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Determinants of Stunting in Indonesia: Investigating Key Factors Influencing Child Growth

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Abstract

Stunting is a condition of growth failure that occurs in children, especially those under the age of five, caused by chronic poor nutritional intake and recurrent infectious diseases. Stunting is a social problem that has an impact on child development and the achievement of human resource quality. This study employed a cross-sectional design to investigate stunting in children in Tapanuli Tengah Regency, North Sumatra, Indonesia. The sample consisted of 402 children from five districts, chosen for their focus on stunting prevention. Data collection involved mother interviews and measuring children's length/height-for-age indicators. The study examined a variety of family and child characteristics, including age, gender, father's occupation, family income, birth weight, birth length, and disease history. Multiple Logistic Regression is used to analyze the determinant impact of stunting events on children under five. It was found that 23.4% of stunted children in Tapanuli Tengah Regency. The results of the study show that there was a significant influence of birth length and history of illness on the incidence of stunting. History of illness is the dominant risk factor for stunting, with an odds ratio (OR) of 1.8 with a Confidence Interval (CI) value of 1.120-2. 895. This informs that children who have a history of illness are almost 2 times more likely to be stunted than children who do not have a history of the disease. This study highlights the prevalence of stunting in Tapanuli Tengah Regency and its association with birth length and a history of illness. Interventions to combat stunting should target improving birth length and addressing children's history of illness. These findings align with existing literature on stunting in Indonesia and underscore the need for targeted interventions. Stunting remains a critical public health concern in Indonesia, necessitating context-specific efforts in Tapanuli Tengah Regency.

Keywords: *Stunting, Child Growth, Risk Factors.*

Introduction

Failure of growth in early childhood, known as stunting, will have an impact on the growth and intellectual development of children in later ages and will affect the quality of human resources. The direct causes of stunting are insufficient nutritional intake and a history of illness, while the indirect causes are very complex and encompass family socioeconomic factors, access to clean water, food availability, and the utilization of healthcare services. Stunting is a condition of chronic malnutrition in children, characterized by a shorter stature compared to normal children of the same age, and can also lead to developmental and cognitive impairments. According to UNICEF (2020), Indonesia ranked fifth in the world in terms of the highest prevalence of stunting. The results of the Integrated Indonesian Child Nutrition Status Survey (SSGBI) conducted in 2019 showed a stunting prevalence of 27.67% (Kemenkes RI, 2019). In the following two years, the 2021 SSGBI results indicated a decrease in stunting prevalence to 24.4% (Kemenkes RI, 2021). Furthermore, based on Kemenkes RI (2022) results showed a national decrease of 21.6%. Compared to the WHO target of 20% and Indonesia's target of 14% in 2014, these data highlight that the issue of stunting in Indonesian children still requires serious attention. Tapanuli Tengah Regency is one of the regencies in North Sumatra with a stunting rate of 36.32% in 2018, which has since decreased to 25.3%, slightly below the 25.8% rate for North Sumatra in 2021. In 2022, the prevalence of stunting in North Sumatra decreased to 21.1% and slightly decreased again to 18.9% in 2023. Meanwhile, the Central Tapanuli Regency has increased to 30.5% in 2022, but it has decreased again to 23.8% in 2023 (Kemenkes RI, 2023).

The causes of stunting in young children are very complex, encompassing both direct and indirect factors. Insufficient nutritional intake, especially in the first one thousand days of life from pregnancy through the child's 24 months and continuing up to age 5, as well as a history of illness, are direct causes. Indirect factors

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include socioeconomic status, hygiene, sanitation, access to clean water, food availability, and the utilization of healthcare services. Regarding the utilization of healthcare services in

