Inappropriate Complementary Feeding Practice Increases Risk of Stunting in Children Aged 12-24 Months

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Inappropriate complementary feeding practice increases risk of stunting in children aged 12-24 months

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ABSTRACT

BACKGROUND

In 2013, the prevalence of stunting in Central Sulawesi province was 41%, which was higher than the national prevalence of 37.2%. Complementary feeding practice, infectious disease, history of exclusive breastfeeding, birth weight and birth length were assumed to contribute to the prevalence of stunting. The objective of the present study was to identify the risk factors for stunting among children aged 12 to 24 months.

METHODS

This study was conducted using a case control design. Subjects were children aged 12-24 months, consisting of 58 cases and 58 controls. Data were obtained with a body length infantometer. Data on complementary feeding practices, history of exclusive breastfeeding, and history of infectious diseases were obtained using questionnaires. Nutrient intakes were measured by semi quantitative food frequency questionnaires. Data on birth weight and birth length were obtained from the *buku KIA* (maternal and child health record). Data were analyzed by chi-square and logistic regression tests.

RESULTS

There was no difference in sex, BMI, and parental education between cases and controls (p>0.05). After controlling for history of exclusive breastfeeding and birth weight, the risk factors for stunting were inappropriate complementary feeding practice in terms of quantity and quality (OR=8.26; 95% CI: 2.69-25.44), history of diarrhea (OR=4.73; 95% CI: 1.08-20.69), birth length (OR=5.11; 95% CI: 1.69-15.46) and respiratory tract infection (OR=5.30; 95% CI: 1.03-27.23). Inappropriate complementary feeding practice was the most dominant factor for stunting.

CONCLUSION

Inappropriate complementary feeding practice increased the risk of stunting in 12-24 months old children by 8.26. This study confirms the need to scale up interventions during the first 2 years of life, including appropriate infant feeding practices.

Keywords: Stunting, complementary feeding practices, diarrhea, children 12-24 months

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INTRODUCTION

Central Sulawesi is one of the provinces with prevalence rates of stunting above the national prevalence and its stunting prevalence rate is categorized as serious.[1] The prevalence of stunting in the underfives in 2013 in Central Sulawesi was 41%, with a prevalence of stunting in the underfives in Palu City of 35.5%. Among the puskesmas (primary health centers) of Palu City, Puskesmas Sangurara has the relatively high prevalence of stunting of 50%.[2]

Complementary feeding practice is important contributes to the prevalence ofstunting. Complementary feeding that is of good quality and is quantitatively adequate is an important component in the diet of the underfives, since it contains contains macro- and micronutrients that affect linear growth.[3] The age of 6 to 24 months is one of the most critical periods for linear growth, and is also the time of peak prevalence of stunting in developing countries, because of the high dietary requirements and the limited quality and quantity of complementary feeding.[4] Complementary feeding refers to the introduction of safe and nutritious foods at the appropriate time.[5] In general, studies on complementary feeding in areas of food shortages show that fortification with micronutrients has only slight or no impact on growth. Complementary feeding may increase linear growth and decrease stunting.[6]

Complementary feeding should preferably be adequate, safe, and appropriate to the age of the child. The period of introduction of complementary feeding that is coincident with the decrease in breastfeeding is the period of peak growth failure, nutrient deficiencies, and infectious diseases in children.[7-8] According to Teshome et al.[9] too early introduction to complementary carries a 1.1-fold risk of stunting, whereas too late introduction to complementary carries a 2.2-fold risk of stunting.

The present study on complementary feeding practice in differs from previous studies, in that it evaluated complementary feeding practice in terms of serving size (portion), provision of snacks, provision of foods of animal and vegetable origin, provision of formula milk, composition of the children's meals, food preparation and storage by the mothers, maternal behavior when the children refuse to eat, provision of breastfeeding, adequacy level of energy, protein, zinc, iron, and vitamin A from the complementary feeding, all of which were lacking in the previous sudies.

Infectious diseases that are associated with linear growth are diarrhea and respiratory tract infection, and result in longterm effects in the form of growth deficit in height.[10] Infectious disease may be the cause of decreased dietary intake. Low dietary intake, decrease in nutrients as a result of vomiting, diarrhea, malabsorption and fever of long duration may cause nutrient deficiencies, and consequently infant and child growth and immune system abnormalities.[11] Stunting is associated with respiratory disease and fever, because of increased metabolic requirements and decreased dietary intake during illness.[12]

The purpose of the present study was to analyze inappropriate complementary feeding practice and infectious diseases as risk factors for stunting in children aged 12-24 months.

