between male and female athletes. The statistical analysis reveals several significant differences in specific macronutrient quantities between the two genders.

Firstly, a significant disparity was observed in the cholesterol intake, with male consuming an average of 619.03±301.55 mg compared to female's intake of 717.83±251.70 mg ($p<0.05$), indicating a notably higher cholesterol consumption among female.

Similarly, a significant variance was detected in the intake of saturated fatty acids, with male recording an average intake of 26.21±11.94 g and female consuming 31.65±15.06 g ($p<0.05$), demonstrating a higher intake among female.

Moreover, notable differences were found in the intake of monosaccharides and disaccharides. Female exhibited higher intakes of both monosaccharides (14.75±8.83 g) compared to male (11.09±8.76 g) ($p<0.05$) and disaccharides (4.40±2.71 g) compared to male (11.89±11.63 g) ($p<0.001$).

However, no statistically significant differences were observed in energy consumption, carbohydrate intake (both in grams and as a percentage), protein intake (both in grams and as a percentage), fat intake (both in grams and as a percentage), polysaccharide intake, or fiber intake between genders ($p>0.05$).

Table 4.18. Comparison of daily energy and macronutrient intake profiles between male and female athletes

	Male (n=185)		Female (n=51)		Overall (n=236)			
	($\bar{x}$±SD)	Median (Min-Max)	($\bar{x}$±SD)	Median (Min-Max)	($\bar{x}$±SD)	Median (Min-Max)	t/U*	p
Energy (kcal)	1231.68±336.08	1231.60 (546.93-2226.44)	1214.86±288.27	1185.11 (729.47-1763.15)	1228.04±325.83	1225.53 (546.93-2226.44)	0.326	0.745
Carbohydrate (g)	103.57±40.09	98.28 (25.81-212.73)	102.17±34.08	98.54 (30.84-212.73)	103.27±38.80	98.41 (25.81-212.73)	0.227	0.821
Carbohydrate (%)	33.51±9.43	32.66 (14.23-59.99)	33.97±9.18	34.58 (14.23-59.99)	33.61±9.36	33.05 (14.23-59.99)	0.313	0.755
Protein (g)	71.28±21.63	69.89 (23.00-134.18)	75.57±21.47	70.55 (45.02-134.18)	72.21±21.63	69.89 (23.00-134.18)	1.255	0.211
Protein%	23.92±6.85	23.07 (11.65-47.21)	25.57±6.86	25.66 (13.96-43.40)	24.28±6.87	23.53 (11.65-47.21)	1.524	0.129
Fat (g)	59.14±22,96	55.35 (15.47-125.04)	55.99±24.43	47.68 (14.74-113.99)	58.46±23.27	54.57 (14.74-125.04)	0.856	0.393
Fat (%)	42.57±9.29	42.84 (17.16-61.64)	40.45±11.16	39.25 (15.98-60.22)	42.11±9.74	41.84 (15.98-61.64)	1.376	0.170

Cholesterol (mg)	619.03±301.55	662.60 (49.70-1208.70)	717.83±251.70	757.14 (85.30-1225.49)	640.38±293.84	686.67 (49.70-1225.49)	2.142	**0.033**
Saturated fat acids. (g)	26.21±11.94	25.21 (6.92-68.78)	31.65±15.06	26.71 (9.91-67.94)	27.38±12.84	25.44 (6.92-68.78)	2.714	**0.007**
Monosaccharides (g)	11.09±8.76	9.87 (0.05-33.12)	14.75±8.83	15.82 (0.06-33.12)	11.89±8.89	10.86 (0.05-33.12)	2.636	**0.009**
Disaccharides. (g)	11.89±11.63	7.31 (0.05-53.56)	4.40±2.71	3.79 (0.15-9.69)	10.27±10.81	6.21 (0.05-53.56)	4.063*	**<0.001**
Polysaccharides (g)	67.14±37.07	59.94 (5.09-199.52)	68.74±31.79	67.84 (6.82-139.68)	67.49±35.94	61.91 (5.09-199.52)	0.281	0.779
Fiber (g)	8.94±6.20	8.19 (0.66-37.66)	9.00±7.88	6.90 (0.66-34.40)	8.95±6.58	7.90 (0.66-37.66)	0.690*	0.490

Table 4.19 provides a comprehensive comparison of daily energy and micronutrient intakes between male and female athletes, highlighting significant differences in various micronutrient components.

A substantial variance was observed in the intake of vitamin D, with male reporting an average intake of 3.39±2.00, whereas female reported a lower intake of 2.20±1.44 ($p<0.001$), indicating a significantly higher vitamin D intake among male.

Similarly, significant disparities were noted in the intake of phosphorus, magnesium, iron, fluoride, chlorine, sodium, and iodine. Male exhibited higher intakes of phosphorus (782.45±310.62 vs. 584.84±219.63, $p<0.001$), iron (7.82±2.65 vs. 8.70±3.07, $p<0.05$), chlorine (4493.50±2515.97 vs. 6895.68±2226.85, $p<0.001$), sodium (3498.57±2498.09 vs. 6895.27±1835.17, $p<0.001$), and iodine (148.50±138.32 vs. 187.22±132.12, $p<0.05$) compared to female. Conversely, female exhibited higher intakes of magnesium (721.13±95.08 vs. 399.19±266.80, $p<0.001$).

However, no statistically significant differences were detected between genders in the intake amounts of vitamin A, vitamin E (ESD), vitamin E, vitamin C, vitamin K, vitamin B1, vitamin B2, niacin, vitamin B6, vitamin B12, calcium, copper, potassium, folate, biotin, and zinc ($p>0.05$).

Table 4.19. Comparison of daily micronutrient intake patterns between male and female athletes

	Male (n=185)		Female (n=51)		Overall (n=236)			
	($\bar{x}$±SD)	**Median (Min-Max)**	**($\bar{x}$±SD)**	**Median (Min-Max)**	**($\bar{x}$±SD)**	**Median (Min-Max)**	**t/U***	**p**
Vit. D (µg)	3.39±2.00	3.42 (0.10-10.96)	2.20±1.44	1.82 (0.55-6.02)	3.13±1.96	2.97 (0.10-10.96)	3.955	**<0.001**
Vit. A (µg)	620.39±335.00	557.80 (97.14-2046.20)	570.20±302.23	571.36 (102.50-1426.16)	609.54±328.22	562.69 (97.14-2046.20)	0.597*	0.551
Vit. E (mg)	8.34±6.23	6.89 (0.96-43.65)	7.75±5.26	6.11 (1.01-21.79)	8.21±6.03	6.83 (0.96-43.65)	0.507*	0.612
Vit. C (mg)	54.74±34.88	53.88 (0.01-193.93)	56.18±27.54	59.14 (3.64-99.28)	55.05±33.38	54.61 (0.01-193.93)	0.273	0.785
Vit. K(µg)	50.52±66.47	31.55 (0.00-495.70)	46.84±73.21	25.61 (1.62-480.00)	49.73±67.84	31.00 (0.00-495.70)	0.898*	0.369
Vit. B1 /Tiamin (mg)	0.60±0.23	.54 (0.13-1,44)	0.65±0.23	0.64 (0.14-1.44)	0.61±0.23	0.57 (0.13-1.44)	1.369	0.172
Vit. B2 /Riboflavin (mg)	1.47±0.52	1.42 (0.34-3.20)	1.43±0.45	1.37 (0.48-2.37)	1.46±0.50	1.41 (0.34-3.20)	0.469	0.640
Niacine (mg)	12.84±6.49	12.42 (2.67-30.67)	14.11±6.25	14.84 (2.67-30.67)	13.11±6.44	12.62 (2.67-30.67)	1.242	0.216

Vit. B6 /Pirid. (mg)	1.18±0.50	1.13 (0.41-2.72)	1.16±0.46	1.18 (0.45-2.33)	1.18±0.49	1.13 (0.41-2.72)	0.301	0.764
Vit. B12(µg)	5.99±5.97	5.02 (1.43-53.68)	5.03±2.49	4.20 (1.58-10.46)	5.78±5.42	4.59 (1.43)	0.674*	0.500
Calcium (mg)	535.68±269.64	533.83 (94.00-1385.50)	536.73±277.70	528.12 (132.52-1385.52)	535.91±270.81	530.49 (94.00-1385.52)	0.024	0.981
Phosphate (mg)	782.45±310.62	781.20 (159.00-1552.27)	584.84±219.63	596.30 (141.60-975.45)	739.75±304.06	745.61 (141.60-1552.27)	4.256	**<0.001**
Magnesium (mg)	399.19±266.80	256.62 (56.20-920.35)	721.13±95.08	721.40 (519.96-961.12)	468.76±274.39	536.48 (56.20-961.12)	8.459	**<0.001**
Iron (mg)	7.82±2.65	7.24 (2.73-17.13)	8.70±3.07	7.84 (5.28-18.64)	8.01±2.76	7.31 (2.73-18.64)	2.030	**0.044**
Chlorine (mg)	4493.50±2515.97	3900.90 (639.12-9993.10)	6895.68±2226.85	7354.62 (1601.70-9885.54)	5012.61±2644.45	4644.90 (639.12-9993.10)	6.182	**<0.001**
Sodium (mg)	3498.57±2498.09	2673.83 (338.84-9613.20)	6895.27±1835.17	6973.65 (2837.37-9854.50)	4232.60±2750.54	3254.30 (338.84-9854.50)	9.054	**<0.001**

Iodine (µg)	148.50±138.32	103.06 (21.33-851.93)	187.22±132.12	153.76 (35.83-729.71)	156.87±137.66	117.69 (21.33-851.93)	2.776*	**0.005**
Potassium (mg)	1640.36±588.79	1661.97 (603.30-3248.15)	1568.37±561.18	1560.90 (607.30-2875.78)	1624.80±582.52	1656.02 (603.30-3248.15)	0.781	0.436
Folate, topl. (µg)	195.86±81.70	192.90 (60.40-452.60)	215.51±99.95	189.80 (74.20-435.27)	200.11±86.13	191.00 (60.40-452.60)	1.446	0.150
Biotin (µg)	48.96±19.60	44.15 (14.74-113.68)	54.89±21.34	52.29 (24.74-123.68)	50.25±20.09	47.25 (14.74-123.68)	1.876	0.062
Zinc (mg)	10.85±5.93	9.49 (3.78-51.35)	13.19±8.68	11.79 (3.18-55.23)	11.36±6.67	9.75 (3.18-55.23)	1.889*	0,059

Table 4.20 presents a comparison of HEI values between different sources of information on sports nutrition. The t and U values represent the differences between these sources.

Individuals who received information about sports nutrition from a trainer had a whole fruit value of (3.95±1.95), while those who received information from a dietitian had a significantly higher total fruit value of (4.63±0.91). Conversely, individuals who obtained information from other sources had a total fruit value of (4.63±0.91). A statistically significant difference was found in the whole fruit value of individuals (3.65±2.14) ($p<0.05$), with those informed by dietitians showing the highest value.

Similarly, individuals informed by dietitians had a significantly higher total vegetable value of (4.75±0.79) compared to those informed by trainers (3.30±1.50) or other sources. The value of dark green leafy vegetables and legumes was also significantly higher in individuals informed by dietitians (4.58±0.94) compared to those informed by trainers (3.40±1.53) or other sources.

Moreover, the total HEI value was significantly higher in individuals who received information from dietitians (52.54±7.45) compared to those informed by trainers (48.36±8.30) or other sources (49.53±9.04) ($p<0.05$).

The total HEI value was significantly higher among individuals who received information about sports nutrition from a dietitian.

