International Journal of Public Health Science (IJPHS)
Vol. 12, No. 3, September 2023, pp. 1093~1101
ISSN: 2252-8806, DOI: 10.11591/ijphs.v12i3.22906

Determinant factors of stunting incidence in Muara Enim Regency, South Sumatra Province

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Article Info

Article history:

Received Jan 1, 2023
Revised May 20, 2023
Accepted Jun 13, 2023

Keywords:

Birth length
Exclusive breastfeeding
Mother education
Mother height
Stunting

ABSTRACT

Early-life chronic malnutrition causes stunting. In 2021, Muara Enim Regency had a 24.8% stunting incidence, which is still higher than the stunting prevalence in South Sumatra at 24.4%. This research aims to look into the factors contributing to stunting in the Muara Enim. The study's design was cross-sectional, with a sample of children aged 6-59 months living in the Rambang sub-district of Muara Enim Regency. There are 269 children under five were selected as samples using a stratified random sampling procedure. The chi-square test and multiple logistic regression analyses were utilized for data analysis. The findings revealed that five variables, including birth length (p=0.224 OR=1.684), exclusive breastfeeding (p=0.009 and OR=2.590), mother's height (p=0.028 OR=1.834), mother's education level (p=0.001 OR=0.488), and ownership of latrine (p=0.045 OR=0.470), had a relation with stunting incidence. According to the multiple logistic regression test result, the most influential variable associated with the stunting incidence was the mother's level of education, with OR=2.369 (95% CI OR=1.376-4.078), indicating that mothers with lower levels of education were 2.37 times more likely to have children with stunting than mothers with higher levels of education.

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1. INTRODUCTION

Stunting is a disorder that results from persistent malnutrition in children from an early age [1]. Chronic undernutrition during growth and development from the beginning of life is called stunting. If a child's height is less than minus two standard deviations from the length or height of a child his age, that youngster is considered stunted [1]. The detrimental consequence of inadequate dietary intake during pregnancy and the early years is stunting, which impacts children's maximum height and cognitive capacity [2]. Stunting can harm a child's mental and physical growth and help pass on hunger and unfavorable birth outcomes to the following generation. Stunting is a sign of poor birth and care conditions, and it is connected to learning difficulties and impediments to community involvement [3].

The 2018 Indonesian Basic Health Research stated that stunting in 2018 nationally was 30.8%, consisting of 11.5% severe stunted and 19.3% stunted. In 2018 the prevalence of stunting decreased from 18.0% in 2013. Based on the 2018 Basic Health Research data, the prevalence of stunting in South Sumatra

was 33.5%, the 2019 Indonesian children nutrition status survey was 29.8%, and the 2021 Indonesia nutrition status survey was 24.4%, higher than the national stunting prevalence. The prevalence of stunting in Muara Enim Regency is among the three highest in South Sumatra, with a prevalence of 24.8% [2].

Stunting is a long-term nutritional problem that causes growth disturbances where the child's height is lower than their age (stunted). Long-term stunting in toddlers, besides being short, also results in malnutrition and impaired development of both psychomotor, cognitive, and growth and development [4]. Stunting occurs in developing countries when children are under the age of five, with the factors that cause stunting in children are three: nutrient intake, infectious diseases, and interactions between mothers and children, all of which are determined mainly by socioeconomic conditions and the level of education in the family [5]. Social factors such as education level, employment, water and sanitation, housing, and politics are some of the factors that determine stunting [6].

Apart from fulfilling adequate nutritional intake, steps in preventing stunting are essential to know the factors that cause stunting. In this study, these factors were divided into factors originating from the toddler itself, from the mother, and from environmental sanitation. This is done to be considered to overcome the problem of stunting nutrition from various aspects that cause it to improve the health status of the community and break the chain of stunting. Based on the high prevalence of stunting data, the researchers wanted to examine the determinants of stunting in Muara Enim Regency, South Sumatra.

