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## The relationship between food intake and psychological performance in martial arts student athletes

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### ABSTRACT

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This study aims to determine the relationship between macronutrient intake and psychological performance in adolescent martial arts athletes. This study uses a cross-sectional method with a quantitative approach, involving student martial athletes in grades 10-12 of SMAN 10 Bandung. This study consisted of 22 male athletes and 18 female athletes. Data collection was conducted through two 24-hour food recall interviews and psychological performance questionnaires, which the athletes themselves completed. The research data were tested by Spearman's rank bivariate analysis. The results of data collection showed that the mean of energy consumption in adolescent athletes was 1782.5 kcal; protein intake was 57.9 g; fat intake was 66.2 g; and carbohydrate intake was 191.5 g. The results showed a significant relationship ( $p$  value  $\leq 0.05$ ) between the variables of energy, protein, and carbohydrate intake with psychological performance. In contrast, fat intake was found to be unrelated to psychological performance. Therefore, it can be concluded that the better the fulfillment of energy, protein, and carbohydrate intake, the better the psychological performance that student martial arts athletes have.

**Key words:** Eating disorders; food intake; performance; psychology; student athletes.

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## INTRODUCTION

Adolescent athletes are a population that is prone to experiencing nutritional problems due to a limited understanding of the effects of strenuous physical exercise and exercise stress on adolescents (Andriyani & Budiono 2021). This indicates that adolescents who participate in athletics have higher nutritional needs than their non-athletic peers of the same age, to meet the dietary requirements for optimal growth, fitness, and sports performance (Hecht et al., 2023).

Nutritional problems that occur in adolescent athletes are eating disorders, with a prevalence of up to 45% in athletes from various sports due to intake restrictions that will develop into chronic diets and eating disorders (Borowiec et al., 2023; Kontele & Vassilakou, 2021). Athletes with eating disorders can lead to poor nutritional status, where athletes with low nutritional status generally do not perform optimally because poor daily dietary intake can affect athletes' performance (Desbrow, 2021).

The fulfillment of nutrients through dietary intake in athletes serves as an energy source and a supplement for body nutrients after exercise (Ansari et al.,

2022). Athletes have different nutritional needs compared to the general population due to variations in physical conditions, activities, and psychological factors. Desbrow (2021) research indicates that meeting well-matched macronutrient and micronutrient intake needs can enhance athletes' overall performance (Mappanyukki & Mutmainnah, 2021).

Adequate food intake plays a crucial role in supporting overall athletic performance, whereas special direction and attention are needed to ensure athletes achieve the recommended daily consumption of macronutrients for success in sports (Amawi et al., 2023). Macronutrient intake that does not meet an athlete's daily needs can reduce performance by depleting glycogen stores, which serve as the primary energy reserve, and by decreasing oxygen-carrying capacity (Noakes, 2022). This is primarily supported by findings from previous studies that have reported significant results related to the fulfillment of macronutrients, such as energy, protein, fat, and carbohydrates, in improving performance (Febriyana & Sefrina, 2022).

Psychological performance in martial arts athletes refers to the integrated capacity for focus, confidence, emotional regulation, and mental strategy preference that enables optimal competition readiness (Cornelia et al., 2025; Nam et al., 2022). Empirical studies suggest that positive nutritional attitudes significantly correlate with enhanced mental toughness among combat sport athletes (Özsarı et al., 2024). These findings underscore the importance of aligning both psychological and nutritional strategies to support the distinctive demands of martial arts, which include rapid decision-making, discipline, and sustained mental resilience.

Athletes in psychological performance conditions are generally able to exhibit their best performance, enabling them to achieve extraordinary achievements (Mayangsari et al., 2024). In addition, athletes' capabilities are often decreased due to pressure from external parties, like the presence of referees, coaches, watchers, and the environment (Al-Habsy et al., 2023).

Based on a preliminary study in January 2025 by conducting interviews with nutritionists who handle most of the athletes at SMA Negeri 10 Bandung, it was stated that the fulfillment of the nutritional intake of martial arts athletes is still inadequate when the ideal energy intake for athletes is 40-70 kcal/kg/day, protein 1.2-2.0 g/kg/day, fat 20-30% from individual total needs, and carbohydrates 6-10 g/kg/day. The number of martial arts athletes' need are based on the athlete's recommendation, which requires endurance and mental discipline (Hecht et al., 2023; Insel et al., 2021).

The calculation of the amount of energy and macronutrient intake in adolescent martial arts athletes is carried out to find out the extent to which nutritional intake can affect the psychological performance of athletes as an effort to optimize athletes' performance through the fulfillment of daily needs.

Therefore, this research is important because there is still limited research on the connection between food intake and psychological performance, particularly among adolescent athletes. This research aims to analyze and determine the relationship between food intake, especially energy and macronutrients with psychological performance in adolescent martial arts athletes.