Table 4.20. Comparison of HEI scores and source of information about sports nutrition in Athletes

	Coach (n=148)		**Dietitian (n=43)**		**Others (n=45)**		**Overall (n=236)**			
	($\bar{x}$±SD)	**Median (Min-Max)**	**($\bar{x}$±SD)**	**Median (Min-Max)**	**($\bar{x}$±SD)**	**Medyan (Alt-Üst)**	**($\bar{x}$±SD)**	**Median (Min-Max)**	F/H*	p
Total fruits	1.02±1.71	0.00 (0-5)	1.12±1.82	0.00 (0-5)	1.16±1.79	0.00 (0-5)	1.07±1.74	0.00 (0-5)	0.131	0.877
Whole Fruits	3.95±1.95	5.00 (0-5)	4.63±0.91	5.00 (0-5)	3.65±2.14	5.00 (0-5)	4.02±1.86	5.00 (0-5)	3.373	**0.036**
Total Vegetables	3.30±1.50	3.52 (0-5)	4.75±0.79	5.00 (1.39-5)	3.50±1.43	3.48 (0.53-5)	3.60±1.49	4.06 (0-5)	18.303	**<0.001**
Greens and Beans	3.40±1.53	3.63 (0.71-5)	4.58±0.94	5.00 (1.65-5)	3.54±1.37	3.86 (0.78-5)	3.64±1.48	4.30 (0.71-5)	11.942	**<0.001**
Whole Grains	9.15±2.16	10.00 (0.24-10)	9.76±0.88	10.00 (6.08-10)	8.94±2.30	10.00 (1.51-10)	9.22±2.03	10.00 (0.24-10)	5.827*	0.054
Dairy	4.09±1.67	4.02 (1.44-10)	4.02±1.86	3.69 (1.81-9.54)	3.97±2.33	3.18 (1.22-10)	4.06±1.84	3.75 (1.22-10)	0.087	0.917
Total Protein Foods	4.13±0.83	4.28 (2.22-5)	4.15±0.85	4.26 (2.39-5)	3.90±0.88	3.86 (2.08-5)	4.09±0.84	4.22 (2.08-5)	1.429	0.242
Seafood and Plant Proteins	3.56±1.24	3.58 (0.35-5)	3.66±1.29	3.80 (1.21-5)	3.85±1.19	3.96 (1.24-5)	3.63±1.24	3.68 (0.35-5)	0.941	0.392
Fatty Acids	1.65±2.77	0.00 (0-10)	1.87±3.49	0.00 (0-10)	2.36±3.34	0.70 (0-10)	1.83±3.02	0.00 (0-10)	0.942	0.391
Refined Grains	4.27±3.18	4.43 (0-10)	4.52±3.07	4.68 (0-10)	5.18±3.50	5.31 (0-10)	4.49±3.23	4.70 (0-10)	1.356	0.260
Sodium	5.71±4.34	6.28 (0-10)	6.01±4.53	9.35 (0-10)	5.15±4.32	5.43 (0-10)	5.66±4.36	7.26 (0-10)	0.451	0.638

Added Sugars	4.06±3.05	4.34 (0-10)	3.33±3.02	2.81 (0-10)	4.09±2.76	4.25 (0-9.53)	3.94±2.99	3.87 (0-10)	1.088	0.339
Saturated Fats	0.07±0.60	0.00 (0-6.54)	0.13±0.61	0.00 (0-3.65)	0.24±1.27	0.00 (0-8.2)	0.11±0.78	0.00 (0-8.2)	2.242*	0.326
Total Score	48.36±8.30	48.04 (26.59-71.84)	52.54±7.45	52.65 (38.33-70.83)	49.52±9.04	49.40 (35.71-78.61)	49.34±8.42	49.31 (26.59-78.61)	4.245	**0.015**

Table 4.21 compares the HEI classification distribution of athletes according to gender, and the analysis examines whether there is a significant difference.It is observed that 60.5% of male athletes have poor HEI scores, while 39.5% have HEI scores that need improvement. Among female athletes, 43.1% have poor HEI scores, and 56.9% have scores that need improvement. A statistically significant difference was found between HEI classification and gender ($p<0.05$).

Table 4.21. Comparison of HEI classification profiles between male and female athletes

	Male		**Female**			
HEI	**n**	**%**	**n**	**%**	χ^2	**p**
Poor	112	60.5	22	43.1	4.934	**0.026**
Needs improvement	73	39.5	29	56.9		

Table 4.22 presents a detailed comparison of Healthy Eating Index (HEI) values between male and female athletes, revealing significant differences in various dietary components.

A substantial discrepancy was noted in the consumption of whole fruits, with male athletes exhibiting an average HEI value of 3.80±2.04, whereas female athletes demonstrated a notably higher value of 4.80±0.43 ($p<0.001$), indicating a significantly greater consumption of whole fruits among female.

Similarly, significant disparities were observed in the consumption of total vegetables, dark green leafy vegetables and legumes, and whole grains. Female athletes displayed significantly higher HEI values for total vegetables (4.42±0.89 vs. 3.37±1.54, $p<0.001$), dark green leafy vegetables and legumes (4.80±0.67 vs. 3.32±1.48, $p<0.001$), and whole grains (9.89±0.53 vs. 9.03±2.24, $p<0.05$) compared to male athletes.

Moreover, the total HEI value was significantly higher among female athletes (52.44±7.42) compared to male athletes (48.49±8.49) ($p<0.05$), indicative of an overall healthier dietary pattern among female. However, no statistically significant differences were observed between genders in the consumption of total fruit, milk and dairy products, total protein foods, seafood and vegetable proteins, fatty acids, processed grains, sodium, added sugar, and saturated fat values ($p>0.05$).

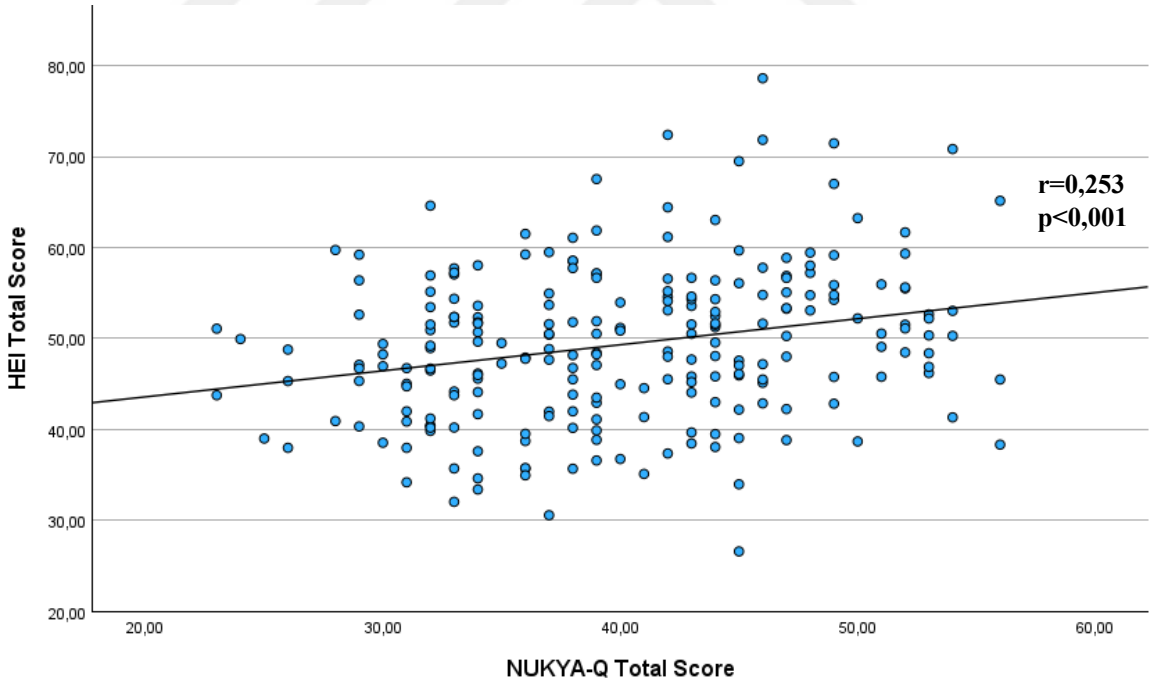
Table 4.22. Comparison of HEI scores and components between male and female athletes

	Male (n=185)		Female (n=51)		Overall (n=236)			
	($\bar{x}$±SD)	**Median (Min-Max)**	**($\bar{x}$±SD)**	**Median (Min-Max)**	**($\bar{x}$±SD)**	**Median (Min-Max)**	**t/U***	**p**
Total fruits (5)	1.00±1.69	0.00 (0-5)	1.32±1.89	0.00 (0-5)	1.07±1.74	0.00 (0-5)	1.155	0.249
Whole Fruits (5)	3.80±2.04	5.00 (0-5)	4.80±0.43	5.00 (3.14-5)	4.02±1.86	5.00 (0-5)	3.480	**<0.001**
Total Vegetables (5)	3.37±1.54	3.54 (0-5)	4.42±0.89	5.00 (1.48-5)	3.60±1.49	4.06 (0-5)	4.652	**<0.001**
Greens and Beans (5)	3.32±1.48	3.48 (0.71-5)	4.80±0.67	5.00 (2.01-5)	3.64±1.48	4.30 (0.71-5)	6.984	**<0.001**
Whole Grains (10)	9.03±2.24	10.00 (0.24-10)	9.89±0.53	10.00 (6.94-10)	9.22±2.03	10.00 (0.24-10)	2.460*	**0.014**
Dairy (10)	4.09±1.89	3.75 (1.22-10)	3.94±1.67	3.73 (1.81-9.54)	4.06±1.84	3.75 (1.22-10)	0.484	0.629
Total Protein Foods (5)	4.04±0.85	4.14 (2.08-5)	4.26±0.81	4.58 (2.49-5)	4.09±0.84	4.22 (2.08-5)	1.622	0.106

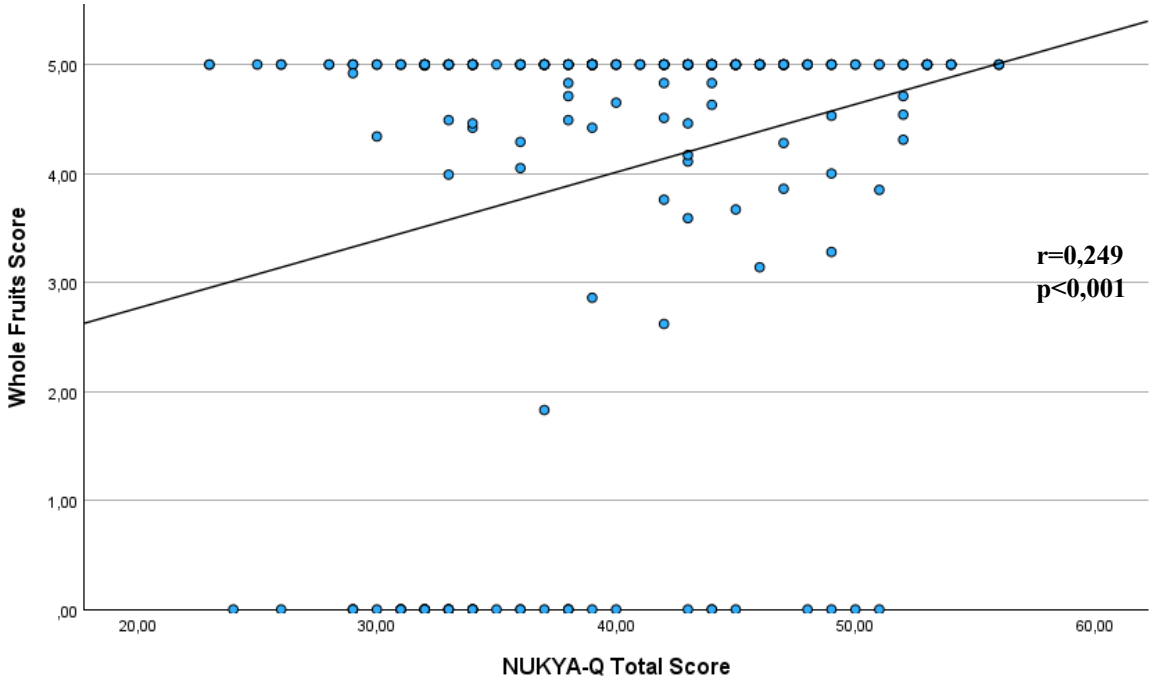
Seafood and Plant Proteins (5)	3.68±1.27	3.69 (0.35-5)	3.47±1.11	3.39 (1.52-5)	3.63±1.24	3.68 (0.35-5)	1.027	0.306
Fatty Acids (10)	1.89±3.07	0.00 (0-10)	1.59±2.85	0.00 (0-10)	1.83±3.02	0.00 (0-10)	0.639	0.523
Refined Grains (10)	4.64±3.27	4.85 (0-10)	3.95±3.05	4.01 (0-10)	4.49±3.23	4.70 (0-10)	1.356	0.177
Sodium (10)	5.55±4.29	5.90 (0-10)	6.05±4.63	10.00 (0-10)	5.66±4.36	7.26 (0-10)	0.736	0.462
Added Sugars (10)	3.99±3.03	3.93 (0-10)	3.73±2.86	3.49 (0-8.13)	3.94±2.99	3.87 (0-10)	0.560	0.576
Saturated Fats (10)	0.09±0.69	0.00 (0-8.2)	0.20±1.04	0.00 (0-6.54)	0.11±0.78	0.00 (0-8.2)	0.722*	0.470
Total Score (100)	48.49±8.49	48.25 (26.59-78.61)	52.44±7.42	51.65 (35.11-71.84)	49.34±8.42	49.31 (26.59-78.61)	3.014	**0.003**

As presented in Figures 4.2 to 4.5, the correlation between the NUKYA-Q total score and various components of the Healthy Eating Index (HEI), including the overall HEI score, whole fruit intake, total vegetable intake, and the intake of dark green leafy vegetables and legumes, is examined.

