JSA 8

by Sport Area

Submission date: 26-Aug-2025 08:30AM (UTC+0700)
Submission ID: 2735322188
File name: 8_Agustus_2025_JSA_Muhamad_Fahmi_Hasan_235_243.pdf (857.33K)
Word count: 5101
Character count: 28984

Journal Sport Area
http://journal.uir.ac.id/index.php/JSP
Vol. 10. No. 2. August, (2025)

Nutrition knowledge and dietary intake among Indonesian professional weightlifters: Implications for performance and policy

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Received 22 January 2025; Accepted 08 July 2025; Published 16 August 2025
Ed 2025; *10*(2): 235-243

ABSTRACT

Background: In weight-class sports like weightlifting, dietary habits and nutrition knowledge are critical to optimizing body composition and performance. Despite the importance of these factors, limited research has explored the nutritional behaviors and knowledge of elite Indonesian weightlifters. This study addresses that gap by evaluating both dimensions in a professional athletic context. **Research Objectives:** This study aims to examine the levels of nutritional knowledge and dietary intake among Indonesian professional weightlifters, with the goal of providing recommendations to enhance Indonesia's achievements in the sport. **Methods:** A cross-sectional study was conducted involving 24 national-level Indonesian weightlifters with at least four years of competitive experience. Participants completed a validated nutrition knowledge questionnaire and a 7-day dietary recall. Data were analyzed using SPSS to determine average intake values and knowledge scores. **Findings/Results:** Findings revealed that none of the athletes met the recommended dietary intake across all major nutrient categories. Protein intake was the closest to adequacy, while energy, carbohydrate, calcium, and fiber intake were below standard recommendations. Additionally, athletes showed low levels of nutritional knowledge in all assessed areas. **Conclusion:** Both nutritional knowledge and dietary intake among Indonesian professional weightlifters are inadequate and may hinder optimal performance and recovery. This highlights the urgent need for targeted nutrition education and individualized dietary planning. Future interventions should also consider psychosocial and environmental factors such as food access, cultural influences, time constraints, and social support to ensure sustainable improvements in athletes' eating behaviors.

Keywords: Nutrition status; lifestyle; weighlifting; questionnaire

https://doi.org/10.25299/sportarea.2025.vol10(2).21131

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How to Cite: Hasan, M. F., Apriantono, T., Ramania, N. S., Solikah, N. L., & Latief, G. R. G. (2025). Nutrition knowledge and dietary intake among Indonesian professional weightlifters: Implications for performance and policy. *Journal Sport Area*, *10*(2), 235-243. https://doi.org/10.25299/sportarea.2025.vol10(2).21131

Authors' Contribution: a – Study Design; b – Data Collection; c – Statistical Analysis; d – Manuscript Preparation; e – Funds Collection

INTRODUCTION

Weightlifting is a sport that is competed based on body weight classes (Durguerian et al., 2016). This regulation makes body composition an important factor in optimizing an athlete's weight and strength potential. An athlete's strength potential can be assessed by the magnitude of their muscle composition; the greater the muscle composition, the greater the lifting potential (Beaumont et al., 2024). Achieving ideal body composition is not only influenced by training and rest programs, but also nutritional intake which plays an important role in helping athletes achieve their desired body composition (Macuh et al., 2023). In sports nutrition emphasizes the need for a dietary strategy that is tailored to the needs of each athlete, taking into account their unique training patterns, metabolic rates, and specific goals (Jagim et al., 2021; Vázquez-Espino et al., 2022).

An athlete's understanding of the importance of nutrition and the food they consume greatly affects their performance through changes that occur in body composition or during training. Nutrition Knowledge (NK) serves as an early indicator of an individual's good eating habits (Scalvedi et al., 2021). Previous studies have shown that the level of NK among Australian soccer athletes is at a commendable level (Jenner et al., 2018). However, differing results were found among student athletes in Iran, where a high correlation was observed between NK and dietary habits as well as Dietary Intake (DI) (Hasanpouri et al., 2023). Similar findings were noted for female athletes, who tend to show greater concern for NK due to its significant impact on performance (Sims et al., 2023).

In recent years, there has been a growing recognition of the critical role that nutrition plays in optimizing athletic performance (Drew et al., 2023; Shaw et al., 2022). Athletes are often subjected to rigorous training regimens that demand not only physical endurance but also proper nutrient intake to support recovery, muscle growth, and overall health (Amawi et al., 2023). Research indicates that athletes with higher levels of nutrition knowledge tend to make better dietary choices, which directly correlates with improved performance outcomes (Leonhardt et al., 2024).

