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Quality of Diet and Nutritional Status on Male Young Athletes in Central Java

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Abstract

Fulfilling energy and nutritional intake that is not in accordance with dietary recommendations and nutritional guidelines will affect the quality of athlete's diet. Preliminary study results that an average of athlete's energy consumption only 74% of the recommended energy requirement and 8% athletes are undernutrition. This study aims to evaluate the quality of the diet and sufficiency of energy and nutrition and to determine the relationship with the nutritional status of young male athletes. This study was conducted in 2019. Kind of this study is observational analytic, which using a cross sectional design to 85 young male athletes of the Central Java Student Sports Education and Training Center from 9 kind of sports (takraw, weightlifting, swimming, fencing, basketball, rowing, volleyball, soccer, and athletics). The subjects were measured of their weight, height, fat mass, and waist circumference and then determined their nutritional status (BMI age, body fat percentage, and height ratio). Energy and nutritional sufficiency were obtained by interview using the Semi-Quantitative FFQ, and data of food quality were obtained by using the Diet Quality Indexs International (DQI-I) questionnaire. Data analysis used the Spearman Rank Test with a significance level (α) 0.05 and a confidence level of 95% CI. The results showed that the quality of the foods (p = 0.144; 0362; and 0296), as well as the sufficient energy and nutrients (p = 0.143; 0410; 0608; 0153; 0735; 0836; 0222; 0533; 0326; 0553; 0392; and 0308) but they were not related to nutritional status (BMI age, body fat percentage, and WtHR). It was concluded that the quality of the diet was related to energy and nutritional sufficiency, but both of them do not show a significant relationship with the nutritional status of young male athletes of Province of Central Java.

Introduction

Fulfilling nutritional needs is a major requirement which becomes basic of every athlete to support their performance. It is not only in exercise programs and physical activity, good nutritional management for athletes, especially athletes who are still younger (athletes from children to adolescent), is certainly an integral part of athlete performance management. Adolescent athletes certainly need special attention, because this period is called as growth spurt, as effect of increasing their physical activities due to intensive training programs, which resulting of increase of energy and nutritional needs (Lloyd et al. 2015). Failure of fulfilling the energy and nutritional needs of adolescent athletes will certainly affect to growth disorders. If this happens continuously for a long time, it will interfere with the fulfillment of energy needs during training and competitions. This will effect of decreasing athlete's performance (Penggalih et al. 2017) and (Oladunni and Sanusi 2013)).

Although the managers knows that nutrition management in adolescent athletes is very important, but in fact, good food management for athletes, especially adolescent, still does not get the same priority as an exercise program. In addition, the problem of good food superintendence in athletes are also becomes an obstacle in nutritional management. The wrong choice of food ingredients, poor dietary habit and insufficient daily intake that occurs continuously will decrease the quality

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of athlete's performance. Previous research in 2015 on adolescent soccer athletes in London showed that the average daily energy intake was still insufficient when compared to energy expended, even though the average fat intake was excessive. Other research data on ultra-endurance cycling athletes showed over that the average athlete's nutritional intake is still lower than that of energy expended. Other research on athletes in various sports shows that the athlete's energy and carbohydrate intake still does not fulfill the recommendations, while protein and fat intake shows the level of fulfillment of excessive intake when compared to recommendations ((Briggs et al. 2015); (Bescós et al. 2012); (Mielgo-Ayuso et al. 2015))

Poor management of athlete's nutrition management does not only effect on decreasing the quality of athlete's performance, it also has negative impact on the nutritional status and growth of adolescent athletes. Research on early age soccer athletes (9-12 years) at the Sinar Harapan Football School, Tulangan, Sidoarjo, East Java showed that there were relationship between the level of adequacy of energy and fat to the nutritional status of athletes (Nur Amin 2017) . Another study was conducted on 40 martial arts athletes aged 14-18 years who showed that adequacy levels of energy and nutrients (carbohydrates, protein, and fat) were not significantly related to nutritional status of BMI for age (Mardiana et al. 2019).

