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Nutrition knowledge and practices among Palestinian athletes

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ABSTRACT

Athletes, who have sufficient knowledge on the importance of nutrition, attitudes and dietary habits, are believed to have better performance. The purpose of the current study is to determine the level of nutrition knowledge related to sports, to determine the nutrition information sources, and to explore the use of ergogenic supplementation among the study sample. In this descriptive study, athletes were required to fill out pretested questionnaire, which consisted of four parts including; socio-demographic and medical history, nutrition status assessment which included anthropometric measurements, dietary practices, ergogenic supplementation use, and developed nutrition knowledge questionnaire. The statistical analysis was done using descriptive analysis, Cronbach Alpha was used to determine the reliability of questionnaire. Independent t-test and ANOVA were done to determine the differences between the selected variables. A total of 170 Palestinian athletes are involved in the final analysis study. The sample consists of males only. The mean of the nutrition knowledge score is (8.91 ± 2.5) out of 21. It is observed that employment status and monthly income has an influence on nutrition knowledge score among athletes. Overall, 59.3% of participated athletes use ergogenic supplements; mostly energy drinks (28.8%) while anabolic steroid is the least type of supplements used by the athletes. The majority of the athletes rely on coaches and internet as a primary source for their information. The nutrition knowledge score seems to be insufficient among participated athletes. The gaps in nutrition knowledge are evident. A better comprehension of nutrition knowledge among athletes, especially the gaps in knowledge will let nutrition education interventions to emphasize specific areas, which in turn, require more awareness and improvement.

Keywords: Nutrition Knowledge; Diet Behaviors; Nutrition Attitudes; Sports Nutrition; ergogenic aids; Palestine.

INTRODUCTION

Athletic performance is promoted by consuming sufficient nutrition. In general, low levels of energy intake can lead to reduced athletes' performance, a higher risk of fatigue and injuries, and delayed recovery process in athletes. The fundamental purpose of a training diet is to supply athletes with adequate nutritional requirement with an intention to be healthy and to maximize exercise outcomes, however, increasing metabolic and functional adaptations to a periodized training schedule which helps an athlete to achieve performance requirement of the event [1].

For an ideal performance, nutritional requirements optimize athletic performance need be met, and involves adequate quantities of energy and timing of meals. The suggested diet, for an athlete, is recommended to contain at minimum three meals a day, in which the daily amount of protein must be 10-15% of the total energy; carbohydrate intake is 55%; and fat content is 30% or lower. Consumption of adequate nutrition coincides to optimal athletic functionality, whereas insufficient intake may result in decreased athletic achievements. Limiting energy consumption and wastage of fat and muscle mass negatively influences athletic achievements. It is fundamental for athletes to maintain a suitable weight and fat mass for peak athletic performance [2-4].

In addition to calories requirement and meals pattern, dehydration has especial concern for athletes. Dehydration increases the

perception of stress and effort which can weaken performance. Therefore, sufficient amounts of fluids prior, within, after training is crucial and the cornerstone for optimal athlete performance. The main target for consuming fluids within a training session is to replace the water loss via sweat. After a training session, it is mandatory for an athlete to measure their weight to estimate the volume of water loss and to consume appropriate amounts of fluids to restore fluid balance. So an athlete is advised to drink approximately 1.25 -1.5 liter for each one-kilogram body weight loss [5].

Ergogenic aids are defined as a substance or an approach used to improve performance. These ergogenic aids are categorized as pharmacologic, nutritional, psychologic or physiologic and range from utilize of passable approaches (e.g. carbohydrate loading) to unsafe and illegal aids (e.g. anabolic-androgenic steroids use) [6]. The prevalence of using supplements by athletes was internationally evaluated to be at 37% to 89%, with higher proportions being declared among older and elite athletes [6].

Anabolic-androgenic steroids (AAS) are one of the most broadly abused hormones taken especially by bodybuilders in order to increase their muscle size. It was assessed that 1 out of 5 American athletes are utilizing one type or more of AAS [8]. In a study conducted by Tahtamouni et al. [9] among Jordanian athletes reported, around 26% of the participants uses AAS, however, the researcher expected higher percentage of AAS consumption.

The use of caffeine is very common among athletes, with documented evidence of side effects and ergogenic response. The effectiveness of caffeine was investigated in various studies [10,11]. According to Del Coso et al. (2011), 3 out of 4 physically active subjects had ingested caffeine prior to or within sports events [12].

Protein is one of the most common dietary supplements sold to physically active subjects. This type of supplements has been recommended to promote nitrogen retention and boost muscle mass, and to stop protein breakdown during long periods of training. In fact, Protein have been considered among the most preferable sports supplements [13]. Up to our knowledge, the prevalence of ergogenic supplements use among Palestinian has not been investigated in published studies.

Nutrition education among athletes is fundamental for achieving performance. It is well-known that athletic performance, recovery from training, physical activity, athletic performance is all enhanced with the appropriate nutrition [4]. Various trials have confirmed that nutrition education will enhance nutrition knowledge among athletes. However, it is still unobvious if the good knowledge turns into good eating behavior; though it is supposed that individuals with a primary knowledge of nutrition will apply that knowledge when selecting foods [14, 15].

There are various causes why nutritional consultation is not pursued. It may be due to the shortage of awareness or acquaintance, and concern of making an alteration in one's diet, or some perceived obstacles that may prohibit individuals from consuming healthier regimen such as dearth of money, or scarcity of time. Athletes may depend on coaches for nutrition advice in several kinds of sports. Thus, when coaches have inaccurate information about nutrition, this will turn into a possible trouble for athletes, too. Nutrition education can be transmitted to individuals by constant and broad training courses as well as the individual educating himself on his own institution. Several researches have concentrated on the exigency of nutrition education [16-18].

