

Knowledge of Physical Education Students about Nutrition: A Cross-Sectional Study from Palestine

Manal M. Badrasawi¹, Naser Y. Shraim², Mahmoud H. Al-Atrash³

¹Department of Nutrition and Food Technology, Faculty of Agriculture and Veterinary Medicine, An-Najah National University, Palestine, ²Department of Pharmacy, Faculty of Medicine and Health Sciences, An-Najah National University, ³Department of Physical Education, Faculty of Educational Sciences and Teachers Training, An-Najah National University, Nablus, Palestine

Abstract

Background and Objectives: Nutrition has a key role in achieving optimal performance level in sports. It was noticed that many athletes do not practice the optimum nutrition habits desired for good health and performance. This study aims to examine the nutrition knowledge levels among sport students at An-Najah National University in Palestine and to identify the associated factors that may influence their knowledge levels. **Materials and Methods:** The study was a cross-sectional observational survey. The questionnaire used in the study included a sociodemographic section and a nutrition knowledge section consisting of 21 questions or statements. The respondent selected from three options: "True," "False," or "I do not know." Kruskal–Wallis and Mann–Whitney tests were conducted to examine the association between selected independent variables and the total score of the nutritional knowledge at $\alpha < 0.05$. **Results:** A total of 249 students were included in the study. A little more than half of the participants were males (136; 54.6%). The mean of the nutrition knowledge score of the students was (11.0 ± 3.1) out of 21 (i.e., 52.4%). The participants' sport nutrition knowledge association with the studied demographic variables showed that the only significant differences were observed in the students' academic year and the level of income. **Conclusion:** The evaluation of nutrition knowledge among sport students at An-Najah National University revealed that the overall nutrition knowledge is insufficient. The result of this study recommends including sport nutrition education course in the program to improve their health, nutritional awareness, and knowledge levels.

Keywords: Knowledge, nutrition, Palestine, physical education students

INTRODUCTION

Nutrition has a vital function in achieving high performance level in sports.^[1] Proper diet for athletes maximizes the exercise capacity and performance during competition, promotes physiological adaptations to training, assists in recovery and protects immune function, and overall health.^[2] The main dietary goal is to obtain adequate nutrition and to optimize health, fitness, and sport performance among the athletes.^[2,3] It starts from providing enough fuels for muscles,^[1] modification of dietary intake, improves the body composition, increases the mean body mass, and decreases the percentage of body fat, which all are required to enhance performance.^[4]

For this vital role, athletes need to learn the healthy food choices, the proper source of energy, convenient meal time according to training schedules, and when and how to eat

during the tournaments. They also need to know how to meet their requirements from both macronutrients (carbohydrate, proteins, and lipids) and micronutrients (vitamins and minerals). For example, fluid intake has special concern in athlete's performance, the daily requirement, types of drinks, proper time, and mode of drinking.^[5]

The application of nutrition knowledge to a practical daily eating plan and to proper eating strategies is important to overall health and wellness.^[1] Research has shown that nutritional knowledge is related to eating

Address for correspondence: Dr. Naser Yousef Shraim, Department of Pharmacy, College of Medicine and Health Sciences, An-Najah National University, Nablus, Palestine.
E-mail: shraim.n@gmail.com

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

How to cite this article: 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;8:101-7.

Access this article online

Quick Response Code:



Website:
www.ijnpnd.com

DOI:
10.4103/ijnpnd.ijnpnd_32_18

behavior and is associated with better nutritional status and better dietary practices.^[6] Heaney *et al.*^[7] reported that athletes with high level of nutrition knowledge have a greater ability to use this knowledge to their daily dietary practices and behavior.^[7]

Some studies explored the nutrition knowledge level among athletes and sport university students to assess their knowledge^[3,8-12] and to design intervention educational programs.^[13] Raymond-Barker *et al.*^[10] went further to assess the nutrition knowledge in female athletes susceptible to female athlete triad syndrome.^[10]

It was found that many athletes do not practice the optimum nutrition habits desired for good health and performance.^[8] They lack sports nutrition knowledge, and so they might disseminate incorrect information.^[9] Inadequate nutritional knowledge among participants was found in other studies.^[8-10,14] Furthermore, the level of nutrition knowledge was reported to be affected by several factors such as gender,^[12] age, the level of education,^[11] and sport disciplines.^[3] However, other studies reported a good overall knowledge of nutrition.^[3] It is maintained that better understanding of nutrition knowledge allows nutrition intervention to target the areas in need for improvement.^[8]

Thus, the current manuscript aims to examine the nutrition knowledge levels among sport students at An-Najah National University in Palestine, as well as to identify the factors that may affect their knowledge levels.

