THE IMPROVEMENT OF FOOD INTAKE IN MALE VOLLEYBALL ATHLETES AFTER NUTRITION COUNSELLING

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ABSTRACT

Introduction: Proper macronutrient intake, including carbohydrates, protein, and fat, is essential for promoting overall well-being and enhancing physical performance. Adequate food intake is helpful to replenish energy stores during physical activities such as training, competition, or recovering.
Purpose: This study was conducted to investigate the energy and macronutrient intake habits of male volleyball players who received nutritional counselling as an intervention.
Methods: This study was an experimental with one group pre and post test design, conducted on ten male volleyball athletes aged 16-22 years in Jember Regency. The data collection included anthropometric measurements, hydration state, biochemical status, and the the participant's food intake. Data of food intake was gathered on two occasions, specifically prior and following the intervention using 24-hour food recall questionnaire.
Result: There was no significant difference in the mean intake of energy, protein, fa t, and carbohydrates before and after the intervention (p>0.05), however there was a tendency towards an increase in the mean intake of energy, protein, and carbohydrates after the intervention.
Conclusion: Nutritional counselling proves beneficial in enhancing the energy and macronutrient consumption of male volleyball athletes, although not statistically significant.

Keyword: volleyball, athletes, nutrition counselling, food intake, macronutrient

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INTRODUCTION

Indonesia periodically arranges volleyball competitions at the national, regional, and local levels. Volleyball tournaments are categorized according to age and gender divisions. Volleyball competitions in Indonesia, at national, provincial, and regional levels, are organized by the All-Indonesian Volleyball Association (PBVSI) and the Indonesian National Sports Committee (KONI).

PBVSI and KONI provide competitive events such as the Provincial Sports Week (PORPROV), where athletes from different districts and cities participate in volleyball competitions. The PORPROV Championship is a formally scheduled event that takes place every year, with a fixed age restriction. The primary objective of organizing the PORPROV championship is to encourage the development of adolescent athletes within the District and City. The annual volleyball championship serves as a platform for athletes to exhibit their capabilities for becoming winners and to identify talent in a local region and city.

In 2022, Jember Regency has been selected as the host for the Provincial Sports Week Competition (PORPROV). In the male volleyball sport branch, athletes have yet to reach their desired objective of earning a gold medal.

Adolescent athletes that have high physical fitness will have a beneficial impact on enhancing blood circulation capacity and cardiac function, endurance, strength, speed, and overall effectiveness of mobility[1]. Hence, in order to achieve and enhance optimal physical fitness, it is essential to ensure macronutrient consumption aligns with the specific requirements of the athlete. Maintaining the proper macronutrient intake is crucial for achieving fitness goals, particularly in terms of enhancing muscle strength and cardiovascular endurance[2].

Adequate intake of macronutrients and sustained commitment in physical exercise can lead to enhanced athletic performance[2]. Athlete need adequate food intake to replenish energy stores during physical activities such as training, competition, or recovering[3]. Proper macronutrient intake, including carbohydrates, protein, and fat, is essential for promoting overall well-being and enhancing physical performance[4]. A study indicating that dietary intake contributes on athletes' physical performance[5]. Additional determinants impacting an athlete's performance or physical fitness include nutritional status, genetic, somatotype, heart rate, and physical activity. The correlation between exercise and dietary consumption has a significant impact on an athlete's performance[5].

Adequate intake of carbohydrates, protein, fat, fiber, fluid, and micronutrients is crucial for athletes, particularly adolescent athletes who are still growing in order to maintain health and enhance stamina during training sessions and competitions[5]. Nutrition has a crucial role in determining the level of training and performance during competitions. Nevertheless, athletes, training centers, coaches, and parents of athletes seem to ignore and lack awareness of dietary factors.

