ORIGINAL ARTICLE

Food Intake, Dietary Quality and Nutritional Status of Female Adolescent in Tasikmalaya, West Java, Indonesia

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ABSTRACT

Introduction: Poor nutritional status of female adolescents does not only have an impact on themselves but also have an impact on the next generation. Food intake and dietary quality are important to support nutritional status during adolescence. This study aims to determine the relationship between food intake and dietary quality with nutritional status of female adolescent in Tasikmalaya, West Java, Indonesia. **Methods:** This research was an observational study using a cross-sectional design. The subjects of this study were female adolescents aged 12-18 years with a total sample of 222 people. Data of food intake and dietary quality were measured using recall method, while nutritional status data were calculated using BMI for Age Z scores (BAZ). A linear regression model was used to predict the relationship of food intake and dietary quality to the nutritional status of female adolescents. **Results:** The average BAZ was 0.1±1.0, with an average dietary quality of 34.6±6.6%. The average energy intake was 1507.9±472.3 kcal, protein 32.4±11.0 g, carbohydrates 258.6±84.4 g, fat 44.9±19.9 g and fiber 3.88±2.7 g. Food intake (energy, protein, and fiber) and dietary quality were related to nutritional status (BAZ) in female adolescents ($p<0.05$). **Conclusion:** The balance of food intake and dietary quality is important to maintain the nutritional status of female adolescent properly. Nutritional interventions are needed to support female adolescent entering pregnancy with good nutritional status.
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Keywords: Female adolescent, Nutritional status, BMI for Age Z scores (BAZ), Food intake, Dietary quality

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INTRODUCTION

The number of female adolescents living in developing countries reaches 90% of all young women in the world (1). In Low Middle Income Countries (LMICs), female adolescents are faced with two nutritional problems (2), namely overweight and underweight (3,4). The nutritional status of female adolescents can have intergenerational effects. Female adolescents with poor nutritional status at the time of entering pregnancy are at risk of experiencing impaired fetal development and contributing to low birth weight (LBW) (5). On the other hand, being overweight during adolescence contributes to greater health risks in adulthood, especially at reproductive age. Being overweight lead to poor pregnancy outcomes (6). Overweight is associated with an increased risk of caesarean section, gestational hypertension, gestational diabetes, macrosomia, and miscarriage (7).

The focus of interventions to address nutritional problems in female adolescent is very important because their current nutritional status can affect their nutritional status during pregnancy and have an impact on the health of newborns (8). Health status and malnutrition in female adolescent are important determinants of adverse pregnancy outcomes, such as low birth weight, preterm birth, stillbirth and increased risk of neonatal death (9). Therefore, consumption of food with adequate nutritional quality in young women is the key to providing many intergenerational benefits (10).

Adolescence is associated with changes in eating behavior and daily activities, especially in young women (6). Consuming a healthy diet plays an important role in protecting young women from all forms of malnutrition (11). Adolescent girls are particularly vulnerable to malnutrition because they are growing faster than at any time after their first year of life. Therefore, they need an adequate nutrition to support their growth spurt (12). A decreased in total energy intake falls below RDAs (Recommended Dietary Allowances) will causes barriers to physical growth (11,13). On the other hand, Excessive total energy intake may lead to overweight and obesity (13) due to the low frequency of consumption of main meals, snack habits and skipping breakfast (14).

Indonesia is one of the Low Middle Income Countries (LMICs) (15) which is currently facing the double burden of malnutrition (16). The population in Indonesia is around 270 million people, of which 22.4 million people are female adolescents (17). In Indonesia the prevalence underweight of female adolescent aged 13-15 years is 5.4% and the prevalence of overweight is 16%. At the age of 16-18 years, the prevalence of underweight in female adolescents is 4.3% and the prevalence of overweight is 15.9% (18). Evidence suggests many Indonesian Adolescents adopt poor dietary intake (16,19). Tasikmalaya is located in West Java which is a province in Indonesia with the largest number of female adolescents (20). Most of the people of West Java are ethnic Sundanese, which is the second largest ethnic in Indonesia (21). Among ethnic Indonesians, the Sundanese are known for their diet which is dominated by plant foods (22,23). This study aims to determine the relationship between food intake and nutritional status, as well as the relationship between dietary quality and nutritional status in young women in Tasikmalaya, West Java, Indonesia.

