International Journal of Human Movement and Sports Sciences 13(6): 1173-1181, 2025 http://www.hrpub.org
DOI: 10.13189/saj.2025.130601

Nutrition Knowledge and Perception of Dietary Supplements regarding Athletic Performance among Amateur and Professional University-Level Athletes

Siraphatthra Thongsawang[1], Techid Lersanekwattana[2], Sukanya Chorcharoenying[3,*]

[1]College of Integrative Medicine, Dhurakij Pundit University, Thailand
[2]Faculty of Sports Science, Chulalongkorn University, Thailand
[3]Faculty of Public Health, Valaya Alongkorn Rajabhat University, Thailand

Received June 11, 2025; Revised September 24, 2025; Accepted October 14, 2025

Cite This Paper in the Following Citation Styles

(a): *[1] Siraphatthra Thongsawang, Techid Lersanekwattana, Sukanya Chorcharoenying, "Nutrition Knowledge and Perception of Dietary Supplements regarding Athletic Performance among Amateur and Professional University-Level Athletes," International Journal of Human Movement and Sports Sciences, Vol. 13, No. 6, pp. 1173 - 1181, 2025. DOI: 10.13189/saj.2025.130601.*

(b): *Siraphatthra Thongsawang, Techid Lersanekwattana, Sukanya Chorcharoenying (2025). Nutrition Knowledge and Perception of Dietary Supplements regarding Athletic Performance among Amateur and Professional University-Level Athletes. International Journal of Human Movement and Sports Sciences, 13(6), 1173 - 1181. DOI: 10.13189/saj.2025.130601.*

Abstract The principal role of athletes' dietary goals is to achieve high performance. However, the nutritional practices of athletes are influenced by their level of nutrition knowledge, which enables them to make positive changes in their dietary intake, thereby eventually resulting in their maximized exercise capacity. This study aimed to evaluate the nutritional knowledge and perception of dietary supplements regarding athletic performance among amateur and professional university-level athletes. A cross-sectional study was performed with 139 university athletes as either amateur (n = 74) or professional (n = 65) athletes. The participants completed a questionnaire about information on their baseline characteristics and sports experience, followed by reporting their consumption behavior, perceptions of dietary supplements, and nutritional knowledge. The results showed that 74% of participants were likely to take dietary supplements on workout day without differences between sport levels. A higher consumption of whey protein was found in professionals than in amateurs, whereas 12% of participants reported never taking any supplements. Professionals considered the use of dietary supplements for recovery and improving strength more than amateurs. Furthermore, greater odds of providing correct responses to the protein and hydration questions were shown in professionals when compared to amateurs ($p < 0.05$). However, the overall nutritional knowledge demonstrated scores that were below the 75th percentile, with no differences between the groups. Thus, the evaluation of dietary decisions in athletes depends on their basic nutritional knowledge. However, practical sports nutrition is recommended for all levels of athletes and coaches to promote their health and physical fitness.

Keywords Nutrition Knowledge, Perception, Dietary Supplements, Workout

1. Introduction

Sports nutrition is a primary factor in promoting athletic performance. Athletes and coaches should be provided with practical, adequate nutrition information. Similarly, sports foods are specialized and designed for athletes to improve their health, performance, and recovery status [1]. Moreover, they may be used as a nutritional intervention approach to improve physical fitness [2].

A better understanding of nutritional knowledge is required to increase the effectiveness of nutrition practices. Jayawardena et al. [3] reported that there was a 10% increase in the mean sports nutrition knowledge (SNK) score of track and field athletes after 16 weeks of receiving an evidence-based diet plan and advice on sports-specific supplements when compared to that of the control group. In addition, the athletes' SNK was substantially associated with the previous nutrition education that they had received [4]. Similarly, Renard et al. [5] indicated that athletes who had previous nutrition education demonstrated higher scores (12.5%), with no difference between playing levels (elite vs. sub-elite). General nutritional knowledge is crucial to improving athletes' performance; however, Adam et al. [6] revealed a deficiency in nutritional knowledge among elite young taekwondo athletes who had an average score of 5.36 out of 11. This was supported by Elsahoryi et al. [7], who reported that athletes and coaches had low levels of nutritional knowledge, with an overall mean score of 35.2 % for athletes. As the primary dietary goal is to optimize health and physical fitness among athletes, it is crucial to provide adequate nutrition based on appropriate nutritional knowledge and the biological needs for growth in young athletes [8]. In line with this, a well-balanced diet containing proper amounts of macro- and micronutrients is essential to provide sufficient energy for optimal growth and activity [9]. Occasionally, misinformation about nutrition or supplements becomes a potential problem for athletes who rely on their coaches for sport-specific guidance, especially considering that adolescent athletes look to their coaches for nutrition advice [10].