Palestinian Central Bureau of Statistics [19] states that the number of sports centers in West Bank region has reached 632. This can be an indication for the increased number of athletes in West Bank region. Therefore, these athletes need nutritional knowledge to optimize their dietary habits for good performance and health. However, literature lacks data about the level of nutrition knowledge, and the prevalence of consuming sports supplements, energy drinks (e.g. caffeinated beverages) and growth hormone among athletes in West Bank area.

For this reason, this study is designed as a completion of a previous cross-sectional study, which was made on a sample of Physical Education students of An-Najah National

University, in order to know the percentages of the use of ergogenic aids and supplements among athletes and to explore nutritional knowledge and behaviors of Palestinian athletes.

METHODS

Study design, settings and population

The current study utilized a cross-sectional design with an aim to evaluate the level of athletes' nutritional knowledge, and the percentage of using ergogenic aids and supplements use among Palestinian athletes in the West bank region. The athletes were selected from thirteen private and local sports clubs from Hebrone, Nablus, Tolkarem and Jenin. The clubs were selected to represent the southern and northern districts in west bank, the invitation was sent through the Palestinian Football Association (the governing body for football in Palestine- Higher Council of Youth and Sports). The invitation was send to the principle of each club by post on the official page of the association on face book. The clubs who respond and agreed to cooperate were visited by the research team. All types of sports were included in the invitation, including the available team and individual sports. The data collection started after personal consent from each athlete to join the study.

Data collection

Data collection started on February 2018 and ended on June 2018. A pretested, structured questionnaire was used to collect the data, and the athletes were asked to fill their answers, without referring to the internet or any other information sources. Similarly, they were asked to answer the questions individually and they informed that they may ask the research team if any clarification is needed. The collected data included: sociodemographic data, medical history, nutritional status assessment, nutritional practices and attitudes, and nutritional knowledge. Sociodemographic data included gender, marital status, educational level, monthly income, working status, and living status. Self-reported questions regarding medical history, smoking habits, sport supplements and ergogenic aids, and nutritional practices and attitudes were also included in the questionnaire. The athletes' nutritional status was done using the anthropometric measurements (weight and height) [20]. The measurements were measured in duplicate then the mean was recorded. The body mass index (BMI) was calculated from the weight and height. Then, the BMI was categorized according to world health organization (WHO) cut off points [21]. A nutrition knowledge questionnaire was also included in order to access athletes' nutritional knowledge.

Sample size and sampling procedure

The sample size was estimated depending on the number of athletes in each club. G power software for sample size calculation was used with 5% margin of error and 95% confidence level. The sampling method used in the study is convenience sampling. The required sample size was 145 participants. The inclusion criteria were all Palestinian athletes (over 18 years old), who are registered in a registered club belong to the Higher Council of Youth and Sports, willing to participate and to provide all the required data. The exclusion criteria included athletes who missed to answer primary questions, and those who refused to join the study or sign the consent form.

Ethical consideration

The study protocol was approved by the Deanship of Scientific Research Ethical Committee at Palestine Polytechnic University committee. Permissions and approval to conduct the study were obtained from the Higher Council of Youth and Sports. All athletes who are registered in an accredited club, which belong to the ministry of youth and sports, were briefed about the study design, objectives, and the type of data that would be collected, with affirmation on the optional participation. Athletes who agreed to sign the consent form were included in the data collection.

Nutrition knowledge questionnaire development

The questionnaire was developed after reviewing many studies and guidelines regarding the sport nutrition, what athletes should eat? How much? when and what? Similar studies were reviewed to determine the knowledge gaps such as Rosenbloom et

al [18], Zawila et al [14], Juzwiak and Ancona-Lopez [22], and Ersoy [23]. The first Arabic version of the questionnaire was developed by three registered dietitians. Content validity was done by sending the primary draft of the questionnaire to 7 evaluators; five of them were holding a PhD degree in nutrition, and the other two were assessment experts. Their feedback was considered in language corrections, rewording and delete three items for redundancy. A pilot study was conducted among 30 participants, who were asked to fill the questionnaire, and were not permitted to refer to any sources of information while responding to the questions. The reliability test was done using Cronbach alpha, 7 items were deleted to increase the reliability. For the final study, 20 items were used with Cronbach alpha = 0.71. In order to estimate the knowledge of nutrition, the volunteers were given 20 nutritional phrases which can be answered as "correct", "false", or "I do not know", 1 mark was given for each correct answer, 0 was given for incorrect answer or for I don't know. The total score was estimated according to the sum of the correct answers to get the overall score out of 20.

Dietary practices

The questionnaire included also dietary practices questions. This part was designed in order to gather information about athletes' dietary practices in a typical day and in exercise day. There were 13 true-false questions related to dietary practices and habits.

Ergogenic supplements use

The questionnaire also examined the proportion of athletes using ergogenic aids. In this part of the questionnaire, there were 8 true-false questions related to different types of ergogenic supplements including protein supplements, amino acids supplements, vitamin and mineral supplements, caffeine beverages, hormones, anabolic steroids, herb or natural products, and energy drinks. The athletes need to answer yes or no for the consumption, if the answer yes, the athletes were asked to report the frequency and the amount of consumption, in addition to the period, and for how long they consume them.

Statistical analysis

The Statistical package for the social Sciences SPSS, version 21 was used to analyze the collected data. The normality test was done for the nutritional knowledge scores using Kolmogorov-Smirnov test. Descriptive analysis including the means and the standard deviations were used to analyze data pertained to continuous dependent and independent variables. The categorical data were described by percentages. Independent t-test and ANOVA tests were conducted to examine the differences between selected independent variables on the total score of the nutritional knowledge, and the nominal level of significance is set to be 0.05.

RESULTS

Socio-demographic Characteristics

Athletes' characteristics are epitomized in Table 1. 170 male athletes were included in the study.). The majority of the athletes (91.2%) are stated to be single, while (7.6%) are married, and (1.2%) are stated as others "e.g. widow, divorced". Participated athletes represent six different types of sport; (80%) football, (7.6%) volleyball, (5.6%) running, (3.5%) tennis, (2.4%) basketball, and (0.6%) gymnastics. Nearly half of the participated athletes (49.4%) are lived in cities, while (42.2%) are lived in villages, and (8.2%) in camps. The majority of athletes (91.2%) are determined to live with their families, whereas others live with their wives and children (4.7%), and alone (1.2%). About three quarter of athletes (71.8%) are unemployed, while the rest (28.2%) are employed. The mean age of the sample was (21.26 ± 3.31).

