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Adequate fruit and vegetable consumption and its association with overnutrition among primary school-aged children

Hubungan kecukupan konsumsi buah sayur dan kegemukan pada anak usia sekolah dasar

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Abstract

Overnutrition among school-aged children increases substantially over the last decade. Among the direct causes of overweight/obesity is inadequate intake of fruit and vegetable. Prior studies have shown that fruit and vegetable (FV) is not merely the main source of vitamins andminerals, but also playing role on preventing weight gain through satiety regulation. This study aims to determine the association of FV consumption adequacy among 5-12 years schoolers and their overnutrition status. This cross-sectional study was conducted in Jakarta and Depok, carried out on 57 children who filled out an online questionnaire survey. Respondents' characteristics were obtained through the self-administered online questionnaire. BMI for age z-score (BAZ) was calculated from the self-reported recall of body weight and height. The FV consumption was evaluated using the WHO STEP-wise questionnaire. Respondent's characteristics were presented in frequency and percentage, while association test was done using Fisher Exact test (CI 95%). In this study, 40,4% of children were overweight and most children did not consume adequate portions of fruit and vegetable (73,7% and 57,9%, respectively). There are no significant association between FV consumption and children's overnutrition (p= 0,171 and p= 0,788, respectively; CI 95%). Overall, a high proportion of children overnutrition was observed. However, there is no significant association was found between fruit and vegetable consumption and children's overnutrition. There is a need for specific regulations and practices that may engage children in consuming fruit and vegetable on the daily basis.

Keywords: childhood, fiber source, Indonesia, obesity

Abstrak

Kegemukan pada anak usia sekolah meningkat secara substansial selama satu decade terakhir. Salah satu penyebab langsung kegemukan adalah kurangnya konsumsi buah dan sayur. Studi terdahulu menunjukkan bahwa konsumsi buah dan sayur tidak hanya menjadi sumber vitamin dan mineral namun juga berperan mencegah kenaikan berat badan melalui regulasi rasa kenyang. Penelitian ini bertujuan untuk menginvestigasi hubungan konsumsi buah sayur pada anak usia 5-12 tahun dan status gizi lebih di Jakarta dan Depok. Desain studi ini adalah cross-sectional dan dilakukan kepada 57 anak yang mengisi kuesioner online. Indeks Massa Tubuh menurut Usia (IMT/U) dihitung berdasarkan tinggi dan berat badan yang dilaporkan mandiri. Karakteristik responden disajikan dalam bentuk frekuensi dan persentase, sementara uji hubungan dilakukan menggunakan uji Fisher Exact (CI 95%).

Konsumsi buah dan sayur dievaluasi menggunakan kuesioner WHO STEP-side. Pada studi ini 40,4% anak mengalami kegemukan. Mayoritas anak tidak mengkonsumsi cukup buah dan sayur (73,7% dan 57,9%). Tidak ada hubungan signifikan antara konsumsi buah sayur dan kegemukan pada anak (p=0,171 dan p=0,788, CI 95%). Secara keseluruhan proporsi kegemukan anak ternilang tinggi namun kecukupan konsumsi buah dan sayur tergolong rendah. Dibutuhkan regulasi spesifik untuk dapat menggalakkan praktik baik makan sayur dan buah dalam keseharian
Kata Kunci: masa anak-anak, sumber serat, Indonesia, obesitas

Introduction

Overnutrition manifested as overweight and obesity among children are deemed as an epidemic both in developing and developed countries (Gupta et al., 2012). Approximately 158 million of children age 5 – 19 years old are obese (Wolrd Obesity Federation, 2019). In Indonesia, for more than a decade, childhood overnutrition prevalence is growing substantially (Indonesia Ministry of Health, 2018). Indonesia Basic Health Research estimated a significant increase in childhood overnutrition prevalence among primary school-age children (5 – 12 years of age) from 2007 until 2018 (15,9% to 20%) (Indonesia Ministry of Health, 2008, 2018). Furthermore, Jakarta and Depok are province and city which has higher obesity prevalence than national level, 29,2% and 30,8%, respectively (Indonesia Ministry of Health, 2019a, 2019b). Childhood obesity is a predictor of adult obesity, which increases the risk of various non-communicable diseases, such as heart disease, diabetes mellitus and cancer (Mullan et al., 2022). Childhood obesity is also associated with low quality of life, such as low self-esteem due to feeling distant to other normoweight classmates, low academic performance especially in physical education subject, and risk of bullying (Bacchini et al., 2015).

