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Stunting prevalence and its relationship to birth length of 18–23 months old infants in Indonesia☆

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Abstract
Objective: This study aims to examine the relationship between birth length and stunting in 18–23 months old infants in Indonesia.
Methods: This study was a cohort study after supplementing pregnant and lactating women with Moringa oleiver, iron folic acid. Several factors have been measured previously including the family characteristics, maternal conditions, breastfeeding complementary foods. Infant body weight and length were measured at age of 18–23 months ($n = 344$). All measurements were evaluated by trained field workers using standard questionnaire. Data were analyzed using bivariate and multiple logistic regression analysis.
Results: The majority of mothers aged 20–35 years, education level was < 12 years, working as housewife, infants born with normal body weight, normal length, born in health facility, fed with exclusive breast milk. Stunting prevalence was 44.2%. Bivariate analysis indicated a threshold significant relationship to stunting for family income (0.079), breastfeeding complementary feed (0.073), whereas the birth length had a significant relationship to stunting (0.048). After controlling for all potential confounding variables, birth length was the online variable to correlate with stunting ($p = 0.0233$).
Conclusion: Stunting prevalence is high at the period of 18–23 months and significantly related to birth length.

Introduction

Stunting is still a n issue for children's growth and development. The prevalence of child stunting in Indonesia remains high, at the national level around 37%. The 2019 RPJMN target is stunting at under-two children is 28%. Stunting

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decreased significantly in the Very Short status group in 2007 with 39.8%, in 2013 with 37.2% and in 2018 with 30.8%. The prevalence of Stunting in under-two children in 2013 was 32.9% while in 2018 it was 29.9%. The prevalence of stunting in toddler in 2007 was 36.8%, in 2010 it was 35.6%, in 2013 it was 37.2% and in 2018 it was 30.8%.[1]

Stunting during infancy is highly correlated with intrauterine growth retardation (IUGR). Causes of stunting in children include maternal nutritional status, maternal height and education, premature birth and birth length, exclusive breastfeeding, supplementary feeding practices, exposure to infections and other determinants such as, health care, clean drinking water and sanitation, infrastructure and services, household socioeconomic status. Community and social factors are also very important.[2]

Stunting on under-two children showed poor growth during a critical period. Stunting is determined based on Body Height at the age of ≤ -2 SD from children growth estándar according to WHO. The consequences of stunting in children are immediate and long-term including increased morbidity and mortality, decreased child development and learning capacity, increased risk of infection and non-communicable diseases in adulthood, and reduced productivity and economic ability.[3]

The reduction in the prevalence of child stunting is the first target of six goals in the Global Nutrition Target of 2025. Local food-based supplementary feeding is developed with a linear programming approach to increase the intake of problematic nutrition among Myanmar children aged 12–23 months.[4] The Government of Indonesia launched the 2017–2021 National Strategy to Accelerate Stunting Prevention (StraNas Stunting) from vision to reality. Stunting in the National Global Goals in 2030, ''end all forms of Malnutrition including Stunting on under-two children and under-five children'' by means of good nutrition, health and well-being, gender equality, clean water & sanitation. Although the prevalence has decreased, the stunting target of 28% has not been achieved. To prevent the increasing number of stunting in the future, it is necessary to do research on the determinants of stunting such as in this study that aims to examine the relationship between birth length and stunting in infants aged 18–23 months in Jeneponto Regency, South Sulawesi, Indonesia.

Method

Design

This study is a cohort study after supplementation for pregnant and lactating women with Moringa oleivera or iron folic acid.[5]

Population and study setting

The study was conducted in 6 sub-districts in Jeneponto Regency which is one of the districts in South Sulawesi with diverse topographic conditions. Some areas are highlands or mountains, and some are coastal areas and lowlands. Research subjects were children whose development was monitored from the age of 18 months to 23 months old. At the beginning of the study a total sample of 438 children were included. The reduced number of samples was due to subjects who did not meet the inclusion criteria, refused to participate, subjects moved locations to other areas so they could not be followed up again in the study. The number of samples that could be measured at 23 months was 344 children divided into 3 intervention groups, namely Iron Folate ($n = 119$), Moringa Powder ($n = 117$), and Moringa Extract ($n = 108$).

