

Understanding the Sport-Nutrition Knowledge and Practices among Jordanian Olympic Preparation Program's Athletes and Coaches for TOKYO2020 Olympic Games

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Abstract Despite the importance of physical activity and training, proper nutrition and good nutrition knowledge plays an important role in enhancing the athletes' performance and health status. Objective: To study the knowledge, attitude, and practice toward sport-nutrition among Jordanian athletes and coaches at Jordanian Olympic Preparation Program for TOKYO2020 Olympic Games. Method: A cross-sectional design was used. 95 participants (85 athletes and 10 coaches) were recruited from 7 Olympic federations (i.e., judo, karate, taekwondo, basketball, football, muay thai, and boxing). The questionnaire consisted of questions related to demographic information, nutritional knowledge, attitude, and practice. Results: Individual federation athletes' practice and attitude were significantly lower than group federation athletes (1.659±0.04, 1.318±0.10, 1.84±0.03, 1.54±0.10). Individual federation athletes had significantly

higher knowledge than group federation athletes (1.638±0.035, 1.620±0.037, respectively). Coaches' knowledge, practice, and attitude (1.471±0.06, 1.675±0.10, 1.300±0.21, respectively) were significantly lower than athletes (1.647±0.02, 1.771±0.03, 1.459±0.07). Knowledge and attitude were found to have a significant positive correlation (0.261), whereas knowledge was found to have a positive correlation with practice (0.037) and practice was found to have a positive correlation with attitude (0.069), but these correlations were not significant ($P > 0.05$). Conclusion: The current study identified some gaps in nutritional knowledge and practice among Jordanian Olympic athletes, implying the need for developing strategies in athlete counseling and teaching to improve their knowledge and practices, which have an impact on performance and health promotion.

Keywords KAP, Nutritional, Knowledge, Olympic Elite, Athletes, Nutrients

1. Introduction

Nutrition has a strong effect on well-being in health and disease. Adequate and appropriate nutrition is a cornerstone of good health. Poor nutrition can lead to reduced immunity, increased susceptibility to disease, impaired mental, and physical development [1]. Adequate nutrient status is critical for the normal growth and development processes and also important to optimize the health, physical fitness and athletic performance [2]. The optimal health; fitness and sports performance are obtained by proper nutrition [3]. In any physical fitness program, nutrition plays a critical role; it has a direct effect on the level of physical performance, achieving and maintaining health. Proper nutrition can decrease fatigue, increase performance, improve endurance, and recover faster between training sessions [4]. Nutrition plays a very important role to obtain a high level of achievement in sports. Hence, physical fitness and training are very much dependent on the nutritional status of athletes [5]. Adequate nutrition has been established to be a significant component of optimal athletic performance, recovery from exercise and exercise-induced injury and is documented to be associated with adequate nutrition knowledge [3].

However, there are many barriers that can hinder athletes from achieving optimal dietary practice, including a lack of time, insufficient financial resources, poor meal planning and preparation skills, being busy during traveling to the competition, participation in excessive exercise, inadequate nutrition knowledge [6]. Athletes must have adequate nutrition knowledge and easily accessible resources for nutrition guidance [6]. Jordan Olympic Committee is the governing body for sports in the Hashemite Kingdom of Jordan. It was founded in 1957 and became the nurturing body for 34 Olympic and non-Olympic sports federations in the kingdom, and is in charge of promoting and developing sports and physical activities in Jordan in consistent with the norms of the Olympic Charter [7], regarding Olympic Preparation Centre which is under the umbrella of the Jordan Olympic Committee, it was established in 2018 and responsible for training and preparing the Jordanian elite athletes who qualify for the championships at high level under the supervision of psychologists and nutritionists [7].

However, many studies showed different results of knowledge and practice of athletes in different countries [2], [4], [6], [8]–[10]; to our knowledge, no research has run to evaluate the sports nutrition knowledge and practice among Jordanian Olympic Athletes and coach. Thus, the aim of the current study was to assess the sports nutrition knowledge and practice among Jordanian athletes and

coaches at the Jordanian Olympic Preparation Program for TOKYO2020 Olympic Games' elite athletes and coaches.