Table (1): Athletes socio demographic characteristics displayed in frequency and percentages.

Variables		Total (170 males)	
		Frequency (F)	**Percentage (%)**
Marital Status	Single	155	91.2
	Married	13	7.6
	Other "e.g. widow, divorced"	2	1.2
Type of sport	Basketball	4	2.4
	Football	136	80
	Gymnastics	1	0.6
	Running	10	5.6
	Tennis	6	3.5
	Volleyball	13	7.6
Location	Camp	11	8.2
	City	38	1.91
	Village	38	18
Employment status	Employed	51	28.2
	Unemployed	119	71.8
Family Income	Less than 3000 NIS	83	8198
	3000-5000 NIS	31	1894
	More than 5000 NIS	83	98
Player Income	Less than 3000 NIS	110	64.7
	3000-5000 NIS	27	15.9
	More than 5000 NIS	33	19.4
Living Status	With family	157	92.3
	Wife and children	8	4.7
	Alone	1	0.6
	Others "hostel"	4	2.4

NIS: New Israeli Shekel

Sport and training data

The majority of the participants play football 80%, volley ball 7.6%, Gymnastics 6%, running 5.9%, tennis 3.5% and Basketball 12.4% and karate 3.5% as the major and main sport. Additionally, 49% of the participants reported that they play more than one sport. The mean of training hours was 7.3±7.2 hour/ week, ranged from 3 hours to 20 hours per week. In regard to the years of training, the mean 5±3.6 years ranged from 1 year to 13 years.

Medical history and smoking

It is found that about (82.4%) of the participated sample are non-smokers. The results also reveal that the majority of the participants (98.8%) doesn't suffer from chronic diseases.

Nutritional status

Figure 1 illustrates that 79.8% of the athletes were normal weight. Only 1.8 % of them were underweight.

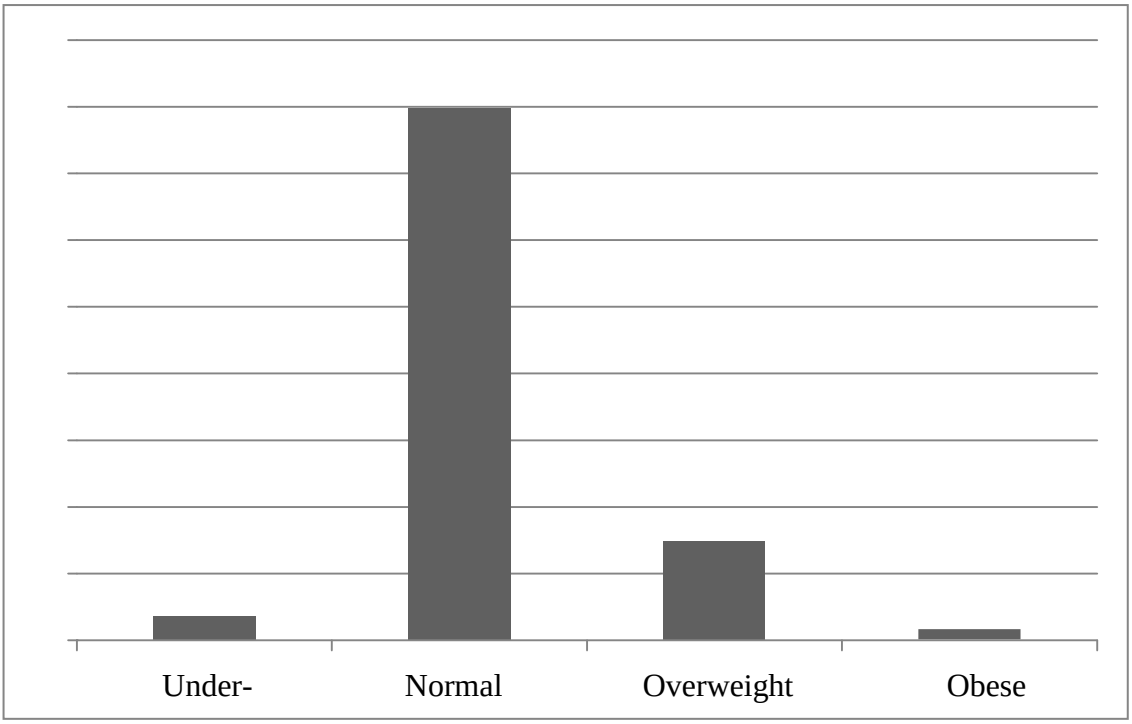

Figure (1): BMI classification of athletes.

Consumption of ergogenic aids

The results reveal a considerable consumption of ergogenic aids among Palestinian athletes. As it is demonstrated in Table 2, the most used ergogenic aids on a daily basis among Palestinian athletes was energy drinks and natural or herbal products by 28.8% and 7.6% respectively.

Table (2): Consumption of Supplements by athletes displayed in frequency and percentages.

Type of supplement	Yes N (%)	No N (%)
Amino acids	6 (3.5)	164 (96.5)
Energy drinks	49 (28.8)	121 (71.2)
Herbs or natural products	13 (7.6)	157 (92.4)
Hormones	7 (4.1)	163 (95.9)
Protein	6 (3.5)	164 (96.5)
Steroids (ASS)	1 (0.6)	169 (99.4)
Vitamins	18 (10.6)	152 (89.4)
Any other supplements not mentioned previously	1 (0.6)	1699.4)

Dietary practices and habits

The results also show that more than half of the athletes (62.3%) weigh themselves on regular basis. And a few percentages of athletes (16.5%) follow a special diet. Data regarding dietary practices and habits are summarized in Table 3.