Overnutrition is a multifactorial issue. Prior studies have associated overnutrition with low consumption of fruit and vegetable (FV) and high consumption of sugary food and beverage (SFB) (Anggraeni et al., 2017; Keller & Bucher Della Torre, 2015; Liu et al., 2018). The 2018 Indonesia Basic Health Research has shown, children aged 5 to 9 years only consume on average 1-2 servings of fruit and vegetable a day. Only 3% of children complied with the recommended 5 servings of fruit and vegetable consumption a day in a week (Kementerian Kesehatan RI, 2018). Fruit and vegetable are major sources of vitamins and minerals that help to regulate metabolism in the body (Pem & Jeewon, 2015). Fruit and vegetable are also a source of fiber, which has a direct influence on obesity through the regulation of appetite and its low calorie content (Yu et al., 2018). A regional case-control study conducted among 488 children in Yogyakarta and Bantul indicated a greater risk of obesity among those who consume FV less than 5 servings/day (OR 4,59; CI 95%) (Nuraeni et al., 2016).

In contrast, the 2018 nationwide survey reported a high proportion of SFB consumption among children. In a sample of more than 92,000 children aged 5 to 9 years, 59% of them consumed SFB more than once a day (Kementerian Kesehatan RI, 2018). A situational analysis of school canteen conducted in Jakarta and Klaten observed beverage items mainly sold at affordable price are sweet iced tea and sweetened fruit juice, and other instant sweetened drink like condensed milk, soft drinks and energy drinks. While food items available are deep-fried snacks and packaged snacks: biscuits, wafer, candies, chocolates and jelly (Rachmadewi et al., 2021). Food and beverage included in the SFB are manufactured products that contained added sugar. SFB consumption contributes to the development of obesity through its high energy density yet low nutritional value. Furthermore, the calories provided by SFB do not share a mutual feeling of fullness as solid food provides (WHO, 2014). A regional study conducted on primary school students in Surabaya revealed a significant association between the consumption of chocolate bars, sweetened beverage, and overnutrition ($p < 0,05$ OR 6,3; OR 13,4, respectively) (Nisak et al., 2017).

The association between fruit and vegetable consumption and overnutrition among children has been extensively

investigated (Anggraeni et al., 2017; Yang et al., 2021). However, the circumstances during the pandemic of COVID-19 are less explored among scholars due to constraint in social mobility for the study conduct. To the best of our knowledge, no study ever conducted investigation related to fruit and vegetable consumption during COVID-19 pandemic when children spent vast majority of their time at home. Therefore, this current study aims to determine the association of FV consumption among 5-12 years schoolers and their overnutrition status.

Methods

This cross-sectional study design was conducted in Jakarta and Depok in June 2021. The study used a self-administered Google Form questionnaire for data collection. The questionnaire was broadcast for one month through Whatsapp. The inclusion criteria were Indonesian children aged 5-12 years old. To ensure the subject's eligibility, several filtered questions were applied at the beginning of the questionnaire that asked about age and residency. The minimum sample size was determined using Lemeshow formula hypotheses testing between two proportion (Lemeshow et al., 1991). The proportion used in the formula derived from prior study related to fruit and vegetable consumption among school aged children in Bandung (P1 0,72; P2 0,38) (Khaerunisa, 2016). A total of 68 subjects filled out the questionnaire through voluntary sampling. From those assessed, 11 were excluded with detail of irrelevant birth of dates and extreme value of BAZ. Finally, 57 children were involved in the analysis with 86% response rate.

The questionnaire consisted of two sections. First, questions related to demographic characteristics, such as age, gender, parent working status, and educational attainment. Second, children's consumption of sugary food and beverage was obtained through the question 'in the last month how often did you eat sugary food/beverage' with responses option including $\geq$ once a day, 3 – 5 times per week, < 3 times per month. Children's fruit and vegetable (FV) consumption was obtained using the WHO STEP-wise questionnaire, which is specified for common fruit and vegetable items. Fruits asked in the questionnaire include apples, oranges, papaya, banana, guava, melon, pear, and watermelon. Vegetables asked in the questionnaire included spinach, mixed vegetable soup, *sayur asem* (vegetable stew in tamarind soup), *lodeh* (vegetable stew in coconut milk), and kale. Overnutrition status was identified by calculating BMI for age (BAZ) z-score using WHO AnthroPlus. The body weight and height data were self-reported. The demographic characteristics and children's FV and SFB consumption was treated as the independent variable, while BAZ was treated as the dependent variable.

