

## Eat well to the best performance: calorie intake and eating behavior among athlete: a review

Isti Dwi Puspita Wati<sup>1,2</sup>, Nining Widyah Kusnanik<sup>1</sup>, Endang Sri Wahjuni<sup>3</sup>, Yohanes Touvan Juni Samodra<sup>2</sup>, Maharani Fatima Gandasari<sup>2</sup>, Davi Sofyan<sup>4</sup>

<sup>1</sup>Faculty of Sport and Health Science, Universitas Negeri Surabaya, Surabaya, Indonesia

<sup>2</sup>Faculty of Teacher Training and Education, Universitas Tanjungpura, Potianak, Indonesia

<sup>3</sup>Department of Medical, Faculty of Medicine, Universitas Negeri Surabaya, Indonesia

<sup>4</sup>Department of Physical Education, Universitas Majalengka, Majalengka, Indonesia

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### ABSTRACT

Good performance can be produced from a structured, systematic, and continuous training pattern. However, a lack of calorie intake during exercise will worsen the athlete's performance. Adequate and appropriate calorie intake can help athletes perform well. Eating habits will greatly affect the availability of calories in athletes. This literature review aims to describe the effects of caloric intake and eating habits of athletes from various literature. Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) is the approach employed. The database is taken from Scopus, Science Direct, Web of Science (WOS), and Pubmed. 16 articles were analyzed through purpose, topic suitability, sample, research protocol, results, and discussion. The results of this literature review explain that athletes tend to experience less calorie intake caused by poor eating habits. Low knowledge of nutrition makes athletes practice wrong eating/dieting arrangements by relying on supplement intake to improve performance.

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### Corresponding Author:

Isti Dwi Puspita Wati

Faculty of Sport and Health Science, Universitas Negeri Surabaya

Raya Kampus Unesa Street, Lidah Wetan, Lakarsantri, Surabaya, East Java 60213, Indonesia

Email: isti.21003@mhs.unesa.ac.id

## 1. INTRODUCTION

Nutrition is a vital component of every athlete's training and exercise program. The balance between calorie intake and energy needs is crucial in adult athletes' training, recuperation, and performance, whereas in young athletes, in addition to meeting the demands of constant training, the focus must be on the athlete's development [1]. Therefore, the application of proper nutrition is one of the main keys to maximizing athlete performance.

Nutrition is vital in sports performance because it allows athletes to maintain an appropriate body weight, and specialized body composition for sports, and recover faster [2]. To reach peak athletic performance, exercise and nutrition must work in sync [3]. Fulfilling nutritional intake demands necessitates a thorough awareness of the significance of athletes' nutritional intake requirements [4]. A lack of knowledge in sports nutrition leads to poor dietary practices, which can have a negative impact on athletic performance. [5], [6]. Adequate nutrition has been identified as a critical component of peak athletic performance as well as recovery after exercise and sports injuries [7].

Fulfillment of adequate nutritional intake for athletes is greatly influenced by many things, including an understanding of nutritional knowledge and also patterns of behavior in consuming nutritious food. The quality and quantity of food intake by athletes are also more or less neglected [8] so the portion of each

nutrient requirement is not fulfilled [9] suggested that athletes have a high tendency for unhealthy eating behavior due to strong pressure and a competitive environment in sports which will result in eating disorders in athletes [10]–[12] proposes assessing eating attitudes and behavior to determine whether athletes are at risk for eating disorders. In addition, a research done by [12], [13] found that the prevalence of athletes who are identified with symptoms of disordered eating and are involved in pathogenic weight control methods is worryingly ongoing with eating disorders. Even though athlete performance is influenced by many factors such as training and psychological effects, food intake and eating habits of athletes also influence athlete performance, although not directly. Therefore, the general objective of this study was to conduct a systematic review of articles investigating the features of athlete's eating habits and dietary intake patterns concerning athlete performance.

## 2. METHOD

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) standards were followed in this study. The analytical structure of this study is comparable to that of previous bibliometric studies on various themes. The PICO method is used to find articles. PICO is a library or research data collection strategy that makes use of a variety of library sources. (books, scientific journals) to survey study subjects. Academic writing on food intake, eating habits, performance, and athletes was conducted on the population.