Table (3): Dietary habits and practices displayed in numbers and percentages.

Dietary practices & habits		Total= 170	
	Yes N (%)	Sometimes N (%)	No N (%)
Regular weight measurement	106(62.3)	---	64 (37.7)
Weight measurement before &after exercises	6 (3.5)	86 (50.5)	79 (46.4)
Eat 3 meals/day	121(71.2)	---	49 (28.8)
Eat between meals	125(73.5)	---	45 (26.5)
Eat outside your home	123(72.4)	---	47 (27.6)
Follow a diet to lose or gain weight	143 84.1)	---	27 (15.9)
Follow a special diet for athletes	28 (16.5)	---	142 (83.5)
Number of meals differ between training & regular days	56 (32.9)	65 (38.2)	49 (28.8)
Eat a meal before training	41 (24.1)	36 (21.2)	93 (54.7)
Drink water during exercise session	127(74.7)	30 (17.6)	13 (7.6)
Drink sport drinks/ juices during exercise session	41 (24.1)	40 (23.5)	89 (52.4)
Eat large amounts of salty foods	39 (22.9)	41 (24.1)	90 (52.4)
Eat a meal immediately after exercise session	114 (67.1)	38 (22.4)	18 (10.6)
Follow special diet before competition	69 (40.6)	19 (11.2)	82 (48.2)

Nutrition knowledge score

Table 4 shows the participants nutrition knowledge mean scores. The overall mean score was (8.91 ± 2.5) out of 21, ranged from 4 to 14 scores. As percentages, the mean score of the correct answer was 42.2%, ranged from 20.2% to 66.7% correct answers. Our analysis also reveals that the majority of participants (77.2%) responded correctly to phrase number 9 "the last meal before a competition should be consumed directly before the competition", while only (12.0%) of participants answered the following phrase "Protein is the major energy source for the muscle" correctly.

Table 5 presents the relationship between athletes' nutrition knowledge and socio-demographic variables. The mean nutrition knowledge scores and standard deviation are displayed according to demographic variables. To detect whether there are differences in the mean nutrition knowledge scores attributed to the socio-demographic variables, the independent t-test (in case of the variable has two levels) and the ANOVA test (in case of the variable has more than two levels) are used. The only significant differences were recognized in the athletes' employment status and family income as p-values were 0.002 and 0.001, respectively. Since employed athletes (9.63 ±2.37) got higher scores than unemployed athletes (6.34 ± 2.47); furthermore, athletes whose family income is less than 3000 (9.71 ± 2.22) got the highest score in comparison with the other two groups. Table 6 presents the relationship between nutrition knowledge score with dietary habits. There were no significant differences in the mean score according to the dietary habits using independent t-test $p>0.05$ for all of the variables.

Table (4): Frequencies and percentages of participant athletes responded to 27 nutritional knowledge items.

Knowledge item	CA N (%)	WA/ DK N (%)
1. Protein is the major energy source for the muscle (F)	20 (12.0)	150 (88.0)
2. Fats have essential roles in the body (T)	117 (68.9)	53 (31.1)
3. During the activity, feeling thirsty is a sufficient 4. indicator of the need for fluids (F)	41 (24.4)	129 (75.6)
5. Vitamin consumption can supply the body with great amounts of energy. (F)	27 (15.8)	143 (84.2)
6. Dehydration can minimize athletic performance. (T)	118 (70.1)	51(29.9)
7. The last meal before a competition should be consumed directly before the competition. (F)	131 (77.2)	39 (22.8)
8. Athletes need to consume the same amounts of energy-dense foods as not physically-active individuals. (F)	63 (37.3)	107 (62.7)
9. Salt has a major role in a healthy diet. (F)	102 (59.9)	68 (40.1)
10. An athlete needs to consume greater amounts of salt and salty foods than not physically active individuals, especially during an intensive training session. (T)	54 (31.7)	116 (68.3)
11. The body can store excess amounts of proteins in the muscles. (F)	30 (17.4)	140 (82.6)
12. Consuming greater amounts of meats and eggs will increase muscle size. (F)	17 (10.2)	153 (89.8)
13. Equal amounts of carbohydrate and protein have approximately the same caloric value (T)	56 (32.9)	114 (67.1)
14. The body can store limited amounts of excess sugar in the body as glycogen. (T)	100 (58.7)	70 (41.3)
15. Caffeine-containing beverages can increase the body ability to bear fatigue during a training session. (T)	68 (40.1)	102 (59.9)
16. Insufficient intake of fluids and energy drinks can result in dehydration, which in turn, can affect the ability of training and endurance. (T)	128 (75.4)	42 (24.6)
17. During the day and training session climate temperature plays an important role in determining the quantity of fluids needed by the body. (T)	143 (85.0)	25 (15.0)
18. Dietary supplements are recommended for all athletes aiming to enhance their performance (F)	33 (19.2)	137 (80.8)
19. Zinc and other vitamins are needed for all physically active individuals to boost immunity. (F)	80 (47.3)	90 (52.7)
20. Underweight athletes have greater ability to bear fatigue and training sessions. (F)	84 (49.4)	86 (50.6)
21. Consuming small amounts of carbohydrate have unfavorable effect on health, and it can also minimize the level of athletic performance. (T)	89 (52.4)	81 (47.6)

(True answers are coded with T; false answers coded with F; don't know answers are coded with DK).

Table (5): Athletes mean nutrition knowledge scores according to demographic variables.