Data were analyzed using statistical software for univariate and bivariate analysis with 95% CI. Univariate analysis to describe the characteristics proportions and mean of BAZ. Overnutrition status (overweight and obesity) was identified when BAZ z-score > 1 SD. Adequate FV consumption was identified if children consumed $\geq$ 5 servings of FV in a day for a week. Bivariate analysis was done using Fisher Exact test to identify the potential association between independent variables and BAZ. This research was ethically approved by the Health Research Ethics Committee of the Universitas Pembangunan Nasional Veteran Jakarta (approval number 167/IV/2021/KEPK). Informed consent was obtained from each participant prior to data collection.

Result and Discussion

The final analytical sample involved 57 respondents. Table 1 shows the descriptive characteristics of the respondents. In our analysis, out of 57 children, most of them were females aged 8 years old whose parents were higher education graduates. The mean of BAZ was 0,44 $\pm$ 1,38 SD which indicates normal nutritional status, however, the proportion showed 40,4% of children were overnourished. Mean BAZ indicates most of the children were normoweight, although there were six children who were obese, this probably due to several children were at the borderline of undernutrition. Most children consumed less than five portions of fruit and vegetable per day in a week that were deemed inadequate (73,7% and 57,9%, respectively). Moreover, the majority of the children consumed sweet beverages and sweet food, 3 to 5 times per week in the last month.

Table 1. Descriptive characteristics of the respondents

Characteristics	Mean ± SD
Age (years)	8,7 ± 1,80
BMI for age (z- score)	0,44 ± 1,38
Weight (kg)	28,9 ± 8,2
Height (cm)	127,8 ± 12,6
	n(%)
BAZ status	
Overweight and obesity	23 (40,4)
Normal weight	34 (59,6)
Sex	
Male	28 (49,1)
Female	29 (50,9)
Paternal education	
Senior high school and below	17 (29,9)
Higher education	40 (70,1)
Maternal education	
Senior high school and below	24 (42,1)
Higher education	33 (57,9)
Fruit portion consumed per week	
Adequate	15 (26,3)
Inadequate	42 (73,7)
Vegetable portion consumed per week	
Adequate	24 (42,1)
Inadequate	33 (57,9)
Consumption frequency of sweet beverages in the last month	
≥ 1 time per day	15 (26,3)
3 – 5 times per week	27 (47,4)
< 3 times per month	15 (26,3)
Consumption frequency of sweet food in the last month	
≥ 1 time per day	20 (35,1)
3 – 5 times per week	30 (52,6)
< 3 times per month	7 (12,3)

Table 2 presented a cross-tabulation between FV consumption and children's nutritional status. The finding suggests there is no association between fruit or vegetable portions consumed per week and children's nutritional status (p=0,171 and p=0,788; CI 95%, respectively).

Table 2. Association between FV consumption and children's nutritional status

Independent variables	Nutritional status		*p*-value
	Overweight/ obesity (%)	Normal weight (%)	
Fruit consumption / week			
Inadequate	19 (45,2)	23 (54,8)	0,171[a]
Adequate	4 (26,7)	11 (73,3)	
Vegetable consumption / week			
Inadequate	14 (42,4)	19 (57,6)	0,788
Adequate	9 (37,5)	15 (62,5)	

[a] based-on Fisher Exact test

The present study aims to determine the association between FV consumption and the overnutrition status among children. The FV consumption was deemed adequate if children consume at least 5 servings a day in a week (Kementerian Kesehatan RI, 2018). Children's overnutrition status was identified as overnourished if BAZ z-score > 1 SD (Cashin & Oot, 2016). Our study found that two-fifths of children were overnourished (40,4%) and more than half of the children had inadequate FV consumption. Indonesia Basic Health Research examined children aged 5-12 years who lived in Jakarta in 2007, 2013, and 2018 and observed the increasing incidence of overweight and obesity (20,4% 30,1%, and 29,2% respectively) (Indonesia Ministry of Health, 2019a; Kementerian Kesehatan RI, 2009; Kementrian Kesehatan RI, 2013). The same survey also reported the increasing incidence of overweight and obesity in Depok in 2007 and 2018 from 27,6% to 30,8% (Indonesia Ministry of Health, 2019b; Kementerian Kesehatan, 2007). A regional study conducted by Kurniawati and Fayasari in 2018 found 25,7% of obese children aged 9-11 years in Depok (Kurniawati & Fayasari, 2018). Another regional study conducted by Kristian et.al in 2019 observed the prevalence of overweight and obesity among primary school-aged children in Jakarta (17,8% and 18,3%, respectively) (Kristian et al., 2019).