Furthermore, food-related problems may become more prevalent among adolescents due to the physical, psychological, physiological, and social changes that occur during this transitional period[6]. Adolescents require a sufficient intake of food in order to encourage physiological changes and sustain tremendous rapid growth[7]. On the other hand, adolescent athletes frequently prefer for unhealthy food options or lack adequate nutritional knowledge to support their physical activities[8]. Prior research has highlighted the significance of adequate nutrition in enhancing athletic performance[9]. Nevertheless, a considerable number of athletes tend to ignore dietary practices that align with sports nutrition standards.

Adolescent athletes engaging in high-intensity exercise require appropriate dietary intake to maximize their growth and development. Adolescent athletes, despite requiring more nutrients, are also susceptible to dealing with nutritional issues such as meal skipping, engaging in fad diets, developing eating disorders, and consuming performance-enhancing sports supplements[10]. Hence, it is necessary to provide adolescents athletes with comprehensive and efficient nutritional education and counselling in order to support them in choosing a variety of nutrient-dense foods, maintaining proper hydration, and making appropriate choices for their food and snacks to achieve the ideal requirements[11]. The findings of this study revealed that the majority of athletes consumed less than the recommended amounts of energy and macronutrients (<80%). This is due to a lack of knowledge about nutrition requirements for sports, optimal menu suggestions, and how to achieve daily intake requirements.

METHOD

This study is an experimental, conducted on ten male volleyball athletes aged 16-22 years in Jember Regency. The athletes have been selected and currently undergoing training in preparation for the 2023 East Java Provincial Sports Week. The research design involves a one group pre and post test design. The research activities are scheduled in August 2023 and

conclude in September 2023. The research subjects were selected using a consecutive sampling technique, specifically targeting male volleyball athletes who fulfilled the inclusion criteria and were willing to participate in the research program by enduring intervention till completion. The conducted intervention is a sports nutrition care process that include multiple stages, including nutritional assessment, nutritional diagnosis, nutritional intervention, as well as nutritional monitoring, and evaluation. The implemented intervention takes the form of nutritional counselling. Athletes receive nutritional counselling on a single occasion. The nutritional counselling process is conducted at the Nutrition Care Center Teaching Factory in Jember State Polytechnic by a sports nutritionist. The nutritional counselling offered the importance of sufficient nutrition for enhancing performance, addressing the dietary requirements of athletes, fluid requirements, and providing daily meal suggestions to fulfill nutritional demands. Furthermore, subjects can consult every day via WhatsApp social media. Athletes receive nutritional counselling interventions to modify their dietary and fluid intake habits, which will subsequently be assessed using the 24-hour food recall method. The data collection included anthropometric measurements, hydration state, biochemical status, and the the participant's food intake. Data on food consumption was gathered on two occasions, specifically prior and following the intervention using 24-hour food recall questionnaire. The anthropometric measurements included assessments of body weight, height, percentage of body fat, and muscle mass. The subject's body height was determined by using a microtoise with a precision of 0.1 cm. The subject maintained an upright posture and directed their attention straight ahead during the measurement. Body weight, percent body fat, and muscle mass were assessed using a body composition measuring instrument (In Body). During the process of assessing body weight, percent body fat, and muscle mass, participants were instructed to remove their footwear and wear minimal clothes. The urine color grading method is used to assess hydration levels. Biochemical status measurements include the assessment of hemoglobin (Hb), fasting blood glucose, uric acid, and cholesterol levels through the usage of blood test using test strips. Subject characteristics including gender, age, weight, height, body mass index (BMI), Hb levels, fasting blood glucose levels, uric acid levels, and cholesterol levels, were described using univariate analysis. The Shapiro-Wilk test was performed to assess normality for a sample size smaller than 40.

The Paired T-test and Willcoxon Test was applied to examine the differences in participants' food consumption before and after the intervention. The statistical analysis was completed using the SPSS version 22.0 program.

