

## ORIGINAL ARTICLE

## CORRELATION BETWEEN APPETITIVE TRAITS AND DIET QUALITY OF YOUNG CHILDREN IN NORTH JAKARTA

Alfi Rahma Putri<sup>1</sup>, Dian Novita Chandra\*<sup>1</sup> and Luh Ade Ari Wiradnyani<sup>2</sup>.<sup>1</sup>Department of Nutrition, Faculty of Medicine, Universitas Indonesia - Dr. Cipto Mangunkusumo General Hospital Jalan Salemba Raya No.6, Jakarta, Indonesia 10430.<sup>2</sup>Southeast Asian Ministers of Education Organization Regional Center for Food and Nutrition (SEAMEO RECFON)-Pusat Kajian Gizi Regional (PKGR) Universitas Indonesia Jalan Utan Kayu Raya no 1A, Jakarta 13120**\*Corresponding author: Dian Novita Chandra**  
Email: dian.chandra@ui.ac.id

## ABSTRACTS

*Appetitive traits as a behavioural factor can contribute to greater or lower food intake among children. However, gaps exist in the literature examining appetitive traits and diet quality among children. Therefore, this study aimed to assess the correlation between appetitive traits and diet quality among children aged 2-6 years in North Jakarta. This cross-sectional study was conducted in Pejagalan village, North Jakarta. A total of 263 subjects were included in this study. Data collection was performed from January to April 2020. Children's appetitive trait was measured using a validated child eating behaviour questionnaire (CEBQ), and the Diet Quality Index-International (DQII) was used to calculate diet quality scores in children. Most subjects had a DQII score below 60, indicating that the diet quality in children was classified as poor. Based on the CEBQ score, desire to drink, emotional undereating and satiety responsiveness were the common traits in our subjects. Using the Spearman test, we found that emotional overeating was negatively correlated with children's diet quality score ( $r = -0.13$ ,  $p$ -value  $< 0.05$ ). Linear regression models showed that food responsiveness was a positive predictor of the 'variety' component ( $\beta = 0.16$ ,  $p$ -value  $< 0.05$ ), and satiety responsiveness was found as a positive predictor of the moderation component of diet quality ( $\beta = 0.17$   $p$ -value  $< 0.05$ ). These findings suggest the potential use of tools, such as the children's emotional overeating assessment, food responsiveness and satiety responsiveness assessments, to identify the risk of poor diet quality and plan an integrated intervention for dietary improvement among children.*

Keywords: Children, Diet quality, and Appetitive traits.

## INTRODUCTION

Nutrition is essential for growth and development during childhood. Unfortunately, inadequate nutrition intake and a non-optimal diet among children is an ever-growing concern. A previous study from South East Asian Nutrition Survey (SEANUTS I) found that the dietary intake among Indonesian children was below the national recommendations<sup>1</sup>. Moreover, the consumption of energy-dense, sweet and savoury snacks have increased, whereas fruit and vegetable consumption has decreased among children<sup>2,3</sup>. A study in Banyumas, Central Java, reported that children under-five consume insufficient fruits and vegetables and that their diet quality needs to be improved<sup>4</sup>. Those findings were further supported by a study in West Java, where most of the children aged 2-5 years had poor diet quality due to its low variety. This study also found that children were more likely to consume carbohydrates and animal protein source foods, but the consumption of fruits, vegetables, plant proteins, and dairy was insufficient<sup>5</sup>. Poor diet quality among children was related to various health problems among children. Low dietary variety as one of the critical factors of diet quality

was related to stunting among children<sup>6</sup>. A study in Canada showed that the quality of diet among school-children was associated with their health-related quality of life<sup>7</sup>.

Children's diet may be influenced by various factors, including a child's characteristics, mother's education, family income, parental feeding practices, and child's eating behaviour<sup>2,8,9</sup>. In this study, we focused on behavioural factors such as a child's appetitive traits. Appetitive traits related to child eating behaviours refer to a child's tendency to start eating when they feel hungry and to stop eating when they feel full. Based on the Child Eating Behaviour Questionnaire, appetitive traits were divided into food approach behaviour and food avoidance behaviour<sup>10</sup>.

