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Association of supplementary feeding with stunting among children in Kintamani, Bangli, Bali Province

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ABSTRACT

Background and purpose: The prevalence of stunting among under-five children in Indonesia and also in Bali is high. Studies on risk factors of stunting have been widely conducted in Indonesia, however association between stunting and diet pattern is still inconsistent. The aim of this study is to examine association of supplementary feeding pattern with stunting among children aged 1-3 years.

Methods: A case control study was conducted in Bangli District. A total of 48 cases and 48 controls were selected to participate in the study. Age and sex variables between cases and controls were matched. Cases and controls were selected using a systematic random sampling method from 26 health post registers in Kintamani I Public Health Centre between November and December 2016. Data were collected in March 2017 by interviewing the mother at the health post. Data were analysed using bivariate and multivariate analysis. A logictic regression was performed to calculate adjusted odd ratio (AOR).

Results: Cases and controls were comparable for age (p=0.773), sex (p=0.219), mother's education (p=0.673) and history of infectious diseases (p=0.584). Cases and controls differed in several variables: frequency, variability and type of supplementary feeding (p=0.002, <0.001 and <0.001), family income (p=0.038), poor personal hygiene (p<0.001), environmental sanitation (p=0.022) and access to clean water (p<0.001). Our analysis showed that several variables were associated with stunting among children aged 1-3 years, which included lack of supplementary feeding variability (AOR=12.45; 95%CI: 2.25-69.71), poor personal hygiene (AOR=3.52; 95%CI: 1.03-12.03), and poor access to clean water (AOR=6.49; 95%CI: 1.61-26.19). Other variables included supplementary feeding initiation, frequency of supplementary feeding, consistency or type of supplementary feeding, sex, and family income were not associated with stunting among children aged 1-3 years.

Conclusions: Variability of supplementary feeding, personal hygiene, and access to clean water were all associated with stunting among children aged 1-3 years.

Keywords: case control, stunting, diet pattern, supplementary feeding

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INTRODUCTION

As many as 154.8 million under-five children globally were stunted in 2016, where the highest prevalence was found in Asia with a total of 87 million stunted children.[1] Indonesia is one among 17 countries that experiences double nutritional problems: malnourished (stunting and wasting) and overweight.[2] The 2013 Basic Health Survey (Riskesdas) showed that the prevalence of stunting among under-five children in Indonesia was 37.2%.[3] The prevalence of stunting in Bali Province was 32.6% while in Bangli District was 40% - ranked 2nd after the Gianyar District.[4] The nutrition surveillance conducted by Bangli District Health Office in 2015 revealed that the highest prevalence of stunting was found in working of Kintamani I Public Health Centre, with the prevalence of 44%.[5]

Studies on risk factors of stunting among children have been conducted in Indonesia, however association between diet patterns and stunting is still inconsistent. A study in Kendal–Central Java found that exclusive breastfeeding practice for six months and scores of supplementary feeding were not associated with stunting among children.[6] Similar finding was reported in a study conducted in Pati, Central Java which found that exclusive breastfeeding, initiation of supplementary feeding, and score of supplementary feeding were not associated with stunting.[7] A study in Mataram City, West Nusa Tenggara Province showed that inappropriate supplementary feeding practices increased the risk of stunting among children.[8] A study in Nepal discovered that inappropriate sources of supplementary feeding against the WHO recommendation increased the risk of stunting among children.[9] A study in Bangladesh also found that the lack of variability of supplementary feeding was associated with increased risk of stunting.[10] The aim of our study is to examine association of supplementary feeding pattern with stunting among children aged 1-3 years.

