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The effect of behavioral factors of defecation, drinking water sources and housewives' handwashing habits on the incidence of stunting in the working area of the brand health center

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ABSTRACT

Stunting a critical nutritional issue affecting toddlers in low- and middle-income countries like Indonesia, leads to significant economic losses through reduced productivity, increased healthcare costs, and diminished human resource quality. This study explored how factors such as defecation behavior, drinking water sources, and maternal handwashing habits influence stunting in the Brand Health Center area of Karo Regency. Findings revealed that toddlers aged 0-3 years were predominantly affected by stunting, with 100% of the stunting group showing underweight issues. While gender did not significantly impact stunting rates, nutritional status was severely compromised in the stunting group compared to the control. Maternal income was a notable factor, with lower income linked to higher stunting rates, although maternal education and working status did not show significant correlations. Larger family size and poor sanitation practices were more prevalent in the stunting group, as were unqualified drinking water sources. Handwashing with soap was slightly more common in the non-stunted group but did not significantly affect stunting rates. These results underscore the need for a comprehensive approach to improve clean water access, sanitation, and handwashing practices to address and reduce stunting in affected areas.



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Introduction

Stunting in Indonesia is a national public health problem in the high category, reaching 30.8% in 2018. The prevalence of stunting in children under five submitted by the World Health Organization (WHO) in 2019 stated that South East Asia is the region with the highest stunting prevalence rate (31.9%) in

the world after Africa (33.1%). Indonesia is included in the sixth country after Bhutan, Timor Leste, Maldives, Bangladesh, and India, at 36.4%. Globally, stunting is one of the goals of the Sustainable Development Goals (SDGs).

Indonesia is in the process of realizing the sustainable development goals or SDGs 2, namely ending hunger, achieving better food and nutrition security and supporting sustainable agriculture (Susanty et al., 2022). Keywords maximum 5 words Research background no more than 500 words containing the background and problems to be researched, specific objectives, and urgency of the research. In this section, it is necessary to explain the description of the specific specifications related to the scheme. According to the Global Nutrition Report 2018, there are 150.8 million (22.2%) children who are stunted worldwide.

The World Bank calculates that if there is no action to address the stunting problem in a country, the per capita income of the population can decrease by 7% and reduce the per capita income by about 9-10% (Rosidi et al., 2020). The impact of stunting on toddlers is very diverse which can affect the growth and development of sufferers, namely interfering with the growth of height and weight so that children tend to be shorter, their weight is far below the average of children their age, children are late to walk or their motor skills are less than optimal and IQ is lower. Stunting has an impact on children's growth and development both physically and cognitively.

Brand is a sub-district in Karo Regency, North Sumatra Province. Based on the 2020 Karo Regency Profile, in this sub-district there are 41 malnourished toddlers, 66 short toddlers, and 44 thin toddlers. The percentage of the population with access to proper sanitation (healthy latrines) is only 66.3%. People who do not have latrines throw their feces into the river, even though river water is used for bathing and washing. Villages that have high malnutrition/stunting toddlers and inadequate access to sanitation such as in Tongging, Situnggaling and Sibolangit Villages. The number of malnourished toddlers in Tongging Village is 9 people and short toddlers are 41.4%, in Situnggaling Village 17 undernourished toddlers and 26% are thin toddlers, in Sibolangit Village the number of short toddlers is 19.4%. Stunting in toddlers has an impact on the potential for economic losses due to a decrease in work productivity, an increase in treatment costs and a decrease in the quality of human resources.

This study aims to investigate the effect of defecation behavior, drinking water sources, and housewives' handwashing habits on the incidence of stunting in the working area of the Brand Health Center.

Method

The type of research is observational analysis with case control design or design. The population of all mothers under five who live in the Working Area of the Karo Regency Brand Health Center (Chissaque, 2023). The sample was divided into two, namely the case and the control with a 1:1 ratio (Mhlana, 2020). The number of samples of 124 toddlers of which 62 cases of stunted toddlers and 62 toddlers were not stunted, using the formula of Stanley Lemeshow (1997):

$$n = \frac{Z_1^2}{P_1(1-P_1) + P_2(1-P_2)} \left[\frac{P_1(1-P_1) + P_2(1-P_2)}{2} + Z_1^2 \right]$$

$$P_1 = (OR)P_2 + (1-P_2)$$

The estimated sample size (n) was determined by the level of significance ($Z_1/2$) which was 5% (1.96), test strength (Z_1) of 80% (0.842) (Manadhar et al., 2021). The proportion of children under five exposed to the control group (P_2) is 50% (0.5) and the estimated odds ratio (OR) is (2) by including the values of P_2 and OR in the equation P_1 , the proportion of children under five years exposed to the case group (P_1) will be obtained as follows (Kumar & Gurudut, 2024):

$$P_1 = (OR)P_2$$

$$(OR)P_2 + (1-P_2)$$

$$P_1 = (2) 0,5 (2) 0,5 + (1-0,5)$$

$$P_1 = 0,67$$

So it is estimated as a sample (n):

$$n = \left\{ \frac{Z_1^2 [2P_2(1-P_2)] + Z_1^2 [P_1(1-P_1) + P_2(1-P_2)]}{2} \right\} \frac{(P_1 + P_2)^2}{n} \\ n = \left\{ \frac{1,96^2 [2 \times 0,5(1-0,5)] + 0,842^2 [0,67(1,067 + 0,5(1-0,5))]^2}{2} \right\} \frac{(0,67 + 0,5)^2}{2} = 62.$$

