

Stunting: what are the potential risk factors?

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Abstract

Stunting in under-five years old children has negative impacts on cognitive and physical development of the children. This research aims to investigate the magnitude of odd ratio of exclusive breastfeeding, birth weight and birth length to stunting incidence in under-five children in Tilamuta District, Boalemo, Gorontalo, Indonesia. This research employs case-control design with purposive sampling. Samples are divided into two groups of case and control group with 40 samples each. The results showed that children in control group are more likely to have normal birth weight, normal birth length and are exclusively breastfed compare to case group. Meanwhile, children with low birth weight have 7.4 times risk to be stunted and children who have not exclusively breastfed have a 3.157 times risk to be stunted. Many factors contribute to stunting including exclusive breastfeeding and low birth weight.

1. Introduction

The incidence of short toddlers or commonly referred to as stunting is one of the nutritional problems experienced by toddlers in the world today. The World Health Organization (WHO) has declared the resolution of global targets on maternal and child nutrition a priority. Stunting is a condition of failure to thrive in children under five years old (infants under five years old) due to chronic malnutrition. One of the biggest barriers to human growth is childhood stunting, which affects over 162 million children under the age of five worldwide. A height that is more than two standard deviations below the median of the World Health Organization (WHO) child growth criteria is referred to as stunting, or being too short for one's age (World Health Organization, 2022a). While the definition of stunting according to the Ministry of Health is children under five with a z-score of less than -2SD/standard deviation (stunted) and less than -3SD (severely stunted) (Menteri Kesehatan Republik Indonesia, 2020).

According to WHO, the prevalence of stunted toddlers becomes a public health problem if the prevalence is 20% or more, therefore the percentage of stunted toddlers in Indonesia is still high and is a health problem that must be addressed. There are as many as 22.2% or around 150.8 million children under five in the world experiencing stunting (World Health Organization, 2022b). In 2017, more than half of the world's stunted

children came from Asia (55%) while more than a third (39%) lived in Africa. Of the 83.6 million stunted children under five in Asia, the highest proportion came from South Asia (58.7%) and the lowest proportion in Central Asia (0.9%). Data on the prevalence of stunting children under five collected by the World Health Organization released in 2018 reported that Indonesia is included in the third country with the highest prevalence in the South-East Asian Region after Timor Leste (50.5%) and India (38.4%) which is 36.4% (World Health Organization, 2022c).

The results of the 2018 Basic Health Research show the prevalence of short toddlers experienced an increase from 2016 which was 27.5%, in 2017 which was 29.6% and 30.8% in 2018. The data shows an increase of approximately 1.6% per year. Meanwhile, stunting data in 2019 from research results on the nutritional status of children under five in Indonesia showed a decrease in the prevalence of stunting by 3.1% to 27.7% (Badan Penelitian dan Pengembangan Kesehatan, 2019).

The negative impacts that can be caused by nutritional problems such as stunting, in the short term is disruption of brain development and intelligence, impaired physical growth and metabolic disorders in the body. Whereas in the long term the bad consequences that can be caused are decreased cognitive abilities and learning achievement, decreased immunity that makes

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them easy to get sick, and a high risk for the emergence of diabetes, obesity, heart and blood vessel disease, cancer, stroke and disability in old age. and uncompetitive work quality which results in low economic productivity (Kementerian Kesehatan RI, 2016).

There are several risk factors of stunting such as birth weight and exclusive breastfeeding (Takele *et al.*, 2022; Uwiringiyimana *et al.*, 2022). Children who have been exclusively breastfed are less prone to stunting compare to children who have not (Habimana and Biracyaza, 2019). In addition, low birth weight can increase the risk of stunting approximately 44.3% (Halli *et al.*, 2022). However, the extend of birth length as one of the risk factors of stunting is not clearly identified. Therefore, this research aims to investigate birth weight, birth length and exclusive breastfeeding as risk factors of stunting.

2. Materials and methods

This is a survey analytic research with case-control design. The 2 groups of samples are the case and control group with 40 samples each. Samples were obtained by using purposive sampling technique. Samples were chosen based on several criteria such as having Kartu Menuju Sehat/KMS (a special card that contains the history of anthropometry records); caregivers are willing to participate in the study; and the children were not having any congenital diseases.

Birth weight and birth length were obtained from the KMS whereas history of exclusive breastfeeding was obtained from interview with caregivers. The analysis was conducted to determine the risk factors of exclusive breastfeeding, birth weight, and birth length on the occurrence of stunting in infants in Tilamuta District, Boalemo Regency, measured using the statistical test of Odds Ratio (OR).

3. Results and discussion

3.1 Samples characteristics

Samples characteristics includes age and sex are presented in Table 1. In both the case and control group, majority of stunting children are female whereas based on age group, normal and stunting children are mostly in the 13-24 months of age. Sex and age are both risk factors of stunting (Habimana and Biracyaza, 2019; Mulyaningsih *et al.*, 2021). Being male increase the chance of suffering from stunting by 26% (Muche and Dewau, 2021). The odds of male children to be stunted range from 1.32-2.37 times higher (Tafesse *et al.*, 2021; Takele *et al.*, 2022; Uwiringiyimana *et al.*, 2022). Results from several researches showed that preterm

birth, early introduction of supplementary food, and short duration of breastfeeding in male babies, contribute to higher odds of being stunted (Central Statistical Agency and ICF, 2016; Muche and Dewau, 2021; World Health Organization, 2009).