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in the community, monitoring the growth of young children at Integrated Health Posts (Posyandu) is one of the efforts to prevent growth failure in children. A range of studies have highlighted the steep impact of nutritional status on infection susceptibility and outcomes. Moghaddam et al. (2022) and Grant et al. (2022) both found a strong association between malnutrition and infection, with Moghaddam et al. (2022) specifically noting a higher risk of infection in malnourished patients. The importance of nutritional status in the context of specific infections is also evident, with (Niki et al., 2020) and (Morais et al., 2021) discussing its role in tuberculosis and COVID-19, respectively. The influence of diet and nutritional status on inflammation and immune response is a key theme in these studies, with Vaivada et al. (2020) and Morais et al. (2021) both emphasizing the need for a balanced diet to support immune function. Zajonz et al. (2021) further underscore the significance of nutritional status in the development of periprosthetic infections, particularly in the context of elective surgery. Other research, non-exclusive breastfeeding, infectious diseases, and poor sanitation as significant risk factors for stunting in children. Low birth weight and infectious diseases, particularly diarrhea and acute respiratory infections, have also been linked to stunting (Hailu et al., 2020). Thus, it is very important to know the risk factors for stunting in each region, so that interventions carried out based on risk factors will be more appropriate and faster to improve children's growth conditions as a social problem.

Literature Review

Stunting in Indonesia

Stunting is a condition in which children's growth and development are disrupted due to chronic malnutrition, recurrent infectious diseases, and lack of psychosocial stimulation. Stunting in children is one of the most significant obstacles to child development, affecting more than one hundred million children under the age of 5 globally. Stunting or children who are too short for their age, is defined as a height that is more than two standard deviations below the median of the child's growth standards (Soliman A, et al, 2021). Stunting can occur throughout childhood, but is largely determined by a child's "first 1,000 days". Stunting starts from the preconception period (which means the mother's nutritional status is very important) to the second birthday of the child. It is at this time that a child experiences the fastest phase of growth and development. Stunting occurs when a child does not have enough nutrients to grow and develop. This can be caused by poor diet alone, but is often exacerbated by illness and poor health. This is an irreversible result of inadequate nutrition and repeated attacks of infection during the first 1000 days of a child's life. Stunting has long-term impacts on individuals and society, including decreased cognitive and physical development, decreased productive capacity and poor health, as well as an increased risk of degenerative diseases such as diabetes. Globally, it is estimated that 149.2 million children under the age of 5 are stunted. In other words, 22% of children worldwide under the age of five are more likely to have poor development and learning skills, are more susceptible to non-communicable diseases, and have higher mortality rates (UNICEF, 2023).

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Risk Factors for Stunting

Stunting in children under five is associated with increased frequency and duration of diarrhea and acute respiratory infections (ARI) (Diyah Arini et al., 2020; Vita Hasta Lusiani & Atika Dhiah Anggraeni, 2021). Determinants of stunting include socioeconomic status, maternal education, exclusive breastfeeding, birth length, and sanitation (Nabilah Nurul Ilma et al., 2019; Fidyah Aminin et al., 2022). Younger children, particularly those under 24 months, are more susceptible to diarrhea and ARI (Satyajit Kundu et al., 2022). Other factors contributing to stunting include inadequate nutrition, poor hygiene practices, and environmental factors such as access to clean water and exposure to indoor air pollution (Adhar Arifuddin et al., 2023). Addressing these determinants through targeted interventions and improved healthcare access is crucial for reducing the prevalence of stunting and associated infectious diseases in children.

Growth faltering in children under five years is associated with various infectious diseases. Non-typhoidal Salmonella infection negatively impacts anthropometric outcomes (Das et al., 2021). Diarrhea and acute respiratory infections are linked to stunting (Arini et al., 2020). Intestinal parasitic infections, particularly ascariasis and giardiasis, correlate with increased risks of stunting, wasting, and being underweight (Fauziah et al., 2022).

The research conducted in Banyumas, Central Java, revealed that three factors collectively influence stunting in children aged 6-36 months, including a history of illness, food availability, and environmental sanitation. The most dominant factor is the history of illness, particularly acute respiratory infections (ARI) and diarrhea (Kusumawati et al., 2015). Another study involving Indonesian children aged 6-23 months found that not receiving exclusive breastfeeding increases the risk of stunting. The findings from this research indicate that improving breastfeeding practices and providing supplementary foods to children can enhance their nutritional status and have both short-term and long-term effects on reducing stunting and wasting (Rivami, 2023). Research in the working area of Lawawoi Health Center, Watang Pulu Subdistrict, Sidrap Regency, shows a significant relationship between exclusive breastfeeding, complementary feeding, and family knowledge and the incidence of stunting (Sastria et al., 2019). A study conducted in 2018 on stunted children aged 25-60 months in Sukorejo Subdistrict, Blitar City, revealed low energy intake in 93.5% of cases, a history of illness in 80.6%, low protein intake in 45.2%, lack of exclusive breastfeeding in 32.3%, and 29.0% of mothers working. These conditions are associated with a lack of family knowledge about child nutrition (Sastria et al., 2019).

