Sports Nutritional Knowledge of Athletes and Non-Athletes Males, Cross-Sectional Study

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Abstract

The study aimed to compare the level of nutrition knowledge among athletes and non-athletes of university male students. This study involved male university students from Menoufia, Sadat, and Zagazig Universities in Egypt. A total of 84 students participated: 28 athletes from the sports sciences and 56 non-athletes from other faculties. Male students in their third or fourth year, aged 20 to 23 years, and agreed to participate were enrolled in the study. In contrast, subjects who were female, engaged in nutrition classes for non-athletes, had disabilities or mental health issues and had chronic illnesses were excluded. This descriptive study assessed sports nutrition knowledge using the Nutrition for Sport Knowledge Questionnaire (NSKQ). Participants' body height (cm), body weight (kg), and BMI (kg/m^2) were measured. The collected data were statistically analyzed and presented in terms of frequency, percentage, mean, and standard deviation (±SD). All participants were 20–23-year-old men, 71.4% of athletes and 82.1% of non-athletes from rural areas. Non-athletes were 14.2% obese, whereas athletes were not. At least 50% of weight management knowledge was known by 57.1% of athletes and 21.4% of non-athletes. Macronutrient domains were 64.3% wrong in both groups. 78.6% of athletes and 67.9% of non-athletes failed the micronutrient domain 50% requirement. In the sports nutrition domain, 92.9% of athletes and 89.3% of non-athletes fell below this standard. Supplementation knowledge was below 50% for 78.6% of athletes and 85.7% of non-athletes. Most groups scored below 50% on the NSKQ, including 85.7% of athletic and 92.9% of non-athletic students.

Keywords: NSKQ, Weight Management, Supplements, Performance, Nutrition Education.

Introduction

Sports nutrition is crucial for athletes because it impacts performance, recovery, and health. A balanced diet that meets athletes' energy and nutrient needs not only improves training results but also acts as a shield, reducing the risk of injuries and ensuring a secure and protected journey in their sports career.

Due to intense training, athletes require more energy from carbohydrates, proteins, and fats (Franjić, 2023; Chaudhary, 2023). Not getting enough energy can cause fatigue and lower performance (Jalp & Kaur, 2023; Chaudhary, 2023). Proper nutrition aids recovery after exercise, allowing athletes to train effectively (Franjić, 2023; Fleming & Al-Zubaidi, 2023). A balanced diet also helps reduce injury risk and supports the immune system (Fleming & Al-Zubaidi, 2023). Timing nutrient intake can enhance competition performance (Jalp & Kaur, 2023; Chaudhary, 2023). Moreover, functional foods rich in antioxidants play a significant role in boosting recovery, making athletes feel rejuvenated and revitalized for their next challenge.

Many male athletes exhibit poor nutritional literacy. Studies indicate that 42.44% of male student-athletes lack a solid understanding of nutrition (Hoseini & Hoseini, 2019). These athletes often struggle with knowledge about food groups, reading food labels, and calculating their nutritional needs, leading to suboptimal dietary choices (Hoseini & Hoseini, 2019; Dunn et al., 2007).

A lack of nutritional knowledge can result in insufficient intake of macronutrients and micronutrients, which may contribute to obesity, cardiovascular diseases, and decreased athletic performance (Mardani et al., 2017; Riviere et al., 2021). Athletes with low nutritional literacy might find it challenging to maintain the optimal body weight and energy levels necessary for competitive sports (Dunn et al., 2007). Several factors worsen this situation, including limited access to healthy food options, time constraints, and unreliable nutritional information (Dunn et al., 2007; Riviere et al., 2021). Although educational interventions have been implemented, knowledge improvements do not always lead to better dietary practices, indicating a complex relationship between knowledge and behavior (Martinelli, 2013).

On the other hand, some studies suggest that targeted nutrition education programs can enhance knowledge and potentially improve dietary habits among athletes, although the effectiveness of these programs may vary and requires further investigation (Martinelli, 2013).

While sports nutrition is crucial for athletes, it is also essential for the whole population to maintain human health and prevent chronic diseases. A

balanced diet offers benefits for everyone, not just those participating in competitive sports.

The major objectives of this study were to explore and measure the depth of nutritional knowledge of male athletic and non athletic university students.

Subjects and methods

Subjects

This study was conducted on male university students selected from Menoufia, Sadat, and Zagazig Universities in Egypt. The total sample consisted of 84 students; 28 were athletes chosen from the sports sciences faculties, while 56 were non-athletes selected from other theoretical faculties. Subjects who were male students enrolled at Menoufia, Sadat, and Zagazig Universities in their third or fourth years of academic education; age between 20 and 23 years; and agree to participate and sign the consent form were enrolled in the study. While subjects who were female students, participated in nutrition classes specifically designed for non-athletes, and had disabilities or mental health issues were excluded from the study.

Methods

The Nutrition for Sport Knowledge Questionnaire (NSKQ)

This descriptive study evaluated sports nutrition knowledge with the Nutrition for Sport Knowledge Questionnaire (NSKQ) created by Trakman et al. (2017). The NSKQ is an extensive instrument with 89 questions categorized into six subsections: weight management, macronutrients, micronutrients, sports nutrition, supplements, and alcohol. The questionnaire has undergone validation via traditional test theory and Rasch analysis, confirming its reliability and efficacy in assessing nutrition knowledge. A corrected version of the questionnaire was obtained through direct contact with Dr. Greg Trakman at g.trakman@latrobe.edu.au.

Moreover, the researchers excluded the last section about alcohol as none of the subjects drank any alcohol.

Anthropometric Indices

Body height (cm) was measured to the closest 0.1 cm utilizing a non-elastic measuring tape. Body weight (kg) was measured using a

handheld scale with an accuracy of 0.1 kg. The body mass index (BMI) was computed utilizing height and weight values. BMI was utilized to categorize individuals into the following classifications: thinness (BMI < 16.5 kg/m²), underweight (16.5-18.5 kg/m²), healthy weight (18.5-25 kg/m²), overweight (25-30 kg/m²), obesity grade II (30-35 kg/m²), obesity grade III (35-40 kg/m²), and severe obesity (BMI ≥ 40 kg/m²). Data for the study were gathered using a questionnaire and in-person interviews.

Statistical Analysis

All collected data were analyzed statistically and reported as frequencies, percentages, and means±SD. Significant differences between numeric variables were assessed using an independent sample t-test. The Chi-squared (Chi2) test was used to compare categorical variables, while the 95% confidence interval was employed for continuous variables. A P value of less than 0.05 indicates statistical significance.

Ethical issues:

The Scientific Research Ethics Committee, Faculty of Home Economics, Menoufia Univerity, Egypt, approved all experiments in this study (Approval No. 14 - SREC- 06 -2022).

Results

In the data presented in Table 1, the research sample comprised 84 university students selected from Menoufia, Sadaat, and Zagzieg Universities, Egypt. Among them, 28 were athletic students from the faculties of sports sciences, and 56 were non-athletic students representing other faculties. Notably, all participants were male, with the predominant age group being 22 years (50.0% for athletic students and 35.7% for non-athletic students). The average age of the students ranged from 20 to 23 years. Importantly, a substantial percentage of athletic and non-athletic students originated from rural areas (71.4% and 82.1%, respectively). Moreover, most of the students were from Zagazieg University (45.2%).