2. Materials and Methods

A cross-sectional study was applied on the Jordanian Olympic athletes and coaches. The current study was approved by the governing and scientific panels at Jordan Olympic Committee. Written consent was obtained from the participants after which they were informed of the purpose, and procedure of participating in the study.

2.1. Participants

A total of 95 (85 Olympic athletes and 10 Olympic coaches) participated in the current study. The participants were recruited from 7 federations divided into 2 groups: individual sport federations (i.e., karate, taekwondo, boxing, and judo, and muay thai), and groups sport federations (i.e., basketball, football).

2.2. Questionnaire

Knowledge and practices questionnaires used were valid and reliable by scientific panel [6], [11]. The questionnaire consists of a demographics section, sport nutritional knowledge, practice and attitude of sport nutritional knowledge. The questionnaire contained 19 questions divided into two parts; part (i) to assess the nutritional knowledge, and part (ii) to assess the practice and attitude of the knowledge.

The sport nutritional knowledge questionnaire contained 5 domains of sport nutrition: energy and weight management, macronutrients, micronutrients, hydration, and information source. The first domain focuses on the energy need and weight loss strategies, the second domain focuses on macronutrient; carbohydrates, fats, and proteins. The third domain focuses on micronutrient; vitamins and minerals. The fourth domain focuses on hydration questions, fluid loss, electrolytes, and hyponatremia. The last domain asks about source of information. Part B focused on the sport dietary habits, the last question about attitude of athletes. Each question contained three choices of answers; so that the first answer (a) has three points, the second answer (b) has two points, and the last answer (c) has one point, the score was calculated as the total number of points.

2.3. Statistical Analysis

Statistical Program for Social Studies software (SPSS version 24) was used to analyze the data results. Descriptions and frequencies were calculated for all variables, and Crosstabs were used to show proportions of participants. The outcomes data was presented in numbers, percentages, means with standard error of the mean and standard deviation. A two-sample t-test and one-way ANOVA was used to evaluate grouped data. The P-value

less than 0.05 was set to assure statistical significance. establish which variables have a significant effect on KAP
 Bivariate correlation (Pearson) analysis was used to status.

Table 1. Characteristics of the study sample (Categorical variables)

Variable	Categories	N*	%**
Gender	Males	87	91.6%
	Female	8	8.4%
Age	18-23 Years	54	56.8%
	24-29 Years	23	24.2%
	30-35 Years	11	11.6%
	36-40 Years	3	3.2%
Sport Type	Judo	11	11.6%
	Karate	22	23.2%
	Taekwondo	2	2.1%
	Basketball	12	12.6%
	Football	31	32.6%
	Muay Thai	8	8.4%
	Boxing	9	9.5%
Federation	Individual	52	54.7%
	Group	43	45.3%
Current Status	Coach	10	10.5%
	Athlete	85	89.5%
Education	Secondary	48	50.5%
	Diploma	6	6.3%
	BSc	41	43.2%
	MSc	0	0.0%
	PhD	0	0.0%
Number of Experience Years	Less than 5 Years	25	26.3%
	5-10 Years	38	40.0%
	More than 10 Years	32	33.7%
Income Source	Income from Family	30	31.6%
	Income from Work	65	68.4%

*N Represents the number of participants.

