Public Health Research Development
eISSN: 3063-3265
Doi: https://doi.org/10.36568/phrd.v1i2.11
Citation: G. P. Wibasusanti, I. Thohari, Winarko, I. R. E. Wardoyo, Sulistijowati, and C. W. Laksono, "Basic Sanitation Factors and Clean and Healthy Living Behavior as Determinants of Stunting: A Case Study in Bondowoso", *PHRD*, vol. 1, no. 2, pp. 58–68, Oct. 2024.

Article

Basic Sanitation Factors and Clean and Healthy Living Behavior as Determinants of Stunting: A Case Study in Bondowoso

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Receive: 04 September 2024
Revised: 18 October 2024
Accepted: 22 October 2024

Keywords:
1. Basic sanitation
2. Clean and healthy living behavior (CHLB)
3. Stunting
4. Public health

Abstract
Stunting is a nutritional problem that remains high in Indonesia, especially in rural areas like Bondowoso. Poor basic sanitation and bad implementation of Clean and Healthy Living Behavior are often associated with stunting in children under five. This study aims to analyze the relationship between basic sanitation factors and Clean and Healthy Living Behavior as a determinant of stunting in the working area of Sempol Community Health Center in 2024. This research used a case-control study methodology in conjunction with observational analytics. The samples were houses with stunting and non-stunting toddlers in the working area of Sempol Community Health Center. The samples are 24 for each group, using a systematic random sampling technique from a population of 925 toddlers. Data analysis using the Chi-square test with 0.05 degree of error. The result of this research showed that there are differences in basic sanitation facilities of houses and Clean and Healthy Living Behavior in stunting and non-stunting toddlers in the working area of Sempol Community Health Center in 2024. Basic sanitation and Clean and Healthy Living Behavior factors are important factors in efforts to prevent stunting. Improving access to sanitation and promoting the Clean and Healthy Living Behavior program must be a priority in the Public Health Intervention Program in Bondowoso.

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Introduction

Stunting is described as a condition of disrupted growth and development in children that occurs due to malnutrition and repeated infection [1]. This condition can be identified by the child's height being less than standard [2]. In general, stunted toddlers experience delays in physical and mental development, low intellectual abilities and productivity, and are at risk of developing degenerative diseases when they become adults [3]. Stunting can occur due to environmental health factors such as water, latrine access, and waste disposal management [4]. A bad environment can affect children's growth and development, so it is necessary to improve the quality of environmental health to reduce the prevalence of stunting [5].

The prevalence of stunting in Indonesia in 2022 is 21,6%. In East Java, the prevalence of stunting is at 19,2%, with the highest cases in Jember (34,9%) and followed by Bondowoso (32,0%) [6]. The prevalence of stunting in Bondowoso has continuously decreased since 2018, but is still quite high when compared to the prevalence in East Jawa [7]. Ijen District, included in the working area of the Sempol Health Center, has the highest stunting case in Bondowoso [8]. The high stunting case in Bondowoso is caused by various factors, such as a history of exclusive breast milk, basic sanitation facilities at the house, economic conditions, and the education of the mother [9].

Sanitation and the environment influence the occurrence of stunting in toddlers [10]. Poor home sanitation can affect the digestive system due to infection, so growth energy is diverted to protecting the immune system from infection. This condition will affect the process of absorption of nutritional intake that occurs through the toddler's digestive system. If digestive disorders occur over a long period of time and there is no additional nutritional intake, stunting can occur. Toddlers who experience infectious diseases for more than three days are at risk of experiencing stunting [11].

The research results in the working area of Citarip Community Health Center showed that stunting toddlers live in houses with poor sanitation, use poor quality water, do not have latrines, septic tanks, and water waste sewerage facility [12]. Another study in Jember found that many households still have difficulty accessing safe drinking water and do not use proper latrine facilities, which causes stunting [13]. Several other studies also showed that the risk of diarrhea, which is an indirect cause of stunting, can occur due to having unsanitary latrines [14].

Implementation of Clean and Healthy Living Behavior influences the incidence of stunting in toddlers [14]. The research results in the working area of Bambang Community Health Center showed a correlation between nutritional status in the toddler phase and Handwashing with Water and Soap [15]. The awareness of Handwashing with Water and Soap behavior after doing activities is still a problem for most mothers. Beside that, in research in Arjasa, it was found that there was a relationship between the water drinking treatment and the occurrence of stunting [16]. Poor drinking water treatment can affect the nutritional status of toddlers [17].