METHODS

Study design

The design of the study was observational with non-matched case controls. This study was conducted in the catchment area of Puskesmas Sangurara, Palu City, Central Sulawesi, from February until April 2016.

Study subjects

The subjects of this study were underfives aged 12-24 months, totaling 116 children, consisting of 58 stunted and 58 non-stunted children. The number of study subjects was calculated for an unpaired case control analytic study with categorical variables, using the following formula:

$$n_1 = n_2 = \frac{\left[Z\alpha\sqrt{2PQ} + Z\beta\sqrt{P_1Q_1 + P_2Q_2}\right]^2}{(P_1 - P_2)^2}$$

Based on the number of study subjects from previous studies using odds ratio,[13-14] the number of subjects for this study was 58 cases and 58 controls, so that the total number of subjects was 116.

The diagnosis of stunting was established by health personnel at Puskesmas Sangurara. Recruitment of the subjects was by consecutive non-random sampling. The inclusion criteria in this study were: children aged 12-24 months, having a height-to-age ratio of less than -2 SD for the cases and ≥-2 SD for the controls, with recorded birth weights and lenghts, living with both parents, and residing in the catchment area of Puskesmas Sangurara. The exclusion criteria were: children with physical or congenital disabilities, and children who were ill and had to be hospitalized during the study.

Measurements

Data on body length were obtained by means of an infantometer and were categorized into stunting and normal. Data on complementary feeding practice in terms of quality, maternal knowledge and sanitation and hygiene, history of exclusive breastfeeding, and history of infectious diseases were obtained through interviews using structured questionnaires. Data on complementary feeding practice in terms of quantity, i.e. nutrient intake from complementary feeding, were obtained using semiquantitative food frequency questionnaires. Adequacy of nutrient intakes were determined from the daily dietary intake of the children as compared with Indonesian recommended dietary allowances (IRDA). The nutrient intakes under study were adequacy level of energy, protein, zinc, iron, and vitamin A from the complementary feeding. The data on complementary feeding practice, which were obtained from 18 questions, were subsequently categorized into appropriate (total score = 1-14) and inappropriate (total score = 15-28). Data on birth weight and birth length were obtained from the *buku KIA* (maternal and child health record). Data on birth weight were categorized into low birth weight if the birth weight was <2500 grams and normal if the birth weight was ≥2500 grams. In addition, birth length was categorized as short if the birth length was <48 cm and normal if the birth length was ≥48 cm.

Data analysis

The data analysis used the chi-square test and significance level á of ≤0.05 and the odds ratio (OR). Multivariate analysis by means of multiple logistic regression was used to determine the most dominant factors for stunting.

Ethical clearance

This study obtained ethical clearance from the Ethics Commission, Faculty of Medicine, Diponegoro University, Semarang in February 2016.

RESULTS

Complementary feeding practice was evaluated from several aspects, i.e. age of introduction of complementary feeding, frequency of provision, variety, servings (portions), provision of snacks, provision of animal and vegetable foods, provision of formula milk, composition of meals, food procurement and storage by the mothers, maternal behavior when the children refuse to eat, breastfeeding, and adequacy levels of energy, protein, zinc, iron, and vitamin A from the complementary feeding. The frequency distribution based on the 18 evaluation aspects of complementary feeding practice in terms of quality and quantity, may be seen in Table 1, and the distribution of maternal knowledge and sanitation and hygiene in Table 2.

Table 1 shows the evaluation aspects of complementary feeding in terms of quality and quantity. With regard to quality, between the cases and controls there was a difference in the frequency of complementary feeding, variety, portion size, provision of snacks, provision of animal and vegetable foods, provision of formula milk, and composition of meals ($p<0.05$). With regard to quantity, between the cases and controls there was a difference in the adequacy levels for

Table 1. Distribution of complementary feeding practice in terms of quality and quantity