## METHOD

This study is observational analytical research with a cross-sectional design, or non-experimental quantitative research. A quantitative method is used to analyze a phenomenon systematically by collecting and analyzing data. Cross-sectional studies are used as an approach that measures the simultaneous observation of data for both dependent and independent variables. This study was conducted to investigate the relationship between food intake and psychological performance in student martial arts athletes at SMA Negeri 10 Bandung.

The sample in this study consisted of 40 student athletes from various martial arts disciplines, including fencing, wrestling, judo, karate, taekwondo, pencak silat, and tarung drajat. The sample taken was students in grades 10-12 at SMA Negeri 10 Bandung. The number of samples was determined through calculations using the Slovin formula, resulting in 36 samples. The results were then added with 10% as the margin of error of the sample size, resulting in a final calculation of 40 samples, including male and female athletes, for this study.

The inclusion criteria for subjects in this study include: (1) active adolescent martial artists; (2) registered as a student at SMAN 10 Bandung at the time of the research; (3) aged 15-18 years; (4) the respondent is willing to be the subject of the research; (5) able to communicate well. The exclusion criteria for subjects in this study include: (1) not present when the data is collected.

Data in this study were collected through anthropometric measurements of subjects, 2x24-hour food recall interviews, and completion of questionnaires. The data collection stage begins with obtaining informed consent, which serves as a statement of willingness to participate from prospective respondents. If willing, the anthropometry of the respondents was then measured with Bio Analytical Impedance (BIA) and a stadiometer. Furthermore, respondents were interviewed with research instruments that included self-identity (name, gender, age, date of birth, class, phone number, sport, frequency of exercise per day, and intensity of exercise per session). Food intake variables were examined through energy, protein, fat, and carbohydrate intake, measured by 2x24-hour food recall interviews, conducted on weekdays and weekends. Later, the food recall results were processed based on Tabel Komposisi Pangan Indonesia (TKPI)

by Microsoft Excel. Subsequently, everyone's macronutrient intake was compared to their respective nutritional requirements.

Meanwhile, the measurement of psychological performance was conducted using a validated questionnaire encompassing eight aspects adapted from: mental relaxation, physical relaxation, confidence and optimism, present-moment focus, high energy, heightened awareness, sense of control, and the 'cocoon' state. The questionnaire consists of 68 items rated on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The mean total score is then categorized into four levels: extremely low, low, high, and extremely high.

Once the data is collected, it will be processed and analyzed descriptively. Univariate analysis was performed to describe the distribution of frequency, percentage, mean, and standard deviation of the study variables. The Spearman-rank correlation statistical test, as a bivariate analysis, was used to identify the relationship between the independent variable (food intake) and the dependent variable (psychological performance).

## FINDINGS AND DISCUSSIONS

### Findings

As part of the analysis, the respondents' food intake was assessed to determine their average consumption of energy and macronutrients. The findings are outlined in Table 1.

Table 1. Distribution of respondents based on food intake level

| Macronutrients | Average intake      |              |
|----------------|---------------------|--------------|
|                | Mean $\pm$ sd       | Min - max    |
| Energy         | 1782.5 $\pm$ 1396.1 | 696.1 – 3170 |
| Protein        | 57.9 $\pm$ 24.3     | 22.4 – 141.3 |
| Fat            | 66.2 $\pm$ 62.6     | 26.4 – 181.5 |
| Carbohydrates  | 191.5 $\pm$ 58.6    | 67.6 – 325.3 |

Table 1 presents the calculated amount of macronutrient intake. The data from the calculation showed that the average energy intake of the respondents was 1.782.5 kcal, comprising 57.9 g of protein, 66.2 g of fat, and 191.5 g of carbohydrates.

Table 2. Distribution of respondents by psychological performance category

| Psychological performance category     | Frequency (n) | Percentage (%) |
|----------------------------------------|---------------|----------------|
| Very Low ( $61 \leq x < 106.75$ )      | 28            | 70.0           |
| Low ( $106.75 < X \leq 152.5$ )        | 12            | 30.0           |
| High ( $152.5 \leq X < 198.25$ )       | 0             | 0.0            |
| Very high ( $198.25 \leq X \leq 244$ ) | 0             | 0.0            |
| Total                                  | 40            | 100.0          |

Table 2 shows that most respondents have a psychological performance that falls into the very low category, with a percentage of 70%, and the low category for the remaining 30%.

Table 3. Results of the relationship test between food intake and psychological performance

| Variable                      | P value | R     |
|-------------------------------|---------|-------|
| Energy Consumption Rate       | 0.006*  | 0.427 |
| Protein Consumption Rate      | 0.005*  | 0.432 |
| Fat Consumption Rate          | 0.244   | 0.129 |
| Carbohydrate Consumption Rate | 0.004*  | 0.045 |

Spearman's Rank Test (\*p-value < 0,05)

The results of the Spearman rank test on food intake and psychological performance, presented in Table 3 above, indicate that three of the four macronutrients — energy, protein, and carbohydrates — have a significant relationship ( $p\text{-value} \leq 0.05$ ) with the psychological performance of adolescent martial artists. Energy, protein, and carbohydrate intake have a moderate positive relationship, indicating the direction of the relationship, which suggests that higher intake of these nutrients is associated with improved psychological performance. Contrary to these three variables, the adequacy of fat consumption was not significantly related to psychological performance.