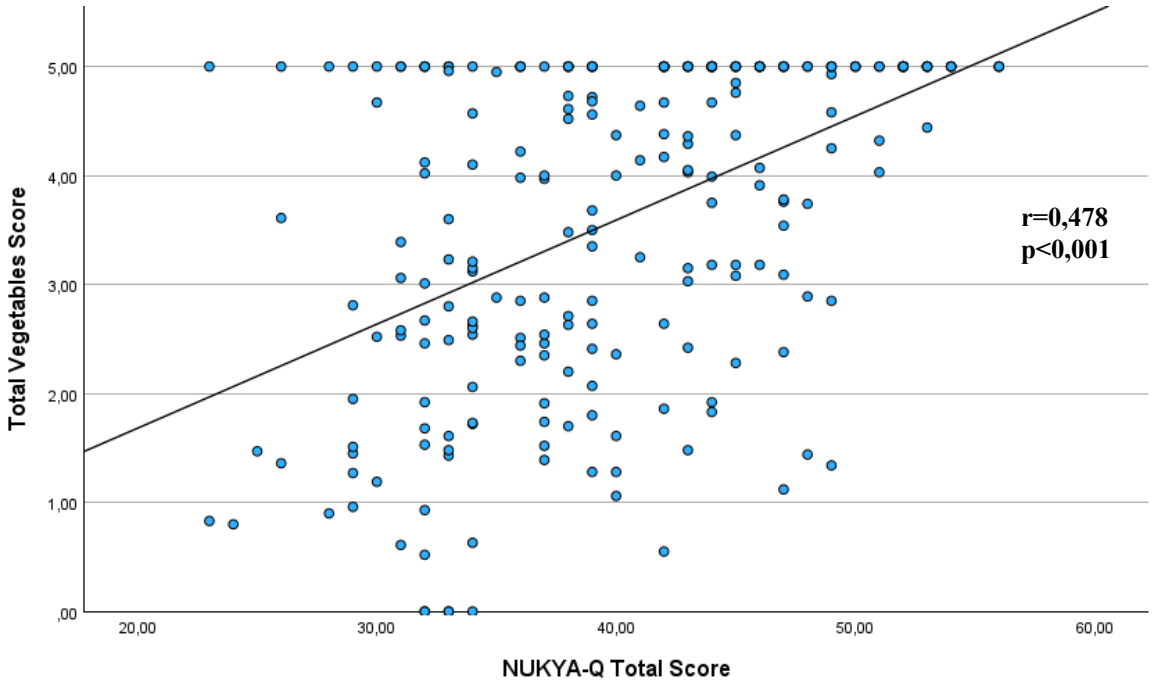
A weak positive correlation was observed between the NUKYA-Q total score and the overall HEI score ($r=0.253$; $p<0.001$). Additionally, weak positive correlations were identified between the NUKYA-Q total score and the HEI components for whole fruits ($r=0.253$; $p<0.001$), dark green leafy vegetables and legumes ($r=0.249$; $p<0.001$), and total vegetables ($r=0.478$; $p<0.001$). No statistically significant correlations were found between the NUKYA-Q total score and other HEI components ($p>0.05$).



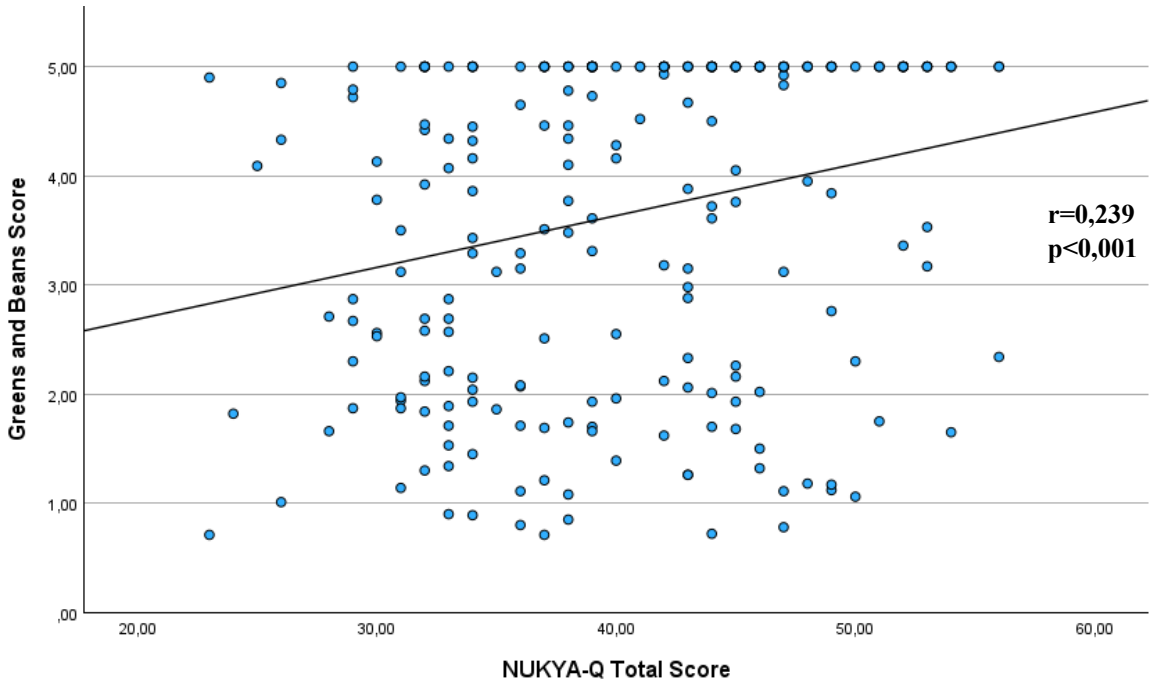
Figures 4.2. Scatter plot analysis of the correlation between NUKYA-Q Score and HEI Score



Figures 4.3. Scatter plot analysis of the correlation between the NUKYA-Q score and the HEI component score for whole fruits



Figures 4.4. Scatter plot analysis of the correlation between the NUKYA-Q score and the HEI component score for total vegetables score



Figures 4.5. Scatter plot analysis of the correlation between the NUKYA-Q score and the HEI

5. DISCUSSION AND CONCLUSION

Adequate nutrient intake and healthy eating habits are crucial for athletes to achieve optimal performance. Therefore, the primary goal of the NUKYA-Q assessment is to raise awareness about healthy eating habits and to improve nutritional knowledge among Turkish athletes. Currently, there are not enough tools with sufficient psychometric measurements in Turkey that specifically target the nutritional information of athletes. Given that a survey must be valid, reliable, and accurate in its measurements, psychometric criteria are essential. The lack of surveys with adequate psychometric testing in Turkey highlights the contribution this study will make to the existing literature. Considering the lengthy completion times of current surveys, the NUKYA-Q stands out as the shortest among its counterparts (7, 67, 76, 77).

Recently, some scales and tests have been adapted into Turkish and have undergone validation and reliability testing to assess athletes' nutritional knowledge. However, these scales and tests generally contain a relatively large number of questions or items. Surveys with a high number of questions tend to have longer completion times and lower completion rates among athletes. The extended completion times of current surveys also contribute to lower completion rates. In our country, the importance of developing and using scales or tests with fewer items or questions, while ensuring their validity and reliability, has increased.

This study aims to introduce a tool to our country that will quickly and reliably assess the nutritional knowledge levels of young and adult athletes, providing an efficient and short-duration survey. In this study, validity and reliability analyses of the "Nutrition Knowledge Questionnaire for Young and Adult Athletes "(NUKYA-Q) were conducted on athletes aged between 13 and 30 (n=236). The study aimed to assess the relationship between athletes' nutritional knowledge and dietary quality using the HEI-2020.

5.1. Assessment of General Characteristics of Individuals

Based on the analysis, under 18 years old, a statistically significant difference in BMI-for-age Z-scores (BAZ) was observed between genders ($p<0.05$). The findings indicate that a higher proportion of females were classified as overweight or obese compared to males, suggesting that females had a higher average BMI. In terms of Height-for-age Z-scores (HAZ), there was no significant difference between genders ($p>0.05$), meaning that both

males and females generally exhibited similar growth patterns in terms of height. For individuals 18 years and above, a statistically significant difference in BMI was also found between genders ($p < 0.05$), with females having a higher average BMI than males. However, similar to the younger group, no significant difference was noted in height ($p > 0.05$). These findings align with previous studies, highlighting the importance of considering gender differences in nutritional and growth assessments across different age groups. Previous studies have demonstrated that gender, educational status, and anthropometric characteristics can vary significantly (75, 94, 95). In this study, body weight, height, and BMI values are provided as descriptive information; therefore, their relationship with other parameters was not evaluated.

All participants in this study reported having access to a sports nutrition advisor where they work or exercise. The majority of these advisors were coaches. Among male participants, 65.4% stated that they learned about sports nutrition from their coaches, while 52.9% of female athletes reported the same. The study sample consisted of professional athletes with varying education levels. The opportunity for an athlete to take a course on sports nutrition is dependent on the school or institution they attend or their own efforts. It is believed that only some athletes in the study sample have regular access to these opportunities. To increase their knowledge about sports nutrition, 65.4% of male athletes consulted their coaches, 11.9% consulted dietitians, and 22.7% used other sources. In contrast, 52.9% of female athletes received information about sports nutrition from their coaches, 41.2% from dietitians, and 5.9% from other sources. This result may be due to the absence of dietitians among the medical staff supporting the athletes or because athletes, who frequently interact with their coaches on various matters, prefer to consult their coaches about nutrition. Similarly, other studies have shown that coaches are often the primary source of nutrition information for athletes (8, 96). However, one study indicated that television/internet was the primary source of nutrition information for 82% of participants (79). In a study of Australian football players with high nutrition knowledge, 98% preferred dietitians as their source of nutrition information, followed by club trainers (45.7%) and teammates (23.9%) (8). These differences in study results could be attributed to various factors, including the preferences of athletes from different sports, the resources and facilities available to the teams and/or federations, athletes' access to dietitians, national policies

regarding nutrition support, and the presence and activity of dietitians in the health personnel team.

5.2. Validity and Reliability Analyses of the NUKYA-Q

The item-whole analysis results of the questions in the NUKYA-Q scale included in the study are shown. The internal consistency of the survey was determined to be 0.735 using the Kuder-Richardson formula, which is appropriate for assessing the reliability of surveys composed of dichotomous items. The test-retest reliability, evaluated by administering the survey to 30 individuals two weeks later, indicated an excellent correlation with an intra-class correlation coefficient (ICC) of 0.971. These results confirm that the NUKYA-Q is a reliable instrument. In surveys or scales where internal consistency is measured with multiple response options, Cronbach's alpha is typically used. However, for surveys or scales consisting of binary category responses (true/false, yes/no), the KR-20 coefficient is recommended (97). In a study assessing athletes' nutritional knowledge using a survey with dichotomous items, the overall internal consistency was similarly evaluated with KR-20, yielding an alpha value of 0.71 (69). A study investigating the validity and reliability of the general nutrition knowledge questionnaire in our country reported internal consistency values of the sub-sections between 0.43 and 0.89. In Spendlove et al.'s study, which evaluated athletes' general nutrition knowledge, internal consistency values ranged from 0.4 to 0.95. These study results are comparable to the internal consistency values of 0.34-0.97 found in other nutrition information validity and reliability studies in the literature (69, 75, 94, 95). Low internal consistency values in the literature's sub-sections are explained and interpreted as acceptable for ensuring content validity, as these sections contain questions on different topics, and being knowledgeable in one area does not guarantee knowledge in another. High internal consistency is not necessary for evaluating a construct such as nutrition knowledge; this measurement is more appropriate for scales assessing attitudes, beliefs, and opinions rather than knowledge.

