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Research Article

Analysis of Risk Factors for Stunting in Toddlers in South Tapanuli Regency in 2024

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Abstract

Stunting is a major public health issue with long-term effects on the quality of human resources. The prevalence of stunting in South Tapanuli Regency increased from 30.8% in 2021 to 39.8% in 2022. This study aims to identify risk factors contributing to stunting in toddlers. The study employs a cross-sectional design with a correlational approach. The sample consists of 350 toddlers selected through purposive sampling, with data collected via structured interviews. The main contributing factors to stunting include a history of low birth weight (p=0.009), the introduction of complementary feeding before six months of age (p=0.000), and incomplete immunization status, which increases the risk of stunting with an odds ratio (OR) of 2.510. Virtual care is associated with a stable or improved HRQOL and patient and family satisfaction in pediatric T1DM. Decision makers need to consider expanding virtual access to pediatric diabetes care that can improve equitable access to quality care across healthcare systems globally.

Keywords: Birth Weight, Immunization, Risk Factors of Stunting

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INTRODUCTION

Stunting is a chronic nutritional problem that has become a global concern due to its implications for a nation's future. The prevalence of stunting in Indonesia remains high compared to neighboring countries such as Vietnam (23%), Malaysia (17%), Thailand (16%),

and Singapore (4%)[1,2]. Nevertheless, the prevalence of stunting in Indonesia has declined from 27.7% in 2019 (SSGBI) to 24.4% in 2021[3] (SSGI) and further to 21.6% in 2022[4].

Similarly, North Sumatra Province has seen a decline in stunting prevalence from 30.1% in 2019 (SSGBI) to 25.8% in 2021 (SSGI)(3) and 22.1% in 2022(4). However, this trend does not hold for South Tapanuli Regency, where stunting prevalence has increased from 30.8% in 2021 to 39.8% in 2022(3,2). At the national level, North Sumatra has improved its ranking from 17th to 26th in terms of stunting prevalence among Indonesia's 34 provinces.

The prevalence of stunting in Indonesia remains above the WHO threshold of <20%. According to the World Bank (2006), stunting prevalence is categorized as mild (20-29%), moderate (30-39%), and severe (≥40%). South Tapanuli Regency falls within the moderate category, necessitating urgent intervention to prevent escalation to severe levels[5][6][7][8]. In other words, approximately one in three children in South Tapanuli Regency is stunted.

Stunting is a condition where a child's height is shorter than the standard for their age. It results from multiple factors, including poverty, chronic malnutrition, inadequate child development environments, and other determinants. Most growth failures occur in children under five, beginning within the first 1,000 days of life[9][10][11][12].

The Indonesian government targets reducing stunting prevalence to 14% by 2024, requiring an annual reduction of 3.8%. North Sumatra achieved a reduction of 3.3% from 2021 to 2022. To meet national targets, coordinated efforts across sectors are necessary. Given this context, further research is needed on the risk factors of stunting in South Tapanuli Regency.

RESEARCH METHOD

This study uses a qualitative approach an analytical observational design with a cross-sectional approach. Time and Place of Research in the working area of Batang Toru Health Center, South Tapanuly Regency of North Sumatra – Indonesia divided five villages The sample consists of 350 toddlers aged 23–59 months. The sample includes both villages with and without stunting cases. Data collection involved structured interviews using questionnaires, birth weight records, immunization completeness, and complementary feeding age, based on maternal recall or records in the Maternal and Child Health (MCH) book. Multivariate analysis was performed using binary logistic regression to determine dominant factors influencing stunting

RESULTS AND DISCUSSION

Table 1. Distribution of Stunted Toddlers in the Working Area of Batang Toru Health Center in 2024

Nutritional status toddlers	**Control village**						**Case village**				**Total**	
	Batuhula		Hutagodang		Aek ngadol		Wek 1		Wek 4			
	F	%	F	%	F	%	F	%	F	%	F	%
Normal	61	36,3	23	13,7	18	10,7	19	11,3	47	28	168	100
Height	2	7	7	38,9	2	11,1	1	5,6	6	33,3	18	100
Stunted	21	32,3	13	20	6	9,2	17	26,2	8	12,3	65	100
Uncategory	6	6,1	31	31,3	13	13,1	39	39,4	10	10,1	99	100
Total	90	25,7	74	21,1	39	11,1	76	21,7	71	20,3	350	100

Based on Table 1, it is known that the highest prevalence of stunted toddlers is in Batu Hula village at 32.3%, which is actually a control village, followed by another control village, Hutagodang, at approximately 20%. Meanwhile, in case villages such as Wek 1 and Wek 4, the prevalence of stunted toddlers is lower than in these two control villages. The difference observed by the researchers was not based on a repeat survey but rather on records from the Maternal and Child Health (MCH) book (KIA-KMS) or small paper notes kept by the child when taken to the Posyandu or visited from house to house by local health cadres and trained enumerators.