Table 1. Samples characteristics

Samples Characteristics	Case		Control	
	n	%	n	%
Sex				
Male	1	2.5	0	0
Female	39	97.5	40	100
Total	40	100	40	100
Age (months)				
6-12	17	42.5	19	47.5
13-24	23	57.5	21	52.5
Total	40	100	40	100

Meanwhile. Looking at the age group, most of children who are suffering from stunting were within the 13-24 months age group. Children in 13-23 months age group have 141% higher odds of being stunted (Halli *et al.*, 2022) while children age 24-36 months are 2.65 times more likely to be stunted (Rahman Chowdhury *et al.*, 2022). Some potential factors that may contribute to this are increasing basic needs such as adequate nutrient intake that is in line with children growth. In this period of age, socioeconomic and biological factor play important role in determine children nutritional status (Rahman Chowdhury *et al.*, 2022).

3.2 Mothers' characteristics

Mothers' characteristics that have been observed in this research such as education and occupation status are presented in Table 2. Mothers are mostly in secondary education level and unemployed. A mother who has a higher level of education is related to her knowledge and understanding of nutrition and the types of food that are good for family consumption. Educated housewives tend to choose better quality and quantity of food compared to mothers with lower education. Maternal education and occupation have correlation with stunting (Habimana and Biracyaza, 2019; Mulyaningsih *et al.*, 2021; Vonaesch *et al.*, 2021). Having educated mothers can reduce the severity of stunting by 62% (Muche and Dewau, 2021).

Table 2. Mothers' characteristics.

Mothers' Characteristics	Case		Control	
	n	%	n	%
Educational Stages				
Primary Education	14	35	15	37.5
Secondary Education	22	55	19	47.5
Tertiary Education	4	10	6	15
Total	40	100	40	100
Occupation				
Unemployed	30	75	32	80
Employed	10	25	8	20
Total	40	100	40	100

3.3 Birth weight, birth length and exclusive breast feeding

Data of birth weight, birth length and exclusive breast feeding are presented in Table 3. It is clear that children with low birth weight and not exclusively breastfed are in the case group. Meanwhile, there is no significant difference between case and control group regarding birth length. The birth weight of the children in this study was grouped into two categories of low birth weight (LBW) and normal. Birth weight is categorized as LBW if <2500 grams and normal if ≥ 2500 grams. The results show that stunting is 7.4 times more likely in children with low birth weight than children with average birth weight. This study's results concurred with research conducted by Rosadi *et al.* (2016) that stunted children are associated with a history of LBW (p-value = 0.015). Children with a history of LBW have a 5.87 times higher chance of experiencing stunting (Rosadi *et al.*, 2016).

The study results differ from research in East Semarang District in that birth weight is not a risk factor for stunting (p = 1.000 OR = 0.64). Most subjects in the case group (93.5%) and the control group (90.3%) had average birth weight (Ni'mah and Nadhiroh, 2015). It happens because birth weight affects stunting during the first six months, then decreases until the age of 2 years. If, at the age of the first six months, the child can catch up with his growth and development, then it is likely that the child can grow to a normal height. The mother's parenting, exclusive breastfeeding and complementary foods can influence growth after six months.

The results obtained in this study is in agreement with the theory that birth weight is a potential indicator of infant growth, response to stimuli, environment, and for infant survival. Birth weight dramatically impacts a child's growth, development, and height as an adult. Babies born with low birth weight are at high risk of morbidity, mortality, infectious diseases, being

underweight, and stunting from the early neonatal period to childhood (Halli *et al.*, 2022). Children experience stunting because when in the womb, they have experienced growth retardation or stunted growth (Intra Uterine Growth Retardation/IUGR). IUGR is caused by poverty, disease, and nutritional deficiencies. It means that mothers with malnutrition from the early trimester to the end of pregnancy will give birth to LBW, which in the future, the child will be at significant risk of becoming stunted.

In developing countries, babies with low birth weight (LBW) tend to experience intrauterine growth retardation due to poor maternal nutrition and increased infection rates compared to developed countries. The impact of babies with low birth weight will continue from generation to generation. In the future, LBW children will have fewer anthropometric measurements in adulthood. Low birth weight babies accompanied by inadequate food consumption, inadequate health services and frequent infections in children during their growth period cause stunted growth and produce stunted children (Titaley *et al.*, 2019).

A baby is said to have a short birth length if they were born with a body length of less than 48 cm. Based on the results of a study of birth length with a risk of stunting, it was found that children with short birth length do not risk becoming stunted as children with normal birth length.

The data obtained in this research is in contrast with the observations obtained in research conducted by Sawitri *et al.* (2021). Birth length is a factor related to the prevalence of stunting when subjects are under-five children. The Spearman test shows it with a p-value <0.01 indicates that a birth length less than normal has a chance to suffer from stunting compared to babies born with normal body length (Sawitri *et al.*, 2021).