Table 1: General Characteristics and Field of University Study of Athletic and Non-Athletic Students

	Athletic students	Non-Athletic students	Total	
	no (%)	no (%)	no (%)	P-value
Gender				
Male	28(100.0%)	56 (100.0%)	84(100.0%)	1.000 NS
Female	0(0.0%)	0(0.0%)	0(0.0%)	
Total	28(100.0%)	56 (100.0%)	84(100.0%)	
Age (year)				
20.00	0(0.0%)	2(3.6%)	2 (2.4%)	0.001***
21.00	14(50.0%)	12(21.4%)	26 (30.9%)	
22.00	14(50.0%)	20(35.7%)	34 (40.4%)	
23.00	0(0.0%)	12(21.4%)	12 (14.3%)	
Total	28(100.0%)	56(100.0%)	84(100.0%)	
Residency				
Rural	20(71.4%)	46(82.1%)	66 (78.6%)	0.259NS
Urban	8(28.6%)	10(17.9%)	18 (21.4%)	
Total	28(100.0%)	56(100.0%)	84(100.0%)	
University				
Menoufia	8(28.6%)	20(35.7%)	28(33.3%)	0.024*
Sadat	10(35.7%)	8(14.3%)	18(21.5%)	
Zagazieg	10(35.7%)	28(50.0%)	38(45.2%)	
Total	28(100.0%)	56(100.0%)	84(100.0%)	

*P value calculated by Chi2 Tests. NS: Not Significant, *P<0.05*

It's noteworthy that no athletes were found to be obese, while 14.2% of non-athletic students were obese (Table 2). However, the body weight and body height of athletic students were higher at (71.1±12.5 vs 68.4±12.4 kg and 170.2±9.6 vs. 165.3±10.4 cm, respectively). Analysis of BMI categorization revealed that a substantial proportion of athletic and non-athletic students (50.0% and 64.3%, respectively) exhibited healthy body weight. Conversely, 50.0% of athletic and 17.9% of non-athletic students were overweight.

Table 2: Anthropometric Measurements of Athletic and Non-Athletic Students (Mean±SD)

	Athletic students (n=28)	Non-Athletic students (n=56)	
	Mean±SD	Mean±SD	P-value
Age (year)	21.5±0.5	21.4±1.4	0.603 NS
Body weight (kg)	71.1±12.5	68.4±12.4	0.355 NS
Body height (cm)	170.2±9.6	165.3±10.4	0.038*
BMI (kg/m^2)	24.4±2.5	25.2±4.9	0.348 NS
BMI classification according to WHO, 2005 (no & %)			
Underweight (BMI: 16.5-18.5)	0(0.0%)	2(3.6%)	0.015*
Healthy weight (BMI: 18.5-25.9)	14(50.0%)	36(64.3%)	
Overweight (BMI: 25:30)	14(50.0%)	10(17.9%)	
Obesity II (BMI 30-35)	0(0.0%)	4(7.1%)	
Obesity III (BMI: 35-40)	0(0.0%)	4(7.1%)	
Total	28(100.0%)	56(100.0%)	

*The p value for numeric variables was calculated using the independent sample t-test, and the P value for string variables was calculated using the Chi2 Tests. NS: Not Significant, *P<0.05, ** P<0.01*

Table 3 presents the nutritional knowledge of athletic and non-athletic students concerning the weight management domain. Regarding nutrient knowledge (Q 1.1), the results revealed that most non-athletic students (92.9%) incorrectly identified carbohydrates as the nutrient providing the most energy per 100 grams. In comparison, 64.3% of athletic students made the same error. This discrepancy indicates a potential gap in nutritional education among non-athletic individuals.

Regarding weight loss beliefs, responses to the statement regarding the benefits of having the lowest possible weight for endurance performance (Q 1.2.1) showed a trend toward acceptance in both groups. However, the results were statistically non-significant ($p = 0.061$). This suggests that, while there is a belief in the importance of weight management, the understanding or agreement on the topic may not be consistent across groups.

There was a strong consensus (78.6% incorrect) regarding dietary changes for muscle gain, which suggests a widespread misunderstanding about the role of protein in muscle development.

When examining dietary practices for weight loss (Q 1.3), significant differences were noted in preferences for dietary strategies. Athletic students were more likely to recognize effective weight-loss strategies, such as replacing energy-dense foods with low-energy options ($p = 0.019$). Additionally, the preference for margarine over butter showed a significant difference ($p = 0.005$), highlighting dietary beliefs based on athletic status variations.

Regarding recovery meal preferences (Q 1.6 & Q 1.7), most non-athletic students tended to choose less optimal options for recovery meals aimed at muscle gain. This indicates a lack of knowledge about effective recovery nutrition.

When considering meals for weight loss, a significant percentage of non-athletic students (85.7%) selected incorrect options ($p = 0.024$), emphasizing improved nutritional guidance.

As for percentage scores in the weight management domain, athletic participants scored an average of 45.8 ± 17.2, while non-athletic participants averaged 34.8 ± 14.9, with a statistically significant p-value of 0.003. When classifying knowledge levels, we observed that 78.6% of non-athletic participants scored below the 50% knowledge threshold, compared to 42.9% of athletic participants ($p = 0.001$). Of the proportion of participants meeting knowledge standards, 57.1% of athletic students met the acceptable knowledge threshold (≥50%), while only 21.4% of non-athletic students did.

Table 3: Nutrition for Sports Knowledge of Athletic and Non-Athletic Students Concerning Weight Management Domain

	Answer	Athletic students	Non-Athletic students	Total	P-value
		no (%)	no (%)	no (%)	
Q 1.1 Which nutrient do you think has the most energy (kilojoules/calories) per 100 grams (3.5 ounces)?					
(1) Carbohydrate; (2) Protein; (3) Fat; (4) Not sure	Incorrect	18(64.3%)	52(92.9%)	70(83.3%)	0.001**
	Correct	10(35.7%)	4(7.1%)	14(16.7%)	
Q 1.2 Do you agree or disagree with the following statements about weight loss?					
(1) Having the lowest weight possible benefits endurance performance in the long term	Incorrect	20(71.4%)	28(50.0%)	48(5(7.1%)	0.061 NS
	Correct	8(28.6%)	28(50.0%)	36(42.9%)	
(2) Eating more protein is the most important dietary change if you want to have more muscle	Incorrect	22(78.6%)	44(78.6%)	66(78.6%)	1.000 NS
	Correct	6(21.4%)	12(21.4%)	18(21.4%)	

	Answer	Athletic students	Non-Athletic students	Total	P-value
		no (%)	no (%)	no (%)	
(3) Eating more energy from protein than you need can make you put on fat	Incorrect	12(42.9%)	30(5(3.6%)	42(50.0%)	0.355 NS
	Correct	16(57.1%)	26(46.4%)	42(50.0%)	
Q 1.3 Do you think the diet changes below are good ways to lose weight?					
(1) Swapping carbohydrates/energy dense foods for low-energy foods like vegetables are good way to lose weight	Incorrect	4(14.3%)	22(39.3%)	26(31.0%)	0.019*
	Correct	24(85.7%)	34(60.7%)	58(69.0%)	
(2) Eating margarine instead of butter	Incorrect	8(28.6%)	34(60.7%)	42(50.0%)	0.005**
	Correct	20(71.4%)	22(39.3%)	42(50.0%)	
(3) Eating protein bars and shakes instead of yogurts, muesli/granola bars and fruits	Incorrect	14(50.0%)	38(67.9%)	52(61.9%)	0.112 NS
	Correct	14(50.0%)	18(32.1%)	32(38.1%)	
(4) Choosing lower glycemic index (GI) carbohydrates to help regulate appetite	Incorrect	22(78.6%)	36(64.3%)	58(69.0%)	0.182 NS
	Correct	6(21.4%)	20(35.7%)	26(31.0%)	
Q 1.4 If they want to lose weight, athletes should:					
(1) Eat less than 50 g (1.7 oz) of carbohydrate per day (2) Eat less than 20g (0.7 oz) of fat per day (3) Eat less calories/ kilojoules than your body needs (4) Not sure	Incorrect	12(42.9%)	50(89.3%)	62(73.8%)	0.000***
	Correct	16(5(7.1%)	6(10.7%)	22(26.2%)	
Q 1.5 To ensure they meet their energy (kilojoule/calorie) requirements, all athletes should:					
(1) Plan their diet based on their age, gender, body size, sport and training program (2) Eat based on their natural hunger and fullness signals (3) Eat at least 8000 kilojoules (2000 calories) per day (4) Eat more foods that have lots of carbohydrate (5) Not sure	Incorrect	10(35.7%)	24(42.9%)	34(40.5%)	0.530 NS
	Correct	18(64.3%)	32(57.1%)	50(59.5%)	
Q1.6 Which is a better recovery meal option for an athlete who wants to put on muscle?					
(1) A 'mass gainer' protein shake and 3 - 4 scrambled eggs (2) Pasta with lean beef and vegetable sauce, plus a dessert of fruit, yoghurt and nuts (3) A large piece of grilled chicken with a side salad (lettuce, cucumber, tomato) (4) A large steak and fried eggs (5) Not sure	Incorrect	22(78.6%)	32(57.1%)	54(64.3%)	0.053 NS
	Correct	6(21.4%)	24(42.9%)	30(35.7%)	
Q1.7 Which is a better recovery meal option for an athlete who wants to lose weight?					
(1) A side salad with no dressing (lettuce, cucumber,	Incorrect	18(64.3%)	48(85.7%)	66(78.6%)	0.024*

