Relationship Between Community-Based Total Sanitation and Stunting Incidence in Medan City

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Abstract

Stunting remains a significant public health issue in Indonesia, particularly in Medan City. Poor sanitation has been identified as one of the key contributing factors to stunting. This study aims to analyze the relationship between community-based total sanitation and stunting incidence in Medan City. The research is a comparative study with a case-control design. It was conducted in five sub-districts with high stunting rates among the fourteen sub-districts in Medan City that have received community-based total sanitation interventions. The study was carried out from November 2023 to February 2024. The study population included all mothers with children age 0-59 months living in sub-districts that received community-based total sanitation interventions. There were 165 participants in the stunting and 49,676 in the not stunting. The sample size was calculated using the Lemeshow formula, resulting in 50 mothers for the stunting group. The not stunting group was matched to the case group in a 1:1 ratio, making the total sample size 100 mothers. Purposive sampling was used to select participants who met the inclusion and exclusion criteria. Data analysis was performed using SPSS software version 27, employing the chi-square test with a 95% confidence level (α = 0.05). The results showed that three pillars of community-based total sanitation were significantly related to stunting incidence: relationship between handwashing with soap and stunting incidence was significant (p=0.005; OR=4.125), relationship between household Latrine and stunting incidence was significant (p=0.001; OR=7.211), and relationship between household solid waste management and stunting incidence was significant (p=0.027; OR=2.681). The overall relationship between community-based total sanitation and stunting incidence was significant (p=0.015; OR=6.769). Recommendations for the Health Department and Community Health Centers in Medan City include enhancing the achievement of the five STBM pillars within the community through health promotion activities.

Keyword: Child, Hygiene, Mother, Sanitation, Stunting

INTRODUCTION

Stunting remains a significant public health issue in Indonesia, including in Medan City. Stunting is defined as a condition of impaired growth in children under five due to chronic malnutrition and recurrent infections, characterized by a height that is shorter than the standard for their age. According to the latest data from the 2022 Indonesian Nutritional Status Study, the prevalence of stunting in North Sumatra, including Medan City, is still at 21.6% (Kementerian Kesehatan Republik Indonesia, 2023a).

Poor sanitation has been identified as a significant contributing factor to stunting. Inadequate sanitation significantly contributes to the occurrence of stunting (Girma et al., 2021; Woldesenbet et al., 2023). Children living in environments with poor sanitation are more vulnerable to gastrointestinal infections, such as diarrhea, which can hinder the absorption of

essential nutrients and lead to chronic malnutrition (Shrestha et al., 2020). Additionally, an unhygienic environment can affect maternal health during pregnancy, thereby impacting fetal growth (Kumari et al., 2023).

The Indonesian government has implemented the Community-Based Total Sanitation program since 2008. Community-Based Total Sanitation (CBTS) is an approach to changing hygiene and sanitation behavior through community empowerment using the triggering method. This program includes five pillars: stopping open defecation, washing hands with soap, managing safe drinking water and household food, managing household waste, and managing household liquid waste (Kementerian Kesehatan Republik Indonesia, 2023b).

The community-based total sanitation implementation has been ongoing since 2013. However, its effectiveness in reducing stunting still requires further evaluation (Grant & Willetts, 2024). A recent study by Siahaan et al. (2022), in North Sumatra indicates that despite improvements in sanitation practices, there remain challenges in consistently changing community behaviors.

Community-based total sanitation in Medan City still faces several challenges. A recent report from the Medan City Health Office in 2023, identifies several barriers, including budget constraints, insufficient community participation, and inadequate sanitation infrastructure in densely populated urban areas (Dinas Kesehatan Kota Medan, 2023). Given the complexity of factors influencing stunting, a comprehensive multisectoral approach is needed. Several recent studies have shown a positive relationship between the community-based total sanitation implementation and the stunting prevalence reduction in various regions of Indonesia.

Based on research findings by Nurhaliza et al. (2023), effective implementation of community-based total sanitation correlates with a decrease in stunting prevalence. Research conducted by Pratiwi, et al. (2022), indicates that villages with well-implemented community-based total sanitation have lower levels of stunting. Findings from Reese et al. (2023), underscore the importance of integrating community-based total sanitation programs with nutrition and other health interventions to achieve optimal impact in reducing stunting. Research by Akseer et al (2023) confirms that inadequate sanitation significantly increases the risk of stunting in low and middle-income countries. Poor sanitation can lead to recurrent infections, which disrupt nutrient absorption and child growth.