MATERIALS AND METHODS

Study design and participants

This research was an observational study with a cross sectional approach because all variables were measured simultaneously at one time. Subjects in this study were female adolescents with inclusion criteria aged 12-18 years and living in Tasikmalaya City, West Java, Indonesia. The minimum sample size was calculated based on the prevalence of overweight in Indonesia (16%) with a confidence level of 95% (18). The calculation results obtained 222 subjects with an addition of 10% in anticipation of non-response bias. Prior to conducting the study, subjects who met the inclusion criteria were given an explanation about the research objectives. Explanation of the research was also provided to the parents or guardians. Subjects who agreed to participate in in this research were asked to sign informed assent and their parents (or guardians) were asked to sign an informed consent. This research has received ethical approval number : LB.01.03/6/8542/22 from the Mataram Health Polytechnic.

Data collection

The dependent variable in this study was nutritional status as measured by calculating Body mass index-for-age (BMI-for-age or BAZ) (24). Body weight was measured using Seca 803 digital scale which has an accuracy of 0.1 kg. The measurement was done with the subject wearing minimal clothing. Height was measured using a stadiometer with an accuracy of 0.1 cm. The height measurement was repeated three times, then the average value was calculated. At the time of measuring height, all subjects wore head coverings (hijab), and none wore shoes. The unit of weight is kilogram (kg), and the unit of height is centimeter (cm). WHO antro+ software is used to help calculate BAZ. Further, The BAZ categories were overweight/obese (OW/OB) if BAZ ≥ +1SD, normal weight if BAZ < +1SD to ≥-2SD and underweight if BAZ >-2SD.

The independent variables in this study were food intake and dietary quality. Food intake includes intake of energy, carbohydrates, protein, fat and fiber. Food intake was measured based on the calculation of the average 24-hour recall results on three non-consecutive days. Food intake was collected in the form of household portions (tablespoons, teaspoons, cups, etc.). Food photos were used to determine household portions. Data was processed using nutrisurvey software.

Diet quality (in %) was measured using the Dietary Quality Index for Adolescent (DQI-A) score instrument. The Dietary Quality Index for Adolescent (DQI-A) comprised of Dietary access (DA), dietary diversity (DD) and Dietary equilibrium (DE) (25). Data were obtained based on the results of a 3x24 hour recall which were then grouped into nine (9) food groups namely 1) water, 2) bread and rice, 3) tubers, 4) vegetables, 5) fruit, 6) dairy products, 7) cheese, 8) protein, and 9) oil and fat (26).

Dietary access (DA) was measured based on the average score of food choices preferred by subjects. Score "1" for each food was represented by a "preference group" (eg, cereal/brown bread, fresh fruit, fish), score "0" for An "intermediate group" (eg, white bread, minced meat), and score '-1" for a "low-nutrient, energy-dense group" (eg, soft drinks, sweet snacks, chicken nuggets). The dietary diversity (DD) described the degree of variation in the diet. This diversity component was obtained by giving points ranging from 0 to 9 when at least one food serving in a recommended food group was consumed.

Dietary equilibrium (DE) was scored by calculating the difference between the dietary adequacy (the percentage of the minimum recommended intake for each of the main food groups, truncated to 1) and the dietary excess (the percentage of intake exceeding the upper level of the recommendation, truncated to 1 if larger than 1 and truncated to 0 when below 0). The result of calculating the average of the three components (DA, DD and DE) is the final DQI-A score. A value of 100% indicates the perfect quality of the diet. Data of recall and anthropometric was carried out by final year students majoring in nutrition from a local university.

This study also measured several confounding variables, namely sleep duration and physical activity. The length of sleep was determined from the hours of sleep at night in units of hours. Physical activity was determined using a questionnaire regarding the frequency of the subject exercising for a week (27). Subjects with physical activity <3 times per week were categorized as "no" having physical activity habits, while subjects with physical

activity ≥3 times per week were categorized as "yes" having physical activity habits. Subjects characteristics include age in years and the subject's last education. Data was collected through interviews conducted by final year nutrition students from local universities.

