

Original Research Report

FACTORS THAT INFLUENCE STUNTING IN THE MARATUA DISTRICT OF BERAU, INDONESIA

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ABSTRACT

Stunting is a community health problem with significant impacts. The estimated prevalence rate of stunting was 24.4% in Indonesia and 25.7% in the Berau Regency. Stunting is a growth disorder caused by chronic malnutrition during the first 1,000 days of life. It is characterized by a height-for-age Z-score below -2 standard deviations from the child growth standards median of the World Health Organization, an insufficient growth rate, and a reduced potential final height. The contributing factors to stunting include maternal variables, as mothers are the primary caregivers. The objective of this study was to determine the factors for stunting and specifically investigate if there is a relationship between maternal employment and stunting in the Maratua District of Berau, Indonesia. This study used a cross-sectional research design. The sample size was determined using the Sample Size Calculator from the World Health Organization for a two-sided test ($\alpha = 0.05$; $\beta = 0.2$; $p_1 = 0.63$; $p_2 = 0.25$; 95% CI). The data were collected from the nutrition report and anthropometric measurements at Maratua Primary Healthcare Center. The research was carried out at the Integrated Health Posts (*Pos Layanan Terpadu/ Posyandu*) in the Maratua District. The toddlers ($n = 56$) were examined with their parental consent. Toddlers with overnutrition, obesity, and acute infectious diseases were excluded from this study. The data were processed using Chi-square and Fisher tests ($p < 0.05$). In the analysis, no significant relationship was found between stunting and maternal employment. However, the results revealed that fathers who were not fishermen had a 6.3 times greater risk of having stunted toddlers compared to fathers who worked as fishermen. Fathers with a junior high school degree showed a 6.1 times higher risk of having stunted toddlers than fathers with different educational levels. In conclusion, stunting in the Maratua District is associated with the fathers' educational attainment and employment.

Keywords: Stunting; public health; Maratua; social determinants of health; nutritional status and parenting

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Highlights:

1. This study investigated the factors contributing to stunting in a remote area, which has not received sufficient attention from key stakeholders.
2. The findings of this study can serve as a reference for the government in addressing stunting through intervention strategies that incorporate paternal roles to improve children's nutritional status.

INTRODUCTION

Stunting is a critical public health problem because it influences the quality of human resources in a generation. Stunting in toddlers is a barrier to global human development, affecting 162 million children under the age of five. A 1% increase in stunting prevalence can lead to a 3.4% decrease in gross domestic product (Helmyati et al. 2020, Nasser et al. 2022). The current prevalence of stunting in

Indonesia was reported to be 24.4%, whereas the National Medium-Term Development Plan of Indonesia aims to reduce it to 14%. There is approximately a 10% difference between the target and actual prevalence of stunting. In East Kalimantan province, the prevalence of stunting was reported to be 22.8%. Meanwhile, in Berau Regency, it was found to be 25.7%. According to the National Institute of Health Research and Development of the Indonesian Ministry of Health,

Berau Regency ranked the 5th highest in terms of stunting cases in East Kalimantan province (Ministry of Health of the Republic of Indonesia 2021).

Stunting is a linear growth disorder caused by chronic malnutrition or recurrent infectious diseases, indicated by a height-for-age Z score of less than -2 standard deviations (SD) from the Child Growth Standards median of the World Health Organization. Stunting has biological implications for the brain and neurological development, which leads to decreased cognitive function. Children who experience stunting in the first two years of life are more likely to have a non-verbal intelligence quotient (IQ) below 89, which is 4.57 times lower than the IQ of non-stunted children. This condition can cause a lack of learning achievement in children (Daracantika et al. 2021). According to a study by de Onis & Branca (2016), these disorders tend to be irreversible, affect future development, and increase the risk of degenerative diseases in adulthood. Besides affecting cognitive abilities, stunting also hinders the developmental capability of social independence. Stunting causes a deviation in the social independence of toddlers. In the long term, the quality of human resources will decline, resulting in decreased competitiveness, productivity, and income (Helmyati et al. 2020).

