The role of nutrition in athletic performance: A systematic review of eating behavior and dietary intake patterns

Peran nutrisi dalam performa atletik: Tinjauan sistematis tentang perilaku makan dan pola asupan makanan

Review Article

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Abstract.

Background Nutrition plays a crucial role in optimizing athletic performance, recovery, and overall well-being. Proper dietary intake and eating behavior directly influence an athlete's energy levels, endurance, and ability to perform at peak capacity.

Objectives This systematic review explores the relationship between eating habits, dietary intake patterns, and athletic performance by analyzing relevant literature.

Methods The study follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, utilizing databases such as Scopus, ScienceDirect, Web of Science (WOS), and PubMed. A total of eight studies were selected based on their relevance to caloric intake, eating behavior, and performance outcomes in athletes.

Results The findings highlight that many athletes fail to meet their caloric needs, often due to poor eating habits and a lack of nutritional knowledge. This deficiency can lead to energy imbalance, impaired recovery, increased injury risk, and reliance on supplements to compensate for inadequate dietary intake. Additionally, restrictive eating patterns and misguided dietary practices contribute to eating disorders and suboptimal athletic performance.

Conclusion This review underscores the importance of nutritional education and structured dietary planning in sports to ensure optimal energy availability, performance sustainability, and long-term athlete health. Implementing personalized nutrition strategies and raising awareness of proper eating habits could significantly enhance athletic performance and well-being.

Keywords: nutrition, athletic performance, eating behavior, dietary intake, sports nutrition.

Abstrak.

Latar belakang Nutrisi memainkan peran penting dalam mengoptimalkan performa atletik, pemulihan, dan kesehatan secara keseluruhan. Asupan makanan dan perilaku makan yang tepat secara langsung memengaruhi tingkat energi, daya tahan, dan kemampuan atlet untuk tampil pada kapasitas puncak.

Tujuan Tinjauan sistematis ini mengeksplorasi hubungan antara kebiasaan makan, pola asupan makanan, dan kinerja atletik dengan menganalisis literatur yang relevan.

Metode Penelitian ini mengikuti pedoman Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), dengan menggunakan database seperti Scopus, ScienceDirect, Web of Science (WOS), dan PubMed. Sebanyak delapan penelitian dipilih berdasarkan relevansinya dengan asupan kalori, perilaku makan, dan hasil kinerja pada atlet.

Hasil Temuan-temuan tersebut menyoroti bahwa banyak atlet yang gagal memenuhi kebutuhan kalori mereka, sering kali karena kebiasaan makan yang buruk dan kurangnya pengetahuan gizi. Kekurangan ini dapat menyebabkan ketidakseimbangan energi, gangguan pemulihan, peningkatan risiko cedera, dan ketergantungan pada suplemen untuk mengimbangi asupan makanan yang tidak memadai. Selain itu, pola makan yang terbatas dan praktik diet yang salah kaprah juga berkontribusi pada gangguan makan dan performa atletik yang kurang optimal.

Kesimpulan Ulasan ini menggarisbawahi pentingnya edukasi nutrisi dan perencanaan diet yang terstruktur dalam olahraga untuk memastikan ketersediaan energi yang optimal, kesinambungan performa, dan kesehatan atlet jangka panjang. Menerapkan strategi nutrisi yang dipersonalisasi dan meningkatkan kesadaran akan kebiasaan makan yang tepat dapat secara signifikan meningkatkan performa atletik dan kesehatan.

Kata kunci: nutrisi, performa atletik, perilaku makan, asupan makanan, nutrisi olahraga.

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INTRODUCTION

Nutrition plays a fundamental role in an athlete's training and performance. Achieving an optimal balance between calorie intake and energy expenditure is crucial for adult athletes to support training, recovery, and peak performance. Meanwhile, for young athletes, nutrition must not only meet the demands of continuous training but also support their overall growth and development (Bowler et al., 2022). Therefore, proper nutritional strategies are essential to maximizing athletic performance.