Many factors that motivate food selection strategy, including taste, convenience, nutrition knowledge, and beliefs, are influenced by psychosocial, financial, and physiological factors. Therefore, these should be carefully integrated into a planned training program [11]. In addition to these factors, individual knowledge and family beliefs also influence food choice and are involved in personal food decision-making rules [12]. Furthermore, nutritional perception differs considerably depending on age, gender, and education level [13], therefore, it is unsurprising that the nutrition knowledge factor is diverse. Thus, a better understanding of the influencing factors is required. This study aimed to evaluate the nutritional knowledge and perception of dietary supplements regarding athletic performance among amateur and professional university-level athletes.

2. Materials and Methods

2.1. Study Design

A cross-sectional study was performed involving athletes from universities in the Bangkok Metropolitan Region (Thailand) who have participated in university league competition for at least 1 year. Information about the study and the questionnaire was shared online with the participants via social media platforms. They were asked to provide baseline characteristics about themselves and complete a series of online questionnaires. Ethical approval was obtained from the Human Research Ethics Department of Dhurakij Pundit University (approval number COA048/67) in accordance with the guidelines of the Declaration of Helsinki. After being informed of the benefits and possible risks, each participant provided written informed consent online before participating in the study. All personal information was kept confidential. Participants had the right to withdraw from the study at any time without providing a reason.

2.2. Participants

The study participants consisted of 140 university-level athletes. They were considered eligible if they provided informed consent and completed the online questionnaire. They were self-reported as either amateur athletes who participated in sports not for financial gain, or professional athletes who earned a living by competing in sports and were assigned to their respective groups accordingly. The required sample size was calculated using the statistical G*Power software (Germany). The power, effect size (E), and alpha (α) were set at 0.80, 0.50, and 0.05, respectively. The minimum required sample size was estimated to be 128 samples. An additional 10% was added to account for possible incomplete data, which resulted in a total sample size of 140. Participants were recruited using the snowball sampling technique, and those who completed the questionnaire were included in the final data analysis. Finally, 139 participants completed the online questionnaire and were self-assigned as either amateur (n = 74) or professional (n = 65) athletes.

2.3. Data Collection

The selected questionnaire was adapted from previous studies [13], [14] to evaluate the participants' SNK and perception of dietary supplements. The questionnaire was endorsed by a panel of experts, which included a nutritionist, two athletic coaches, and two university instructors in the sports science program. The item objective congruence (IOC) value for each item was calculated to assess content validity. These items had IOC values ranging from 0.60 to 1.00, exceeding the acceptable IOC value of 0.5 [15]. To assess reliability, we conducted a pilot study with 30 university-level athletes using the questionnaire (Cronbach's $\alpha = 0.80$), which is superior to the acceptance of 0.70 [16].

The questionnaire was composed of four sections. The first part was to collect baseline characteristics in frequency and percentage, including age, sex, sport levels, types of

sports, and sport experiences. The second part focused on their consumption behavior regarding dietary supplements, with questions about their opinions on choosing dietary supplements for athletes. The third part was to identify their perception of dietary supplements, with answers ranging from "strongly disagree" to "strongly agree." Lastly, the participants were given the 10 "true" or "false" statements to evaluate their nutritional knowledge. The items were coded using the scoring system of "1" = correct statement and "0" = incorrect statement. The total scores were calculated for each subject.

2.4. Statistical Analysis

The data were expressed as frequency (%) for the categorical variables and mean ± standard deviation (SD) for continuous data. The chi-squared (χ^2) test was used to evaluate the categorical data of the baseline characteristics. The consumption behavior of dietary supplements at the different sports levels was measured with an adjusted odds ratio (OR). The *t*-test was applied to assess differences in the perception of dietary supplement scores based on the sport level. Logistic regression was performed to determine the association between nutritional knowledge and the sports level as represented by an OR of having a correct statement relative to an incorrect statement, with a confidence interval of 95% after adjusting for variables. The statistical significance was set at $p < 0.05$ for all analyses. Statistical analysis was performed using SPSS software.

3. Results

3.1. Baseline Characteristics

A total of 139 participants were included in the study, consisting of amateur (n = 74) and professional (n = 65) athletes. The overall mean age was 20.42 ±2.56 years, with no difference between the amateur (20.27 ±2.47 years) and professional (20.58 ±2.67 years) athletes. In addition, there were no significant differences in sex, types of sports, and sport experiences (Table 1).

3.2. Consumption Behavior of Dietary Supplements

Most participants regularly used one or more supplements, predominantly sports drinks and whey protein, with only 12% reporting they never take any supplements. Surprisingly, professional athletes had greater odds of consuming whey protein (OR 4.29) than other supplements compared to amateur athletes (Table 2). Approximately 74% of the participants were likely to take dietary supplements on working out days rather than daily, with no differences between the groups (p = 0.33) (Figure 1).