This statement is supported by previous research findings, where the five pillars of Community-Led Total Sanitation are associated with stunting incidence (Lopa et al., 2022; Malusha, 2023). However, in Medan City, these five pillars of community-based total sanitation still have a low percentage of 36.04%, which is significantly below the national

target achievement of 68.06% in implementing the five pillars of CBTS, compared to other districts/cities in North Sumatra province (Dinas Kesehatan Sumatera Utara, 2020).

Medan City is one of the largest cities located on the island of Sumatra, making it a significant attraction for people seeking employment opportunities (Nasution & Rika, 2019). The community-based total sanitation programs implementation in Medan City still lacks comprehensive data (Susilawati et al., 2022). However, as of 2020-2021, fourteen sub-districts have been recorded to have implemented community-based total sanitation interventions (Astari & Nasution, 2024). Among these fourteen sub-districts, five are identified as contributing significantly to the incidence of stunting in Medan City, namely Medan Belawan, Medan Marelan, Medan Labuhan, Medan Sunggal, and Medan Denai.

This study aims to analyze the relationship between CBTS and stunting incidence in Medan City, with the expectation of providing valuable insights to enhance program effectiveness and ultimately reduce stunting prevalence in Medan City.

METHODS

The research method employed in this study is a case-control comparative study design, where it compares a group of children with stunting to a group of children without stunting to assess the relationship between family practices in implementing the five pillars of community-based total sanitation in preventing stunting incidence in Medan City. The study was conducted in five sub-districts with high stunting rates among fourteen sub-districts that received Community-Based Total Sanitation interventions, from November 2023 to February 2024. The study population consisted of mothers with stunted children age 0-59 months living in sub-districts that received community-based total sanitation interventions, with 165 participants in the case group and 49,676 in the control group. Sample size for the case group was calculated using the Lemeshow formula, resulting in 50 mothers with toddlers who were stunted, while the control group was matched to the case group in a 1:1 ratio, resulting in a total sample size of 100 mothers with toddlers.

The sampling technique employed was purposive sampling, a non-random sampling method where sample selection was based on specific considerations and predefined criteria. Inclusion criteria for the study included mothers with children age 0-59 months, children without chronic illnesses in the past three months, children currently or previously affected by stunting, mothers of children who have experienced stunting, and stable residential conditions. Inclusion criteria for the control group included mothers with children age 0-59 months, children without chronic illnesses in the past three months, and children who have never

experienced stunting. Additional exclusion criteria involved mothers who leave their children in the care of others for more than 12 hours per day (from 06:00 to 20:00 WIT) and mothers who have not received education about the five pillars of CBTS. Data analysis was conducted using SPSS version 27. The analysis consisted of two stages: first, univariate analysis using frequencies, and second, bivariate analysis using the chi-square test with a significance level of 95% ($\alpha = 0.05$).

The principal researcher obtained a certificate of ethical approval from the University of Sumatera Utara the Health Research Ethics Committee (No: 04/KEPK/USU/2024). In addition, permission was also sought from university academic administrators and relevant authorities before data collection, aiming to obtain consent from respondents before distributing the questionnaire.

RESULTS

The characteristics in this study consist of maternal and child characteristics. Maternal characteristics include age, age during pregnancy, highest education level, occupation, household size, family income, and number of children. Meanwhile, child characteristics include toddler age, gender, immunization status, and exclusive breastfeeding, as detailed in the following table:

Table 1 Characteristics of Maternal and Child in Five Sub-Districts of Medan City in 2024

Characteristics	Stunting		Not Stunting	
	n	%	n	%
Maternal Characteristics				
Age				
< 18 years and > 35 years	10	45	12	54
18-35 years	40	51	38	48
Age during pregnancy				
< 18 years and > 35 years	7	50	7	50
18-35 years	43	50	43	50
Highest Education				
Elementary School-Middle School	33	75	11	25
High School-Higher School	17	30	39	69
Occupation				
Work	9	40	13	59
Not Working	41	52	37	47
Household Size				
> 4 persons	7	63	4	36
≤ 4 persons	43	48	46	51
Family Income				
< 3,769,082	47	56	37	44
> 3,769,082	3	18	13	81
Number of Children				
> 2 children	19	48	21	51
≤ 2 children	31	50	30	49

Child Characteristics				
Toddler Age				
< 24 months	16	32	16	32
> 24 months	34	68	34	68
Gender				
Male	25	50	25	50
Female	25	50	25	50
Exclusive Breastfeeding				
No	24	38	39	61
Yes	26	70	11	29
Immunization				
No	22	43	29	56
Yes	28	57	21	42

According to table 1, the distribution of maternal characteristics across five sub-districts in Medan City-namely Medan Sunggal, Denai, Marelan, Labuhan, and Belawan, can be observed. It is evident that the most prevalent maternal age group is 18-35 years, with 40 mothers (51%) in the stunting and 38 mothers (48%) in the not stunting. The most common maternal age at pregnancy is also 18-35 years, with 43 mothers (50%) in the stunting and not stunting. In terms of the highest educational attainment, 33 mothers (75%) in the stunting had education levels ranging from primary to junior high school, whereas 39 mothers (69%) in the not stunting had education levels ranging from senior high school to higher education.