MATERIALS AND METHODS

Study design, participants, and setting

The study design was an observational cross-sectional survey. A questionnaire was administered on Physical Education undergraduate students attending the sports teaching and training classes at the department of Physical Education at An-Najah National University in Palestine.

Sample size and sampling procedure

The sample size was estimated based on the number of students registered at the Department of Physical Education at An-Najah National University in Fall semester of 2017. Raosoft sample size calculator (http://www.raosoft.com/sample_size.html) was used with predetermined margin of error of 5% and confidence level of 95%. A convenience sampling technique was used in this study. Eligible participants had to meet a set of inclusion criteria. These criteria are studying Physical Education; willing to participate and who had provided verbal consent to participate in the study; and completely filled the questionnaire form and answered all questions. The participant students were invited to participate by filling out the questionnaire in the presence of the researcher, and they were not allowed to refer to any information resources while answering the questions.

Data collection form

The data collection form was adapted from Ozdoğan and Özcelik^[15] originally developed and validated to examine the nutrition knowledge of sports department students of universities in Turkey. It contained two parts: the first was allocated for the sociodemographic information (i.e., age, gender, income and area of living, academic standing, sport participation, and training hours) and the second for the 21 items on nutrition knowledge. The items were translated into Arabic to ensure that students understand the meaning of each item. The items on nutrition and sports nutrition were coded following the original scoring system (“1 = Correct,” “0 = Incorrect,” and “0 = Do not know”) and the total score was calculated for each participant.^[15]

Statistical analysis

The Statistical Package for the Social Sciences (SPSS), version 21 (IBM-SPSS Statistics 21) was used to analyze the collected data. The normality test was performed for the nutritional knowledge scores using Kolmogorov–Smirnov test. Descriptive statistics including the means and standard deviations were used with interval data of the continuous dependent and independent variables, and the percentages used with the categorical variables. Kruskal–Wallis and Mann–Whitney tests were conducted to examine the association between selected independent variables and the total score of the nutritional knowledge at alpha <0.05.

Ethical approval

The complete research protocol was approved by the Institutional Review Board at An-Najah National University before the initiation of this study. Besides, informed verbal consent was obtained from the participant students prior to the initiation of the study.

RESULTS

Demographic properties

The total number of students enrolled at Physical Education department was 525 students divided on four different year-levels. Using Raosoft sample size calculator, the sample size was estimated to be 223 participants. However, to minimize erroneous results and to increase the reliability of this study, the target sample size was set to be more. A representative sample was randomly selected from the population and consisted of 249 students. Table 1 shows the demographic characteristics of the sample participated in the study presented in frequencies and percentages. The difference in the number of male students (136; 54.6%) and female students (113; 45.4%) was small. The mean age of the participants was 20.7 ± 1.8 years ranged from 17 to 28 years old. Ninety-three (37.3%) students were third-year students, whereas 62 (24.9%) were first and second years, and only 32 (12.9%) were from fourth year. The mean of years of playing sport games was 3.8 ± 3.1 years, whereas the mean of the daily training hours was 113 ± 70 min/day.

