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Defining food literacy and dietary patterns among senior high school students in Malang City, East Java

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ABSTRACT

Background: *Food literacy is a collection of interrelated knowledge, skills, and behavior required to plan, manage, select, prepare, and eat food for further meeting dietary requirements and determining dietary intake. In Indonesia, 93.6% of all adolescents aged 10 years or over consumed an inadequate amount of fruits and vegetables and more than half often consumed food rich in sugar, fat and salt. Only one-third of students always had breakfast, only 3,81% always brought their own food to school. Adolescence has been considered as a nutritionally critical period of life. Improve the health promotion is important to prevent malnutrition and risk of chronic disease.*

Objectives: *The study aimed to investigate the association of food literacy and dietary patterns among senior high school students in Malang, East Java.*

Materials and Methods: *The cross-sectional study determined food literacy level and dietary patterns among senior high school students using a questionnaire as the instrument. This study recruited 464 students aged from 14 to 18 years old. Demographic characteristics of adolescents and their parents, adolescent food literacy, and dietary intake data were self-report collected. The height was measured using stature meter and weight using electronic scale to determine the BMI-for-age. The research was conducted from July to September 2015 in Malang, East Java.*

Results: *Out of 464 adolescents, 59.9% were females, and female adolescents had a better food literacy ($P < .001$) and higher dietary pattern scores ($P < .05$). Adolescents whose family had higher income or higher percentage of income spent on food consumed more vegetables ($P < .05$) and dairy products ($P < .05$), and had higher dietary pattern scores ($P < .05$) compared with those whose family had lower income or lower percentage of income spent on food. The perception of food literacy ($r = 0.187$, $P < .001$), the behavior of food literacy ($r = 0.333$, $P < .001$), and overall food literacy ($r = 0.329$, $P < .001$) were positively correlated with dietary pattern scores.*

Conclusions: *Food literacy is positively associated with dietary patterns in adolescents. Nutrition education is suggested to implement as a guide in healthy food choices for adolescent.*

KEYWORDS: *food literacy; dietary intake; anthropometric data; adolescent; Indonesia*

BACKGROUND

Food literacy has been influenced by health professionals, nutritionist, and home economists, and fundamentally aims to achieve personal health-related goals.[1] Food literacy was defined as the concept that empowers individuals, households, communities, or nations to protect diet quality through changing and strengthening dietary resilience over time. Food literacy is a collection of interrelated knowledge, skills, and behavior required to plan, manage, select, prepare, and eat food for further meeting dietary requirements and determining dietary intake.[1,2] Food literacy could affect the quality of dietary intake and health status.[3] Low literacy level of nutritional knowledge among adolescents in Minnesota, USA was associated with poor decision making on the maintenance of energy balance and healthy body weight in adulthood.[4] Additionally, better nutritional knowledge and more frequent food preparation in adolescents were correlated with healthy dietary practices.[5,6]

In regard to eating habits in Indonesia, 93.6% of all adolescents aged 10 years or over consumed an adequate amount of fruits and vegetables and more than half often consumed food rich in sugar, fat and salt. Data from the Indonesian Global School Health Survey 2015 showed that only one-third of students always had breakfast, only 3,81% always brought their own food to school and more than half teenagers consumed fast food at least once per week.[7] Daily dietary intake as dietary patterns of an individual is crucial in health promotion throughout the lifespan.[8] However, the diversity of dietary patterns could be varied in different countries. Dietary patterns of school children and adolescents in 42 developing countries were limited in

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diversity, primarily a plant-based diet, but limited in the intake of fruit and vegetables, which resulted in insufficient energy and micronutrient intake.[9] The healthy diet is one of the most important factors for maintaining ideal body weight and preventing chronic disease.[10,11] Dietary patterns such as fruit and vegetables,[12] dairy products,[13] and whole grains[14] have been considered to reduce the risk of chronic disease, whereas saturated fat intake was associated with greater risk of chronic disease.[12]

Adolescence has been considered as a nutritionally critical period of life because of rapid physical growth and development as well as a change of lifestyle and dietary habits that can affect both nutrient intake and needs.[15] Malnutrition, particularly under-nutrition, was prevalent in adolescents which may lead to the retardation of growth and intellectual capacity.[16,17] Limited evidence has demonstrated the impact of food literacy on dietary patterns in adolescents. Therefore, this study aimed to investigate determine the association between food literacy and dietary patterns among adolescents in Malang City, East Java.