Moreover, inadequate nutritional knowledge can lead to detrimental eating habits, such as restrictive dieting or improper supplementation, which may adversely affect an athlete's health and performance (Kontele & Vassilakou, 2021). Many athletes struggle with balancing their dietary intake while managing weight classes, particularly in sports like weightlifting where body composition is paramount (Das et al., 2024). The consequences of poor dietary practices can manifest as decreased energy levels, increased risk of injury, and impaired recovery processes (Turnagöl et al., 2022).

Various studies related to NK and DI highlight the urgency of nutrition in supporting athletic performance. These findings serve as evaluation materials for coaching teams to enhance athletes' awareness and responsibility regarding their nutritional intake. In the context of weightlifting, NK and DI are crucial aspects to analyze, given the close relationship between body composition and DI, as well as the relationship between NK and DI (Adhelia & Sefrina, 2022; Barus et al., 2024; Heaney et al., 2011; Rossi et al., 2017; Trakman et al., 2016).

Nevertheless, research on nutrition knowledge and dietary intake among professional weightlifters remains limited (Marquart et al., 2022; Parducho, 2024). This analysis is essential to provide insights for coaching teams and stakeholders to improve athlete development and performance. This is particularly relevant for Indonesia, considering that Indonesian weightlifting has consistently won medals at the Olympics since the 1990s. This study highlights a critical gap in athlete nutritional knowledge that often has a lack of nutritional knowledge (Magee et al., 2023; Trakman et al., 2016), especially in Indonesia.

This study aims to evaluate the levels of NK and DI among professional weightlifters in Indonesia. The initial hypothesis posits that the levels of NK and DI among the samples fall into a poor category based on nutritional adequacy rates and educational backgrounds. The results of this research are expected to serve as evaluation material to enhance nutritional coaching and performance among professional weightlifters in the future.

METHOD

This study employed a cross-sectional observational design, aiming to assess the nutrition knowledge and dietary intake of professional weightlifters at a single point in time. By using this design, the researchers were able to capture a snapshot of the participants' nutritional status and behaviors during their training camp period, without intervening or applying experimental treatment.

Participants

The research sample consisted of 24 Indonesian professional weightlifters, with an average age of 24.7 years. All participants were male and met specific inclusion criteria: they had competed at the national level, participated in weightlifting competitions in the Indonesian Pekan Olahraga Nasional (PON), had been athletes for more than four years, and were currently undergoing a training camp in preparation for competition. The exclusion criteria included any athlete who was recovering from an injury or surgery.

Sampling Procedures

The sample selection process was conducted by applying the aforementioned inclusion and exclusion criteria to professional weightlifting athletes in Lampung Province. This province was chosen due to its history of producing national-level weightlifting athletes who excel on the world stage. Out of a total of 47 athletes in the club, 24 met the criteria for inclusion in this study. The entire study protocol received ethical approval from the Health Research Ethics Committee of the Ministry of Health, Bandung Health Polytechnic, under Letter No.10/KEPK/EC/IV/2020.

Materials and Apparatus

This study utilized two primary indicators: Nutrition Knowledge (NK) and Dietary Intake (DI). The NK assessment was administered to all participants through a single questionnaire. Dietary intake data were collected using a 7-day dietary recall method by ensuring that the data presented were appropriate. Upon collection, all questionnaires were processed for analysis.

Procedures

The data collection process began with obtaining informed consent from participants, which was approved by the research ethics committee of Bandung City Health Polytechnic. Following consent, participants underwent anthropometric measurements, including height and weight, using the Omron Karada Body Composition. Subsequently, they completed the Dietary Intake questionnaire over a period of seven days and filled out the Nutrition Knowledge Questionnaire.

The research instrument used to assess Nutrition Knowledge (NK) was an adapted version of the General Nutrition Knowledge Questionnaire – Revised (GNKQ-R) by Kliemann et al. (2016), consisting of 28 items categorized into three sections: Advice (national nutrition recommendations), Food Groups (classification of food types including sugar, fat, salt, protein, and fiber), and Food Choices (selecting healthier food options). The maximum possible score was 72 points, comprising the domains of dietary advice (11 points), food groups (51 points), and food choice (10 points). Each score was converted into a percentage of the maximum, then classified into four categories: very poor (< 60%), poor (60-79%), good (80-89%), and very good (≥ 90%). The questionnaire was adapted and has undergone appropriate validation to ensure its suitability and reliability for use among Indonesian athletes.

Data Analysis

Data collected from the questionnaires were analyzed to determine levels of Nutrition Knowledge and Dietary Intake using SPSS Statistics Version 25.0. The analysis included calculating the average scores for each variable to assess overall performance in NK and DI among the participants. This approach provided insights into the nutritional awareness and dietary habits of professional weightlifters in Indonesia.