Table 1: Demographic characteristics of the participant students

Demographic characteristics	Frequency	Percentage
Gender		
Male	136	54.6
Female	113	45.4
Place of living		
City	137	55.0
Village	105	42.2
Camp	7	2.8
Living status		
With family	165	66.3
Hostel	84	33.7
Family income		
<2000	30	12.0
2000 to <5000	128	51.4
5000 to <10,000	61	24.5
>10,000	30	12.0
Academic year		
First	62	24.9
Second	62	24.9
Third	93	37.3
Fourth	32	12.9
Years of playing experience		
<5 Years	189	75.9
>5 Years	60	24.1
Favorite game		
Individual	50	20.1
Team	103	41.4
Both	96	38.6
Smoking status		
Smoker	53	21.3
Nonsmoker	196	78.7
Chronic diseases		
Yes	6	2.4
No	243	97.6
Taking vitamins		
Yes	59	23.7
No	190	76.3
Taking ergogenic supplement		
Yes	15	6.0
No	234	94.0
Body mass index		
Underweight	32	12.9
Normal weight	159	63.9
Overweight	49	19.7
Obese	6	2.4

Table 1 summarizes the students' characteristics presented in frequencies and percentages. Figure 1 illustrates the BMI classification of the included students in the study according to their gender.

Nutrition knowledge score

Overall participants showed inadequate knowledge on nutrition and the mean of the nutrition knowledge score

was 11.0 ± 3.1 out of 21 (i.e., 52.4%). The students' scores ranged from 2 to 18 correct answers with a median and interquartile range of 11.^[9-12] The highest score (i.e., 18 out of 21) obtained by 2% ($n = 5$) of participant students in which three of them were in third year and the rest two were of fourth-year level. Table 2 shows the students' knowledge on nutrition associated with the studied demographic variables. More specifically, the only significant differences were observed in the students' academic year and the level of income using the Kruskal–Wallis test. Students in the first year had scored significant lower knowledge compared to the other academic years.

Table 3 demonstrated that the majority participant students answered correctly item number 19 (milk and milk products are the best source of calcium) where 204, 81.9% of the students gave the right answer, followed by question number 5 (vitamin D and sun exposure). A total of 80.7% of the participants answered it correctly, whereas the question with the lowest correct answer was item number 18, where only 14.5% ($n = 36$) of the students selected the correct answer. Detailed results were listed in Table 3.

DISCUSSION

This study is aimed to examine the nutrition knowledge among physical education undergraduate students at a public university in Palestine. Overall, the results of the study revealed that the study sample lacked the essential nutrition knowledge indicated by their low scores on the given items regardless of their demographic characteristics. However, the academic year and the level of income showed significant differences in the mean of nutritional knowledge score, evidenced by the significant mean differences among the groups.

The overall mean score of the nutritional knowledge was 11.0 ± 3.1 out of 21. This score is considered insufficient as all items included basic nutritional knowledge that athletes or sports students should normally know. Similar results were reported in other previous studies.^[8,9,16,17] For example, Andrews *et al.*^[16] found that the mean score of the correct answers was 56.9% when they assessed the nutrition knowledge in sport students. Yahia *et al.*^[17] concluded that undergraduate university students including sports students had low level in nutrition knowledge but with a relatively higher mean score of the correct answers (17.9 out of 24). Likewise, Torres-McGehee *et al.*^[9] reported that adequacy of the nutritional knowledge was only among 9% of the athletes, whereas different findings were found in a recent study performed by Sadhu and Kotwal^[18] in 2018, who have reported moderate-to-high nutrition knowledge among teenager athletes in India. As the evidence behind the sport nutrition information is controversial, this means the level of awareness and knowledge is different according to institute or team administration. Moreover, each study used different tool to assess the knowledge and nutrition information.