5.3. Analysis of Athletes' Sports Nutrition Knowledge

The athletes' NUKYA-Q total score is 40.11±7.43, with 73.22±10.04% correct responses. A positive relationship was determined between the athletes' age and NUKYA-Q total score ($r=0.443$; $p<0.001$). Age information may also be evaluated. It can be observed that as age increases, nutritional knowledge also increases slightly. In a review evaluating the general and/or sports nutrition knowledge of athletes of different types and levels, it was found that their knowledge ranged between 45% and 65%. In other studies assessing the nutritional knowledge of professional-level athletes, the percentages of correct responses (57.3-74.4%) were similar to the results of this study (8, 98). It was expected that the research would show a higher level of knowledge based on other studies in the literature. The study results supported these hypotheses. The clarity and simplicity of Nukya-Q played a significant role in its solvability and in supporting the hypotheses of the research results. Its simple and clear language, helped participants to understand and absorb the information more easily. Similar to this study, NUKYA-Q was used to assess the success of athletes (n=264) in various sports (Hockey, Futsal, Basketball, Football) at Barcelona Football Club. The total scores of these athletes (25.1) were lower (91) than the results of this study (30.74). The low score could be due to nearly 30% of the population in the study being 15 years old, with their main source of information being their families.

The athletes received one of the lowest scores in the hydration information section (Correct response: 49.84±13.42%, Min-Max value: 1-7). The relatively low scores in this section can be partly attributed to the limited number of questions, which restricts the range of possible scores. They do not fully understand the requirements for maintaining adequate hydration based on their current knowledge. Additionally, they do not know what the appropriate fluids are to maintain hydration. The skewness value of 0.168 indicates a slight positive skew, suggesting that some athletes scored significantly higher than others. The kurtosis value of -0.520 shows a platykurtic distribution, meaning the scores are more spread out than a normal distribution. A significant portion of athletes first turn to their coaches for information, who may not be sufficiently equipped regarding hydration.A significant portion of athletes first turn to their coaches for information, who may not be sufficiently equipped regarding hydration. This highlights the lack of emphasis on nutrition and especially

"hydration" in the training provided to athletes. A seven-month classroom-based educational training program significantly improved the sports nutrition knowledge, particularly storage knowledge, of adolescent swimmers (n=15) (99). This study demonstrates that group personal training can effectively enhance knowledge acquisition in adolescent athletes over a short period, even when delivered by an undergraduate student athlete. The change in hydration scores reached 22.2% (from 66.7 to 68.9), indicating that the training significantly improved fluid storage knowledge (100).

The sub-section that was answered least correctly by athletes after hydration was the periodization section (Correct response: 88.56±6.45%, Min-Max value: 1-3). Similar to hydration, the low scores in the periodization section can be partly attributed to the limited number of questions, which restricts the range of possible scores. The skewness value of -1.260 indicates a significant negative skew, showing that many athletes scored lower on this section. The kurtosis value of 0.535 shows a leptokurtic distribution, indicating that the scores are more concentrated around the mean.

The correct answer percentages of the athletes were higher in the macronutrient elements (Correct response: 75.51±11.13%, Min-Max value: 10-29) and micronutrient elements (Correct response: 77.14±13.50%, Min-Max value: 3-19) sections, where most questions evaluate sports nutrition knowledge. The larger number of questions in these sections allows for a wider range of scores, leading to more accurate assessments of knowledge. The skewness values of -0.201 and -0.324, respectively, indicate slight negative skews, meaning there are more lower scores. The kurtosis values of -0.297 and -0.099 indicate platykurtic distributions, showing the scores are more spread out. These results indicate that some athletes fully understand and have sufficient information on the vitamin and mineral contents of some foods. In another study, similar to our findings, it was determined that university athletes in athletics had sufficient knowledge about vitamins and minerals (78).

Overall, the total score (40.11±7.43, Min-Max value: 23-56) with a correct response rate of 73.22±10.04% reflects a nearly symmetrical distribution (Skewness: 0.056) with a platykurtic distribution (Kurtosis: -0.731), indicating that the athletes' nutrition knowledge scores are well-distributed around the mean with no significant outliers. The broader range

of questions contributing to the total score provides a more comprehensive assessment of the athletes' overall nutrition knowledge.

In the study, the average correct response percentage for female athletes on the NUKYA-Q was 79.03±9.16, while the average for male athletes was 71.62±9.69, with the difference being statistically significant ($p<0.001$). Athletes using supplements scored significantly higher in the macronutrients, micronutrients and hydration sub-sections. It was found that the NUKYA-Q total scores of those who used supplements (43.27±7.11) were significantly higher than those of non-supplement users (38.09±6.94) ($p<0.001$). This result is likely due to increased knowledge, awareness, motivation for performance improvement, and taking sports nutrition lessons among athletes using supplements.

The scores of athletes who took sports nutrition lessons were also significantly higher in the macronutrients, micronutrients and hydration sub-sections ($p<0.001$). The NUKYA-Q scores (44.47±5.50) of athletes who took sports nutrition lessons were significantly higher than those (36.18±6.02) of athletes who did4 not take these lessons ($p<0.001$). In a study (69), involving 343 university athletes, it was determined that the nutrition knowledge scores of 4th-grade students taking nutrition courses were statistically higher than those of 1st-grade students. This result is consistent with other studies in the literature (72, 98).

Athletes whose source of information about sports nutrition was a dietitian scored significantly higher in the macronutrients, micronutrients, hydration, and periodization sub-sections. The total mean score on the NUKYA-Q scale for individuals who received information from a dietitian (49.33±4.71) was higher than for those who received information from a coach (38.34±6.46) or other sources (37.11±5.65) ($p<0.001$).

Differences in study results may be explained by the variety of surveys assessing nutritional knowledge (poor validity and reliability, author-developed, Likert-type, multiple-choice, etc.). Additionally, the different methods used to evaluate nutrition knowledge, sample characteristics (sport type, level, gender, socio-demographic, and cultural differences), and sample size are also thought to affect the results.

5.4. Examination of Athletes' General Nutritional Habits and Nutritional Status

The general eating habits of the athletes are provided. Among male, 68.6% sometimes skip meals, while this rate is 86.3% for female and 72.5% among all participants. 45.6% of male skip lunch, whereas 40.4% of female skip breakfast. The differences between gender and meal-skipping behavior and the specific meals skipped are statistically significant ($p<0.05$). There is no statistically significant difference between gender and the perception of healthy eating or nutritional evaluation ($p>0.05$). A significant portion of the athletes (30.4%) skip breakfast, which is statistically significant ($p<0.05$) and aligns with findings in the literature (101, 102). This can be explained by the intense training schedules of athletes who skip breakfast and have irregular eating times. 43.2% of athletes use supplements. The difference between gender and supplement use is statistically significant ($p<0.001$), with female using supplements significantly more than male. The difference between gender and protein powder use is also statistically significant ($p<0.05$), which may be due to female having a tendency for lower protein intake compared to male. This finding is consistent with previous studies indicating that amino acids/proteins and vitamins are the most popular supplements among athletes (103, 104). No statistically significant difference was found between gender and the use of other supplement types such as glutamine, L-carnitine, CLA, BCAA, creatine, multivitamins, weight/volume gainers, Omega-3, and other supplements ($p>0.05$).

5.5. Evaluation of Athletes' Dietary Quality

In the study, 60.5% of male athletes had poor HEI scores, while 39.5% had scores that needed improvement. Among female, 43.1% had poor HEI scores, and 56.9% had scores that needed improvement. A statistically significant difference was found between gender and HEI classification ($p<0.05$). The average total HEI-2020 score for athletes was 49.34±8.42. These results show that a significant portion of athletes have HEI scores that need improvement. The small number of athletes with high HEI scores can be attributed to factors such as insufficient nutritional knowledge, intense training schedules, travel, gastrointestinal issues, and the effect of high-intensity exercise on appetite perception. A study examining 91 windsurfers found that 8.7% had high HEI scores, 47.82% had scores needing improvement, and 43.5% had low scores (98). Another study found that all athletes

had low HEI scores, with 51.4% of female and 45.7% of male having particularly low scores (105). These findings, consistent with other studies, suggest that a significant portion of athletes need to make changes to their dietary habits.

The average HEI scores and their variations across different sports and HEI calculation methods can provide important insights into athletes' eating habits and diet quality. In one study, the average HEI score of 21 professional female soccer players was 54.6±0.7 (82), while in Webber et al.'s study, the average HEI score of 138 university athletes was 51.2±8.8 (88). Malinauskas et al. (106) observed that the HEI scores of university basketball players varied between 56±5 and 58±6 on different training days (non-game, home game, and away game days). These differences can be attributed to the variety of sports in the samples and the different HEI calculation methods (e.g., 24-hour dietary recall and food frequency questionnaires). Therefore, it is important to consider these factors when interpreting average HEI scores and their variations. More research is needed to better understand the impact of different sports and HEI calculation methods on nutritional requirements and eating habits. These findings can contribute to developing nutrition programs to optimize athletes' performance.

The total HEI value was significantly higher among female athletes (52.44±7.42) compared to male athletes (48.49±8.49) ($p<0.05$), indicating an overall healthier dietary pattern among female. Statistically significant differences were found in the total vegetables, dark green leafy vegetables and legumes, and whole grains scores between genders ($p<0.05$). Similarly, in a study of 138 university athletes, the average HEI scores of female athletes (53.1±8.6) were significantly higher than those of male athletes (47.7±7.9) ($p<0.001$) (106). This finding suggests that female have better diet quality than male athletes. According to the study's findings, female athletes prioritize dark green leafy vegetables (such as spinach, arugula, chard, watercress, broccoli, parsley), legumes (such as chickpeas, beans, lentils, kidney beans), and whole grains (such as whole wheat, oats, whole wheat cereals). These foods are consumed more by female than male. This may be due to female being more inclined to cooking and paying more attention to their diet, leading them to prefer dark green leafy vegetables, legumes, and whole grains. Gender roles and socio-cultural factors may also influence female's dietary preferences. However, no statistically significant differences were found between genders in total fruit, dairy products, total protein foods, seafood and

plant-based proteins, fatty acids, and limited components such as refined grains, sodium, added sugars, and saturated fats ($p>0.05$).

Athletes scored the highest in the whole fruits and whole grains components. Similar to our study, Jürgensen et al. found that athletes had high consumption of vegetables, fruits, and whole grains when analyzing their dietary habits based on HEI components (105). There were no statistically significant differences in the total HEI scores and subcomponent scores among athletes based on the type of sport they participated in ($p>0.05$). Similarly, another study found no statistically significant differences in HEI scores among athletes from different sports (58.1-54.3, $p=0.369$) (107). Athletes who received information from dietitians had a significantly higher total HEI score (52.54±7.45) compared to those who received information from coaches (48.36±8.30) or other sources (49.53±9.04) ($p<0.05$). The value of dark green leafy vegetables and legumes was also significantly higher in individuals informed by dietitians (4.58±0.94) compared to those informed by coaches (3.40±1.53) or other sources (3.54±1.37) ($p<0.001$). Similarly, athletes who received information from dietitians had higher total vegetable scores (4.75±0.79) compared to those who received information from coaches (3.30±1.50) or other sources (3.50±1.43), which was statistically significant ($p<0.001$). In a study involving 101 athletes, individuals who had previously received dietitian support had significantly higher diet quality compared to those who had not ($p=0.034$) (74).