### 2.1. Search and selection strategy

As illustrated in Figure 1, the databases used are Scopus, Science Direct, Web of Science (WOS), and Pubmed. The keywords in this study were food intake, eating habits, athletes, and performance. The inclusion criteria in this study were journals that discussed calorie intake, eating behavior, and performance in athletes. Reference management software (Mendeley) was used to collate notes, perform title and abstract screening, and check the selection criteria for each full-text article. The total number of papers gathered is 56, which were published between 2016 and 2022.

### 2.2. Inclusion and exclusion criteria

Scopus electronic database, Science Direct, Web of Science (WOS), and Pubmed were used in the study's search and selection procedure. The structure of analysis employed in this study is consistent with prior studies on the subject. From 2016 to 2022, 56 articles were gathered and published. Notes were compiled using reference management software (Mendeley), title and abstract screening was conducted, and each full-text paper on food intake and eating behaviors published between 2016 and 2022 was reviewed. Only abstracts, publications not published in scientific journals, articles that are not open access, and journals that meet one or more of the inclusion criteria are excluded. The criterion journals chosen for evaluation are those that meet the inclusion criteria.

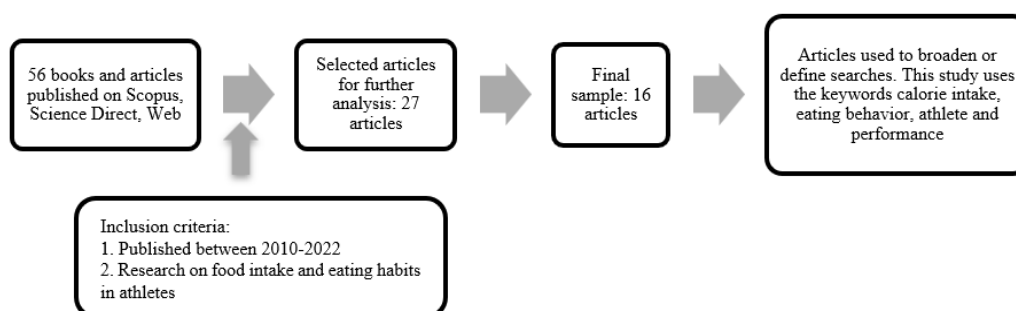


Figure 1. Research design

## 3. RESULTS AND DISCUSSION

Table 1 summarizes the methodological aspects of all publications that analyzed all studies from 2016 to 2022. Knowledge of proper dietary intake resulted in lower average athletes [14]–[16] can experience a lack of intake [17] and worsen athlete performance [18]. However, [19] state that an athlete's eating disorder does not depend on the percentage of fat and symptoms of an athlete's eating disorder that appear.