Previous studies have found that appetitive traits related to child eating behaviour were related to their diet. The food approaching factor was related to a greater intake of food. Several previous studies have also shown that food responsiveness and enjoyment of food was related to greater total food intake. The greater tendency

of emotional overeating in children was related to a higher intake of snack foods. Children with a greater desire to drink were associated with the greater consumption of sugar-sweet beverages<sup>11-13</sup>. In contrast, food avoidance behaviours were related to the risk of inadequate intake of several essential nutrients<sup>14</sup>. Previous studies related to food avoidance behaviour have shown that children who exhibit greater food fussiness were negatively associated with the number of main meals in a day. A higher score on satiety responsiveness was related to lower meal size. Satiety responsiveness and slowness in eating were also negatively associated with the preference for fruit and vegetables. Food avoidance behaviours were in correlation with the consumption of snacks and sweet sugar beverages<sup>12,14-16</sup>.

To our knowledge, studies of appetitive traits were typically focused on the child's weight and child diet-related to quantity. There is a limited study, particularly in Indonesia that used CEBQ as well. A previous study in Indonesia showed that enjoyment of food as one of the food-approaching traits was correlated with overweight in preschool children<sup>17</sup>. However, there have been no similar studies in Indonesia that have assessed the relationship between appetitive traits and diet quality. Therefore, in this study, we aimed to assess the correlation between appetitive traits among children and overall diet quality. As a result, assessing these appetitive traits in children may help identify children at risk of poor diet quality.

## METHODS

This cross-sectional study was conducted in Jakarta. DKI Jakarta Province was purposively chosen because of the increasing prevalence of overweight/obesity in childhood<sup>18</sup> that is caused by poor diet. Pejagalan Village, located in North Jakarta, was chosen through a multistage random sampling process (Figure 1). Participants of this study were mothers who have children aged 2-6 years in the selected Integrated Service Post (*Posyandu*) area that provides health and nutrition services for child and pregnant women as well as lactating women. Consecutive sampling was applied to select subjects who were met the inclusion criteria. Inclusion criteria for participating in this study were: 1) children aged 2 - 6 years because this is a peak period of having eating behaviour problem, such as picky eater and food fussiness<sup>19,20</sup>, 2) mother of children willing to sign the informed consent, 3) mothers of children were able to communicate in Bahasa Indonesia and 4) mothers of children complete their child's 24-hour food recall over two days. Using the formula for sample size calculation for correlation study<sup>21</sup> and with 0.28 for the expected

correlation<sup>11</sup>, the minimum total of subjects required in this study was 216 subjects.

## Data Collection

Data collection was carried out from January to April 2020 via interviews between the trained enumerator and the participant's mother. The time needed to interview each respondent during the survey was approximately 45-60 minutes.

## General Characteristics

Our subjects' characteristics, including the child's age, gender, mother's educational level, mother's occupation, and family income, were obtained via an interview with the child's mother or caregiver.

## Appetitive Traits

The traits were measured using a validated child eating behaviour questionnaire. This questionnaire consists of four food-approaching traits, or traits of a child's tendency to approach foods, such as food responsiveness, emotional over-eating, enjoyment of food and desire to drink and four food-avoidance traits, or traits of a child's tendency to avoid foods, such as satiety responsiveness, slowness in eating, emotional under-eating and food fussiness<sup>22</sup>. Parents were asked to rate their child's appetitive traits on a 5-point Likert scale ranging from "never" to "always". The mean score was calculated for further analysis. A higher score in food-approaching traits indicated a greater tendency of a child to approach food and a higher score in food-avoidance traits indicated a greater tendency of a child to avoid food. Good internal reliability was found in seven subscales of appetitive trait, with a value ranging from 0.65 to 0.75.

## Diet Quality

The dietary intake of the subjects was assessed using a 24-hour recall method over two days because we aim to examine children's usual consumption. The two days were divided into one weekday and one weekend for each respondent. The Diet Quality Index-International (DQII)<sup>23</sup> was used to assess the overall diet quality of our respondents. The DQII has four components that form a child's diet, including variety, adequacy, moderation and overall balance. The total DQII score is the sum of the four components' scores which ranges from 0 to 100. The higher the score means that the better the child's diet quality. In addition, the four categories' scores were also divided into good and poor categories based on a cut-off of 60% of the overall score. In this current study, we did not validate the DQII since the original study<sup>23</sup> already validated the DQII for International use. In addition, the scoring for each food item and nutrients in this tool was already based on the national Recommended Dietary Allowances (RDA) for Indonesian.