Table 1. Baseline characteristics

	Amateur (n = 74)	**Professional (n = 65)**	**P**
	n (%)	**n (%)**	
Sex			
Male	24 (17.3)	19 (13.7)	0.69
Female	50 (36.0)	46 (33.1)	
Types of sports			
Individual sports	14 (10.1)	7 (5.0)	0.13
Team sports	60 (43.2)	58 (41.7)	
Sport experiences			
1–3 years	15 (10.8)	10 (7.2)	0.55
3–5 years	19 (13.7)	14 (10.1)	
≥5 years	40 (28.8)	41 (29.5)	

Table 2. The consumption behavior of dietary supplements

Dietary supplements	**Amateur n (%)**	**Professional n (%)**	**P**	**Adjusted OR**	**95% CI**
Sports drink	50 (36.0)	52 (37.4)	0.12	1.92	0.88–4.18
Whey protein	28 (20.1)	47 (33.8)	<0.001*	4.29	2.09–8.80
Vitamin	29 (20.9)	27 (19.4)	0.86	1.10	0.56–2.17
Energy drink	28 (20.1)	32 (23.0)	1.00	0.95	0.48–1.91
Energy gel	13 (9.4)	28 (37.8)	0.23	1.59	0.81–3.13

Adjusted odds ratio (OR) for age, sex, types of sports, and sport experiences

CI, confidence interval; * Statistical significance; $p < 0.05$

3.3. Perception of Dietary Supplements

To measure their perception of dietary supplements, the participants were asked to respond to several statements with answers ranging from "strongly disagree" to "strongly agree," and their responses are presented in Table 3. The overall mean score was significantly different, with a greater score in professional athletes (4.25 ± 0.45) than in amateur athletes (4.02 ± 0.42) ($p = 0.003$). In addition, professional athletes were more likely to use dietary supplements for recovery from post-exercise fatigue and to enhance muscle strength than amateur athletes ($p < 0.05$). The statement regarding the importance of dietary supplements during the recovery phase among professional athletes received the highest mean score (4.48 ± 0.71), whereas the statement suggesting that dietary supplements regulated weight control in amateur athletes presented the lowest mean score (3.91 ± 0.92).

3.4. Nutritional Knowledge

Table 4 represents the number of correct responses to the 10-statement nutritional knowledge between the amateur and professional athletes. Approximately 83% of the overall mean score (6.37 ± 1.35) was lower than 7 (the 75th percentile), with scores ranging from 3 to 10 correct answers (Figure 2). After adjusting for age, sex, types of sports, and sports experiences, there was no significant difference in the mean score of nutritional knowledge between the professional (6.48 ± 1.42) and amateur (6.28 ± 1.29) athletes ($p = 0.61$). However, the professional athletes exhibited greater odds of correct responses on the protein (OR 2.57) and hydration (OR 3.66) questions than the amateur athletes.

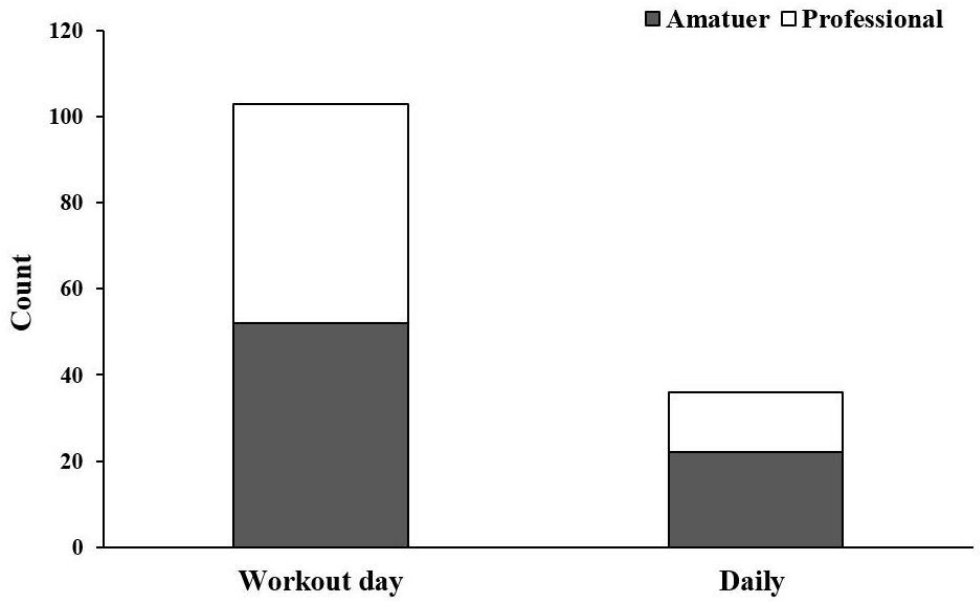

Figure 1. Timing of dietary supplement consumption

Table 3. Perception of dietary supplements in athletes

Statements	Amateur Mean ± SD	Professional Mean ± SD	P
Dietary supplements can play a role in recovery from post-exercise fatigue in athletes.	4.12 ± 0.92	4.48 ± 0.71	0.01*
Supplementation appears to prevent exercise-induced muscle tissue damage.	4.00 ± 0.97	4.20 ± 0.92	0.22
Many dietary supplements are promoted for weight loss.	3.91 ± 0.92	4.08 ± 0.96	0.29
Dietary supplements were designed to enhance muscle strength and athletic performance.	4.05 ± 0.92	4.35 ± 0.78	0.04*