**% represents the percentage of the participants

Table 2. Comparisons in knowledge, practice, and attitude (Mean \pm SEM) *

Sport type	Knowledge	Practice	Attitude
Judo	1.688 \pm 0.067 ^a	1.523 \pm 0.104 ^b	1.455 \pm 0.247 ^a
Karate	1.656 \pm 0.041 ^a	1.705 \pm 0.061 ^{ab}	1.182 \pm 0.107 ^a
Taekwondo	1.500 \pm 0.357 ^a	1.875 \pm 0.375 ^{ab}	1.000 \pm 0.000 ^a
Basketball	1.506 \pm 0.038 ^a	1.854 \pm 0.057 ^a	1.333 \pm 0.142 ^a
Football	1.694 \pm 0.055 ^a	1.839 \pm 0.053 ^a	1.613 \pm 0.144 ^a
Muay Thai	1.509 \pm 0.037 ^a	1.875 \pm 0.116 ^a	1.625 \pm 0.263 ^a
Boxing	1.564 \pm 0.097 ^a	1.667 \pm 0.059 ^{ab}	1.556 \pm 0.294 ^a
Individual federation	1.638 \pm 0.035 ^a	1.659 \pm 0.045 ^b	1.318 \pm 0.102 ^b
Group federation	1.620 \pm 0.037 ^b	1.848 \pm 0.038 ^a	1.549 \pm 0.102 ^a
Coaches	1.471 \pm 0.068 ^b	1.675 \pm 0.106 ^b	1.300 \pm 0.213 ^b
Athletes	1.647 \pm 0.027 ^a	1.771 \pm 0.032 ^a	1.459 \pm 0.078 ^a

Table 3. Pearson Correlation between Knowledge, Practice and Attitude of the participants

Attribute	Knowledge	Practice	Attitude
Knowledge	1	0.037	0.261*
Practice	0.037	1	0.069
Attitude	0.261*	0.069	1

*Correlation is significant at the 0.05 level

3. Result

A total of 95 subjects aged 18 to 40 years old participated in. The physical characteristics (i.e., age, sex, sport type, federation, status, education, experience year, and income source) of the participants are presented in Table 1

Table 2 shows the differences in knowledge, practice, and attitude variables according to the differences in the categories, there are no significant differences between sport type and knowledge, and between sport types and attitude ($P > 0.05$). Regarding the practice the basketball, football and muay thai players (1.854 ± 0.057 , 1.839 ± 0.053 and 1.875 ± 0.116 respectively) have significantly ($P < 0.05$) better practices than judo players (1.523 ± 0.104), while karate, taekwondo and boxing have no significant difference among each other and among other games players in practice ($P > 0.05$).

Table 3 shows the KAP correlation of the participants. Knowledge-attitude-practice model is based on the cognitive-affective-behavior theory in the area social psychology and this model suggests that an increase in knowledge affects attitude and consequently changes the nutritional practices [14]. The Pearson correlation between knowledge, practice, and attitude of the participants, from the table above, it was found that the knowledge has a positive significant correlation with attitude (0.261) at ($P < 0.05$), whereas the knowledge has

a positive correlation with practice (0.037) but not significant correlation ($P > 0.05$). There also appears to be a non-positive significant correlation between practice and attitude ($P > 0.05$).

4. Discussion

Many outcomes for athletes including optimal health and performance are associated with proper knowledge, attitude, and practice (KAP) of sport nutrition [12]. Sports and nutrition are directly related to each other, sports persons need more energy to carry out their sporting activity effectively. This should be taken into consideration in the athletes' lifestyle and training; therefore the attention to sports nutrition becomes a priority to improve sports performance. Careful planning and implementation are required when it comes to athlete sports nutrition [13]. In this study, we assessed the knowledge, attitude, and practice for a group of athletes in different sport types and different federations in Jordan.

Demographic data and distribution of participants

For those ninety-five participants, the mean age (23.6 ± 0.53 years) indicates that the more the younger age group the more participation in different sports in community, which means younger ages tend to play more sports than

older ages. They have stronger bodies to join sports federations, and better awareness about the importance of the sport in life. 56.8% of the participants are in adolescent age group (18-23 years). Adolescence is defined as the period of life between the ages of 11 and 21. Significant changes occur, during this crucial transition period which prepares a child for adulthood. The requirements for energy and other nutrients in adolescence age increased to meet the rapid growth and development during this stage [14]. In addition to the normal nutrient demands, when an adolescent is an athlete, there are several important nutritional factors to consider for both growth and sports performance [14].

