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Article

Risk Factors of Home Sanitation on the Incidence of Stunting in the Working Area of Tetewatu Health Centre, North Konawe (2024)

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Abtract

Stunting remains a major public health issue in Indonesia, influenced by multifactorial determinants including environmental sanitation. Poor household sanitation increases the risk of repeated infections and nutrient malabsorption, contributing significantly to impaired growth among children under five. This study aims to analyze the association between household environmental sanitation factors and the incidence of stunting in children under five in the Tetewatu Health Centre area, North Konawe District. A case-control study was conducted from January to March 2024, involving 54 respondents (27 stunted cases and 27 matched controls). Data were collected through structured interviews, direct observations, and anthropometric measurements. Variables assessed included ownership of clean water sources, healthy latrines, handwashing with soap (HWWS) practices, and household food management. Data were analyzed using Chi-Square and Fisher's Exact tests, with significance set at $p<0.05$. The results showed significant associations between all environmental sanitation variables and stunting. Households with poor access to clean water (OR=10.95; p=0.024), lack of healthy latrines (OR=10.95; p=0.024), poor HWWS behavior (OR=7.35; p=0.019), and inadequate food management (OR=29.69; $p<0.001$) had a significantly higher risk of stunting. Food management emerged as the strongest predictor. Conclusion: Environmental sanitation factors, particularly food hygiene, access to clean water, sanitation facilities, and handwashing practices, play a critical role in preventing stunting. Interventions targeting household sanitation and hygiene behaviors are essential to achieve sustainable reductions in child stunting rates. Strengthening the WASH (Water, Sanitation, and Hygiene) component in stunting prevention programs is urgently recommended.

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Intruduction

Stunting is a serious public health problem in many developing countries, including Indonesia. Stunting is defined as a chronic growth disorder characterised by height-for-age (TB/U) below -2 standard deviations (SD) of child growth standards set by the World Health Organisation (WHO) [1]. Children who have a TB/U Z-score of less than -3 SD are categorised as severely stunted [2], [3]. It is an indicator of long-standing malnutrition, recurrent infections, and inadequate environmental care, especially during the first 1000 days of life-from pregnancy to two years of age [4].

Globally, it is estimated that more than 144 million children under the age of five are stunted[5]. The impact of this condition is not only limited to physical growth, but also greatly affects children's brain development and cognitive abilities. Children who are stunted in early life tend to have lower IQs, learning difficulties, memory impairment, and poor academic performance [6]. Furthermore, stunting can have a long-term impact on economic productivity, working capacity in adulthood, as well as an increased risk of non-communicable diseases such as diabetes and cardiovascular disease. Therefore, the prevention and control of stunting is a top priority in national health development [7].

In Indonesia, the prevalence of stunting is still relatively high and is a major challenge in achieving sustainable development targets (SDGs). Based on the Indonesian Nutrition Status Survey (SSGI) in 2021, the national prevalence of stunting reached 24.4% [8]. Some provinces recorded much higher rates, such as Southeast Sulawesi Province, which ranked in the top five nationally with a prevalence of 30.2%. Although this has decreased to 27.7% in 2022, it is still far from the national target of 14% by 2024 [9]. At the district level, North Konawe recorded a stunting prevalence of 29.5% in 2021, and decreased to 21.6% in 2022. Data from Tetewatu Health Centre shows that the prevalence of stunting in its working area was 15.2% in 2021, and decreased slightly to 15.0% in 2022.

Stunting is a multifactorial condition, where various determinants are interrelated-from biological, behavioural, to environmental factors. Among these factors, household environmental sanitation plays an important but often overlooked role[10]. Poor sanitation increases the risk of transmission of infectious diseases, especially diarrhoea and chronic intestinal dysfunction such as Environmental Enteric Dysfunction (EED), which directly affects nutrient absorption and impacts child growth[11].

Environmental health is an integral part of promotive and preventive efforts in the health sector. According to the Government Regulation of the Republic of Indonesia Number 66 Year 2014 on Environmental Health, environmental health is an integral part of promotive and preventive efforts in the health sector. [12]One of the main objectives is to create a healthy physical, chemical, biological, and social environment. In the context of stunting prevention, home environmental sanitation-including access to clean water, ownership of healthy latrines, clean and healthy living behaviour (PHBS), and household food management-is an important key in maintaining the health of children and families[13].

