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Correlation Between Body Image, Eating Disorders, and Nutrient Adequacy Level with Nutritional Status of Adolescent Swimmers in Bogor City, Indonesia

Hubungan Persepsi Tubuh, Gangguan Makan, dan Tingkat Kecukupan Gizi dengan Status Gizi Atlet Renang Remaja di Kota Bogor, Indonesia

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ABSTRACT

Background: Adolescent swimmers can have negative body images that lead to eating disorders. It can cause nutritional imbalances and changes in body composition and nutritional status.
Objectives: This study analyzed the correlation between body image, eating disorders, and nutrient adequacy level with the nutritional status of adolescent swimmers at the OSC and POSSI, Bogor City.
Methods: This research design was a Cross-Sectional Study of 21 subjects selected by purposive sampling with several sample criteria. Body perception data were collected using the Contextual Body Image Questionnaire for Athletes (CBIQA), the risk of eating disorders using the Eating Disorders Screen for Athletes (EDSA) questionnaire, and food consumption using the 2x24 hour Food Recall method.
Results: The subject's body image correlated with nutritional status (p=0.030 r=0.473) but no correlation with the risk of eating disorders. The risk of eating disorders was not correlated with nutrient adequacy level (except fluid) and nutritional status. However, there was a correlation between nutrient adequacy level with body composition and nutritional status.
Conclusions: Most subjects were satisfied with their body shape because they had normal nutritional status. Subjects who have overweight and obese are more worried about their appearance and are at risk of eating disorders. However, their concern for appearance does not change their diet.

INTRODUCTION

Teenagers can experience nutritional problems, including malnutrition and obesity[1]. Based on the 2018 Indonesian Basic Health Research (Riskesdas) data, the prevalence of underweight adolescents aged 16-18 years in Bogor (2.36%) has a higher prevalence than in West Java Province (1.4%) and nationally (1.4%)[2]. There was also an increase in the prevalence of overweight (5.02%) and obesity (6.89%) in adolescents aged 13-18 years in Bogor City compared to the 2013 Indonesian basic Health Research (Riskesdas)[3].

Teenage swimmers need a good nutritional status to maintain physical fitness and support their daily sports activities[4]. The most significant factor that influences adolescent nutrition problems is external factors. One of the external factors is the social environment that influences how adolescents think about their physical condition. The influence of peers and social media makes teenagers want an ideal body shape[5]. In adolescent swimming athletes, several factors influence body perception[6,7]. Firstly, swimming athletes need slim bodies to maximize their performance. This sport focuses on speed, so it requires a light body weight[6]. Secondly, although success does not depend on beauty, such as in aesthetic sports (gymnastics and skating), athletes' bodies tend to be shown when wearing swimsuits, thus increasing self-awareness and objectivity of the body[7]. The final factor is the dual identity of female swimming athletes, as athletes and women in social life. The sports environment makes them look more masculine (having a muscular body), but the social environment demands an ideal aesthetic (having a slim body)[7].

Negative body perception can make a person dissatisfied with their body shape. Feelings of dissatisfaction with body shape can change their eating patterns, and some even make extreme changes in eating behavior to the point where eating disorders occur in

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adolescents, such as *Anorexia Nervosa* and Bulimia Nervosa, which is most common in athletes[8]. Research on adolescent and adult athletes in France shows that the prevalence of Anorexia Nervosa is 0.5% in males and 2.1% in females. The prevalence of Bulimia Nervosa in males is 0.7%, while in females, it is 2.6%[9]. The prevalence of eating disorders in athletes is higher than in non-athletes, but the specific demands of each sport result in more significant variation across sports[10].

Poor eating behavior can cause adolescent athletes to have an imbalance in nutritious food consumption. Athletes need an adequate intake of nutrients, both macro and micro-nutrients. Fluids and fiber are also needed to maintain athlete performance and digestive tract function. Problems with hydration status can also occur in athletes with eating disorders due to the desire to lose weight, resulting in reduced fluid intake. An imbalance of nutrients can result in changes in nutritional status[11].

Adolescents who live in urban areas have easier access to various foods and faster access to information, so new things more easily influence adolescents, follow trends and influence their body perceptions[12]. One of the professional clubs and organizations that foster youth swimming athletes in Bogor City is OSC (Oceanus Swimming Club) and POSSI (Indonesian Diving Sports Association) Bogor City. The existence of age factors (adolescents), environment, and daily activities put youth swimmers at OSC and POSSI at risk of having negative body perceptions that will impact other aspects of their lives. Based on this explanation, analyzing the relationship between body perception, risk of eating disorders, and the level of nutritional adequacy with the nutritional status of adolescent swimmers in OSC and POSSI, Bogor City, is essential.

METHODS

This cross-sectional study was conducted from November 2020 to March 2021 at the Mikancana Swimming Pool and the Pusdikzi Swimming Pool, Lawang Gintung, Bogor City. This research received ethical permission from the Research Ethics Commission, Bogor Agricultural University (No 319/IT3.KEPMSM-IPB/SK/2021).

Subjects were selected by purposive sampling with several required sample criteria: (1) the subject was a swimming athlete at OSC and POSSI Bogor City, (2) aged 12-18 years, (3) carried out intensive training according to the training schedule, (4) had participated in a swimming competition, (5) was not currently injured and was willing participate in research. Ten swimming clubs in Bogor City, OSC, and POSSI were selected as the sampling targets because both clubs and professional organizations foster youth swimming athletes in the City. Bogor has won various achievements. The subjects chosen were experienced athletes because they had participated in various swimming competitions.