According to the World Health Organization (2016), various factors influence the occurrence of stunting. The direct causes of stunting include inadequate nutrient intake and infectious diseases. Stunting can also be caused by other factors, including family food safety, parenting, health services, and poor environmental health such as water and sanitation (Faiqotul 2020). One determinant of stunting is the household factor, specifically the lack of maternal employment. Approximately six out of ten female workers over the age of 15 in Indonesia work in the informal sector (Statistics Indonesia of Berau 2019). Furthermore, Statistics Indonesia of Berau (2022) reported that in 2022, 31.7% of the labor force in Berau Regency consisted of women. The effects of mothers' employment can vary widely. One of the effects is the failure to promptly prepare the children's meals and oversee their unhealthy behavior. Mothers' working hours were found to correlate with nutritional disorders in children, including obesity. Working mothers often rely on fast foods or packaged foods (Datar et al. 2014). However, many studies on stunting lack information regarding the relationship between maternal employment and stunting in extremely remote areas. Against this fact, this study aimed to examine the factors influencing stunting and determine whether there is any relationship between maternal employment and the prevalence of stunting in the Maratua district of Berau, Indonesia. Maratua is one

of the island belonging to Derawan Islands groups in Berau District, the outermost island in East Kalimantan, bordering directly with South Philippines and Sabah, East Malaysia.

MATERIALS AND METHODS

This cross-sectional study was conducted on children under five years old in the Maratua district of Berau, Indonesia. The sample size was determined using the Sample Size Calculator from the World Health Organization. A two-sided test was used for the sample size calculation ($\alpha=0.05$, $\beta=0.2$, $p_1=0.63$, $p_2=0.25$, 95% CI) (Lwanga & Lemeshow 1991). All of the participants were children under the age of five who attended the October 2022 Stunting Class at the Integrated Health Post (*Pos Layanan Terpadu/ Posyandu*). The participants ($n=56$) were randomly selected during *Posyandu* visits. Children suffering from acute infections and obesity were excluded from this study. The research was carried out after obtaining ethical clearance from the Research Ethics Committee of Universitas Padjajaran, Bandung, Indonesia (No. 831/UN6.KEP/EC/2022 on 22/8/2022).

The participants' anthropometric status was determined through weight and height measurements using a digital scale and a stadiometer. The measurement results were plotted into height-for-age curves according to the participants' sex categories (Asif et al. 2022). The participants were classified as stunted if their height measurement fell below -2 standard deviations (SD) off the height-for-age curve. Furthermore, the participants were classified based on several criteria, i.e., growth rate not aligning with their age, estimated final height falling below genetic potential, and anamnesis of nutritional problems from pregnancy to the first 1,000 days of life.

This study employed quantitative research methodologies with a descriptive-analytical approach. A hypothesis test was conducted on unpaired categorical variables. The maternal employment variable was defined as the mother's occupation, whether working from home or an office. The independent variables were analyzed in relation to the dependent variable (stunting status) using the Chi-square test if it met the test requirement, or the Fisher test if it did not, with a significance value of $p<0.05$ (Lin et al. 2015). Variables that exhibited any significant value were further analyzed using multiple logistic regression in IBM SPSS Statistics for Windows, version 23.0 (IBM Corp., Armonk, N.Y., USA).

RESULTS

Univariate analysis of factors that affect stunting

The total participants were 56 children under the age of five, with 28 toddlers having normal nutritional status and 28 toddlers experiencing stunting. The social demographic data collected from the participants are presented in Table 1. The majority of the stunted children were between the ages of 12 and 23 months (42.9%), female (75%), and lived in Bohe Silian village (46%).

Table 1. Social demographics of the study participants.

Characteristics	n	%
Sex categories		
Male	19	33.9%
Female	37	66.1%
Villages		
Teluk Harapan	13	23.2%
Payung-Payung	19	33.9%
Bohe Silian	13	23.2%
Teluk Alulu	11	19.6%
Age groups		
0–11 months	23	41.1%
12–23 months	23	41.1%
24–59 months	7	12.5%
>59 months	3	5.4%
Father's age (y.o.)		
<20	0	0.0%
20-40	48	85.7%
>40	8	14.3%
Paternal educational attainment		
Elementary school dropout	0	0.0%
Elementary school	22	39.3%
Junior high school	13	23.2%
Senior high school	13	23.2%
Diploma/bachelor's degree	8	14.3%
Paternal employment		
Fisherman	30	53.6%
Private-sector employee	14	25.0%
Civil servant	11	19.6%
Others	1	1.8%
Mother's age (y.o.)		
<20	2	3.6%
20–35	50	89.3%
>35	4	7.1%
Maternal educational attainment		
Elementary school dropout	0	0.0%
Elementary school	20	35.7%
Junior high school	14	25.0%
Senior high school	11	19.6%
Diploma/bachelor's degree	11	19.6%
Maternal employment		
Housewife	45	80.4%
Working mother	11	19.6%
Total income		
<Rp 3.412.331	44	78.6%
>Rp 3.412.331	12	21.4%

Most of the stunted children had fathers who were in their early adulthood (66.7%), had completed elementary school (57%), and worked as fishermen

(78.7%). Similarly, their mothers were mostly in early adulthood (82.1%) and had completed elementary school (39%). The majority of these mothers were housewives (92.9%). In 2021, more than 90% (92.9%) of families with stunted children had a total income below the Berau minimum wage. The minimum wage in Berau for the year 2021 was Rp 3,412,331.