5.6. Correlation between Total NUKYA-Q Scores and HEI-2020 scores Among Athletes

In this study, a difference was observed between athletes' NUKYA-Q total score and HEI total score. There appears to be a weak but statistically significant positive relationship between these scores ($r=0.253$; $p<0.001$). This indicates that as athletes' nutritional knowledge increases, their diet quality also improves, though at a lower rate. According to the research results, there was no strong relationship between HEI-2020 scores and nutrition knowledge. This may be because food intake is influenced by numerous factors such as taste, preferences, cultural factors, religious beliefs, family factors, shopping skills, food preparation, and label reading. Similarly, a weak but statistically significant positive relationship was detected between the diet quality and general nutrition knowledge scores of

101 professional athletes (r=0.261, p=0.008). However, a different study found no statistical relationship between HEI scores and nutrition knowledge scores (69).

The NUKYA-Q total score showed a positive but weak relationship with HEI components like whole fruits score (r=0.249, p<0.001), total vegetables score (r=0.478, p<0.001), and greens and beans score (r=0.239, p<0.001). Accordingly, as athletes' nutritional knowledge increases, their consumption of fiber foods such as whole fruits, vegetables, dark green leafy vegetables, and legumes also increases. A review found similar results, indicating a significant but weak positive relationship between high fruit and vegetable consumption and nutritional knowledge (r<0.5) (74). Another review examining nutritional knowledge and dietary intake in athletes found a weak positive relationship between the consumption of carbohydrate-containing foods and fiber-rich foods and nutritional knowledge (r=<0.44) (11). In contrast, one study found a weak relationship between high vegetable and fruit intake and low-fat consumption in adults and nutritional knowledge (r = 0.52, p<0.05) (81).

The limitations of this study include the use of self-reported data (24-hour dietary recall), which may introduce recall bias and affect the accuracy of the results. Additionally, after removing 15 items, the internal consistency value of the NUKYA-Q was determined to be 0.828, with coefficients for macronutrients, micronutrients, and hydration sub-sections being 0.674, 0.617, and 0.621, respectively. Due to only one item remaining in the periodization section, its internal consistency could not be calculated. The removal of 15 items resulted in a significant loss of questions, prompting a reevaluation that excluded sub-sections, yielding a KR-20 value of 0.735. Another limitation is the unequal distribution of male and female athletes. Furthermore, the study is confined to athletes from specific clubs (Bulvarspor and Avcılar Football Academy), which may limit the generalizability of the findings to a broader population.

The results obtained from this study, conducted to evaluate the validity and reliability of the NUKYA-Q in athletes and its relationship with diet quality, are presented below.

1. A statistically significant difference in BMI-for-age Z-scores (p=0.016) was found between genders for individuals under 18 years old, indicating that males

have a higher prevalence of normal weight, while females have a higher prevalence of being overweight; however, for this age group, no significant differences were found in height-for-age Z-scores between genders ($p=0.073$).

2. A statistically significant difference in weight was observed between genders for individuals 18 years and above($p<0.05$), with females having a higher average BMI than males, but no significant difference in height was found ($p>0.05$).
3. The internal consistency value (KR-20) of the NUKYA-Q is 0.735.
4. The test-retest intraclass correlation coefficient (ICC) for the NUKYA-Q is 0.971, indicating excellent reliability.
5. The difference between genders regarding the source of information about sports nutrition was statistically significant ($p<0.001$). However, there was no statistically significant difference between genders in terms of the person giving advice on sports nutrition and the evaluation of nutritional information ($p>0.05$).
6. Among male, 99.5% engage in sports regularly, while this rate is 100% for female, resulting in an overall rate of 99.6%. In terms of sports branches, 82.2% of male are interested in football, compared to 58.8% of female, with an overall participation rate of 77.1%. The difference in sports branch participation between genders was found to be statistically significant ($p<0.05$). The average monthly sports duration for male is 109.69±44.73 hours, while for female it is 91.76±39.06 hours. A statistically significant difference was found between exercise duration and gender ($p<0.05$).
7. The difference between gender and meal skipping status, as well as skipped meals, was found to be statistically significant ($p<0.05$). However, there was no statistically significant difference between gender in terms of thinking about eating healthy and nutritional evaluation ($p>0.05$).
8. Significantly, while 63.8% of male respondents disclosed non-utilization of supplements, a notably higher proportion of female athletes, accounting for 68.6%, reported supplement intake. The difference in supplement use between genders was found to be statistically significant ($p<0.001$), with female's supplement use rate significantly higher. Regarding the type of nutritional supplement used, the difference in protein powder use between genders was found

to be statistically significant ($p<0.05$). No statistically significant difference was detected between the use of glutamine, l-carnitine, CLA, BCAA, creatine, multivitamin, weight/volume, omega-3, and other types of nutritional supplements and gender ($p>0.05$).

9. A moderate positive relationship was found between age and the total score of the NUKYA-Q ($r=0.443$; $p<0.001$).
10. The results indicate that the NUKYA-Q reveals varying levels of knowledge across different sections: Macronutrients, Micronutrients, Hydration, and Periodization. The average score for Macronutrients is 20.72, with a correct response rate of 75.51%, indicating a moderate level of knowledge in this area. For Micronutrients, the average score is 13.86, with a higher correct response rate of 77.14%, showing good knowledge. The Hydration section has a lower average score of 2.93 and a correct response rate of only 49.84%, indicating that athletes have less knowledge in this area. The Periodization section shows a high level of knowledge, with an average score of 2.60 and a correct response rate of 88.56%. Overall, the total mean score for the NUKYA-Q is 40.11, with an overall correct response rate of 73.22%, suggesting that the athletes possess a fairly high level of nutrition knowledge. The skewness and kurtosis values indicate slight variations from a normal distribution, with some sections exhibiting more significant deviations.
11. The results indicate a statistically significant difference in the total NUKYA-Q scores concerning supplement use ($p<0.001$). Individuals who used supplements had a significantly higher total mean score ($M=43.27$, $SD=7.11$) compared to those who did not use supplements ($M=38.09$, $SD=6.94$).
12. A statistically significant difference was found between the total NUKYA-Q score and the status of taking sports nutrition lessons ($p<0.001$). The total mean score on the NUKYA-Q scale for individuals who took sports nutrition lessons ($M=44.47$, $SD=6.41$) was significantly higher than for those who did not take such courses ($M=36.24$, $SD=6.02$).
13. A statistically significant difference was found between the total NUKYA-Q score and the source of information about sports nutrition ($p<0.001$). The total

mean score on the NUKYA-Q scale for individuals who received information from a dietitian (M=49.33, SD=4.71) was higher than those who received information from a coaches (M=38.34, SD=6.46) and other sources (M=37.11, SD=5.65). The Tamhane test results showed that individuals who received information about sports nutrition from coaches and other sources scored significantly lower than those who received information from a dietitian.

14. The findings indicate that both supplements use and taking courses on sports nutrition significantly impact the NUKYA-Q scores. Individuals who used supplements had higher total mean scores compared to those who did not use supplements. Similarly, those who took courses on sports nutrition scored higher on the NUKYA-Q scale than those who did not take such courses, highlighting the positive influence of both supplement use and educational courses on nutrition knowledge.

15. A substantial variance was observed in vitamin D intake, with male reporting an average of 3.39±2.00 and female 2.20±1.44 ($p<0.001$), indicating a higher intake among male. Significant disparities were also noted in mineral intake: male had higher intakes of phosphorus (782.45±310.62 vs. 584.84±219.63, $p<0.001$), iron (7.82±2.65 vs. 8.70±3.07, $p<0.05$), chlorine (4493.50±2515.97 vs.6895.68±2226.85, $p<0.001$), sodium (3498.57±2498.09 vs.6895.27±1835.17, $p<0.001$), and iodine (148.50±138.32 vs. 187.22±132.12, $p<0.05$). Conversely, female had higher magnesium intake (721.13±95.08vs.399.19±266.80, $p<0.001$). No statistically significant differences were found between genders in the intake of vitamin A, vitamin E (ESD), vitamin E, vitamin C, vitamin K, vitamin B1, vitamin B2, niacin, niacin ESD, vitamin B6, vitamin B12, calcium, copper, potassium, folate, biotin, and zinc ($p>0.05$).

16. Individuals who received sports nutrition information from a dietitian had significantly higher values in several dietary measures compared to those informed by trainers or other sources. Specifically, they had higher total fruit (4.63±0.91 vs. 3.95±1.95), total vegetable (4.75±0.79 vs. 3.30±1.50), and dark green leafy vegetable and legume intake (4.58±0.94 vs. 3.40±1.53) ($p<0.05$). Additionally, their total Healthy Eating Index value was also higher (52.54±7.45)

compared to those informed by trainers (48.36±8.30) or other sources (49.53±9.04) ($p<0.05$).

17. It was observed that 60.5% of male athletes have poor HEI scores, while 39.5% have scores needing improvement. Among female athletes, 43.1% have poor HEI scores, and 56.9% have scores needing improvement. A statistically significant difference was found between HEI classification and gender ($p<0.05$).
18. A substantial discrepancy was noted in whole fruit consumption, with male athletes having an average HEI value of 3.80±2.04 and female athletes a higher value of 4.80±0.43 ($p<0.001$). Female athletes also had significantly higher HEI values for total vegetables (4.42±0.89 vs. 3.37±1.54, $p<0.001$), dark green leafy vegetables and legumes (4.80±0.67 vs. 3.32±1.48, $p<0.001$), and whole grains (9.89±0.53 vs. 9.03±2.24, $p<0.05$). The total HEI value was significantly higher among female athletes (52.44±7.42) compared to male athletes (48.49±8.49) ($p<0.05$), indicating a healthier dietary pattern among female. No significant differences were found between genders in the consumption of total fruit, milk and dairy products, total protein foods, seafood and vegetable proteins, fatty acids, processed grains, sodium, added sugar, and saturated fat ($p>0.05$).
19. A weak positive correlation was observed between the NUKYA-Q total score and the overall HEI score ($r=0.253$; $p<0.001$). Additionally, weak positive correlations were identified between the NUKYA-Q total score and the HEI components for whole fruits ($r=0.249$; $p<0.001$), total vegetables ($r=0.478$; $p<0.001$) and greens and beans score ($r=0.239$; $p<0.001$), and No statistically significant correlations were found between the NUKYA-Q total score and other HEI components ($p>0.05$).

6. RECOMMENDATIONS

Insufficient knowledge of nutrition among athletes is a key factor that negatively impacts their dietary practices and overall diet quality, leading to decreased sports performance. Increasing the number of studies on the effect of nutrition knowledge on food intake, diet quality, and athlete performance is essential to address this issue.

- The NUKYA-Q is recommended for assessing the nutrition knowledge levels of athletes across various branches and levels (e.g., recreational athletes, university athletes).
- The NUKYA-Q is suggested for evaluating the impact of nutrition knowledge on the performance of professional and national-level athletes.
- Identifying areas where athletes lack nutrition knowledge and providing targeted training can help improve their dietary practices. Conducting various studies to enhance the nutrition knowledge of athletes is encouraged.
- In addition to using valid and reliable tools to measure nutrition knowledge, tools like food consumption frequency questionnaires and diet quality indices specific to athletes are needed to understand the relationship between nutrition practices and nutritional status.
- A comprehensive team, including conditioners, coaches, physiotherapists, and masseurs, influences an athlete's performance. It is recommended to create plans and policies to ensure that dietitians specializing in sports nutrition are actively involved in these teams.

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8. APPENDICES

8.1. Appendix-1 Ethical Approval

T.C.
YEDİTEPE ÜNİVERSİTESİ REKTÖRLÜĞÜ
Girişimsel Olmayan Klinik Araştırmalar Etik Kurulu

Sayı : E.83321821-805.02.03-67
Konu : Etik Kurul Karar Yazısı

Sayın Dr. Öğr. Üyesi Gözde Dumlu Bilgin

Yeditepe Üniversitesi Girişimsel Olmayan Klinik Araştırmalar Etik Kuruluna etik onay için başvuru yapılmış olan araştırma önerisinin başlığı, araştırmacılar, başvuru numarası, sunulan belgeler ve toplantı bilgileri aşağıda yer almaktadır. İlgili araştırma önerisi, etik kurulumuz üyeleri tarafından değerlendirilmiş olup, etik ve bilimsel açıdan **UYGUN** olduğuna karar verilmiştir.