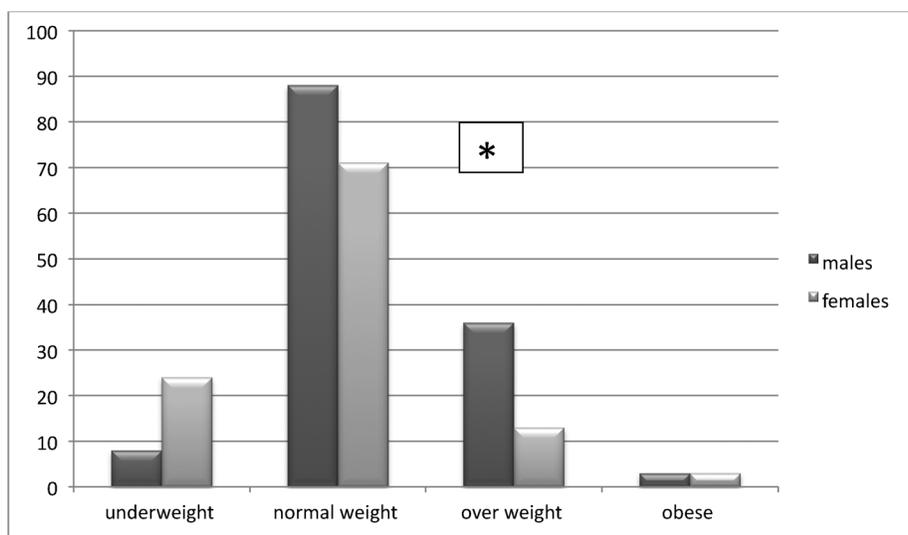


Figure 1: Participants' BMI classification according to gender (*P < 0.05, using Chi-square test)

Table 2: Association between the sociodemographic and obtained knowledge scores

Variables	N	Total score (mean ± SD)	P value
Gender	Male	136	10.9 ± 3.2
	Female	113	11.1 ± 3.0
Place of living	City	137	11.0 ± 3.1
	Village	105	10.9 ± 3.2
Living status	Camp	7	12.0 ± 2.2
	With family	165	10.9 ± 2.9
Academic year	Hostel	84	11.2 ± 3.6
	First	62	9.8 ± 2.9
BMI	Second	62	11.1 ± 3.0
	Third	93	11.5 ± 3.1
	Fourth	32	11.7 ± 3.2
Favorite game	Underweight	32	10.7 ± 3.0
	Normal weight	159	10.9 ± 3.1
	Overweight	49	11.4 ± 3.0
	Obese	6	10.3 ± 4.6
Taking ergogenic supplement	Individual	49	12.0 ± 2.8
	Team	100	11.2 ± 2.8
Taking vitamins	Both	94	10.8 ± 2.9
	Yes	15	10.9 ± 2.9
Family income	No	234	11.1 ± 3.1
	Yes	59	10.8 ± 2.9
	No	190	11.1 ± 3.2
Family income	<2000	30	10.3 ± 2.6
	2000–5000	128	11.1 ± 3.2
	5000–10,000	61	11.8 ± 2.4
	>10,000	30	9.8 ± 4.2

¹Using nonparametric Mann–Whitney test. ² Using nonparametric Kruskal–Wallis test. **Correspondence to Significant at P < 0.05 using Kruskal–Wallis test.

The study sample was comparably distributed according to gender; the males represented 54.6% and females 45.4% of the study sample. Female students showed slightly higher

level of nutritional knowledge 11.1 ± 3.0 as compared to males (10.9 ± 3.2); however, the differences did not reach the significant level. Similar finding was reported in a study conducted by Dunn *et al.*,^[12] whereas other study performed in Korea reported significantly higher nutrition knowledge in females as compared to males.^[19] In general, females were found to be more aware of diet and health issues and embrace dietary changes to a greater degree than men.^[20] There are at least four possible explanations for the higher rate of dietary guideline compliance among women. First, women are more knowledgeable about food, nutrition, health, and their relationships. Second, women exhibit more positive health and food-related beliefs and attitudes. Third, women manifest a more heightened concern about their personal and physical appearance than men do. Fourth, women more likely prefer the taste of healthy foods and meals than men.^[21]

The increase of the level of nutrition knowledge with the academic years was reported in this study, evidenced by significant increase in the total score of the correct answers; it was found that the total score among first-year students is 9.8 ± 2.9, whereas it was 11.1 ± 3.0 among second, 11.5 ± 3.1 among third years, and 11.7 ± 3.2 among the fourth years; this significant increase may be because the later years students have better in knowledge in many health aspect during their study courses.^[15]

The current study informed that the economic status has impact on the nutritional knowledge, as the level of income less than 2000 group and more than 10,000 group have lower scores of correct answers, whereas the rest is around or slightly above the mean. This finding is supported by the literature, in a study conducted in Australia by Hendrie *et al.*^[22] where they reported significant difference in nutritional knowledge in different socioeconomic classes in community-based study.