Many studies have identified a relationship between basic sanitation of house facilities and Clean and Healthy Living Behavior and the incidence of stunting. However, there is still no comprehensive research that specifically examines the differences in basic household sanitation facilities and Clean and Healthy Living Behavior among stunting and non-stunting toddlers in the working area of Sempol Community Health Center. With the results of this research, it is hoped that it can help when planning programs to reduce stunting so that they are more effective, especially those related to sanitation and Clean and Healthy Living Behavior. An example of programs that can be implemented is interventions to improve Clean and Healthy Living Behavior, such as the triggering program of the 5 Pillars of Community-Led Total Sanitation.

Materials and Methods

Research Design and Setting. This research used a case control study design with a quantitative approach to analyze the relationship between basic sanitation factors and Clean and Healthy Living Behavior on the incidence of stunting in Bondowoso.

Participants. Sample determination was carried out using a systematic random sampling technique from a population of 925 toddlers, while the data collection techniques used were interviews and observation. Primary data came from interviews and house assessments using a form, while secondary data was obtained from the Sempol Community Health Center regarding the number of stunting toddlers and house addresses. The research samples in this study were 48 samples with a ratio of 1:1.

The samples were 24 for each group. The case sample in this study were stunting toddlers who lived in the working area of the Sempol Community Health Center. Meanwhile, the control sample is a non-stunting toddler who lived in the working area of the Sempol Community Health Center with a house that is located close to the case sample and has the same characteristics as the case sample in terms of type of house building and residential density.

Source and Measurements. The research was conducted in two stages: the preparation stage and the implementation stage. The preparation stage begins with an initial survey at the Sempol Community Health Center to obtain data related to stunting incidents, basic sanitation of house, and other supporting data, collecting relevant literature as references, and conducting preliminary surveys with stunting toddler houses to establish the research variables. Next, the implementation stage begins with an application for research permission, interviews, and observations. The instruments used in this research were interview and observation forms of basic sanitation of house, which included questions about sample characteristics, the implementation of Clean and Healthy Living Behavior, and an assessment of the requirements for basic sanitation of house.

Data Analysis. Data analysis was carried out using univariate and bivariate analysis. Univariate data was analyzed descriptively to determine the characteristics and distribution of each variable. Bivariate data analysis uses the Chi-Square test to determine the difference between independent and dependent variables. The analysis results are presented as an Odds Ratio (OR) with a 95% confidence interval.

Research Ethics. This research has been declared ethically appropriate by the 7 (seven) WHO 2011 Standards published by the Health Assessment Ethics Commission (KEPK) of the Surabaya Ministry of Health Polytechnic Health with number No. EA/2829/KEPK-Poltekkes_Sby/V/2024.

Results

Characteristics of Respondents

Table 1
Characteristics of Respondents

Characteristics	Amount	Percentage (%)
Toddler's Category		
Stunting	24	50
Non-*stunting*	24	50
Total	**48**	**100**
Gender		
Male	28	58.3
Female	20	41.7
Total	**48**	**100**
Age		
12-23 months	6	12.5
24-35 months	23	47.9
36-47 months	8	16.7
48-59 months	11	22.9
Total	**48**	**100**

Table 1 shows that the characteristics of toddlers based on the incidence of stunting are 48 samples consisting of 24 Stunting samples (50%) and 24 non-stunting samples (50%). Of the samples, 28 toddlers (58.3%) were male, while 20 toddlers (41.7%) were female. Based on age, the sample was dominated by toddlers aged 24-35 months with 23 children (47.9%). Meanwhile, the fewest toddlers aged 12-23 months were 6 toddlers (12.5%).

Differences in Basic Sanitation of House Facilities of Stunting and Non-Stunting Toddlers in the Working Area of Sempol Health Center in 2024

Table 2

Differences in Basic Sanitation of House Facilities of Stunting and Non-Stunting Toddlers

Variable	Toddler's Category				p-value	OR (CI 95%)
	Stunting		Non-*Stunting*			
	n	%	n	%		
Clean Water Supply Facility						
Not Qualify	16	66.7	4	16.7	0.001	10.000 (2.545- 39.293)
Qualify	8	33.3	40	83.3		
Latrine Facility						
Not Qualify	16	66.7	5	20.8	0.004	7.600 (2.071- 27.895)
Qualify	8	33.3	19	79.2		
Water Waste Sewerage Facility						
Not Qualify	13	54.2	2	8.3	0.002	13.000 (2.483- 68.051)
Qualify	11	45.8	22	91.7		
Waste Disposal Facility						
Not Qualify	14	58.3	5	20.8	0.018	5.320 (1.485- 19.064)
Qualify	10	41,7	19	79,2		