Araştırma Başlığı:	**Genç ve Yetişkin Sporcular için Beslenme Bilgisi Anketinin Türkçe Geçerlik ve Güvenirliğinin Yapılması**
Araştırmacılar:	**Merve Safa Avağ, Dr. Öğr. Üyesi Gözde Dumlu Bilgin**
Başvuru Numarası:	**202210Y0301**

TOPLANTI BİLGİLERİ			
Toplantı Tarihi:	14.10.2022	**Toplantı Yeri:**	Çevirim içi (Google Meet)

SUNULAN BELGELER
Islak imzalı başvuru dosyası, CD veya USB belleğe kaydedilmiş başvuru dosyası ve elektronik başvuru
Araştırma başlığı ve araştırmacıların isimleri
Başvuru dilekçesi
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Araştırmanın;
• Niteliği
• Önemi ve özgün değeri
• Amaç ve hedefleri
• Yöntemi
• Yönetimi
• Yaygın etkisi
• Araştırma bütçesi (Mevcutsa)
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Yeditepe Üniversitesi 26 Ağustos Yerleşimi, İnönü Mahallesi Kayışdağı Caddesi 34755
Ataşehir / İSTANBUL
Telefon No: (0216) 578 00 00 Faks No : (0216) 578 02 99
İnternet Adresi www.yeditepe.edu.tr
Kep Adresi : yeditepeuniversitesi@hs03.kep.tr

Bilgi İçin: Sinem ARI
Unvan: Uzman Yardımcısı
Telefon No:

Taahhütname-1 Araştırmanın yapılacağı kurumdan izin alma sorumluluğunun araştırmacılara ait olduğuna dair taahhüt
Taahhütname-2 Dünya Tıp Birliği Helsinki Bildirgesinin son versiyonunun ve Sağlık Bakanlığı'nın ilgili tüm kılavuzlarının okunmasına dair taahhüt
Taahhütname-3 Daha önce yapılmış etik kurul başvuruları mevcut olup olmadığına dair taahhüt
Taahhütname-4 Araştırma sırasında araştırma bütçesinde yer almayan ve gönüllünün kendisine veya Sosyal Güvenlik Kurumuna ek yük getirecek hiçbir işlem uygulanmayacağına dair taahhüt
Taahhütname-5 COVID-19 hastalarında tedavi yaklaşımları ve bilimsel araştırmalar genelgesi okunmasına dair taahhüt
Taahhütname-6 Milli Eğitim Bakanlığı Araştırma Uygulama İzinleri konulu yazının okunmasına dair taahhüt
Araştırmacıların her birisine ait özgeçmiş formu
Ek belgeler (Varsa kullanılan ölçek)

Prof. Dr. Didem ÖZDEMİR ÖZENEN
Başkan

Doç. Dr. Gökhan ERTAŞ
Başkan Yardımcısı

Doç. Dr. Elif SUNGURTEKİN EKÇİ
Raportör

Doç. Dr. Binnur OKAN BAKIR
Üye

Dr. Öğr. Üyesi Elif Çiğdem KELEŞ
Üye

Dr. Öğr. Üyesi Emine Nur ÖZDAMAR
Üye

Dr. Öğr. Üyesi Sevim ŞEN
Üye

Yeditepe Üniversitesi 26 Ağustos Yerleşimi, İnönü Mahallesi Kayışdağı Caddesi 34755
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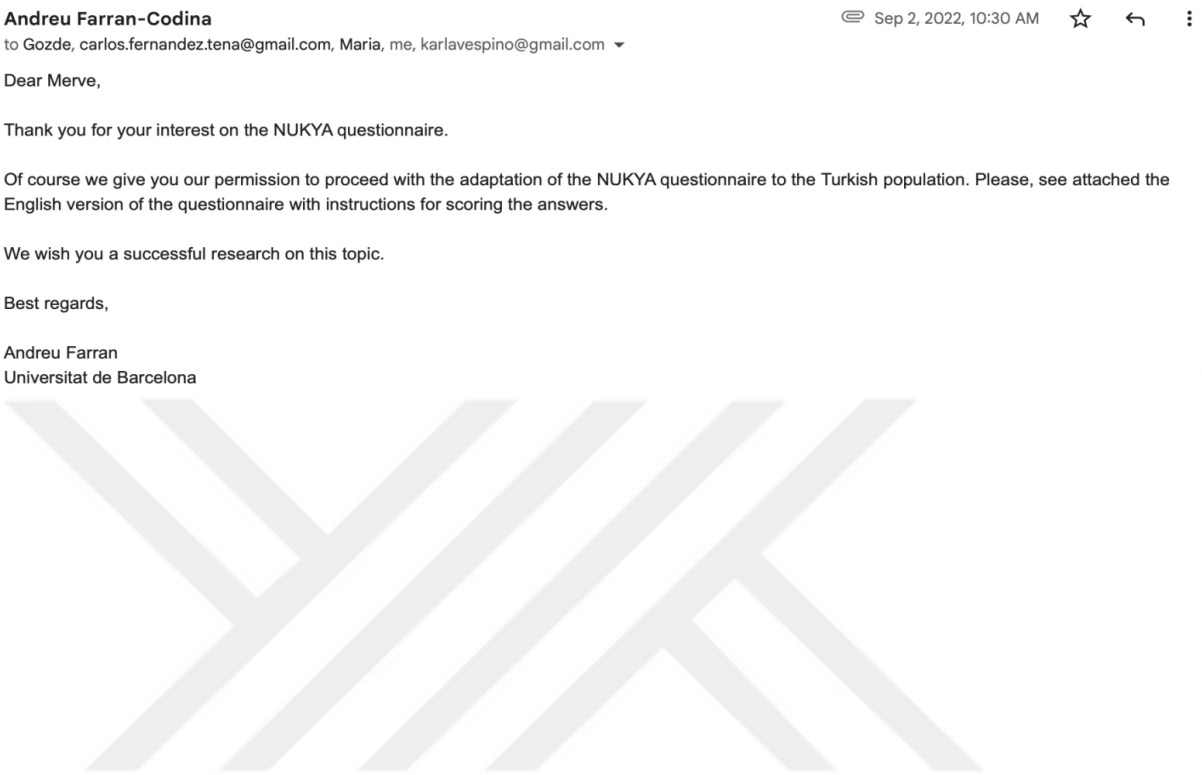
Bilgi İçin: Sinem ARI
Unvan: Uzman Yardımcısı
Telefon No:

8.2. Appendix-2 Scale Permission



Andreu Farran-Codina Sep 2, 2022, 10:30 AM

to Gozde, carlos.fernandez.tena@gmail.com, Maria, me, karlavespino@gmail.com

Dear Merve,

Thank you for your interest on the NUKYA questionnaire.

Of course we give you our permission to proceed with the adaptation of the NUKYA questionnaire to the Turkish population. Please, see attached the English version of the questionnaire with instructions for scoring the answers.

We wish you a successful research on this topic.

Best regards,

Andreu Farran
Universitat de Barcelona

8.3. Appendix-3 Data Collection Form

Anket No:..... Tarih:.....

A. GENEL BİLGİLER

1. Yaş (y):

2. Cinsiyet: 1. Erkek 2. Kadın

3. Eğitim Durumunuz: 1. Öğrenci 2. Mezun

4. Boy: cm Ağırlık: ... kg

5. Medeni Durumu: 1. Evli 2. Bekar 3. Boşanmış/Dul

6. Düzenli spor/egzersiz yapıyor musunuz? 1. Evet 2. Hayır (Cevabınız HAYIR ise lütfen 11.sorudan devam ediniz.)

7. Lütfen dahil olduğunuz/ilgilendiğiniz spor branşını belirtiniz...

8. Ne kadar süredir bu sporu yapmaktasınız.....ay

9. Lütfen antrenman/egzersiz programınızı belirtiniz

Tür :.....; .....kez (gün/hafta) ; .....kez (gün/hafta)

Tür :.....; .....kez (gün/hafta) ; .....kez (gün/hafta)

Tür :.....; .....kez (gün/hafta) ; .....kez (gün/hafta)

10. Çalıştığınız/spor yaptığınız yerde spor beslenmesi ile ilgili öneri veren herhangi bir uzman bulunmakta midir?

1. Evet 2. Hayır

11. Cevabınız EVET ise spor beslenmesi ile ilgili öneri veren kişi kimdir?

1. Beslenme Uzman/Diyetisyen 2. Antrenör/Koç 3. Doktor 4.Diğer.....

12. Genel olarak beslenme bilginizi nasıl değerlendirirsiniz? 1. Çok iyi 2. Iyi 3. Orta 4. Kötü 5. Çok kötü

13. "Spor Beslenmesi" ile ilgili ders aldınız mı? 1. Evet 2. Hayır

14. Spor beslenmesi ile ilgili bilgi edindiğiniz ilk 3 kaynak nedir? (Lütfen kutucuklara 3 kaynağı 1, 2, ve 3 şeklinde sıralayınız)

- ☐ Antrenör
- ☐ Diyetisyen
- ☐ Diğer sporcu/takım arkadaşı
- ☐ Okul
- ☐ Dergiler/gazete/kitap Ders Kitaplan Kongre/sempozyum
- ☐ Televizyon/internet
- ☐ Bilimsel Makaleler

Anket No:..... Tarih:.....

B. BESLENME ALIŞKANLIKLARI

15. Günde kaç öğün yemek yersiniz? a. Ana Öğün:.....

16. Ana öğünleri (sabah, öğle, akşam) atlar mısınız? 1. Evet 2. Hayır 3. Bazen

17. Cevabınız "evet"/"bazen" ise; Genellikle hangi öğünü atlarsınız? 1. Sabah 2.Öğle 3. Akşam

18. Genel olarak sağlıklı beslendiğinizi düşünür müsünüz? 1. Evet 2.Hayır 19. Genel olarak beslenmenizi nasıl değerlendirirsiniz?

1. Çok iyi 2. İyi 3.Orta 4. Kötü 5. Çok kötü

20. Herhangi bir besin destek ürünü (supleman) kullanıyor musunuz? 1. Evet 2. Hayır

21. Cevabınız EVET ise lütfen kullandığınız besin destek ürünü (supleman) ya da ürünlerinin adlanını (ticari adlanını) yazınız.

Besin Destek Ürünü (Supleman) Türü	Besin Destek Orünü (Supleman) Adı	Sıklık (günde……kez / haftada ……kez)	Tek Seferde Kullanım Miktari (lçek/tablet/gram)
Protein tozu			
Glutamin			
L-karnitin			
CLA			
BCAA			
Kreatin türevleri			
Multivitamin			
Kilo/hacim arttirici			
HMB (hidroski metil butirat)			
Nitrik Oksit			
Omega3			
Diğer belirtiniz.....			

8.4. Appendix-4 NUKYA-Q Form

Genç ve Yetişkin Sporcular için Beslenme Bilgi Anketi

Bu anket sporcu beslenmesinin farklı yönleriyle ilgili sorulardan oluşmaktadır. Sonuçlar, ilgili konularda size nasıl yardımcı olabileceğimizi belirlemek için faydalı bilgiler sağlayacaktır.

1. 1. Bu besinlerin kompleks karbonhidrat içeriği yüksek veya düşük müdür? Her besin için 3 seçenekten bir tanesini seçiniz (Yüksek, Düşük, Emin değilim / Bilmiyorum).