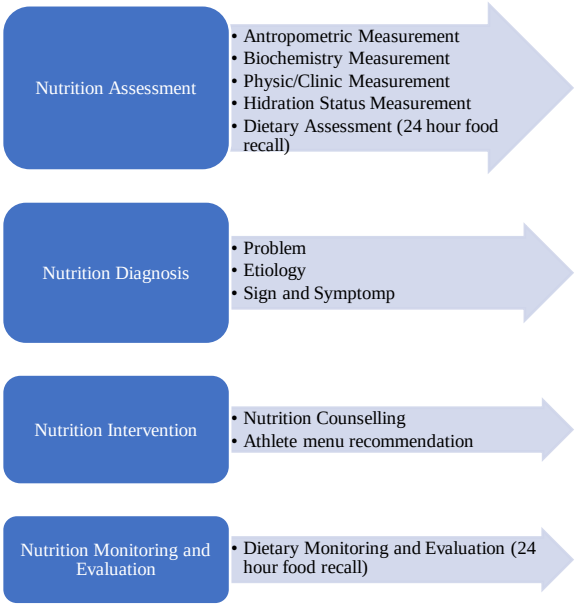

Figure 1. Data Collection Process

RESULT

Table 1 presents the characteristics of the participants engaged in this study. The study included entirely male participants, with 30% being under the age of 18 and 70% being beyond the age of 18. According to the subjects' educational status, 40% were high school students and 60% were college students. The majority of participants in this study (60%) resided at their parental homes, whereas just 40% of participants lived in boarding houses. The findings from the interviews on the topic of pocket money revealed that the majority of participants, specifically 60%, received a monthly allowance ranging from IDR 1.000.000,- to IDR 2.000.000,-.

Table 1. Subject Characteristic

Category	n	%
Age		
<18	3	30
≥18	7	70
Education		
Senior High School	4	40
College Student	6	60
Residency		
Parental Home	6	60
Boarding House	4	40
Allowance		
<1.000.000	4	40
1.000.000-2.000.000	6	60

Table 2 indicates that 50% of athletes have a body mass index within the normal range, while 20% are in risk of being overweight, 20% are already overweight, and a mere 10% is classified as obese. According to body composition, up to 40% of athletes have a healthy fat percentage, 40% have an excessive amount of fat, and 20% have a lower than optimal fat level. In addition, the majority of athletes (60%) have favorable muscle mass, while the remaining 40% exhibit excessive muscle mass. All athletes maintain optimal hydration levels. Based on the findings of biochemical examinations, a significant majority (>70%) of athletes exhibited favorable profiles in terms of hemoglobin levels, fasting blood sugar levels, uric acid levels, and cholesterol levels.

Table 2. Antropometric, Biochemistry, and Hidration Status Profile

Category	n	%
Body Mass Index		
Normal	5	50
Risk to overweight	2	20
Overweight	2	20
Obesity	1	10

Percent Body Fat		
Overfat	4	40
Normal	4	40
Underfat	2	20
Skeletal Muscle Mass		
Normal	6	60
Overmuscle	4	40
Hidration Status		
Good hidration	10	100
Hemoglobin Level		
Low	2	20
Normal	8	80
Blood Glucose Level		
Normal	10	100
Uric Acid Level		
Normal	8	80
Over	2	20
Cholesterol Level		
Normal	9	90
Over	1	10

The level of adequacy of a athlete's dietary consumption is shown in table 3. Prior to the intervention, the majority of athletes had an insufficient intake of macronutrients, with their energy adequacy level being less than 80% of the recommended intake. There was no change in the amount of energy intake adequacy, both prior to and following the intervention. Regarding the adequacy level of protein and fat intake, one athlete had insufficient intake before the intervention, but their intake became sufficient after the intervention. As for the adequacy level of carbohydrate intake, two athletes had insufficient intake before the intervention, but their intake became sufficient after the intervention.