METHODS

A case control study using matching by frequency for age and sex variables was conducted in Kintamani I Public Health Centre. Sample size was calculated at

95% confidence interval with power of 80%. A total of 48 cases and 48 controls (case and control ratio is 1:1) were recruited to participate in our study. All cases (stunting) were selected using a systematic random sampling from 140 children aged 1-3 years who registered at 25 health posts in Kintamani I Public Health Centre between November and December 2016. By applying the same sampling method, controls were selected from 160 children (normal body height/length) aged 1-3 years from the same registers. Data were collected through interview at health posts. Respondents of the study were mother of the subjects who visited health post in March 2017. Written informed consent from the mother was obtained prior to data collection. Selected samples who did not attended the health post were replaced by other children who were listed in our sampling frame. Interviews were conducted by the researcher and assisted by two trained enumerators. Data about supplementary feeding consisted of feeding initiation, frequency, variability, type, concistency and exclusive breastfeeding. Other data collected included age and sex of the children, education of the mother, family income, personal hygiene, history of infections over the last three months, sanitation and access to clean water. In addition, data from the mother and child health book which included birth weight, immunization status and congenital diseases were collected.

Data were analysed using STATA SE 12.1. A logistic regression analysis was performed to calculate the adjusted odd ratio (AOR). The study protocol has been approved by the Human Research Ethics Committees of Faculty of Medicine Udayana University and Sanglah General Hospital Denpasar.

RESULTS

Table 1 presents characteristics of samples and respondents which included age and sex of the children, nutritional status, education, family income, personal hygiene, access to clean water and history of infections over the last three months. Sex and age variables between cases and controls were matched. Our analysis showed that cases and controls were comparable for age, sex, education level of the mother and history of infections over the last three months ($p>0.05$). Several variables significantly differed between cases and control which included family income, personal hygiene, environmental sanitation, and access to clean water ($p<0.05$). These variables were included in the multivariate analysis.

Table 2 depicts our bivariate analysis using chi-square test between dependent and independent variables. Several variables were found to have positive association with stunting among children which included: supplementary feeding initiation (OR=2.84; 95%CI: 1.08-7.63), frequency of supplementary feeding (OR=4.23; 95%CI: 1.51-12.54), variability of supplementary feeding sources (OR=11.95; 95%CI: 3.44-51.55) and type or concistency of supplementary feeding (OR=11.0; 95%CI: 3.44-40.96).

Our multivariate analysis showed that risk factors of stunting among children aged 1-3 years were lack of variability of supplementary feeding sources (AOR=12.45; 95%CI: 2.25-69.71), lack of access to clean water (AOR=6.49; 95%CI: 1.61-26.19) and poor personal hygiene (AOR=3.52; 95%CI: 1.03-12.03). Other variables included sex, family income, supplementary feeding initiation, frequency of supplementary feeding, type or consistency of supplementary feeding were not associated with stunting among children aged 1-3 years. These can be seen in Table 3.

DISCUSSION

Our study found that the only significant risk factor related to supplementary feeding is the variability of the feeding sources. Further analysis showed that the association of stunting and supplementary feeding variation influenced by the difference of feeding sources by age among control group of the children. We found that the variability of supplementary feeding sources was significantly different between control group aged 4-6 months and ≥7 months. The proportion of cases and controls who received rice-based supplementary feeding were 50% respectively among children aged 4-6 months. However, among children aged ≥7 months, cases mainly still received rice-based feeding (33.3%) and some received rice-based and vegetables (31.3%). Controls however received more varied sources of supplementary feeding – by combining rice, vegetables and animal protein (60.4%).

Findings of our study is consistent with a study conducted in Bangladesh which showed that there was a significant association between food variability and stunting among children aged 6-11 months (OR=1.88; 95%CI: 1.32-2.67); aged 12-23 months (OR=1.71; 95%CI: 1.52-1.92), and aged 24-59 months (OR=1.15; 95%CI: 1.11-1.19).[10] The Bangladesh study involved six areas and food variability was measured by scoring technique. Respondents were asked how many days their children were provided each out of nine available food during the previous week.[10] Our study is also consistent with other study conducted in seven countries which found that food variability was associated with nutritional status among children using height or length over age indicator.[11] Food variability may enable completion of essential nutrients among children. These essential nutrients are required to