The proportion of stunted toddlers in the working area of the Batang Toru Health Center is 17.14%, lower than the achievement of North Sumatra Province at 18.9% (2023), but still higher than South Tapanuli Regency at 15.6% (2023). The survey was conducted without re-weighing and re-measuring by enumerators but was solely based on the data recorded in the MCH book. However, not all MCH books had complete records of both height and weight; approximately 99 or 28.29% were categorized as "uncategorized." The determination of case and control villages was based on reports from the Batang Toru Health Center in 2023. The data discrepancies may have resulted from improvements in some stunted toddlers, while other toddlers did not experience similar improvements, and new cases emerged in villages that previously had no reported cases.

History of weight birth

Table 2 Birth Weight History of Toddlers in the Working Area of Batang Toru Health Center in 2024

Nutritional status toddlers	**Birth weight history (gram)**						**Not remembered**		**Total**	
	< 2500		2500 – 3500		> 3500					
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
Normal	10	5,95	123	73,21	20	11,90	15	8,93	168	100
Height	0	0	13	72,22	0	0	5	27,78	18	100
Stunted	8	12,31	40	61,54	6	9,23	11	16,92	65	100
Uncategory	4	4,04	59	59,59	21	21,21	15	15,15	99	100
Total	22	6,28	235	67,14	47	13,43	46	13,14	350	100
Mean	2704									
SD	1156.834									
Chi Square	0,009									

Based on Table 2, it is known that the average birth weight history of toddlers is 2704 grams with a standard deviation of ± 1156.83. This table indicates that toddlers with a history of low birth weight (< 2500 grams) tend to experience stunting during their growth and development period (12.31%). This is supported by the results of the Chi-Square Test (0.009), which means that birth weight history influences the growth and development of children during the toddler stage. The table also explains that the higher the birth weight of a toddler, the greater the chances of preventing stunting during their growth and development period.

The study results indicate that birth weight history tends to significantly influence the occurrence of stunting later in life. In other words, the lower the birth weight, the higher the risk of stunting during the growth and development period. These findings do not align with the study by Dasantos et al., which states that birth weight history does not affect stunting during childhood development. This is because, physiologically, an infant's birth weight naturally declines between the ages of 6 to 24 months. If the baby can catch up on growth within the first six months of life, there is a high possibility of achieving a normal height[13,14]. Even if a child is born with a normal birth weight, insufficient nutritional intake can lead to growth faltering (a condition where a baby's weight gain does not meet the standard for a

healthy baby). Additionally, exposure to infectious diseases can exacerbate growth failure[13]. This statement aligns with the findings of this study, which show that around 61.54% of stunted toddlers were born with a normal birth weight. The study also found that among children with normal height (for their age), approximately 5.95% had a history of normal birth weight. This suggests that children with low birth weight may still achieve normal growth if they receive adequate nutrition and grow up in a supportive environment that promotes healthy development.

Toddlers with a history of normal birth weight but experiencing stunting are likely affected by an energy intake deficit and a history of chronic infectious diseases. If energy intake is insufficient to meet the body's metabolic needs, energy will be drawn from fat reserves and muscle glycogen. If this condition persists for an extended period, catabolism will occur to fulfill energy demands, leading to impaired growth in children and ultimately resulting in stunting[13,15].

The results of this study also found that birth length significantly influences the occurrence of stunting later in life. The study revealed that toddlers with a birth length of less than 48 cm tend to experience stunting. These findings do not align with the study by Dasantos et al. As is known, birth length reflects the linear growth of a baby during pregnancy. Proper nutritional intake is crucial to catch up on growth, especially between the ages of 2–3 years, as it can help reduce the prevalence of growth retardation during the toddler stage[13].

A mother's height is one of the factors influencing a child's growth process across four stages: the intrauterine period, birth to age two, age two to mid-childhood, and adulthood. However, both genetic and non-genetic factors, including maternal nutrition during pregnancy, may also play a role[13]. Inadequate fetal growth during pregnancy affects a child's subsequent growth and development. Several factors contribute to a baby being born with short stature, such as growth retardation or intrauterine growth restriction, often caused by poverty, illness, and maternal nutritional deficiencies from the early to late stages of pregnancy.

Based on this explanation, the findings of this study also indicate that approximately 55% of stunted toddlers had a birth length of more than 48 cm (or within the normal range). This suggests that optimal postnatal conditions, particularly during critical growth periods, play a crucial role in a child's development.