In the section on maternal employment, the majority of mothers were unemployed, with 41 mothers (52%) in the stunting and 37 mothers (47%) in the not stunting. Regarding household size, most mothers reported having fewer than four family members in their household, with 43 mothers (48%) in the stunting and 46 mothers (51%) in the not stunting. For family income, most mothers reported earning less than IDR 3,769,082, with 47 mothers (56%) in the stunting and 37 mothers (44%) in the not stunting. In terms of the number of children, most mothers reported having fewer than two children, with 31 mothers (50%) in the stunting and 30 mothers (49%) in the not stunting.

The distribution of child characteristics in the five sub-districts of Medan City that have implemented the CBTS program shows the following: The majority of children were older than 24 months, with 34 children (68%) in the stunting and not stunting. In terms of gender, there were an equal number of male and female children, with 25 children (50%) in the stunting and not stunting. Regarding exclusive breastfeeding, 26 children (52%) in the stunting were exclusively breastfed, while 39 children (78%) in the not stunting were not exclusively breastfed. Lastly, in the immunization category, 28 children (57%) in the stunting had received complete immunizations, whereas 29 the children (58%) in not stunting had incomplete immunizations.

The results of the analysis on the relationship between the five pillars of community-based total sanitation, can be seen in the table below:

Table 2 Relationship Between Community-Based Total Sanitation and Stunting Incidence in Medan City in 2024

Community-Based Total Sanitation	Stunting Incidence				P-Value	OR
	Stunting		Not Stunting			
	n	%	n	%		
Stopping open defecation						
Less good	11	68	5	31	0.173	2.358
Good	39	46	45	53		
Handwashing with soap						
Less good	22	73	8	26	0.005	4.125
Good	28	40	42	60		
Household drinking water and food management						
Less good	10	20	3	6	0.071	3.917
Good	40	80	47	94		
Household waste management						
Less good	27	79	7	20	0.001	7.211
Good	23	34	43	65		
Household liquid waste management						
Less good	33	61	21	38	0.027	2.681
Good	17	37	29	63		
Five pillars of community-led total sanitation						
Less good	11	84	2	15	0.015	6.769
Good	39	44	48	55		

According to table 2, the relationship between stopping open defecation and stunting incidence can be observed. In the stunting, 39 mothers (46%) practiced good stopping open defecation, while 11 mothers (68%) had less good practices. In the not stunting, 45 mothers (53%) practiced good stopping open defecation, whereas 5 mothers (31%) had less good practice. The analysis yielded a p-value of 0.173 ($p>0.05$), indicating no significant relationship between stopping open defecation and the stunting incidence in Medan City in 2024.

The relationship between handwashing with soap and stunting incidence can be observed. In the stunting, 28 mothers (40%) practiced good handwashing with soap, while 22 mothers (73%) had less good practices. In the not stunting, 42 mothers (60%) practiced good handwashing with soap, and 8 mothers (26%) had less good practice. The analysis yielded a p-value of 0.005 ($p<0.05$), indicating a significant relationship between handwashing with soap and the stunting incidence in Medan City in 2024. This means the risk of stunting is 4.125 times higher in children whose mothers do not practice proper handwashing with soap.

The relationship between household water and food management and stunting incidence can be observed. In the stunting, 40 mothers (80%) practiced good managed household water and food, while 10 mothers (20%) had less good practices. In the not stunting, 47 mothers (94%) practiced good managed household water and food, while 3 mothers (6%)

had less good practices. The analysis yielded a p-value of 0.071 (p>0.05), indicating no significant relationship between household water and food management and the stunting incidence in Medan City in 2024.

The relationship between household waste management and stunting incidence can be observed. In the stunting, 23 mothers (34%) practiced good household waste management, while 27 mothers (79%) had less good practices. In the not stunting, 43 mothers (65%) practiced good household waste management, while 7 mothers (20%) had less good practices. The analysis yielded a p-value of 0.001 (p<0.05), indicating a significant relationship between household waste management and the stunting incidence in Medan City in 2024. This means the risk of stunting is 7.211 times higher in children whose mothers do not practice proper household waste management.