Proper nutrition is critical in sports performance, as it helps athletes maintain an ideal body weight, achieve sport-specific body composition, and enhance recovery (Hsu et al., 2023). Optimal athletic performance requires a well-integrated approach where training and nutrition complement each other (Bird & Rushton, 2020). Meeting the nutritional demands of athletes necessitates a comprehensive understanding of their dietary needs (Sasmarianto et al., 2021). Insufficient knowledge of sports nutrition often leads to poor dietary habits, which negatively impact athletic performance (Jürgensen et al., 2020; Zaman et al., 2021). Adequate nutrition has been identified as a key factor not only in achieving peak athletic performance but also in facilitating post-exercise recovery and reducing the risk of sports-related injuries (Boumosleh et al., 2021).

The ability to meet an athlete's nutritional needs is influenced by multiple factors, including their knowledge of nutrition and their eating behaviors. However, the quality and quantity of athletes' food intake are often overlooked (Vici et al., 2019), resulting in an imbalance of essential nutrients (Nusri et al., 2022). Athletes are particularly susceptible to unhealthy eating behaviors due to the pressures and competitive nature of sports, which may contribute to the development of disordered eating patterns (Evans & Docter, 2020; Huang & McNesby, 2021; Id et al., 2022). Furthermore, assessments of athletes' eating attitudes and behaviors have been proposed to identify those at risk for eating disorders (Id et al., 2022). Studies by Boudreault et al. (2022) highlight the ongoing concern regarding athletes exhibiting symptoms of disordered eating and engaging in harmful weight control practices.

While athletic performance is influenced by various factors, including training and psychological aspects, dietary intake and eating habits also play a significant—though sometimes indirect—role. Given the importance of these factors, this study aims to systematically review existing literature on athletes' eating behaviors and dietary intake patterns in relation to their performance.

METHOD

Research Design.

This study adheres to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Its analytical framework aligns with previous bibliometric studies across various topics. The study employs the PICO method to identify relevant articles. PICO is a research strategy that utilizes multiple academic sources, including books and scientific journals, to explore study subjects. The focus of this review is on academic literature related to food intake, eating habits, athletic performance, and athletes.

Search and Selection Strategy

As shown in Figure 1, the databases used for this study include Scopus, ScienceDirect, Web of Science (WOS), and PubMed. The selected keywords for the search were food intake, eating habits, athletes, and performance. The inclusion criteria for this study were journal articles discussing calorie intake, eating behavior, and athletic performance. Reference management software (Mendeley) was used to organize citations, screen titles and abstracts, and evaluate full-text articles based on the selection criteria. A total of 123 articles published between 2021 and 2022 were collected..

Inclusion and Exclusion Criteria.

The search and selection process utilized electronic databases, including Scopus, ScienceDirect, Web of Science (WOS), and PubMed. The analytical framework applied in this study is consistent with previous research in the field. In total, 123 articles published between 2021 and 2022 were selected. Reference management software (Mendeley) was used for compiling notes, screening titles and

abstracts, and reviewing full-text papers related to food intake and eating behaviors published between 2021 and 2022. Articles were excluded if they: (1) Contained only abstracts without full-text access, (2) Were not published in peer-reviewed scientific journals, (3) Were not open-access, or (4) Did not meet at least one of the inclusion criteria. Only journals that fulfilled all inclusion criteria were selected for evaluation. PRISMA can be seen in Figure 1.