In the Tetewatu Health Centre working area, basic sanitation coverage shows uneven progress. Based on 2022 data, only 76% of households have access to clean water sources, 60% have healthy latrines, 65% have adequate housing environment quality, and 73% of villages have implemented the Community-Based Total Sanitation (STBM) approach. However, infrastructure alone is not enough without fundamental behavioural changes. Many households still practice open defecation, wash hands without soap, and process food without regard to hygiene[14].

Handwashing with soap (HWWS) behaviour at five key times-before eating, after defecation, before breastfeeding, after cleaning children, and before preparing food-is a simple yet highly effective intervention in preventing infectious diseases.[15]. However, the level of compliance with HWWS practices in rural communities is still low. Low awareness and limited facilities are the main causes of poor hygiene practices. In fact, research shows that HWWS behaviour can reduce the incidence of diarrhoea by 47%, thus playing a significant role in stunting prevention[16].

Similarly, unhygienic household food management increases the risk of cross-contamination, food poisoning and gastrointestinal infections.[17]. Food that is poorly cooked, stored at inappropriate temperatures, or served with unclean utensils can be a medium for pathogenic microorganisms to thrive. This increases the chances of children developing diseases that inhibit nutrient absorption and worsen nutritional status. In households with low food management knowledge and practices, the risk of child stunting increases significantly[18].

The availability and use of healthy latrines is also an important indicator in breaking the chain of transmission of water- and faecal-based diseases. An environment polluted by human faeces, either through open defecation or the use of inadequate latrines, increases the risk of children contracting intestinal infectious diseases.[19]. In the long run, repeated exposure to pathogens through polluted

environments leads to chronic gut inflammation and reduced nutrient absorption capacity. Therefore, sanitation infrastructure development needs to be accompanied by continuous education so that people not only have the facilities, but also utilise them properly and consistently.

Amidst the complexity of the problem, scientific evidence that is contextualised and locally based is needed. Each region has unique geographical, social, economic and cultural characteristics, so intervention approaches must be customised accordingly [20]. This study aims to analyse the relationship between household environmental sanitation-including ownership of clean water sources, ownership of healthy latrines, HWWS behaviour, and household food management-with the incidence of stunting among under-fives in the working area of Tetewatu Health Centre, North Konawe District.

Furthermore, the results of this study are expected to strengthen the integrative approach between the health, sanitation, education, and community empowerment sectors in an effort to accelerate stunting reduction. The national stunting prevention programme has placed WASH (Water, Sanitation, and Hygiene) as one of the important pillars, but its implementation at the household level still needs strengthening. Therefore, the identification of evidence-based risk factors is crucial in developing more effective and sustainable strategies.

Methods

Research Design and Location

This study is a quantitative observational study with a *case-control* design that aims to analyse the relationship between risk factors for home environmental sanitation and the incidence of stunting in toddlers. The *case-control* design was chosen because it is effective for identifying risk factors associated with a health condition, especially in populations where cases have already occurred. The study was conducted in the working area of Tetewatu Health Centre, Wiwirano Sub-district, North Konawe District, Southeast Sulawesi Province. This area was chosen because the prevalence of stunting is still relatively high and there are variations in the quality of environmental sanitation between households. The research was conducted from January to March 2024.

Population, Sample, and Sampling Technique

The population in this study included all toddlers aged 4 to 59 months who live in the working area of Tetewatu Health Centre. The sample was divided into two main groups, namely the case group and the control group. The case group consisted of toddlers who based on anthropometric measurements were classified as stunted, while the control group was toddlers with normal nutritional status who were not stunted. Determination of nutritional status uses indicators of height-for-age (TB/U) or length-for-age (PB/U) categorised according to WHO Z-score standards.