Complementary feeding practice	Cases (n=58)	Controls (n=58)	p
Frequency of complementary feeding			0.001
<3 times daily	32 (55.2)	14 (24.1)	
≥3 times daily	26 (44.8)	44 (75.9)	
Variety of complementary feeding			0.0001
Not varied	30 (51.7)	6 (10.3)	
Occasionally varied	24 (41.4)	17 (29.3)	
Varied	4 (6.9)	35 (60.3)	
Portion size of complementary feeding			0.0001
Less than ½ portion	13 (22.4)	1 (1.7)	
½ to ¾ portion	28 (48.3)	15 (25.9)	
One portion	17 (29.3)	42 (72.4)	
Provision of snacks			0.0001
Not provided	30 (51.7)	3 (5.2)	
Occasionally provided	18 (31.0)	13 (22.4)	
Regularly provided	10 (17.2)	42 (72.4)	
Provision of vegetable food			0.0001
Not provided	21 (36.2)	2 (3.4)	
Occasionally provided	29 (50.0)	19 (32.8)	
Regularly provided	8 (13.8)	37 (63.8)	
Provision of animal food			0.0001
Not provided	19 (32.8)	1 (1.7)	
Occasionally provided	27 (46.6)	14 (24.1)	
Regularly provided	12 (20.7)	43 (74.1)	
Provision of formula milk			0.0001
Not provided	23 (39.7)	4 (6.9)	
Occasionally provided	27 (46.6)	32 (55.2)	
Regularly provided	8 (13.8)	22 (37.9)	
Composition of meals			0.0001
Rice only	14 (24.1)	2 (3.4)	
Rice + meat or rice + vegetables	32 (55.2)	13 (22.4)	
Rice + meat + vegetables	12 (20.7)	43 (74.1)	
Adequacy level for energy			0.002
Inadequate if <90%	40 (69.0)	19 (32.8)	
Adequate if ≥90%	18 (31.0)	39 (67.2)	
Adequacy level for protein			0.0001
Inadequate if <90%	40 (69.0)	30 (51.7)	
Adequate if ≥90%	18 (31.0)	28 (48.3)	
Adequacy level for zinc			0.003
Inadequate if <90%	38 (65.5)	28 (48.3)	
Adequate if ≥90%	20 (34.5)	30 (51.7)	
Adequacy level for iron			0.0001
Inadequate if <90%	42 (72.4)	30 (51.7)	
Adequate if ≥90%	16 (27.6)	28 (48.3)	
Adequacy level for vitamin A			0.0001
Inadequate if <90%	36 (62.1)	7 (12.1)	
Adequate if ≥90%	22 (37.9)	51 (87.9)	

energy, protein, iron, zinc, and vitamin A from the complementary feeding ($p<0.05$).

Table 2 shows the evaluation aspects of complementary feeding in terms of maternal konwledge and sanitation and hygiene. With regard to maternal knowledge, there was a difference in age of introduction of complementary feeding between cases and controls ($p<0.05$). However, between cases and controls there was no difference in maternal behavior when the child refuses to eat and in breastfeeding ($p>0.05$). With regard to sanitation and hygiene, between cases

Table 2. Distribution of complementary feeding practice in terms of maternal knowledge and sanitation and hygiene

Complementary feeding practice	Cases (n=58)	Controls (n=58)	p
Age of introduction of complementary feeding			0.001
> 6 months	12 (20.7)	7 (12.1)	
< 6 months	35 (60.3)	22 (37.9)	
6 months	11 (19.0)	29 (50.0)	
Maternal behavior when child refuses to eat			0.845
Left alone	20 (34.5)	10 (17.2)	
Persuaded and served bit by bit	38 (65.5)	48 (82.8)	
Breastfeeding			0.184
None	26 (44.8)	18 (31.0)	
Regular	32 (55.2)	40 (69.0)	
Preparation of complementary food by mother			0.145
More frequently purchased from shops/market and seldom self-prepared	9 (15.5)	5 (8.6)	
Occasionally self-prepared/cooked	26 (44.8)	23 (39.7)	
Frequently self-prepared/cooked	23 (39.7)	30 (51.7)	
Storage of complementary food			0.072
Left exposed without cover	8 (13.8)	3 (5.2)	
Left exposed under cover	31 (53.4)	21 (36.2)	
Stored in a safe, clean, and covered place (eg, pantry)	19 (32.8)	34 (58.6)	

and controls there was no difference in preparation and storage of complementary food by mothers (p>0.05).

Table 3 shows that there were more children with inappropriate complementary feeding practice in the group of cases (79.3%) than in the control group (24.1%). Mothers with inappropriate complementary feeding practice carried a risk of stunting that was 12.04-fold greater than those with appropriate complementary feeding practice (OR=12.04; 95% CI: 5.02-28.89). There were more children suffering from URI in the last 2 months in the group of cases (70.7%) than in the control group (20.7%). Children suffering from URI in the last 2 months had a 9.24 times greater risk of stunting when compared with those not suffering from URI in the last 2 months (OR=9.24; 95% CI: 3.95-21.64). There were more children suffering from diarrhea in the last 2 months in the group of cases (56.9%) than in the control group (10.3%). Children suffering from diarrhea in the last 2 months had a 11.44 times greater risk of stunting when compared with those not suffering from diarrhea in the last 2 months (OR=11.44; 95% CI: 4.24-30.85). There were more children without exclusive breastfeeding in the group of cases (81.0%) than in the control group (50.0%). Children without exclusive breastfeeding had a 4.27 times greater risk of stunting when compared to children with exclusive breastfeeding (OR=4.27; 95% CI: 1.85-9.84).