	Answer	Athletic students	Non-Athletic students	Total	P-value
		no (%)	no (%)	no (%)	
tomato). (2) A pure whey protein isolate (WPI) shake made on water (3) A mixed meal that includes a small-moderate serving of meat and carbohydrate (e.g., small bowl pasta with lean mincemeat and vegetable sauce) plus a large side salad (4) Not sure	Correct	10(35.7%)	8(14.3%)	18(21.4%)	
Overall classification of participants according to the percentage obtained in the weight management domain (out of 12)					
Percentage obtained in the weight management domain (out of 12)		45.8±17.2	34.8±14.9	0.003**	
Not Accepted (less than 50%)		12 (42.9%)	44(78.6%)	0.001	
Accepted (Equal or more than 50%)		16(57.1%)	12(21.4%)		
Total		28(100.0%)	56 (100.0%)		

*Q: Question: The significance of numeric variables was assessed using an independent sample t-test, while the Chi-square tests determined the significance of categorical variables. NS = Not Significant, *P < 0.05, ** P < 0.01. SD: Standard Deviation. The percentage obtained for the domain is calculated by dividing the sum of answers by the full score, then multiplying by 100.*

Table 4 offers insights into the understanding and beliefs about macronutrient intake among athletic and non-athletic students. The data includes responses to various questions concerning carbohydrate, fat, and protein intake, recovery nutrition, and macronutrients' roles in athletic performance and general health. The results reveal notable similarities and differences in knowledge and beliefs between the two groups.

Regarding carbohydrate intake recommendations (Q 2.1), both athletic (28.6%) and non-athletic students (28.6%) exhibited a low correct response rate about carbohydrate intake for athletes in endurance training, with a p-value of 1.000.

In terms of recovery nutrition (Q 2.2), responses varied significantly concerning post-exercise food options. Notably, the correct response rate for baked beans on bread was higher among athletic students (57.1%) than non-athletic students (32.1%), yielding a p-value of 0.028.

For identifying food sources of carbohydrates (Q 2.3), a majority in both groups provided incorrect responses regarding which foods contain the highest carbohydrate content, with a p-value of 0.726.

A significant misconception emerged regarding fat (Q 2.4 & Q 2.5); 78.6% of athletic students incorrectly believed that athletes should limit fat intake to 20g per day, with p-values of 0.053 across multiple questions.

Regarding protein knowledge (Q 2.6 to Q 2.11), most incorrectly identified protein as the main muscle fuel during exercise, with a 71.4% incorrect response rate and a p-value of 0.334. Regarding recognizing protein sources, only 28.6% of athletic students correctly identified chicken breast as having the highest protein content, accompanied by a significant p-value of 0.005, indicating a notable difference in understanding protein sources.

The overall classification of macronutrient knowledge revealed mean percentages that were similar between athletic (45.0 ± 12.5) and non-athletic students (43.3 ± 12.7), with a p-value of 0.571 indicating no significant difference between the groups. The low percentage of correct responses (64.3% incorrect) among both groups highlights an urgent need for improved nutritional education to enhance understanding and application of macronutrient knowledge.

Table 4: Nutrition for Sports Knowledge of Athletic and Non-Athletic Students Concerning Macronutrient Domain

		Athletic students	Non-Athletic students	Total	P-value
		no (%)	no (%)	no (%)	
Q 2.1 An athlete doing a moderate to high-intensity endurance training program for about two hours should eat:					
(1) 1 - 3 g carbohydrate per kg body weight per day (2) 5-7 g, increasing up to 10 g/kg with intense training/competition loads (15 - 25%) of total daily kilojoule/calorie intake as carbohydrate (3) 75 - 85% of total daily kilojoule/calorie intake as carbohydrate (4) Not sure	Incorrect	20(71.4%)	40(71.4%)	60(71.4%)	1.000
	Correct	8(28.6%)	16(28.6%)	24(28.6%)	
Q 2.2 Which options have enough carbohydrate for recovery from about 1 hour of high intensity aerobic exercise? Assume the athlete weighs about 70kg and has an important training session again tomorrow.					
(1) 1 medium banana	Incorrect	22(78.6%)	32(5(7.1%)	54(64.3%)	0.053
	Correct	6(21.4%)	24(42.9%)	30(35.7%)	
(2) 1 cup cooked quinoa and 1 tin tuna	Incorrect	22(78.6%)	42(75.0%)	6476.2%)	0.717
	Correct	6(21.4%)	14(25.0%)	2023.8%)	
(3) 1 cup plain yoghurt	Incorrect	18(64.3%)	40(71.4%)	58(69.0%)	0.504
	Correct	10(35.7%)	16(28.6%)	26(31.0%)	
(4) 1 cup baked beans on two slices of bread	Incorrect	12(42.9%)	38(67.9%)	50(59.5%)	0.028
	Correct	16(5(7.1%)	18(32.1%)	34(40.5%)	

		Athletic students	Non-Athletic students	Total	P-value
		no (%)	no (%)	no (%)	
Q 2.3 Which food has the most carbohydrate? (1) 1 cup (168 g/5.6 ounces) boiled rice (2) 2 slices of white sandwich loaf bread (3) 1 medium (150 g/ 5 ounces) boiled potato (4) 1 medium (150 g/5 ounces) ripe banana (5) Not sure	Incorrect	20 (71.4%)	42(75.0%)	62(73.8%)	0.726
	Correct	8(28.6%)	14(25.0%)	22(26.2%)	
Q 2.4 Do you agree or disagree with these statements about fat? (1) The body needs fat to fight off sickness	Incorrect	14(50.0%)	26(46.4%)	40(47.6%)	0.757
	Correct	14(50.0%)	30(5(3.6%)	44(52.4%)	
(2) Athletes should not eat more than 20g of fat per day	Incorrect	22(78.6%)	32(5(7.1%)	54(64.3%)	0.053
	Correct	6(21.4%)	24(42.9%)	30(35.7%)	
(3) When we increase the intensity of exercise, the %) of fat we use as a fuel also increases	Incorrect	18(64.3%)	34(60.7%)	52(61.9%)	0.751
	Correct	10(35.7%)	22(39.3%)	32(38.1%)	
(4) When we exercise at a low intensity, our body mostly uses fat as a fuel	Incorrect	16(57.1%)	38(67.9%)	54(64.3%)	0.334
	Correct	12(42.9%)	18(32.1%)	30(35.7%)	
Q 2.5 Do you think these foods are high in fat? (1) Cheddar cheese	Incorrect	6(21.4%)	36(64.3%)	42(50.0%)	0.000**
	Correct	22(78.6%)	20(35.7%)	42(50.0%)	
(2) Margarine	Incorrect	2(7.1%)	22(39.3%)	24(28.6%)	0.002**
	Correct	26(92.9%)	34(60.7%)	60(71.4%)	
(3) Mixed nuts	Incorrect	14(50.0%)	34(60.7%)	48(57.1%)	0.350
	Correct	14(50.0%)	22(39.3%)	36(42.9%)	
(4) Honey	Incorrect	14(50.0%)	28(50.0%)	42(50.0%)	1.000
	Correct	14(50.0%)	28(50.0%)	42(50.0%)	
Q 2.6 Do you agree or disagree with the statements about protein? (1) Protein is the main fuel that muscles use during exercise	Incorrect	20(71.4%)	34(60.7%)	54(64.3%)	0.334
	Correct	8(28.6%)	22(39.3%)	30(35.7%)	
(2) Vegetarian athletes can meet their protein	Incorrect	14(50.0%)	28(50.0%)	42(50.0%)	1.000