Methods

This study is a quantitative observational research with a cross-sectional design. The study population consists of all children in Tapanuli Tengah Regency. The sample size was determined using the formula developed by Lemeshow (1991).

$$n = \frac{N.Z\left(1-\frac{\alpha}{2}\right).p\ (1-p)}{Nd^2+Z\left(1-\frac{\alpha}{2}\right).p\ (1-p)}$$

The number of samples studied consisted of 402 children selected from 5 districts: Pandan District, Pinangsori District, Sarudik District, Tukka District, and Sorkam District. This selection was based on the consideration that these areas are among the focal points for addressing stunting in the stunting prevention program in Tapanuli Tengah Regency. Data collection was conducted through interviews with mothers of children using questionnaires. The incidence of stunting was determined based on the Z-score values of the length/height-for-age indicators. The length of children under 24 months of age was measured using a length measuring instrument, while the height of children aged 24-60 months was measured using a microtoise. The analysis of the relationship between family characteristics (father's job, family income) and child characteristics (birth weight, birth length, history of illness) with stunting incidence was carried out by chi-square test. Furthermore, to analyze the determinants of stunting incidence in children under five years old, multiple logistic regression analysis was carried out.

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Results

Characteristics of Children and Families

Table 1 reflects the level of stunting in the population. Based on the available data, it can be concluded that approximately 23.4% of the total sample, or 94 children are experiencing stunting. Meanwhile, the majority of children, around 76.6% or 308 children, are not experiencing stunting. This information provides an initial overview of the distribution of the stunting issue in the population and will be used as a basis for further analysis in this study.

Table 1. Distribution Of Stunting Incidence in Children Under Five

Incidence of Stunting	n = 402	%
Stunted	94	23,4
Not Stunted	308	76,6

Table 2 offers a comprehensive overview of the characteristics of children and their families in a study involving 402 respondents. The data reveals that the majority of respondents have children aged 1-3 years (56.7%), with a steep percentage in the 4-6 years age group (25.9%) and 6-11 months (16.7%). In contrast, the 1-5 months age group constitutes a smaller percentage (0.7%) of the sample. Gender distribution is nearly balanced, with females accounting for 53.2% and males for 46.8% of the sample. The paternal occupations are diverse, with a substantial portion of fathers working as civil servants (47.3%) and self-employed individuals (25.9%). Some are employed in the private sector (18.7%), while others have various occupations (8.2%). Family income data indicates that the majority of families have income levels below the Central Tapanuli District Minimum Wage (73.9%), while 26.1% have incomes equal to or higher than the Central Tapanuli District Minimum Wage.

When it comes to birth characteristics, most children in the sample had a normal birth weight (96.8%), while a smaller percentage of children had a low birth weight (3.2%). Additionally, birth length data reveals that 79.1% of children in the sample had a normal birth length, while 20.9% had a shorter birth length. Lastly, the history of illness of the children shows that approximately 36.3% have a history of illness, while the majority (64.7%) have no reported history of illness. These characteristics provide researchers with valuable insights into the diversity within the sample and serve as a foundation for further analysis, allowing for a better understanding of potential factors associated with stunting and other health-related outcomes in this population

Table 2. Distribution of Characteristics of Children and Families

Characteristics		n = 402	%
Child's Age	1-5 month	3	0,7
	6-11 month	67	16,7
	1-3 month	228	56,7
	4-6 month	104	25,9
Gender	Female	214	53,2
	Male	188	46,8
Father's work	Private Sector	75	18,7
	Entrepreneurship	104	25,9
	Civil Servant	190	47,3
	Others	33	8,2
Family Income	>= District Minimum Wage	105	26,1
	< District Minimum Wage	297	73,9
Birth Weight	Low	13	3,2
	Normal	389	96,8
Birth Length	Low	84	20,9

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	Normal	318	79,1
History of Illness	with a history of illness	146	36,3
	without a history of illness	256	64,7

Table 3 presents data on the history of illness of children based on two different age categories. The two observed age categories are 0-24 months and 25-59 months. From the table, it can be observed that out of the children in the 0-24 months age group, 74 of them (50.6%) have a history of illness, while 103 children (40.2%) in this age group do not have a history of illness. Meanwhile, in the 25-59 months age group, there are 72 children with a history of illness (49.4%), and 153 children (59.8%) in this age group do not have a history of illness.