Variable		N	Mean ± SD	p-value
Marital Status	Single	149	8.87 ± 2.50	0.229
	Married &others "e.g. widow, divorced"	15	9.33 ± 2.96	
Occupational status	Employed	48	9.63 ± 2.37	0.001*
	Unemployed	107	6.34 ± 2.47	
Family Income	Less than 3000 NIS	48	9.71 ± 2.22	0.002*
	3000-5000 NIS	60	7.97 ± 2.64	
	More than 5000 NIS	30	9.47 ± 2.40	
Player income	Less than 3000 NIS	73	8.71 ± 2.76	0.490
	3000-5000 NIS	19	9.11 ± 2.90	
	More than 5000 NIS	22	8.86±0.86	
Living Status	With family	151	8.81 ± 2.54	0.398
	Wife and children	8	10.00 ± 3.30	
	Alone	1	9.00	
	Others "hostel"	2	11.00 ±0.00	
Bodyweight Status	Underweight	6	8.33 ± 1.03	0.597
	Normal weight	128	8.86 ± 2.66	
	Overweight	25	9.24 ± 2.22	
	Obesity	3	7.33 ± 1.15	

*significant at $p<0.05$ using ANOVA test

Table (6): Athletes mean nutrition knowledge scores according to dietary habits and practices.

Variable		Frequency (N)	Mean ±SD	p-value
Regular weight measurement	No	59	8.66 ± 2.48	0.527
	Yes	104	9.07 ± 2.60	
Weight measurement before &after exercises	No	76	8.55 ± 2.43	0.216
	Sometimes	81	9.31 ± 2.65	
Eat 3 meals/day	No	45	8.13 ± 2.84	0.152
	Yes	119	9.21 ± 2.38	
Eat between meals	No	38	8.74 ± 2.38	0.166
	Yes	119	8.94 ± 2.68	
Eat outside your home	No	47	9.42 ± 2.72	0.644
	Yes	117	8.71 ± 2.46	
Follow a diet to lose or gain weight	No	137	8.86 ± 2.56	0.801
	Yes	27	9.19 ± 2.54	
Follow a special diet for athletes	No	136	8.72 ± 2.55	0.565
	Yes	28	9.88 ± 2.41	
Sources of Nutrition Information	Internet	51	8.92 ± 2.80	0.677
	Seminars	10	8.10 ± 3.38	
	Couch	59	8.85 ± 2.48	
	Specialized nutritionist	44	9.18 ± 2.17	

Variable		Frequency (N)	Mean ±SD	p-value
Sources of Nutrition Information	No	49	8.37 ± 2.38	0.216
	Yes	53	9.19 ± 2.58	
Eat a meal before training	No	91	8.74 ± 2.40	0.295
	Yes	39	9.62 ± 2.69	
Drink water during exercise session	No	13	9.69 ± 2.21	0.146
	Yes	122	9.01 ± 2.64	
Eat a meal immediately after exercise session	No	16	8.88 ± 2.96	0.635
	Yes	110	8.94 ± 2.62	
Follow special diet before competition	No	78	8.64 ± 2.64	0.330
	Yes	66	9.42 ± 2.42	
Consumptionof protein supplements	No	158	8.96 ± 2.54	0.840
	Yes	6	7.83 ± 2.93	

*significant p <0.05 using independent t-test.

DISCUSSION

The current study is designed in order to determine level of nutrition knowledge and the prevalence ergogenic supplement use among Palestinian athletes. Out of the 20 nutrition knowledge questions, there were 6 questions focused on macronutrients (Carbohydrate, Protein and Fat), 4 on micronutrients (Vitamins and Minerals), 4 on hydration, 2 on ergogenic aids and supplements, while the other 4 phrases were specialized in diet practices and attitudes.

Nutrition knowledge score

From the analysis of the results, the nutrition knowledge score among Palestinian athletes in the current study was determined to be inadequate. The results reveal that the mean nutrition knowledge score was (8.91 ± 2.54) out of 21, and this finding is considered similar to former studies conducted by Ozdoğan & Ozcelik (12.25 ± 3.52) [16]; Torres-McGehee et al (54.9±13.5) [24]; Devlin & Belski (17.9 ± 3.0) [25]; Andrews et al (14.3) [26]. It is also found that the mean score was higher among married, divorced category in comparison with single category but there were no significant differences between the two groups. The mean score of athletes, who are taking the nutritional information from a specialized nutritionist, was higher than the mean score of athletes depending on internet, seminars, or coaches as sources of their information.

The current study confirmed that the financial status of the athlete has an influence on the nutritional knowledge score, as the level of income is lower than 3000 or higher than 5000, the greater is the knowledge score. In fact, financial status is usually used in nutritional research especially dietary knowledge and behavior. This result is consistent with previous studies [27, 28]. Employment status also affected knowledge score; respondents who were employed either part time or full time had the highest score when compared to unemployed respondents. This finding is supported by the literature, in a trial performed by Hendrie et al. [29], it was noticed a significant difference in nutritional knowledge level between employed and unemployed volunteers.

The areas of nutrition knowledge that appeared to be lacked in this general sample, as confirmed by lower than 50% of the participated athletes answering the nutritional questions correctly, were the role of macronutrients (especially protein), the importance of micronutrients in the body (especially sodium), the role of ergogenic aids (e.g. caffeine) in bearing fatigue, and the calories of macronutrients.

In the current study, it was reported that most athletes (89.9%) responded wrongly to the statement "consuming greater amounts of meats and eggs will increase muscle size". This observation is consistent with former

study conducted by Jacobson et al. [30] where 13% of their athletes believed that protein has a role in increasing muscle size. In fact, only the essential amino acids are considered essential to trigger muscle protein synthesis. Furthermore, it has been confirmed that carbohydrates alone have a minimal effect on muscle protein synthesis, but consuming carbohydrates in combination with amino acids have a synergistic effect on muscle protein synthesis. And for athletes attempting to increase or even maintain muscle mass, they are recommended to consume a minimum of 6g essential amino acids, with or without 20-30g of carbohydrate [30, 31].

Proteins can be utilized as a source of energy only if the body has limited stores of carbohydrate [1]. Only 12% of the athletes correctly answered the nutritional phrase "protein is the major energy source for the muscle". This finding was also similar to two former studies; Webb & Beckford [32] have found that 20% of participants answered this question correctly and Zawila et al. [14] also explored that only 31.7% of women runners answered this question truly. While Ozdoğan & Ozcelik [16] have found a different result, as 77.8% of the participated athletes in their study responded to this question correctly.