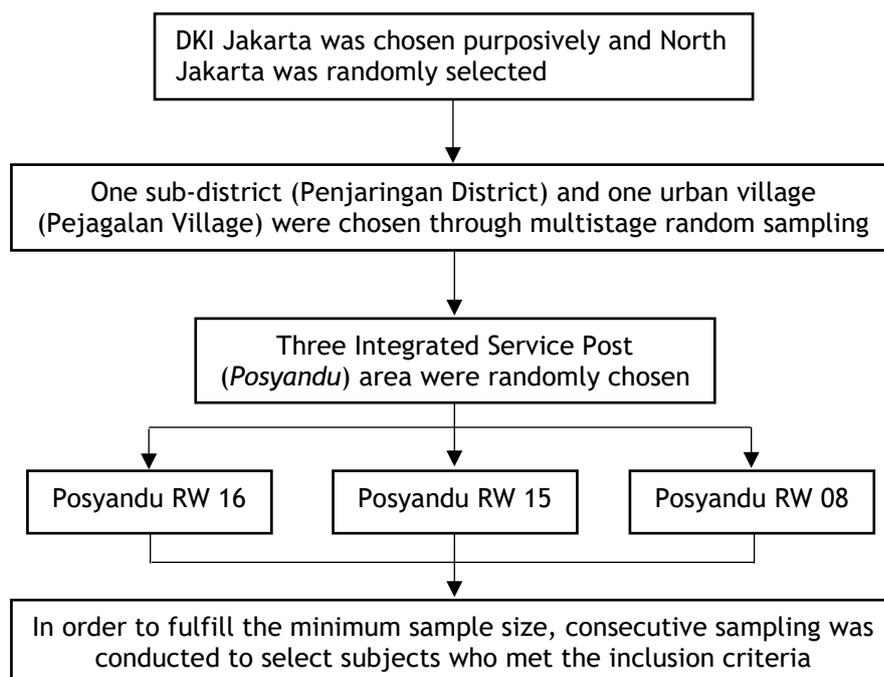


Figure 1. Sampling procedure of the study

### Statistical Analysis

The statistical analyses were performed using the Statistical Product and Service Solutions (SPSS) statistics 20.0. Normality tests for all numerical variables were performed using Kolmogorov-Smirnov and coefficient of variance analysis. Missing data were analysed using the simple mean imputation method<sup>24</sup>. Since the data were not normally distributed, Spearman rank-correlation was used to evaluate any correlation between appetitive traits and diet quality score. Furthermore, multivariate linear regression analysis was performed to determine the predictor of diet quality among children. Statistically significant differences were determined based on a p-value < 0.05.

### Ethical Consideration

This study has been approved by the Ethical Committee of Faculty of Medicines, Universitas Indonesia (No. ND-6/UN2.F1/ETIK/PPM.00.02/2020).

### RESULTS

In total 263 subjects were eligible for this study. Table 1. presents the distribution of general characteristics among our subjects. Most of our subjects were 4-6 years old, and half of them were boys. About one-third of the mothers (32.3%) had senior high school education. A majority of mothers were unemployed and worked as housewives (68.1%). The median family income was about IDR 3 million per month, with seventy-six per cent of the subjects living in a family with lower-middle income.

Table 2. shows the distribution of the child's diet quality score. Overall, the median score of DQI-I was 46, which was classified as poor diet quality. In the variety component, our subjects, on average, had a relatively high score that reached almost 60 per cent of the total (11.3 out of 20). In comparison, the moderation component only reached 49 per cent (14.7 out of 30), and the adequacy component reached 47 per cent (18.8 out of 40). Unfortunately, the median score for the overall balance component was 1.4 points out of 10.

In the food approach category (Table 3.), desire to drink had the highest median score, and emotional overeating had the lowest score among our subjects. Conversely, the emotional undereating variable had the highest median score and slowness in eating had the lowest median score in the food avoidance category. Results from the Spearman test (Table 3.) show a significant correlation established between emotional overeating and total diet quality score. This means that children who tend to overeat in response to their emotions were associated with decreasing the quality of their diet. We also found that children who were more responsive to satiety had a higher score in the moderation component of diet quality.