Statistical analysis

Categorical data were presented in a frequency distribution table, while numerical data were presented in mean ± SD. Bivariate analysis for the independent and dependent variables, both of which were normally distributed, used the Pearson product moment or the independent t-test. Meanwhile, if one of the data or both data is not normally distributed, the Spearman Rank test or Man Whitney test was used. Significance at pValue<0.05. The data distribution normality test used the Kolmogorov Smirnov with a significance at p>0.05. Variables with p<0.25 in the bivariate analysis were included in the linear regression analysis model.

RESULTS

All subjects (100%) had complete data at the end of the study. The average age of the subjects was 14.9 years and more than half had junior high school education. Subjects have an average length of sleep at night for 4.9 hours and an average frequency of physical activity 1.7 times per week. The nutritional status of the subjects as measured by BAZ obtained an average of 0.1±1.0 SD, which means normal nutritional status. When the nutritional status of BAZ was classified, the results showed that there were no subjects with underweight. The results of the classification of nutritional status show that 17.1% of subjects have nutritional status with the category of over nutrition or overweight (Table I).

The results of the Spearman rank test showed that the subject's age, sleep duration and frequency of physical activity were not related to BAZ (p> 0.05) (Table I). The results of the independent t-test also showed that there was no difference in nutritional status (BAZ) between junior and senior high school education, and there was no difference in nutritional status (BAZ) between female adolescents who were usually physically active and those who were not physically active (Table I).

The results showed that the subjects' average intake of energy, carbohydrates, protein, fat and fiber was below the recommended dietary allowances (RDA) for young women aged 13-15 years and 16-18 years. Statistical test showed that there was a relationship between intake of energy, carbohydrate, fat and fiber with BAZ. Meanwhile, protein intake was not related to nutritional status based on BAZ (Table II).

Dietary quality score was a mean of dietary quality score, dietary diversity score, and dietary equilibrium score, with values ranging from -33% to 100%. A DQI-A score of 100% indicates an excellent quality diet . The calculation results show that the average score of the subject's diet quality was 34.6% (Table. III). The pearson product moment test showed that the higher the DQI-A score, the lower the BAZ score. This showed that the better of the dietary quality, the better of the nutritional status.

We included eight variables with p values<0.25 in a bivariate analysis in the first linear regression model. These variables were education, physical activity habits, food intake (energy, carbohydrate, protein fat and fiber) and dietary quality. During modeling, variables that had a pValue>0.05 were eliminated one by one, starting with the variable that had the largest p value. The last model (4th model) left four variables that have a p-value<0.05, namely energy intaeke, protein intake, fiber intake and dietary quality. The results of linear regression modeling showed that energy intake, protein intake, fiber intake and dietary quality contributed 28.4% to changes BAZ in female adolescents (Table IV).

Table I: Characteristics of female adolescents

Variable	Mean ±SD or n (%)	pvalue
Age (years)	14.9 ±1.9	0.458[a]
Education[#]		
Junior High School	137 (61.7)	0.228[b¶]
Senior High School	85(38.3)	
Sleep duration (hours)	4.9±0.8	0.672[a]
Frequency of physical activity (times per week)	1.7±1.5	0.258[a]
Physical activity habit[#]		
Yes	181(81.5)	0.061[b¶]
No	41(18.5)	
BAZ	0.1±1.0	
Classification of nutritional status[#]		
Normal weight	184(82.9)	
Overweight/obesity (Ow/Ob)	38(17.1)	

[#]presented in n(%), *significant at p<0.05, ¶Significan at p<0.25, [a]rank spearman, [b]independent t test