2. METHOD

The study was conducted from October to December 2022 at the Sugih Waras Health Center's working area, specifically in the villages of Sugiwaras Barat, Pagar Agung, Kencana Mulia, and Marga Mulya, Rambang District, Muara Enim Regency, South Sumatra Province, Indonesia. This study employs a cross-sectional design. This study included children aged 6 to 59 months who lived in the working area of the Sugih Waras Health Center in the Rambang sub-district. The sample in this study is drawn from the population that meets the following criteria: aged 06-59 months, living in the working area of the Sugih Waras Health Center, Rambang sub-district, not suffering from serious infectious diseases, and parents willing to be respondents by signing an inform concern, with a minimum sample size of 269 people.

The data collected in this study included risk factors for stunting originating from individual toddlers (weight, length/height, exclusive breastfeeding, early initiation of breastfeeding, and appropriate form of food for the child's age), risk factors for stunting originating from the mother (maternal age during pregnancy, level of maternal nutrition and health knowledge, frequency of antenatal care, and parity), and risk factors for stunting originating from the environment (clean water facilities and availability of latrines).

Anthropometric data collection was carried out by direct measurement, body weight data were taken using a digital scale with an accuracy of 0.01 kg, and length/height data was taken using a length board/microtoice with an accuracy of 0.1 cm. Data other than anthropometry was obtained through interviews with samples using a questionnaire. All data collected for the study were analyzed using a chi-square statistical test and continued with logistic regression tests.

3. RESULTS AND DISCUSSION

3.1. Result

3.1.1. Stunting risk factors based on children's criteria

In this study, there were samples with a total of 269 toddlers. From the study results, it was known that 139 (51.8%) samples were female, and 130 (48.2%) were male. There were 181 (67.3%) toddlers with normal nutritional status, and 88 (32.7%) toddlers had short stature. Short stature is a condition of children whose height are 2 standard deviations or more below the mean for children of that sex and chronologic age (length/height-for-age). Table 1 shows that 2 variables have a relationship with the incidence of stunting: birth length (p=0.224 OR=1.684) and exclusive breastfeeding (p=0.009 and OR=2.590).

Among the 269 children, there were 139 (51.8%) female and 130 (48.2%) male. About 88 (32.7%) children failed to reach their growth. The risk factors based on children's criteria in the study are shown in Table 1. It shown that birth length and exclusive breastfeeding have a relationship with the incidence of stunting.

3.1.2. Stunting risk factors based on mother's criteria

The risk of stunting does not only come from the children themselves but can also come from the mother. Table 2 shows the risk factors for stunting coming from the mother. Table 2 shows that 2 variables have a relationship with the incidence of stunting: the mother's height and the mother's education level.

Table 1. Frequency distribution of stunting risk factors based on children's criteria

Variables		Nutritional status (TB/U) Short n (%)	Normal n (%)	Total n (%)	p-value	OR
Birth weight	Low-birth weight	5 (29.4)	12 (70.6)	17 (100.0)	0.921	0.819
	Normal-birth weight	83 (32.9)	169 (67.1)	252 (100.0)		
Birth length	Short <48 cm	15 (44.1)	19 (55.9)	34 (100.0)	0.224*	1.684
	Normal ≥48 cm	73 (31.1)	162 (68.9)	235 (100.0)		
Exclusive breastfeeding	Yes	76 (36.9)	130 (63.1)	206 (100.0)	0.009*	2.590
	No	12 (19.0)	51 (81.0)	63 (100.0)		
Early breastfeeding initiation (EBI)	Yes	70 (34.1)	135 (65.9)	205 (100.0)	0.377	1.383
	No	18 (28.1)	46 (71.9)	64 (100.0)		
Age-appropriate forms of food	Yes, age-appropriate	77 (32.6)	159 (67.4)	236 (100.0)	0.856	0.864
	No, not age-appropriate	11 (33.3)	22 (66.7)	33 (100. 0)		

*The p-value is greater than significant

Table 2. Frequency distribution of stunting risk factors based on mother's criteria