MATERIALS AND METHODS

The study design was a cross-sectional survey using a questionnaire to define the food literacy and dietary patterns among adolescents in Malang City, East Java, Indonesia. This study recruited the students aged 14 to 18 years old from 6 senior high schools in Indonesia. There were a total of 530 students aged 14 to 18 years old from 6 senior high schools in Malang City, East Java After excluding 66 students who did not complete the questionnaire, 464 students participated in this study. The research approved by Brawijaya University Institutional Review Board (No. 465/EC/KEPK/088/2015).

All participants were provided the informed consent form under their parents or guardian signature. This study used a questionnaire to collect data among adolescents from July to September 2015 in Malang City, East Java. The questionnaire was comprised of 4 parts: demographic characteristics, food literacy, dietary patterns, and anthropometric measurements.

The demographic characteristics such as gender, age, parental education, parental employment, family income, and the person who took the responsibility for cooking at home were collected by self-report in the questionnaire. The employment status was classified as part-time (<8 h per day) or full-time (≥8 h per day). The cutoff family income of 3,000,000 Indonesian Rupiah (IDR) was the monthly regional minimum wages in Malang city, East Java.

The food literacy questionnaire included the perception of food literacy with 8 questions and the participants' behavior regarding food literacy with 26 questions. The four components of food literacy including planning and management, selection, preparation, and eating from empirical research were identified, and the best aligned questions with these components were selected.[1] The questionnaire started with proposing the suitable scale or questionnaire items using a series of validity and reliability processes. The content validity was evaluated by 5 panel nutrition experts who provided content and format feedback during the development of questionnaire based on components of food literacy.[1,2] The questionnaire was then tested to the face validity by 10 students aged 14-18 years using forum group discussion with the participants to establish how the target group understood questions. The pilot study was conducted to the participants (n = 31) who completed the questionnaire, and the questionnaire was revised based on feedback response to examine the performance of each question. Cronbach's alpha was used to assess the reliability of the internal consistency. The acceptable values of Cronbach's alpha for internal consistency were ranged from 0.71 to 0.84.[18]

The perceived importance of food literacy was categorized as unimportant, somewhat unimportant, neutral, somewhat important, and very important. The scores were assigned as 1 to 5 from unimportant to very important. The minimum and maximum scores of the perception of food literacy were 8 and 40, respectively. The response frequency of participants' behavior regarding food literacy was classified as never, 1-2 times, 3-4 times, 5-6 times, and 7 times per week, and the scores were assigned accordingly as 1 to 5 from never to 7 times per week. The minimum and maximum scores of the behavior on food literacy were 26 and 130, respectively. Therefore, the total minimum and maximum scores of food literacy including perception and behavior were 34 and 170, respectively.

Dietary patterns in the past three months were determined using a validated semi-quantitative food frequency questionnaire (FFQ). All food items were adopted from Indonesian dietary guideline represented by four-layer food groups in a rice cone-like shape, locally known as *Tumpeng Gizi Seimbang*. A rounded pyramid-like shape represents the principle of balanced nutrition made up of different food groups.[19] The individual food items from 24-h recall were also collected from 50 senior high school students to add other food list by a trained person.

The FFQ included 6 food groups: cereals with 13 food items, vegetables with 20 food items, legumes with 6 food items, meat with 18 food items, fruit with 10 food items, and dairy products with 2

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food items. The dietary intake frequency of 69 food items in the FFQ included 6 categories: never, 1 to 3 times a month, once a week, 2 to 4 times a week, 5 to 6 times a week, and 7 times or more a week. The score of each food item was assigned as 0 to 5 from the lowest frequency (never) to the highest frequency (7 times or more a week). The score of the dietary intake was then calculated by summing the score for each food item. The total score of all 6 food-groups was ranged from 0 to 345, and the cutoff point was the median of 172 in this study. The score ≥172 or <172 was defined as a good or a poor dietary pattern, respectively.