Table 1 Characteristics of samples and respondents

Variables	Case (48) n (%)	Control (48) n (%)	p value
Age of the children (month), (mean ±SD)*	25.37±6.91	24.97±6.74	0.773
Sex of the children:			
Male	29 (60.4)	23 (47.9)	0.219
Female	19 (39.6)	25 (52.1)	
Nutritional status BW/Age:			
Overweight	1 (2.1)	0 (0.0)	0.008
Underweight	12 (25.0)	2 (4.2)	
Normoweight	35 (72.9)	46 (95.8)	
BW/Height:			
Overweight	12 (25.0)	2 (4.2)	0.014
Underweight	1 (2.1)	2 (4.2)	
Normoweight	35 (72.9)	44 (91.6)	
Mother's education:			
<Senior high graduate	31 (64.6)	29 (60.4)	0.673
≥Senior high graduate	17 (35.4)	19 (39.6)	
Family income			
<minimum regional wages	33 (68.7)	23 (47.9)	0.038
≥minimum regional wages	15 (31.3)	25 (52.1)	
Personal hygiene			
Poor	33 (68.7)	12 (25.0)	<0.001
Good	15 (31.3)	36 (75.0)	
Access to clean water			
Poor	30 (62.5)	6 (12.5)	<0.001
Good	18 (37.5)	42 (87.5)	
History of infections Diarrhoea			
Yes	9 (18.8)	7 (14.6)	0.584
No	39 (81.2)	41 (85.4)	
Acute respiratory infections			
Yes	15 (31.2)	13 (27.1)	0.653
No	33 (68.8)	35 (72.9)	

support optimum growth and development of the children both physically and mentally.[10]

Supplementary feeding initiation was not associated with stunting among children. In our study, supplementary feeding initiation was classified as appropriate if it was initiated between the age of 4-6 months and inappropriate if it was initiated at the age either <4 months or ≥7 months. This classification follows the guideline from European Society for Pediatric Gastrohepatology and Nutrion (ESPGHAN) which recommends that the appropriate age for supplementary feeding initiation is between 4 to 6 months.[12] Our finding is not consistent with a study at Sanglah General Hospital Denpasar which found that babies who initiated supplementary feeding before the age of 4 months (early initiation) were 4.7 times more likely to experience growth failure during toodler period when compared to those who initiated supplementary feeding at the age of 4-6 months. This study also found that those who initiated supplementary feeding at the age of >12 months (late initiation) were 3.6 times more likely to experience growth failure when compared to those who initiated supplementary feeding at the age 4-6 months.[13]

Our study found that frequency of supplementary feeding was not associated with stunting among children. However, our study did not measure the amount of supplementary feeding provided to the children because it was difficult to obtain such information

Table 2 Association between feeding patterns in the first year of life and stunting

Variables	Cases n (%)	Control n (%)	Crude odd ratio	95%CI	p value
Exclusive breastfeeding					
No	38 (79.2)	41 (85.4)	0.42	0.18-2.11	0.420
Yes	10 (20.8)	7 (14.6)			
Supplementary feeding initiation					
Inappropriate timing	22 (45.83)	11 (22.9)	2.84	1.08-7.63	0.020
On-time	26 (54.2	37 (77.1)			
Frequency of supplementary feeding					
Inappropriate	40 (83.3)	26 (54.2)	4.23	1.51-12.54	0.002
Appropriate	8 (16.7)	22 (45.8)			
Variability of supplementary feeding sources					
Inappropriate	44 (91.7)	23 (47.9)	11.95	3.44-51.55	<0.001
Appropriate	4 (8.3)	25 (52.1)			
Type or concistency of supplementary feeding					
Inappropriate	43 (89.6)	21 (43.8)	11.05	3.44-40.96	<0.001
Appropriate	5 (10.4)	27 (56.2)			

Table 3 Factors associated with stunting among children aged 1-3 years

Variables	Adjusted odd ratio	95%CI	p value
Sex	2.64	0.77-8.99	0.119
Family income	1.14	0.32-4.11	0.830
Access to clean water	6.49	1.61-26.19	0.009
Personal hygiene	3.52	1.03-12.03	0.044
Supplementary feeding initiation	0.35	0.07-1.70	0.198
Frequency of supplementary feeding	1.54	0.29-8.15	0.611
Variability of supplementary feeding sources	12.45	2.25-69.71	0.004
Type or concistency of supplementary feeding	3.81	0.74-19.49	0.107

retrospectively from the mother. This may influence our finding related to association between stunting and frequency of supplementary feeding. A study in Ethiopia found that frequency and the amount of supplementary feeding provided to children were associated with stunting (p=0.03). Children who consumed food of >600 ml/day were more likely to have higher score on length/age when compared to those who consumed food of <600 ml/day.[14]