		Athletic students	Non-Athletic students	Total	P-value
		no (%)	no (%)	no (%)	
requirements without the use of protein supplements	Correct	14(50.0%)	28(50.0%)	42(50.0%)	
(3) An experienced athlete needs more protein than a young athlete who is just starting training	Incorrect	20(71.4%)	38(67.9%)	58(69.0%)	0.739
	Correct	8(28.6%)	18(32.1%)	26(31.0%)	
(4) The body has a limited ability to use protein for muscle protein synthesis	Incorrect	16(57.1%)	20(35.7%)	36(42.9%)	
	Correct	12(42.9%)	36(64.3%)	48(5(7.1%)	
(5) A balanced diet with enough kilojoules/calories (energy) has enough protein for most athletes	Incorrect	12(42.9%)	18(14.3%)	20(23.8%)	
	Correct	16(57.1%)	48(85.7%)	6476.2%)	
Q 2.7 Which food has the most protein? (1) 2 eggs; (2) 100g (3 ounces) raw skinless chicken breast; (3) 30g (1 ounce) almonds; (4) Not sure	Incorrect	8(28.6%)	34(60.7%)	42(50.0%)	0.005**
	Correct	20(71.4%)	22(39.3%)	42(50.0%)	
Q 2.8 The protein needs of a 100 kg (220 lb.) well trained resistance athlete are closest to: (1) 100g (1g/kg); (2) 150g (1.5g/kg); (3) 500g (5g/kg); (4) They should eat as much protein as possible; (5) Not sure	Incorrect	20(71.4%)	32(5(7.1%)	52(61.9%)	0.204
	Correct	8(28.6%)	24(42.9%)	32(38.1%)	
Q 2.9 Which of these foods do you think have enough protein to promote muscle growth after a bout of resistance exercise?					
(1) 100g (3 ounces) chicken breast	Incorrect	10(35.7%)	18(32.1%)	28(33.3%)	0.743
	Correct	18(64.3%)	38(67.9%)	56(66.7%)	
(2) 30g (1 ounce) Yellow cheese	Incorrect	10(35.7%)	32(57.1%)	42(50.0%)	0.064
	Correct	18(64.3%)	24(42.9%)	42(50.0%)	
(3) 1 cup baked beans	Incorrect	20(71.4%)	38(67.9%)	58(69.0%)	0.739
	Correct	8(28.6%)	18(32.1%)	26(31.0%)	
(4) 1/2 cup cooked quinoa	Incorrect	20(71.4%)	34(60.7%)	54(64.3%)	0.334
	Correct	8(28.6%)	22(39.3%)	30(35.7%)	
Q 2.10 Do you think these foods have all the essential amino acids needed by the body?					
(1) Beef steak	Incorrect	12(42.9%)	26(46.4%)	38(45.2%)	0.757
	Correct	16(57.1%)	30(53.6%)	46(54.8%)	

		Athletic students	Non-Athletic students	Total	P-value
		no (%)	no (%)	no (%)	
(2) Eggs	Incorrect	8(28.6%)	26(46.4%)	34(40.5%)	0.116
	Correct	20(71.4%)	30(5(3.6%)	50(59.5%)	
(3) Lentils	Incorrect	20(71.4%)	30(53.6%)	50(59.5%)	0.116
	Correct	8(28.6%)	26(46.4%)	34(40.5%)	
(4) Cow's Milk	Incorrect	12(42.9%)	34(60.7%)	46(54.8%)	0.121
	Correct	16(57.1%)	22(39.3%)	38(45.2%)	
Q 2.11 The amount of protein in skim milk compared to full cream milk is: (1) Much less; (2) About the same; (3) Much more; (4) Not sure	Incorrect	20(71.4%)	36(64.3%)	56(66.7%)	0.513
	Correct	8(28.6%)	20(35.7%)	28(33.3%)	
Overall classification of participants according to the percentage obtained in the macronutrient domain (out of 30)					
Percentage of macronutrients domain (Mean±SD)		45.0±12.5	43.3±12.7	0.571	
Not Accepted (less than 50%)		18(64.3%)	36(64.3%)	1.000	
Accepted (Equal or more than 50%)		10(35.7%)	20(35.7%)		
Total		28(100.0%)	56 (100.0%)		

*Q: Question: The significance of numeric variables was assessed using an independent sample t-test, while the Chi-square tests determined the significance of categorical variables. NS = Not Significant, *P < 0.05, ** P < 0.01. SD: Standard Deviation. The percentage obtained for the domain is calculated by dividing the sum of answers by the full score, then multiplying by 100.*

Table 5 presents findings on the knowledge and beliefs regarding vitamins and minerals among athletic and non-athletic students. It evaluates their understanding of essential micronutrients, sources, and roles in health and athletic performance. The results reveal significant differences in knowledge, particularly concerning calcium and its role in bone health, highlighting the need for improved nutritional education.

Regarding calcium as a primary component of bone (Q 3.1.1), a significant majority of athletic students (78.6%) correctly identified calcium's role, compared to only 53.6% of non-athletic students, with a p-value of 0.026.

The level of agreement for vitamin C as an antioxidant (Q 3.1.2) was lower than expected, with only 57.1% of athletic students correctly acknowledging its role.

As for thiamine and oxygen transport (Q 3.1.3), most respondents incorrectly believed that thiamine is necessary for oxygen transport to muscles, with 71.4% of athletic students holding this misconception.

Concerning iron and energy production (Q 3.1.4), a high incorrect response rate (71.4%) regarding iron's role in energy metabolism indicates a widespread misunderstanding among both groups.

Only 67.9% of non-athletic students recognized that vitamin D enhances calcium absorption (Q 3.1.5).

When discussing sources of micronutrients (Q 3.1.6 to Q 3.1.12), many students misidentified food sources of key vitamins and minerals, such as the role of whole grains and fruits in providing calcium. There were also misunderstandings about the increased iron requirement for menstruating women and the misconception that vitamins contain energy.

In terms of overall micronutrient knowledge, the average percentage of correct responses was low for both groups (42.3% ± 9.7 for athletic and 44.8% ± 15.1 for non-athletic students), with 78.6% of athletic students and 67.9% of non-athletic students failing to meet the acceptable threshold of 50%.