The anthropometric data including height, body weight, and body mass index (BMI) of adolescents were determined. Height in centimeter (cm) measured using stature meter with accurately record to the nearest 0,1cm. The measurer put the scale correctly in the wall and participant have to stand with feet flat against the flat surface while head, shoulders, buttocks and heel touching the wall. Measurer's eyes were at the same level as the headpiece to get the height measurement. Body weight in kilogram (kg) measured using an electronic scale accurately record to the nearest 0.1kg. The measurer placed the scale on firm flooring and participant should stand with both feet in the center of the scale without shoes and heavy clothing. BMI (kg/m^2) was calculated as body weight (kg) divided by the square of height in meters (m^2). After BMI is calculated for adolescent, it is plotted by age on a gender specific growth chart. WHO AnthroPlus was used to calculate BMI-for-age among adolescents using Z-score. Underweight, overweight, and obesity were defined as BMI-for-age Z-score <-2 standard deviation (SD), >+1 SD, and >+2 SD, respectively.[20,21]

All statistical analyses were performed using SPSS Statistics version 22.0 (IBM Corp., Armonk, NY).[1] The normality test was done by the Shapiro-Wilk test and the data were analyzed using nonparametric measurements due to a skewed distribution. Mann-Whitney U and Kruskal-Wallis tests were used to compare the median between the groups. Chi-square test was performed to compare the distribution of age groups, parental education, parental employment, family income, the percentage of income spent on food, cooking responsibility, and BMI weight status between males and females. Spearman's rank correlation coefficient was used to assess the relationship between food literacy and dietary patterns. After normalization by log transformation, the association between food literacy and dietary patterns was determined using the multivariate linear regression analysis. The *P*-values <.05 were considered statistically significant.

RESULTS

The demographic characteristics of adolescents and their parents are presented in Table 1. Out of 464 adolescents, 59.9% were female, and 71.3% aged 16 to 18 years old. Parents' demographic information showed that over half of parents (fathers and mothers) had university-level education (66.8% vs. 59.5%), and 95.0% of participants' fathers and 56.3% of their mothers had a part-time or full-time job. The results found that 55.2% of participants' household had a monthly family income of ≥3,000,000 IDR. In addition, 55.0% of household spent 50% or more on food. Mothers (81.7%) were the main responsible person for cooking in the family. There were no significant different in demographic characteristic such as parents education level, employment status and family income for all participants (P>.01). The anthropometric data showed that the prevalence of underweight, overweight, and obesity was 23.3%, 10.1%, and 4.1%, respectively. The distribution of weight status was significantly different between males and females (*P* = .01). The prevalence of underweight, overweight, and obesity was 26.9%, 14.0% and 4.8% in males, and 20.9%, 7.5%, and 3.6% in females.

The median scores of food literacy and dietary intake are summarized in Table 2. The median scores of food literacy in the perception of food literacy and behavior of food literacy were 30 and 64, and the overall median score of food literacy was 94. The median scores of dietary intake in cereals, vegetables, legumes, meat, fruit, and dairy products were 19, 26, 9, 25, 12, and 5, respectively, and the overall median score of dietary intake was 97.5.

The results in Table 3 showed that adolescents aged from 16 to 18 years consumed more cereals (*P* = .04), vegetables (*P* = .01), and legumes (*P* = .05), and had higher dietary intake scores (*P* = .03) compared with those aged 14 to 15 years. Female adolescents had better perception of food literacy (*P* < .001), behavior of food literacy (*P* < .001), and overall food literacy (*P* < .001) than males. In addition, female adolescents consumed more vegetables (*P* = .03) and fruit (*P* = .03), and had higher dietary intake scores (*P* = .04) compared with males. The intrapersonal may influences such as psychological and biological influence adolescents eating behaviors and food choice. Factor influencing eating behavior of adolescents need to be better understood to develop effective nutrition intervention including possible difference in male and female adolescents.[22]