Only 47.3% of the athletes have responded correctly to the nutritional phrase "Zinc and other vitamins are needed for all physically-active individuals to boost immunity". Furthermore, the question "dietary supplements are recommended for all athletes aiming to enhance their performance" was not responded well by the participated athletes with only 19.2% correctly selecting "false" which was the case in two previous trials; Webb & Beckford [32] have found that 10.5% of participants answered this question correctly, and Zawila et al. [14] have found out that only 10% of participated runners answered this question truly. Whereas a study conducted by Ozdoğan & Ozcelik [16] was found that participated athletes answered the same question well, where 67.9% of the answers was correct. Vitamin supplements don't improve the athletic performance among well-nourished athletes; thus it can be stated that as a balanced diet is consumed, which ensure adequate amount of calories, further vitamin supplements are not needed.

Water and electrolytes balance and hydration are believed to be an essential aspect of athletes' life. It's important to note that water requirement is influenced by various factors including duration and intensity of exercise, humidity, and temperature. In normal conditions, thirst may be sufficient to trigger fluid intake; however, in intense exercise sessions, thirst may be not a valid indicator of dehydration among athletes which increase the risk of impaired performance and possibly life-threatening heat-related injury. The rate of athletes who correctly answered the question "During the activity, feeling thirsty is a sufficient indicator of the need for fluids" was 24.4%, which was also the case in a study conducted by Webb & Beckford [32]. Whereas Ozdoğan & Ozcelik [16] have found a different finding, as the percentage of athletes being well-informed about this fact was higher than half the percentage noted in the current study. However, 70.1% of athletes correctly selected "true" as an answer to "Dehydration can minimize athletic performance" statement. This finding is supported by the literature [32, 33].

Dietary practices associated with sport performance

Pre/post – exercise meal

According to Thomas et al. [1], consuming a meal 1-4 hour before an exercise or a sporting event can contribute to carbohydrate storage in the body, maintain gastrointestinal comfort and assure hydration status during an exercise session. The timing, amount and type of pre-workout meal vary from one athlete to another based on their tolerance and preferences Limited studies have discussed the diet practices of athletes and there was no consistency in the discussed statements; therefore, comparisons to other studies are a little bit difficult. The consumption of meal before a sporting event or a training session among Palestinian athletes was (24.1%), which was consistent to two previous studies [34, 35]. On the contrary, most of the participated athletes (67%) consumed a meal post –exercise. Similarly, Walsh and colleagues observed that 62% of their athletes ate a meal after a training session.

Weight follow-up

Athletes' weight plays a fundamental role in physical performance, as well as long-term health. The determination of the energy requirements of an athlete depends on his/her average daily energy expenditure, as well as if the athlete needs to lose weight, maintain weight, or gain weight. Thus, it is very essential to start the nutrition assessment process by addressing and evaluating this issue thoroughly. Continuous measurement of body weight before and after the exercise session is also considered essential for all athletes since this strategy enables the athlete to evaluate the amount of sweat losses throughout sport events or activities; therefore, enables them to restore hydration and body mass through fluid and food intake [1, 30]. In the current study, it is reported that only 3.5% of athletes weigh themselves pre and post exercise session. No previous studies addressing weight follow-up were found.

Hydration

Dehydration can negatively influence athletic performance possibly by elevating cardiovascular strain, glycogen utilization, and body temperature, changing metabolic function and reducing cognitive function. Exercise-induced dehydration may also detrimentally impact saliva antimicrobial immunoglobins and proteins related to mucosal immunity, therefore possibly increasing the risk for infection. Thus, it is essential that athletes maintain an adequate hydration status during exercise. In addition to the habitual daily water losses through gastrointestinal, renal, respiration and sweat sources, athletes have urgent necessary to replace sweat losses. Besides water, sweat also consists of considerable quantities of sodium, with lesser quantities of magnesium, potassium, and calcium. Therefore, athletes should maintain their euhydration status pre, during, and post exercise session. The consumption of sports drinks is one of the approaches that can be used by the athlete to replace water and electrolyte loss since these fluids contain carbohydrate (6-10%), electrolytes (especially sodium and potassium) and flavor [1, 36,37]. In our study, it was noted that the percentage of athletes consuming sports drinks or fruit juices (41%) during exercise session was higher in comparison with a study performed by Manore et al. [34], where it was demonstrated that the consumption of sport drinks and fruit juices throughout the exercise session were by 12% and 5.8%, respectively. While water consumption by our athletes was approximately 75%.

The use of ergogenic supplements

The use of ergogenic supplements has become more popular over the last decades. Both amateur and professional and athletes are convinced that ergogenic aids are necessary to enhance athletic performance. This study also showed a considerable number of athletes utilize ergogenic aids (59.3%). This result corroborates former observations [38]. As it was reported by Frączek and colleagues that 48.2% of professional Polish athletes use ergogenic aids [38].

However, the percentage of ergogenic supplements use among Palestinian athletes is low in comparison to what was formerly declared [7, 39]. As Hackett and colleagues reported that all bodybuilders "100%" in their study confirmed their use of ergogenic supplements to improve performance [39]. Likewise, in German research conducted by Braun et al. [7], it was found that the percentage of using nutritional supplements among athletes is 80%. One clarification for this result could be that the assessment method for ergogenic supplements uses adopted by the current study may have misevaluated the true prevalence of supplement use in the general sample. However, it is still probable that the mentioned prevalence is a correct representation, since no dietary estimation was taken to make sure that the athletes were suffering from nutritional deficiency, and thus needing ergogenic supplements.

Athletes who used supplements mostly consumed energy drinks (28.8%), followed by vitamin and mineral supplements (10.6%), herbs or natural products (7.6%), hormones (4.1%), proteins and amino acids (3.5%), and the least used ergogenic aid is AAS by 0.6%. Based on some trainers and coaches the prevalence of using AAS should be higher, since some of the participated athletes might have not revealed their abuse.