Primary data in this study included subject characteristics (gender, age, class, monthly allowance), body perception, risk of eating disorders, anthropometry (weight, height), body composition (percent skeletal muscle, percent body fat), and food consumption. The secondary data was an overview of OSC and POSSI in Bogor City, the number of athletes researching subjects, schedule, duration and type of training, athlete specialization, health care, information related to athlete nutrition, and other supporting data to research. Secondary data was obtained through direct interviews with trainers, health workers, and the subject's parents.

Data on subject characteristics were collected using a questionnaire, body perception using the Contextual Body Image Questionnaire for Athletes (CBIQA) questionnaire, and the risk of eating disorders using the Eating Disorders Screen for Athletes (EDSA) questionnaire. The filling in the questionnaire was self-administered, distributed on sheets of paper, and the researcher guided the filling. The CBIQA and EDSA questionnaires use English which was translated into Indonesian. This questionnaire is used internationally for athletes in general.

Contextual Body Image Questionnaire for Athletes (CBIQA) was used to assess how satisfied athletes were with their body appearance in sports and non-exercise (daily life) contexts[13]. This questionnaire had 30 questions filled in by the subject himself with several factors related to body perception: appearance, body shape, body weight, percent body fat, and muscle[13]. This questionnaire looked at the athlete's satisfaction with their body because the athlete was asked for their opinion about their own body, compared to other people's bodies, and other people's views about their own body. The EDSA questionnaire is a screening tool for male and female athletes' risk of eating disorders. This instrument consists of six questions representing the core issues of eating disorders, including the subject's importance of body weight, body shape, body composition, feelings of overeating, and restrictions on food intake[14].

Food recall was conducted on school days and holidays. In several studies, a 2x24-hour recall can describe nutrient intake, so the minimum limit was chosen, two days of a food recall, due to time, effort, and cost limitations. Food consumption data collection and questionnaire filling were done offline but still implemented the Covid-19 health protocol. The 2x24-hour food recall interview was conducted by researchers assisted by six enumerators from the Department of Community Nutrition, IPB University students.

Height, weight, percent skeletal muscle, and percent body fat were measured directly. The tools used were a 2 m high microtoise (0.1 cm accuracy) and the Omron Body Fat Monitor (HBF-375) Bioelectrical Impedance Analysis (BIA). Microtoise is the gold standard measurement tool for measuring height[15]. For measurements of body weight and body composition, such as percent skeletal muscle and percent body fat, athletes can use BIA[16]. The measuring instrument is well cared for by the anthropometric laboratory of the Department of Community Nutrition IPB University to maintain its accuracy and precision. Researchers assisted by six enumerators carried out measurements. Each person's weight, height, percent skeletal muscle, and percent fat were measured twice each and then averaged. The researcher standardized the measurements explained to the enumerators to prevent errors.

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Classification of percent body fat and percent skeletal muscle for athletes, especially swimming athletes, is minimal, so the following chosen classification can also be used for people who are not athletes. Classification of body fat percentage for men is categorized into athletic (5-10%); good (11-14%); pretty good (15-20%); fat (21-24%); obesity (>24%)[17]. Classification of body fat percentage for women is categorized into athletic (8-15%); good (16-23%); pretty good (24-30%); fat (31-36%); obesity (>37%)[17]. Classification of skeletal muscle percentage for men is categorized into low (5.0-32.8%); normal (32.9-35.7%); high (35.8-37.3%); very high (37.4-60.0%)[18]. Classification of skeletal muscle percentage for women is categorized into low (5.0-25.8%); normal (25.9-27.9%); high (28.0-29.0%); very high (29.1-60.0%)[18].

Data processing was done using Microsoft Excel 2019, Nutrisurvey 2007, WHO Anthroplus 2007, and SPSS 16.0 for Windows. The CBIQA questionnaire data were processed by adding the total score during daily activities and exercising and then calculating the average[13]. The subject's body perception is said to be more positive if on the appearance subscale if the score is higher towards a score of seven or if he feels his appearance is attractive. On the other subscales, the subject's body perception is said to be more positive at a score of four. If the score gets further from the score of four towards a score of one or seven, the body perception becomes more negative[19]. The researcher gave scores on the EDSA questionnaire using a Likert Scale. The rating category is 1 = never; 2 = rarely; 3 = sometimes; 4 = often; 5 = always. The scores of the six questions were averaged. If the average was ≥ 3.33, the subject was at high risk of experiencing eating disorders[14].

Nutritional status data were obtained from the calculation of the BMI/U z-score using the WHO Anthroplus 2007 software, then categorized into severe malnutrition (<-3 SD); under-nutrition (-3 SD <-2 SD); good nutrition (-2 SD to +1 SD); over nutrition (+1 SD to +2 SD); obesity (>+2 SD)[20]. Nutritional status based on BMI/U in athletes is less able to describe the actual condition of the athlete's nutritional status. Therefore, body composition measurements were carried out to see precisely the dimensions of the body. Based on data on body weight, nutritional status, and body composition data, it will be seen that the subject is high in muscle or fat composition.

Weight measurement in collecting data on food consumption used several tools, such as a food photo book from the Ministry of Health of the Republic of Indonesia (2004) and directly weighing food samples consumed. Food photo books are printed and used directly during a food recall with the subject. The type and amount of food are complete, and the book's cutlery photos help researchers estimate the subject's food consumption. The calculated nutrient content was energy; macro-nutrients (protein, fat, carbohydrates); micro-nutrients (vitamin B1, vitamin B2, vitamin B3, vitamin C, vitamin D, calcium, iron, zinc); fiber, and water. The calculation of nutrients uses the 2007 Nutrisurvey with the help of the 2017 Indonesian Food Composition Table (TKPI) and the Nutrition Facts of the food consumed.