Table 3. Distribution of Illness History by Age Group

Age Group (month)	**History of Illness**			
	with a history of illness		without a history of illness	
	n	%	N	%
0-24	74	41,8	103	58,1
25-59	72	49,4	153	59,8

Table 4 illustrates the analysis of the relationship between family characteristics and the incidence of stunting in children. The results indicate that there is an insignificant difference in the incidence of stunting among children based on their father's occupation (private, self-employed, civil servant, or other occupation). Additionally, there is a non-significant difference based on the family income level (below or equal/higher than the Central Tapanuli District Minimum Wage). The high p-values for both categories affirm that the relationship between family characteristics and the incidence of stunting is not statistically significant.

Table 4. Relationship Between Family Characteristics and the Incidence of Stunting

Family Characteristics		Incidence of Stunting				*p*
		Stunted		Not Stunted		
		n	%	N	%	
Father's Work	Private Sector	16	21,3	59	78,7	0,676
	Entrepreneurship	28	26,9	76	73,1	
	Civil Servant	41	21,6	149	78,4	
	Others	9	27,3	24	72,7	
Family Income	>= District Minimum Wage	67	22,6	230	77,4	0,601
	< District Minimum Wage	27	25,7	78	74,3	

Table 5 illustrates the results of an analysis aimed at evaluating the relationship between birth weight and the incidence of stunting in children. In this table, children are divided into two groups based on birth weight. The first group is Low Birth Weight, with 13 children in this category. In this group, 6 children (46.1%) experience stunting, while 7 children (53.9%) do not experience stunting. The second group is Normal Birth Weight, with 389 children in this category. In this group, 88 children (22.6%) experience stunting, while 301 children (77.4%) do not experience stunting. Table 8 indicates that there is no significant relationship between birth weight and the incidence of stunting in children. The high p-value (0.057) confirms the insignificance of the relationship between these two factors.

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Table 5. Relationship Between Birth Weight and the Incidence of Stunting

Birth Weight	Incidence Of Stunting				*p*
	Stunted		Not Stunted		
	n	%	n	%	
Low Birth Weight	6	46,1	7	53,9	0,057
Normal Birth Weight	88	22,6	301	77,4	

Table 6. Relationship Between Birth Length and the Incidence of Stunting

Birth Weight	Incidence Of Stunting				*p*
	Stunted		Not Stunted		
	n	%	n	%	
Low Birth length	30	10,5	254	89,5	0,003
Normal Birth length	64	54,2	54	45,8	

Table 6 demonstrates a significant relationship between birth length and the incidence of stunting in children. The low p-value (0.003) confirms the presence of a significant relationship between birth length and stunting. In the group with low birth length, approximately 10.5% of children experience stunting, while in the group with normal birth length, approximately 54.2% of children experience stunting. With the low p-value, these results indicate that birth length significantly influences the risk of stunting in the children within the study, with those born with low birth length being at a higher risk of stunting compared to those born with a normal birth length.

Table 7 illustrates a notable relationship between a history of illness and the incidence of stunting in children. The low p-value, 0.006, confirms the presence of a significant relationship between a history of sickness and stunting. In the group with a history of illness, approximately 30.8% of children experience stunting, while in the group without a history of disease, about 19.1% of children experience stunting. With the low p-value, these results indicate that a history of illness significantly influences the risk of stunting in children.

Table 7. Relationship Between a History of Illness ang the Incidence of Stunting

History Of Illness	Incidence Of Stunting				*p*
	Stunted		Not Stunted		
	n	%	n	%	
with a history of illness	45	30,8	101	69,2	0,006
without a history of illness	49	19,1	207	80,9	

The results of multiple logistic regression showed a significant influence of birth length and history of child illness on the incidence of stunting. In Table 8, it can be seen that birth length and history of illness have a significant effect on the incidence of stunting in toddlers, thus the history of childhood illness is the dominant factor affecting the incidence of stunting with an odds ratio (OR) value of 1.8 and a confidence interval (CI) value of 1,120-2,895. This shows that children who have a history of illness are almost 2 times more likely to be stunted than children who do not have a history of illness.