Majority of children in Jakarta and West Java aged 5-9 years consumed 1-2 servings of FV per day in a week and only a few complied with the WHO recommendation (2,87% and

1,74%, respectively) (Indonesia Ministry of Health, 2019a, 2019b). Several studies suggested reasons behind children's dislike tendency toward FV consumption in terms of taste and texture. Steiner 1979 mentioned that children had innate preferences for sweet taste and dislike for bitter taste (Steiner, 1979). It was also strengthened by their taste sensitivity toward bitterness rather than sweetness (Mennella, 2014). In a view of food texture, children tend to reject food that is difficult to chew and swallow (Laureati et al., 2020). However, as age, children will undergo musculature and dentition changes (Poelman et al., 2022). In the end, children's preference toward FV consumption was expected to rise as they age.

No association was found between FV consumption adequacy and children's overnutrition status. This finding is not in line with the majority of similar studies (Anggraeni et al., 2017; Epstein et al., 2001; Nuraeni et al., 2016), however, it shares mutually reported findings with several other studies (Bayer et al., 2014; Łuszczki et al., 2019). FV contains low calories and several pivotal substances that ipso facto attenuate weight gain. Adequate consumption of FV is associated with decreased consumption of other energy-dense foods, as it replaces the amount of calorie intake and even provides a longer feeling of satiety that may control appetite (Yu et al., 2018). Satiety and appetite regulation may be attributed to high dietary fiber contents in FV, which alter through several ways. The fermented soluble fiber in the large intestine produces glucagon-like peptide (GLP-1) a peptide YY (PYY) that may induce satiety (Lattimer & Haub, 2010). Furthermore, soluble fiber can hold water and form a viscous material in gastrointestinal tract which delays digestive time and lead to longer satiety (Davidson & McDonald, 1998). Finally, food that is contained low calories and high dietary fiber like FV can manage ideal body weight.

Majority of the children in this study had parents with higher education attainment, which may contribute to a better understanding of balanced nutrition (Alderman & Headey, 2017). A previous cross-sectional study conducted among schoolchildren in Europe suggested that parental educational level was positively correlated with children's FV daily intake (Lehto et al., 2015). Another regional study conducted in Bogor reported that the higher parental education attainment, the better the children's FV intake (Mohammad & Madanijah, 2015). This can be further explained that parents with higher education may produce higher family income and be able to steadily provide fruit or vegetable at home (Ansem et al., 2017). In addition, a cohort study among parent-child dyads found that low maternal education creates a less supportive home environment by showing negative perceptions about the quality and variety of fresh fruit and vegetable (Wyse et al., 2011). An online survey conducted by Raggio and Gambaro in 2018 revealed that the unavailability of certain vegetables in family's usual menu would lead to children's preferences (Raggio & Gámbaro, 2018).

This study also captured the consumption pattern of sweet food and beverage that influence childhood obesity. Furthermore, study that involved anthropometric assessment will be better conducted with a direct measurement as it reduces error. In the end, this study implies the importance of adequate FV consumption to prevent and treat childhood obesity. It is also important to pay attention to children's sweet food and beverage consumption as it provides high energy-dense yet poor nutrition value. Family becomes the first channel for children to be introduced and obtained balanced nutrition. Parents should be better informed on the importance of childhood obesity prevention and not wait until their children become one. Balance nutrition and healthier food consumption are started from home environment.

Several explanations give details on why the present study showed no significant association between FV consumption adequacy and overnutrition. First, the number of children who consumed adequate and inadequate vegetables is slightly different, this might lead to statistically retaining the null hypothesis. Second, the current study was limited by a quite small sample, as a consequence of online data collection during the pandemic, the low engagement of potential respondents was challenging. Third, several numbers of samples on the cross-tabulation

table were under the expected value, and cause the use of Fisher Exact test which might produce low statistical power to reject the research hypothesis. However, the present study was able to determine the estimated proportion of overnutrition incidence close to established surveys.

Conclusion

In summary, a high proportion of children overnutrition was observed in this study, subsequently, the FV consumption was inadequate. However, there is no significant association was found between fruit and vegetable consumption and children's overnutrition.

There is a need for specific regulations and practices that may engage children in consuming fruit and vegetable on the daily basis. Parental support is critical to encourage children on eating more fruit and vegetable, by being role model and ensuring the healthier food choices are available at home daily. Further, when social restriction would have been eased, school environment may become channel for promoting healthier food and snacks through food available in canteen. Future research with more robust methodology and bigger sample size is needed to capture the actual association and possible mechanism of fruit and vegetable inadequate intake on causing obesity.

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