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Associations of Dietary Diversity and Other Factors with Prevalence of Stunting among Children Aged 6-35 Months

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Abstract

Prevalence of stunting among under five children in Indonesia is still considered as a public health problem. Dietary diversity, one of the important assessments in infant and child feeding practice, is one of important determinants of stunting. This study is aimed to examine associations between dietary diversity with other factors with prevalence of stunting in Babakan Madang District, Bogor Regency in 2019. A cross-sectional design study was performed in this study during April-June in 2019. A total of 149 children's height aged 6-35 months was measured and defined based on WHO growth standards. Dietary diversity scores were collected from 24-hour food recall based on 7 food groups. Results showed that the prevalence of stunting in this study was 32.2% and 31.5% of them had low dietary diversity. There was association between dietary diversity and minimum acceptable diet with stunting (p-value = 0.033 and 0.013). Therefore, interventions should be taken by improving dietary diversity to reduce the burden and prevalence of stunting in both household and community level.

Keywords: dietary diversity; stunting; children aged 6-35 months

Abstrak

Prevalensi stunting pada balita di Indonesia masih merupakan masalah kesehatan masyarakat. Keragaman pola makan sebagai salah satu asesmen penting dalam praktik pemberian makan bayi dan anak, merupakan salah satu determinan penting untuk stunting. Penelitian ini bertujuan untuk mengetahui hubungan antara keragaman pola makan dan faktor lain terhadap prevalensi stunting di Kecamatan Babakan Madang Kabupaten Bogor tahun 2019. Studi cross sectional dilakukan pada penelitian ini selama bulan April-Juni tahun 2019. Sebanyak 149 anak usia 6-35 bulan diukur tinggi badannya dan didefinisikan menggunakan standar pertumbuhan tinggi badan menurut usia dari WHO. Skor keragaman pangan dikumpulkan dari Food Recall 24 jam berdasarkan 7 kelompok pangan. Hasil penelitian menunjukkan prevalensi stunting pada penelitian ini sebesar 32,2% dan sebanyak 31.5%-nya memiliki keragaman pola makan rendah. Terdapat hubungan antara keragaman diet dan asupan minimum yang dapat diterima dengan stunting (p-value = 0.033 dan 0.013). Dengan demikian, intervensi harus dilakukan dengan meningkatkan keragaman pangan untuk mengurangi beban dan prevalensi stunting baik di tingkat rumah tangga maupun masyarakat.

Kata kunci: keanekaragaman makanan; stunting; anak usia 6-35 bulan.

Introduction

Stunting is still considered as one of the major problems in child malnutrition, especially in children under 5-years old (1). Stunting increases risk of health problems in the future such as infectious diseases, delayed cognitive development, and degenerative diseases (2,3). Nearly 30% of under 5 children in Indonesia are stunted, even though it was decreasing during the last five years. To tackle this, Indonesian Government selected first 100 prioritized cities for stunting interventions focus location, including Bogor City.

Adequate linear growth and development during conception until 2 years of life are important (4). According to Barker's (1993) theory (5), that

malnourished children since they are in the womb will increase the risk of becoming obese and experiencing non-communicable diseases in adulthood compared to normal toddlers. Dietary diversity is not only important for a child starting from they reach 6 months, but also important since they are in the womb by taking into account balanced nutrition in the fulfilment status of macro and micronutrients in pregnant women. Thus, children must receive proper nutrition and health to optimize growth, development and prevent nutrition problem, including stunting. One of the main causes of stunting in children is inadequate both quantity and quality of dietary intake, in a long term period (5). It could be related to household food insecurity and poor child feeding practices. Dietary diversity is one of the ways to assess the quality of dietary intake, alongside with meal frequency, minimum acceptable diet, breastfeeding, and others. Dietary diversity can express diverse nutrient given to the children (6). Dietary diversity itself is associated and correlated nutrient adequacy, especially in micronutrients and protein, which is associated with dietary intake and stunting (7). Higher dietary diversity has been negatively associated with stunting and other under-nutrition status. Around 40% of children in Indonesia have not met minimum dietary diversity (3). Thus, this study aimed to examine associations between dietary diversity and other factors with stunting in children aged 6-35 months. The objectives of the study were to find the prevalence of stunting among children aged 6-35 months and its association with dietary diversity and other factors.