RESULTS AND DISCUSSION

The initial data obtained were anthropometric tests to describe the athletes' general physical condition. These measurements—height, weight, and body composition—showed that participants had a mean BMI of 29.32 ± 5.71, placing them in the upper threshold of the overweight category, which is common among weightlifters due to higher lean body mass (56.22 ± 9.77%).

Table 1. Anthropometric

Items	Result
Age (years)	22.87 ± 3.25
Weight (kg)	76.12 ± 18.40
Height (cm)	160.56 ± 4.79
BMI (kg/m2)	29.32 ± 5.71
Body fat (%)	24.38 ± 7.24
Lean body mass (%)	56.22 ± 9.77

Nutrition knowledge (NK) was found to be poor across all assessed domains. The average scores were 73% for dietary advice, 62% for food group knowledge, and 59% for food choice, with an overall average of 72%, placing all participants in the "poor" category. No correlations between NK and dietary intake (DI) were found to be statistically significant (all $r < 0.2$, $p > 0.05$).

Table 2. Nutrition Knowledge

Categories	Mean (SD)	%	Knowledge Caterogy
Dietary Advance (11 point)	8.34	73%	Poor
Food Group (51 point)	31.29	62%	Poor
Food Choice (10 point)	5.32	59%	Poor
Overall score (72 point)	46.88	72%	Poor

Table 3. Dietary Intake

Categories	Recommended Intake	Average per day (mean±SD)
Energy (MJ)	~15 MJ	8.1 ± 1.8
Carbohydrate ($g \cdot kg^{-1} \cdot day^{-1}$)	6–10 $g \cdot kg^{-1} \cdot day^{-1}$	2.4 ± 0.8
Protein ($g \cdot kg^{-1} \cdot day^{-1}$)	1.2–2.0 $g \cdot kg^{-1} \cdot day^{-1}$	1.8 ± 0.4
Fat ($g \cdot kg^{-1} \cdot day^{-1}$)	20–35% total energy	0.9 ± 0.3
Fruit (serves)	2 serves per day	1.0 ± 0.8
Vegetable (serves)	5 serves per day	4.3 ± 1.7
Calcium (mg)	1000 mg-day− 1	952. ± 287
Fibre (g)	30 g-day− 1	27.0 ± 7.6

Table 3 shows total energy, macronutrient, micronutrient (Calcium) and food group intakes (mean ± SD) collected via a 7-day food diary (Dietary Intake). Dietary intake revealed that the majority of athletes failed to meet recommended nutrient targets. Average energy intake (8.1 ± 1.8 MJ) was substantially lower than the ~15 MJ recommended by American College of Sports Medicine (ACSM). Carbohydrate intake was 2.4 ± 0.8 g/kg/day, well below the recommended 6-10 g/kg/day by International Olympic Committee (IOC). While protein intake (1.8 ± 0.4 g/kg/day) approached the recommended level, fat (0.9 ± 0.3 g/kg/day), fruit (1.0 ± 0.8 servings), fiber (27.0 ± 7.6 g), and calcium (952 ± 287 mg) were also below standard recommendations. Based on the results, most athletes did not meet the recommended intake levels, particularly for energy, carbohydrate, calcium, and fiber.

In terms of influencing factors, educational status showed a significant positive correlation with energy intake ($r = 0.42$, $p = 0.037$) and vegetable intake ($r = 0.45$, $p = 0.028$). No significant associations were observed between education and other nutrients. Confounding factors such as training load, supplement use, or access to a sports nutritionist were not assessed in this study but warrant consideration in future research. No significant relationships were found between DI measures and age or years of training experience.

The aim of this study is to serve as a reference and evaluation of the weightlifting team and stakeholders regarding the nutritional intake of athletes. In this study, it was found that the DI and NK of the samples in

this study were categorized as poor. In accordance with the hypothesis at the beginning of the article, there needs to be education and attention to weightlifting athletes in terms of nutrition.

According to the results of the study, All participants had a BMI in the upper overweight range, with an average BMI of 29.32 ± 5.71, which is almost in the obesity category. The health and performance of athletes are greatly affected by the condition if their weight is obese. Obesity can increase the risk of various health problems, including cardiovascular disease, type 2 diabetes, and joint disorders. These health problems can interfere with training and competition. Research has demonstrated that athletes who are obese are more likely to have certain health concerns, which could result in a decline in their performance during competitions and training sessions (Baranauskas et al., 2023; Stokes et al., 2018).