The relationship between household liquid waste management and stunting incidence can be observed. In the stunting, 17 mothers (37%) practiced good household liquid waste management, while 33 mothers (61%) had less good practices. In the not stunting, 29 mothers (63%) practiced good household liquid waste management, while 21 mothers (21%) had less good practices. The analysis yielded a p-value of 0.027 (p<0.05), indicating a significant relationship between household liquid waste management and the stunting incidence in Medan City in 2024. This means the risk of stunting is 2.681 times higher in children whose mothers do not practice proper household liquid waste management.

The relationship between the five pillars of CBTS and stunting incidence can be observed. In the stunting, 39 (44%) families practiced good the five pillars of CBTS, while 11 (84%) had less good practices. In the not stunting, 48 (55%) families practiced good the five pillars of CBTS, while 2 (15%) had less good practices. The analysis yielded a p-value of 0.015 (p<0.05), indicating a significant relationship between the five pillars of CBTS and the stunting incidence in Medan City in 2024. This means the risk of stunting is 6.769 times higher in children from families that do not practice the five pillars of CBTS properly.

DISCUSSION

The analysis results for the relationship between open defecation and stunting incidence in Medan City in 2023 yielded a p-value of 0.08 (p>0.05). Therefore, it can be concluded that there is no significant association between open defecation and stunting incidence in Medan. This finding aligns with a study conducted by Amir, et al. (2023), where Pillar 1 of the CBTS, which is open defecation free, showed no significant relationship with the prevalence of stunting.

This research also indicates that the majority of mothers fall into the category of good practices regarding open defecation, and Medan City has been implementing open defecation free (ODF) practices since 2019. However, there are still cases where mothers in the study group lack private latrines and neglect hygiene and sanitation in their latrines.

Unsanitary latrine conditions can contribute to various diseases originating from latrines. One of the common illnesses is recurrent diarrhea in children, which is part of the multifactorial support for stunting incidents (Zairinayati & Purnama, 2019). Therefore, Noviansyah et al. (2022), study confirms that the CBTS program is a preventive measure against child stunting by improving sanitation, especially latrine ownership and the practice of avoiding open defecation.

The increase in access to proper sanitation through CBTS programs, while not significantly altering the stunting rates, may be attributed to the unbalanced focus of interventions (Rahman et al., 2023; Nurhayati et al., 2023). If CBTS programs prioritize the provision of sanitation facilities without accompanying nutritional education and improvements in food intake, their impact on stunting may be limited (Wijayanti, et al., 2023). The effects of CBTS programs on stunting may require a longer time to manifest (Tosepu et al., 2023). The influence of good sanitation on reducing infections may only become apparent in subsequent generations.

Based on the analysis, the relationship between handwashing with soap and stunting incidence in Medan City in 2023 was found to have a p-value of 0.001 ($p < 0.05$). Therefore, it can be concluded that there is a significant association between handwashing with soap and stunting incidence in Medan City in 2023. This finding is consistent with the study conducted by Syam & Sunuh (2020), where statistical testing yielded a p-value of 0.000 ($p < 0.05$), indicating a significant relationship between handwashing with soap behavior and stunting incidence.

Based on the observations and interviews, it was found that some families still lack handwashing facilities with soap, some do not practice handwashing at specific times, and some mothers only wash their hands when visibly dirty. Key considerations for setting up handwashing facilities at home include ensuring water and soap are available at toilets, having handwashing stations easily accessible before food preparation and meals, and understanding specific times that necessitate handwashing (Kementerian Kesehatan Republik Indonesia, 2023b).

Handwashing with soap is effective in removing pathogens that can cause infections such as diarrhea and respiratory infections. Recurrent diarrhea can disrupt the absorption of

essential nutrients crucial for child growth, thus reducing infection rates can contribute to reducing stunting. By reducing diarrhea incidents, children's bodies can absorb nutrients more effectively. Sufficient and well-absorbed nutrition is critical for optimal growth and development of children.

This study aligns with previous research where handwashing with soap and its association with stunting had a p-value of 0.000>0.05 (Soeracmad, et al., 2019). Handwashing behaviors after defecation and before feeding children were also associated with stunting in Ethiopia (Kwami, et al., 2019), and handwashing practices showed a significant relationship with stunting incidence (Sinatrya & Muniroh, 2019).