Addressing the macronutrients (carbohydrate, protein, and fat) data as source of energy was assessed in items 1, 2, and

Table 3: Frequencies and percentages of participant students answered the 21 statement—knowledge questions (with correct answers provided beside each statement; T = true and F = false)

Knowledge items	CA, N (%)	WA/DK, N (%)
1. Protein is the main energy source for the muscle (F)	49 (19.7)	200 (80.3)
2. Fats have important roles in the body (T)	196 (78.7)	53 (21.3)
3. Iron-deficiency anemia results in a decrease in the amount of oxygen that can be carried in the blood (T)	170 (68.3)	79 (31.7)
4. Iron in meat is absorbed at the same rate as iron in a plant food (F)	132 (53)	117 (47)
5. The body can synthesize vitamin D upon exposure to the sun (T)	201 (80.7)	48 (19.3)
6. Vitamin supplementation is recommended for all physically active people (F)	70 (28.1)	179 (71.9)
7. During the activity, feeling thirsty is an enough indicator of the need for liquid (F)	64 (25.7)	185 (74.3)
8. Skipping meals is justifiable if you need to lose weight quickly (F)	152 (61)	97 (39)
9. The food like chocolate, biscuits, chips are the most appropriate foods to be consumed after the training (F)	180 (72.3)	69 (27.7)
10. Vitamins are good sources of energy (F)	44 (17.7)	205 (82.3)
11. Alcohol consumption can affect absorption and utilization of nutrients (T)	140 (56.2)	109 (43.8)
12. Saturated and unsaturated oils both have the equal effect on the health (F)	142 (57)	107 (43)
13. Eating carbohydrates makes you fat (F)	79 (31.7)	170 (68.3)
14. Dehydration decreases performance (T)	195 (78.3)	54 (21.7)
15. The last meal before a competition should be consumed 3–4h before the competition (T)	164 (65.9)	85 (34.1)
16. Males and females at the same age group spend equivalent amount of calorie during the same exercise (F)	169 (67.9)	80 (32.1)
17. Bananas are good sources of potassium (T)	157 (63.1)	92 (36.9)
18. Salt is an essential part of a healthy diet (F)	36 (14.5)	213 (85.5)
19. Milk and milk products are the best sources of calcium (T)	204 (81.9)	45 (18.1)
20. Basic sugars like cube sugar, jam, honey are the most suitable energy sources for sportsmen (F)	81 (32.5)	168 (67.5)
21. Glycogen muscles store carbohydrate (T)	118 (47.4)	131 (52.6)

CA = correct answer, DK = don't know, WR = wrong answer.

13. The knowledge item 1 asked about the use of protein as main energy source for muscle. Although it is necessary for athletes to know the fact that protein is not the main source of energy, in the study, we found that only 20% of the participants answered the question correctly. Different results were reported in the Turkish study where the majority of the respondents (77.8%) answered the question correctly.^[15] Fat plays an essential role in human body (knowledge item 2) achieved high percentage of correct answers 79%. As this fact is very basic, such result is expected. The relationship between the carbohydrate intake and obesity was mentioned in knowledge item 13, only 32% of the answers were correct; the balance between the energy intake and the energy expenditure is behind the relationship; the carbohydrate intake have to be within the acceptable range of carbohydrate intake (45%–60%) of the total energy requirement.^[23] Similar question was asked in a different study, the percentage of correct answer was 56.3% of the total answers.^[15]

Volpe^[24] declared the micronutrient requirements in athletes, iron among the crucial minerals that affect the performance, and have major implications among athletes. The role of iron includes formation of the hemoglobin, myoglobin, and enzymes for energy utilization, in addition to the differences in iron absorption and bioavailability according to dietary sources. In our study sample, the answers regarding the iron role in athletes “knowledge items 3 and 4” were 68% and 53% correct, respectively, which mean the study participants are relatively aware of this crucial role of iron for them as athletes.