In general, energy drinks compose from caffeine (active ingredient), guarana, ginseng, B vitamins, taurine, and glucuronolactone. Energy drinks contain approximately 72-300 mg of caffeine per 8-oz serving. Ingesting 150-200 mg/kg caffeine can result in fatal caffeine overdose because of ventricular tachycardia. Athletes consume these drinks to enhance their athletic performance. However, there is incompatible evidence regarding whether athletic performance really improves as a response to energy drinks consumption [40].

Source of nutrition information

Finally, the participated athletes declared that they mostly rely on sources (e.g. internet) or unqualified persons (e.g. coaches). These findings are in agreement with former researches quoting parents, magazines, and coaches as the main source of information [14, 41].

Palestinian athletes were less likely to get their nutrition information from qualified sources such as nutritionists or educational seminars. On the other hand, Jacobson et al.'s [29] athletes mostly get their nutritional information from qualified sources such as athletic trainer, conditioning and strength coaches, or educational seminars; this presents a transformation from previous studies in which magazines or parents were the main source of nutrition information [42, 43].

It is essential to know that most Palestinian conditioning and strength trainers or coaches get little nutrition-specific education in their training and are not capable to provide the same information as a nutritionist or sports dietitian; in other words, Palestine has a shortage in qualified sport-science professionals. Palestinian athletes encounter various problems during their athletic career due to the shortage of suitable facilities and a shortage of access to qualified persons to supply appropriate information.

LIMITATIONS

There were few limitations in this study. Firstly, the general sample contain only male athletes (no females' athletes participated in the current study). Secondly, data collected were self-reported. This may lead to misreporting and recall bias because of the nature of the study. Thirdly, there was no estimation for athletes' dietary intake to see whether they have nutrition deficiency or not. Lastly, the developed questionnaire does not include a comprehensive list of herbal supplements commonly used by the public.

CONCLUSIONS

The present study reveals that nutrition knowledge score among Palestinian athletes was inadequate which could possibly affect the performance and health in a negative way. It was further demonstrated that nutrition knowledge was influenced by employment status and monthly income. To our knowledge, this study is considered the first of its kind on ergogenic supplement use among athletes in Palestine. It unambiguously affirms that Palestinian athletes readily consume ergogenic aid, mainly energy drinks. As it was observed, only a very small proportion of Palestinian athletes obtain the nutrition information from nutritionist or educational seminars while most athletes depend on unqualified coaches or the internet as a primary source for their knowledge.

RECOMMENDATIONS

The study has come out with several recommendations. Firstly, there is a need to develop educational programs targeting the athlete, coach and club administrations to increase the level of awareness and improve practices in the following areas including the importance of fluid replacement, the best strategies to maximize muscle mass, dietary supplements, and ergogenic supplements use "mostly energy drinks". Secondly, further studies are needed to determine if coaches and trainers possess the required nutrition knowledge that will enable them to provide their athletes with accurate information. Thirdly, coaches and athletic trainers should attend workshops and courses to assure that their athletes are not following harmful dietary practices and attitudes. Lastly, clubs and sports centers should hire a dietitian or sports nutritionist.

CONFLICT OF INTEREST

The authors declare no conflict of interest. All researchers involved independently collected, analyzed, and interpreted the results from this study and have no financial

interests concerning the outcome of the current investigation.

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ETHICS APPROVAL AND CONSENT TO PARTICIPATE

A consent form was attached to the questionnaire to be signed by athletes before filling the questionnaire.

REFERENCES

1) Thomas DT, Erdman KA, Burke LM. Position of the academy of nutrition and dietetics, dietitians of Canada, and the American college of sports medicine: nutrition and athletic performance. J Acad Nutr Diet. 2016; 116(3): 501–528.

2) Brooks GA, Fahey TD, White TP, et al, Exercise Physiology: Human. Bioenergetics and its Applications. 3rd ed. Boston: Mc-Graw-Hill Higher Education; p. 2000, 2000.

3) Potgieter S. Sport nutrition: A review of the latest guidelines for exercise and sport nutrition from the American College of Sport Nutrition, the International Olympic Committee and the International Society for Sports Nutrition. South Afr Clin J Nutr. 2013; 26(1): 6–16.

4) Rodriguez NR, Di Marco NM, Langley S. American College of Sports Medicine position stand. Nutrition and athletic performance. Med Sci Sports Exerc. 2009; 41(3): 709-731.

5) Kenefick RW, Cheuvront SN. Hydration for recreational sport and physical activity. Nutr Rev. 2012; 70 (suppl 2): S137-S142.

6) Silver MD. Use of ergogenic aids by athletes. J Am Acad Orthop Sur. 2001; 9(1): 61-70.

7) Braun H, Koehler K, Geyer H, et al, Dietary supplement use among elite young German athletes. Int J Sport Nutr Exe. 2009; 19(1): 97-109.

8) Hall RC, Hall RC. Abuse of supraphysiologic doses of anabolic steroids. South Med J. 2005; 98(5): 550- 555.

9) Tahtamouni LH, Mustafa NH, Alfaouri AA, et al, Prevalence and risk factors for anabolic-androgenic steroid abuse among Jordanian collegiate students and athletes. Eur J Publ Health. 2008; 18(6): 661–665.

10) Astorino TA, Roberson DW. Efficacy of acute caffeine ingestion for short-term high- intensity exercise performance: A systematic review. J Strength Condit Res. 2010; 24(1): 257-265.

11) Tarnopolsky MA. Caffeine and creatine use in sport. Ann Nutr Metabol. 2010; 57; suppl 2: 1-8.

12) Del Coso J, Muñoz G, Muñoz-Guerra J. Prevalence of caffeine use in elite athletes following its removal from the World Anti-Doping Agency list of banned substances. Appl Physiol Nutr Metabol. 2011; 36(4): 555-561.

13) Williams M. Dietary Supplements and Sports Performance: Amino Acids. Sports Nutr Rev J. 2005; 2(2): 63-67.