Table 5: Nutrition for Sports Knowledge of Athletic and Non-Athletic Students Concerning Micronutrient Domain

	Answer	Athletic students	Non-Athletic students	Total	
		no (%)	no (%)	no (%)	P-value
Q 3.1 Do you agree or disagree with these statements on vitamins and minerals?					
(1) Calcium is the main component of bone	Incorrect	6(21.4%)	26(46.4%)	32(38.1%)	0.026*
	Correct	22(78.6%)	30(53.6%)	52(61.9%)	
(2) Vitamin C is an anti-oxidant	Incorrect	12(42.9%)	32(5(7.1%)	44(52.4%)	0.217
	Correct	16(5(7.1%)	24(42.9%)	40(47.6%)	
(3) Thiamine (Vitamin B1) is needed to take oxygen to muscles	Incorrect	20(71.4%)	30(5(3.6%)	50(59.5%)	0.116
	Correct	8(28.6%)	26(46.4%)	34(40.5%)	
(4) Iron is needed to turn food into usable energy	Incorrect	20(71.4%)	38(67.9%)	58(69.0%)	0.739
	Correct	8(28.6%)	18(32.1%)	26(31.0%)	
(5) Vitamin D enhances calcium absorption	Incorrect	12(42.9%)	18(32.1%)	30(35.7%)	0.334
	Correct	16(5(7.1%)	38(67.9%)	54(64.3%)	

	Answer	Athletic students	Non-Athletic students	Total	
		no (%)	no (%)	no (%)	P-value
(6) Meat, chicken and fish are good sources of zinc	Incorrect	12(42.9%)	28(50.0%)	40(47.6%)	0.537
	Correct	16(5(7.1%)	28(50.0%)	44(52.4%)	
(7) Wholegrain foods are good sources of vitamin C	Incorrect	22(78.6%)	34(60.7%)	56(66.7%)	0.102
	Correct	6(21.4%)	22(39.3%)	28(33.3%)	
(8) Fruit and vegetables are good sources of calcium	Incorrect	20(71.4%)	30(5(3.6%)	50(59.5%)	0.116
	Correct	8(28.6%)	26(46.4%)	34(40.5%)	
(9) Fatty fish is a good source of vitamin D	Incorrect	14(50.0%)	22(39.3%)	36(42.9%)	0.350
	Correct	14(50.0%)	34(60.7%)	48(5(7.1%)	
(10) Women who have a monthly period need more iron than men	Incorrect	20(71.4%)	32(5(7.1%)	52(61.9%)	0.204
	Correct	8(28.6%)	24(42.9%)	32(38.1%)	
(11) Athletes aged 15 to 24 years need 500 mg of calcium each day	Incorrect	18(64.3%)	36(64.3%)	54(64.3%)	1.000
	Correct	10(35.7%)	20(35.7%)	30(35.7%)	
(12) A fit person eating a balanced diet can improve their athletic performance by eating more vitamins and minerals from food	Incorrect	18(64.3%)	42(75.0%)	60(71.4%)	0.306
	Correct	10(35.7%)	14(25.0%)	24(28.6%)	
(13) Vitamins contain energy (kilojoules/calories)	Incorrect	16(57.1%)	34(60.7%)	50(59.5%)	0.753
	Correct	12(42.9%)	22(39.3%)	34(40.5%)	

Overall classification of participants according to the percentage obtained in the micronutrient domain (out of 13)

Percentage of micronutrients domain (Mean±SD)	42.3±9.7	44.8±15.1	0.433
Not Accepted (less than 50%)	22(78.6%)	38(67.9%)	0.306
Accepted (Equal or more than 50%)	6(21.4%)	18()32.1%)	
Total	28(100.0%)	56 (100.0%)	

*Q: Question: The significance of numeric variables was assessed using an independent sample t-test, while the Chi-square tests determined the significance of categorical variables. NS = Not Significant, *P < 0.05, ** P < 0.01. SD: Standard Deviation. The percentage obtained for the domain is calculated by dividing the sum of answers by the full score, then multiplying by 100.*

Table 6 summarizes athletic and non-athletic students' knowledge and beliefs about sports nutrition. It evaluates their understanding of hydration, carbohydrate, and protein needs during and after exercise. The results reveal significant gaps in knowledge for both groups, which could affect athletic performance and health.

Regarding hydration knowledge (Questions 4.1 to 4.4), in Question 4.1, most of both groups incorrectly believed that athletes should drink water to "keep plasma volume stable, stop dry mouth, and allow proper sweating." Only 14.3% of athletic and 21.4% of non-athletic students answered correctly ($p = 0.432$). In Question 4.2, only 35.7% of athletic students and 10.7% of non-athletic students recognized that athletes should drink according to body weight changes during training, resulting in a significant p-value of 0.006. Question 4.4 revealed a high prevalence of incorrect identification of appropriate sodium levels in sports drinks, with 85.7% of athletic and 78.6% of non-athletic students answering incorrectly ($p = 0.432$).

As for pre-competition nutrition (Question 4.5), there was a significant difference in responses regarding food choices before competition. Fifty percent of athletic students correctly identified that athletes should consume foods high in fluids and carbohydrates, compared to only 3.6% of non-athletic students ($p < 0.0001$).

Regarding carbohydrate intake during exercise (Questions 4.6 to 4.9), Question 4.6 showed that misconceptions about carbohydrates, such as the belief that they hinder muscle building, were widespread; 57.1% of athletic students answered incorrectly.

In Question 4.7, a significant majority (92.9% of athletic and 57.1% of non-athletic students) wrongly believed that energy gels are a better option than water or sports drinks, with a noteworthy p-value of 0.001.

Regarding post-competition nutrition (Questions 4.10 to 4.11), in Question 4.10, most students from both groups misunderstood post-competition nutrition needs, with 64.3% of athletic and 85.7% of non-athletic students incorrectly identifying the roles of carbohydrates and protein ($p = 0.024$). In Question 4.11, a high percentage of both groups (85.7% of athletic and 89.3% of non-athletic students) failed to recognize the correct protein intake needed after resistance exercise, underlining a clear need for enhanced understanding of macronutrient requirements ($p = 0.634$).

For the overall assessment of sports nutrition knowledge, the mean percentage of correct responses was low for both groups: 28.0% ± 12.7 for athletic students and 25.3% ± 14.8 for non-athletic students. Notably, a high percentage (92.9% of athletic and 89.3% of non-athletic students) did not meet the acceptable 50% correct responses threshold.

Table 6: Nutrition for Sports Knowledge of Athletic and Non-Athletic Students Concerning Sports Nutrition Domain

		Athletic students	Non-Athletic students	Total	P-value
		no (%)	no (%)	no (%)	
Q 4.1 Athletes should drink water to:					
(1) Keep plasma (blood) volume stable; (2) Stop dry mouth; (3) Allow proper sweating; (4) All of the above; (5) Not sure	Incorrect	24(85.7%)	44(78.6%)	68(81.0%)	0.432
	Correct	4(14.3%)	12(21.4%)	1619.0%)	
Q 4.2 Experts think that athletes should: (1) Drink 50 - 100 ml every 15 - 20 minutes (2) Suck on ice cubes rather than drinking during practice (3) Drink sports drinks rather than water when exercising (4) Drink to a plan, based on body weight changes during training sessions performed in a similar climate (5) Not sure	Incorrect	18(64.3%)	50(89.3%)	68(81.0%)	0.006
	Correct	10(35.7%)	6(10.7%)	1619.0%)	
Q 4.4 How much sodium (salt) should fluid consumed for hydration purposes (during exercise) contain? (1) At least 11 - 25 mmol/L (~ 250 - 575 mg/L); (2) At least 4 - 8 mmol/L (~ 90 - 185 mg/L); (3) None; (4) Not sure	Incorrect	24(85.7%)	44(78.6%)	68(81.0%)	0.432
	Correct	4(14.3%)	12(21.4%)	16(19.0%)	
Q 4.5 Before competition, athletes should eat foods that are high in: (1) Fluids, fat and carbohydrate; (2) Fluids, fiber and carbohydrate; (3) Fluids and carbohydrate; (4) Not sure	Incorrect	14(50.0%)	54(96.4%)	68(81.0%)	0.000**
	Correct	14(50.0%)	2(3.6%)	1619.0%)	
Q 4.6 Do you agree or disagree with the statements on carbohydrate?					
(1) Eating carbohydrates when you exercise makes it harder to build strength and muscles	Incorrect	16(5(7.1%)	34(60.7%)	50(59.5%)	0.753
	Correct	12(42.9%)	22(39.3%)	34(40.5%)	
(2) In events lasting 60 - 90 minutes, 30- 60 g (1.0 - 2.0 ounces) of carbohydrates should be eaten per hour	Incorrect	16(5(7.1%)	40(71.4%)	56(66.7%)	0.190
	Correct	12(42.9%)	16(28.6%)	28(33.3%)	
(3) Eating carbohydrates when you exercise will help keep blood sugar levels stable	Incorrect	16(5(7.1%)	26(46.4%)	42(50.0%)	0.355
	Correct	12(42.9%)	30(5(3.6%)	42(50.0%)	
Q 4.7 Some athletes get a sore stomach if they eat during exercise. What might make stomach pain worse? (1) Having energy gels rather than water or sports drinks (2) Having small amounts of water at a time (3) Having sports drinks with different types of carbohydrates (e.g., fructose and sucrose) (4) Not sure	Incorrect	26(92.9%)	32(5(7.1%)	58(69.0%)	0.001
	Correct	2(7.1%)	24(42.9%)	26(31.0%)	
Q 4.8 During a competition, athletes should eat foods that are high in:					