Children of low birth weight had a 5.16 times greater risk of stunting in comparison with those of normal birth weight (OR=5.16; 95% CI: 1.77-15.03). Children with a birth length of <48 cm had a 6.91 times greater risk of stunting in comparison with those with a birth length of ≥48 cm (OR=6.91; 95% CI: 3.05-15.62).

The variables tested in the multiple logistic regression analyis were complementary feeding practice, history of URI, history of diarrhea, history of exclusive breastfeeding, birth weight, and birth length. The results of the multiple logistic regression analysis may been seen in Table 4. The results show that the variables that constituted risk factors for stunting in children aged 12-24 months were complementary feeding practice, history of diarrhea, history of URI, and birth length. The most dominant risk factor was inappropriate complementary feeding practice (OR=8.26; 95% CI: 2.69-25.44).

Table 3. Crude odds ratis with 95% confidence interval limits for stunting in children aged 12-24 months

Variable	Cases (%)	Controls (%)	p	OR (95% CI)
Complementary feeding practice				
Inappropriate	46 (79.3)	14 (24.1)	0.0001	12.04
Appropriate	12 (20.7)	44 (75.9)		(5.02 – 28.89)
History of upper respiratory tract infections (URI)				
Suffers from URI if attacked ≥3 times in last 2 months	41 (70.7)	12 (20.7)	0.0001	9.24 (3.95 – 21.6)
Not suffering from URI if attacked <3 times in last 2 months	17 (29.3)	46 (79.3)		
History of diarrhea				
Suffers from diarrhea if attacked ≥3 times in last 2 months	33 (56.9)	6 (10.3)	0.0001	11.44 (4.24 – 30.85)
Not suffering from URI if attacked <3 times in last 2 months	25 (43.1)	52 (89.7)		
History of exclusive breastfeeding				
No	47 (81.0)	29 (50.0)	0.001	4.27
Yes	11 (19.0)	29 (50.0)		(1.85 – 9.84)
Birth weight				
Low, <2500 gram	19 (32.8)	5 (8.6)	0.003	5.16
Normal, ≥2500 gram	39 (67.2)	53 (91.4)		(1.77 – 15.03)
Birth length				
Short, <48 cm	43 (74.1)	17 (29.3)	0.0001	6.91
Normal, ≥48 cm	15 (25.9)	41 (70.7)		(3.05 – 15.26)

DISCUSSION

The frequency of complementary feeding in children with stunting tended to be lower than in normal children. The food frequency in children with stunting was very low and several subjects were found who had only one meal daily, in contrast to normal children who had 3 to 4 meals daily. This is in line with a study in Nepal showing that a food frequency of less than 4 times daily was a risk factor of stunting, in which the children who had fewer than 4 meals daily carried a 3.60 times greater risk of stunting.[15] The majority of children with stunting did not consume a variety of foods. Several subjects consumed only complementary foods of a certain brand and breast milk since the age of 6 months until 1 year. Similar to the study in Nepal, the present study shows that children with lower than the standard food variety had a 4.06 times greater risk of stunting.[15] The portion size in children with stunting tended to be smaller than in normal children. The results of our study shows that the majority of children with stunting consumed less than ½ portion at each meal, in contrast to normal children, most of whom consumed 1 full portion at each meal. These study results also show that normal children had more frequent snacks than children with stunting. Most of the children with stunting were given a main dish of rice porridge or steamed rice,

Table 4. Results of multiple logistic regression analysis

	p	OR	95%CI	
Complementary feeding practice	0.0001	8.26	2.69	25.44
History of URI	0.046	5.30	1.03	27.24
Birth length	0.004	5.11	1.69	15.46
History of diarrhea	0.039	4.73	1.08	20.69
History of exclusive breastfeeding	0.846	5.97	0.16	4.57
Birth weight	0.215	2.84	0.55	14.78

alternated only with breastfeeding, whereas normal children were given snacks such as biscuits of two popular brands. At the age of 12-24 months, the combination of breastfeeding and main dish only is inadequate to meet the energy requirements of the children for optimal growth, for which additional feeding is required such as snacks in the form of fruits or biscuits that contain adequate amounts of nutrients.[16]