The Karate and football are the most played sports in Jordan (23.2% and 32.6% respectively); this is based on the numbers of athletes in the Jordanian Olympic Committee. Individual sports can only be performed by one player per team, whereas group games must have more than one player to form a team. Individual (54.7%) and group (45.3%) federation games were represented equally in the sample. Furthermore, the ratio of coaches (10.5%) to athletes (89.5%) is normal because each coach can train up to ten athletes at the same time. According to table 1, half of the participants (50.5%) are in secondary school, indicating that they are more interested in physical exercise than in science and completing their university studies. If we look at the distribution of participants based on the number of experience years, we can see that 73.7% have more than 5 years of experience, which has a positive impact on the precision of the results.

Table 2 also shows that male to female ratio was (87:8), those eight females were in Judo and Karate games, this may be because of the availability of sports clubs and coaches for these two sports and because this type of sports gives them high fitness, in addition to that it enables the girl to defend herself. The football was the most popular and preferable game in the Jordanian community (32.6%). The younger ages were found in football sport maybe because it needs a lot of efforts which gradually drop by age. Judo, football, and karate are the most games that need long-term training, which is why these players have the most years of experience.

The relationship between the sport type and KAP.

Different sports players may tend to have different levels of knowledge, practice, and attitude [5]. No significant differences are between sport type and knowledge and between sport type and attitude, and all sport types have similar levels of knowledge and attitude. Up to our knowledge, there is no research done on this topic according to comparison of knowledge, attitude, and practice between sport types. However, from our point of view, this similarity in the results of knowledge and attitude may be attributed to the random distribution of athletes in different games regarding their ages and educational level.

Basketball, football and muay thai players have significantly better practice than judo players. The basketball and football are group federation games while Judo is an individual federation game, maybe because in team sports the team encourage for each other as their performance is collective as a group. This result was consistent with Molobe 2012 who found that team players have better scores in KAP assessment [15].

There are no differences between karate, taekwondo, and boxing in practice among each other and among other games players. This maybe because all these three games teach same skills which are patience and discipline and all of them offer a full body workout.

The relationship between federation type and KAP

Group federation players show significantly better practices and attitude than the individual federation players, and it is the opposite regarding knowledge, the individual federation players show significantly better knowledge than the group federation players. There is no research done to compare KAP results for group and individual players.

Differences between Coaches and athletes in KAP results

Trakman et al. [11] in their review and analysis of 36 articles, they concluded that coaches' knowledge is better than athletes' knowledge which disagrees with our results, where our results showed that athletes have better knowledge, attitude and practice than coaches, and this could be because the coaches did not pursue academic sports education at universities, despite the fact that coaches should have more knowledge, attitude, and practice than athletes due to their influence, not only for giving information but also for shaping attitudes [6], that's why they should have a better attitude and better practice, as confirmed by Smith-Rockwell et al. who found that coaches have a very good attitude, and they can be a good pacemaker for their team athletes [16].

The overall knowledge assessment questionnaire shows that 25.3% only have very good knowledge, 74.7% have a poor knowledge background. These findings do not concur with the Grete et al., 2011 study where athletes' nutrition knowledge is continually average around the 60th percentile [17]. Athletes in general lack nutritional knowledge [18]. Athletes who have the knowledge and understanding of how they eat and what they eat and reflect this knowledge to their total daily needs and athletic performances are considered to be more successful in their sports life [18].

Golshanraz et al. 2012 study found that knowledge of the athletes regarding sports supplements was not adequate in 69.3% of the respondents [19]. This may lead to amazement of athletes in selecting appropriate supplements to meet their requirements. In addition,

10.5% of the participants show very good nutritional practices, 89.5% have poor nutritional practices. Lack of time (for food purchasing and preparation) was identified as the primary barrier to optimal nutrition [20]. Other factors included monetary constraints and limited access to nutritious food due to limited availability [20].

Regarding the attitude assessment part, around 68.4% of the participants have a good nutritional attitude, 18.9% and 12.6% have a weak attitude, this result was inconsistent with the Ozdoğan and Ozcelik 2011 study who suggested that students, coaches and teachers in physical education were found not to give the necessary importance to their diets, and they were still not aware of the importance of nutrition on performance [3].