The calculation of the nutritional needs of athletes in this study refers to the Achievement Sports Nutrition Guidebook[21]. Energy requirements are determined by basal metabolic rate energy, specific dynamic action, physical activity, energy expenditure for each type of exercise (according to specialization), and exercise duration. Teenage athletes are still growing, so they need additional energy. The addition of energy is adjusted to the age of the subject. Both male and female adolescents aged 10-14 added 2 calories/kg BW, aged 15-16 added 1 calorie/kg BW, and aged 17-18 added 0.5 calories/kg BW[22]. Calculating the subject's protein, fat, and carbohydrate needs were adjusted to the energy needs of each individual. The amount needed also refers to several references while considering the energy proportion from each macronutrient. The protein requirement for teenage athletes is 1.5 g/kg BW/day[21]. Some say that the protein requirement for teenage athletes is 1.3-1.8 g/kg BW/day[23]. Other references suggest 2 g/kg body weight/day[24]. The recommended proportion of energy from protein for children aged 4-18 years is 10-30% of total energy[25]. Due to limited reference sources, adolescent swimming athletes' protein requirement is not specific. However, this requirement is for young athletes, so the protein requirement is relatively high.

Swimming athletes need a carbohydrate intake of 3-10 g/kg BW/day[26]. The calorie intake consumed by children aged 4-18 should consist of 45% to 65% calories from carbohydrates[25]. However, at least 50% of adolescent athletes' total energy intake comes from carbohydrates[27]. The need for fat is calculated based on the amount of energy besides protein and carbohydrates while considering the proportion of energy from fat. The proportion of energy from fat for children aged 4-18 years is 25-35%[25]. However, good fat consumption for athletes is no more than 30% of total energy per day[28].

The subject's energy and nutrient intake was compared with the actual needs (for energy and macro-nutrients) and the RDA (for micro-nutrients, fiber, and fluids). However, the level of fluid adequacy was also calculated based on the fluid requirement of 1 mL/kcal/day. The reference source for micro-nutrients in athletes was still limited. If the number of needs was still too general, then the RDA was chosen as a personalized need by converting body weight according to age and gender. The hope of an athlete should be that the minimum needs of an average person who is not an athlete should be fulfilled. The subject's AKG calculation used 2019 RDA data[29] converted to actual body weight.

The results of the calculation of the Adequacy of Nutrition Level (TKG) were categorized as "sufficient" if the intake of energy, protein, fat, and carbohydrates met ≥100% of the requirement, while "insufficient" if the intake was <100% of the requirement. The categories for vitamins, minerals, fiber, and water were classified as "deficient" (<77% RDA) and "sufficient" (≥77% RDA)[30]. The data that had been processed were then tested for normality using the Shapiro-Wilk test because the data was less than 50 samples[31]. The data was then analyzed using descriptive tests and statistical tests. Descriptive analysis was performed on the subject's characteristic data (gender, age, class, monthly allowance), body

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perception, eating disorders, nutritional adequacy level, body composition, and nutritional status. Statistical tests were performed using the Pearson and Spearman correlation tests.

RESULTS AND DISCUSSION

Subject Characteristics

The subjects studied were swimming athletes registered with the Oceanus Swimming Club (OSC) and the Indonesian Diving Association (POSSI) in Bogor City. Athletes at POSSI Bogor City have participated in the PORDA, PORPROV, and PON multi-event competitions. At PORDA 2018, POSSI won 4 silvers and 1 bronze. OSC has also won various achievements in swimming championships, such as winning the championship at the Swimmeet Intern Club in Bogor City in 2020, the overall champion of HAORNAS for Jabotabek 2017, the overall champion for Diaspora Cup 2 for Jabotabek 2018. The number of athletes as research subjects was 21 people. There were 14 male subjects (66.7%) and seven female subjects (33.3%). The subjects aged 12-17 attended high school from 6th to 12th grade. The mean age of the subjects was 14.48 ± 1.63 years. A total of 23 (23.8%) subjects were 16 years old.

Most (66.6%) subjects received pocket money to buy food and drinks at≥Rp—300,000.00 monthly. As many as 33.3% of the subjects received an allowance of Rp. 300,000.00–Rp. 399,000.00 per month. The remaining 33.3% of the subjects received monthly pocket money from their parents ≥Rp—400,000.00. Several subjects experienced a decrease in pocket money because most of the subjects' activities were carried out at home due to the Covid-19 pandemic. As many as 14.3% of subjects were not given pocket money during the Covid-19 pandemic.

Body Perception

Body perception consisted of negative (dissatisfied with the body) and positive (body satisfied) body perceptions. The average total body perception score of the subjects was 4.77 ± 1.17. The score was close to a score of 4, so it can be said that the subject's body perception tends to be positive. Subjects tended to be satisfied with body shape, muscle and fat composition, and body weight. The subject's body perception was more positive or more satisfied than during exercise, 4.71 ± 1.25 during daily activities and 4.83 ± 1.24 during exercise. Aesthetic and endurance athletes, like swimming athletes, can experience "Body Satisfaction Transiency." In everyday life, athletes may experience satisfaction because their bodies are slim under socially constructed standards, but when exercising, their body satisfaction can become more negative because of the body's demand stricter in their sport[13].

Risk of Eating Disorders

Negative body perceptions can lead to eating disorders. Eating disorders often encountered in sports are Anorexia Nervosa and Bulimia Nervosa, especially among athletes who need a slim body[8]. The score average subject's risk for an eating disorder was 2.6 ± 1.0. If the average EDSA score is ≥ 3.33, the subject is at high risk of experiencing eating disorders. Thus, based on the average score of the EDSA questionnaire, the subject was not at risk for eating disorders. Most subjects (66.7%) were not at risk of eating disorders, while the other 33.3% were at risk. More women (19.0%) are at risk of eating disorders than men (14.3%).