The sampling technique was carried out with a 1:1 *matching* approach between case and control groups, to ensure balanced baseline characteristics such as age and gender. The total number of respondents in this study was 54 children, consisting of 27 cases and 27 controls. The *matching* procedure was intended to reduce potential bias and ensure that differences between groups were truly caused by exposure to environmental sanitation, not by differences in demographic variables.

Research Variables

This study has one dependent variable and four main independent variables. The dependent variable was the incidence of stunting in children under five years old, which was determined based on anthropometric measurements with a Z-score < -2 SD. The independent variables included ownership of a clean water source, ownership of a healthy toilet, handwashing with soap (HWWS) behaviour, and household food management. These four variables were chosen because they have been identified as important determinants in the literature that affect children's nutritional status, both directly and indirectly.

Operational Definition and Categorisation Criteria

Stunting is defined as a growth disorder characterised by a child's length or height being below the age standard, with a Z-score of TB/U or PB/U < -2 SD. The source of clean water is categorised as

eligible if it comes from PDAM, protected wells, or refillable bottled water that is physically feasible and free from the risk of pollution, and has a closed and clean reservoir. Latrine ownership was considered eligible if the household had a toilet with a gooseneck, connected to a septic tank, easy to flush, clean, and not a source of pollution. HWWS behaviour was categorised as good if mothers of children under five washed their hands using soap and running water at five important times, namely before eating, after defecating, before breastfeeding, after cleaning children, and before preparing food. Household food management was categorised as good if there were hygienic practices in storing, processing and serving food for children.

Data Collection Instruments and Techniques

Data were collected through a combination of interviews, field observations and anthropometric measurements. The main instruments used in this study included a pre-validated structured questionnaire to gather information on home sanitation, hygiene behaviour and food management. In addition, observation sheets were used to directly verify the physical condition of the house and sanitation facilities, such as the presence of clean water sources and the type of latrine used.

For the measurement of nutritional status, anthropometric tools such as a microtoise to measure the height of children who can stand and a length board to measure the length of children under two years old were used. The measurement results were then interpreted using the WHO Child Growth Standards, specifically the height-for-age index (TB/U or PB/U), adjusted for the age and sex of the child.

Prior to data collection, enumerators were given intensive training on interview techniques, instrument completion procedures, and appropriate anthropometric measurement methods. Data were collected directly at respondents' homes to ensure accuracy and prevent report bias.

Research Procedures

The study began with an administrative and ethical process, including application for permission to the local health authorities and explanation to potential respondents. After obtaining written consent from the families, the data collection process began.

The initial steps included identification of the case group based on stunting records from the Puskesmas and selection of a control group matched by age and gender. Next, a visit was made to each respondent's home to conduct interviews, observations of environmental conditions, and anthropometric measurements of children. All data was collected manually and then transferred into statistical software for analysis.

Data Analysis

The collected data were analysed using SPSS software version 25.0. Univariate analysis was conducted to describe the frequency distribution characteristics of each variable. Bivariate analysis was conducted to test the association between each independent variable and the incidence of stunting using the Chi-Square test. For data with small numbers or unbalanced categories, the alternative Fisher's Exact Test was used. In addition, the Odds Ratio (OR) value was calculated to measure the risk of stunting in the group with a certain exposure compared to the group without exposure.

The level of statistical significance was set at $p < 0.05$. The results of this analysis were used to determine whether there was a statistically significant association between home environmental sanitation and the incidence of stunting among under-fives in the study area.

Results

Respondent Characteristics

This study involved 54 respondents consisting of 27 cases (toddlers with stunting) and 27 controls (toddlers without stunting), with a ratio of 1:1. This division aims to ensure the balance of analysis between the case and control groups.

Table 1 shows that 83.3% of respondents used unqualified clean water sources (e.g. water from open, unprotected, or polluted sources), while only 16.7% of respondents used qualified water sources such as PDAM, protected wells, or hygienic refill water. The majority of respondents (83.3%) did not have latrines that met health requirements (e.g. pit latrines or without closed drains), while only 16.7% had

proper latrines with septic tanks and hygiene support facilities. A total of 77.8% of respondents showed poor HWWS behaviour, such as not washing hands after defecation or before eating, and only 22.2% had HWWS habits that met health standards. A total of 61.1% of respondents had good food management (cooking until cooked, storing food properly), while 38.9% still showed unhygienic practices in food processing and serving.