* Statistical significance, $p < 0.05$; SD; standard deviation

Table 4. The correct responses to the 10-statement nutritional knowledge

Nutritional knowledge (correct response)	Amateur n (%)	Professional n (%)	P	Adjusted OR	95% CI
1. Protein supplements are mainly for muscle building. (F)	47 (33.8)	52 (37.4)	0.02*	2.57	1.13–5.83
2. Eating excess carbohydrate leads to fat accumulation. (F)	38 (27.3)	41 (29.5)	0.23	1.51	0.74–3.12
3. The last meal should be consumed 3–4 h before the competition. (T)	68 (48.9)	54 (38.8)	0.10	0.40	0.13–1.21
4. Inadequate hydration decreases performance. (T)	50 (36.0)	57 (41)	0.01*	3.66	1.45–9.24
5. Sport drink is better than water. (T)	36 (25.9)	29 (20.9)	0.52	0.79	0.38–1.62
6. Vitamin supplements are not recommended for healthy people. (F)	54 (38.8)	44 (31.7)	0.42	0.72	0.33–1.58
7. Vitamins are good sources of energy. (F)	32 (23.0)	27 (19.4)	0.88	0.94	0.46–1.95
8. Caffeine intake can improve performance. (T)	27 (19.4)	24 (17.3)	0.96	1.02	0.48–2.15
9. Fiber intake can support the digestive system, regulate blood sugar, and cancer protection. (T)	70 (50.4)	59 (42.4)	0.52	0.64	0.17–2.49
10. Skipping a meal is justifiable if you need to lose weight quickly. (F)	37 (26.6)	33 (23.7)	0.80	0.91	0.45–1.86

Adjusted odds ratio (OR) for age, gender, types of sports, and sport experience; CI, confidence interval; T, true; F, false

* Statistical significance, $p < 0.05$

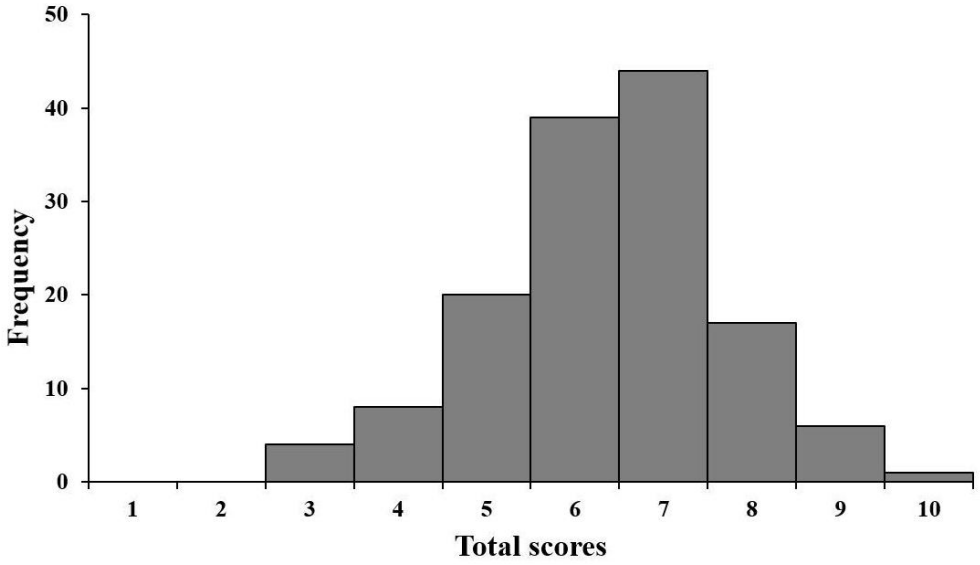

Figure 2. Number of correct answers for the 10-statement nutritional knowledge

4. Discussion

To the best of our knowledge, this is the first study to explore the nutritional knowledge and perception of dietary supplements regarding athletic performance among amateur and professional university-level athletes. The main findings were that professional athletes had greater odds of consuming whey protein, and professional athletes had significantly higher scores in their positive perception of dietary supplements for recovery status and enhancing muscle strength than amateur athletes. However, there was no significant difference in the overall mean score of nutritional knowledge between professional and amateur athletes.