Energy Adequacy Level

Athletes' eating arrangements were carried out independently by the athlete's parents. The trainer provides input and suggestions regarding the eating arrangements of the athletes to their parents. No nutritionist regulates the diet of the athletes except during preparations for competitions such as PON, Porda, and Porprov. Athletes will live in the hostel and be provided with food. There was one subject whose eating arrangements were assisted by a nutritionist to improve his performance in sports. The energy and nutritional adequacy levels of the subjects are presented in Table 1.

Table 1. Level of the adequacy of subject energy and nutrients

Nutritional Substances	Percentage (%)
Energy	
Enough	9.52
Not enough	90.48
Mean ± SD	72.0 ± 31.1
Proteins	
Enough	38.10
Not enough	61.90
Mean ± SD	88.7 ± 47.2
Fat	
Enough	23.81
Not enough	76.19
Mean ± SD	77.0 ± 39.8
Carbohydrate	
Enough	14.29
Not enough	85.71
Mean ± SD	68.3 ± 31.8

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Nutritional Substances	Percentage (%)
Vitamin B1	
Enough	47.62
Not enough	52.38
Mean ± SD	86.69 ± 70.79
Vitamin B2	
Enough	71.43
Not enough	28.57
Mean ± SD	107.20 ± 59.40
Vitamin B3	
Enough	52.38
Not enough	47.62
Mean ± SD	89.03 ± 48.16
Vitamin C	
Enough	23.81
Not enough	76.19
Mean ± SD	77.47 ± 138.10
Vitamin D	
Enough	14.29
Not enough	85.71
Mean ± SD	39.52 ± 44.64
Calcium	
Enough	9.52
Not enough	90.48
Mean ± SD	33.55 ± 33.44
Iron	
Enough	47.62
Not enough	52.38
Mean ± SD	101.67 ± 62.46
zinc	
Enough	52.38
Not enough	47.62
Mean ± SD	86.79 ± 34.98
Fiber	
Enough	0.00
Not enough	100.00
Mean ± SD	30.2 ± 13.9
Liquid (AKG 2019)	
Enough	52.38
Not enough	47.62
Mean ± SD	77.3 ± 36.8
Fluids (1 mL/kcal/day)	
Enough	9.52
Not enough	90.48
Mean ± SD	54.4 ± 27.3

Most subjects (90.48%) experienced energy insufficiency with an average sufficiency level of 72.0 ± 31.1%, and only 9.52% of the subjects whose energy intake met 100% of their needs. The average energy intake of the subjects was 2.487 ± 999 kcal. Inadequate intake of macronutrients results in low energy intake. Based on the results of a 24-hour food recall, subjects with sufficient energy intake consumed more food with a frequency of 3-4 main meals and 1-2 snack times, while subjects who experienced insufficient energy ate 1-3 main meals, 0-2 meals interlude with smaller portions. Long-term energy deprivation in adolescent athletes poses a risk of growth retardation, fatigue, loss of muscle mass, injury, and disease[32].

Protein contributes to energy production. As many as 61.90% of subjects experienced insufficient protein intake, while 38.10% had fulfilled their daily protein needs. The average protein adequacy level was 88.7 ± 47.2%, and the intake was 89.1 ± 47.1 g. Subjects with adequate protein intake consumed more animal

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protein sources such as chicken, eggs, fish, and meat. Animal protein is high quality because it contains complete essential amino acids, the composition follows the body's needs, and has high protein digestibility[33].

Subjects who experienced protein deficiency often eat chicken eggs, tempeh, and tofu. They consume more carbohydrates than other macro-nutrients. Athletes who do regular training, big competitions, and are teenagers need more protein. The subjects' average protein intake was 1.7 grams/kg BW/day. This finding showed that the average protein intake of the subjects was under the protein needs of adolescent athletes, namely 1.3-1.8 g/kg BW/day[23]. Adequate protein intake is needed by athletes to repair muscle fibers damaged by exercise and to form enzymes[34].

As many as 76.19% of subjects experienced insufficient fat intake. The subjects' average fat adequacy level was 77.0 ± 39.8%, and their intake was 87.0 ± 35.8 g. Only 23.81% of the subjects were categorized as having sufficient fat intake. Based on the 24-hour food recall interview results, the food they consumed was a high-fat and moderate-fat source of protein, with quite a large portion. Some foods were chicken meat with skin, beef, sausages, chicken eggs, peanuts, whole cream milk, and its preparations (ice cream, cheese, yogurt). Most ways to process food were fried or baked using additional oil or margarine, thereby increasing fat intake. The subject's fat intake was less than the needs of swimming athletes. The subject's average fat intake was 1.6 g/kg BW/day[34]. Less fat intake can affect the quality of athletes' training because fat is a source of energy for athletes. Fat intake is needed during exercise to have a protective effect on the use of muscle glycogen. Swimming athletes need extra fat because it requires higher buoyancy, so athletes move faster[24].

Another nutrient that is the primary source of energy for athletes is carbohydrates. The results of the 24-hour food recall showed that the subjects' average carbohydrate intake was still less than their needs. Most of the subjects (85.71%) experienced insufficient intake of carbohydrates. The subjects' average carbohydrate adequacy level was 68.3 ± 31.8%, with a total intake of 336.0 ± 139.9 g. As many as 14.29% of the subjects had sufficient carbohydrate needs due to the high consumption of food sources of carbohydrates (rice). Subjects with sufficient carbohydrate intake can consume white rice 3-4 times daily in large portions. Subjects also usually consume high-carbohydrate foods at leisure, such as noodles, bread, macaroni, donuts, cassava chips, chocolate, sweet drinks, and soft drinks.

The average subject's carbohydrate intake was 6.4 g/kg BW/day, while endurance athletes who usually train at moderate to high intensity (1-3 hours/day or 20 hours/week) require a carbohydrate intake of 7-10 g/day per Kg body weight/day[34,35]. This finding showed that the subjects' average carbohydrate intake was insufficient for the general carbohydrate needs of swimming athletes. Adequate carbohydrate intake is essential for athletes to maintain energy reserves and reduce fatigue to maintain good performance. So meeting the athlete's carbohydrate intake is needed to maintain glycogen stores in the muscles and liver[36].