The observation in this study was supported by the

Table 3. Birth weight, birth length and exclusive breast feeding.

Categories	Case		Control		Statistics	
	n	%	n	%	OR	p-value
Birth weight						
Low	15	37.5	3	7.5	7.4 (1.939-28.245)	0.001
Normal	25	62.5	37	92.5		
Total	40	100	40	100		
Birth length						
Short	17	42.5	15	37.5	1.23 (0.503-3.018)	0.648
Normal	23	57.5	25	62.5		
Total	40	100	40	100		
Breastfeeding						
Exclusive	17	42.5	28	70	3.157 (1.255-7.938)	0.013
Not exclusive	23	57.5	12	30		
Total	40	100	40	100		

data obtained in the research by Swathama *et al.* (2017), the results of an analysis of the considerable risk of the baby's length at birth on the incidence of stunting obtained an OR of 4.078. It means that respondents who have children with short body lengths at birth have a 4.078 times greater risk of experiencing stunting compared to respondents who have children with average body lengths at birth (Swathma *et al.*, 2017).

This condition can occur because, in this study, the incidence of stunting was measured when the child was 6-23 months old. At the same time, the birth length was measured when the baby was born so that babies with short birth lengths have enough time and opportunity to grow and develop during this period. Due to the existence of various intervention programs, it is possible to increase the length of the baby born starting from the government program as well as better public awareness in dealing with the problem of short birth length in children.

Various efforts to improve nutrition in infants, especially to increase short birth length in infants, seem to be quite successful, so in this study, for children aged 6-23 months who were not stunted, the proportion of babies born typically was higher compared to babies born short, namely 52.1% and 46.9%.

According to WHO, exclusive breastfeeding is breastfeeding only without the addition of other liquids, be it formula milk, water, orange juice, or other additional food. Before the baby is six months old, the baby's digestive system cannot function properly, thus, they cannot eat food other than breast milk (World Health Organization, 2022c). The results show that there is a significant relationship between a history of exclusive breastfeeding and the risk of stunting in children in Tilamuta District, Boalemo Regency, where children with non-exclusive breastfeeding have 3.157 times the risk of becoming stunted compared to children with exclusive breastfeeding. The research conducted by Ni'mah and Nadhiroh (2015) supported the observation made in this study, which showed that children who did not receive exclusive breastfeeding for the first six months were higher in the stunting group (88.2%) compared to the standard group (61.8%). The Chi-Square test results showed a relationship between exclusive breastfeeding and the incidence of stunting with an OR of 4.643.

Breast milk is essential in fulfilling nutrition during the baby's growth period. Breast milk consumption also increases the baby's immune system, reducing the risk of infectious diseases. Until the age of 6 months, it is recommended that babies only consume whole breast milk. Therefore, it is essential to monitor the baby's

growth to determine whether or not enough breast milk is being given (Kementerian Kesehatan RI, 2016). Exclusive breastfeeding is a protective factor against stunting because it is possible. After all, exclusive breastfeeding affects a certain age, that is within the 0-6 months. Families who provide good parenting, especially regarding nutritional needs, will affect the nutritional status of children. Proper provision of MP-ASI to young children will reduce the risk of malnutrition because, at that age, children's nutritional needs cannot be fulfilled solely from breast milk. It should be noted that breastfeeding alone, which is too long or more than six months, is related to stunting (Rosadi *et al.*, 2016).

Exclusive breastfeeding can support baby growth, especially height because breast milk calcium is more efficiently absorbed than breast milk substitutes or formula milk. Therefore, babies who are given exclusive breastfeeding tend to have a higher height, following the growth curve compared to babies who are given formula milk. Breast milk contains more calcium and can be absorbed by the body properly to maximize growth, especially height, and avoid the risk of stunting (Donkor *et al.*, 2022).

Breast milk also has lower calcium, phosphorus, sodium, and potassium levels than formula milk, while copper, cobalt, and selenium are at higher levels (Donkor *et al.*, 2022). The content of breast milk follows the baby's needs to maximize the baby's growth, including height. Based on this, it can be ensured that the baby's needs are met and the baby's nutritional status becomes normal both in height and weight if the baby gets exclusive breastfeeding.

Hasanah's (2016) conducted a study involving 60 samples consisting of thirty children as case groups and 30 children as control cases. The significance value between exclusive breastfeeding and the incidence of stunting in children using the chi-square test showed a value of $p = 0.034$ with an OR = 0.234, which means that exclusive breastfeeding is a protective factor against stunting in children so that exclusive breastfeeding can reduce the incidence of stunting in children. Breast milk is a nutritional intake following the needs that will help the growth and development of children. Babies who don't get enough breast milk mean they have poor nutritional intake and can cause malnutrition, one of which can cause stunting.

4. Conclusion

Many factors contribute to stunting such as low birth weight and exclusive breastfeeding. Therefore, health professionals should more focus on increasing exclusive breastfeeding practices and ante-natal care services.

Conflict of interest

The authors declare no conflict of interest.

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