Table II: Food intake of female Adolescents

Variable	Mean±SD	pvalue	r or ρ
Food Intake			
Energy (kcal)	1507.9±472.3	0.000[a*]	0.273
%RDA	72.8±22.9		
Carbohydrate (g)	258.6±84.4	0.000[a*]	0.254
%RDA for carbohydrate	86.2±28.2		
Protein (g)	32.4±11.0	0.205[b¶]	-
%RDA for Protein	49.8±16.9		
Fat (g)	44.9±19.9	0.000[a*]	0.252
%RDA fat	64.1±28.4		
Fiber	3.88±2.7	0,000[a*]	-0.256

*significant at p<0.05, ¶ significant at p<0.25, [a]derived from rank spearmann, [b]derived from pearson product moment

Table III: Dietary quality of female Adolescents

DQI-A component	Mean ± SD (in %)	pValue	r
Dietary quality score	29.9±9.0	-	-
Dietary diversity score	48.5±8.6	-	-
Dietary equilibrium score	25.5±8.6	-	-
DQI-A score	34.6±6.6	0,000	-0,290

DQI-A =Diet Quality Index for Adolescent; derived from pearson product moment; significant at p<0.05

Table IV: Multivariate model to predict the relationship between food intake and dietary quality with nutritional status (BAZ)

Variable	β	Standardized koef β	p value	R	R^2
Energy intake	0.001	0.417	0.000	0.533	0.284
Protein intake	-0.015	-0.178	0.028		
Fiber intake	-0.078	-0.232	0.000		
Dietary quality (DQI-A Score)	-0.035	-0.255	0.000		

DISCUSSION

Adolescence is a period that is no longer a child, but also has not become an adult with enormous psychological and physical changes (28). The World Health Organization defines youth as someone aged 10-19 years (29). The results of this study show that the prevalence of overweight in female adolescents aged 12-18 years was 17.1%, slightly above the latest national data (18). The prevalence of overweight in low-middle-income countries (LMICs) is on the rise as it is in high-income countries (HICs) (30).

Being overweight can be caused by abnormal or excessive fat accumulation (31). Determination of overweight in children and adolescents can use indicators of BMI according to age and sex or often referred to as BAZ (32). Overweight in adolescent is an important risk factor for overweight in adults, which can increase the risk of degenerative diseases (30), and increases the risk of mortality (33). Overweight is a consequence of a positive energy balance that is sustainable over time (34).

This study show that there was a relationship between energy intake and BAZ in female adolescent (p=0,.000; r=0.273). the results of a study on women in Malaysia showed that there was a significant relationship with moderate strength between energy consumption and BMI (35). Energy intake that exceeds energy expenditure is the main driver of weight gain (36). In general, understanding of the pathogenesis of overweight is based on the energy balance model. Chronic positive energy balance (constantly daily energy consumption exceeds energy expenditure) can lead to weight gain due to excess energy storage as body fat (37). Energy for the body is supplied by macronutrients consisting of carbohydrates, fats and proteins (38).

Carbohydrates and fats are macronutrients which have been the most influential factors for obesity. Excess carbohydrates or fats consumed will be stored as triglycerides in adipose tissue (39). Cases of obesity began to increase along with the increasing production of foods containing carbohydrates and sugar. Selection of foods with types of carbohydrates that play a role in increasing the risk of obesity needs to be limited (39). The habit of consuming simple carbohydrates and sugars such as sweet drinks in adolescents is increasing from time to time. This habit increases the risk of being overweight because sweet drinks contain high sugar, are not filling and have a high glycemic index. A high glycemic index contributes to obesity in adolescents through increased insulin resistance and excess energy (40). A good diet with a balanced diet can help maintain a normal body mass index (41).

The results of this study indicate that the quality of the diet is related to nutritional status based on BAZ. The results of Paulo HA, et al (2022) are in line with our study which shows that food quality is an important predictor of overweight and obesity among young women (42). Low diet quality scores are associated with overweight and obesity (43). Diet quality can exert its effect on energy balance through complex hormonal and neurological pathways that influence satiety and possibly through other mechanisms (34).

CONCLUSION

Food intake (energy, protein and fiber) had relationship with nutritional status (BAZ) among female adolescents. Dietary quality also had relationship with nutritional status (BAZ) among female adolescents. Nutritional attention and interventions are needed to support young women in the hope that they can enter pregnancy with good nutritional status.

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