Bivariate analysis of factors that affect stunting

Table 2 displays the results of the Chi-square test, indicating statistically significant relationships between stunting and several variables, including participants' villages of residence (p=0.000), maternal education (p=0.018), maternal occupation (p=0.019), paternal education (p=0.001), paternal occupation (p=0.001), and total income (p=0.009).

Table 2. Variables related to stunting among the participants.

Variables	Stunting		Total	p
	Yes	No		
Sex categories				
Male	7	12	19	0.158
Female	21	16	37	
Age groups				
0–11 months	9	14	23	0.432
12–23 months	12	11	23	
24–59 months	5	2	7	
>59 months	2	1	3	
Villages				
Teluk Harapan	5	8	13	0.000*
Payung-Payung	5	14	19	
Bohe Silian	13	0	13	
Teluk Alulu	5	6	11	
Father's age (y.o.)				
20–40	23	25	48	0.445
>40	5	3	8	
Paternal educational attainment				
Elementary school	16	6	22	0.001*
Junior high school	9	4	13	
Senior high school	2	11	13	
Diploma/bachelor's degree	1	7	8	
Paternal employment				
Fisherman	22	8	30	0.001*
Private-sector employee	4	10	14	
Civil servant	1	10	11	
Others	1	0	1	
Mother's age				
>20	2	0	2	0.223
20–35	25	25	50	
>35	1	3	4	
Maternal educational attainment				
Elementary school	11	9	20	0.018*
Junior high school	8	6	14	
Senior high school	8	3	11	
Diploma/bachelor's degree	1	10	11	

Maternal employment				0.019*
Housewife	26	19	45	
Working mother	2	9	11	
Caregiver				0.545
Mother	23	22	45	
Grandmother	0	1	1	
Combination	5	4	9	
Others	0	1	1	
Drinking water sources				0.101
Bottled water/well water/tap water	14	20	34	
Rainwater	14	8	22	
Exclusive breastfeeding				0.397
Yes	20	17	37	
No	8	11	19	
Formula feeding				0.252
Yes	17	21	38	
No	11	7	18	
Total income				0.009*
<Rp 3.412.331	26	18	44	
>Rp 3.412.331	2	10	12	

Legend: (*) indicates significant p-value.

Multivariate analysis of factors that affect stunting

A multivariate test was conducted on all the statistically significant variables from the previous bivariate analysis. This multivariate statistical analysis was multiple logistic regression utilizing IBM SPSS Statistics for Windows, version 23.0 (IBM Corp., Armonk, N.Y., USA). Table 3 indicated that two variables, i.e., paternal occupation and paternal education, were significantly associated with stunting.

Table 3. Multivariate analysis of variables that influence stunting.

Variables	p	OR	95% CI	
			Lower	Upper
Villages (1)	0.332	2.268	0.433	11.883
Low income (1)	0.361	5.604	0.138	227.035
Paternal employment				
Fisherman (1)	0.006*	0.076	0.012	0.476
Maternal employment				
Housewife (1)	0.123	0.029	0.000	2.629
Paternal education	0.073			
Paternal education (1)	0.031*	51.368	1.440	1832.969
Paternal education (2)	0.178	12.256	0.319	471.337
Paternal education (3)	0.867	0.797	0.056	11.387
Maternal education	0.106			
Maternal education (1)	0.180	0.073	0.002	3.343
Maternal education (2)	0.247	0.110	0.003	4.613
Maternal education (3)	0.158	8.161	0.443	150.245

Two significant variables identified in the initial multivariate analysis were further investigated through another multiple logistic regression (Table 4). The results showed that fathers who worked as fishermen had a 0.158 risk of having stunted children. In contrast, non-fisherman fathers had a 6.3 times greater risk of having stunted children compared to fisherman fathers. Furthermore, fathers with a junior high school degree had a 6.1 times higher risk of having stunted children in comparison to fathers with different educational attainments.

Table 4. Final multivariate analysis of variables that influence stunting.

Variables	p	OR	95% CI	
			Lower	Upper
Paternal employment				
Fisherman (1)	0.004*	0.158	0.045	0.559
Paternal education	0.007			
Paternal education (1)	0.004*	6.175	1.803	21.143
Paternal education (2)	0.119	2.642	0.78	8.952
Paternal education (3)	0.422	0.503	0.094	2.694

Legend: (*) indicates significant p-value.