Table 2 shows that 66,7% of the clean water supply facilities in the house of stunting toddlers are not qualified, 66,7% of the latrine facilities in the house of stunting toddlers are not qualified, 54,2% of the Water Waste Sewerage Facilities in the house of stunting toddlers are not qualified, and 58,3% of waste disposal facilities in the house of stunting toddlers are not qualified. Based on the results of the Chi-Square test, it was obtained that the *p-value <0,05*, which means there were differences in the clean water supply facilities, latrine facilities, Water Waste Sewerage Facilities, and waste disposal facilities in the house of stunting and non-stunting toddlers.

Differences in Clean and Healthy Living Behavior of Stunting and Non-Stunting Toddlers in the Working Area of Sempol Health Center in 2024

Table 3

Differences in Clean and Healthy Living Behavior of Stunting and Non-Stunting Toddlers

Variable	Toddler's Category				p-value	OR (CI 95%)
	Stunting		Non-*Stunting*			
	n	%	n	%		
Handwashing with Water and Soap Behavior of Mothers						
Not Qualify	21	87.5	9	37.5	0.001	11.667 (2.696- 50.490)
Qualify	3	12.5	15	62.5		
Drinking Water Behavior of Toddlers						
Not Qualify	17	70.8	6	25	0.004	7.286 (2.034- 26.102)
Qualify	7	29,9	18	72		

Table 3 shows that 87,5% of the Handwashing with Water and Soap behavior of mothers of stunting toddlers are not qualified and 70,8% of stunting toddlers are not qualified for drinking water behavior. Based on the results of the Chi-Square test, it was obtained that the p-value <0,05, which

means there were differences in the Handwashing with Water and Soap behavior of mothers and drinking water behavior of stunting and non-stunting toddlers.

Discussion

Determination of stunting in toddlers uses height measurement parameters compared with age, which is categorized into 3 categories: short (stunted), very short (severely stunted), and normal [18]. Stunting occurs more often in male toddlers, in the short and very short categories, compared to female toddlers. Male toddlers do more activities than female toddlers. Stunting can occur if these activities are not accompanied by adequate nutritional intake [19].

Stunting incidents often occur in toddlers aged 24–36 months (45,8%). According to a study, nutritional intake increases as children age [20]. This nutritional intake is needed to produce energy. After the age of 2 years, toddlers do not understand the importance of maintaining personal hygiene, so they are easily exposed to disease. Appetite will decrease when toddlers exposed to disease, so nutritional intake is difficult to fulfill. Insufficient nutritional intake can interfere with growth which can cause stunting [21].

Based on the results of the assessment of clean water supply facilities, it was found that 66,7% of clean water supply facilities are not qualified in the house of stunting toddlers with the water reservoir being open. This condition allows contamination of clean water and becomes a breeding medium for vectors. Clean water sources are supplied by pipes that are dirty, mossy, and leaky, which also allow contamination of the water.

According to WHO, clean water is water that is free from contamination [22]. Consuming contaminated water risks intestinal infections. Chronic intestinal infections can cause impaired absorption of nutrients for growth in toddlers. As a result, malnutrition occurs, which is the main cause of stunting [23]. The results of observations found the difference in the treatment of water use for stunting and non-stunting toddlers. For daily needs, mothers of non-stunting toddlers collect water in reservoirs to settle dirt that may be carried by the water due to leaking pipes. Meanwhile, mothers of stunting toddlers directly use water without any treatment. So this behavior influences the difference in clean water quality for stunting and non-stunting toddlers.

Based on the results of the Chi-Square test, it was found that there was a difference in the clean water supply facilities in the house of stunting and non-stunting toddlers. This is in line with research in Tamanmartani showing that clean water supply is correlated with the occurrence of stunting. Children who grow up in an environment with a poor clean water supply system have the opportunity to become stunting due to infection. When an infection occurs, toddlers experience difficulty absorbing nutritional intake, so they have the potential to experience growth failure, which can cause stunting in toddlers [24].

In line with research in the working area of the Aturan Mumpo Community Health Center, access to clean water supply facilities is related to stunting. Houses without access to clean water increase the chances of stunting in toddlers. Clean water supply facilities are the dominant factor associated with diarrhea. Water that comes from a protected source can prevent diarrhea [25]. Based on the results of the assessment of latrine facilities, it was found that 66,7% of latrine facilities that are not qualified were found in the house of stunting toddlers. All latrine facilities in toddler houses have walls and roofs. In the group of stunting toddlers, many latrine facilities were found that are not qualified, with the condition of the latrine being dirty, with slippery floors, and causing a bad smell. Standards for healthy latrine buildings are: walls, roof, floor, water-seal latrine, septic tank, or pit latrine [26].