Our study revealed that consistency and type of supplementary feeding were not associated with stunting among children. Our finding is consistent with a study conducted in Sumatera which discovered that there was no significant association between nutritional status among children and concistency/type of supplementary feeding (OR=0.8; 95%CI: 0.3-2.3).[15] Inappropriate consistency and type of supplementary feeding based on age of the children may influence physiological functions of kidney and digestive systems, which among babies are not completely mature. The extra workload on these immature systems might result in reduced absorption of nutrients. In a long term, this condition may lead to malnutrition among children.[16]

Other factors found to be associated with stunting is personal hygiene. Personal hygiene indicators used in our study included hand washing practices, water source used to wash plates and other dining facilities using, shower practices, the use of thong or shoes, and clean nail. Our bivariate analysis discovered that good personal hygiene practices reduced the likelihood of acquiring acute respiratory infections (OR=0.26; 95%CI: 0.08-0.76), but were not associated with diarrhea (OR=2.97;

95%CI: 0.84-11.84). Our finding is consistent with the 2007 Indonesia Basic Health Survey data which found that mothers who had children with normal nutritional status were more likely to perform good hand washing practices when compared to those who had stunted children (p<0.001).[17] Another cross-sectional study conducted in Makasar revealed that personal hygiene was significantly associated with stunting among children (p<0.001).[18]

We also found that access to clean water was associated with stunting among children. In our study, access to clean water was measured by assessing water used for drinking and cooking. Our descriptive analysis revealed that the sources of drinking and cooking water were differed between cases and controls. The majority of cases utilized rain water while controls mainly used piped water. Our interview showed that as many as 58.3% of cases did not optimally boil their water prior to consumption. Our findings are consistent with other study in Sumatera which found that families who have no access to clean water were 1.35 times more likely to have stunted children than those who have access to clean water (95%CI: 1.05-1.72).[19] Our analysis however showed that there was no significant association between access to clean water and acute upper respiratory track infections (OR=0.57; 95%CI: 0.19-1.60) and diarrhea (OR=1.37; 95%CI: 0.38-4.62). Our study found that there was no significant association between history of infections and personal hygiene or access to clean water. It can be explained that we only collected information about history of infections over the last three months whereas stunting is related to repeated infections over a long period of time.[20]

Our study found that sex of the child was not associated with stunting. This finding is not consistent with a study conducted in Libya which documented that boys were 1.28 times more likely to experience stunting than girls (95%CI: 1.05-1.55).[21] Our study revealed that family income was not a risk factor of stunting among children. This is consistent with other study conducted in Makasar City which found that there was no significant correlation between family income and stunting among children (p=0.599).[22]

Our study indicates a need for improving variability of sources of supplementary feeding, especially within the first 12 months to reduce risks of stunting. Health education related to personal hygiene in particular hand washing is also essential in order to prevent recurrent infections which contribute to growth and development of the children.

Our study has several limitations. We relied on information provided by the mother on previous diet patterns which is vulnerable to recall bias. In addition, we did not collect information on the amount of supplementary feeding provided to the children. We did not convert nutritional status of stunted children based on their parent's height either. Therefore we are unable to calculate the genetic potential height of the children and also unable to differentiate genetic or nutritional associated stunting. Lastly, we only selected children who attended health posts between November and December 2016 – indicating that our study might be vulnerable to selection bias.

CONCLUSION

The lack of variability of supplementary feeding increases the risk of stunting among children. Varied sources of supplementary feeding contribute to fulfilment of essential nutrients required by children to achieve optimum growth and development. Other factors related to supplementary feeding are also important to prevent stunting which include initiation time, frequency, and concistency or type. Personal hygiene, particularly hand washing practices, and access to clean water are risk factors of stunting among children.

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