Table 8. Result of Multiple Logistic Regression Analysis

Variable	Coefficient (B)	p-value	Exp (B)	95% C.I for exp (B)	
				Lower	Upper
Selection I:					
Birth Weight	-0.557	0.350	0.573	0.178	1.844

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Variable	Coefficient (B)	p-value	Exp (B)	95% C.I for exp (B)	
				Lower	Upper
Birth Length	-0.711	0.009	0.491	0.288	0.839
History of illness	0.542	0.029	1.719	1.056	2.796
Constant	1.783	0.037	5.948		
Selection II:					
Birth Length	-0,745	0,006	0,475	0,280	0,806
History of illness	0,588	0,015	1,800	1,120	2,895
Constant	1,172	0,029			

Discussion

Characteristics Family and Incidence Stunting

In the analysis of family characteristics, there was no significant difference in the nutritional status of children based on their father's occupation (p = 0.676). Similarly, in the family income category, there was also no significant difference in the nutritional status of children between families with incomes above or below the Tapanuli Tengah Regency Minimum Wage (p = 0.601). These results indicate that, in this case, there is no significant relationship between the examined family characteristics and the nutritional status of toddler children based on the Height-for-Age Index. The findings of Titaley C et al (2019) that family characteristics that are risk factors for stunting are the number of children under five three or more in the family, less than 4 maternal pregnancy checks, birth weight less than 2500 g, and children aged 12-23 months, and low family economic status. Therefore, further research may be necessary to understand other factors that play a role in the incidence of stunting in toddler children in that region.

The study by Pramithasari & Sefrina (2022) supports the above findings, as it displayed no significant relationship between the number of family members, the mother's knowledge level, history of breastfeeding, and complementary feeding (MP-ASI) with the incidence of stunting in the Sampang Health Center working area. According to Tamir et al. (2022) stunting incidence is related to various variables of family characteristics such as maternal education, maternal work, and family economy, so the stunting rate reduction program must focus on improving nutrition and improving the direct and underlying causes of various consequences due to stunting.

The study titled "Mother's Knowledge Level About Nutrient Intake is Not Related to the Degree of Stunting in Children" by Sahroni in 2020 also supports these findings. The research found that mothers with good knowledge had 49% of children classified as short stature and 34.1% as very short stature. The chi-square calculation result showed a p-value of 0.075. These findings are further supported by the research by Ruswati et al. (2021), which examined the relationship between maternal knowledge and child stunting in Muarasari Sub-District and obtained a P-value of 0.221, indicating no significant relationship between maternal knowledge and the incidence of stunting in children. Therefore, the conclusion of these studies is that there is no significant relationship between the mother's knowledge level regarding nutrient intake and the degree of stunting in children.

Birth Length and Incidence Stunting

According to Sawitri et al. (2021), the length of a baby's body at birth is one of the factors that influence a child's nutritional status and growth, especially in children under the age of two. The research findings indicate a connection between birth weight and birth length with the incidence of stunting in children at the Tambak Wedi Surabaya Health Center. Regarding the strength of the relationship between birth weight and birth length with the incidence of stunting in children, babies born with short body length (less than 48 cm) have a higher risk of experiencing stunting compared to babies born with a normal or longer body length, typically around 50 cm. (Hidayati et al., 2022) also mentioned that birth length is associated with the incidence of stunting. Babies with a low birth length are at a 6.29 times higher risk of experiencing stunting than babies with a normal birth length.

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However, according to Anggraeni et al. (2020), her research findings do not support this relationship, and there is no evidence of a proven link between a baby's birth length and the incidence of stunting. This may be due to other factors, such as the child's nutritional intake during growth. Therefore, even if a child has a short body birth length, the incidence of stunting may not happen if the child' nutritional intake is well-maintained. According to Gonete et al. (2021), research results show that the odds ratio between birth length and stunting is 1.645, meaning that babies born with a short body length have a 1.65 times higher risk of causing stunting than babies born with a normal birth length. These findings align with the study by Rukmana et al. (2016) on 360 children in the city of Bogor, which found no relationship between birth length and stunting with a p-value of 0.707 ($p > 0.05$). Similarly, Hidayati et al., (2022) on 46 children in the Gebang Health Center area, Gebang District, Purworejo Regency, also did not show a connection between birth length and stunting with a p-value of 0.226 ($p > 0.05$).