Variables

Stunting is a chronic growth disorder in children due to malnutrition for a long time, so that affected children are generally shorter in stature than children in their age. Stunting is determined based on Body Height according to Age ≤ -2 SD from standard children growth according to WHO. Several factors related to growth during infancy measured previously include family characteristics, maternal conditions during pregnancy and lactation, history of breastfeeding and complementary feeding and nutritional care during the first year of life obtained through direct interviews using research forms.

Data collection

In the next step, the height z-score is calculated according to age (BH/A). Collection of body length anthropometric data was carried out by trained personnel using 0.1 cm lengthboard. Variables in birth length were categorized as normal ($\geq$48 cm) and stunting (<48 cm). All measurements were assessed by trained field workers using a standardized questionnaire except for birth weight and length as measured by midwives.

Data analysis

To identify factors related to the Stunting incidence, a bivariate analysis was performed to select the determinants to be included in the multivariate regression. The determinants were father's education, family income, Ante Natal Care (ANC), exclusive breastfeeding, breastfeeding complementary feed, and length of birth. Multivariate logistic regression was used to identify predictor variables after controlling for confounding variables. All variables with a p value < 0.25 in the bivariate analysis were included in the model.

Results

The data shows the majority of mothers aged 20–35 years, sex of boys, education of mothers and fathers < 12 years, mothers who did not work, father's occupation as a farmer/fisherman, family income < 2 million per month. Based on the intervention group, Iron (34.6%) Moringa flour (34.0%), Moringa extract (31.4%) (Table 1).

Data shows the majority of ANC < 4 times, Parity > 1, babies get Colostrum, Mothers did not know the benefits of breast milk, Mothers did not do prelacteal, most babies were born with normal weight, normal length of body length, in health facilities, and get exclusive breastfeeding, Normal

Table 1 Characteristics of respondents according to socio demographic.

Characteristics	Frequency ($n = 344$)	Percent (%)
Maternal age		
20–35 years	247	71.8
<20 and >35 years	97	28.2
Sex		
Male	190	55.2
Female	154	44.8
Maternal education		
<12 years	239	69.5
≥12 years	105	30.5
Paternal education		
<12 years	233	67.7
≥12 years	111	32.3
Maternal job		
Working	70	20.3
Not working	274	79.7
Paternal job		
Farmer/fisherman	149	43.3
Driver/laborer	87	25.3
Public/private employee	52	15.1
Entrepreneur	47	13.7
Others	9	2.6
Monthly income		
<2 millions	252	73.3
≥2 millions	92	26.7
Intervention group		
Moringa flour	117	34.0
Moringa extract	108	31.4
Iron	119	34.6
Smoking in the house		
Yes	313	91.0
No	31	9.0

Table 2 Characteristics of infants and pregnancy and delivery history.

Variable	Frequency (n)	Percent (%)
ANC		
<4 times	216	62.8
≥4 times	128	37.2
Parity		
>1	238	68.6
1	108	31.4
Breastfeeding benefits		
Know	105	30.5
Do not know	239	69.5
Delivery process		
Normal	324	94.2
Sectio Cesaria	20	5.8
Birth place		
Health facility	314	91.3
Home	30	8.7
Post natal care		
Yes	78	22.7
No	266	77.3
Birth weight		
≥2500 g	329	95.6
<2500 g	15	4.4
Birth length		
≥48 cm	292	84.9
<48 cm	52	15.1
Pre lacteal		
Yes	82	23.8
No	262	76.2
Colostrum		
Yes	314	91.3
No	30	8.7
Breastfeeding		
Exclusive	182	52.9
Non exclusive	162	47.1
Imunisasi		
Complete	169	49.1
Less adequate	175	50.9
Complementary feed		
≥6 months	254	73.8
<6 months	90	26.2

birth process, the mother did not do PNC care, the baby gets exclusive breastfeeding, complementary feeding ≥ 6 months, immunization was incomplete. Mothers always wash their hands before preparing food (Table 2).

Bivariate analysis showed a threshold significant relationship with stunting, namely family income ($p = 0.079$) and complementary feed ($p = 0.073$). While the length of birth was significant with stunting ($p = 0.048$). After controlling for confounding, birth length was the only variable that correlated with stunting ($p < 0.023$). Children who have a Body Length (PBL) < 48 cm were 2.02 times more likely to experience stunting compared to children born with a Body Length of ≥48 cm (AOR 2.029 CI 95% (1.101–3.737) (Table 3).