		Athletic students	Non-Athletic students	Total	P-value
		no (%)	no (%)	no (%)	
(1) Fluids, fiber and fat; (2) Fluids and protein; (3) Fluids and carbohydrate; (4) Not sure	Incorrect	20(71.4%)	4682.1%)	66(78.6%)	0.259
	Correct	8(28.6%)	10(17.9%)	18(21.4%)	
Q 4.9 Which is the best snack to have during an intense 90-minute training session?					
(1) A protein shakes; (2) A ripe banana; (3) 2 boiled eggs; (4) A handful of nuts; (5) Not sure	Incorrect	26(92.9%)	34(60.7%)	60(71.4%)	0.002
	Correct	2(7.1%)	22(39.3%)	24(28.6%)	
Q 4.10 After a competition, athletes should eat foods that are high in?					
(1) Protein, carbohydrate and fat; (2) Only protein; (3) Only carbohydrate; (4) Carbohydrate and protein; (5) Not sure	Incorrect	18(64.3%)	48(85.7%)	66(78.6%)	0.024*
	Correct	10(35.7%)	8(14.3%)	18(21.4%)	
Q 4.11 How much protein do you think experts say athletes should eat after resistance exercise?					
(1) 0.3g/kg body weight (~ 15 - 25 g for most athletes) (2) 1.0 g/kg body weight (~ 50 - 100 g for most athletes) (3) 1.5g/kg body weight (~ 150 – 130 g for most athletes) (4) Not sure	Incorrect	24(85.7%)	50(89.3%)	74(88.1%)	0.634
	Correct	4(14.3%)	6(10.7%)	10(11.9%)	
Overall classification of participants according to the percentage obtained in the sports nutrition domain (out of 12)					
Percentage of sports nutrition domain (Mean±SD)		28.0±12.7	25.3±14.8	0.416	
Not Accepted (less than 50%)		26(92.9%)	50(89.3%)		
Accepted (Equal or more than 50%)		2(7.1%)	6(10.7%)		
Total		28(100.0%)	56 (100.0%)		

*Q: Question: The significance of numeric variables was assessed using an independent sample t-test, while the Chi-square tests determined the significance of categorical variables. NS = Not Significant, *P < 0.05, ** P < 0.01. SD: Standard Deviation. The percentage obtained for the domain is calculated by dividing the sum of answers by the full score, then multiplying by 100.*

Table 7 presents the findings on the knowledge and beliefs regarding vitamin and mineral supplements among athletic and non-athletic students. It evaluates their understanding of the efficacy, safety, and regulation of dietary supplements, as well as the specific roles of these supplements in athletic performance. The results indicate significant gaps in knowledge and misconceptions that could impact health and performance.

Regarding vitamin C supplementation (Q 5.1.1), most athletic students (92.9%) incorrectly believed that athletes should always take vitamin C, compared to 64.3% of non-athletic students, with a p-value of 0.005.

Regarding B vitamins and energy levels (Q 5.1.2), the incorrect belief that B vitamins should be taken to address low energy levels was prevalent.

Specifically, 85.7% of athletic and 78.6% of non-athletic students responded incorrectly ($p = 0.432$).

Concerning using salt tablets for cramps (Q 5.1.3), both groups had the same incorrect response rate of 64.3%, with a p-value of 1.000.

Regarding iron supplementation for fatigue (Q 5.1.4), 78.6% of athletic students and 67.9% of non-athletic students incorrectly believed that all tired and pale athletes should take iron tablets ($p = 0.306$).

Regarding the safety of supplements (Q 5.2), a substantial proportion of both groups—64.3% of athletic students and 60.7% of non-athletic students—incorrectly believed that all supplements are tested for safety and contamination ($p = 0.751$).

In relation to the accuracy of supplement labels (Q 5.3), a significant majority—64.3% of athletic students and 71.4% of non-athletic students—incorrectly believed that supplement labels are always accurate ($p = 0.504$).

As for understanding specific supplements (Q 5.4), responses to statements about the efficacy of creatine, caffeine, beetroot juice, and beta-alanine revealed substantial misunderstanding, with incorrect response rates of 85.7% for creatine and 71.4% for beetroot juice among athletic students.

Regarding the evidence for body composition supplements (Q 5.5), a high incorrect response rate was noted, with 71.4% of athletic students and 64.3% of non-athletic students unsure which supplement lacks sufficient evidence for improving performance ($p = 0.525$). This indicates a lack of critical evaluation of supplements.

Concerning WADA-banned substances (Q 5.6), a majority of both groups—71.4% of athletic students and 82.1% of non-athletic students—incorrectly identified substances banned by the World Anti-Doping Agency (WADA), with a p-value of 0.259.

In terms of overall knowledge of supplementation, the mean percentage of correct responses was low for both groups: 29.2 ± 13.9 for athletic students and 31.5 ± 14.5 for non-athletic students. A significant percentage—78.6% of athletic students and 85.7% of non-athletic students—failed to meet the acceptable threshold of 50% ($p = 0.473$).

Table 7: Nutrition for Sports Knowledge of Athletic and Non-Athletic Students Concerning Supplementation Domain

		Athletic students	Non-Athletic students	Total	P-value
		no (%)	no (%)	no (%)	
Q 5.1 Do you agree or disagree with the statements about vitamin and mineral supplements?					
(1) Vitamin C should always be taken by athletes	Incorrect	26(92.9%)	36(64.3%)	62(73.8%)	0.005
	Correct	2(7.1%)	20(35.7%)	22(26.2%)	
(2) B vitamins should be taken if energy levels are low	Incorrect	24(85.7%)	44(78.6%)	68(81.0%)	0.432 NS
	Correct	4(14.3%)	12(21.4%)	1619.0%)	
(3) Salt tablets should be taken by athletes that get cramps when they exercise	Incorrect	18(64.3%)	36(64.3%)	54(64.3%)	1.000
	Correct	10(35.7%)	20(35.7%)	30(35.7%)	
(4) Iron tablets should be taken by all athletes who feel tired and are pale	Incorrect	22(78.6%)	38(67.9%)	60(71.4%)	0.306 NS
	Correct	6(21.4%)	18(32.1%)	24(28.6%)	
Q 5.2 All supplements are tested to make sure they are safe, don't have any contamination. (1) Agree; (2) Disagree; (3) Not sure	Incorrect	18(64.3%)	34(60.7%)	52(61.9%)	0.751 NS
	Correct	10(35.7%)	22(39.3%)	32(38.1%)	
Q 5.3 Supplement labels may sometimes say things that are not true. (1) Agree; (2) Disagree; (3) Not sure	Incorrect	18(64.3%)	40(71.4%)	58(69.0%)	0.504 NS
	Correct	10(35.7%)	16(28.6%)	26(31.0%)	
Q 5.4 Do you agree or disagree with the statements about supplements?					
(1) Creatine makes the brain think that exercise feels easier	Incorrect	24(85.7%)	42(75.0%)	66(78.6%)	0.259
	Correct	4(14.3%)	14(25.0%)	18(21.4%)	
(2) Caffeine makes muscles able to work harder even without more oxygen	Incorrect	14(50.0%)	30(5(3.6%)	44(52.4%)	0.757 NS
	Correct	14(50.0%)	26(46.4%)	40(47.6%)	
(3) Beetroot juice (nitrates) makes muscles feel less sore after exercise	Incorrect	20(71.4%)	44(78.6%)	6476.2%)	0.469 NS
	Correct	8(28.6%)	12(21.4%)	2023.8%)	
(4) Beta-Alanine can decrease how much acid muscles make during intense exercise	Incorrect	18(64.3%)	34(60.7%)	52(61.9%)	0.751 NS
	Correct	10(35.7%)	22(39.3%)	32(38.1%)	
Q 5.5 Which supplement does not have enough evidence in relation to improving body composition or sporting					