Table 1. Frequency distribution of sanitary characteristics of respondents

Variable	Category	Frequency	Percentage (%)
Clean Water Ownership	Qualified	9	16.7
	Not Eligible	45	83.3
Latrine Ownership	Have a proper latrine	9	16.7
	Do not have a latrine	45	83.3
HWWS behaviour	Good	12	22.2
	Not good	42	77.8
Food Management	Good	33	61.1
	Not good	21	38.9

Relationship between Environmental Sanitation and Stunting Incidence

The results of bivariate analysis using the chi-square test show that all household sanitation variables have a significant relationship with the incidence of stunting.

Table 2. Relationship between Environmental Sanitation Risk Factors and the Incidence of Stunting

Variable	Category	Stunting (n/%)	Non-Stunting (n/%)	p-value	OR
Clean Water Ownership	Not Qualified	26 (96.2%)	19 (70.3%)	0.024	10.95
	Eligible	1 (3.8%)	8 (29.7%)		
Latrine Ownership	Do not have	26 (96.2%)	19 (70.3%)	0.024	10.95
	Own	1 (3.8%)	8 (29.7%)		
HWWS behaviour	Not good	25 (92.6%)	17 (63%)	0.019	7.35
	Good	2 (7.4%)	10 (37%)		
Food Management	Not good	19 (71.4%)	2 (7.5%)	0.000	29.69
	Good	8(28.6%)	25 (92.5%)		

Table 2 shows that the results of the analysis indicate that children under five living in homes with inadequate water sources have a 10.9 times greater risk of being stunted than those with access to clean water. This emphasises the importance of providing and protecting the quality of drinking water in the community. Lack of access to healthy latrines also has a significant association with stunting, with the same odds ratio of 10.9 times. This is related to the high risk of environmental contamination by human faeces that can cause chronic infections in children.

Poor handwashing behaviour increases the risk of stunting by 7.35 times. Repeated infections due to poor hand hygiene can interfere with nutrient absorption and worsen children's nutritional status. Poor food management was the most dominant factor, with a 29.7 times greater risk of stunting. This shows that food sanitation in households plays a crucial role in stunting prevention, especially in preventing diarrhoeal diseases that interfere with nutrient absorption.

Discussion

This study aims to identify the relationship between household environmental sanitation risk factors and the incidence of stunting in children under five years of age in the working area of Tetewatu Community Health Centre, North Konawe Regency in 2024. The results showed that four main variables-ownership of a clean water source, latrine ownership, handwashing with soap (HWWS) behaviour, and household food management-had a significant association with the incidence of stunting.[21], [22]. These

four factors have p values <0.05, as well as high Odds Ratio (OR) values, indicating that households with poor sanitation conditions have a much greater risk of causing stunting in children.

The availability and quality of clean water sources are important determinants in the prevention of infectious diseases and intestinal inflammation, both of which contribute to impaired nutrient absorption. This study shows that children from households without an eligible clean water source have a 10.9 times greater risk of stunting compared to those with access to clean water. This condition is in line with research findings by [21] in Lumajang district which states that contaminated drinking water can increase the risk of gastrointestinal infections and ultimately contribute to chronic malnutrition such as stunting.

WHO also notes that water contamination by pathogenic bacteria, particularly *Escherichia coli* and *Vibrio cholerae*, is one of the main causes of diarrhoea that often affects children under five. Long-term recurrent diarrhoea contributes to malabsorption syndrome which ultimately impacts the linear growth of the child[13]. Therefore, the provision of safe and proper clean water is an important strategy in preventing stunting in rural and peri-urban areas such as Tetewatu.

Poor excreta sanitation through open defecation or use of inadequate latrines causes environmental pollution and increases the risk of pathogen exposure. The results of this study showed that 96.2% of stunted children came from households that did not have healthy latrines, with an OR value of 10.9 [15]. This suggests that the unavailability of proper basic sanitation facilities can significantly increase the risk of stunting.