Discussion

This study found that the variable birth length was the only variable that correlated with stunting. Previous factors have been identified associated with the incidence of Stunting, namely father education, family income, Ante Natal Care (ANC), exclusive breastfeeding, breastfeeding complementary feed, and body length with bivariate analysis, but after inclusion in a significant multivariate regression only body length was significant.

This is largely determined by the intake of nutrients, especially protein consumed by pregnant women. Protein is very necessary for the physical development of the fetus. The risk for growth disturbances (growth faltering) is greater in infants who have experienced previous falter, namely the state during pregnancy and prematurity. That is, body length that is far below the average birth

Table 3 Determinant factors affecting stunting.

Socio demographic features	*p*-Value	OR crude (95% CI)	*p*-Value	OR adjusted*(95% CI)
Paternal education				
<12 years	0.161	1.390 (0.877–2.203)	0.378	1.244 (0.765–2.024)
≥12 years		1.0 (reference)		1.0 (reference)
Income				
<2 millions	0.062	1600 (0.977–2.618)	0.126	1.506 (0.892–2.543)
≥2 millions		1.0 (reference)		1.0 (reference)
ANC				
<4 times	0.148	0.723(0.466–1.123)	0.159	0.724 (0.461–1.135)
≥4 times		1.0 (reference)		1.0 (reference)
Breastfeeding				
Exclusive	0.153	1.0 (reference)	0.904	1.0 (reference)
Non exclusive		0.732 (0.477–1.123)		0.967 (0.557–1.679)
Complementary feed				
<6 months	0.056	0.616 (0.375–1.013)	0.145	0.622 (0.329–1.178)
≥6 months		1.0 (reference)		1.0 (reference)
Birth length				
≥48 cm	0.035	1.0 (reference)	0.023**	1.0 (reference)
<48 cm		1.900 (1.046–3.453)		2.029 (1.101–3.737)

* Each Factor adjusted for the others. Odds ratios from univariate and multiple generalized estimation equation logistic regression models.
** Significant (CI > 1).

rate is due to growth retardation while in the womb. Growth retardation while still in the womb shows a lack of nutritional status and maternal health during pregnancy, causing the child to be born with a less length. There are many potential causes of stunted child growth in Indonesia, including nearby factors such as maternal nutritional status, breastfeeding practices, supplementary feeding practices, exposure to infections and other related determinants such as education, nutrition, health care, water and sanitation infrastructure and service.[6] Other factors that influence nutritional status are mother's education level and economic level.[7]

Espo's research results state that the strongest predictor of stunting in infants is the small birth size.[8] The disruption of linear growth begins immediately after birth and continues throughout infancy. Gandhi's research shows that neonatal length is the strongest negative predictor of HAZ and positive linear growth predictor in infants 0–12 months.[9] Different research results found by Fahmi risk factors for stunting in children aged 6–23 months in Bontoramba Sub-district, Jeneponto Regency are low birth weight, maternal height < 150 cm, and incomplete basic immunization.[10] Research conducted by Meilyasari, Ismawati (2014), and Anugraheni (2012) in Pati showed that the risk of stunting was higher for toddlers with a low birth length < 48 cm.[11]

To prevent stunting at an early age, especially at birth, pregnant women need adequate intake of macro and micro nutrients, because nutritional status at birth greatly influences the growth of subsequent infants, especially at the age of the first 2 years of life. Interventions to prevent child stunting must begin before conception by increasing nutritional status during adolescence and pregnancy and facilitating the development of healthy pregnancy, and continuing until the child is 24 months old.[12] Interventions to increase birth size can have an important role in preventing early childhood stunting. Anthropometric indicators such as stunted height are important in evaluating the health and nutritional status of children in areas with many malnutrition problems. The researcher considers that the application of anthropometric standards from the Indonesian Ministry of Health remains a top priority, because the Indonesian and WHO anthropometric standards are both the same for measuring child stunting in Indonesia.

Conclusions

We conclude that the factor associated with the occurrence of stunting is the infant birth length. Measurement of birth length is very important, so children who are born short must receive special treatment so that their body length can be corrected as soon as possible.

Conflict of interest

The authors declare no conflict of interest.

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