Method

This community-based cross-sectional quantitative study was performed during April-May 2019 in Babakan Madang District, Bogor Regency. The study population consisted of children aged 6-35 years old and their mothers/caregivers selected from 6 of 9 sub-districts chosen by cluster sampling technique. A total of 149 mother-child pairs participated in this study. Data of length/height's child were collected and measured by well trained enumerators, using a digital infant meter and microtoise with a precision of 0.1 cm. Length/height data were then categorized using WHO Child Growth Standards.

Statistical analysis was supported by IBM SPSS statistics 16 with a license from Public Health Faculty Universitas Indonesia, with descriptive analysis and the relationship of independent variables with the incidence of stunting using *chi-square* for bivariate analysis. Values were deemed to be statistically significant when $p < 0.1$. Anthropometric *Z*-scores were calculated using *WHO*-Anthro; Length/Height z-scores were then classified as stunting with <-2 SD and ≥-1.999 as normal. Intake from 24-hours recall questionnaire and semi quantitative FFQ (Food Frequency Questionnaire) were interpreted using Household Dietary Diversity Score (HDDS) questionnaire to analyze food adequacy. DDS was based on 7 food groups, namely; 1) grains or staples, 2) flesh food (meat, poultry, fish, and organ meat), 3) eggs, 4) pulses or legumes or nuts, 5) vitamin-A-rich fruits and vegetables, 6) other fruits and vegetables, and 7) dairy products that were then categorized as low (<4 food groups) and high (≥4 food groups).

The independent variables of social demographics were: family income, mother's education, children gender, history of infectious disease, frequently visiting to integrated services (posyandu), and birth weight.

Result

This study included 149 children aged 6-35 months in 6 sub-districts of Babakan Madang District, Bogor Regency. 34.9% of children were within the age group 6-11 months old. Only about one fourth of mother has attained high school or above. Most of the child's family in this study (69.8%) also received income in below regional minimum wage (IDR 3,760,000) (Table 1).

Table 2 showed that 32.2% of children were stunted, and only 31.5% of the children had met minimum dietary diversity based on 7 food groups. Most of the children had met their minimum meal frequency. Combining dietary diversity and meal frequency, only 21.5% of children had achieved minimum acceptable diet. 90.6% of the children also had met minimum meal frequency. Almost all of the children (89.3%) had history of infectious disease within 3 months, such as upper respiratory tract infection/URTI and diarrhea (Table 2).

According to bivariate analyses, results showed that there is significant association between dietary diversity and stunting (p=0.033, OR=2.61, 95% CI=1.14-5.99). Children with low dietary diversity have 2.61 times higher odds of having stunting compared with children with adequate dietary diversity. This study found another significant association between minimum acceptable diet and stunting (p=0.013, OR=4.22, 95% CI=1.37-12.6) (Table 3).

Table 1. Frequencies of children aged 6-35 months based on social characteristics

Variables	n = 149	
	n	%
Age group (month)		
6-11	52	34.9
12-23	59	39.6
24-35	38	25.5
Biological sex		
Male	82	55.0
Female	67	45.0
Mother's education level		
Low	114	76.5
High	35	23.5
Family income		
Below minimum	104	69.8
Above minimum	45	30.2

Discussion

This study result showed that 32.2% of children aged 6-35 months are stunted, higher than national and province prevalence of stunting. WHO malnutrition classification also considered as high and critical (>30%). Result showed the prevalence stunting is higher in age group of 24-35 month and males than other age group and females. This may occur due to higher nutrient requirement but same child feeding and diet in older age (1). Further analysis in this study found children in older age has 5-6 times higher risk of stunting than younger age (6-11 month).