Sun exposure as a source of vitamin D as a fact is comparatively known among the study sample as 80.7% of the students answered it correctly. Similar results was reported in the study conducted by Ozdoğan and Ozcelik^[15] in which approximately two-third of the students answered the question. The growing international concern about vitamin D deficiency highlighted the role of sun exposure to enhance vitamin D status and decrease the prevalence of deficiency or inadequacy.^[25]

Time of meals before and after the training or the competition is important; the need to increase the energy store before the training and to restore the depleted energy store after the exercise has significant role in the performance.^[26] Item no. 15 probed the proper time of the last meal before the exercise, about two-third of the participants answered correctly the statement. This percentage was lower than the percentage of correct answer of similar question (81.6%) who gave correct answer in Turkey.^[15]

Knowledge item no. 16 examined the factors that affect the energy requirements: gender, age, weight, and height; nearly 33% of the answers were false. This rate of incorrect answer reflects confusion regarding the factors that affect the energy requirement in general and among the athletes specifically, which assign lack of basic knowledge in this field. The effect of meal skipping on weight loss is recommended (item no. 8) was answered correctly by 61% of the study sample. Similar question in the study of Ozdoğan and Ozcelik^[15] got very low percentage of correct answer around 12%, which indicate poor

knowledge regarding the effect of meal distribution on weight and health. With regard to the role of the vitamins as energy source (item no. 10) and the necessity of the vitamin supplementation (item no. 6), low percentages of correct answers were obtained by respondents (i.e., 17.7% and 28.1%, respectively), which tick a poor understanding of the vitamins role and requirements among the study group. Nutrients and diseases relationship was questioned in item no. 12 through asking about the effect of different fat types (saturated and unsaturated) have same effect on health; the correct answers were observed by 57% of the participants; this percentage was much higher than what was reported among Turkish students (32.7%).^[15] Decreasing the amount of saturated fat from the total dietary fat is recommended for normal population and for athletes^[26] as the saturated fat has more adverse effect on health; however, the results from both of aforementioned studies pointed out that the students are not aware of this recommendation.

Finally, glycogen store in muscle is among the major nutrition implications in sports, which include glycogen depletion after exercise, glycogen loading regimen before the competition, and recommendation to increase the glycogen stores in muscle.^[26] Knowledge item no. 21 asked about the ability of muscle to store the carbohydrate as glycogen, and the percentage of correct answer among the participants was 47.7%. This percentage is considered low if we consider the important implication of this glycogen store on athletes' performance.

CONCLUSION

The evaluation of nutrition knowledge among sport students at An-Najah National University revealed that the overall nutrition knowledge is insufficient, with absence of statistically significant differences between males and females students. The level of the nutrition knowledge was affected by the academic years; students at the first year of study have lower nutrition knowledge. The result of this study recommends sport nutrition education course in the program to improve their health and nutritional awareness and knowledge levels. Further research is required to assess the nutritional status and dietary practices of the sport students and to design intervention research to improve the knowledge and so improve the dietary practices among the sport students.

Limitations

The current study only explored the nutrition knowledge, neither the attitude nor the practices. The study design lacks the assessment of the practices and nutritional status, in addition to academic excellence. The study did not target the students who are categorized as athletes, did not report the number of nutrition education courses that the participants may attend. The generalization of the results is limited as the sample of participant students was taken from An-Najah

National University alone and may not be representative of all Physical Education students.

Acknowledgments

The authors thank Prof Ozdogan Y. for granting the permission to use his validated instrument tool. The authors thank the students who participated in this study.