Table 4. displays the summary of regression analysis. Significant predictors of diet quality scores include child's age ( $B = -0.24$  p-value < 0.01) and mother's educational level ( $B = -0.15$  p-value < 0.05), however appetitive traits were not found to be significant predictors of diet quality. Further analysis of each of diet quality components, food responsiveness significantly predicted the score of variety component ( $B =$

0.16 p-value < 0.05) and satiety responsiveness significantly predicted the score of moderation component (B = 0.17 p-value < 0.05). This indicates that, for every unit increase in food

responsiveness score, the ‘variety’ component score increases 0.16 times, and for every unit increase in satiety responsiveness score, the moderation component score increases 0.17 times

**Table 1. General characteristic among children aged 2-6 years in North Jakarta (n=263)**

Variables	Median (Q1 - Q3)	N	%
Age	4 (3 - 5)		
2-3 years old		113	43
4-6 years old		150	57
Sex			
Boy		150	57
Girl		113	43
Mother Education			
Less than elementary school		13	4.9
Elementary school graduate		77	29.3
Junior high school graduate		75	28.5
Senior high school graduate		85	32.3
Diploma/university graduate		13	4.9
Mother Occupation <sup>a</sup>			
Unemployed		179	68.1
Partially employed		46	17.5
Fully employed		38	14.4
Family Income Level (n=262) <sup>b</sup>	3 million (2 - 4.02 million)		
Low (< 2 million per month)		38	14.5
Middle (2-4.02 million per month)		161	61.5
High (> 4.02 million per month)		63	24.0

<sup>a</sup> mother occupation was categorized into unemployed (housewife), partially employed (a mother who work less than 30 hours in a week) and fully employed (a mother who work at least 35-40 hours in a week or 8 hours in a day)

<sup>b</sup> Family income level was divided into low <Q1 (< 2 million per month); middle Q1 - Q3 (2-4.02 million per month); and high >Q3 (> 4.02 million per month)

**Table 2. Diet quality score among children aged 2-6 years in North Jakarta (N=263)**

Component	Median (Q1 - Q3)
Variety (Range 0-20 points)	11.3 (9 - 14)
Overall food group variety (meat/ poultry/fish/eggs; dairy /beans; grain; fruit; vegetable)	8.2 (6 - 9)
Within-group variety for protein source (meat, poultry, fish, dairy, beans, eggs)	3 (3 - 5)
Adequacy (Range 0-40 points)	18.8 (15 - 22)
Vegetable	0.7 (0 - 1)
Fruit	0 (0 - 0.5)
Grain/staple food	3 (2.7 - 3)
Fibre	1 (1 - 1.4)
Protein	5 (4.5 - 5)
Iron	3.4 (3 - 5)
Calcium	2.8 (1 - 3)
Vitamin C	2.5 (1 - 3)
Moderation (Range 0-30 points)	14.7 (12 - 18)
Total fat	1.4 (0 - 3)
Saturated fat	0 (0 - 0.15)
Cholesterol	6 (4.6 - 6)
Sodium	6 (5.5 - 6)
Empty calorie foods	3 (2.9 - 3)
Overall balance (Range 0-10 points)	1.4 (0 - 2)
Macronutrient ratio (Carbohydrate: Protein: Fat)	1.4 (0 - 2)
Fatty acid ratio (PUFA: MUFA: SFA)	0 (0 - 0)
Total diet quality score (range 1-100)	46.2 (42 - 49)

**Table 3. Child’s appetitive traits and its correlation with diet quality score among children aged 2-6 years in North Jakarta (N=263)**

Child’s Appetitive Traits	Median (Q1 - Q3)	Diet Quality Index-International (DQII)				
		Variety	Adequacy	Moderation	Overall balance	Overall DQII
Food Approach						
FR	2.6 (2 - 3.2)	0.81	0.04	-0.07	-0.03	0.02
EOE	1.5 (1 - 2)	-0.11	-0.08	-0.12	-0.00	-0.13*
DD	3.5 (2 - 4)	-0.1	0.02	-0.05	0.05	-0.03
Food Avoidance						
SR	3.2 (2.6 - 3.8)	-0.07	-0.07	0.16**	0.05	0.02
SE	2.6 (1.6 - 4)	-0.06	-0.02	0.00	0.08	-0.01
EUE	3.3 (2.3 - 4)	-0.04	-0.03	0.09	0.12	0.02
FF	2.75 (2 - 3.5)	0.05	-0.02	0.03	0.02	-0.00

FR: Food responsiveness, EOE: Emotional overeating, DD: Desire to drink, SR: Satiety responsiveness, SE: Slowness in eating, EUE: Emotional under-eating and FF: Food fussiness

The score range is 1 - 5 (Never = 1, Rarely = 2, Sometimes = 3, Often = 4, Always = 5)