	Yüksek	Düşük	Emin değilim/Bilmiyorum
1.1 Tavuk	❑	❑	❑
1.2 Bal	❑	❑	❑
1.3 Baklagiller	❑	❑	❑
1.4 Ekmek	❑	❑	❑
1.5 Reçel	❑	❑	❑
1.6 Tereyağı	❑	❑	❑
1.7 Kahvaltılık Gevrek	❑	❑	❑
1.8 Pirinç	❑	❑	❑
1.9 Şekerler	❑	❑	❑

2. Ağırlık kaybetmek isteyen bir sporcu karbonhidratları diyetinden tamamen çıkarmalı mıdır?

❑ Evet	❑ Hayır	❑ Emin değilim / Bilmiyorum

3. Karbonhidratlar kaslarda glikojen olarak depolanır mı?

❑ Evet	❑ Hayır	❑ Emin değilim / Bilmiyorum

4. Kaslar egzersiz sırasında başlıca enerji kaynağı olarak proteinleri kullanır mı?

❑ Evet	❑ Hayır	❑ Emin değilim / Bilmiyorum

5. Bu besinlerin protein içeriği yüksek veya düşük müdür? Her bir besin için 3 seçenekten birini seçiniz. (Yüksek, Düşük, Emin değilim / Bilmiyorum)

	Yüksek	Düşük	Emin değilim/Bilmiyorum
5.1 Tavuk	❑	❑	❑
5.2 Baklagiller	❑	❑	❑
5.3 Meyve	❑	❑	❑

5.4 Margarin/Tereyağı	❑	❑	❑
5.5 Kahvaltılık gevrekler	❑	❑	❑
5.6 Sert kabuklu yemişler	❑	❑	❑

6. Yağlar vücutta önemli bir rol oynar mı?

❑ Evet	❑ Hayır	❑ Emin değilim / Bilmiyorum

7. Doymuş ve doymamış yağlar sağlık üzerinde aynı etkiye mi sahiptir?

❑ Evet	❑ Hayır	❑ Emin değilim / Bilmiyorum

8. Bu besinlerin doymamış yağ içeriği yüksek veya düşük müdür? Her bir besin için 3 seçenekten birini seçiniz. (Yüksek, Düşük, Emin değilim / Bilmiyorum)

	Yüksek	Düşük	Emin değilim/Bilmiyorum
8.1 Tavuk	❑	❑	❑
8.2 Sert kabuklu yemişler	❑	❑	❑
8.3 Avokado	❑	❑	❑
8.4 Balık ve deniz ürünleri	❑	❑	❑
8.5 Peynirler	❑	❑	❑
8.6 Sosis	❑	❑	❑
8.7 Kahvaltılık gevrekler	❑	❑	❑
8.8 Marul	❑	❑	❑
8.9 Zeytinyağı / Ayçiçek yağı	❑	❑	❑

9. Günde kaç porsiyon meyve ve sebze tüketilmesi önerilmektedir? Bir porsiyon bir parça (avuç içi) meyve veya bir kâse salata veya sebzedir. (Bir seçeneği seçiniz)

❑ Günde 1 veya 2
❑ Günde 3 veya 4
❑ Günde 5 veya daha fazla
❑ Emin değilim/ Bilmiyorum

10. Aşağıdaki ifadeler doğru veya yanlış mıdır?
a. Su kaybı nedeniyle vücut ağırlığınızın %2'sini (örneğin, 75 kg ağırlığındaysanız 1,5 kg) kaybederseniz atletik performansınız düşer.

❑ Evet	❑ Hayır	❑ Emin değilim / Bilmiyorum

b. Antrenman sırasında iyi bir hidrasyon için susayana kadar beklemeniz gerekir.

❑ Evet	❑ Hayır	❑ Emin değilim / Bilmiyorum

c. Egzersiz sonrasında hidrasyonun yeniden sağlanması için egzersiz sırasında kaybedilen su hacminden (antrenman veya müsabaka öncesi ve sonrası ağırlığınızı tartarak bildiğimiz) daha büyük bir hacimde sıvı almamız gereklidir.

❑ Evet	❑ Hayır	❑ Emin değilim / Bilmiyorum

d. Meyve suyu antrenmanda ve karşılaşma/maç ortasında içilmesi uygun bir sıvıdır.

❑ Evet	❑ Hayır	❑ Emin değilim / Bilmiyorum

e. Sporcuların egzersiz sırasında tüketmeleri için "Red Bull" gibi enerji içecekleri önerilir.

❑ Evet	❑ Hayır	❑ Emin değilim / Bilmiyorum

11. Sizce antrenmana başlamadan önce en uygun idrar rengi nedir? (Bir seçeneği seçiniz)
- ❑ Berrak
- ❑ Uçuk sarı / (limon suyu)
- ❑ Koyu sarı / (elma suyu)
- ❑ Emin değilim / Bilmiyorum

12. Yoğun veya uzun süreli egzersiz sırasında, terle kaybedilen suyu yerine koymanın en iyi yolu nedir? (Bir seçeneği seçiniz)
- ❑ Su
- ❑ Su ve mineral tuzları
- ❑ Su ve karbonhidratlar
- ❑ Su, karbonhidratlar ve mineraller
- ❑ Emin değilim / Bilmiyorum

13. İzotonik bir sporcu içeceğindeki karbonhidrat yüzdesi şöyle olmalıdır: (Bir seçeneği seçiniz)
- ❑ %4-6
- ❑ %6-8
- ❑ %8-10
- ❑ %10-12
- ❑ Emin değilim / Bilmiyorum

14. Egzersiz veya müsabaka sonrası toparlanmayı başlatmak üzere bir şeyler yemek ve içmek için en uygun zaman nedir? (Bir seçeneği seçiniz)
- ❑ Mümkün olan en kısa sürede (Egzersizden sonrası ilk 2 saatte)
- ❑ Egzersizden 2-3 saat sonra
- ❑ Egzersizden 3 saat sonra
- ❑ Acıktığımda
- ❑ Emin değilim / Bilmiyorum

15. Antrenmandan sonra tüketilmesi gereken en önemli besin öğe(si)leri şunlardır: (Bir seçeneği seçiniz)
- ❑ Su
- ❑ Karbonhidratlar
- ❑ Protein
- ❑ Yağ
- ❑ Su + karbonhidratlar + protein
- ❑ Emin değilim / Bilmiyorum

16. Son ana öğün (kahvaltı, öğle yemeği veya akşam yemeği) bir müsabaka/egzersizden en az 3-4 saat önce mi yenmelidir?

❑ Evet	❑ Hayır	❑ Emin değilim / Bilmiyorum

17. İnsan vücudu D vitamininin büyük bir çoğunluğunu güneş ışığından alabilir mi?

❑ Evet	❑ Hayır	❑ Emin değilim / Bilmiyorum

18. Vitaminler ve mineraller iyi bir enerji kaynağı mıdır?

❑ Evet	❑ Hayır	❑ Emin değilim / Bilmiyorum

19. Bu besinler iyi bir demir kaynağı mıdır?

	Yüksek	Düşük	Emin değilim/Bilmiyorum
19.1 Avokado	❑	❑	❑
19.2 Et	❑	❑	❑
19.3 Balık	❑	❑	❑
19.4 Baklagiller	❑	❑	❑
19.5 Ispanak	❑	❑	❑
19.6 Sert kabuklu yemişler	❑	❑	❑
19.7 Ekmek	❑	❑	❑
19.8 Tereyağı	❑	❑	❑

20. Bu besinler iyi bir kalsiyum kaynağı mıdır?

	Yüksek	Düşük	Emin değilim/Bilmiyorum
20.1 Meyve	❑	❑	❑
20.2 Et	❑	❑	❑
20.3 Badem	❑	❑	❑
20.4 Süt	❑	❑	❑
20.5 Ispanak	❑	❑	❑
20.6 Peynir	❑	❑	❑
20.7 Ekmek	❑	❑	❑
20.8 Tereyağı	❑	❑	❑

8.5. Appendix-5 24-hour Dietary Recall Form

24 SAATLİK BESİN TÜKETİM KAYDI

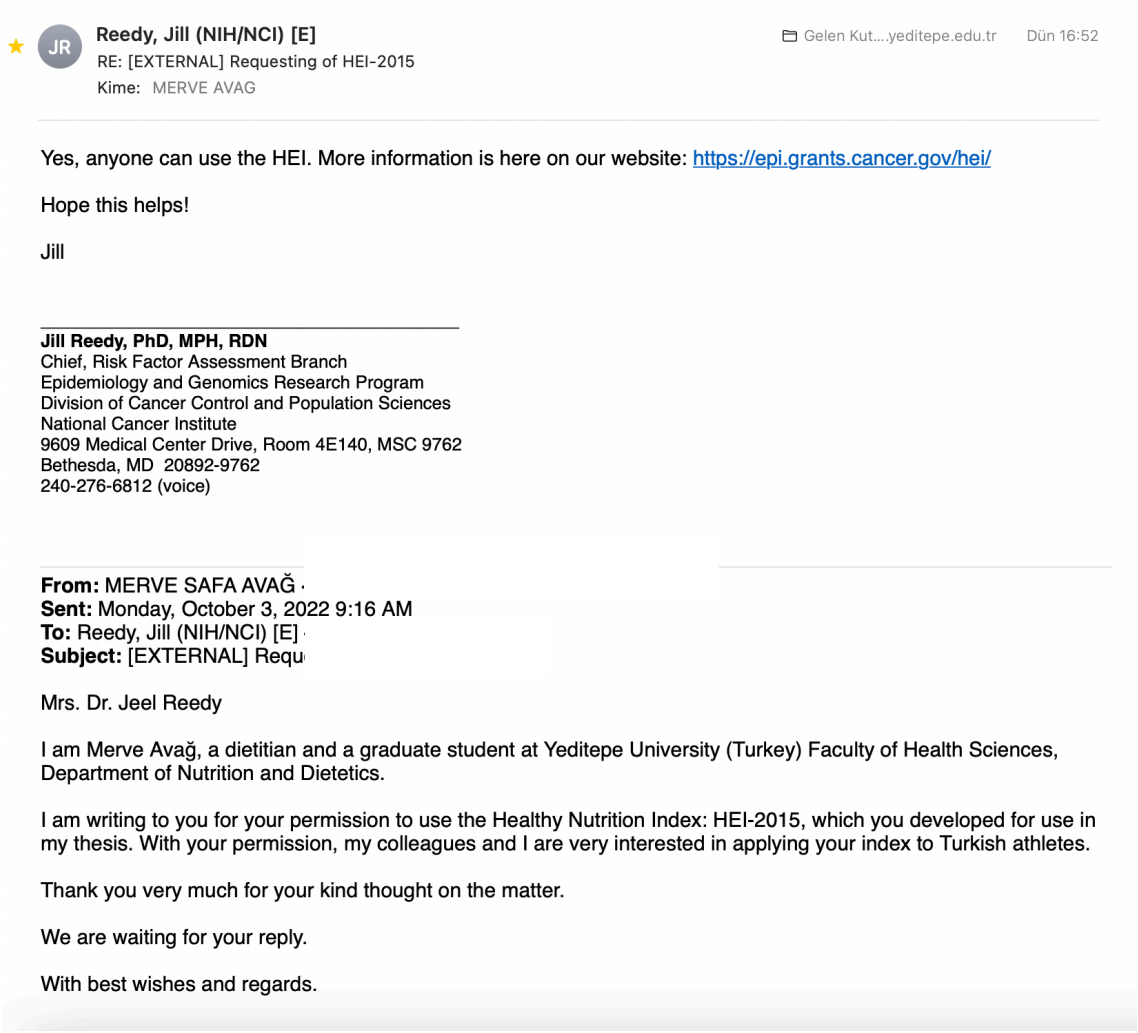
ÖĞÜNLER	TÜKETİLEN BESİNLER, YİYECEKLER, İÇECEKLER	HAZIRLANIRKEN İÇİNE KONAN MALZEMELER	MİKTAR	
			ÖLÇÜ	AĞIRLIK
SABAH				
KUŞLUK				
ÖĞLE				
İKİNDİ				
AKŞAM				
GECE				

8.6. Appendix-6 24-hour Physical Activity Form

24 SAATLİK FİZİKSEL AKTİVİTE KAYDI

Aktivite Türü	PAR değeri (katsayı)	Ortalama süre (dakika/gün)	BMH / dak.	Enerji Maliyeti (kkal)
Uyku	1			
Günlük Aktiviteler				
Uzanarak yapılan işler *(dinlenme, TV izleme, kitap-gazete okuma, müzik dinleme)*	1.2			
Otururak Yapılan işler; *Ofis işleri (daktilo, bilgisayar, masa başı işler)* *Ev işleri (sebze ayıklama, örgü örme, dikiş dikme,ütü)* *Okulda ders dinleme* *Diğer (araba-traktör sürme, resim yapma, müzik aleti çalma, kağıt oynama, halı dokuma, ayakkabı boyama, balıkçılık)*	1.75			
Ayakta yapılan hafif aktiviteler *(yavaş yürüme, ev temizleme, yemek pişirme, çamaşır yıkama, bulaşık yıkama, marangoz işleri, fırıncı, çöpçü, terzi vb.)*	2.75			
Ayakta yapılan ORTA aktiviteler *(orta hızda yürüme yüklü ve yüksüz, bahçe işleri, mekanize tarla işleri, hayvan bakımı-besleme-tımar, süt sağma, kuyudan su çekme, boya işleri vb.)*	3			
Ayakta yapılan AĞIR aktiviteler *(yük taşıma, inşaat işleri, tarla işleri (hasat, gübreleme, harman, kazma), hamallık, ağaç-odun kesme vb.)*	5			
Spor Faaliyetleri				
HAFİF egzersiz/spor faaliyetleri *(aerobik yapma, hızlı yürüme)*	3.5			
ORTA egzersiz/spor faaliyetleri *(volyebol, tenis, dans, bilardo, halk dansları vb.)*	5.5			
AĞIR egzersiz/spor faaliyetleri *(basketbol, futbol, kürek çekme, yüzme, squash (duvar tenisi), uzun mesafe koşu, uzak doğu sporları, vücut geliştirme)*	7			
TOPLAM		1440		

8.7. Appendix-6 HEI-2015 Permisson Form



Reedy, Jill (NIH/NCI) [E]
RE: [EXTERNAL] Requesting of HEI-2015
Kime: MERVE AVAG

Gelen Kut....yeditepe.edu.tr Dün 16:52

Yes, anyone can use the HEI. More information is here on our website: https://epi.grants.cancer.gov/hei/

Hope this helps!