Table 1. Demographic characteristics of participants

Characteristics	Total (n = 464) n (%)	Male (n = 186) n (%)	Female (n = 278) n (%)	*P*-value
Age, years				0.62
14-15	133 (28.7)	51 (27.4)	82 (29.5)	
16-18	331 (71.3)	135 (72.6)	196 (70.5)	
Father's education				
Primary	15 (3.2)	4 (2.1)	11 (4.0)	0.04
High school	139 (30.0)	47 (25.3)	92 (33.1)	
University	310 (66.8)	135 (72.6)	175 (62.9)	
Mother's education				0.02
Primary	19 (4.1)	3 (1.6)	16 (5.7)	
High school	169 (36.4)	62 (33.3)	107 (38.5)	
University	276 (59.5)	121 (65.1)	155 (55.8)	
Father's employment				
None	23 (5.0)	11 (5.9)	12 (4.3)	0.70
Part-time job	130 (28.0)	53 (28.5)	77 (27.7)	
Full-time job	311 (67.0)	122 (65.6)	189 (68.0)	
Mother's employment				0.94
None	203 (43.7)	81 (43.5)	122 (43.9)	
Part-time job	89 (19.2)	37 (19.9)	52 (18.7)	
Full-time job	172 (37.1)	68 (36.6)	104 (37.4)	
Family income, IDR[a]				
<3,000,000	208 (44.8)	78 (41.9)	130 (46.8)	0.30
≥3,000,000	256 (55.2)	108 (58.1)	148 (53.2)	
Percentage of income spent on food				0.81
<50%	209 (45.0)	85 (45.7)	124 (44.6)	
≥50%	255 (55.0)	101 (54.3)	154 (55.4)	
Cooking responsibility				0.61
Mother	379 (81.7)	154 (82.8)	225 (80.9)	
Maid/others	85 (18.3)	32 (17.2)	53 (19.1)	
BMI, kg/m^2				0.01
Underweight (Z < -2SD)	108 (23.3)	50 (26.9)	58 (20.9)	
Normal weight	290 (62.5)	101(54.3)	189 (68.0)	
Overweight (Z > +1SD)	47 (10.1)	26 (14.0)	21 (7.5)	
Obese (Z > +2SD)	19 (4.1)	9 (4.8)	10 (3.6)	

[a]1 USD = 14,347.3 IDR (Indonesian Rupiah).

Adolescents whose fathers had higher education level consumed more vegetables compared with those whose fathers had primary education (P = .02). Adolescents whose family had higher income or higher percentage of income spent on food consumed more vegetables (P < .05) and dairy products (P < .05), and had higher dietary intake scores (P < .05) compared with those whose family had lower income or lower percentage of income spent on food. Parents with higher education and income level more likely affect the availability and knowledge of healthier food such as vegetable and dairy product. Also in the level of self-efficacy to eat healthy food were noted in some higher educational level. The facilitation from the parents more likely acted as mediators to consume healthy food.[23]

A significant positive correlation was found between food literacy and dietary intake (Table 4). The perception of food literacy, behavior of food literacy, and overall food literacy were positively correlated with the intake of cereals, vegetables, legumes, meat, fruit, and dairy products. The perception of food literacy (r = 0.187, P < .001), the behavior of food literacy (r = 0.333, P < .001), and overall food literacy (r = 0.329, P < .001) were also positively associated with dietary intake scores.

The association between food literacy and dietary patterns using the multivariate linear regression analyzes after the log transformation of food literacy data is shown in Table 5. The results revealed that the perception of food literacy (β = 0.40, P = .001), the behavior of food literacy (β = 0.32, P = .002), and food literacy (β = 0.35, P = .001) were positively correlated with dietary intake scores. The concept of food literacy is not just nutrition knowledge; it includes skills and behaviors in ways

that meet nutrition guideline. Food literacy builds upon the work that has been done around the relationship between food knowledge and food choice. Food literacy may play a role in shaping dietary intake.[22]

DISCUSSION

Female adolescents had not only better food literacy, but also higher scores of dietary patterns compared with male adolescents in this study. A previous study demonstrated that nutritional knowledge was significantly associated with a higher dietary pattern score.[24] Personal knowledge in nutrition was considered as an important factor by both males and females across different levels of habitual intake.[25] Similarly, the differences in food literacy between genders were also reported in the previous studies.[17,26] Female adolescents had better nutritional knowledge, and male adolescents showed good nutritional practice.[17] Additionally, premenopausal women had a better dietary intake in terms of energy distribution from macronutrients and a higher eating-related self-determination index than men.[26] Different aspect of adolescents' food consumption behavior may be influenced by different factors, which may vary between males and females. Educational and treatment strategies need to be specific to both genders.[27]