Complementary feeding practice was also viewed from the aspect of composition of the meals. Table 1 shows that the majority of subjects only consumed rice and fish without vegetables. This was due to the fact that these children did not like vegetables. Several subjects were also found to consume only rice and vegetables without fish, because they did not like fish. However, there were also subjects who consumed rice only without fish or vegetables. The parents preferred to give sugar water, tea, and even coffee to their children. Some children even received sugar water 3 times daily. The reason given by the parents was that their children did not like milk and that they could not afford to buy formula milk for their children, because of their low economic status. Some subjects were also found who were not breastfed from the age of less than 1 year.

The low adequacy level for energy was more frequent in children with stunting than in normal children. The present study is in line with a study on children aged 6-24 months in Penanggalan District, Subulussalam City, Aceh Province, which found that a low level of adequacy for energy was a risk factor of stunting. Stunting occurs more frequently in children with a low adequacy level for energy.[13]

The proportion of children with stunting was also higher in children with low adequacy level for protein. A study on children aged 2-5 years in Kenya and Nigeria found that inadequate protein intake was associated with stunting.[17] The low level of adequacy for protein in children with stunting in the our study was caused by inadequate consumption of fish, chicken, and beef, which are highly adequate sources of animal protein. Some subjects only consumed fish once weekly, chicken once a month or at longer intervals, and beef once a year. In addition, vegetable protein was also occasionally consumed, because some children did not like to consume vegetables and fruits in adequate amounts (data not presented).

The present study also shows that the proportion of children with stunting was higher in children with low adequacy levels for zinc. A study in Klungkung District in children aged 24-60 months showed that low zinc level was a risk factor of stunting. The risk of stunting in children with zinc deficiency was 16.1-fold.[18] The low adequacy level of zinc in children with stunting was caused by the low intake of foods with adequate zinc content, such as amaranth, fish and meat. The intake of iron was also exceedingly low in the group of children with stunting in comparison with normal children. This was caused by inadequate consumption of foods that are sources of iron, such as meat and fish.

Vitamin A is one of the important nutrients for growth. Vitamin A deficiency causes children to be vulnerable to disease, so that their body defenses are reduced and their dietary intake becomes irregular. Table 1 shows that the proportion of children with stunting was higher in children with low adequacy levels of vitamin A. A study in Kenya in children aged 24-35 months found that the prevalence of stunting was 50% higher in children who did not consume vitamin A supplements, in comparison with children who did.[19]

The present study found that too early or too late introduction of complementary feeding was more frequent in children with stunting than in normal children. A study in Ethiopia in children aged 0-59 months showed that children with delayed complementary feeding had a 2.2 times greater risk of stunting, whereas too early introduction of complementary feeding had a 1.1 times greater risk of stunting.[20] The role of the mothers is very important in determining the nutritional status of their children, such as when the children have their meals, the mothers should pay attention to what is consumed by the children. Some mothers only let their children cry or play

when they refuse to eat, so that the portions consumed are very small, and some subjects were even found to consume 2-3 spoonful only. This is due to the fact that their mothers do not like their children to cry when given food and are afraid that their children will vomit when forced to eat. But some mothers persuade their children when they refuse to eat by giving them the food bit by bit so that their children will consume some.

Regarding the storage of the prepared food, in the group of children with stunting the food was more frequently left exposed in the covers, whereas in normal children, the mothers more frequently stored the food in a closed and clean place such as a pantry. Storing food while letting them remain exposed may result in bacterial contamination of the food so that it may become a health hazard for the children.

Complementary feeding practice was more frequently inadequate in terms of quality and quantity, in comparison with maternal knowledge and sanitation and hygiene. The results of the present study are consistent with those of a study in Banda Aceh City on children aged 12-60 months, showing that children with inadequate complementary feeding had a 3.4 times greater risk of stunting.[14] Nutrient intake plays an essential role in the growth process of children, so that to achieve optimal growth and development, nutrient intakes have to be met. By the age of 6 months, exclusive breastfeeding does not adequately meet the nutrient requirements of the children, so that additional sources of nutrients are needed from complementary feeding.