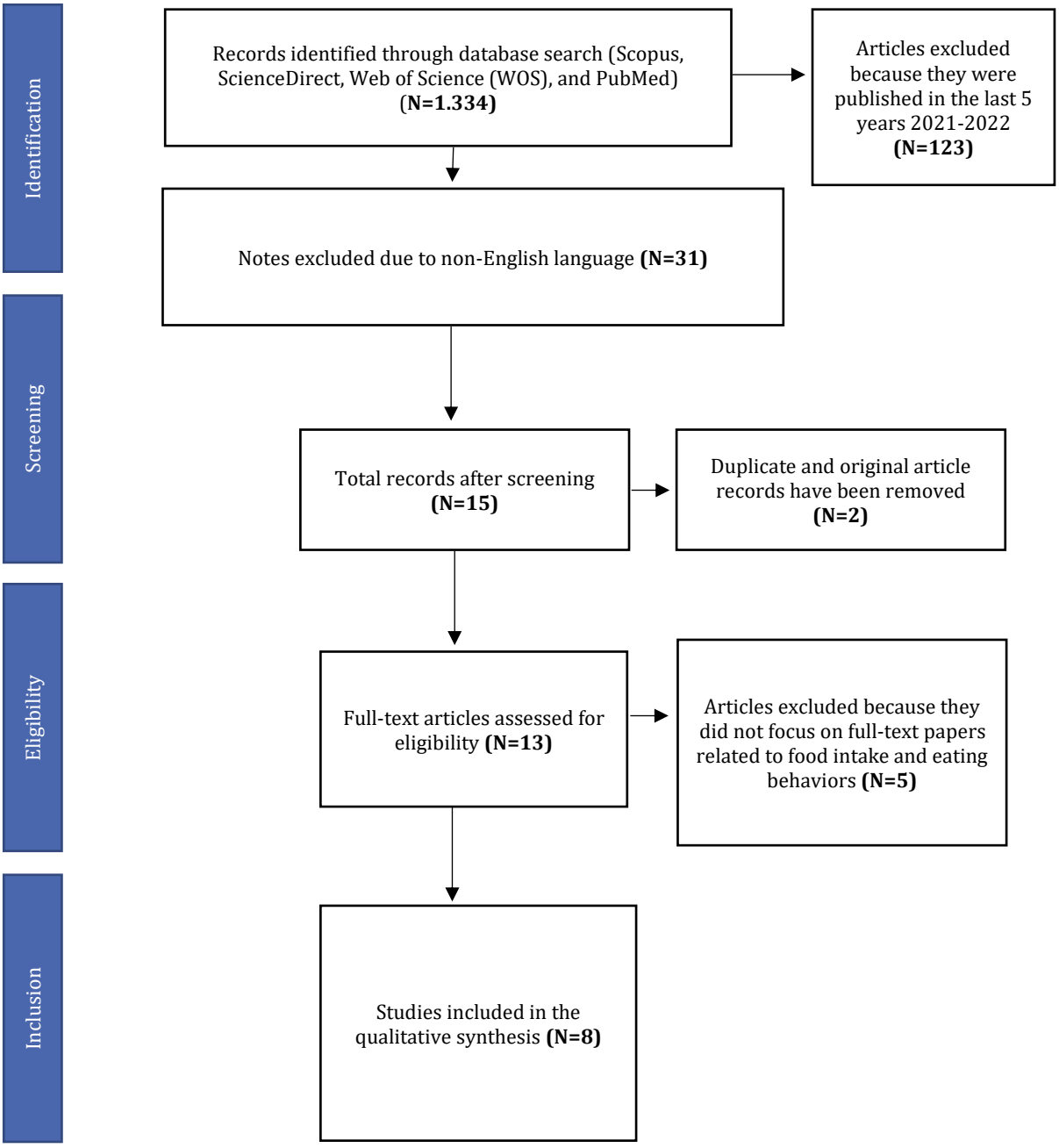

Figure 1. PRISMA Research Flowchart

RESULTS AND DISCUSSION

Results

Table 1 provides a summary of the methodological aspects of studies conducted between 2016 and 2022. Research findings indicate that inadequate knowledge of proper dietary intake is associated with lower overall energy consumption among athletes (Adams et al., 2016; Richter et al., 2021; Wilson et al., 2021). A deficiency in essential nutrients and caloric intake has been shown to negatively impact athletic performance (Logue et al., 2021) and contribute to performance deterioration over time (Cadegiani & Kater, 2020).

However, Apsey et al. (2019) argue that the presence of eating disorders among athletes is not necessarily linked to body fat percentage or the severity of eating disorder symptoms. This suggests that psychological, environmental, and sport-specific pressures may play a more significant role in disordered eating behaviors than body composition alone. Understanding these complex relationships is crucial in developing targeted nutritional interventions and psychological support systems to optimize both physical performance and overall well-being in athletes.