\*Significance level of P-value<0.05

\*\*Significance level of P-value<0.01

**Table 4. Multiple linear regression data with appetitive traits and general characteristics as predictors of children’s diet quality score among children aged 2-6 years in North Jakarta (N=263)**

	Variety	Adequacy	Moderation	Overall Balance	Overall DQII
	R <sup>2</sup> = 0.07	R <sup>2</sup> = 0.11	R <sup>2</sup> = 0.13	R <sup>2</sup> = 0.03	R <sup>2</sup> = 0.11
	B	B	B	B	B
Child’s age	0.08	-0.22**	-0.27**	-0.07	-0.24**
Child’s sex	-0.01	-0.01	0.06	0.08	0.04
Mother’s education <sup>a</sup>	-0.05	-0.12	-0.11	-0.05	-0.15*
Mother’s Occupation <sup>b</sup>	-0.04	-0.01	-0.00	-0.08	-0.03
Family Income	0.11	0.13*	-0.01	-0.05	0.09
<b>Food Approach</b>					
Food Responsiveness	0.16*	0.03	-0.08	-0.03	0.03
Emotional overeating	-0.11	-0.05	-0.04	-0.01	-0.09
Desire to drink	-0.09	0.05	0.00	0.05	0.01
<b>Food Avoidance</b>					
Satiety responsiveness	-0.11	-0.13	0.17*	-0.08	-0.04
Slowness in eating	0.03	0.04	-0.14	0.04	-0.03
Emotional undereating	0.03	-0.01	0.05	0.08	0.04
Food Fussiness	0.03	-0.03	0.01	0.04	0.01

Standardised regression coefficients (B) are from linear regression models with the enter method.

Missing data were analysed with simple mean imputation

\*Significance level at P-value <0.05

\*\*Significance level at P-value <0.01

<sup>a</sup> Mother’s Educational Level (1: Diploma/university graduate; 2: Senior high school graduate; 3: Junior high school graduate; 4= Elementary school graduate; 5: Less than elementary school)

<sup>b</sup> Mother occupation (1: unemployed; 2: partially employed; 3: fully employed)

**DISCUSSION**

In the present study, we assessed the diet quality score among children aged 2-6 years using the Diet Quality Index-International. According to our findings, diet quality among children aged 2-6 years in North Jakarta was classified as poor, with most of the children scoring below 60% of the total (46 out of 100). The findings are in line with a study among Canadian children, which found that the average DQII score was 58 out of 100, and a study of Greek pre-schoolers measuring diet quality score using a healthy eating index which found that 80% of children had poor diet quality<sup>25,26</sup>. In Indonesia, a study conducted in Banyumas found that the diet quality among children under-five needed to be improved<sup>4</sup>.

The Diet Quality Index-International has four components of diet quality, including variety, adequacy, moderation and overall balance. In the variety component, we found that children had relatively high scores (11 out of 20). Dietary variety is one of the most important components in diet quality. Consuming a diverse diet can potentially reduce nutritional problems, such as stunting, wasting and underweight<sup>27</sup>. Data obtained regarding the adequacy component showed that the consumption of fruits and vegetables among our respondents was significantly insufficient, leading to an intake of fibre and vitamin C which did not meet the recommended amount. A previously conducted study reported that the average consumption of

vegetables and fruits among children under-five were 33.1 g/day and 32.7 g/day, which did not reach the recommended amounts<sup>28</sup>. In the moderation component, total fat and saturated fat have the lowest scores meaning that the energy from total fat was more than 30% and energy from saturated fat was more than 10%. This finding may be related to the consumption of fried snacks such as fried sausages, tofu, tempeh, nuggets that are common in our respondents. The habit of consuming high-energy dense food and high-fat foods such as fried chicken, fried tofu or tempeh, sweetened milk, etc. may also contribute to a worse score of the overall balance component. Therefore, dietary interventions that promote a well-balanced diet, particularly the consumption of fruits and vegetables, as well as the development of food-based recommendations for children, are likely to improve the quality of children's diets and eating habits.

According to the result of the CEBQ, appetitive traits had a median score ranging from 1.5 to 3.5. The most common trait in our subject is the desire to drink in the food approach category. A higher score of DD in our sample could be due to the accessibility of sugar-sweetened beverages that were easily found at an affordable price in our study area. While emotional overeating and satiety responsiveness was also had a higher score in the food avoidance category. Children and adolescents are common facing emotional eating. A previous study among preschool in Swiss showed that in response to their emotional feeling, children tend to under-eating rather than overeating<sup>29</sup>. Snacking habits before eating among our respondents might be the reason for the higher score on satiety responsiveness. Children's satiety responsiveness refers to their proclivity to leave foods when they become full. As the child gets older, food avoidance traits will decrease, and food approach traits will increase overtime<sup>30</sup>.