Dietary diversity and stunting

This study showed the significant association between dietary diversity and stunting (p=0.033; 95% CI=1.14-5.99; OR=2.61). Children with less diverse diet have a 2.61 higher risk of stunting. Similar study in India found negative association between dietary diversity and stunting on children (6). Another study in Africa countries showed a good and adequate

dietary diversity could give a better HAZ on children (7).

Dietary diversity is considerably a good assessment to describe good child feeding in quality. Dietary diversity ensures children is given diverse nutrients, both macronutrient and micronutrient. Meeting minimum dietary diversity as suggested can assure children is given proper energy, protein, and other micronutrients such as vitamin A, vitamin D, and iron (8). Both have important roles to achieve adequate linear growth and maintain nutritional status.

Table 2. Frequencies of nutritional status, dietary diversity, and other factors among children aged 6-35 months

Variables	Frequency (n=149)	Percentage
Height-for-age (HAZ)		
Stunted	48	32.2
Not stunted	101	67.8
Dietary diversity		
Low (<4 groups)	102	68.5
High (≥4 groups)	47	31.5
Meal frequency		
Not achieved	14	9.4
Achieved	135	90.6
Minimum aceptable diet		
Not achieved	117	78.5
Achieved	32	21.5
Energy intake		
Inadequate (<90%)	82	55.0
Adequat (≥90%)	67	45.0
Protein intake		
Inadequate (<90%)	53	36.5
Adequat (≥90%)	96	63.5
Iron intake		
Inadequate (<77%)	118	79.2
Adequat (≥77%)	31	20.8
History of infectious disease		
Yes	133	89.3
No	16	10.7
Exclusive breastfeeding		
Not exclusive	81	54.4
Exclusive	68	45.6
Frequently visiting to integrated services (posyandu)		
Not routinely visit	70	47.0
Routinely visit	79	53.0
Vitamin A supplementation		
Not given	51	34.2
Given	98	65.8
Birth weight		
Low birth weight	8	5.5
Normal birth weight	137	94.5

Table 3. Bivariate analyses and stunting among children aged 6-35 months

Variable	HAZ				*p-value*	OR (95% CI)
	Stunting		Normal			
	n	%	n	%		
Dietary diversity						
Low	39	38.2	63	61.8	**0.033***	**2.61** (1.14 – 5.99)
High	9	19.1	38	80.9		
Meal frequency						
Not achieved	4	28.6	10	71.4	0.995	0.83 (0.25 – 2.79)
Achieved	44	32.6	91	67.4		
Minimum acceptable diet						
Not achieved	44	37.6	73	62.4	**0.013***	**4.22** (1.37 – 12.6)
Achieved	4	12.5	28	87.5		
Energy intake						
Inadequate	22	26.8	60	73.2	0.168	0.58 (0.29 – 1.16)
Adequate	26	38.8	41	61.2		
Protein intake						
Inadequate	18	34.0	35	66.0	0.876	1.13 (0.88 – 2.31)
Adequate	30	30.3	66	69.7		
Iron intake						
Inadequate	35	29.7	83	70.3	0.278	0.58 (0.26 – 1.32)
Adequate	13	41.9	18	58.1		
History of infectious disease						
Yes	42	31.6	91	68.4	0.845	0.77 (0.26 – 2.26)
No	6	37.5	10	62.5		
Exclusive breastfeeding						
Not exclusive	27	32.1	54	67.9	0.932	1.06 (0.50 – 2.02)
Exclusive	21	30.9	47	69.1		
Integrated Services Post (*Posyandu*) visit						
Not routinely	28	40.0	42	60.0	0.082	1.97 (0.98 – 3.95)
Routinely	20	25.3	59	74.7		
Vitamin A Supplementation						
Not given	11	21.6	40	78.4	0.069	0.453 (0.21 – 1.00)
Given	37	37.8	61	62.2		
Birth weight						
LBW	5	62.5	3	37.5	0.149	2.99 (0.69 – 13.1)
Normal BW	49	35.8	88	64.2		
Mother's education						
Low	35	30.7	79	69.3	0.612	0.75 (0.34 – 1.66)
High	13	37.1	22	62.9		
Family income						
Below MRW	37	35.6	67	64.4	0.253	1.71 (0.78 – 3.76)
Above MRW	11	24.4	34	75.6		