Dietary intake scores were positively associated with family income and the percentage of income spent on food. Consistent with a previous study in Malaysia, low socioeconomic status and low household income led to limited access to an adequate diet.[21] Food prices had a greater effect on dietary consumption in low-income countries and in poorer households.[28] A high-quality diet or a nutritionally adequate diet was, in general, consumed by better educated and more affluent people with higher socioeconomic status.[29,30] Dietary patterns could be varied by sex, ethnicity, income, and education. The present study also reported that the adolescents whose fathers had higher education consumed more vegetables compared with those whose fathers had lower education. Similar to a previous study, children and adolescents whose parents had a higher education level had significantly better dietary intake of vegetables, fruit, and dairy products.[31] Study showed that higher parental education level and higher income had the strongest mediators such as availability, knowledge and self efficacy about healthy food.[32]

The present study pointed out that food literacy was positively correlated with dietary intake scores. Both the perception of food literacy and the behavior of food literacy exerted a positive influence on dietary intake scores. Consistent with a previous study, higher nutritional knowledge scores were associated with a healthy dietary pattern.[33] Contrarily, low nutritional knowledge resulted in an unhealthy eating habit.[34,35] Additionally, positive behavior on food literacy such as more frequent food preparation was correlated with a healthy dietary pattern toward more vegetables and fruit in adolescents.[34] A healthy dietary pattern could be attributed to the improvement of nutritional knowledge in children and young adolescents.[36]

Food literacy education could positively influence dietary behavior and long-term health among adolescents.[37] The link between food literacy and dietary patterns is clearly highlighted in this study as a significant strength. To the best our knowledge, this is the first study in Indonesia to determine the relationship between food literacy level and dietary patterns among adolescents. However, the present study has some limitations. First, the study was conducted in the senior high schools in Malang, East Java that may limit generalization to other community settings and populations in Indonesia. Second, the cross-sectional design of the present study just indicated the association between the study variables, but did not infer any causality from the current findings.

Table 2 Median scores of food literacy and dietary intake

	Median	Interquartile
Food literacy	94.00	85.00-102.00
Perception of food literacy	30.00	27.00-32.00
Behavior of food literacy	64.00	57.00-71.00
Dietary intake	97.50	74.25-124.00
Cereals	19.00	15.00-24.00
Vegetables	26.00	17.00-37.00
Legumes	9.00	6.00-12.00
Meat	25.00	19.00-33.00
Fruit	12.00	8.00-18.00
Dairy products	5.00	3.00-6.00

Table 3 Comparisons of food literacy and dietary intake scores in participant subgroups