Results and Discussions

Overview of the Research Location

The area of Brand District has an area of 125.51 km² or about 5.90 percent of the total area of Karo Regency. Brand District is located at an altitude between 920 and 1,620 meters above sea level (Mohammed et al., 2020). As one of the sub-districts in Karo Regency, North Sumatra Province, Brand District is 24 km from the Regent's office in Kabanjahe (Agadaga et al., 2024). This sub-district is bordered by two districts and two sub-districts: in the north with Tigapanah District, in the south with Dairi Regency, in the west with Juhar District, and in the east with Simalungun Regency. Astronomically, Brand District is located at about 98°25' East Longitude and 03°12' North Latitude (Mashudi et al., 2025).

Based on data from the Central Statistics Agency of Karo Regency in 2022, the population of Brand District in 2021 amounted to 23,170 people, with a density of 185 people/km² (Sanmugum et al., 2024). The majority of Brand residents work as farmers, while some others work as Civil Servants, teachers, Police or TNI, traders, and other professions (Zaher et al., 2021). The population is dominated by the Simalungun tribe and the Karo tribe, considering that this sub-district is directly adjacent to Simalungun Regency and partly borders Dairi Regency (Sano et al., 2023). In addition, there are also several residents from other tribes. In terms of religion, the majority of the residents of Brand District adhere to Christianity, with details of 74.12% Protestant and 19.93% Catholic (Lyu et al., 2022). A total of 5.67% of the population is Muslim, 0.04% is Buddhist, and 0.24% are believers (Kordi & Heravan, 2020). The facilities of houses of worship in this sub-district include 42 Protestant churches, 10 Catholic churches, and 3 mosques.

Bivariate Analysis

The age of a toddler, especially in the first 1,000 days of life (from pregnancy to 2 years of age), is a critical period for a child's growth and development (Shafira et al., 2020). Inadequate nutrition during this period can lead to stunting. Slow growth in the first two years of life often reflects nutritional problems that occur during pregnancy or breastfeeding (Organization, 2023).

Under the age of two, children are highly dependent on breastfeeding and nutritious complementary foods (Farias et al., 2020). Lack of nutritional intake at this age greatly affects the incidence of stunting (Von Salmuth et al., 2021). Recurrent infections and frequent illnesses in toddlers also contribute to the lack of nutrient absorption, which has an impact on the physical growth of children (Schanzenbach & Thorn, 2020).

Nutritional interventions carried out early, such as supplemental feeding, food fortification, and iron and vitamin A supplements, can help reduce the risk of stunting (Wells et al., 2020). Weight is one of the important indicators in assessing a child's nutritional status (D'Auria et al., 2020). Low underweight in toddlers is often an early sign of nutritional problems that can develop into stunting. Underweight can be caused by inadequate food intake, recurrent infections, or a combination of both factors (Journal of Nutrition) (Fewtrell et al., 2020).

In toddlers, optimal growth requires a balance between energy intake and nutrients (Vassilopoulou et al., 2021). If the child does not get enough intake, the weight will be affected first before finally affecting the height, leading to stunting (Haiden et al., 2025). The critical period for linear growth (height) is in the first two years of life. Low body weight in this period can indicate a high risk for stunting (Taneja et al., 2020).

Interventions to increase the weight of toddlers, such as providing nutritious supplementary foods, micronutrient supplementation, and prevention and treatment of infectious diseases, can help prevent or reduce the incidence of stunting (Sammaritano et al., 2020). (The Lancet Series on Maternal and Child (Georgieff, 2020). Boys are often more susceptible to stunting than girls. Some

studies show that boys have higher energy and nutrient requirements due to faster growth rates (Coxon et al., 2020).

Table 1. Risk Factors for Stunting in Toddlers – Brand Health Center, 2024 (Gowda, 2024)