The perception of choosing dietary supplements for athletes was evaluated. We found that the impact of supplement consumption decisions was mostly related to muscle strength and recovery from post-exercise fatigue in professional athletes. This was similar to the results reported by Maughan et al. [17], where it was revealed that athletes used dietary supplements to help recover from training and promote health benefits, and the use of supplements was widely prevalent. Furthermore, Roy et al. [18] reported that the most frequent reasons for consuming dietary supplements in Canadian varsity athletes were to increase energy and promote recovery. In our study, approximately 90% of athletes revealed regularly taking one or more supplements, with more than 50% of the participants consuming sports drink or whey protein. This was supported by Jovanov et al. [19], who reported that the

prevalence rate of sports supplement intake was 82.2%, with protein supplements being predominant. Previous research conducted by Tawfik et al. [20] demonstrated that sports supplement intake by young Egyptian athletes predominantly included sports drinks (66.9%) and creatine (54.3%) for better physical appearance and enhanced athletic performance, whereas Adam et al. [6] showed that taekwondo athletes might not believe that energy drinks and soda enhance their performance.

However, the findings in our study showed that professional athletes have greater odds of consuming whey protein than amateur athletes. This result was consistent with the previous work of Sebastián-Rico [21], in which female elite soccer players exhibited higher levels of whey protein consumption, regardless of their playing position. The use of certain performance sports supplements was based on the competitive level, with a significantly higher intake in top-level athletes, especially whey protein intake in male athletes [22]. Similarly, the study by Langan-Evans et al. [23] found that a higher prevalence of supplement use was found in elite athletes (76%) compared with amateur athletes (61%), independent of their gender, age, training hours, and types of sports, in which the most popular supplement across all competitive levels was whey protein. Furthermore, the study by Sheridan et al. [24] proposed an individualized approach to the needs and goals of the athlete, aimed at improving the frequency of protein intake throughout the day with tailored doses. It should be considered when to begin supplementation, as there is a "window of opportunity." For example, the continuous daily use of protein supplements induced protein synthesis after 16–48 h of resistance exercise [25]. Similarly, Trommelen et al. [26], reported that the ingestion of whey protein typically stimulated muscle protein synthesis rates over periods of up to 6 h at rest or following resistance-type exercise. These findings were supported by our study, where more than 74% of participants were likely to use supplements on workout days rather than daily. On the other hand, Kathure et al. [27] found that 40.9% of elite athletes in athletic camps had the right knowledge on protein consumption 1-2 hours before an event. Interestingly, there was evidence to suggest that the participants had the basic knowledge that adding protein supplements might induce protein synthesis.

The current study showed that approximately 50% of the overall nutritional knowledge mean scores were less than the 75th percentile. This might be a lack of basic knowledge among university athletes, which was supported by previous studies. For example, Andrews et al. [28] found that the overall mean SNK scores (56.9%) for student athletes were considered inadequate (mean score <75%). Similarly, Badrasawi et al. [13] revealed that the mean nutritional knowledge score of 249 sports students in universities in Turkey was 11 out of 21, which was related to the academic year and level of income. This is in agreement with the results reported by Adam et al. [6], who showed a notable deficiency in nutritional knowledge with a mean score of 5.36 out of 11 among elite young taekwondo athletes. Surprisingly, we found that the total nutritional knowledge scores were not different between the amateur and professional athletes. This was consistent with the studies reported by Mitchell et al. [4] and Renard et al. [5], which showed no significant differences in nutritional knowledge scores between elite and nonelite football players. Devlin et al. [29] reported a mean score of 57% for evidence of nutrition knowledge with no differences between elite and sub-elite Australian footballers and soccer players in an A-league soccer club. In contrast, Trakman et al. [30] reported higher nutritional knowledge scores in non-elite than elite players regarding macronutrients and supplementation. However, we demonstrated that professional athletes were different from amateur athletes in terms of their correct responses for some nutritional knowledge statements, particularly in the protein and hydration questions. Recent research has confirmed a better understanding of a nutritional approach in adolescent athletes, with a predominant protein intake accounting for 10%–35% of their daily caloric intake [31]. Besides, Judge et al. [32] reported that collegiate track and field throwers who were concerned that dehydration would decrease their performance also believed that thirst was the best indicator of dehydration. Our study showed that overall knowledge scores remained low in both groups; although, protein and hydration awareness in professionals was superior to amateurs. It was possible that the available nutritional information may influence individual dietary intakes, which are related to attitudes, behaviors, and information resources, revealed by Varamenti et al. [33]. However, evidence of ongoing sports nutrition information is still controversial.

Generally, the level of nutritional knowledge varies among athlete groups. Therefore, nutrition education programs are primarily beneficial for promoting positive dietary habits to enhance physical performance and health [34]. For instance, Lydon et al. [35] reported that after Gaelic Athletic Association (GAA) players in Ireland (n = 336) participated in a 3-hour nutrition education workshop on preparing meals from simple ingredients, they improved nutritional knowledge regarding food consumption for optimal sports performance, particularly in women. It was similar to Tektunali et al. [36] who recruited young female endurance athletes (n = 83), with 45 individuals receiving six physical nutrition education lectures, and 38 receiving no nutrition lectures. The results showed that sports nutrition knowledge questionnaire scores increased positively following the intervention. Nor et al. [14] showed that Malaysian university athletes had inadequate overall knowledge scores with no association with their levels of sports participation. However, nutrition knowledge scores were significantly higher among individuals with prior nutrition education compared to those without such basic knowledge. Thus, further studies may need to explore the novel sport nutrition education programs in athletes.