Provision of foods with inadequate nutrient intake, exceedingly low frequency of meals and portion size constitute the main causes of poor nutritional status in children. Complementary feeding must provide sources of macro- and micronutrients that play a role in linear growth in the underfives. Food variety is also very important in maintaining the nutritional status of children. Some subjects were found to consume only a single type of food even for a period of one week. In our study area, there is a special type of vegetable dish, namely *Moringa oleifera* leaves *(daun kelor)* in coconut milk *(santan)*, which is the type of vegetable dish most frequently consumed by the children. Some children in one week consume only *kelor* leaves and rice without other foods.

Several evaluation aspects of complementary feeding practice that have been explained are essential in determining the quality and quantity of the provided complementary feeding. This is the reason why children with inappropriate complementary feeding practice have a 12.37 times greater risk of stunting. The risk of stunting in our study area was greater that that in previous studies. The prevalence of stunting may hopefully decrease to 20% (amounting to 127 million children) in 2025, which is the target of the World Health Assembly.[20] If the specific nutritional intervention package (provision to the mothers of folic acid, calcium, micronutrients, balanced protein and energy supplements, and promotion of breastfeeding and appropriate complementary feeding) will have been increased for a coverage of 90%, stunting will decrease and consequently also the mortality rate of the underfives.[21]

Children with URI in the last 2 months were more numerous in the group of cases than in the group of controls. The present study is in accord with a study in Kupang, showing that children with a history of infectious disease had a greater probability of stunting than children without a history of infectious disease. Stunting is associated with infectious disease, since during an illness the metabolic requirements increase, whereas the dietary intakes decrease, resulting in disturbed growth.[22] A history of diarrhea in the last 2 months was more frequent in the group of cases than in the group of controls. This study agrees with a study in Nepal showing that diarrhea is a risk factor of stunting, where children with diarrhea have a 7.46 times greater risk of stunting.[15] Diarrhea is associated with growth failure because of the occurrence of malabsorption of nutrients when the children have diarrhea. The age of 2 years is the age at which infectious diseases such as diarrhea carry an extremely high risk of stunting.[23]

Children without exclusive breastfeeding were more numerous in the group of cases than in the group of controls. This study is similar to a study in Ethiopia which showed that children with less than 6 months of breastfeeding had a greater risk of stunting than children with exclusive breastfeeding during the first 6 months.[24] A study in Nepal showed that children who did not receive colostrum had a 3.40 times greater risk of stunting.[13]

Low birth weight infants tend to have intrauterine growth retardation because of poor maternal nutrition. Low birth weight infants with subsequent inadequate nutrient intakes frequently have childhood infections in the growth period so that the growth of these children is retarded and ultimately results in stunting. These results are in agreement with those of a study in Semarang City, in that low birth weight is a risk factor of stunting in children aged 1-2 years. Children with a history of low birth weight have a 11.2 times greater risk of stunting than children with normal birth weight.[25] Short birth length was more frequent in the group of cases than in the group of controls. This is in line with a study conducted in Bogor District in 2013 on children aged 12 months, where it was found that birth length significantly affects stunting in children aged 12 months.[26]

The most dominant risk factor of stunting in children aged 12-24 months in Palu City, Central Sulawesi, was inappropriate complementary feeding practice in terms of quantity and quality. After controlling for the variables of history of exclusive breastfeeding and birth weight, the variables of birth length, complementary feeding practice, history of URI and history of diarrhea constituted the risk factors of stunting in children aged 12-24 months in Palu City, Central Sulawesi.

In the present study, the risk factors of stunting that were studied were only complementary feeding practice and adequacy levels of nutrients from complementary feeding, determined by means of semiquantitative FFQ. This method carries informational bias (recall bias) since it is exclusively based on the capacity to remember. Some mothers forgot what were the foods usually consumed by their children, so that they had to be questioned repeatedly.

For health personnel, there is a need for improved dissemination of information in the form of health education to mothers of underfives on the quality and quantity of complementary feeding that is appropriate for consumption by children in their growth period so that it may prevent the risk of growth failure and deficiencies of certain nutrients that may be detrimental to the development of health and mental capacity of the children. In addition, health personnel need to improve dissemination of information to mothers of underfives so that they always practice behaviors of clean and healthy living *(perilaku hidup bersih and sehat,* PHBS*)* to prevent the occurrence of infectious diseases, especially by maintaining food hygiene so that it may not be easily contaminated by bacteria.

CONCLUSION

Inappropriate complementary feeding practice was the must dominant risk factor of stunting in children aged 12-24 months old. This study confirms the need to scale up interventions during the first 2 years of life, including appropriate infant feeding practices.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest with regard to the present study.

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