Educating athletes on aspects of hydration is an important part of being an allied health care professional [14]. The percentage of those who are aware of the importance of hydration is very low. This result agreed with the results that were observed by Esa et al, 2015 who reported that athletes not only lacked knowledge, but also had poor attitudes and behaviors on sports drinks consumption [21].

KAP correlation

The Pearson correlation between knowledge, practice and attitude of the participants as shown in Table 3, the significant positive correlation ($P < 0.05$) between knowledge and attitude (0.261); this correlation means that good knowledge leads to good attitude. This was confirmed by Montecalbo and Cardenas 2015[18], who found that athletes who have a higher level of nutritional knowledge also have better dietary habits, and if athletes do not possess basic nutritional knowledge, it possibly affects their peak athletic performance, so, there is a direct correlation seen between healthy food choices and an athlete's nutritional knowledge [13].

The knowledge has a positive correlation with practice (0.037), but not significant correlation ($P > 0.05$). This result was not going with the result of Wiita et al., 1995 who found that athletes who receive nutrition education have significantly higher knowledge and attitude scores, and as their knowledge increases, they are more likely to eat or avoid certain foods [22]. There also seems to be no significant positive correlation between practice and attitude ($P > 0.05$). This result was inconsistent with the result that was obtained by Grete et al., 2011, who found a significant positive relationship between the players' attitude and their nutritional practices [17].

5. Conclusion

Individual federation players have significantly better knowledge than group federation, and it is the opposite regarding practice and attitude. Also, athletes have significantly better knowledge, practice, and attitude than

coaches. Generally Olympic Athletes lacked knowledge regarding to macronutrient and hydration; on the other hand, the knowledge about importance of micronutrient intake was good, so the overall knowledge of athletes was only 25.3% good. In addition, only 10.5% from participants were good practice.

It is recommended to develop strategies at the Jordan Olympic Committee in providing counseling and teaching to coaches and athletes that aim to improve their sport-nutritional knowledge and practices, which have an impact on their health, performance and achievement.

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REFERENCES

- [1] M. Kohlmeier, C. A. Nowson, R. A. DiMaria-Ghalili, and S. Ray, "Nutrition Education for the Health Care Professions," *Journal of Biomedical Education*, vol. 2015, p. e380917, Aug. 2015, doi: 10.1155/2015/380917.
- [2] A. Ali, M. S. Al-Siyabi, M. I. Waly, and H. A. Kilani, "Assessment of nutritional knowledge, dietary habits and nutrient intake of university student athletes," *Pakistan Journal of Nutrition*, vol. 14, no. 5, p. 293, 2015.
- [3] Y. Ozdoğan and A. O. Ozcelik, "Evaluation of the nutrition knowledge of sports department students of universities," *Journal of the International Society of Sports Nutrition*, vol. 8, no. 1, p. 11, Sep. 2011, doi: 10.1186/1550-2783-8-11.
- [4] W. Lin and Y.-W. Lee, "Nutrition knowledge, attitudes, and dietary restriction behavior of the Taiwanese elderly," p. 9, 2005.
- [5] P. Nazni and S. Vimala, "Nutrition Knowledge, Attitude and Practice of College Sportsmen," *Asian J Sports Med*, vol. 1, no. 2, pp. 93–100, Jun. 2010.
- [6] T. M. Torres-McGehee, K. L. Pritchett, D. Zippel, D. M. Minton, A. Cellamare, and M. Sibilia, "Sports nutrition knowledge among collegiate athletes, coaches, athletic trainers, and strength and conditioning specialists," *Journal of athletic training*, vol. 47, no. 2, pp. 205–211, 2012.
- [7] "Jordan Olympic Committee," *Jordan Olympic Committee*. <https://www.joc.jo/en/> (accessed Oct. 12, 2021).
- [8] S. Partida, A. Marshall, R. Henry, J. Townsend, and A. Toy, "Attitudes toward Nutrition and Dietary Habits and Effectiveness of Nutrition Education in Active Adolescents in a Private School Setting: A Pilot Study," *Nutrients*, vol. 10, no. 9, Art. no. 9, Sep. 2018, doi: 10.3390/nu10091260.
- [9] A. Badau, D. Badau, L.-G. Talaghir, and V. Rus, "The impact of the needs and roles of nutrition counselling in