The age of complementary feeding (MP-ASI) introduction

Table 3 Age of Toodlers Receiving Complementary Feeding (MP-ASI) in the Working Area of Batang ToruHealth Center in 2024

Nutritional status of toddlers	**Age of toodlers receiving MP-ASI**								**Total**		**Sig Fisher's Exact**
	< 1 bulan		1 - < 6 bulan		≥ 6 bulan		Lupa				
	F	%	F	%	F	%	F	%	F	%	
Normal	6	1,74	56	16,28	2	0,58	103	29,94	167	48,55	0,000
Height	1	0,29	7	2,03	0	0	10	2,92	18	5,23	
Stunted	3	**0,87**	**28**	**8,14**	0	0	29	8,43	60	17,44	
Uncategory	3	0,87	25	7,27	0	0	71	20,64	99	28,78	
Total	13	3,77	116	33,72	2	0,58	208	61,93	344	100	

Based on Table 3 above, it is known that stunted children tend to receive complementary feeding (MP-ASI) before the age of six months, with some toddlers even receiving it before they were one month old (within a few days, a week, or two weeks). This is supported by the results of Fisher's Exact test, which shows a significant p-value of 0.000

Weaning is a process that allows a child to consume food like an adult. Early weaning can increase the risk of infections, especially diarrhea. This occurs because the baby consumes

less breast milk, which contains anti-infective factors. If this condition continues, the child may become more vulnerable to malnutrition, which can hinder their growth and development[16]. The researcher suspects that mothers accelerate the weaning process due to a lack of knowledge about the benefits and consequences of insufficient breast milk intake, inadequate breast milk production, and the mother's busy work schedule.

In this study, mothers with children aged 0–24 months reported that approximately 52.29% of them could not recall whether they had performed early initiation of breastfeeding (IMD)) on their newborns immediately after birth. Based on interview results, some respondents did not fully understand the concept of IMD. The study found that in approximately 23.33% of the 60 stunting cases, mothers had not performed IMD on their newborns. However, the findings indicated that IMD had no significant effect on the prevalence of stunting in toddlers. This study aligns with research conducted by Mamlu'atul Mufidah et al., which also concluded that there is no significant relationship between IMD and the prevalence of stunting [17,18,19]. Physiologically, breast milk production and secretion in mothers are influenced by the hormone prolactin, which is stimulated by IMD. Additionally, it is well known that IMD provides essential nutrients for newborns and helps meet their nutritional needs from the earliest stages of life. Therefore, mothers require support from their environment to successfully perform IMD, as it is a crucial part of postpartum care. This practice involves engaging mothers in early breastfeeding and providing the necessary education to enhance its success. However, not all IMD processes can be carried out effectively. Several factors influence its implementation, including maternal knowledge, health conditions, and an unsupportive environment.

This study found that the early introduction of complementary feeding (MP-ASI) before six months of age is significantly associated with the incidence of stunting. The data indicate a tendency for stunted children to have received MP-ASI before six months, with some even being introduced to complementary foods before one month of age within days, a week, or two weeks after birth. These findings align with the study by Kusmayanti and Ikhsan, which reported that stunted toddlers were given MP-ASI as early as four to five months old. This practice was justified by cultural traditions and had been passed down through generations within their families [20].

As widely known, the World Health Organization (WHO) recommends that infants be introduced to complementary feeding (MP-ASI) at ≥ 6 months of age. Infants aged 6–8 months may receive MP-ASI 2–3 times per day, while at 9 months, the frequency may increase to 3–4 times per day, with 1–2 additional snack times at later stages [21]. Introducing MP-ASI too early can disrupt the digestive system, as during the 0–6 month period, the digestive organs are still developing and forming enzymes. At this stage, an infant's digestive system is not yet ready to process more solid foods, which may lead to various adverse reactions, including constipation, diarrhea, vomiting, increased risk of infections, excessive weight gain, and food allergies due to intolerance to certain nutrients [22]. Other researchers have stated that mothers introduce MP-ASI earlier due to the belief that it accelerates growth and increases the baby's weight. Additionally, some mothers perceive that their breast milk supply is insufficient, leading them to introduce complementary foods prematurely [22].

Based on the findings of this study, the risk factors for stunting include the age at which complementary feeding (MP-ASI) is introduced and the completeness of a child's basic immunization. The Odds Ratio (OR) for the age of MP-ASI introduction is 1.172, meaning that the risk of stunting is 1.17 times higher when a child receives MP-ASI before six months of age. This study aligns with research conducted by Wangiyana et al., which emphasizes the importance of timely MP-ASI introduction between 6–23 months. This is because the incidence of growth failure, micronutrient deficiencies, and infections is highest within this age range. MP-ASI serves as a supplementary source of nutrition to bridge the nutrient gap, as breast milk alone cannot fully meet a child's nutritional needs after six months of age. If

complementary feeding is inadequate, the child's macronutrient and micronutrient intake will be insufficient, ultimately affecting their linear growth and development [(23)].