Table 1. Food intake and eating behavior on athlete

Author	Characteristics of the sample	Study design	Method	Conclusion
[18]	39 athletes	Survey	In the EROS study, 5 independent factors were adjusted from 37 independent variables (calories, carbs, protein consumption, sleep quality, and duration of cognitive activity).	Athletes' metabolic and hormonal processes, clinical behavior, and performance status may all be altered by their nutrition, sleep, and social behaviors.
[15]	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.
[8]	24 elite track and field athletes between the ages of 18 and 30.	Survey	Anthropometric measures (weight, height, body circumferences, skinfold thickness) were taken, and dietary habits were assessed using a seven-day food diary.	Female athletes take less macronutrients than is suggested, particularly carbs. Protein consumption is adequate, while fat intake is excessive.
[16]	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.
[20]	Twenty-two participants		Endurance incentive training on cycling athletes for 4 weeks to improve performance and see the RED-S sign	During the endurance training mesocycle, male athletes are at risk of getting RED-S.
[21]	In a total of 39 athletes (OTS-Affected athletes (OTS)=14 and healthy athletes (ATL)=25),	Survey	Using data from the modified Endocrine and Metabolic Responses on Overtraining Syndrome (EROS) research (carbohydrate, protein, and total calorie intake, sleep quality, and concurrent cognitive effort),	OTS is caused by diet and OTS can reduce hormone response
[14]	155 collegiate athletes		Athletes self-reported data through questionnaire.	There are significant differences between male and female athletes regarding weight perception and nutritional practices
[22]	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
[23]	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
[24]	A total of 999 French-Canadian participants aged 14 to 17 competed in various sports.	Survey	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
[19]	During the 2018-2019 academic year, NCAA Division 1 student athletes (n=56) were recruited from the following sports: men's soccer (n=2), women's soccer (n=13), women's basketball (n=12), women's swimming (n=12), football (n=13), track & field (n=4) and gymnastics (n=8).	Survey	The Eating Attitudes Test (EAT-26) questionnaire was used to assess height and weight, and dual energy X-ray absorptiometry was used to calculate % body fat, fat mass, and lean mass.	None of the athletes had eating disorders. Eating disorder symptoms and body fat are not related
[25]	The study included 20 Brazilian elite women's artistic gymnasts aged 10 to 16.	Survey	Eating Attitude Test-26, Sociocultural Attitudes Toward Appearance Questionnaire-3 (SATAQ-3), Body Shape Questionnaire (BSQ), In a 9-month study, the Multidimensional Perfectionism Scale (MPS), Brunel Mood Scale (BRUMS), and triceps and subscapular skinfolds were employed.	Eating disorders are a predictor of body dissatisfaction, while eating disorders will appear in the pre-competition season
[26]	Thirteen highly-trained male cyclists	Experiment	Incentive training for 9 days with high carbohydrate intervention. Sleep measurement through watch actigraphy, mood state questionnaire and VO2max	In highly experienced cyclists, 9 days of intense training led in substantial and gradual decreases in sleep quality, psychological state, and maximum exercise performance.
[27]	22 male athletes from a national indoor volleyball program	Survey	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
[28]	32 Japanese para-athletes (22 men) and 45 collegiate student athletes (27 men) without impairments	Survey	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.
[17]	9 top athletes (6 females, 3 men) and 9 high-performance coaches (3 females, 6 males)	Survey	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.

Various literature reviews illustrate the importance of proper dietary intake for athletes and the impact of deficiencies and factors on athletes' eating habits. The availability of sufficient energy will help athlete performance but will hinder performance if it is not sufficient [17], [29], [30]. Although [31] says that an athlete's endurance does not affect the level of nutritional adequacy and nutritional status. In injuries that often occur in athletes, one of the supporting factors is energy insufficiency. As stated by McAdam *et al.* [32] adequate food intake is critical for adapting to and preventing musculoskeletal problems in response to physical training.

The results of this literature review show that there is evidence that many people experience a lack of calorie intake, including athletes. This is proven by research from [8], [22], [32]–[34]. This is caused by a lack of knowledge of athletes and coaches in setting the right athlete's diet [13], [15], [28], [35]. By having good nutritional knowledge, athletes will manage intake appropriately [36]. Diets followed by athletes tend to make athletes experience eating disorders [37]. In addition, with knowledge, athletes can modify their food intake so that they continue to consume healthy foods [38]. Lack of food intake will be bad for athletes. Athletes who experience a lack of intake will result in disturbances in recovery and tend to experience eating disorders [27], [39]. A special diet for athletes began to be implemented since the preparation period in order to improve athlete fitness [40]. With low-carb and high-fat intake, it can reduce the athlete's metabolic workload [41]. Therefore, recovery stage is important so that athletes are ready to train again the next day. Exercises performed by athletes always increase every time according to the training period. With this routine exercise, athletes will experience a relative lack of energy [20] if they do not consume proper food intake after training. According Papadopoulou [42] that "nutritional rehabilitation" is needed to be able to fill and restore muscles after training.

Belinchón-Demiguel [43] said that athletes tend to experience nutritional disorders, hormonal dysfunctions, and low bone density due to the effects of hard and continuous training. Fatigue and the desire to always perform well encourage many athletes to take supplements [44]. Athletes tend to believe that by taking supplements, fast results for their body to give good performance will be achieved. One of the supplements that are always abused to improve athletic performance is anabolic steroids. The negative effects of using supplements such as anabolic steroids are never heeded by athletes, as stated by Ayubi *et al.* [45] several organs will be damaged. Understanding of consuming proper food intake for athletes is lacking. This is shown through research conducted by [35], [46], [47]. The average athlete has low nutritional knowledge so they consume inappropriate foods. Knowing proper food intake is indeed very necessary, but what is no less important is awareness and motivating athletes so that athletes consume proper food intake which is no less important [17]. So that athletes have the right and correct eating habits.