14) Zawila LG, Steib CSM, Hoogenboom B. The female collegiate cross-country runner, nutritional knowledge and attitudes. J Athl Training. 2003; 38(1): 67-74.

15) Cupisti A, D'Alessandro C, Castrogiovanni S, et al, Nutrition Knowledge and Dietary Composition in Italian Adolescent Female Athletes and non-athletes. Int J Sport Nutr Exe. 2002; 12(2): 207-219.

16) Ozdoğan Y, Ozcelik AO. Evaluation of the nutrition knowledge of sports department students of universities. Sports Nutr Rev J. 2011; 8(1): 11.

17) Rastmanesh R, Taleban FA, Kimiagar M, et al, Nutritional Knowledge and Attitudes in Athletes with Physical Disabilities. J Athl Training. 2007; 42(1): 99-105.

18) Rosenbloom CA, Jonnalagadda SS, Skinner R. Nutrition Knowledge of Collegiate Athletes in a Division I National Collegiate Athletic Association Institution. J Am Diet Assoc. 2002; 102(3): 418-420.

19) PCBS, 2017. Retrieved from: http://www.pcbs.gov.ps/Portals/_Rainbow/Documents/Culture-2017-10A.htm

20) Lee RD, Nieman DC. Nutritional assessment (6th ed.). New York: McGraw Hill. 2013.

21) Nuttall FQ. Body mass index: Obesity, BMI, and Health: A Critical Review. Nutr Today. 2015; 50(3): 117–128.

22) Juzwiak CR, Ancona-Lopez F. Evaluation of nutrition knowledge and dietary recommendations by coaches of adolescent Brazilian athletes. J Strength Condit Res. 2004; 14(2): 222-235.

23) Ersoy G. Egzersiz ve spor yapanlar için beslenme. Ankara: Nobel Yayın Dağıtım, 2004.

24) Torres-McGehee TM, Pritchett KL, Zippel D, et al. Sports Nutrition Knowledge Among Collegiate Athletes, Coaches, Athletic Trainers, and Strength and Conditioning Specialists. J Athl Training. 2012; 47(2): 205-211.

25) Devlin Bl, Belski R. Exploring General and Sports Nutrition and Food Knowledge in Elite Male Australian Athletes. Int J Sport Nutr Exe. 2015; 25(3): 225-232.

26) Andrews A, Wojcik JR, Boyd JM, et al. Sports Nutrition Knowledge among Mid-Major Division I University Student-Athletes. J Nutr Metab. 2016; 2016: Article ID 3172460.

27) Badrasawi MM, Shraim NY, Al-Atrash MH. Knowledge of Physical Education Students about Nutrition: A Cross-Sectional Study from Palestine. Int J Nutr Pharmacol Neurol Dis. 2018; 8(4): 101-107.

28) Hendrie GA, Coveney J, Cox D. Exploring nutrition knowledge and the demographic variation in knowledge levels in an Australian community sample. Public Health Nutr. 2008; 11(12): 1365-1371.

29) Jacobson BH, Sobonya C, Ransone J. Nutrition Practices and Knowledge of college varsity college varsity athletes: a follow-up. J Strength Condit Res. 2001; 15(1): 63-68.

30) Antonio J, Kalman D, Stout JR, et al. Essentials of sports nutrition and supplements. NY: Humana Press, 2014.

31) Layman DK, Baum JI. Dietary protein impact on glycemic control during weight loss. J Nutr. 2004; 134(4): 968S-973S.

32) Webb MC, Beckford SE. Nutritional Knowledge and Attitudes of Adolescent Swimmers in Trinidad and Tobago. J Nutr Metab. 2014; 2014: Article ID 506434, 2014.

33) Davar V. Nutrition knowledge and attitudes towards healthy eating of college-going women hockey players. J Hum Ecol. 2012; 37(2): 119–124.

34) Manore MM, Patton-Lopez MM, Meng Y, et al, Sport Nutrition Knowledge, Behaviors and Beliefs of High School Soccer Players. Nutrients, 2017; 9(4): E350, doi: 10.3390/nu9040350,

35) Walsh M, Cartwright L, Corish C, *et al*, the body composition, nutritional knowledge, attitudes, behaviors, and future education needs of senior schoolboy rugby players in Ireland Int J Sport Nutr Exe. 2011; 21 (5): 365- 376.

36) Broughton D, Fairchild RM, Morgan MZ. A survey of sports drinks consumption among adolescents. Brit Dent J. 2016; 220(12): 639-643.

37) Magee PJ, Gallagher AM, McCormack JM. High Prevalence of Dehydration and Inadequate Nutritional Knowledge Among University and Club Level Athletes. Int J Sport Nut Exe. 2017; 27(2): 158-168.

38) Frączek B, Warzecha M, Tyrała F, *et al*. Prevalence of the use of effective ergogenic aids among professional athletes. Rocz Państw Zakł Hig. 2016; 67(3): 271-278.

39) Hackett DA, Johnson NA, Chow CM.

Training practices and ergogenic aids used by male bodybuilders. J Strength Condit Res. 2013; 27(6): 1609- 1617.

40) Hardy R, Kliemann N, Evansen T, et al, Relationship Between Energy Drink Consumption and Nutrition Knowledge in Student-Athletes. J Nutr Educ Behav. 2017; 49(1): 19-26.

41) Jessri M, Jessri M, RashidKhani B, et al. Evaluation of Iranian College Athletes' Sport Nutrition Knowledge. Int J Sport Nutr Exe. 2010; 20(3): 257-263.

42) Jessri M, Jessri M, RashidKhani B, et al. Evaluation of Iranian College Athletes' Sport Nutrition Knowledge. Int J Sport Nutr Exe. 2010; 20(3): 257-263.

43) Parr RB, Porter MA, Hodgson SC. Nutrition Knowledge and Practice of Coaches, Trainers, and Athletes. Phys SportsMed. 1984; 12(3): 126-138, 1984.