Vitamin Adequacy Level

Vitamin D had not yet reached the requirement, while vitamin B (B1, B2, B3) and vitamin C intake had met the requirement. Athletes need adequate vitamin intake. Water-soluble vitamins (B and C) are components of enzyme systems that are heavily involved in energy metabolism [37]. Subjects were categorized as sufficient vitamin B1 (47.62%), vitamin B2 71.43%, and vitamin B3 52.38%. The average sufficiency levels of vitamins B1, B2, and B3 were sufficient, vitamin B1 86.69 ± 70.79%, vitamin B2 107.20 ± 59.40%, vitamin B3 89.03 ± 48.16%. The average intake of vitamin B1 was 1.14 ± 1.14 mg, vitamin B2 1.48 ± 1.06 mg, and vitamin B3 14.58 ± 8.36 mg.

Most of the subjects habitually consumed food sources of B vitamins such as chicken, beef, fish, chicken eggs, milk, peanuts, bananas, and mangoes. Consumption of rice, bread, and noodles in large portions also contributed to the intake of B vitamins in the subjects. Some subjects were also used to taking supplements containing B complex vitamins to fulfill the needs for vitamins B1, B2, and B3. Adequate intake of vitamins B1, B2, and B3 benefits athlete performance because all three are cofactors and activators of energy metabolism, influencing nerve function, muscle contraction, and fat synthesis[34].

Another vitamin needed by athletes is vitamin C. As many as 76.19% of the subjects experienced a vitamin C deficiency, while the other 23.81% met their daily needs. The subjects' average level of vitamin C adequacy was 77.47 ± 138.10%, classified as sufficient. The subjects' average vitamin C intake was 65.94 ± 114.88 mg.

Fruits and vegetables are food sources of vitamin C. Most of the subjects consumed fewer vegetables and fruit, especially vegetables. Some fruits and vegetables high in vitamin C commonly consumed by the subjects were mustard greens, moringa leaves, kale, cassava leaves, cabbage, broccoli, oranges, and mangoes. Several subjects took vitamin C supplements so that their intake could meet their needs, and the average level of adequacy was sufficient. Vitamin C plays a role in repairing body tissues and metabolic processes[38]. Athletes need adequate consumption of vitamin C because vitamin C can reduce physiological stress. A deficiency of vitamin C can cause the weakening of muscle contractions, decreased endurance, fatigue, and cell damage due to free radicals[37].

On average, the subjects were not able to meet the needs of vitamin D. Subjects who experienced vitamin D deficiency were 85.71%, while the other 14.29% were able to meet their daily intake of vitamin D. The average adequacy level was 39.52 ± 44.64% so that it had not reached the minimum limit for intake of a nutrient, which was 77%. The subjects' average vitamin D intake was 7.04 ± 9.07 mcg.

Subjects consumed food sources of vitamin D from chicken eggs, shrimp, and fish. Most subjects also consumed milk, which was insufficient to meet their daily vitamin D needs. Other food sources of vitamin D were salmon, mackerel, tuna, mushrooms, and cod liver oil[39]. Some subjects used to take supplements containing vitamin D and fish oil to help optimize the fulfillment of

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the subject's vitamin D needs. Inadequate vitamin D intake in athletes can affect bone health, absorption and regulation of calcium in the body, enzyme activity, and muscle contractions in athletes[32].

Mineral Adequacy Level

The mineral whose intake had not yet reached the requirement was calcium, while iron and zinc intake had met the requirement. Most subjects (90.48%) had calcium deficiency, with an average intake of 461.79 ± 529.52 mg. The average subject's calcium adequacy level was 33.55 ± 33.44%, so it can be considered deficient. This finding was caused by subjects who consumed fewer food sources of calcium. The foods that contributed the most to the subject's calcium intake were milk and yogurt. However, these foods have not met the subject's calcium needs. As many as 9.52% of the subjects could meet their calcium needs because they were assisted with supplements. Calcium is essential in the growth process, especially for teenage athletes. In addition, calcium plays a role in maintaining heart rate, muscle relaxation contractions, and blood clotting. Insufficient calcium intake in the long term will increase the risk of osteoporosis, thereby reducing athlete performance[40].

Another mineral needed to support athlete performance is iron. As many as 47.62% of the subjects could meet their iron needs. However, 52.38% of subjects still had not met their daily iron needs. The subjects' average iron intake was 12.17 ± 6.72 mg with an average adequacy level of 101.67 ± 62.46%, categorized as sufficient. This finding was caused by subjects accustomed to consuming food sources of iron, such as tofu, tempeh, shrimp, beef lung, clams, chicken liver, chicken meat, beef, fish, peanuts, and chicken eggs. In addition, some of the subjects also used to take iron-containing supplements to increase the subject's iron intake. The subject's Fe intake was mainly obtained from animal protein food sources with a higher level of bio-availability[41]. Some subjects were accustomed to consuming milk, which contains calcium which can inhibit the absorption of iron[42].

Zinc is one of the minerals needed by young athletes for the growth and development of the body. Most of the subjects (52.38%) had sufficient levels of zinc adequacy, while 47.62% of other subjects could not meet their daily zinc needs. The subjects' average zinc intake was 9.57 ± 4.29 mg with an adequacy level of 86.79 ± 34.98%, categorized as sufficient. This result can happen because most subjects consume animal foods with a reasonably high zinc content, such as chicken, beef, shrimp, clams, squid, milk, chicken eggs, chicken liver, and fish, and some were derived from tempeh. Some subjects also used to take zinc-containing supplements so they could increase zinc intake[34].