Table 1. Food intake and eating behavior on athlete

Author	Characteristics of the sample	Method	Conclusion
(Richter et al., 2021)	17 young healthy males of normal weight	administration of 26 kcal saccharide and placebo capsules at breakfast	Low sugar levels will have an impact on subsequent food intake so that it will lead to a decrease in overall calorie consumption.
(Wilson et al., 2021)	Eighty-five sources were synthesized.	Literature review	Changes in body weight and composition are influenced by diet and physical activity, but alcohol intake is related with negative changes in body weight and composition..
(Jurov et al., 2021)	Twelve well-trained endurance athletes (levels 3, 4, and 5)	the cross-sectional controlled laboratory study. Fat-free mass, exercise energy expenditure, and energy intake were all used to determine EA.	The energy availability threshold for male endurance athletes is lower than that of women
(Austin J. et al., 2022)	Two hundred thirty-one endurance athletes (124 women)	a questionnaire on their eating habits and related characteristics	Female athletes tend to stick to strict diets
(Boudreault, Gagnon-Girouard, et al., 2022)	A total of 999 French-Canadian participants aged 14 to 17 competed in various sports.	Extreme weight-control practices, weight-related abuse from coaches and parents, and compliance to sport ethic standards were all assessed in a survey.	Athletes go on a strict diet supported by coaches and parents who provide psychological violence
(Sesbreno et al., 2021)	22 male athletes from a national indoor volleyball program	etrospective cross-sectional design, Anthropometric, dual-energy X-ray absorptiometry, and resting metabolic rate testing, as well as a 4-day food consumption and hematological study, were all done.	Athletes are at risk of having trouble adapting and recovering during the competitive season
(Deguchi et al., 2021)	32 Japanese para-athletes (22 men) and 45 collegiate student athletes (27 men) without impairments	The demographics, eating habits, dietary practices, and nutrition knowledge questions were all included in the questionnaire.	Para-athletes have distinct eating habits and limited nutrition understanding.
(Logue et al., 2021)	9 top athletes (6 females, 3 men) and 9 high-performance coaches (3 females, 6 males)	Semistructured (20-minute) interviews were conducted using internet communication tools, audiorecorded, and verbatim transcribed.	The athlete's drive to adjust behavior for adequate nutritional intake is just as crucial as his or her knowledge of proper nutritional intake.

Discussion

Numerous literature reviews highlight the significance of adequate dietary intake in athletes and the consequences of nutritional deficiencies on their eating behaviors. Sufficient energy availability is

essential for optimal athletic performance, whereas energy deficits can hinder performance and recovery (Logue et al., 2021; Stellingwerff et al., 2021; Frączek et al., 2020). However, Dewi & Andriani (2020) suggest that an athlete's endurance is not necessarily influenced by nutritional adequacy or overall nutritional status. Nonetheless, insufficient energy intake has been identified as a contributing factor to injuries commonly experienced by athletes. As noted by McAdam et al. (2018), proper dietary intake plays a crucial role in musculoskeletal adaptation and injury prevention in response to physical training.

Findings from this literature review further confirm that many athletes struggle to meet their required calorie intake (McAdam et al., 2018; Vici et al., 2019; Jurov et al., 2021; Wati et al., 2022; Rodrigues et al., 2021). One of the primary reasons for this deficiency is the lack of nutritional knowledge among both athletes and coaches, leading to poorly structured diets (Deguchi et al., 2021; Richter et al., 2021; Boudreault, Gagnon-Girouard et al., 2022; Hitendre, Jordan, Theodorakopoulos, White et al., 2022). On the other hand, when athletes possess adequate nutritional knowledge, they are more likely to manage their dietary intake effectively (Citarella et al., 2019). However, restrictive dietary practices commonly followed by athletes increase their susceptibility to disordered eating patterns (de Borja et al., 2021). Conversely, athletes who are well-informed about nutrition can modify their food intake to maintain a balanced and healthy diet (Joaquim et al., 2019).