Variables		Nutritional status (TB/U) Short n (%)	Normal n (%)	Total n (%)	p-value	OR
Mother's height	Short	46(41.4)	65 (58.6)	111 (100.0)	0.028*	1.834
	Tall	44 (27.8)	114 (72.2)	158 (100.0)		
Mother's age during pregnancy	Not risky	69 (3 3.3)	138 (6 6.7)	207 (100.0)	1.000	0.976
	Risky	21 (3 3. 9)	41 (6 6.1)	262 (100.0)		
Mother's level of education	Low	61 (42.7)	82 (57.3)	143 (100.0)	0.001*	0.488
	High	29 (23.0)	97 (77.0)	126 (100.0)		
The level of knowledge of the mother	Low	63 (33.5)	125 (66.5)	188 (100.0)	0.866	1.092
	High	25 (30.9)	56 (69.1)	81 (100.0)		
Antenatal care (ANC) frequency	<4 times during pregnancy	21 (33.3)	42 (66.7)	63 (100.0)	1.000	0.993
	≥4 times during pregnancy	67 (32.5)	139 (67.5)	206 (100.0)		
Parity	≤2 children	50 (30.7)	113 (69.3)	163 (100.0)	0.422	0.782
	>2 children	38 (35.8)	68 (64.2)	106 (100.0)		

*The p-value is greater than significant

3.1.3. Stunting risk factors based on environmental health sanitation

Besides risk factors from mothers and children, environmental health sanitation also has a significant impact on children health that affected their health. Table 3 shows the risk factors for stunting coming from environmental health sanitation. According to this study, there is a relationship between environmental health care, namely latrine ownership (p=0.045 OR=0.470), and the risk of stunting.

Table 3. Frequency distribution of stunting risk factors based on environmental health sanitation

Variables		Nutritional status (TB/U) Short n (%)	Normal n (%)	Total n (%)	p-value	OR
Clean water facilities	None	1 (25.0)	3 (75.0)	4 (100.0)	1.000	0.659
	Exist	89 (3 3. 6)	176 (6 6. 4)	265 (100.0)		
Ownership of latrines	Yes, there are	69 (30.0)	161 (70.0)	230 (100.0)	0.045*	0.470
	None	19 (48.7)	20 (51.3)	39 (100.0)		

*The p-value is greater than significant

3.1.4. Multivariate analysis

Multiple linear regression tests were conducted to determine the strength of the relationship between independent and dependent variables, which has a linear relationship with p<0.25. Linear regression tests were carried out to create a simple logistic model to predict the stunting characteristics variables related to or influencing the prevalence of stunting in Muara Enim Regency, South Sumatra Province. The selection of candidates for multivariate analysis is shown in Table 4.

The variables are analyzed to determine which can be included in modeling analysis. After analyzing these variables, in the table above, it can be seen that 5 variables have a p-value <0.25, namely birth length, exclusive breastfeeding, mother's height, mother's education level, and latrine ownership. These variables are processed in Multivariate Analysis Modeling as follows.

Only three variables, namely, exclusive breastfeeding, mother's height, and mother's education that reached Model III out of the five variables in Model I, as shown in Table 5. Next, the variables are entered into

the Final Modeling to determine which variables are significantly associated with the incidence of stunting in children under the age of five. The result of Final Modeling of Multivariate Analysis Modeling are shown in Table 6.

Table 4. Selection of candidates for multivariate analysis

Variable	p-value	OR	Category
Birth weight	0.921	0.819	Not candidate
Birth length	0.224	1.684	Candidate
Exclusive breastfeeding	0.009	2.590	Candidate
Early breastfeeding initiation	0.377	1.383	Not candidate
Age-appropriate forms of food	0.856	0.864	Not candidate
Mother's height	0.028	1.834	Candidate
Mother's age during pregnancy	1.000	0.976	Not candidate
Mother's level of education	0.001	0.488	Candidate
Mother's level of knowledge	0.866	1.092	Not candidate
ANC	1.000	0.993	Not candidate
Parity	0.422	0.782	Not candidate
Clean water facility	1.000	0.659	Not candidate
Ownership of latrines	0.045	0.470	Candidate

The variables are analyzed to determine which can be included in modeling analysis. After analyzing these variables, in the table above, it can be seen that 5 variables have a p-value <0.25, namely birth length, exclusive breastfeeding, mother's height, mother's education level, and latrine ownership. These variables are processed in Multivariate Analysis Modeling as follows.