Regarding the factors that may contribute to the diet quality score among children, we examined the correlation between appetitive traits and the child's diet quality score. Results from the Spearman tests showed that emotional overeating was negatively correlated with overall diet quality. A previous study concluded that emotional overeating was associated with the consumption of energy-dense snack, which was generally high in sugar and fat. These snacks could contribute to poor nutrition and diet quality<sup>12,31</sup>. A study conducted among Belgian children found that stress related to emotional eating was associated with increased consumption of unhealthy foods, such as sweets and fatty foods<sup>32</sup>. Hence providing and offering affordable nutritious food and training children to make healthy food choices in response to their emotions may help improve children's diet quality. In addition, we also found a positive correlation between satiety responsiveness and the moderation component of diet quality. Findings from previous studies have

shown that satiety responsiveness was related to lower food intake. We hypothesised that satiety responsiveness might contribute to the overall reduction in the consumption of total fat, saturated fat, cholesterol, sodium, and empty calorie foods, which would result in a high moderation component score. However, findings from the previous study revealed that children who were more responsive to satiety tended to eat more unhealthy snack foods<sup>11</sup>.

Findings from the multiple linear regression model revealed that the child's age and mother's educational level were a significant predictor of appetitive traits and diet quality scores among children aged 2-6 years. These findings indicate that the older the child, the lower their diet quality score. Supported by a previous study, the diet quality score began to decline from the first year of life<sup>33</sup>. Findings from previous studies explained that younger children might have higher diet quality scores because they tended to eat less often outside the home, where foods were usually less nutritious. They were also participating in family meals more frequently, which resulted in lower consumption of sugar-sweet beverages<sup>34,35</sup>. So, it is necessary to increase parental supervision and assistance to children in the older age group regarding their eating patterns, as well as their eating habits outside the home. In addition, in this model, mother education was negatively associated with the diet quality score. This is in contrast to a US-based study, which found that children who lived in a family with a higher educational level tended to have a higher score on the quality of their diet<sup>33</sup>. One possible reason for our finding is that mothers with low educational levels were more likely to be unemployed, and it will give them more time to stay at home and focus on their child's diet.

Overall, multivariate analysis showed that no significant correlation between appetitive traits and diet quality score among children aged 2-6 years could be established. Emotional overeating that was significantly correlated with diet quality score in the Spearman test became insignificant in the multiple linear regression test. One possible explanation for this finding is the existence of interrelationship between independent variables in the multivariate analysis. However, we found that food responsiveness significantly predicted the variety score, indicating that children who were more responsive to foods were more likely to have a diverse diet. Syrad et al<sup>15</sup>, showed that children who had a higher score for food responsiveness consumed meals more frequently. Food responsiveness was also related to greater consumption of protein-rich foods, vegetables, fruits, and white bread<sup>11,14</sup>. Higher food intake among children who were responsive to foods may contribute to a diverse diet consumed by the children. Moreover, we found that satiety

responsiveness significantly predicted the moderation component of diet quality.

This study has some limitations that need to be considered. Firstly, our data was homogeneous in the context of socioeconomic characteristics, and hence we cannot generalise our findings with the overall Indonesian children population, living in different socioeconomic characteristics. Secondly, one-third of the diet quality data in eligible subjects were missing, so we analyzed them using the simple mean imputation method. Finally, the dietary intake of the children was reported by their parents using a 24 hours food recall method over 2 days. Even though we have used food photo books to make it easier for mothers to estimate the portion of food eaten by their children, parents may still underestimate the amount of food and snacks consumed by the children outside the home. However, we have already minimized this limitation by asking the children as well about foods they consumed outside the home.

## CONCLUSION

Diet quality score among children aged 2-6 years in North Jakarta was classified as poor. Dietary intervention on promoting a balanced diet, focused primarily on fruits and vegetables, along with developing food-based recommendations targeted at children, may have an impact on improving child diet quality and their healthy eating habits. Among the factors that may contribute to diet quality, a significant correlation was established through bivariate analysis between emotional overeating and children's diet quality score. While in multivariate analysis, food responsiveness and satiety responsiveness were significant predictors of the variety and moderation component of diet quality, respectively. In conclusion, assessing appetitive traits in children can help identify children at risk of poor diet quality.