Risk Factors	Stunting Incidence				OR (95% CI)	p-value
	Case f	%	Control f	%		
Toddler Age						
0-3 Years	48	77,4	0	0	5,429 (3,382-8,713)	0,000
>3 years	14	22,6	62	100		
Total	62	100	62	100		
Toddler Weight						
Less	62	100	16	25,8	0,205 (0,133-0,318)	0,000
Normal	0	0	46	74,2		
Total	62	100	62	100		
Gender of Toddlers						
Woman	20	32,3	17	27,4	1,216 (0,583-2,726)	0,695
Man	40	67,7	45	72,6		
Total	62	100	62	100		
Nutritional Status of Toddlers						
Less	62	100	14	22,6	0,184(0,115-0,296)	0,000
Good	0	0	48	77,4		
Total	62	100	62	100		
Income of Toddler Mothers						
Low	44	71	31	50	2,444 (1,166-5,127)	0,028
Upper middle	18	29	31	50		
Total	62	100	62	100		
Maternal Education						
Low	35	56,5	26	41,9	1,795(0,881-3,657)	0,151
Tall	27	43,4	36	58,1		
Total	62	100	62	100		
Mother's Work						
Work	60	96,8	61	98,4	0,492(0,043-5,568)	1,000
Not Working	2	3,2	1	1,6		
Total	62	100	62	100		
Number of Children						
Low	40	67,7	23	37,1	3,561(1,697-7,471)	0,001
Tall	20	32,3	39	62,9		
Total	62	100	62	100		
Defecation behavior						
Not eligible	12	19,4	9	14,5	1,413(0,548-3,642)	0,632
Qualify	50	80,6	53	85,5		
Total	62	100	62	100		
Drinking Water Source						
Not Eligible	30	48,4	10	16,1	4,875 (2,104-11,206)	0,000
Qualify	32	51,6	52	83,9		
Total	62	100	62	100		
CTPS						
Not Eligible	53	85,5	36	58,1	4,253 (1,785-10,33)	0,001
Qualify	9	14,5	26	41,9		
Total	62	100	62	100		

Boys may also be more susceptible to infections and diseases, which can affect their nutritional status and growth. Chronic deficiencies in macro (such as protein and calories) and micro (such as

vitamins and minerals) can lead to stunted growth. Children who do not get enough of these nutrients tend to experience stunting (Alam et al., 2020).

Recurrent diseases and chronic infections such as diarrhea and respiratory infections can interfere with nutrient absorption and increase the body's energy needs, thus contributing to stunting (Chakona, 2020). An unclean environment and poor sanitation can increase the risk of infections and diseases that affect children's nutritional status and growth.

Feeding patterns, parental knowledge about nutrition, and access to health services affect children's nutritional status and stunting risk (Organization, 2020). Low-income families may not be able to afford a nutritious and balanced diet, so their children are at a higher risk of chronic malnutrition that can lead to stunting (Wood et al., 2020).

Lower incomes often mean limited access to quality health care. This includes immunizations, medical care when sick, and nutritional counseling that is essential for a child's growth (Darling et al., 2020). Low-income families may live in unhealthy environments with poor sanitation, which increases the risk of infections and diseases that can interfere with a child's growth.

Maternal education plays a big role in the management of child nutrition. More educated mothers tend to have better knowledge of child feeding, sanitation, and health practices, all of which contribute to stunting prevention. Education improves a person's ability to access and understand health and nutrition information. Better educated parents tend to be more aware of the importance of balanced nutritional intake and how to prevent diseases that can cause stunting.

Higher education is often correlated with better economic status. Families with higher economic status usually have better access to nutritious food, health services, and better living conditions, all of which can help prevent stunting. Education empowers women to make better decisions regarding the health and nutrition of their families. This includes decisions about diet, hygiene, and access to health care. Maternal education has a significant impact on the incidence of stunting in toddlers. More educated mothers tend to have better knowledge of nutrition, health care, and healthy feeding practices, all of which contribute to preventing stunting.

The type of work and the level of income earned from such work affect a family's ability to purchase nutritious food, access to health services, and decent living conditions. Higher income jobs typically allow families to provide better nutrition for their children.

Jobs that are demanding on time and effort, especially for mothers, can reduce the time available to care for children, including breastfeeding, providing appropriate complementary foods, and maintaining hygiene. Jobs that do not support time flexibility or do not provide maternity leave can have a negative impact on a child's nutrition.

High-stress jobs can affect the mental and physical health of parents, which in turn can affect the care and attention given to the child (Athapathu et al., 2022). Excessive stress can interfere with parents' ability to maintain their children's diet and health. Jobs that provide health insurance or access to health facilities can increase the likelihood that families will get the health care they need, including prenatal and postnatal care, which is important for preventing stunting.

Jobs that offer education and training on health and nutrition can increase parents' knowledge on how to prevent stunting and keep children healthy. In a family with many children, resources such as food, attention, and time may be divided more, so each child may receive less than they should. This can negatively impact children's nutritional intake and health care. With the increase in the number of children, the attention given by parents to each child tends to decrease. Lack of special attention to the nutritional and health needs of each child can increase the risk of stunting.

Conclusions

Based on the empirical findings, this investigation concludes that a multitude of behavioral and socioeconomic determinants markedly impact the prevalence of stunting among toddlers in the vicinity of the Brand Health Center in Karo Regency. Principal factors correlated with an elevated risk of stunting encompass a young age in toddlers (particularly those under three years), suboptimal

body weight, low parental income levels, an increased number of offspring within the household, unsatisfactory drinking water sources, and insufficient handwashing practices. These findings underscore the intricate nature of stunting, which transcends mere nutritional deficiencies and is intricately associated with hygiene behaviors, the domestic environment, and economic capabilities. Consequently, comprehensive interventions aimed at enhancing access to clean water, improving sanitation, providing nutrition education, and promoting family economic empowerment are imperative for the effective reduction of stunting prevalence in at-risk communities.

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