5. Conclusions

In summary, the findings indicated that both professional and amateur athletes often lack adequate nutritional knowledge, which may hinder their ability to meet optimal dietary requirements. In the field of sports training, where performance, recovery, and long-term health are closely linked to nutrition, this gap presents a remarkable awareness. Initial nutritional knowledge is a critical factor influencing athletes' dietary behaviors. Therefore, it is recommended that athletes and coaches across all levels of sport should receive targeted nutritional education programs. Such education can enhance dietary awareness, support sport-specific training demands, and contribute to improved health and athletic performance.

6. Limitations

First, the snowball sampling method was designed to expand the desired characteristics of the target group in proportion to the university-athlete community. However, some of our findings might be biased compared to probability sampling strategies. Thus, reducing bias by selecting various initial points from different communities and monitoring sample growth may help. Second, the samples that were drawn from a specific urban region in Thailand might limit the interpretation and generalization of the findings to athletes in rural areas or other overseas regions, because nutritional practices were diverse. Therefore, a multicenter study may be considered in further studies. Last, self-reported categorization was designed to divide participants as either amateurs or professionals in this study by giving a definition to both groups via an online questionnaire. Indeed, a self-administered questionnaire reduces the time and effort needed for face-to-face interaction. However, the validity of this questionnaire is often uncertain. Thus, the questionnaire may include additional questions asking about their primary motivation and compensation for engaging in a sports activity.

Acknowledgements

We are grateful to all athletes from universities in the Bangkok Metropolitan Region (Thailand) for their valuable support, participation, and collaboration in the process of this study. Finally, we greatly appreciate the assistance of all staff at Dhurakij Pundit University and Valaya Alongkorn Rajabhat University throughout this study.

Authors' Contribution

ST (first author) participated in the project conceptualization, methodology, data curation, data analysis, visualization, and manuscript writing. TL arranged the data curation and data analysis. SC (corresponding author) provided technical support throughout the experiment, project administration, and manuscript writing. All authors read and edited the manuscript and approved the final version for publication.

Funding

No funding agencies were reported by the authors.

Data Availability Statement

Data are available upon request.

Disclosure Statement

The authors declare no potential conflicts of interest.

REFERENCES

[1] Arenas-Jal, M., J. Suñé-Negre, P. Pérez-Lozano, and E. García-Montoya, "Trends in the food and sports nutrition industry: A review," Critical Reviews in Food Science and Nutrition, vol. 60, no. 14, pp. 2405-2421, 2020. DOI: https://doi.org/10.1080/10408398.2019.1643287.

[2] Ma, X., H. Chen, L. Cao, S. Zhao, C. Zhao, et al., "Mechanisms of physical fatigue and its applications in nutritional interventions," Journal of Agricultural and Food Chemistry, vol. 69, no. 24, pp. 6755-6768, 2021. DOI: https://doi.org/10.1021/acs.jafc.1c01251.

[3] Jayawardena, R., K. Weerasinghe, I. Nanayakkara, T. Madhujith, A.P. Hills, et al., "The effects of a nutritional intervention on the sports nutrition knowledge and nutritional status of track and field athletes: protocol for a randomized controlled trial," Trials, vol. 26, no. 1, pp. 61, 2025. DOI: https://doi.org/10.1186/s13063-024-08683-9.

[4] Mitchell, L., P. Lehane, M. McCarthy, K. O'Shea, M. Tracey, et al., "Nutrition knowledge of elite and non-elite Gaelic footballers," Science and Medicine in Football, vol. 6, no. 2, pp. 159-163, 2022. DOI: https://doi.org/10.1080/24733938.2021.1906440.

[5] Renard, M., A. Anton-Solanas, D.T. Kelly, and C. Ó Catháin, "Evaluation of nutrition knowledge in elite and sub-elite Gaelic football players," Science and Medicine in Football, vol. 6, no. 1, pp. 82-88, 2022. DOI: https://doi.org/10.1080/24733938.2021.1883195.

[6] Adam, T.A., A. Hamza, A. Amani, O. Batool, T. Nataly, et al., "Nutritional Knowledge, Attitudes, and Practices among Elite Young Taekwondo Athletes: A Cross-Sectional KAP Study," International Journal of Human Movement and Sports Sciences, vol. 13, no. 2, pp. 318-325, 2025. DOI: https://doi.org/10.13189/saj.2025.130209.

[7] Elsahoryi, N.A., G. Trakman, and A. Al Kilani, "General and sports nutrition knowledge among Jordanian adult coaches and athletes: A cross-sectional survey," PloS one, vol. 16, no. 11, pp. e0258123, 2021. DOI: https://doi.org/10.1371/journal.pone.0258123.