		Athletic students	Non-Athletic students	Total	P-value
		no (%)	no (%)	no (%)	
performance?					
(1) Caffeine; (2) Ferulic acid; (3) Bicarbonate; (4) Leucine; (5) Not sure	Incorrect	16(5(7.1%)	36(64.3%)	52(61.9%)	0.525 NS
	Correct	12(42.9%)	20(35.7%)	32(38.1%)	
Q 5.6 WORLD ANTI-DOPING AGENCY (WADA) bans the use of….					
(1) Caffeine; (2) Bicarbonate; (3) Carnitine; (4) Testosterone; (5) Not sure	Incorrect	20(71.4%)	4682.1%)	66(78.6%)	0.259 NS
	Correct	8(28.6%)	10(17.9%)	18(21.4%)	
Classification of participants according to the percentage obtained in the supplementation domain (out of 12)					
Percentage of Supplementation Domain (Mean±SD)		29.2±13.9	31.5±14.5	0.473	
Not Accepted (less than 50%)		22(78.6%)	48(85.7%)	0.408	
Accepted (Equal or more than 50%)		6(21.4%)	8(14.3%)		
Total		28(100.0%)	56 (100.0%)		

*Q: Question: The significance of numeric variables was assessed using an independent sample t-test, while the Chi-square tests determined the significance of categorical variables. NS = Not Significant, *P < 0.05, ** P < 0.01. SD: Standard Deviation. The percentage obtained for the domain is calculated by dividing the sum of answers by the full score, then multiplying by 100.*

Table 8 presents findings on the knowledge and understanding of nutrition and physical activity, as measured by the Nutrition and Sports Knowledge Questionnaire (NSKQ) scores among athletic and non-athletic students. It highlights the mean scores, the percentage of participants meeting the acceptable knowledge threshold, and the statistical significance of the differences observed between the two groups.

The mean NSKQ percentage scores were 39.7 ± 8.5 for athletic students and 37.7 ± 7.0 for non-athletic students, with a p-value of 0.268. Regarding the knowledge acceptance threshold, most groups scored below the accepted benchmark of 50% in the NSKQ. Specifically, 85.7% of athletic and 92.9% of non-athletic students did not meet the acceptable level, resulting in a p-value of 0.293. When distributing subjects according to their knowledge levels, it was found that only 14.3% of athletic students and 7.1% of non-athletic students achieved an acceptable level of knowledge (≥50%).

Table 8: Nutrition for Sports Knowledge of Athletic and Non-Athletic Students Concerning Overall NSKQ (out of 79)

	Athletic students	Non-Athletic students	P-value
	no (%)	no (%)	
NSKQ percentage (Mean±SD)	39.7±8.5	37.7±7.0	0.268
Not Accepted (less than 50%)	24(85.7%)	52(92.9%)	0.293
Accepted (Equal or more than 50%)	4(14.3%)	4(7.1%)	
Total	28(100.0%)	56 (100.0%)	

*Q: Question: The significance of numeric variables was assessed using an independent sample t-test, while the Chi-square tests determined the significance of categorical variables. NS = Not Significant, *P < 0.05, ** P < 0.01. SD: Standard Deviation. NSKQ: Nutrition for Sports Knowledge Questionnaire. The percentage obtained for the NSKQ domains is calculated by dividing the sum of answers by the full score, then multiplying by 100.*

Discussion

Our research, which classifies knowledge levels within the weight management domain, has revealed significant disparities in nutrition knowledge among participants. We found that 78.6% of non-athletic participants scored below the 50% knowledge threshold, compared to 42.9% of athletic participants. Among those meeting knowledge standards, 57.1% of athletic students achieved an acceptable knowledge level (≥50%), while only 21.4% of non-athletic students did. These findings underscore the importance of our research in understanding and addressing the knowledge gaps in weight management.

Our findings are further supported by two studies (Labovic et al., 2024; Boucherville Pereira et al., 2023) which indicate that male athletes generally have an average level of nutrition knowledge, with scores ranging from 50% to 77% depending on the specific area assessed. A study involving senior competition climbers found that male participants had an average score of 53.5% in nutrition knowledge, highlighting significant individual variation (Gibson-Smith et al., 2024). Another study (Labovic et al., 2024) concluded that while athletes possess better nutrition knowledge than recreational participants, both groups still demonstrate a low overall understanding of nutrition concepts, suggesting a potential for improvement.

The level of knowledge regarding weight management among male athletes reveals a concerning trend of inadequate understanding. The Weight Management Nutrition Knowledge Questionnaire (WMNKQ) was developed to assess nutrition knowledge related to weight management, indicating that many athletes lack essential expertise in this area (Mikhail et al., 2020).

However, our research shows that athletes who have previously consulted with nutritionists scored higher on nutrition knowledge assessments, underscoring the significant role of professional guidance in improving knowledge scores (Boucherville Pereira et al., 2023). This finding should reassure the audience about the potential for improvement in athletes' nutrition knowledge with the right support.

Male athletes' understanding of macronutrients, as assessed by the Nutrition for Sport Knowledge Questionnaire (NSKQ), reveals a concerning trend of inadequate knowledge. The overall assessment of macronutrient knowledge shows similar mean percentages between athletic and non-athletic students. The low rate of correct responses—64.3% incorrect—among both groups underscores the urgent and crucial need for enhanced nutritional education to improve understanding and application of macronutrient information.

Various studies indicate that while male athletes generally score higher than female athletes in nutritional knowledge, their grasp of specific topics, such as macronutrients, remains limited. In one study involving recreational athletes, male participants averaged a score of 45.2% in sports nutrition knowledge, categorized as "poor" (Boucherville Pereira et al., 2023). Another study reported that, although athletes had an overall average of 77.2% correct answers, their knowledge about protein sources and dietary practices was notably lacking (Labovic et al., 2024).

Athletes who received prior nutritional education or consulted with nutritionists scored significantly higher on knowledge assessments (Boucherville Pereira et al., 2023; Klein et al., 2021). This underscores the crucial role of your work in enhancing athletes' nutritional knowledge. Reliance on non-expert sources for nutritional information—such as social media and coaches—further contributes to these knowledge gaps (Klein et al., 2021).

Despite these findings, some studies suggest that approximately 59.8% of athletes possess good overall nutritional knowledge (Khan et al., 2021). However, understanding of macronutrients remains a critical area that needs improvement.

Regarding overall knowledge about micronutrients, it's concerning that both athletic and non-athletic students demonstrated low average percentages of correct responses, at 42.3% ± 9.7 for athletic students and 44.8% ± 15.1 for non-athletic students. Notably, 78.6% of athletic students and 67.9% of non-athletic students failed to reach the acceptable threshold of 50%. These significant gaps in knowledge, particularly in micronutrients, are a cause for concern and require immediate attention.

A study of NCAA Division III athletes revealed that the mean score for total sports nutrition knowledge was only 36.9%. Individual sports athletes scored higher in micronutrient knowledge than team sports athletes (Klein et al., 2021). In a separate assessment, Division II female athletes achieved an overall nutritional knowledge score of 54.7%, which suggests a poor understanding across both team and individual sports (Allie et al., 2024).