It was stated previously that a adolescent athlete who is still in a period of growth and development certainly needs optimal nutritional intake to support his growth. Fulfilling energy and nutritional intake that is not in accordance with dietary recommendations or nutritional guidelines will affect the quality of athlete's diet. Diet quality assesses the quality and variety of food ingredients which are consumed and can be related to a person's health status. In addition, diet quality is able to describe the quality of energy consumption, sugar, saturated fat, vegetables, fruits, meats and vegetables and micronutrients (Vilela et al. 2014); (Sahara, Widyastuti, and Candra 2019)). This research aimed to evaluate the quality of the diet and the level of energy and nutrient sufficiency in adolescent male athletes at the Jatidiri Sport Arena complex, Semarang, Central Java. In addition, this research also examined the relationship between diet quality and adequacy levels of energy and nutrients with nutritional status using indicators of Body Mass Index (BMI) for age, body fat percentage, and Waist-Height Ratio (WtHR).

Method

This analytic observational research was conducted using a cross sectional research design and was completed at the end of September 2019. This research was conducted at the Jatidiri Sport Arena complex, Semarang, Central Java. The research subjects were selected using a random sampling technique, as many as 85 people from a total population of 108 adolescent male athletes. As for the research subjects were athletes from 9 kind of sports (football, weightlifting, swimming, fencing, basketball, rowing, volleyball, football, and athletics) and fulfill the criteria, including aged 13-18 years, male, being a PPLP athlete of Central Java Province, being not sick or has a history of cardiovascular disease, metabolic syndrome, immunity disorders, and or orthopedic disorders, and is not currently using or has ever used drugs or supplements that can affect muscle work, and is willing to take part in a series of studies through informed consent.

Physical measurements taken on research subjects included measurements of body weight, height, waist circumference, and thickness of subcutaneous fat. Measurement of body weight using the OMRON Digital Personal Weight Scale Type HN-289 (0.1 kg precision level) and height measured using the GEA Wireless Body Height Meter Type HT-721 (0.1 cm precision level). Waist circumference was measured using a metline (0.1 cm precision level). The thickness of the subcutaneous fat was measured using the KaradaScan Body Composition Monitor Type HBF-375.

The level of energy and nutrient adequacy was obtained from the results of interviews with research subjects about the average daily food intake using the Semi-Quantitative FFQ (Food Frequency Questionnaire). The results of the interview regarding the average daily intake then would be converted into units of calories (energy) and grams (macro nutrients) and compared with the energy and nutrient

requirements for athletes who are specifically based on TEE (Total Energy Expenditure) calculations. The adequacy level of energy and nutrients can be calculated using the formula:

Energy and Nutrients Adequacy%
= daily intake Total Expnditure × 100%

The percentages of adequacy levels of energy and nutrients were categorized into three groups, namely deficit (<80% TEE), adequate (80-110% TEE), and excessive (> 110% TEE) (WNPG, 2014). Characteristic data of research subjects including age, sports, physical measurement data, nutritional status, adequacy levels of energy and nutrients, and diet quality were analyzed descriptively and displayed in table form. Bivariate analysis used the Spearman Rank Test to assess the relationship between diet quality, adequacy levels of energy and nutrients with nutritional status (BMI for age, body fat percentage, and WtHR) with a significance level (α) 0.05 and a confidence level of 95% CI.

Result and Discussion

The results showed that most of the research subjects still showed poor diet quality. The level of energy and nutritional adequacy of research subjects is mostly still unable to meet daily needs even though there are also research subjects who show excessive levels of energy and nutrient fulfillment. Besides that, this research have measured anthropometrics assessment. Anthropometrics assessment defined as physical measure of body size and body composition include measurement of height, weight, body circumference like waist, hip, mid-thigh, calf, biceps and subcutaneous fat thickness (Ackland et al. 2012); (Larson-Meyer, Woolf, and Burke 2018). The results of the assessment of nutritional status in research subjects using the BMI for age index showed that most of the research subjects had normal nutritional status. However, when it was seen from the percentage of body fat based on each sport, almost part of the research subjects still had an excess percentage of body fat. Similar to the assessment of nutritional status based on the WtHR index, half of the research subjects had a waist circumference ratio to height greater than 0.42, which means they are at risk of being overweight (Table 2). The detailed characteristics of research subjects are presented in Tables 1 and 2.