- sport,” *Human. Sport. Medicine (ISSN (online) 2500-0195)*, vol. 18, pp. 88–96, Jun. 2018, doi: 10.14529/hsm180208.
- [10] I. Alaunyte, J. L. Perry, and T. Aubrey, “Nutritional knowledge and eating habits of professional rugby league players: does knowledge translate into practice?,” *Journal of the International Society of Sports Nutrition*, vol. 12, no. 1, p. 18, Apr. 2015, doi: 10.1186/s12970-015-0082-y.
- [11] G. L. Trakman, A. Forsyth, B. L. Devlin, and R. Belski, “A systematic review of athletes’ and coaches’ nutrition knowledge and reflections on the quality of current nutrition knowledge measures,” *Nutrients*, vol. 8, no. 9, p. 570, 2016.
- [12] S. S. M. Elias, H. A. Saad, M. N. M. Taib, and Z. Jamil, “Effects of sports nutrition education intervention on sports nutrition knowledge, attitude and practice, and dietary intake of Malaysian team sports athletes,” p. 14, 2017.
- [13] V. Supriya and L. Ramaswami, “Knowledge, attitude and dietary practices of track and field athletic men and women aged 18-22 years,” *International journal of innovative research and development*, vol. 2, no. 11, pp. 399–404, 2013.
- [14] R. M. Sobana, “Sports Nutritional Knowledge, Attitude and Practice of Adolescent Cricket Players,” p. 4, 2016.
- [15] M. Daniel, “Knowledge, Attitude and Practice on Drug Abuse among Sports Men and Women in Lagos State, Nigeria,” p. 11, 2012.
- [16] M. Smith-Rockwell, S. M. Nickols-Richardson, and F. W. Thye, “Nutrition knowledge, opinions, and practices of coaches and athletic trainers at a division 1 university,” *Int J Sport Nutr Exerc Metab*, vol. 11, no. 2, pp. 174–185, Jun. 2001, doi: 10.1123/ijsnem.11.2.174.
- [17] H. Grete R., F. Carol A., E. Jane E., and P. Kimberli, “Nutrition Knowledge, Practices, Attitudes, and Information Sources of Mid-American Conference College Softball Players,” *Food and Nutrition Sciences*, vol. 2011, Apr. 2011, doi: 10.4236/fns.2011.22015.
- [18] R. Montecalbo and R. Cardenas, “Nutritional Knowledge and Dietary Habits of Philippine Collegiate Athletes,” *International Journal of Sports Science*, p. 6, 2015.
- [19] A. Golshanraz *et al.*, “Patterns of Sports Supplement Use among Iranian Female Athletes,” *International Journal of Sport and Health Sciences*, vol. 6, no. 9, pp. 2480–2483, Sep. 2012.
- [20] R. Wali, “A Pilot Program To Evaluate the Effect of Training Table-Based Nutrition Education and Menu Modification on the Nutrition Knowledge and Dietary Intake of Collegiate Football Players at a NCAA Division I University,” Master of Science, San Jose State University, San Jose, CA, USA, 2013. doi: 10.31979/etd.jtq3-ze2c.
- [21] N. H. Esa, H. A. Saad, C. H. Phing, and H. Karppaya, “Knowledge, attitudes and behaviours regarding hydration and hydration status of Malaysian national weight category sports athletes,” p. 8, 2015.
- [22] B. Wiita, I. Stombaugh, and J. Buch, “Nutrition knowledge and eating practices of young female athletes,” *Journal of Physical Education, Recreation & Dance*, vol. 66, no. 3, pp. 36–42, 1995.