## ACKNOWLEDGEMENT

The authors would like to extend their gratitude to the Pejagalan Primary Health Centre and Pejagalan village that allowed the study to be conducted in Pejagalan village.

## FUNDING

This research was funded by a research grant from Universitas Indonesia under the International Indexed Publication scheme.

## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest in this study or publication.

## REFERENCES

1. Sandjaja S, Budiman B, Harahap H, Ernawati F, Soekatri M, Widodo Y, et al. Food consumption and nutritional and biochemical status of 0-5-12-year-old Indonesian children: The SEANUTS study. *Br J Nutr.* 2013;110:11-20.
2. Chen LW, Fung SM, Fok D, Leong LP, Toh JY, Lim HX, et al. The development and evaluation of a diet quality index for asian toddlers and its perinatal correlates: The GUSTO cohort study. *Nutrients.* 2019;11:535.
3. Ford CN, Slining MM, Popkin BM. Trends in Dietary Intake among US 2- to 6-Year-Old Children, 1989-2008. *J Acad Nutr Diet.* 2013;113(1):35-42.
4. Agustia FC, Sitasari A. Konsumsi Zat Gizi Makro, Mikro Dan Kualitas Diet Pada Anak Usia 1-5 Tahun Di Desa Sumampir, Kabupaten Banyumas: Studi Deskriptif. *J Pembang Pedesaan.* 2013;13(1):11-6.
5. Wahyuningsih U, Anwar F, Kustiyah L. Kualitas Konsumsi Pangan Kaitannya dengan Status Gizi Anak Usia 2-5 Tahun pada Masyarakat Adat Kasepuhan Ciptagelar dan Sinar Resmi. Institute Pertanian Bogor; 2018.
6. Muslimatun S, Ari Wiradnyani LA. Dietary diversity, animal source food consumption and linear growth among children aged 1-5 years in Bandung, Indonesia: A longitudinal observational study. *Br J Nutr.* 2016;116:27-35.
7. Wu XY, Ohinmaa A, Veugelers PJ. Diet quality, physical activity, body weight and health-related quality of life among grade 5 students in Canada. *Public Health Nutr.* 2012;15(1):75-81.
8. Entin A, Kaufman-Shriqui V, Naggan L, Vard H, Shahar DR. Parental feeding practices in relation to low diet quality and obesity among LSES children. *J Am Coll Nutr.* 2014;0(0):1-9.
9. Couch SC, Glanz K, Zhou C, Sallis JF, Saelens BE. Home food environment in relation to children's diet quality and weight status. *J Acad Nutr Diet.* 2014;114(10):1569-79.
10. Wood AC. Appetitive Traits: Genetic Contributions to Pediatric Eating Behaviors. In: Julie C. Lumeng JOF, editor. *Pediatric Food Preferences and Eating Behaviors.* Academic Press; 2018.