BMI cannot be used as a single indicator in assessing the nutritional status of athletes ((Infante et al. 2013) and (Popa, Botnariu, and Antohe 2017). Weight which is one of the indicators used in calculating BMI is an indicator of body composition which includes the proportion of fat mass and fat-free mass including muscle, water and bone mass which of course cannot it is known specifically only through measurement of body weight (Pontaga and Žīdens 2011).

Table 1. The Characteristic of Research Subject

Characteristics of Subject (N=85)	Mean ± SD	Minimum	Maximum
Age (years)	15.88 ± 0.931	13	18
Body Weight (kg)	64.49 ± 9.399	49.05	93.85
Height (cm)	171.30 ± 7.012	155.40	186.60
Daily Intake of Energy and Nutrients			
Energy (kcal)	2358.20 ± 1013.792	1120.80	7922.30
Carbohydrate (g)	360.96 ± 162.477	134.80	1121.50
Protein (g)	96.600 ± 46.186	38.60	304.20
Fat (g)	69.348 ± 36.292	27.90	266.10
Energy and Nutrients Requirements			
Energy (kcal)	4678.90 ± 1025.883	2765.04	8272.36
Carbohydrate (g)	643.35 ± 141.059	380.19	1137.45
Protein (g)	233.94 ± 51.294	138.25	413.62
Fat (g)	129.97 ± 28.497	76.81	229.79

Source: Primer Data, 2019

Study which was conducted by Canda (2017) on 173 male and female athletes showed that 72% of athletes had a BMI score of overweight to obesity, but their fat mass was in the normal category. This study suggests to cross-check the results of anthropometric assessments using the IMT indicator with other indicators, such as body fat mass percent or waist circumference ratio based on height (Canda 2017). Referring to the results of this study, in this study the indicators for assessing nutritional status were used not only BMI but also indicators of body fat percentage and the ratio of waist circumference to height. High body mass, whether due to increased body fat or decreased lean body mass, has an impact on aerobic performance (Maciejczyk et al. 2014). Body composition is an important aspect of physical fitness, as well as in developing athlete profiles and conditioning programs. The relative amounts of fat and fat free mass in the body are referred to as body composition. The another research showed that the percentage body fat predict aerobic performance rather than the muscle mass (Anwar and Noohu 2016).

Based on the results of the analysis using the Spearman Rank Test correlation, it shows that the quality of the diet was not significantly related to the nutritional status of the research subjects (BMI for age, body fat percentage, and WtHR) which was indicated by a value of p> 0.05 (p = 0.144; 0.362; and 0.296). However, the quality of the diet has a significant relationship with the level of energy and nutrient adequacy as indicated by the value of p <0.05 (p = 0.0001, r = 0.735; 0.565; 0.626; and 0.688) (Table 2). This is because the nutrient adequacy level is an indicator of the quantity of the diet which is one of the components in assessing the quality of the diet using DQI-I. In addition, diet quality is able to describe the quality of energy consumption, sugar, saturated fat, vegetables, fruits, animal and vegetable side dishes as well as micronutrients such as calcium, iron, and vitamin C (Sahara, Widyastuti, and Candra 2019). Another research said there is a significant positive correlation between % body fat (BF) and energy intake of the athletes, ($r = 0.300$, $p < 0.05$). The athletes with $\%BF \geq 17$ receive significantly higher amounts of protein and fat in comparison with athletes with $\%BF < 17$ (Papadopoulou and Papadopoulou 2010); (Azam et al. 2018) reported that there was difference between Weight, BMI, waist-circumference, hip-circumference, and type of tour (p0.05). Finally, the most influential factors were BMI and tour type. BMI does not provide specific information about body fatness, but rather body heaviness, it is not a good predictor of BF. Methods such as bioimpedance and anthropometry could be used to monitor non-obese subjects in clinical trials and population-based studies (Gacesa et al. 2003)

Dietary quality is a method that can be used to evaluate dietary patterns and food selection behavior based on food groups. Diet quality also examines the quality and variety of food ingredients consumed and can be related to a person's health status (Vilela et al. 2014). Dietary quality measured by DQI-I may reduce weight gain in childhood and prevent chronic disease later in life (Setayeshgar et al. 2017). Based on the results of the research, most of the research subjects still showed a low quality diet with a score <60. When it was seen from the variation of food ingredients, all research subjects consumed various sources of protein (meat, poultry, milk and their processed products, fish, nuts, and eggs) as well as other food sources such as grains, fruits, and vegetables.