Table 5. Multivariate Analysis Modeling

Variable	p-value	OR
Model I		
Birth length	0.024	2.103
Exclusive breastfeeding	0.066	0.405
Mother's height	0.014	1.874
Mother's education	0.003	2.332
Ownership of latrines	0.035	2.200
Model II		
Exclusive breastfeeding	0.010	0.390
Mother's height	0.030	1.815
Mother's education	0.004	2.250
Ownership of latrines	0.060	1.997
Model III		
Exclusive breastfeeding	0.008	0.382
Mother's height	0.046	1.722
Mother's education	0.002	2.369

OR: odds ratio

Only three variables, namely, exclusive breastfeeding, mother's height, and mother's education that reached Model III out of the five variables in Model I, as shown in Table 5. Next, the variables are entered into the Final Modeling to determine which variables are significantly associated with the incidence of stunting in children under the age of five. The result of Final Modeling of Multivariate Analysis Modeling are shown in Table 6.

Table 6. Final Multivariate Analysis Model

Variable	p-value	OR	95% CI
Final modeling			
Exclusive breastfeeding	0.008	0.382	0.188–0.775
Mother's height	0.046	1.722	1.011–2.932
Mother's education	0.002	2.369	1.376–4.078

In the final modeling, the variables significantly related to the incidence of stunting under five are the mother's height, exclusive breastfeeding, and education level. Based on the Nagerkerke R-square, a value=0.116 is obtained, which means that the independent variables contained in the model can explain the

incidence of stunting by 11.6%. The most dominant variable related to the incidence of stunting is the education level of the mother with OR: 2.369 (95% CI OR: 1.376-4.078), so it can be concluded that mothers with a low education level are more at risk of stunting by 2.37 times compared to mothers with a higher education level.

3.2. Discussion

3.2.1. Stunting risk factors based on children's criteria

Stunting at birth has a long-term negative impact on children's physical, cognitive, health, and economic well-being. Birth length is an essential measure of the perinatal environment and a predictor of child growth and survival [7]. Height, particularly birth length, influences the likelihood of an infant developing developmental delays. If short toddlers do not acquire adequate nourishment, they will be unable to compensate for normal age-related growth, resulting in youngsters who are smaller than other teenagers [8]. It is an irreversible physiological, physical, and cognitive syndrome caused by poor nourishment and repeated bouts of infection beginning at conception [1], [9].

Exclusive breastfeeding is a risk factor for stunting in infants. These results are supported by previous studies showing that stunting is positively correlated with exclusive breastfeeding [10]. Exclusive breastfeeding is giving only breastfeeding to the baby from when the baby is born until the baby is six months [11]. Breast milk contains milk-digesting enzymes, so babies' digestive organs are very easy to digest and absorb breast milk. Breast milk is needed by babies to meet their nutritional needs in the first six months of life. The main ingredients of breast milk, namely carbohydrates, fats, proteins, multivitamins, water, creatinine, and minerals, are very easily digested by babies [12]. Non-exclusive breastfeeding can jeopardize children's growth and development, as well as have a detrimental impact on human resource quality. Children not exclusively breastfed have lower nutritional intake and are at risk of stunting [13]. The impact of stunted children is that they will have a lower level of intelligence, rendering them more prone to disease and, in the future, in danger of lower productivity levels. One of the most pressing issues is the large number of youngsters suffering from stunting [14].

Exclusive breastfeeding provides numerous advantages, including improving the baby's immune system and other nutrients for building and supplying energy in the required amount [14]. Early breastfeeding within the first hour of life after birth promotes proper growth in low birth-weight babies and lowers the risk of newborn death [15]. During antenatal care visits, mothers are given information, including how to breastfeed during pregnancy. The mother will be better equipped to care for her young due to this preparation [16].