DISCUSSION

The results of this study revealed an association between maternal employment and stunting in toddlers. Nevertheless, the association did not reach statistical significance in the multivariate logistic regression analysis. Perhaps this occurred because of the limited number of participants in this study. Prior research in Ecuador found that working mothers are at a 25.4-fold higher risk of having stunted toddlers compared to non-working mothers (Andrade & Gil 2023). Another study conducted by Rashad & Sharaf (2019) in Egypt discovered similar findings. According to these studies, a mother's employment is significantly related to the incidence of stunting in toddlers. This is likely due to the mother's employment affecting her availability and energy to care for the baby. Parenting involves providing nutrition to children, starting with exclusive breastfeeding and progressing to the introduction of complementary foods and toddler meals over the first two years of life. However, mothers have limited time to monitor toddlers' behavior when engaging in unhealthy habits, such as consuming unhealthy snacks and not being physically active. Consequently, many working mothers may depend on ready-to-eat meals and fast foods (Datar et al. 2014, Jakaria et al. 2022). This phenomenon was also observed in the Maratua district of Berau, Indonesia. Mothers in this area

might find instant foods and formula milk convenient for meeting their toddlers' nutritional needs.

A prior study conducted by Lee et al. (2022) revealed contrasting results compared to this study. Their investigation of children in Peru revealed no statistically significant relationship between maternal employment and the prevalence of stunting in children aged 6–36 months. The conclusion may be attributed to the fact that the working mothers in their study had adequate incomes. This is similar to earlier studies conducted in Colombia, Asia, and Africa (Jesmin et al. 2011). The working mothers had access to food, improved health facilities, and good environmental sanitation.

Another variable that affected stunting in toddlers in the Maratua district was paternal educational attainment. Fathers with a lower educational level exhibited a 6.1 times higher risk of having stunted toddlers. This result is in line with a previous study carried out in Southeast Aceh and Gianyar, Indonesia (Manggala et al. 2018, Wicaksono et al. 2021). The World Health Organization has identified lower educational levels as a predictor in their framework on stunting. Fathers with lower educational attainment may lack the knowledge required to provide proper care for their toddlers. In addition, they may be unable to afford high-quality foods because of their limited income. In the end, this condition is related to a poor food supply.

In addition to paternal educational attainment, paternal employment was associated with stunting in toddlers in the Maratua district. This study found that fishermen were less likely to have stunted children. Non-fishermen had a 6.3-fold higher risk of having stunted children compared to fishermen. This could be because fishermen had an abundant supply of fish, which is a good animal protein source with an excellent Digestible Indispensable Amino Acid Score (DIASS). Protein is an essential nutrient for the growth of children. Conversely, a different study conducted by Nurriszka et al. (2020) in Jakarta, Indonesia, yielded opposite results. Differences in sociocultural factors between Maratua and Jakarta could be the reason. In Jakarta, fishermen are associated with low-paid jobs.

According to the conceptual framework of the World Health Organization, stunting is closely associated with household and community factors. Household factors include insufficient breastfeeding and complementary feeding, poor food quality, compromised food and water safety, infections, maternal care, and inadequate toddler care. Community factors consist of education, political economy, agricultural and food systems, water, sanitation, environments, health systems,

healthcare, and sociocultural aspects (Wirth et al. 2017).

Strength and limitations

The limitation of study was that the variables affecting stunting are broad and thus had not been fully measured through the cross-sectional approach. Despite the limitations, this study provides a glimpse into the prevalence of stunting in the Maratua district of Berau, Indonesia, as well as its association with several factors such as maternal and paternal employment. Further research with a significantly larger sample size is required to examine the impact of maternal variables on stunting. In addition, this study can assist the government by offering guidance on addressing nutritional issues among toddlers, particularly those residing in fishermen's communities in Maratua. Intervention strategies should be integrated with existing programs to address stunting in children. These include improving health education for all fathers.

CONCLUSION

Maternal employment was not related to stunting in toddlers across villages of the Maratua district of Berau, Indonesia. However, stunting among toddlers correlates with fathers' low educational attainment and work status as fishermen.

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Conflict of interest

None.

Ethical consideration

The Research Ethics Committee of Universitas Padjajaran, Bandung, Indonesia, issued the ethical clearance for this study, with reference No.831/UN6.KEP/EC/2022 dated 22/8/2022.

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Author contribution

RHT contributed to the conception and design, analysis and interpretation of the data, drafting of the article, and critical revision of the article for important intellectual content. EN contributed to the conception and design, critical revision of the article for important intellectual content, and final approval of the article.

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