## Discussion

The results of this study show a significant ( $p\text{-value} \leq 0.05$ ) positive correlation between energy, protein, and carbohydrate intake with psychological performance. Based on research by M et al. (2025), deficiencies in energy intake lead to low energy availability (LEA), which can result in decreased bone formation and an increased risk of eating disorders. In addition, in male athletes, it was found that LEA reduces cognitive performance, leading to cognitive restraint or conscious eating restriction, which can ultimately decrease athletic performance (Jurov et al., 2022; M et al., 2025). In this study, it was found that some respondents, particularly girls, have the habit of skipping meals or restricting their intake to maintain their weight.

Other results showing a positive correlation between protein and psychological performance are also supported by research by Nakamura et al. (2024), which found that high protein intake is related to adolescent intelligence in general due to better brain development. Intelligence can be defined as the mental ability to integrate various cognitive functions, such as reasoning, problem-solving, and learning, which are essential in the world of sports, including alertness and decision-making, to enhance athletes' psychological performance (Habekost et al., 2024; Romanenko et al., 2025). Not only that, but mechanisms have also been identified in the brain related to aspects of

psychological performance, such as the regulation of focus by the prefrontal and parietal cortex, and alertness by the parietal and occipital cortex, among others (Friedman & Robbins, 2022).

The following result of this study was a positive and significant correlation ( $p\text{-value} \leq 0.05$ ) between carbohydrates and psychological performance. This is supported by the results of the 2x24-hour recall, which shows that almost half of the respondents experience a deficit in carbohydrate intake ( $< 90\%$  of individual needs), and the results of psychological performance scoring, which is classified as very low in 70% of subjects. Additionally, a lack of glycogen reserves in the brain and muscles can lead to central fatigue, which affects the central nervous system and results in decreased motivation, focus, and performance in athletes (Grebner et al., 2024).

In contrast to the intake of other macronutrients, the study's results showed no relationship between fat intake and psychological performance. This study differs from research conducted by Putri et al. (2024) and Ansari et al. (2025), which found that fat in general is related to athletes' psychological performance. This difference in results is possible because the performance studied in this study is a psychological aspect, whereas previous research examined aerobic performance ( $\text{VO}_2 \text{ max}$ ). A literature review by Sales and Reimer (2023), indicates that fat intake related to psychological quality is primarily composed of fatty acids, such as omega-3. In contrast, the results of recall interviews suggest that the type of fat athletes consume most is saturated fat, often found in processed foods that are fried. This difference may be one of the reasons why, in this study, fat intake did not correlate with performance psychology. In summary, adequate nutritional intake is crucial for optimal psychological performance in martial arts athletes, as it provides sufficient energy, carbohydrates, proteins, and fats to support focus, emotional regulation, and mental resilience. For example, one review found that adolescents in sports who maintain an appropriate dietary intake display better cognitive and motivational outcomes (Spriet, 2022). In this study, the athletes' intake fell short of recommended targets (e.g., 40-70 kcal/kg/day, 1.2-2.0 g/kg protein), suggesting that insufficient nutrition may have contributed to suboptimal psychological performance. The findings found that tailored nutrition strategies are important in martial arts, where mental discipline and rapid decision-making are essential.

This study has limitations related to the use of food recall questionnaires and eating history interviews, which rely solely on the subject's memory ability, thereby introducing bias in calculating the amount of macronutrient intake.

In any case, this research will yield benefits in the form of increased knowledge and awareness among athletes, coaches, clubs, and schools regarding the intake of necessary macronutrients and the importance of

performance psychology for athletes. In addition, the findings expand existing theories of sports psychology by showing that psychological performance can also be influenced by nutritional factors, not only mental training.

## **CONCLUSION**

Most subjects experienced deficits in the adequacy of all macronutrients (energy, protein, fat, and carbohydrates), along with a very low level of psychological performance. The results of the study show a relationship between energy intake, protein, and carbohydrate in psychological performance. Meanwhile, no significant association was found between fat intake and psychological performance in adolescent martial artists. Therefore, it can be concluded that the better the fulfillment of energy, protein, and carbohydrate intake, the better the psychological performance that student martial arts athletes have. The findings also suggest the need for further investigation into this relationship using a larger and more diverse sample. Future studies should consider variations across martial arts disciplines and age groups, as these factors may influence both nutritional requirements and psychological responses to exercise. Practically, the results highlight the importance of developing integrated programs that combine proper nutritional planning with psychological skill training to optimize overall performance and enhance the holistic well-being of adolescent athletes.

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