Poor dietary intake can have detrimental effects on athletic performance. Athletes with insufficient energy intake often struggle with post-training recovery and are at a higher risk of developing eating disorders (Sesbreno et al., 2021; Charlton et al., 2022). Therefore, specialized diets are commonly introduced during the preparatory phase to enhance athlete fitness (Yerzhanova et al., 2020). Nutritional strategies, such as low-carbohydrate and high-fat diets, have been shown to reduce metabolic workload in athletes (Terink et al., 2021). This underscores the importance of the recovery phase, ensuring athletes are physically prepared for subsequent training sessions. Given that training intensity progressively increases over time, athletes who fail to replenish their energy reserves may experience relative energy deficiency (Stenqvist et al., 2020). According to Papadopoulou (2020), "nutritional rehabilitation" is essential for muscle recovery following intense physical exertion.

Intense and continuous training may also lead to various physiological disturbances, including nutritional deficiencies, hormonal imbalances, and decreased bone density (Belinchón-Demiguel et al., 2021). The pressure to consistently perform at a high level has driven many athletes to rely on supplements as a quick fix (Finamore et al., 2022). However, a concerning trend is the misuse of performance-enhancing substances, particularly anabolic steroids, which are widely abused despite their well-documented adverse effects. As highlighted by Ayubi et al. (2023), prolonged use of anabolic steroids can cause severe damage to multiple organs, yet many athletes continue to overlook these risks.

The overall lack of awareness regarding proper dietary intake among athletes is evident in various studies (Vázquez-Espino et al., 2022; Werner et al., 2020; Hitendre, Jordan, Theodorakopoulos & White, 2022). Research suggests that many athletes have insufficient nutritional knowledge, leading them to consume inappropriate foods. While understanding the principles of proper nutrition is crucial, fostering motivation and awareness among athletes is equally important to ensure adherence to optimal dietary practices (Logue et al., 2021). Developing structured and evidence-based eating habits is essential for long-term athletic success.

Athletes' dietary and resting patterns play a significant role in regulating metabolic function. As Cadegiani & Kater (2019) emphasize, an imbalance in macronutrient and micronutrient intake can impair athletic performance and hinder physiological adaptation to training. This, in turn, increases the risk of health complications. A well-balanced diet is essential for fueling the body before, during, and after exercise, ultimately preventing negative health consequences (Abdullah et al., 2022). Moreover, specialized diets should be implemented from the preparatory phase of training to optimize fitness and performance (Yerzhanova et al., 2020). However, such dietary plans should be supervised by nutritionists to prevent adverse effects, such as the development of eating disorders (de Borja et al., 2021).

Findings from this literature review suggest that many athletes exhibit poor eating habits due to inadequate nutritional knowledge. This lack of awareness fosters unhealthy dietary behaviors, leading to insufficient energy intake. Given the rigorous and continuous nature of athletic training, insufficient caloric consumption can be detrimental to an athlete's body, as it impairs recovery and disrupts subsequent training sessions. Addressing these dietary gaps is crucial in ensuring athletes achieve peak performance while maintaining their overall health and well-being.

CONCLUSION

This systematic review highlights the significant role of nutrition and eating behavior in optimizing athletic performance. Proper dietary intake is essential for sustaining energy levels, enhancing recovery, and reducing the risk of injuries. However, the findings indicate that many athletes fail to meet their caloric needs due to poor eating habits, lack of nutritional knowledge, and reliance on supplements rather than balanced diets. Insufficient calorie intake can lead to energy deficits, impaired performance, and increased susceptibility to injuries and health complications. Additionally, restrictive eating patterns and disordered eating behaviors are common among athletes, further exacerbating nutritional deficiencies. While training and psychological factors influence performance, a well-structured and individualized nutritional plan is equally vital for sustaining long-term athletic success. To improve athletes' dietary habits, it is crucial to implement nutritional education programs and promote awareness of proper food intake, meal timing, and balanced macronutrient consumption. Future research should focus on personalized nutrition strategies tailored to different sports disciplines, training intensities, and individual metabolic needs. By fostering better nutritional practices, athletes can enhance their performance, recovery, and overall health, ensuring sustainable long-term success in their respective sports.

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AUTHOR CONTRIBUTION STATEMENT

SS was responsible for developing the research concept and design, conducting data collection, and preparing the initial draft of the manuscript. ZN played a key role in interpreting the findings, and provided critical revisions to the manuscript. In addition, she served as the correspondence author, managing all communications and revisions throughout the publication process.

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