[8] Cotugna, N., C.E. Vickery, and S. McBee, "Sports nutrition for young athletes," The Journal of School nursing, vol. 21, no. 6, pp. 323-328, 2005. DOI: https://doi.org/10.1177/10598405050210060401.

[9] Purcell, L.K., C.P. Society, and P.S.E.M. Section, "Sport nutrition for young athletes," Paediatrics and Child Health, vol. 18, no. 4, pp. 200-202, 2013. DOI: https://doi.org/10.1093/pch/18.4.200.

[10] Cherian, K.S., S.M. Gavaravarapu, A. Sainoji, and V.R. Yagnambhatt, "Coaches' perceptions about food, appetite, and nutrition of adolescent Indian athletes-A qualitative study," Heliyon, vol. 6, no. 2, pp. e03354, 2020. DOI: https://doi.org/10.1016/j.heliyon.2020.e03354.

[11] Birkenhead, K.L. and G. Slater, "A review of factors influencing athletes' food choices," Sports Medicine, vol. 45, pp. 1511-1522, 2015. DOI: https://doi.org/10.1007/s40279-015-0372-1.

[12] Contento, I.R., S.S. Williams, J.L. Michela, and A.B. Franklin, "Understanding the food choice process of adolescents in the context of family and friends," Journal of Adolescent Health, vol. 38, no. 5, pp. 575-582, 2006. DOI: https://doi.org/10.1016/j.jadohealth.2005.05.025.

[13] Badrasawi, M.M., N.Y. Shraim, and M.H. Al-Atrash, "Knowledge of physical education students about nutrition: a cross-sectional study from Palestine," International Journal of Nutrition, Pharmacology, Neurological Diseases, vol. 8, no. 4, pp. 101-107, 2018. DOI: https://doi.org/10.4103/ijnpnd.ijnpnd_32_18.

[14] Nor Azizam, N.S., S.N. Yusof, J.J. Amon, A. Ahmad, N.S. Safii, et al., "Sports nutrition and food knowledge among Malaysian university athletes," Nutrients, vol. 14, no. 3, pp. 572, 2022. DOI: https://doi.org/10.3390/nu14030572.

[15] Turner, R.C. and L. Carlson, "Indexes of item-objective congruence for multidimensional items," International Journal of Testing, vol. 3, no. 2, pp. 163-171, 2003. DOI: https://doi.org/10.1207/S15327574IJT0302_5.

[16] Kliemann, N., J. Wardle, F. Johnson, and H. Croker, "Reliability and validity of a revised version of the General Nutrition Knowledge Questionnaire," European Journal of Clinical Nutrition, vol. 70, no. 10, pp. 1174-1180, 2016. DOI: https://doi.org/10.1038/ejcn.2016.87.

[17] Maughan, R.J., "Risks and rewards of dietary supplement use by athletes," The Encyclopaedia of Sports Medicine: An IOC Medical Commission Publication, vol. 19, pp. 291-300, 2013. DOI: https://doi.org/10.1002/9781118692318.ch23

[18] Roy, K.-A., D. El Khoury, J.J. Dwyer, and M. Mountjoy, "Dietary supplementation practices among varsity athletes at a Canadian university," Journal of Dietary Supplements, vol. 18, no. 6, pp. 614-629, 2021. DOI: https://doi.org/10.1080/19390211.2020.1826618.

[19] Jovanov, P., V. Đorđić, B. Obradović, O. Barak, L. Pezo, et al., "Prevalence, knowledge and attitudes towards using sports supplements among young athletes," Journal of the International Society of Sports Nutrition, vol. 16, no. 1, pp. 27, 2019. DOI: https://doi.org/10.1186/s12970-019-0294-7.

[20] Tawfik, S., N. El Koofy, and E.M.I. Moawad, "Patterns of nutrition and dietary supplements use in young Egyptian athletes: a community-based cross-sectional survey," PloS one, vol. 11, no. 8, pp. e0161252, 2016. DOI: https://doi.org/10.1371/journal.pone.0161252.

[21] Sebastián-Rico, J., J.M. Martínez-Sanz, J. Sanchis-Chordà, M. Alonso-Calvar, P. López-Mateu, et al., "Supplement consumption by elite soccer players: differences by competitive level, playing position, and sex," Healthcare, vol. 12, no. 4, pp. 496, 2024. DOI: https://doi.org/10.3390/healthcare12040496.

[22] Romero-García, D., J.M. Martínez-Sanz, J. Sebastián-Rico, C. Manchado, and R. Vaquero-Cristóbal, "Pattern of consumption of sports supplements of Spanish handball players: differences according to gender and competitive level," Nutrients, vol. 16, no. 2, pp. 315, 2024. DOI: https://doi.org/10.3390/nu16020315.