Table 3. The Adequacy Level of Macronutrient Food Intake Pre and Post Intervention

Category	Pre n(%)	Post n(%)
Energy		
Adequate (≥80%)	3(30)	3(30)
Low (<80%)	7(70)	7(70)
Protein		
Adequate (≥80%)	2(20	3(30)
Low (<80%)	8(80)	7(70)
Fat		
Adequate (≥80%)	4(40)	5(50)
Low (<80%)	6(60)	5(50)
Carbohydrate		
Adequate (≥80%)	1(10)	3(30)
Low (<80%)	9(90)	7(70)

Table 4 shows the test outcome about the differences in mean energy and macronutrient consumption prior to and following the intervention. There was no significant difference in the mean consumption of energy, protein, fat, and carbohydrates before and after the intervention, based on statistical analysis (p>0.05). While no significant differences were seen, there was a tendency towards an increase in the mean consumption of energy, protein, and carbohydrates following the intervention. However, it had not yet achieved the ideal target requirement. Meanwhile, the mean of fat intake showed improvement. Prior to the intervention, the mean of fat intake exceeded the recommended target. However, after the intervention, there was a decrease in fat intake, moving towards the required target.

Table 4. Difference of Macronutrient Food Intake Pre and Post Intervention

Macronutrient	Requirement Mean+SD	Pre Mean+SD	Post Mean+SD	p
Energy	2947,2±186.8	1795±745	2141,8±743	0,25[a]
Protein	110,5±7,04	64,4±25,8	77,4±24,2	0,17[a]
Fat	82±5,3	89,5±63	80±45	0,72[b]
Carbohydrate	442±28	189,6±74,5	286±142	0,09[a]

[a]Paired T-Test; [b]Willcoxon Test

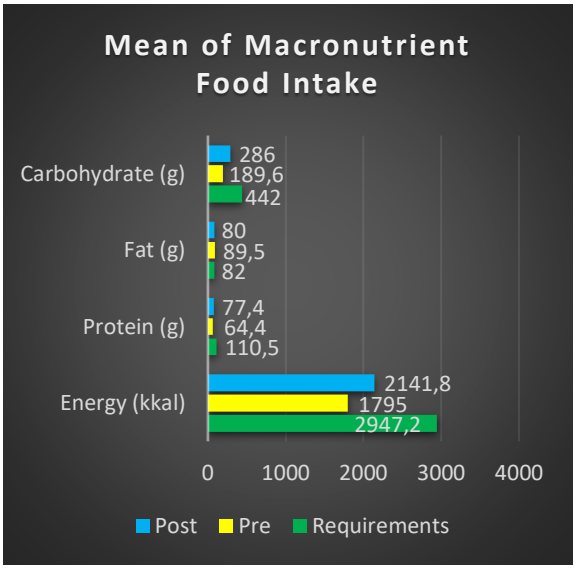

Figure 2. Mean of Macronutrient Food Intake

DISCUSSION

Volleyball is a full-body sport that requires power, strength, speed, and agility. Athletes must be mentally and physically prepared to move quickly and precisely during competition. Volleyball players who want to perform at their best must plan a diet with balanced nutrition that is consistently adapted to their individual needs. Athletes also need to keep sufficient water intake in order to avoid fluid and electrolyte imbalances. Proper and consistent meal planning with flexible menu can assist athletes in achieving energy balance, allowing them to perform better during training and competition[12]. In order to ensure that athletes adhere to the principles of balanced nutrition, it is necessary to enhance their nutritional knowledge. This will enable prompt correction of any misconceptions related to improper eating habits[13]. Nutrition counselling is a two-way communication process between clients and counselors to identify nutritional problems that occur and together find solutions to these problems. The nutritional counselling process is targeted to the client's individual needs and focuses on addressing their specific issues, resulting in a more precise and targeted nutritional intervention[14].

Up to 50% of athletes in this study exhibited an excessive nutritional status. An elevated body mass index will lead to reduced agility. This is related to a study that suggests that individuals with an endomorphic body type and higher body weight may experience a deterioration in agility[15]. Agility can be diminished by excessive body weight, as athletes take additional weight[16]. Athletes with an elevated BMI exhibit a greater body weight, which consequently leads to reduced agility and slower to move around[17].