This finding is supported by research [23] in Banyumas District, which concluded that the presence of latrines with septic tanks and goosenecks plays a role in reducing the incidence of environment-based infectious diseases and supporting optimal child growth. In addition, a study conducted by [24] also reinforces that the cleanliness of the sanitation environment is highly correlated with the nutritional status of children under five.

Access to proper latrines is not only about their physical availability, but also their consistent and correct use. Therefore, infrastructure development must be accompanied by clean and healthy living behaviour (PHBS) education, so that people not only have the facilities, but also have the motivation to use them properly and sustainably.

Hygienic behaviour, especially the habit of washing hands with soap at five important times, is the cheapest and most effective preventive measure for infectious diseases. This study showed that respondents with poor HWWS behaviour had a 7.35 times greater risk of stunting than those with good HWWS behaviour. The high proportion of respondents with poor HWWS behaviour (77.8%) indicates weak public awareness of the importance of hand hygiene in preventing infectious diseases.

This result is in line with the study of [25] in Banten Province, which found that poor hygiene behaviours such as not washing hands before eating or after using the toilet were strongly associated with the incidence of stunting in children aged 12-59 months. [13] even categorised the practice of HWWS as one of the basic interventions in the WASH (Water, Sanitation, and Hygiene) approach to prevent stunting in developing countries.

Building a culture of handwashing must be done early through educational interventions at the family, posyandu, and primary school levels. A community-based approach that integrates the provision of HWWS facilities, visual education, and supervision by health cadres has proven effective in increasing community compliance with the practice.

The results showed that household food management was the most dominant risk factor for stunting, with an OR of 29.6. Children living in homes with unhygienic food management practices were almost 30 times more likely to be stunted than children from families with good food management practices. This finding confirms that even if food availability is sufficient, if it is not properly processed and stored it is still at risk of causing infections and food poisoning.

Poor food management can include food storage at inappropriate temperatures, sub-optimal reheating, and food contact with contaminated surfaces or containers. [26] showed that kitchen sanitation

and food processing play a major role in reducing the risk of enteric infections in children under five in rural areas. Therefore, education on proper cooking methods, safe food storage and understanding of food hygiene principles need to be improved at the household level.

Interventions to improve food management can be done through practical training by nutrition officers or sanitarians, empowerment of mothers of children under five in Posyandu, and provision of illustrated educational modules that are easily understood by people with low education levels.[27].

The local context of the Tetewatu Health Centre work area is an important factor in the interpretation of the results. The area has variable coverage of basic sanitation, with many households not having access to clean water or proper sanitation facilities. The percentage of villages that have met Community-Based Total Sanitation (STBM) indicators has only reached 73%, with clean water facilities around 76% and ownership of healthy latrines 60%. This data reflects that structural and behavioural constraints are still a major challenge in reducing stunting.

This study makes an important contribution in highlighting that household sanitation quality not only affects general health, but also has a direct impact on child growth. The *case-control* approach used provides analytical power in identifying key risk factors, which can be used as a basis for formulating evidence-based intervention policies.

The results of this study indicate that efforts to accelerate stunting reduction should include improved household sanitation as a key intervention, in line with the national stunting reduction programme that has established the WASH pillar as an important foundation. STBM-based interventions, which encourage collective community behaviour change in five pillars (stop open defecation, HWWS, household drinking water management, waste management, and liquid waste), need to be expanded in scope and strengthened in implementation down to the household level.

Cross-sectoral synergy is needed, especially between the Health Office, Public Works Office, and Community Empowerment Office, so that sanitation infrastructure development can be aligned with behavioural and educational interventions. In addition, regular monitoring by health centre staff and health cadres of food management practices and household hygiene can strengthen the achievement of stunting reduction targets.

Conclusions

This study shows that home environmental sanitation has a significant relationship with the incidence of stunting in the Tetewatu Health Centre working area. Factors that play a role include ownership of clean water sources, ownership of healthy latrines, handwashing with soap behaviour, and household food management. The most dominant factor was food management, followed by water quality and basic sanitation. Efforts to improve household sanitation and promote clean living behaviour need to be increased as an effective and sustainable stunting prevention strategy.

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