The study revealed that the athletes consumed only 54% of the recommended protein intake, which is concerning given the critical role of protein in muscle growth, repair, and recovery. For weightlifting athletes who engage in rigorous resistance training, protein is essential to optimize muscle protein synthesis and support recovery after intense physical activity (Capra et al., 2024; Carbone & Pasiakos, 2019). Research suggests that resistance-trained athletes require between 1.6 and 2.2 grams of protein per kilogram of body weight to enhance recovery and prevent muscle breakdown (Cintineo et al., 2018; Kanaan et al., 2025). Insufficient protein intake not only delays muscle recovery but also increases the risk of injuries and hinders muscle mass development, which are crucial for peak performance in strength-based sports like weightlifting (West et al., 2023). Therefore, addressing this protein deficiency is vital to improving the athletes' performance and reducing injury risks.

The participants' average nutrition knowledge score of 72%, categorized as "poor," highlights a significant gap in their understanding of proper dietary practices. Limited nutrition knowledge can lead to suboptimal food choices and inadequate nutrient intake, ultimately impairing both health and athletic performance. According to Iwasa-Madge and Sesbreno (2022), many athletes lack sufficient knowledge about nutrition, which prevents them from making informed dietary decisions that align with their training goals. While the study found a weak positive correlation between nutrition knowledge and dietary intake, this suggests that knowledge alone is insufficient to drive behavioral change. To bridge this gap, nutrition education programs should prioritize practical applications such as meal planning, food preparation, and portion control to help athletes translate theoretical knowledge into actionable habits (Mancone et al., 2024; Silva et al., 2023).

Previous studies have corroborated these findings by emphasizing the disconnect between nutrition knowledge and its application among athletes. Loncarica (2016) found that many athletes fail to meet recommended nutrient intakes despite having basic nutrition knowledge, particularly in areas like protein consumption and micronutrient adequacy. Similarly, Burke et al. (2019) highlighted the importance of comprehensive nutrition education programs that go beyond theoretical knowledge by incorporating practical strategies such as meal preparation and personalized dietary planning. These interventions have been shown to improve athletes' ability to make better food choices, thereby supporting both their short-term performance and long-term health outcomes. This aligns with the current study's conclusion that a holistic approach is needed to address the gap between knowledge and practice.

Another critical issue identified was the imbalance in macronutrient intake, with excessive carbohydrate consumption overshadowing other essential nutrients such as protein, fats, fruits, vegetables, calcium, and fiber. This imbalance can disrupt overall nutrient equilibrium and negatively affect long-term health and performance (Amawi et al., 2023). A balanced diet is crucial for ensuring that athletes receive all necessary nutrients to support energy demands during training and competition while also promoting recovery and reducing injury risks (Burke, 2021; Sasmarianto et al., 2021). Addressing this imbalance requires tailored dietary strategies that emphasize nutrient diversity and adequacy.

To address these challenges effectively, future research should explore additional factors influencing athletes' dietary behaviors. Studies suggest that factors such as social support, access to healthy foods, cultural influences, and time constraints play a significant role in shaping eating habits (Perez-Montilla et al., 2022). Understanding these factors could guide the development of more effective nutrition intervention programs that combine education with practical tools for meal planning and preparation. By adopting a holistic approach

that integrates knowledge dissemination with behavioral strategies, these programs could empower athletes to make sustainable changes in their dietary practices.

This study also has limitations, as it did not include bivariate or multivariate analyses to examine the influence of factors such as education level, years of experience, and other individual or contextual variables on nutrition knowledge and dietary intake. In addition, the use of the 7-day dietary recall method is prone to recall bias and underreporting, which may affect the accuracy of dietary intake data. Future studies should address these gaps to provide a more comprehensive understanding of the determinants of athletes' dietary behaviors.

CONCLUSION

Weightlifting athletes require enhanced focus on nutritional education to elevate their performance outcomes. None of the athletes achieved the advised nutritional requirements for their category. Only 54% of the necessary protein intake was attained by the samples. Moreover, the athletes exhibited insufficient nutritional knowledge. The athletes' dietary intake is inadequate, as is their comprehension of optimal nutrition for performance improvement. This situation is troubling and necessitates immediate attention for enhancements in athletic performance to be achieved. Therefore, it is strongly recommended to assign sports nutritionists to guide athletes' dietary planning, implement structured and periodized protein intake targets, and improve the quality and nutritional adequacy of meals provided at training camps. These measures can help bridge the gap between current practices and optimal nutritional standards, ultimately enhancing athlete performance in the long term.

ACKNOWLEDGEMENTS

The authors would like to express their sincere gratitude to all individuals who participated in and contributed to this research. Their cooperation and valuable contributions were essential for the successful completion of this research. We also extend our heartfelt thanks to Institut Teknologi Bandung (ITB) for providing the funding support that made this study possible. Without their assistance, this research would not have been realized.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this research.

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