Babies born with a short body length (<48 cm) are at four times the risk of experiencing stunting, with the risk occurring at 3 months and 2 years of age (Wulandari et al., 2022). Even one of the studies in Indonesia in 2021 shows that babies born with a short body length have a 5.06 times greater chance of experiencing stunting and developmental delays (Lukman et al., 2021). This indicates that birth length is significantly related to a child's growth and development. The percentage of children born with a short body length and abnormal growth is higher (66.7%) than those with a normal birth length (33.8%) (Amaliah et al., 2016). According to Hastuti et al. (2020), birth length is related to the incidence of stunting. Children born with a short birth length status have an 18 times higher chance of experiencing stunting compared to children with a normal birth length status (OR=18). Research by Krebs et al. (2022) found that a child's growth is influenced by conditions from the fetus and early birth. Birth length is a picture of growth during pregnancy that greatly determines the shape of a child's growth, especially up to the first 2 years of life.

History of Illness and Incidence Stunting

Stunting is a condition of failure to thrive in children due to malnutrition for a long time and repeated infections, which are characterized by the child's stature being shorter than normal children his age and can also cause impaired intelligence development. The prevalence of stunting in children under five varies across different regions, with rates of 37% in southern Ethiopia (Mengesha et al., 2021), 21.9% globally (Syahriani, 2020), 23% in Ogun State, Nigeria (Amoo & De Roos, 2021), 89.3% in Bushenyi district, Uganda (Mugarura et al., 2021), 27% in Punjab, Pakistan (Mahmood et al., 2020), 33.8% in Tasikmalaya Regency, Indonesia (Susanti, 2021), and 14.1% in a tertiary health center in West Bengal (Das et al., 2022). Factors associated with stunting include age, family size, wealth status, source of drinking water, undiversified diet, and household food insecurity (Mengesha et al., 2021), gender, socioeconomic factors, maternal age, maternal education level, nutritional status, and overweight (Syahriani, 2020), age, and exclusive breastfeeding (Mugarura et al., 2021), age, birth order, parental education, sanitation, and poverty (Mahmood et al., 2020), and age, gender, inappropriate feeding, working mothers, birth spacing, low birth weight, and delayed initiation of breastfeeding (Das et al., 2022). A history of chronic diarrhea and non-exclusive breastfeeding are the main risk factors to stunting in Indonesian children aged 1 to 60 months (Wicaksono et al., 2021). These findings highlight the need for targeted interventions to address the multifaceted causes of stunting in children under five. These findings highlight the need for targeted interventions to address the multifaceted causes of stunting in children under five.

Furthermore, research on children aged 24-59 months in the working area of Cepu Health Center, Blora Regency, found that low energy sufficiency, low maternal nutritional knowledge, and low family per capita income are risk factors for stunting in infants (Aini & Nugraheni, 2018). Another study conducted in Brebes Subdistrict in 2016 demonstrated that risk factors for stunting in children aged 12-24 months include low energy sufficiency, low protein sufficiency, and low zinc sufficiency. These three variables contribute to stunting by 45% (Wellina & Kartasurya, 2016).

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Conclusion

This study sheds light on the prevalence of stunting in Tapanuli Tengah Regency and its correlation with birth length and a history of illness in children. The findings underscore the significance of these factors in influencing the risk of stunting among children. Contrary to certain studies, the research highlights the substantial role of birth length as a crucial determinant of stunting in this specific region. Children born with shorter lengths are at a significantly higher risk of stunting. Additionally, the study confirms that a history of illness has a marked impact on the likelihood of stunting among children. These insights are invaluable for devising targeted interventions to combat stunting in the area. While some prior research suggests varying relationships between family characteristics and stunting, this study demonstrates that factors like the father's occupation and family income do not significantly influence the incidence of stunting in Tapanuli Tengah Regency. Further investigations are essential to explore additional facets contributing to stunting in this context. Overall, this research emphasizes the necessity for comprehensive strategies to address stunting in this region and contributes to the broader understanding of childhood stunting's determinants.

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