The successful implementation of Early Initiation of Breastfeeding is achieved through good collaboration between healthcare providers, ensuring a safe and comfortable delivery process for both mother and baby. Additionally, maternal knowledge about the benefits of IMD, along with support from husbands and healthcare professionals, plays a crucial role from childbirth until the completion of the IMD process. Proper IMD implementation significantly influences the nutritional status of the baby, as it allows the infant to receive colostrum. Colostrum is highly beneficial for strengthening the baby's immune system, providing protection against various infectious diseases, and promoting healthy digestion, thereby ensuring adequate nutritional intake [(22)].

Basic immunization for toddlers

Table 4 Distribution of Immunization Completeness in Toddlers in the Working Area of Batang Toru Health Center

Nutritional status of toddlers	**Frequency of immunization completeness**						**Total**		***Chi-Square***
	completeness		**Not yet completeness**		**Not completeness**				
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	
Normal	105	62,5	15	8,9	48	28,6	168	100	0,000
Height	13	72,2	3	16,7	2	11,1	18	100	
Stunted	22	33,8	1	1,5	42	64,6	65	100	
Uncatagory	66	66,7	11	11,1	22	22,2	99	100	
Total	206	58,9	30	8,6	114	32,6	350	100	

Based on Table 4, it is known that 58.9% of toddlers have received complete immunization. However, there is a tendency for toddlers with incomplete immunization to experience stunting, with a prevalence of approximately 64.6%. This is supported by the results of the Chi-Square test, which shows a p-value of 0.000, indicating that the completeness of basic immunization significantly influences the occurrence of stunting. This means that the less complete a toddler's immunization, the higher the likelihood of experiencing stunting.

This study found that the basic immunization coverage for toddlers in five villages within the working area of Batang Toru Public Health Center (Puskesmas) was 58.9%. This coverage rate remains significantly lower than the National Target for 2024, which aims for 90% coverage among children aged 12–23 months and 80% coverage among infants aged 0–11 months, as outlined in the National Medium-Term Development Plan (RPJMN)[(24)].

This study found that approximately 64.6% of stunted toddlers did not have complete basic immunization. Statistical analysis revealed a significant relationship between immunization completeness and stunting incidence, indicating that toddlers who do not receive complete basic immunization are more likely to experience stunting. However, these findings contradict the study by Vasera et al., which stated that basic immunization completeness has no association with stunting incidence in children [(25)].

Incomplete immunization weakens a toddler's immune system, making them more susceptible to infectious diseases. If this condition persists, repeated infections can increase the risk of stunting. However, it is important to note that even children with complete immunization may still experience stunting if their nutritional intake is insufficient[(25)]. These findings align with this study, which observed that some children with complete immunization still experienced stunting, while some without complete

immunization did not. Similarly, research by Asmin et al. explains that immunization status is one of the risk factors for stunting. In other words, the prevalence of stunting in toddlers can be reduced through complete immunization [(26)].

Table 5 Results of Multivariate Analysis of Stunting Risk Factors in Toddlers in Batang Toru in 2024

Variables in the Equation

								95,0% C.I.for EXP(B)	
		B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Step 1[a]	Immunization completeness	.920	.171	28.985	1	.000	2.510	1.795	3.508
	History of weight birth	-.455	.201	5.146	1	.023	.634	.428	.940
	Age of Toodlers Receiving MP-ASI	.158	.073	4.729	1	.030	1.172	1.016	1.352
	Constant	14.830	7.537E3	.000	1	.998	2.758E6		

a. Variable(s) entered on step 1: immunization completeness, history of weight birth, age of toodlers receing _MPASI.

Based on Table 5, the results of the multivariate analysis indicate that the risk factors for stunting in toddlers in Batang Toru, according to this study's data, are the age of complementary feeding (MP-ASI) introduction and the completeness of basic immunization.

Based on the results of the multivariate analysis, it was found that basic immunization completeness had an Odds Ratio (OR) of 2.510, meaning that children who do not receive complete basic immunization have a 3 times higher risk of experiencing stunting in the future.This study is consistent with the findings of Yuniarti et al., which stated that children with an incomplete immunization history are 8.4 times more likely to experience stunting.

Immunization plays a crucial role in preventing stunting in children by protecting them from infectious diseases that can lead to malnutrition and stunting. Additionally, immunization is effective in preventing diarrhea, which is one of the key triggers of malnutrition and stunting.Therefore, immunization is an essential government initiative that must be supported by all stakeholders in efforts to prevent stunting in children [(27,28,29,30)].

CONCLUSION

The findings indicate that early introduction of complementary foods and incomplete immunization are key risk factors for stunting in South Tapanuli Regency. The study recommends improving the accuracy of health records at Posyandu (integrated health posts), conducting immunization sweeps, and providing education on proper complementary feeding practices

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AUTHOR CONTRIBUTIONS

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all

these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

CONFLICTS OF INTEREST

The authors report no conflicts of interest in this work.

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