Table 2. Characteristic of Research Subject based on Quality of Diet

Characteristics of Subject	Quality of Diet (49.81 ± 7.863) (N=85)				P-Value
	Poorly		Healthy		
	N	%	N	%	
Sport Branch^					0.643
Takraw	9	10.6	0	0	
Weight lifting	2	2.4	2	2.4	
Swimming	6	7.1	1	1.2	
Fencing	5	5.9	1	1.2	
Basketball	10	11.8	4	4.7	
Rowing	4	4.7	1	1.2	
Volleyball	7	8.2	4	4.7	
Football	19	22.4	3	3.5	
Athletics	7	8.2	0	0	
Body Mass Index (BMI) (21.91 ± 2.356 kg/m^2)^					0.144
Lean	4	4.7	0	0	
Normal	59	69.4	13	15.3	
Overweight	6	7.1	3	3.5	
Body Fat Mass (14.27 ± 3.486%)#					0.362
Normal	39	45.9	7	8.2	
Overweight	30	35.3	9	10.6	
Waist to Height Ratio (WtHR) (0.43 ± 0.027)#					0.296
Normal	36	42.4	6	7.1	
Overweight	33	38.8	10	11.8	
Adequacy of Energy Intake (64.04 ± 32.641%)^					0.0001*
Deficit	66	77.6	3	3.5	
Adequacy	2	2.4	9	10.6	
Excessive	1	1.2	4	4.7	
Adequacy of Carbohydrate Intake (71.42 ± 37.640%)^					0.0001*
Deficit	58	68.2	2	2.4	
Adequacy	9	10.6	7	8.2	
Excessive	2	2.4	7	8.2	
Adequacy of Protein Intake (51.82 ± 26.195%)^					0.0001*
Deficit	68	80	8	9.4	
Adequacy	1	1.2	3	3.5	
Excessive	0	0	5	5.9	
Adequacy of Fat Intake (67.86 ± 40.923%)^					0.0001*
Deficit	60	70.6	3	3.5	
Adequacy	6	7.1	4	4.7	
Excessive	3	3.5	9	10.6	

^Correlation test using Spearman Rank Test
#Correlation test using Chi-Square Test
Significant at 0.05 and showed by notation *
Source: Primer Data, 2019

Table 3. Overview of Quality of Diet Score based on DQI-I Indicator on Research Subject

DQI-I Indicators	Mean ± SD
Variety (0-20)	
Food Groups (meat/poultry/fish/egg, dairy/beans, grains, fruits, and vegetables) (0-15)	20.00 ± 0.000
Protein Sources (meat, poultry, fish, dairy, beans, eggs) (0-5)	
Adequacy of Nutrients (0-40)	
Vegetables(0-5)	
Fruit (0-5)	
Grain (0-5)	
Fiber (0-5)	13.44 ± 5.763
Protein (0-5)	
Iron (0-5)	
Calcium (0-5)	
Vitamin C (0-5)	
Moderation (0-30)	
Total Fat (0-6)	
Saturated Fat (0-6)	9.22 ± 2.157
Cholesterol (0-6)	
Sodium (0-6)	
Empty calorie foods (0-6)	
Balance (0-10)	
Macronutrient Ratio (0-6)	7.15 ± 1.296
Fatty Acid Ratio (0-4)	
Total Score of DQI-I (0-100)	49.81 ± 7.863

Source: Primer Data, 2019

As for the scores for foodstuff variations, all research subjects obtained the highest score (20). However, if it was related to the level of nutrient adequancy, only a little of research subjects showed a good level of nutrient fulfillment. Similar to the level of nutrient dequancy indicators, the moderation indicators have not shown satisfactory scores for all research subjects. The balance indicator, which consists of two sub-indicators, namely the macronutrient ratio and the fatty acid ratio, was still fail to show a maximum score, especially on the fatty acid ratio sub-indicator. This was because almost all research subjects really like eating fried foods and sources of saturated fat compared to unsaturated fat (Table 3).