Fiber Adequacy Level

Fiber intake should not be ignored. There will be an impact on health if fiber intake is not sufficient. Based on the results of a 24-hour food recall, all subjects (100%) experienced a lack of fiber intake. The average amount of subject intake is 10.7 ± 5.4 g with an average sufficiency level of 30.2 ± 13.9%, so it was classified as insufficient. Foods contributing to the subject's fiber intake included mangoes, bananas, oranges, and dragon fruit. Many subjects still do not add vegetables to their diet, and the portion cannot meet their fiber need.

Fluid Adequacy Level

Athletes need to maintain the balance of body fluids. Schoolchildren's average fluid requirement is 1-1.5 mL/kcal/day[43]. Other references state that the amount of fluid needed is 1 mL/kcal of energy requirement.[44] The special energy requirements of athletes make the subject need more fluids. A person's body can obtain fluids from the food and drinks they consume and a small part of the results of metabolism[45]. Total fluid intake in this study results from the sum of fluids from food and beverages consumed based on the results of a 2x24-hour food recall.

The average amount of the subject's fluid intake was 1.785.8± 791.1 mL. As many as 52.38% of the subjects could meet their fluid needs, while the other 47.62% were not. However, if the fluid requirement was based on energy requirements, most subjects (90.48%) experience insufficient fluid intake, and only 9.52% of subjects can meet their fluid needs. This result was supported by the average value of the subject's fluid adequacy level, which was sufficient based on the 2019 RDA, which was 77.3 ± 36.8%. However, the subjects' average fluid adequacy level was classified as low regarding their energy needs, reaching 52.3 ± 27.3%. Types of food besides water that contribute enough fluids for the subject were dragon fruit and soupy foods such as instant noodles and meatballs.

Body Composition

As many as 47.6% of the subjects had a good body fat percentage, and the other 28.5% were quite good. However, only 4.8% of subjects had athletic body fat percent. The rest were classified as obese (14.3%) and obese (4.8%). Increasing age is generally accompanied by an increase in one's body fat percentage. Approaching adulthood, athletes have other responsibilities and activities, such as school activities which are increasingly crowded, so the frequency of exercise and eating patterns change. These changes can change body composition, such as reduced muscle mass and increased body fat[46]. Gender and sport also affect the percentage of fat in athletes. Boys tend to have less fat than girls[47]. Swimming athletes have higher body fat than athletic sports[48]. This composition causes swimming athletes to have better buoyancy abilities[49]. An athlete's excess body fat percentage will affect body composition, immune system, cardiovascular, muscle endurance and flexibility, and performance[50]. There is an increase in body mass, so motion acceleration will decrease. Body temperature increases more, so the athletes get tired faster[4].

Most subjects (47.62%) had a very high percentage of skeletal muscles due to their usual daily sports activities—subjects with the same percentage of high and normal skeletal muscles (19.05%). However, as many as 14.28% of the subjects had a low percentage of skeletal muscles. The high percentage of body fat can cause this result in the subject. One of the effects of unbalanced energy intake, especially energy deficits, is loss of muscle mass[32]. Incorrectly implementing an

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exercise program can also result in reduced muscle mass[46].

Nutritional Status

The subject's average body weight was 56.5 ± 13.4 kg, while the average height was 162.1 ± 7.2 cm. Most subjects (81%) were classified as well-nourished based on BMI/Age indicators. The direct factors that affect the nutritional status of adolescents are food intake and infectious diseases. Indirect factors related to the level of consumption are body perception, the amount of pocket money, and knowledge of nutrition[51].

The subject had a body perception that tends to be positive. Adolescents with positive body perceptions are encouraged to behave healthily and tend to have normal nutritional status[52]. Most (66.6%) subjects received pocket money ≥Rp300,000.00 per month. The high allowance can increase the variety and purchasing food[51]. During the Covid-19 pandemic, the subject was at home more often, so their parents mainly provided the subject's food intake. Adequately available food is crucial in improving adolescents' nutritional status of adolescents[53]. Some factors can cause 81% of subjects to be classified as well-nourished, and none are classified as undernourished or severely malnourished.

As many as 9.5% of the subjects were overweight, and the other 9.5% were obese. Being overweight in adolescents is influenced by a lack of physical activity and lifestyle or adolescent habits such as fast food consumption and lack of sleep, which can exacerbate this condition[54]. Subjects routinely exercise five to seven times a week for two hours, so physical activity is not the main factor causing some subjects to be overweight.

Measuring the nutritional status of teenage athletes is less accurate using the BMI/U indicator because the nutritional status of obesity refers more to being overweight, not to excess fat. So the measurement of percent body fat is needed in measuring the nutritional status of athletes. Excess weight experienced by athletes can be caused by higher muscle mass than fat. So athletes who are overweight and obese do not necessarily have excess body fat percent[55]. However, based on body composition measurements, subjects who were obese and over-nourished had a low percentage of body fat classified as obese and obese and a low percentage of skeletal muscle. These results indicate a need to improve some subjects' nutritional status and body composition.

Correlation between Body Perception and Risk of Subjects with Eating Disorders

As many as 42.9% of subjects were more satisfied with shape, muscle and fat composition, and body weight compared to 57.1% of other subjects. However, overall the subject's body perception still tended to be joyous or satisfied with their body shape, with an average of 4.77 ± 1.17 (close to a score of 4). In addition to the subject's body perception, which tends to be positive, most subjects were not at risk of eating disorders. This result can be influenced by most male research subjects because, based on the results of various studies, men are more satisfied with their bodies than women. However, dissatisfaction with body shape may arise if men do not have a muscular body[56]. Women have a higher tendency for eating disorders than men because women are often demanded by society to have thin bodies. Although biologically, the body fat percentage in women is higher than in men[57].