Authors' contributions

MMB conducted the statistical analyses, interpreted the data, and drafted the initial manuscript; NYS conceived the idea for the study, led study design, coordinated data collection, and conceptualized and drafted the manuscript; MHA-A collected the data, entered the data into SPSS, and helped in the statistical analyses. All authors have read and approved the final version of the manuscript and agree with the order of presentation of the authors.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Indoria A, Singh N. Role of nutrition in sports: A review. *Indian J Nutr* 2016;3:147.
2. Broad EM, Cox GR. What is the optimal composition of an athlete's diet? *Eur J Sport Sci* 2008;8:57-65.
3. Nazni P, Vimala S. Nutrition knowledge, attitude and practice of college sportsmen. *Asian J Sports Med* 2010;1:93-100.
4. Maughan RJ, Shirreffs SM. Nutrition for sports performance. *Issues and opportunities. Proc Nutr Soc* 2012;71:112-9.
5. Purcell LK, Canadian Paediatric Society PS, Exercise Medicine S. Sport nutrition for young athletes. *Pediatr Child Health* 2013;18:200-5.
6. Spronk I, Kullen C, Burdon C, O'Connor H. Relationship between nutrition knowledge and dietary intake. *Br J Nutr* 2014;111:1713-26.
7. Heaney S, O'Connor H, Naughton G, Gifford J. Towards an understanding of the barriers to good nutrition for elite athletes. *Int J Sports Sci Coach* 2008;3:391-401.
8. Devlin BL, Belski R. Exploring general and sports nutrition and food knowledge in elite male Australian athletes. *Int J Sport Nutr Exerc Metab* 2015;25:225-32.
9. Torres-McGehee TM, Pritchett KL, Zippel D, Minton DM, Cellamare A, Sibilia M. Sports nutrition knowledge among collegiate athletes, coaches, athletic trainers, and strength and conditioning specialists. *J Athl Train* 2012;47:205-11.
10. Raymond-Barker P, Petroczi A, Quested E. Assessment of nutritional knowledge in female athletes susceptible to the female athlete triad syndrome. *J Occup Med Toxicol* 2007;2:10.
11. Spendlove JK, Heaney SE, Gifford JA, Prvan T, Denyer GS, O'Connor HT. Evaluation of general nutrition knowledge in elite Australian athletes. *Br J Nutr* 2012;107:1871-80.
12. Dunn D, Turner LW, Denny G. Nutrition knowledge and attitudes of college athletes. *Sport J* 2007;10:45-52.
13. Hawk MF. Assessing sports nutrition knowledge of adolescent athletes and their parents: An intervention approach. 2014.
14. Magee PJ, Gallagher AM, McCormack JM. High prevalence of dehydration and inadequate nutritional knowledge among university and club level athletes. *Int J Sport Nutr Exerc Metab* 2017;27:158-68.

15. Ozdoğan Y, Özcelik AO. Evaluation of the nutrition knowledge of sports department students of universities. *J Int Soc Sports Nutr* 2011;8:11.
16. Andrews A, Wojcik JR, Boyd JM, Bowers CJ. Sports nutrition knowledge among mid-major Division I university student-athletes. *J Nutr Metab* 2016;2016:3172460.
17. Yahia N, Wang D, Rapley M, Dey R. Assessment of weight status, dietary habits and beliefs, physical activity, and nutritional knowledge among university students. *Perspect Public Health* 2016;136:231-44.
18. Sadhu AR, Kotwal D. Knowledge–Attitude–Practice (KAP) study and nutrition education of athletic and non-athletic teenagers (13–18 years). In: *Ergonomics in caring for people*. Singapore: Springer; 2018. pp 73-82.
19. Lee SL, Lee SH. Survey on health-related factors, nutrition knowledge and food habits of college students in Wonju area. *Korean J Community Nutr* 2015;20:96.
20. Özcelik A, Ucar A. Gender differences in adult's knowledge about dietary fats, cholesterol, fiber and energy. *Pak J Nutr* 2008;7:234-9.
21. Turrell G, Hewitt B, Patterson C, Oldenburg B. Measuring socio-economic position in dietary research: Is choice of socio-economic indicator important? *Public Health Nutr* 2003;6:191-200.
22. 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;11:1365-71.
23. Jeukendrup A, Gleeson M. *Sport nutrition: An introduction to energy production and performance*. Illinois: Human Kinetics; 2010.
24. Volpe SL. Micronutrient requirements for athletes. *Clin Sports Med* 2007;26:119-30.
25. Holick MF, Chen TC. Vitamin D deficiency: A worldwide problem with health consequences. *Am J Clin Nutr* 2008;87:1080S-6S.
26. Maughan RJ. *Nutrition in sport*. Vol. 7. New York City: John Wiley & Sons; 2008.