According to body composition results, specifically body fat percentage, up to 40% athletes have a high fat percentage, whereas all athletes have adequate muscle mass. Elevated fat thickness can elevate the risk of capillary obstruction, consequently impeding the supply of vital nutrients and oxygen required for muscle contraction[18]. The combination of intense muscular contractions and speed generates dynamic power that can impact agility. Physiological

changes in muscles, such as hyperplasia, hypertrophy, increased mitochondria, and enhanced muscle strength, along with improved performance of the nervous system, can result in better agility[19]. Hence, an excessive amount of body weight can diminish agility as a consequence of the resistance caused by adipose tissue against muscle fibers, leading to a decrease in muscle contractility[20]. Optimal speed can be achieved through efficient and rapid muscle contractions. Muscle strength has an impact on speed[19]. Enhancing the power used in each movement leads to the production of powerful energy, which in turn increases speed and consequently enhances agility. Efficient control of the nervous system's coordination in activating muscles can significantly enhance agility[19].

20% of athletes continue to have low Hb levels. Hemoglobin concentrations indicate the amount of iron present in the body. Iron is a vital mineral whose primary function is to transport oxygen in red blood cells and muscle cells via hemoglobin molecules and myoglobin, respectively. In addition to contributing to enzymes, energy metabolism, and the electron transport chain, it performs other crucial functions[21,22]. Iron deficiency is a common occurrence among athletes and can be induced by various factors such as sweating, micro-ischemia, or hemolysis during physical activity. A correlation has been observed between inadequate iron status and low energy intake among athletes, potentially due to insufficient iron consumption from food sources[23]. The inflammatory response induced by exercise, such as elevated concentrations of IL-6 and hepcidin, reduces iron absorption and regeneration[24,25].

There was no significant difference in the consumption of energy, protein, fat, and carbohydrates among athletes before and after the intervention. However, there was a tendency towards enhancement in energy and macronutrient intake, although it had not yet adhered to the optimal target requirements for energy, protein, and carbohydrates. The fundamental aspect of achieving optimal energy requirements is maintaining energy balance. Energy balance is achieved when the amount of energy consumed is equal to the amount of energy expended through activities. It is crucial for athletes to optimize their performance and minimize the adverse health effects caused by excessive training-induced fatigue[26]. This may be attributed to the fact that the intervention, specifically nutritional counselling, was administered to athletes on a single occasion, taking into account their daily training commitments. Ideally, repeated exposure to knowledge is necessary to induce a change in behavior. An athlete's optimal food intake cannot be achieved rapidly, but rather slowly through

the formation of healthy eating habits. Athletes should be provided with the chance to acquire knowledge on food, nutrition, and health, and subsequently put it into practice in order to develop healthy eating habits. Therefore, in order to attract top-tier athletes in sports, it is crucial to prioritize investment in nutrition[27,28]. In addition, during the process of conducting *24-hour food recall* interviews to assess daily food consumption, it was observed that a significant number of athletes (40%), particularly those residing in boarding houses, frequently skipped meals, especially breakfast. This was primarily due to their training schedules, which were further complicated by their busy schedules, academic commitments, part-time jobs, and family obligations[14].

CONCLUSION

Nutritional counselling proves beneficial in enhancing the energy and macronutrient consumption of male volleyball athletes. This is evident from the observed trend towards improvement in energy and macronutrient intake, specifically carbohydrates, protein, and fat. However, even after the intervention, the athletes' energy intake, carbohydrates, and protein have not yet reached the optimal target requirements for athletes. The research is limited by the small sample size. Fortunately, it is anticipated that these findings can serve as a preliminary study that can be later determined to a larger and more diverse population. Additionally, multiple nutritional counselling interventions can be implemented to enhance the obtained outcomes.

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