Jill

Jill Reedy, PhD, MPH, RDN
Chief, Risk Factor Assessment Branch
Epidemiology and Genomics Research Program
Division of Cancer Control and Population Sciences
National Cancer Institute
9609 Medical Center Drive, Room 4E140, MSC 9762
Bethesda, MD 20892-9762
240-276-6812 (voice)

From: MERVE SAFA AVAĞ
Sent: Monday, October 3, 2022 9:16 AM
To: Reedy, Jill (NIH/NCI) [E]
Subject: [EXTERNAL] Requ

Mrs. Dr. Jeel Reedy

I am Merve Avağ, a dietitian and a graduate student at Yeditepe University (Turkey) Faculty of Health Sciences, Department of Nutrition and Dietetics.

I am writing to you for your permission to use the Healthy Nutrition Index: HEI-2015, which you developed for use in my thesis. With your permission, my colleagues and I are very interested in applying your index to Turkish athletes.

Thank you very much for your kind thought on the matter.

We are waiting for your reply.

With best wishes and regards.

8.8. Appendix-7 Informed Consent Form

BİLGİLENDİRİLMİŞ GÖNÜLLÜ OLUR FORMU

(Araştırmacının Beyanı)

Sevgili Katılımcı **" Türk Toplumunda Genç ve Yetişkin Sporcular İçin Beslenme Bilgisi Anketinin Türkçe Geçerlik ve Güvenirliğinin Yapılması"** başlıklı bu araştırma, Yeditepe Üniversitesi Sağlık Bilimleri Fakültesi Beslenme ve Diyetetik Bölümü tarafından yapılmaktadır. Araştırma sporcuların spor beslenmesi bilgi düzeylerinin belirlenmesini sağlayan anketin Türk toplumuna uyarlanması amacıyla planlanmıştır. Bu nedenle sorularım tümüne ve içtenlikle cevap vermeniz büyük önem taşımaktadır

Araştırmaya katılmanız gönüllülük esasına dayalıdır. Bu form aracılığı ile elde edilecek bilgiler gizli kalacaktır ve sadece araştırma amacıyla (veya "bilimsel amaçlar için") kullanılacaktır. Çalışmaya katılmamayı tercih edebilirsiniz veya anketi doldururken istemezseniz son verebilirsiniz. Anket formuna adınızı ve soyadınızı yazmayınız

Anketimiz 4 bölümden oluşmaktadır. Yanıtlarınızı, soruların altında yer alan seçenekler arasından uygun olanı daire içine alarak, kutuların içerisini işaretleyerek belirtiniz. Birden fazla seçenek işaretleyebileceğiniz sorularda, size uygun gelen bütün seçenekleri işaretleyiniz. Eğer sorunun yanıtları arasında "diğer" seçeneği mevcutsa ve yanıtınız var olan seçenekler arasında yer almıyorsa, bu durumda yanıtınızı diğer seçeneğindeki boşluğa yazınız. Eğer çalışmaya katılmayı kabul ederseniz anket tahminen 12-15 dakika zamanınızı alacak, bu anketi doldurduktan sonra veri toplama formunu doldurmanız istenecek, araştırmacı tarafından besin tüketim kaydınız ve besin tüketim sıklığınız alınacaktır. Rastgele seçilecek olan bazı bireylere ilk uygulamadan 2 hafta sonra tekrar geri dönülecek ve yalnızca Genç ve Yetişkin Sporcular İçin Beslenme Bilgisi Anketinden oluşan bir bölüm tekrar uygulanacaktır

(Katılımcının Beyanı)

Sayın Dr. Öğr. Üyesi Gözde DUMLU BİLGİN ve Merve AVAĞ tarafından bilimsel bir araştırma yapılacağı belirtilerek bu araştırma ile ilgili yukarıdaki bilgiler bana aktarıldı. Bu bilgilerden sonra böyle bir araştırmaya "katılımcı" olarak davet edildim. Eğer bu araştırmaya katılırsam araştırmacı ile aramda kalması gereken bana ait bilgilerin gizliliğine bu araştırma sırasında da büyük özen ve saygı ile yaklaşacağına inanıyorum. Araştırma sonuçlarının eğitim ve bilimsel amaçlarla kullanımı sırasında kişisel bilgilerimin özenle korunacağı konusunda bana yeterli güven verildi. Çalışmanın yürütülmesi sırasında herhangi bir sebep göstermeden araştırmadan çekilebilirim (Ancak araştırmacıları zor durumda bırakmamak için araştırmadan çekileceğimi önceden bildirmemim uygun olacağının bilincindeyim) Ayrıca araştırmacı tarafından araştırma dışı tutulabilirim.

Araştırma için yapılacak harcamalarla ilgili herhangi bir parasal sorumluluk altına girmiyorum. Bana da bir ödeme yapılmayacaktır. Bu araştırmaya katılmak zorunda değilim ve katılmayabilirim. Araştırmaya katılmam konusunda zorlayıcı bir davranışla karşılaşmış değilim. Eğer katılmayı reddedersem, bu durumun araştırıcı ile olan ilişkime herhangi bir zarar getirmeyeceğini de biliyorum. Bana yapılan tüm açıklamaları ayrıntılarıyla anlamış bulunmaktayım. Kendi başıma belli bir düşünme süresi sonunda adı geçen bu araştırma projesinde "katılımcı" olarak yer alma kararını aldım. Bu konuda yapılan daveti büyük bir memnuniyet ve gönüllülük içerisinde kabul ediyorum.

İmzalı bu form kağıdının bir kopyası bana verilecektir.

Anketi yanıtladığınız için teşekkür ederiz. Çalışma ile ilgili herhangi bir sorunuz olduğunda aşağıdaki kişi(ler) ile iletişim kurabilirsiniz:

Sorumlu Araştırmacı: Dr. Gözde DUMLU BİLGİN*
Yardımcı araştırmacı: Merve Safa AVAĞ**

Çalışmaya katılmayı kabul ediyorsanız aşağıdaki kutucuğu X ile işaretleyiniz ve devam ediniz.

☐ Kabul ediyorum

Tanık Adı soyadı

İmzası ☐

8.9. Appendix-8 Informed Consent Form

size uygun gelen bütün seçenekleri işaretleyiniz. Eğer sorunun yanıtları arasında "diğer" seçeneği mevcutsa ve yanıtınız var olan seçenekler arasında yer almıyorsa, bu durumda yanıtınızı diğer seçeneğindeki boşluğa yazınız. Eğer çalışmaya katılmayı kabul ederseniz anket tahminen 12-15 dakika zamanınızı alacak, bu anketi doldurduktan sonra veri toplama formunu doldurmanız istenecek, araştırmacı tarafından besin tüketim kaydınız ve besin tüketim sıklığınız alınacaktır. Rastgele seçilecek olan bazı bireylere ilk uygulamadan 2 hafta sonra tekrar geri dönülecek ve yalnızca Genç ve Yetişkin Sporcular İçin Beslenme Bilgisi Anketinden oluşan bir bölüm tekrar uygulanacaktır Araştırmadan elde edilecek bilgiler yukarıda "araştırma amacı" kısmında belirtilen amaç dışında kullanılmayacak ve sizin ve velayetiniz/vesayetiniz altındaki katılımcının kişisel bilgileriniz gizli tutulacaktır. İzin vererek araştırmamıza yaptığınız destek için teşekkür ederiz.

(Vali/Vasi Beyanı)

Yukarıda ayrıntıları belirtilen ve veli/vasi olarak tarafıma aktarılan Sayın Dr. Öğr. Üyesi Gözde DUMLU BİLGİN ve Merve Safa AVAĞ tarafından bilimsel bir araştırma yapılacağı belirtilerek bu araştırma ile ilgili yapılan tüm bilgilendirmeleri ayrıntılarıyla anlamış bulunmaktayım. Gerek araştırma yürütülürken gerekse yayınlandığında katılımcı ve veli/vasi kimliğinin gizli tutulacağı konusunda güvence aldım. Ayrıca araştırma sonuçlarının eğitim ve bilimsel amaçlarla kullanımı sırasında kişisel bilgilerin dikkatle korunacağı konusunda bana yeterli güven verildi. Araştırma için yapılacak harcamalarla ilgili herhangi bir parasal sorumluluk altına girmiyorum ve bana herhangi bir ödeme de yapılamayacaktır. Araştırmaya katılmam konusunda zorlayıcı bir davranışla karşılaşmış değilim. Eğer katılmayı reddedersem, bu durumun araştırıcı ile olan ilişkime herhangi bir zarar getirmeyeceğini de biliyorum. Araştırmanın yürütülmesi sırasında herhangi bir sebep göstermeden iznimi çekebilirim. (Ancak araştırmacıları zor durumda bırakmamak için araştırmadan çekileceğimi önceden bildirmemim uygun olacağının bilincindeyim) Bu şartlar altında velayetim/vesayetim altındaki aşağıda adı soyadı yazılı katılımcının araştırmaya katılmasına izin veriyorum.
İmzalı bu form kağıdının bir kopyası bana verilecektir.

Katılımcı Adı ve Soyadı		
Veli/Vasi Adı ve Soyadı		
Veli / Vasi Adres, telefon, e-posta		
Veli / Vasi	İmza:	Tarih:

Anketi yanıtladığınız için teşekkür ederiz. Çalışma ile ilgili herhangi bir sorunuz olduğunda aşağıdaki kişi(ler) ile iletişim kurabilirsiniz:

Sorumlu Araştırmacı: Dr. Gözde DUMLU BİLGİN*
Yardımcı araştırmacı: Merve Safa AVAĞ**

Çalışmaya katılmayı kabul ediyorsanız aşağıdaki kutucuğu X ile işaretleyiniz ve devam ediniz.

☐ Kabul ediyorum

Tanık Adı soyadı

İmzası ☐

8.10. Appendix-9 Bulvarspor Club Permission

8.11. Appendix-10 Avcılar Football Academy Permisson Form

9. CURRICULUM VITAE

Personal Informations

Name	Merve Safa	**Surname**	Avağ
Place of Birth		**Date of Birth**	
Nationality	T.C.	**TR ID Number**	
E-mail		**Phone number**	

Education

Degree	Department	The name of the Institution Graduated From	Graduation year
Doctorate			
Master	Nutrition and Dietetics	**Yeditepe University**	2024
University	Nutrition and Dietetics	**Hacettepe University**	2018
High school	-	**Yalova Anadolu Lisesi**	2012

Languages	**Grades (#)**
English	Advanced

All the grades must be listed if there is more than one (KPDS, ÜDS, TOEFL; EELTS vs),

Work Experience (Sort from present to past)

Position	Institute	**Duration (Year - Year)**
Dietitian	Movebility Clinic	2024-continued

Computer Skills

Program	Level
Microsoft Office	Good

Journals in the proceedings book of the refereed conference / symposium

Effect of Protein Intake on Wound Healing and Quality of Life After Impacted Mandibular Third Molar Extraction, ACBID, 2024