The risk of eating disorders was more significant in subjects who felt dissatisfied with their bodies. Subjects who were at risk of eating disorders and felt dissatisfied with their bodies were 23.8%. This number was more significant than those subjects at risk of eating disorders but have positive body perceptions or feel satisfied with their bodies (9.6%). However, the number of subjects not at risk for eating disorders did not differ much between subjects with positive or negative body perceptions. This finding indicates that subjects with negative body perception are not always at risk of having eating disorders.

Table 2. The body perception correlation test results with the risk of eating disorders

	Body Perception	
	Pearson Correlation	***Sig. (2-tailed)***
Risk of Eating Disorders	0.085	0.714

**. Correlation is significant at the 0.05 level (2-tailed)*

The Pearson correlation test results showed no relationship between body perception and the risk of eating disorders (p=0.714 r=0.085). This result was in line with Kurniawan and Briawan's research which found no relationship between body perception and eating disorders[58]. The more negative/positive the subject's body perception is, the less risky the eating disorder will be. These results were not in line with research on athletes in Brazil, whose results show a positive relationship between body perception and the risk of eating disorders[59]. Subject data in this study failed to prove this relationship.

The Relationship between the Risk of Eating Disorders and the Level of Adequacy of Nutrition

Correlation tests were carried out on the risk of eating disorders with the adequacy level of various nutrients. The results showed that the risk of eating disorders had no relationship with the level of nutritional adequacy, except for fluids. The following are the correlation test results for the risk of eating disorders with the level of fluid adequacy (Table 3).

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Table 3. Correlation test results for the risk of eating disorders with adequate fluid levels

		Risk of Eating Disorders
Fluid Adequacy Level (AKG 2019)	*Pearson Correlation*	-0.596**
	Sig.(2-tailed)	0.004
Liquid Adequacy Level (According to Energy Needs)	*Correlation Coefficient*	-0.511*
	Sig. (2-tailed)	0.018

**. Correlation is significant at the 0.05 level (2-tailed)*
***. Correlation is significant at the 0.01 level (2-tailed)*

The risk of eating disorders had a negative relationship with the level of fluid adequacy based on the RDA (p=0.004 r=-0.596). In addition, the risk of eating disorders was also negatively related to the level of fluid adequacy based on energy requirements (p=0.018 r=-0.511). The lower the risk of eating disorders, the better the fluid intake because subjects not at risk of eating disorders are more aware of the importance of fluids for their bodies. Adolescents with positive body perceptions are encouraged to behave healthily, so they try to fulfill their daily fluid intake[52].

The risk of eating disorders had no relationship with the adequacy of energy, protein, fat, carbohydrates, B vitamins (B1, B2, B3), vitamin C, vitamin D, calcium, iron, zinc, and fiber. This result was in line with Oktafiandini's research, which stated that there was no relationship between adequate levels of protein, fat, and calcium with the risk of eating disorders[60]. The higher/lower the risk of eating disorders, it is not certain that the level of adequacy of energy and nutrients is fulfilled properly because the fulfillment of the adequacy level of energy and nutrients through food consumption in adolescents is also influenced by knowledge, attitudes, pocket money, the role of family, and the role of friends. peer[61].

Relationship between Adequacy of Nutrition and Body Composition of Subjects

This study conducted a correlation test to see the relationship between the adequacy level of various nutrients and the percent body fat. Several nutrients were related to the percent body fat, and some were unrelated. The following are the correlation test results for the adequacy of nutrients related to percent body fat (Table 4).

Table 4. Correlation test results for adequacy of nutrition with body fat percent

	Body Fat Percent	
	Pearson Correlation	***Sig. (2-tailed)***
Energy	-0.500*	0.021
Proteins	-0.492*	0.023
Carbohydrate	-0.576**	0.006
Vitamin B3	-0.453*	0.039
zinc	-0.585**	0.005
	Correlation Coefficient	*Sig. (2-tailed)*
Iron	-0.578**	0.006

**. Correlation is significant at the 0.05 level (2-tailed)*
***. Correlation is significant at the 0.01 level (2-tailed)*

The Pearson and Spearman correlation test showed a significant negative relationship between the adequacy of energy, protein, carbohydrates, vitamin B3, zinc, iron, and body fat. The results of this study were not in line with Nisa's research, and namely, there was a positive relationship between energy and carbohydrate intake and percent body fat[62]. Energy results from the metabolism of carbohydrates, fat, and protein nutrients in the food consumed. If excess energy is consumed, it will be stored as fat in the body[62]. Apart from nutrient intake, other factors can affect the amount of fat stored in the body, including the level of physical activity. The subject's physical activity was high because of their usual routine exercise. High intake of energy and macronutrients will be used as a source of daily energy and during exercise. Therefore, the subject's high energy intake, protein, and carbohydrates may not necessarily be stored as fat in the subject's body. High intakes of vitamin B3, zinc, and iron are utilized in metabolic processes to meet the subject's high energy needs so that energy intake is not stored as much fat in the subject's body.

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Table 5. Correlation test results of the adequacy of nutrition with skeletal muscle percent

	Skeletal Muscle Percent	
	Correlation Coefficient	***Sig. (2-tailed)***
Proteins	0.472*	0.031
Carbohydrate	0.541*	0.011
Iron	0.525*	0.015
zinc	0.578**	0.006

**. Correlation is significant at the 0.05 level (2-tailed)*
***. Correlation is significant at the 0.01 level (2-tailed)*

Based on the Spearman correlation test results, there was a positive relationship between the adequacy level of protein, carbohydrates, iron, and zinc and the percentage of skeletal muscle. The results of this study align with Andarbeni's research. Protein intake was positively related to muscle strength and the percentage of skeletal muscles in the body[63]. Protein intake significantly affects muscle mass by increasing protein synthesis resulting in muscle hypertrophy and the percentage of skeletal muscles[63]. Food sources of protein usually contain the minerals iron and zinc. These minerals have a significant positive relationship with the percentage of skeletal muscle because with adequate intake of zinc and iron, muscle formation and maintenance can be carried out properly[64].