- p. 127-46.
11. Carnell S, Pryor K, Mais LA, Warkentin S, Benson L, Cheng R. Lunch-time food choices in preschoolers: Relationships between absolute and relative intakes of different food categories, and appetitive characteristics and weight. *Physiol Behav.* 2016;162:151-60.
  12. Rodenburg G, Kremers SPJ, Oenema A, van de Mheen D. Associations of Children's Appetitive Traits with Weight and Dietary Behaviours in the Context of General Parenting. *PLoS One.* 2012;7(12).
  13. Sweetman C, Wardle J, Cooke L. Soft drinks and "desire to drink" in preschoolers. *Int J Behav Nutr Phys Act.* 2008;5(60).
  14. Jalkanen H, Lindi V, Schwab U, Kiiskinen S, Venäläinen T, Karhunen L, et al. Eating behaviour is associated with eating frequency and food consumption in 6-8 year-old children: The Physical Activity and Nutrition in Children (PANIC) study. *Appetite.* 2017;114:28-37.
  15. Syrad H, Johnson L, Wardle J, Llewellyn CH. Appetitive traits and food intake patterns in early life. *Am J Clin Nutr.* 2016;103:231-5.
  16. Fildes A, Mallan KM, Cooke L, van Jaarsveld CHM, Llewellyn CH, Fisher A, et al. The relationship between appetite and food preferences in British and Australian children. *Int J Behav Nutr Phys Act.* 2015;12:116.
  17. Herawati HD, Gamayanti IL, Tsani AFA, Gunawan IMA. Perilaku makan berlebih dan hubungannya dengan kegemukan pada anak prasekolah. *J Gizi dan Diet Indones (Indonesian J Nutr Diet).* 2017;4(3):161.
  18. Kementerian Kesehatan Republik Indonesia. Profil Kesehatan Indonesia Tahun 2018. Jakarta: Kementerian Kesehatan RI; 2018.
  19. Taylor CM, Wernimont SM, Northstone K, Emmett PM. Picky/fussy eating in children: Review of definitions, assessment, prevalence and dietary intakes. *Appetite.* 2015;96:349-59.
  20. Mascola AJ, Bryson SW, Agras WS. Picky eating during childhood: A longitudinal study to age 11- years. *Eat Behav.* 2011;11(4):253-7.
  21. Hulley SB, Cummings SR, Browner WS, Grady D NT. Designing clinical research : an epidemiologic approach. 4th ed. Replication and Evidence Factors in Observational Studies. Philadelphia, PA: Lippincott Williams & Wilkins; 2013. 79 p.
  22. Wardle J, Guthrie CA, Sanderson S, Rapoport L. Development of the children's eating behaviour questionnaire. *J Child Psychol Psychiatry Allied Discip.* 2001;42(7):963-70.
  23. Kim S, Haines PS, Siega-Riz AM, Popkin BM. The Diet Quality Index-International (DQI-I) Provides an Effective Tool for Cross-National Comparison of Diet Quality as Illustrated by China and the United States. *J Nutr.* 2003;133:3476-84.
  24. Heymans MW, Eekhout I. Applied Missing Data Analysis with SPSS and R Studio. First Draft. Amsterdam; 2019.
  25. Setayeshgar S, Maximova K, Ekwaru JP, Gray-Donald K, Henderson M, Paradis G, et al. Diet quality as measured by the Diet Quality Index-International is associated with prospective changes in body fat among Canadian children. *Public Health Nutr.* 2017;20(3):456-63.
  26. Manios Y, Kourlaba G, Kondaki K, Grammatikaki E, Biribilis M, Oikonomou E, et al. Diet Quality of Preschoolers in Greece Based on the Healthy Eating Index: The GENESIS Study. *J Am Diet Assoc.* 2009;109:616-23.
  27. Khamis AG, Mwanri AW, Ntwenya JE, Kreppel K. The influence of dietary diversity on the nutritional status of children between 6 and 23 months of age in Tanzania. *BMC Pediatr.* 2019;19:518.
  28. Hermina, Prihatini S. Fruits and Vegetables Consumption of Indonesian Population in the Context of Balanced Nutrition: A Further Analysis of Individual Food Consumption Survey (SKML) 2014. *Bul Penelit Kesehat.* 2016;
  29. Messerli-Bürgy N, Stülb K, Kakebeeke TH, Arhab A, Zysset AE, Leeger-Aschmann CS, et al. Emotional eating is related with temperament but not with stress biomarkers in preschool children. *Appetite.* 2018;120:256-64.
  30. Ashcroft J, Semmler C, Carnell S, van Jaarsveld CHM, Wardle J. Continuity and stability of eating behaviour traits in children. *Eur J Clin Nutr.* 2008;62:985-90.
  31. Sekiyama M, Roosita K, Ohtsuka R. Snack foods consumption contributes to poor nutrition of rural children in West Java,

- Indonesia. *Asia Pac J Clin Nutr.* 2012;21(4):558-67.
32. Michels N, Sioen I, Braet C, Eiben G, Hebestreit A, Huybrechts I, et al. Stress, emotional eating behaviour and dietary patterns in children. *Appetite.* 2012;59(3):762-9.
33. Hamner HC, Moore L V. Dietary quality among children from 6 months to 4 years, NHANES 2011-2016. *Am J Clin Nutr.* 2020;111:61-9.
34. Gu X, Tucker KL. Dietary quality of the US child and adolescent population: Trends from 1999 to 2012 and associations with the use of federal nutrition assistance programs. *Am J Clin Nutr.* 2017;105:194-202.
35. Fink SK, Racine EF, Mueffelmann RE, Dean MN, Herman-Smith R. Family Meals and Diet Quality Among Children and Adolescents in North Carolina. *J Nutr Educ Behav.* 2014;46(5):418-22.