From the results of data analysis in this study, it is known that the form of food according to age is unrelated to stunting. Their understanding of nutrition is fundamental to meeting the nutritional needs of their children, especially those under the age of five. Malnourished children currently suffer from malnutrition, often making them sick and preventing them from growing and developing typically [17]. Early introduction of food before the age of six months has no visible impact on the height or weight of the newborn. Therefore, giving complementary foods too early (less than six months) is dangerous for toddlers [10]. The type of food consumed affects whether there is a delay in growth even though the nutrients given are appropriate. Because toddlers are fragile regarding nutrient absorption, the diet must be adjusted to their needs and digestive level [18].

3.2.2. Stunting risk factors based on mother's criteria

Stunting at birth is caused by a variety of maternal and extra-maternal nutritional and economic issues, including (but not limited to) short maternal stature, poor maternal nutritional status, diseases during pregnancy (DM, hypertension, and anemia), failure to perform ANC, birth to teenage mothers, and failure to provide iron folate supplements during pregnancy [7], [19]–[22]. Stunted children are more vulnerable to sickness and death due to inadequate nutrition in gestation and early childhood, as well as recurrent illnesses before or after delivery [23].

Taller mothers are more likely than shorter mothers to have un-stunted children. Previous research found that the mother's height was substantially associated with stunting in children. Compared to taller women (above 160 cm), mothers less than 150 cm tall are 2.5 times more likely to produce stunted children [24]. In Tanzania, lowering a mother's height by one centimeter raises the risk of stunting by 12% [25]. Amaha *et al.* discovered that a 1 cm increase in maternal height reduced the incidence of stunting by 1% (p=0.01). This study suggests that stunting is passed down through generations, with shorter moms having stunted children who grow up to be short mothers with stunted offspring [24].

Mothers are the primary caregivers in most households in Indonesia [10]. Mothers' characteristics that can meet their children's nutritional needs are influenced by their level of education, ability to obtain information, and level of knowledge [26]. It has been established that 46% of the causes of development abnormalities are non-organic and are related to the mother's dietary habits [27], [28]. One of the essential strategies to increase children's feeding behavior and growth is maternal education. Many research findings

have proved the relevance of practical education in raising parental knowledge of the importance of improving child weight [29].

Earlier research found a significant favorable association between child development and the mother's education [30], [31]. A new WHO analysis of child growth in 14 countries found a clear link between better maternal education and a lower risk of childhood stunting. Many explanations have been advanced to explain this link. First, education enables mothers to make informed parenting decisions. Second, moms with formal education are more likely to work, allowing them to provide better meals for their children. Finally, educated women can promptly recognize different disorders and seek better health treatment [32].

3.2.3. Stunting risk factors based on children's criteria

According to this study, there is a relationship between environmental health care, namely latrine ownership (p=0.045 OR=0.470), and the risk of stunting. In this study, proper latrine ownership is another variable affecting toddlers' growth [4]. Children whose feces were disposed of through open-field defecation were more likely to be stunted. This may be attributable to a lack of access to restrooms and other sanitation-related facilities; the practice of open defecation poses grave threats to the health of populations, particularly children in developing nations, through a number of interconnected mechanisms [33].

Based on the results of this study, clean water sanitation is not a risk factor for stunting. Some sources state that it is essential to consider protected and unprotected drinking water sources. For example, protected drinking water sources include bottled water and water from processing units by local water companies (In Indonesia, it is called *perusahaan daerah air minum* or *PDAM*), but unprotected sources include river water, well water, and rainfall. A community-based clean water supply system with good sanitation and safe drinking water through a sensitive nutrition program can improve facilities [34]. The primary strategy for reducing stunting is preventing diarrhea through improved water, sanitation, and hygiene (WaSH) [35]. In addition, one way to stop stunting is for every household to practice Clean and Healthy Behavior so that the environment around their house remains clean [36].

4. CONCLUSION

There are 5 variables have a relation with the incidence of stunting; birth length, exclusive breastfeeding, mother's height, mother's education level, and ownership of a latrine. The most dominant variable related to the incidence of stunting was the mother's education level. The mothers with low educational were more at risk of stunting by 2.37 times compared to mothers with higher education.

ACKNOWLEDGEMENTS

The authors would like to thank the Ministry of Education, Culture, Research, and Technology for funding this research of the Kedaireka Matching Fund program 2022.

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