Characteristics	Perception of food literacy *P*-value Median	Behavior of food literacy *P*-value Median	Food literacy *P*-value Median	Cereals *P*-value Median	Vegetables *P*-value Median	Legumes *P*-value Median	Meat *P*-value Median	Fruit *P*-value Median	Dairy products *P*-value Median	Dietary intake *P*-value Median
Age, years	0.40	0.69	0.90	0.04	0.01	0.05	0.54	0.52	0.76	0.03
14-15	29.00	64.00	94.00	18.00	24.00	8.00	25.00	13.00	5.00	95.00
16-18	30.00	63.00	94.00	20.00	27.00	9.00	25.00	12.00	5.00	99.00
Gender	<0.001	<0.001	<0.001	0.35	0.03	0.15	0.48	0.03	0.53	0.04
Male	29.00	62.00	92.00	19.50	24.50	9.00	24.00	10.50	5.00	96.00
Female	31.00	65.00	95.00	19.00	27.00	8.00	26.00	12.00	5.00	99.00
Father's education	0.56	0.61	0.51	0.32	0.02	0.95	0.67	0.54	0.82	0.79
Primary	30.00	62.00	92.00	18.00	22.00	10.00	26.00	12.00	5.00	95.00
High school	30.00	63.00	93.00	20.00	24.00	10.00	24.00	13.00	5.00	97.00
University	30.00	64.00	94.00	19.00	26.00	10.00	25.00	12.00	5.00	98.00
Mother's education	0.38	0.93	0.67	0.45	0.13	0.34	0.66	0.19	0.16	0.18
Primary	30.00	65.00	95.00	21.00	28.00	10.00	26.00	13.00	4.00	29.50
High school	30.00	64.00	94.00	20.00	27.00	9.00	24.00	12.00	4.00	30.00
University	31.00	64.00	95.00	20.00	27.00	9.00	25.00	12.00	5.00	30.00
Father's employment	0.79	0.24	0.29	0.64	0.79	0.38	0.11	0.45	0.12	0.54
None	30.00	65.00	97.00	22.00	23.00	7.00	19.00	10.00	4.00	96.00
Part-time job	29.50	62.00	92.00	19.00	27.50	9.00	26.00	11.50	5.00	98.00
Full-time job	30.00	64.00	94.00	19.00	26.00	9.00	25.00	12.00	5.00	99.00
Mother's employment	0.87	0.88	0.94	0.53	0.71	0.35	0.62	0.94	0.35	0.54
None	29.00	63.00	94.00	20.00	25.00	8.00	24.00	12.00	5.00	96.00
Part-time job	30.00	62.00	93.00	20.00	25.00	9.00	26.00	12.00	5.00	97.00
Full-time job	30.00	64.00	94.00	21.00	25.00	9.00	25.00	12.00	5.00	98.00
Family income, IDR[a]	0.60	0.83	0.89	0.65	0.03	0.95	0.91	0.40	0.01	0.02
<3,000,000	30.00	63.00	94.00	20.00	25.00	8.00	25.00	11.00	4.50	96.00
≥3,000,000	30.00	64.00	93.50	19.00	27.00	9.00	25.00	12.00	6.00	99.00
% of income spent on food	0.09	0.14	0.10	0.20	0.04	0.30	0.02	0.30	0.03	0.02
<50%	29.00	63.00	93.00	19.00	24.00	8.00	24.00	11.00	4.00	94.00
≥50%	30.00	64.00	94.00	20.00	28.00	9.00	26.00	12.00	5.00	100.00
Cooking responsibility	0.39	0.70	0.45	0.12	0.52	0.11	0.70	0.26	0.60	0.17
Mother	30.00	64.00	94.00	20.00	26.00	9.00	25.00	12.00	5.00	99.00
Maid/others	29.00	63.00	92.00	19.00	26.00	8.00	26.00	12.00	5.00	97.00

[a]1 USD = 14,347.3 IDR (Indonesian Rupiah).

Table 4 Correlation coefficient (r) between food literacy and dietary intake

	PFL 1	BFL 2	FL 3	Cereals 4	Vegetables 5	Legumes 6	Meat 7	Fruit 8	Dairy products 9	Dietary intake 10
1	1.000									
2	0.461***	1.000								
3	0.673***	0.960***	1.000							
4	0.078	0.170***	0.172***	1.000						
5	0.196***	0.298***	0.300***	0.444***	1.000					
6	0.081	0.164***	0.153***	0.360***	0.524***	1.000				
7	0.118*	0.282***	0.267***	0.505***	0.589***	0.473***	1.000			
8	0.207***	0.289***	0.300***	0.484***	0.549***	0.396***	0.490***	1.000		
9	0.084	0.180**	0.170***	0.280***	0.235***	0.236***	0.350***	0.277***	1.000	
10	0.187***	0.333***	0.329***	0.684***	0.856***	0.637***	0.810***	0.749***	0.411***	1.000

Abbreviations: PFL, perception of food literacy; BFL, behavior of food literacy; FL, food literacy.
*$P < .05$; **$P < .01$; ***$P < .001$.

Table 5 Association between food literacy and dietary patterns using the multivariate linear regression analysis after the log transformation

	β	95% CI	*P*-value
Log10 Perception of food literacy	0.40	0.33-0.74	0.001
Log10 Behavior of food literacy	0.32	0.28-0.68	0.002
Log10 Food literacy	0.35	0.14-0.76	0.001

Abbreviation: CI, confidence interval.

CONCLUSIONS

The present study indicated that food literacy might influence adolescents' dietary intake. In conclusion, a significant positive correlation is found between food literacy and dietary patterns. Female adolescents have a higher food literacy level and better dietary patterns with more vegetables and fruit intake than male adolescents. Dietary patterns are also positively associated with household socioeconomic status. Nutrition education in food literacy is suggested to guide adolescents in choosing healthy foods. Further researches are needed to investigate the association between food literacy and nutritional status among adolescents with bigger community setting and population in Indonesia. The other methods to find direct causality between variables could be determined in the future.

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