[23] Langan-Evans, C., M.A. Hearris, S. McQuilliam, L.M. Burke, T. Stellingwerff, et al., "Hormonal contraceptive use, menstrual cycle characteristics and training/nutrition related profiles of elite, sub-elite and amateur athletes and exercisers: One size is unlikely to fit all," International Journal of Sports Science & Coaching, vol. 19, no. 1, pp. 113-128, 2024. DOI: https://doi.org/10.1177/17479541231163088.

[24] Sheridan, H.C., L.J. Parker, and K.M. Hammond, "Dietary supplements for consideration in elite female footballers," European Journal of Sport Science, vol. 22, no. 5, pp. 733-744, 2022. DOI: https://doi.org/10.1080/17461391.2021.1988149.

[25] Van Loon, L.J., "Is there a need for protein ingestion during exercise?," Sports Medicine, vol. 44, no. Suppl 1, pp. 105-111, 2014. DOI: https://doi.org/10.1007/s40279-014-0156-z.

[26] Trommelen, J., M.W. Betz, and L.J. van Loon, "The muscle protein synthetic response to meal ingestion following resistance-type exercise," Sports Medicine, vol. 49, no. 2, pp. 185-197, 2019. DOI: https://doi.org/10.1007/s40279-019-01053-5.

[27] Kathure, D.M., P. Bukhala, and S. Konyole, "Assessment of nutrition knowledge and sources of nutrition information among middle-and long-distance elite athletes in North Rift region of Kenya," African Journal of Food, Agriculture, Nutrition, Development, vol. 22, no. 5, pp. 20300-20316, 2022. DOI: https://doi.org/10.18697/ajfand.110.22445.

[28] Andrews, A., J.R. Wojcik, J.M. Boyd, and C.J. Bowers, "Sports Nutrition Knowledge among Mid-Major Division I University Student-Athletes," Journal of Nutrition and Metabolism, vol. 2016, no. 1, pp. 3172460, 2016. DOI: https://doi.org/10.1155/2016/3172460.

[29] Devlin, B.L., M.D. Leveritt, M. Kingsley, and R. Belski, "Dietary intake, body composition, and nutrition knowledge of Australian football and soccer players: implications for sports nutrition professionals in practice," International Journal of Sport Nutrition Exercise Metabolism, vol. 27, no. 2, pp. 130-138, 2017. DOI: https://doi.org/10.1123/ijsnem.2016-0191.

[30] Trakman, G.L., A. Forsyth, K. Middleton, R. Hoye, S.

Jenner, et al., "Australian football athletes lack awareness of current sport nutrition guidelines," International Journal of Sport Nutrition Exercise Metabolism, vol. 28, no. 6, pp. 644-650, 2018. DOI: https://doi.org/10.1123/ijsnem.2018-0002.

[31] Gibbs, R.L. and T.B.J.J.o.t.I.S.o.S.N. Becker, "General and sport-specific nutrition knowledge and behaviors of adolescent athletes," Journal of the International Society of Sports Nutrition, vol. 22, no. 1, pp. 2477060, 2025. DOI: https://doi.org/10.1080/15502783.2025.2477060.

[32] Judge, L.W., D.M. Bellar, J.K. Popp, B.W. Craig, M.A. Schoeff, et al., "Hydration to maximize performance and recovery: Knowledge, attitudes, and behaviors among collegiate track and field throwers," Journal of human kinetics, vol. 79, pp. 111, 2021. DOI: https://doi.org/10.2478/hukin-2021-0065.

[33] Varamenti, E., D. Tod, and S.A.J.S.m.-o. Pullinger, "Redox homeostasis and inflammation responses to training in adolescent athletes: A systematic review and meta-analysis," Sports medicine-open, vol. 6, no. 1, pp. 1-17, 2020. DOI: https://doi.org/10.1186/s40798-020-00262-x.

[34] Boidin, A., R. Tam, L. Mitchell, G.R. Cox, and H. O'Connor, "The effectiveness of nutrition education programmes on improving dietary intake in athletes: a systematic review," British Journal of Nutrition, vol. 125, no. 12, pp. 1359-1373, 2021. DOI: https://doi.org/10.1017/s0007114520003694.

[35] Lydon, R., A. McCloat, E. Mooney, and E. Kelly-Blakeney, "Recipes for Success: Lessons learned from the implementation of a food skills and nutrition education workshop with Gaelic athletic players on the Island of Ireland (IOI)," Health Education Journal, vol. 82, no. 1, pp. 41-53, 2023. DOI: https://doi.org/10.1177/0017896922113 6838.

[36] Tektunalı Akman, C., C. Gönen Aydın, and G. Ersoy, "The effect of nutrition education sessions on energy availability, body composition, eating attitude and sports nutrition knowledge in young female endurance athletes," Frontiers in Public Health, vol. 12, pp. 1289448, 2024. DOI: https://doi.org/10.3389/fpubh.2024.1289448.