The analysis results for the relationship between household drinking water and food management and stunting incidence in Medan City in 2023 yielded a p-value of 0.287 (p>0.05). Therefore, it can be concluded that there is no significant relationship between household drinking water and food management with stunting incidence. Although clean drinking water and safe food are crucial, stunting is more influenced by the quality and quantity of nutritional intake. Without balanced and nutritious food intake, the risk of stunting remains high even if water and food are managed well.

These findings align with Cameron et al. (2022), who stated the absence of a relationship between drinking water and stunting incidence, indicating that despite increased access to clean drinking water, there was no significant decrease in stunting rates. Other factors such as maternal nutrition intake during pregnancy play a more significant role in determining child growth status. These results contrast with the study conducted by Amir, et al (2023), where families implementing Household Drinking Water and Food Management pillar III had a 0.044 times lower risk of stunting compared to those who did not implement Household Drinking Water and Food Management.

Based on observations and interviews conducted regarding drinking water management, it was found that the majority of mothers have access to clean drinking water, despite some instances of water being tasteless, odorous, or discolored. Regarding food management, most mothers ensure that drinking bottles and children's cups are clean, serve food covered, and reheat food served for more than 4 hours, both in the case and control groups, thus no significant differences were found in this study. However, it is possible that some mothers still store drinking water and food in uncovered containers, and there are still families that do not store food utensils properly.

The analysis results regarding the relationship between household waste management and stunting incidents in Medan City in 2023 revealed a p-value of 0.001 (p<0.05). Therefore,

it can be concluded that there is a significant association between household waste management and stunting incidents. Effective waste management can prevent water and soil contamination, which are often sources of pathogenic diseases.

Contaminated water can lead to chronic diarrhea in children, thereby impeding their growth. Poorly managed waste can serve as breeding grounds for disease vectors such as flies, mosquitoes, and rats. These vectors can spread diseases that cause infections in children, such as diarrhea and respiratory infections, which can hinder nutrient absorption and lead to stunting. These research findings align with studies by Mayasari, et al. (2022), where inadequate waste management was associated with a 5.932 times higher risk of stunting compared to cases where waste management met standards.

Based on interviews and observations conducted, it was found that scattered household waste is still prevalent in the vicinity of mothers' homes, open waste disposal sites persist, and some mothers dispose of waste by burning it, burying it underground, or dumping it in ditches, with general lack of waste sorting. Adhering to proper waste disposal facilities can prevent insects or other animals from entering the household environment, thereby reducing environmental pollution, including air pollution, and the risk of disease transmission (Sukmawati, et al., 2021). Therefore, community commitment to waste management by individuals is crucial to minimizing stunting cases in a region.

The analysis results for the relationship between household liquid waste management and stunting incidents in Medan City in 2023 revealed a p-value of 0.008 ($p<0.05$). This indicates a significant relationship between household liquid waste management and stunting. Proper liquid waste management can prevent pathogens spread and environmental contamination. Clean water and good sanitation are crucial for reducing the risk of diseases that affect nutritional status and child growth. Poorly managed liquid waste can contaminate water and soil sources, increasing the risk of infections such as diarrhea and parasitic infections. Recurrent infections can impair nutrient absorption in children, contributing to stunting.

The findings of this study align with the research conducted by Mayasari, et al., (2022), which found that households with non-compliant sewage disposal systems have a 5.207 times higher risk of stunting compared to those with compliant systems. In this study, water stagnation was found around homes due to open and non-sealed domestic sewage channels that were not connected to infiltration wells. Some mothers did not always ensure their sewage channels were unobstructed. However, the majority reported that they did not discharge liquid waste directly into open spaces; for example, rice washing water was used for watering plants (Hassan et al., 2021). This simple waste management practice can reduce environmental

pollution by decreasing the breeding grounds for disease-carrying insects and animals such as flies, cockroaches, rats, and mosquitoes (Amir, et al., 2023).

CONCLUSIONS

Based on the results of a study on the relationship between total sanitation and stunting incidents in Medan City, which involved 50 mothers with stunted children and 50 mothers with non-stunted children, it was found that the practice of stopping open defecation and the management of drinking water had no significant relationship with stunting incidents in Medan City. Meanwhile, handwashing with soap, household waste management, and household liquid waste management were found to be significantly related to stunting incidents in Medan City.

Recommendations for the Health Office and Community Health Centers in Medan City include enhancing efforts to achieve the five pillars of CBTS in the community through health promotion activities. This effort not only aims to achieve CBTS-certified villages but also plays a crucial role in accelerating the handling of stunting in Medan City. Additionally, increasing awareness not only among mothers but also the broader community is essential to effectively reduce stunting rates in Medan City through the implementation of the five CBTS pillars.

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