The Nutrition for Sport Knowledge Questionnaire (NSKQ) indicated that many athletes, including males, struggle with specific micronutrient knowledge, with only 58.6% of Brazilian athletes scoring in the medium range (de Sousa et al., 2024). A study focusing on athletes in Montenegro found that while athletes had slightly better nutritional knowledge than recreational players, their overall understanding of nutrition, including micronutrients, remained low (Labovic et al., 2024).

The low levels of knowledge regarding micronutrients underscore the urgent need for targeted educational programs. These programs are crucial to enhance athletes' understanding and application of nutritional principles in their training and performance (Khan et al., 2021). It's not just a matter of improving knowledge, but also of ensuring the health and performance of our athletes.

The overall assessment of the sports nutrition domain is concerning, as it reveals that a significant percentage of both athletic and non-athletic students failed to meet the acceptable threshold of 50%. In fact, a staggering 92.9% of athletic and 89.3% of non-athletic students did not achieve this mark, indicating a critical need for improved education in sports nutrition.

Research consistently shows that male athletes' understanding of sports nutrition is not uniform, with studies often highlighting a wide disparity in knowledge levels. While some studies report moderate knowledge levels, others reveal concerning deficiencies, especially concerning macronutrient sources and dietary

practices. This disparity underscores the need for a more comprehensive and targeted approach to education in sports nutrition.

For instance, a study involving male gym users in Jordan found that 77.6% exhibited moderate knowledge, which did not translate into effective dietary practices (Al-Quran et al., 2023). In contrast, South Indian athletes had a mean knowledge score of only 40.2%, with merely 4.7% achieving adequate knowledge levels (Selvi Kumbamoorthy, 2024).

Many male athletes depend on coaches and trainers for nutritional guidance, which can lead to knowledge gaps if these sources are not well-informed (Musau et al., 2024). Additionally, many athletes seek nutritional information online, which may not always be reliable (Labovic et al., 2024). The prevalence of insufficient nutrition knowledge among athletes underscores the urgent need for targeted educational interventions to improve performance and recovery (Selvi Kumbamoorthy, 2024).

Despite the current state of athletes' nutrition knowledge, there is a significant potential for improvement. While some athletes may perform well despite limited knowledge, the overall trend indicates a critical need for enhanced education in sports nutrition to improve performance outcomes. However, it's reassuring to note that practical experience and training can occasionally compensate for a lack of theoretical understanding, providing a sense of reassurance to the audience.

The overall knowledge of dietary supplementation was found to be low in both athletic and non-athletic students. Notably, a significant percentage of athletic students (78.6%) and non-athletic students (85.7%) did not meet the acceptable threshold of 50% correct responses. While research indicates that athletes generally possess slightly better knowledge than recreational participants, both groups show considerable gaps in their understanding of dietary supplements and their effects on performance.

Athletes scored an average of 77.2% in nutrition knowledge, whereas recreational individuals scored 67.7% (Labovic et al., 2024). In a separate study of gym users, male respondents achieved a nutrition knowledge score of 61.5%, indicating a moderate level of understanding (Finamore et al., 2022). Professional karate athletes, however, exhibited a weak knowledge level, averaging only 34.18% (Göbel, 2023).

Approximately 60.6% of athletes reported using supplements, primarily vitamins (Labovic et al., 2024). A significant portion of gym users (46.4%) also reported supplement use, with multivitamins being the most common choice (Finamore et al., 2022).

Athletes often rely on trainers for nutritional information, with 28.6% making decisions based on trainer recommendations. In contrast, many recreational users seek information online, which poses a risk of encountering misinformation (Labovic et al., 2024).

Given these findings, it is crucial to recognize that low knowledge about supplementation can lead to improper use and potential health risks. This underscores the need for enhanced education and guidance in sports nutrition.

Most groups evaluated did not meet the established knowledge acceptance threshold of 50% on the Nutritional Knowledge Questionnaire (NSKQ). This threshold is considered a baseline level of understanding that is crucial for athletes and non-athletes to make informed nutritional choices. Specifically, 85.7% of athletic and 92.9% of non-athletic students scored below this acceptable level. A closer analysis of knowledge distribution indicated that only 14.3% of athletic and 7.1% of non-athletic students attained a 50% or greater knowledge score.

In a study examining Division II female athletes, the overall nutritional knowledge score was 54.7%, signifying a considerable lack of understanding, with only 8.4% successfully passing the assessment (Allie et al., 2024). However, this data also suggests a potential for positive change, with the majority of athletes having the capacity to improve their nutritional knowledge. Additionally, athletes in combat sports reported an average nutritional knowledge score of 55%, highlighting a critical gap in their understanding of nutrition (Dunican et al., 2024). In contrast, a more positive outcome was observed among Ugandan endurance athletes, as 68% exhibited a commendable level of knowledge regarding sports nutrition (Musau et al., 2024).

Conclusion

The findings reveal that both athletic and non-athletic students exhibit insufficient knowledge of nutrition, as demonstrated by their low NSKQ scores. The absence of a significant difference between the two groups highlights the critical need for comprehensive nutrition education programs to bridge these knowledge gaps effectively.

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قياس مقدار ثقافة التغذية الرياضية لدى الرياضيين وغير الرياضيين من الذكور، دراسة مقطعية عرضية

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الملخص

هدفت الدراسة إلى مقارنة مستوى الثقافة الغذائية بين الرياضيين وغير الرياضيين من الطلاب الذكور في الجامعات. شملت هذه الدراسة طلاب الجامعات الذكور من جامعات المنوفية والسادات وزقازيق في مصر. شارك في الدراسة ما مجموعه 84 طالبًا: 28 رياضيًا من كليات التربية الرياضية و56 غير رياضيين من كليات أخرى. تم اختيار الطلاب الذكور في السنة الثالثة أو الرابعة، الذين تتراوح أعمارهم بين 20 و23 عامًا والذين وافقوا على المشاركة، في الدراسة. وتم استبعاد المشاركات الإناث، أو الذين كانوا يشاركون في دروس التغذية لغير الرياضيين، والذين يعانون من إعاقات أو مشاكل صحية عقلية، والذين يعانون من أمراض مزمنة. تم في هذه الدراسة الوصفية تقييم مقدار ثقافة التغذية الرياضية باستخدام استبيان ثقافة التغذية للرياضيين .(NSKQ) تم قياس طول الجسم (سم)، وزن الجسم (كجم)، ومؤشر كتلة الجسم (كجم/م2) للمشاركين. تم تحليل البيانات المجمعة إحصائيًا وعرضها من حيث التكرار والنسبة المئوية والمتوسط والانحراف المعياري. كان جميع المشاركين رجالًا تتراوح أعمارهم بين 20 و23 عامًا، 71.4% من الرياضيين و82.1% من غير الرياضيين من المناطق الريفية. كان 14.2% من غير الرياضيين يعانون من السمنة، في حين أن الرياضيين لم يكونوا كذلك. على الأقل 50% من ثقافة إدارة الوزن كانت معروفة من قبل 57.1% من الرياضيين و21.4% من غير الرياضيين. كانت مجالات المغذيات الكبيرة خاطئة بنسبة 64.3% في كلا المجموعتين. فشل 78.6% من الرياضيين و67.9% من غير الرياضيين في متطلبات 50% لمجال المغذيات الدقيقة. في مجال التغذية الرياضية، فشل 92.9% من الرياضيين و89.3% من غير الرياضيين في هذا المعيار. كانت ثقافة المكملات الغذائية أقل من 50% بالنسبة لـ 78.6% من الرياضيين و85.7% من غير الرياضيين. معظم المجموعات حصلت على درجات أقل من 50% في اختبار المعرفة بالمكملات الغذائية (NSKQ)، بما في ذلك 85.7% من الطلاب الرياضيين و92.9% من الطلاب غير الرياضيين.

الكلمات المفتاحية :استبيان ثقافة التغذية للرياضيين، إدارة الوزن، المكملات، الأداء، التثقيف الغذائي.