Increased protein intake must be balanced with sufficient energy intake because it can increase muscle mass[65]. Protein will be broken down to produce energy if energy intake is lacking. If the intake of carbohydrates is less, the availability of the hormone insulin is relatively low, and protein breakdown will increase[66]. Therefore, there was a significant positive relationship between percent of skeletal muscle and the level of carbohydrate sufficiency because carbohydrates are needed as the primary source of energy for skeletal muscle contraction. Excess carbohydrates will also be stored in the muscles as glycogen. Adequate carbohydrate intake is needed before training, so protein intake is used to increase muscle protein synthesis during recovery[67].

The relationship between the level of nutritional adequacy and the nutritional status of the subjects

This study conducted a correlation test to see the relationship between the adequacy level of various nutrients and nutritional status. Several nutrients were related to nutritional status, and some were unrelated. The correlation test results for the level of nutritional adequacy associated with nutritional status (BMI/U) can be seen in Table 6.

Table 6. Correlation test results of nutrition adequacy levels with nutritional status

	Nutritional Status (BMI/A)	
	Pearson Correlation	*Sig. (2-tailed)*
Carbohydrate	-0.554**	0.009
	Correlation Coefficient	*Sig. (2-tailed)*
Iron	-0.466*	0.033

**. Correlation is significant at the 0.05 level (2-tailed)*
***. Correlation is significant at the 0.01 level (2-tailed)*

The level of carbohydrate adequacy was negatively related to nutritional status. These results were not in line with the results of Muchlisa's study that showed a positive relationship between carbohydrate intake and nutritional status (p=0.000 r=0.303), meaning that if the intake is insufficient, there will be a decrease in nutritional status[68]. This discrepancy can occur because the food intake data has not adequately described the subject's daily intake. The 24-hour recall method has the disadvantage of the flat slope syndrome. Delicate subjects tend to overestimate food consumed (overestimate) while obese subjects underestimate, resulting in a discrepancy, namely subjects with higher BMI/U z-scores have lower carbohydrate intake and vice versa[69].

Based on the results of the Spearman correlation test, there was a significant negative relationship between the level of iron adequacy and the nutritional status of the subjects. These results did not align with Muchlisa's research, which stated a significant positive relationship between iron intake and nutritional status (p=0.001 r=0.262)[68]. Iron deficiency affects growth and nutritional status due to reduced appetite and worsening immune system[70]. This discrepancy is because subjects with lower BMI/U scores make more efforts to meet their intake of micro-nutrients, especially iron, by taking multivitamin supplements.

Correlation between Body Perception and Risk of Eating Disorders with Nutritional Status of Subjects

The variables of body perception and risk of eating disorders are known to be related to nutritional status through food consumption. However, several studies also state that body perception can directly relate to nutritional status. The following are the correlation test results of this study (Table 7).

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Table 7. Body perception correlation test results and risk of eating disorders with nutritional status

	StatusNutrition (BMI/U)	
	Pearson Correlation	***Sig. (2-tailed)***
Body Perception	0.473*	0.030
Risk of Eating Disorders	0.275	0.227

**. Correlation is significant at the 0.05 level (2-tailed)*

The correlation test results proved a significant positive relationship between body perception and nutritional status (p=0.030 r=0.473). These results follow the research of Widianti and Candra that there was a significant positive relationship between body image and nutritional status (p=0.001 r=0.482)[71]. The higher the dissatisfaction with body image, the more abnormal its nutritional status. These results were proven by subjects who are obese and overweight having dissatisfaction with their bodies compared to subjects with normal nutritional status.

Based on the Pearson correlation test results, no significant relationship existed between the risk of eating disorders and nutritional status (p=0.227 r=0.275). These results follow Merita's research that there was no significant relationship between the tendency of eating disorders and nutritional status with indicators of BMI/Age in young women in Jambi City (p=0.657)[72]. Subjects in this study tended to feel that they were overeating and wanted to be thinner, especially subjects with obesity and overweight nutritional status. However, most subjects had normal nutritional status due to certain factors, such as physical exercise. Even though the intake of nutrients was relatively high, it can be balanced with energy expenditure due to the subject's activity. If there is a change in eating behavior due to the risk of eating disorders experienced by the subject, it will take time for the subject to change in nutritional status. Nutritional status is a picture of food consumption in the long term. Nutritional status is also influenced by other factors such as economic conditions and nutritional knowledge[73]. This research had limitations related to the information provided by the subject through a questionnaire or when carrying out a Food Recall, which sometimes did not show the actual condition. This condition could happen due to several factors, such as the different understanding of each subject. There was also the factor of honesty, or the subject's memory when doing Food Recall.

CONCLUSIONS

Subjects tend to feel satisfied with their body condition, which had good nutritional status. Several subjects were dissatisfied with their bodies because they had more nutritional status and obesity, high body fat, and low skeletal muscle percentage. They were more at risk for eating disorders. However, their concern for appearance does not make them change their diet. Further research is needed to identify appropriate and sensitive methods for assessing the risk of eating disorders in athletes in Indonesia. A 24-hour recall should be done for seven days, and it would be better if the researcher added a method SQ-FFQ (Semi-Quantitative Food Frequency Questionnaire). It is necessary to examine the relationship between body perception and disordered eating because the probability of athletes experiencing disordered eating is higher than disordered eating. It is also necessary to examine other factors that affect nutritional status, namely smoking habits, infectious diseases, sleep quality, and knowledge of nutrition, and their impact on athlete performance.

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