The Diet and resting patterns of athletes will greatly affect the metabolic system. As stated by that in the presence of inadequate macro and micro nutrition athletes will experience impaired performance and training adaptation, which can increase the risk of health problems. A balanced diet is also helpful for athletes to feed the body before, during, and after exercise in order to avoid any negative consequences. The diet and resting patterns of athletes will greatly affect the metabolic system [21]. As stated Sousa *et al.* [48], with inadequate macro and micro nutrition, athletes will experience impaired performance and training adaptation, increasing the risk of health problems. A balanced diet is also beneficial for athletes to fuel the body before, during, and after training to avoid all bad risks [49]. A special diet for athletes must be implemented from the preparation period to improve athlete fitness [40]. However, this special diet must be accompanied by a nutritionist so that negative things do not occur, such as the emergence of eating disorders as research conducted by Borja *et al.* [37].

The findings from this literature review illustrate that athletes have bad eating habits. This is due to the low nutritional knowledge possessed by athletes. With insufficient knowledge of nutrition, unhealthy eating habits are formed. This causes athletes to experience a lack of energy intake considering the training process carried out by athletes continuously and prolonged. The impact of lack of energy intake can be harmful to the athlete's body because the athlete is unable to make the required recovery. So, it will interfere with subsequent training performance.

#### 4. CONCLUSION

Athletes tend to experience less calories/energy intake. Inadequate energy possessed by athletes is driven more by the athlete's bad eating habits. The low knowledge of athletes and trainers about proper diet and dietary patterns is the main trigger for the practice of wrong eating intake. If the lack of energy intake occurs continuously, it will result in a decrease in athletes' performance both during training and during competition. Diet or improper eating arrangements and relying on supplement intake make athletes have a high risk of damaging their health and performance of athletes. Therefore, knowledge of food intake and proper eating habits must be possessed by athletes, coaches, and parents.




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## BIOGRAPHIES OF AUTHORS






**Isti Dwi Puspita Wati**    is a doctoral program of sport science at Universitas Negeri Surabaya also lecturer in Sport Coaching Education at Universitas Tanjungpura Pontianak, West Kalimantan (Borneo). She can be contacted at email: [isti.21003@mhs.unesa.ac.id](mailto:isti.21003@mhs.unesa.ac.id) or [isti.dwi.puspita.w@fkip.untan.ac.id](mailto:isti.dwi.puspita.w@fkip.untan.ac.id).






**Nining Widyah Kusnanik**    is the lecturer professor at Faculty of Sport Science Universitas Negeri Surabaya, East Java. A professor at sport and exercise physiology. She can be contacted at email: [niningwidyah@unesa.ac.id](mailto:niningwidyah@unesa.ac.id).






**Endang Sri Wahjuni**    is a lecturer at Faculty of Sport Science, Universitas Negeri Surabaya, East Java. The area of sport and health, injury prevention and treatment, and biopsychology. She can be contacted at email: endangwahjuni@unesa.ac.id.






**Yohanes Touvan Juni Samodra**    is a lecturer in Sport Coaching Education, At Tanjungpura University, Pontianak, West Kalimantan (Borneo). The subyek matter in sport pedagogy and sport coaching. Concern in training for coaching, fitness, and motoric and teaching-learning in sport pedagogy. He can be contacted at email: tovan@fkip.untan.ac.id.



**Maharani Fatima Gandasari**    is Lecturer in Sports Coaching Education, Tanjungpura University, Pontianak, West Kalimantan (Kalimantan). The subyek matter in sport pedagogy and sport fitness. Concern in training for Coaching, fitness and learning in sports pedagogy. She can be contacted at email: maharani.fatima@fkip.untan.ac.id.



**Davi Sofyan**    is a lecturer in the Physical Education study program, Majalengka University, West Java, Indonesia. The areas of education covered are physical education and sports, basketball games, sport management, sport and religion, bibliometrics and scientometrics. He is also a reviewer in various Scopus indexed reputable journals. She can be contacted at email: davisofyan@unma.ac.id.