Dietary diversity could describe not only food intake in quality, but also food intake in quantity, such as nutrient adequacy. An adequate nutrient adequacy could give a proper nutrient needs for development and linear growth10. Many studies confirmed significant association between DDS and nutrient adequacy, which also could describe food intake by quantity.

Studies in South Ethiopia and India suggested a medium to strong correlation between DDS and nutrient adequacies, particularly in protein and micronutrients such as iron, zinc, and vitamin B (6,9). Further analysis in this study also found higher means of protein and iron intake adequacy percentages in children with high dietary diversity and also a medium correlation between nutrient adequacy and DDS (9,10).

Proportion of children who haven't met minimum dietary diversity is higher in age group 6-11 month (88.5%), rather than older age groups. Similar result also showed in national survey in Indonesia. In addition, a study in Madagascar also found children in younger age group, particularly in aged 6-11 months, had higher risk to have less dietary diversity (11). Complementary food is first introduced in children aged 6-11 month; hence they tend not to provide diverse diet and food, compared to children in older ages. Food recall analysis found children in younger age tend to be given 1-2 food groups in the previous day, i.e. baby instant oatmeal or porridge with vegetable broth. Less diverse dietary feeding in certain age group can influence macro and micronutrient diversity and intake (12). Further analysis in this study found significant association between children's age and dietary diversity given by their caregiver.

Meal frequency and stunting

This study showed no significant association between meal frequency and stunting (p=0.995) that align with a study in countries in Africa and South Asia that also found no association between minimum meal frequency and lower risk of stunting (13,14). Meal frequency counts any liquid, semi-solid, or solid food given to child, but does not count the density or volume of each meal frequency. Most of children who had met minimum meal frequency may often to be given less dense food, i.e. formula milk, biscuits, or snack foods. Children may achieve minimum meal frequency, but have not met daily energy requirement. Children may be given different meal frequency in different days, based on physiological or psychological condition of child while given food, or caregivers' efficacy to give certain food to children (9).

Minimum acceptable diet and stunting

This study showed significant association between dietary diversity and stunting (p=0.013; 95% CI=1.37-12.6; OR=4.22) where children who have not achieved minimum acceptable diet have a 4.22 higher risk of stunting. Similar study in Bangladesh found negative association between dietary diversity and stunting on children (17). Another study in Zambia showed children who met the minimum acceptable diet dietary diversity could have better linear growth (15).

Proper child feeding practice is one of the effective strategies to lower the risk of malnutrition and stunting, and thus to achieve a better linear growth and development. A good quality of child feeding can be described well in minimum acceptable diet by assessing children's dietary diversity and meal frequency (16,17). Children who are unable to meet the minimum acceptable diet are likely to be given a less diverse diet and less energy-dense foods. An ideal child feeding quality can influence nutrient intake in children. Diverse diet and proper feeding frequency ensure children to achieve adequate amount and variety of nutrients for growth, which helps child's growth and development (11).

Conclusion

This study showed a significant association between minimum acceptable diet and stunting. Providing food diversity in daily consumption in household, and community level is needed to prevent stunting. Governments in the health sector also have to take action such as giving awareness campaigns to mothers and pregnant women, and interventions aimed at the importance of child nutrition and proper child feeding practice with routine counseling in integrated services post (posyandu).

Ethical Clearance

Ethical clearance has been reviewed and released by Ethical Commitee of Faculty of Public Health, Indonesia, issued from May 6, 2019 (No. 257/UN2/F10/PPM.0002/2019).