Adequacy levels of energy and nutrients (carbohydrates, fats, and proteins) also did not show a significant relationship to the nutritional status of the research subjects (BMI for age, body fat percentage, or WtHR) which was indicated by a p value> 0.05 (p = respectively. 0.143; 0.410; 0.608; 0.153; 0.735; 0.836; 0.222; 0.533; 0.326; 0.553; 0.392; and 0.308) (Table 4). The results of this research are in line with previous research conducted on 40 martial arts athletes aged 14-18 years which showed that adequacy levels of energy and nutrients (carbohydrates, protein, and fat) were not significantly related to nutritional status of BMI for age (Mardiana et al. 2019). However, it was different from the results of that which also examined the relationship between the level of energy and nutrient adequacy with the nutritional status of soccer athletes aged 9-12 years, which showed that the level of energy and fat adequacy was significantly related to the nutritional status of BMI for age (Nur Amin 2017). It was also different between another results that intake of energy, protein, fat and carbohydrates significantly influence changes in anthropometric indicators of body height and height/age (p = 0.00). Energy intake, fats and carbohydrates have a significant effect on body weight, BMR, BMI and muscle arm (p<0.05)

Table 4. Relation of Average of Daily Intake and Level of Adequacy of Energy and Nutriens Status of Research Subject

Variables	Nutritional Status (P-Value)		
	BMI for Age	% Fat Mass	WtHR
Food Intake			
Energy	0.344	0.958	0.688
Carbohydrate	0.508	0.534	0.622
Protein	0.950	0.858	0.400
Fat	0.576	0.750	0.613
Adequacy of Intake			
Energy	0.143	0.410	0.608
Carbohydrate	0.153	0.735	0.836
Protein	0.222	0.533	0.326
Fat	0.553	0.392	0.308

Correlation test using Spearman Rank Test
Significant at 0.05 and showed by notation *
Source: Primer Data, 2019

Adolescent athletes certainly need special attention because during this period there were major changes both physically and psychologically. The adolescent phase is a phase where growth spurt occurs during increasing of physical activity , so that it affects of increasing of need of energy and nutrients. In early adolescence to middle, there occurs rapid physical growth and it is a top of height increase (Peak Height Velocity) which will gradually decrease with age and the end of adolescence. In addition, the adolescent phase is the most productive asset in the motor development of athletes. Therefore, it is very important to pay attention to the quality and quantity of intake so that it can optimize athlete's performance in adolescence. Adolescent athletes are also more prone to injury and eating disorders, and are more at risk of dehydration, so they require dietary arrangements both in terms of quality and quantity ((Lloyd et al. 2015); (Lestari, Yanesti Nuravianda 2019)).

In order to support their performance, athletes need energy intake according to their daily needs. Energy from foodstuffs which maintain body mass,that are formed as fat mass and fat free mass, optimizing the immune system and body reproductive function. Achieving the fulfillment of daily energy needs is influenced by the balance between the energy consumed from food materials and energy expended in the form of physical activity and exercise. The quality and quantity of food consumed and the physical condition of athletes are also important factors that determine the fulfillment of daily energy needs (Nur Amin 2017). There are numerous scientific studies that show that high-CHO diets or CHO solutions consumed before exercise allow for an increase in muscle glycogen concentration, delaying the onset of fatigue and improving performance. enhancing performance (Burke et al. 2011). Some of them have concentrated solely on soccer, working to improve their skills, total distance travelled, ability to perform high-intensity activities ((Souglis et al. 2013); (Kingsley et al. 2014)), and technical performance (Russell and Kingsley 2014), as well as a decrease in net muscle glycogen utilization across throughout the game.

Conclusion

Based on the results of this research, it can be concluded that diet quality, daily intake and adequacy levels of energy and nutrients are not related to nutritional status (BMI for age, body fat percentage, and WtHR) of adolescent male athletes of Central Java Province. The recommendation for further research is that there is a need for research on the effect of energy density from the diet consumed and nutritional status on the energy adequacy level and performance of athletes. In addition, there is a need for research to further examine about e the appropriate indicators for the assessment of nutritional status on athletes.

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