Conflict of Interest

There is no conflict of interests.

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References

1. (WHO, UNICEF & Group, 2018).World Health Organization. *Child stunting: Prevalence of stunting in children under 5*. (Online). cited February 8, 2019. Available from : http://apps.who.int/gho/data/ node.sdg.2-2-viz-1?lang=en.
2. (de Onis and Branca, 2016). Childhood stunting: a global perspective. *Maternal & Child Nutrition*, 2016, 12: 12–26.
3. (Victora *et al.*, 2008). Maternal and child undernutrition: consequences for adult health and human capital. *The Lancet*, 2008; 371, 340–357.
4. (Achadi, EL. 2014). Kuliah Umum : Periode Kritis 1000 Hari Pertama Kehidupan dan Dampak Jangka Panjang terhadap Kesehatan dan Fungsinya. Yogyakarta: Persagi. https://docplayer.info/168456-Periode-kritis-1000-hari-pertama-kehidupan-dan-dampak-jangka-panjang-terhadap-kesehatan-dan-fungsinya.html
5. (Environmental *et al.*, 2000) Barker, David JP., Osmond, Clive. (1993). 'Fetal, Infant, and Childhood Growth Are Predictors of Coronary Heart Disease, Diabetes, and Hypertension in Adult Men and Women'. MRC Environmental Epidemiology. Southampton General Hospital. University of Southampton. United Kindom.
6. (Aguayo *et al.*, 2016). Determinants of stunting and poor linear growth in children under 2 years of age in India: an in-depth analysis of Maharashtra's comprehensive nutrition survey. *Maternal & Child Nutrition*, 2016. 12: 121–140.
7. (Black, 2003). Operationalizing dietary diversity: a review of measurement issues and research priorities. 2003; 133(11):3911-26.
8. (UNICEF, 2012). *Programming Guide: Infant and Young Child Feeding*. New York: United Nations Children's Fund; 2012.
9. (Tegegne *et al.*, 2017). Factors associated with minimal meal frequency and dietary diversity practices among infants and young children in the predominantly agrarian society of Bale zone, Southeast Ethiopia: a community based cross sectional study. *Archives of Public Health*; 75:53
10. (FAO, 2010). Kennedy, GL, Ballard T, & Dop MC. *Guidelines for Measuring*

Household and Individual Dietary Diversity. Roma: FAO.

11. (Rakotonirainy *et al.*, 2018). Dietary diversity of 6- to 59-month-old children in rural areas of Moramanga and Morondava districts, Madagascar. *PLoS One;* 13(7).
12. (Issaka *et al.*, 2015). Comparisons of complementary feeding indicators among children aged 6–23 months in Anglophone and Francophone West African countries. Maternal & Child Nutrition; 11 Suppl 1: 1-13.
13. (Altare *et al.*, 2016). Factors Associated with Stunting among Pre-school Children in Southern Highlands of Tanzania. Journal of Tropical Pediatrics; 62:390–408.
14. (Tessema, Belachew and Ersino, 2013). Feeding patterns and stunting during early childhood in rural communities of Sidama, South Ethiopia. *Pan African Medical Journal;* 14:75.
15. (Mallard *et al.*, 2014). Dietary diversity at 6 months of age is associated with subsequent growth and mediates the effect of maternal education on infant growth in urban Zambia. *The Journal of Nutrition*; 2014; 14(11):1818–1825.
16. (Omaghomi Jemide *et al.*, 2016). Association of maternal nutrition knowledge and child feeding practices with nutritional status of children in Calabar South Local Government Area, Cross River State, Nigeria. *International Journal of Home Science*; 2016; 2(1):293-98.
17. (Mya, Kyaw and Tun, 2019). Feeding practices and nutritional status of children age 6-23 months in Myanmar: A secondary analysis of the 2015-16 Demographic and Health Survey. *PLoS One*: 2019; 14(1): e0209044.