The group of stunted toddlers who do not have a private latrine use a public lavatory for daily use. They consider private latrines not an important problem because there are public latrines. In fact,

using public lavatory carries the risk of transmitting disease-causing germs. The group of non-stunting toddlers without private latrine use latrine belonging to neighbors/closest family for daily use. Access to the latrine is always available and easy to reach at any time, the condition of the latrine facilities is qualified so that it is free from vectors. Mothers of non-stunting toddlers also have a habit of Handwashing with Water and Soap that are qualified. So that toddlers who do not have a private latrine in their house are not stunted.

Based on the results of the Chi-Square test, it was found that there was a difference in latrine facilities in the house of stunting and non-stunting toddlers. This is in line with findings in Murung that the ownership of latrines that are not qualified is dominated by stunting toddlers [27]. Apart from that, houses with water-seal latrines but without septic tanks have a big influence on the incidence of stunting [23].

The results of research at the working area of Cicalengka Community Health Center show that stunting is dominated by toddlers who live in houses with unhealthy latrines. There is a link between the condition of latrines and the occurrence of stunting in toddlers. Healthy latrines can prevent environmental pollution, which can reduce the risk of diarrhea. Recurrent diarrhea has the potential to cause stunting due to impaired nutrient absorption [28]. In line with the results of research in the working area of Talun Kenas Community Health Center, it was found that there was a correlation between the condition of latrines and the occurrence of stunting. Respondents with latrine conditions that are not qualified are at risk of stunting. In addition, latrines that are not qualified can cause waste pollution [29].

Based on the results of the assessment of Water Waste Sewerage Facilities, it is known that 54,2% of Water Waste Sewerage Facilities are not qualified were found in the house of stunting toddlers with an open water ditch or directly on the ground, causing puddles and bad odors. Puddles can become a breeding ground for vectors, which are a medium for disease transmission. Vector breeding also occurs due to piles of rubbish in the ditch. If vectors interact with food, food contamination will occur. So, if these foods are consumed, they will cause infectious diseases so that, in the long term, stunting will occur [30].

In the group of non-stunting toddlers who have a Water Waste Sewerage Facilities that is not qualified, waste water disposal is carried out directly on the ground, causing puddles and bad odors that can attract vectors such as flies. However, the Water Waste Sewerage Facilities in non-stunting toddler is located far from house buildings, waste disposal facilities, and water supply facilities. Apart from that, the waste disposal facilities in the house of non-stunting toddlers are qualified: being closed and watertight. So that toddlers who have a Water Waste Sewerage Facilities that are not qualified in this case will not be stunted.

Based on the results of the Chi-Square test, it was found that there was a difference in Water Waste Sewerage Facilities in the house of stunting and non-stunting toddlers. This is in line with the findings at the working area of Simpang Tuan Community Health Center that houses with Water Waste Sewerage Facilities are not qualified for being occupied by stunted toddlers. Water Waste Sewerage Facilities that are not qualified occur because they are not cleaned regularly due to laziness, so lots of rubbish is found. In addition, the Water Waste Sewerage Facilities are located <10 meters from the water source, which puts the water at risk of causing infectious diseases. In the aesthetic aspect, Water Waste Sewerage Facilities that are not qualified emit bad odors that can disturb the sense of smell and damage the view [31].

In line with research at the working area of Yosomulyo Community Health Center, it was found that Water Waste Sewerage Facilities were related to the incidence of stunting, with the percentage of families that had unqualified Water Waste Sewerage Facilities being dominated by stunting toddlers

[32]. The results of research at the working area of Kassi-Kassi Community Health Center also showed that there was a correlation between wastewater management and the incidence of stunting. Water Waste Sewerage Facilities are safe if they are closed so that there are no puddles. A closed sewerage will prevent the water source from being contaminated by both dangerous chemicals and pathogenic bacteria [4].

Based on the results of the assessment of waste disposal facilities, it was found that 58,3% of waste disposal facilities that are not qualified were found in the houses of stunting toddlers in open conditions, making it possible to become breeding places for vectors. In addition, some waste disposal facilities have construction that leaks easily and is not watertight. Good waste management facilities at least meet the following requirements: located close to the source of the waste, closed, strong construction, and watertight [33].

Waste management aims to ensure that waste does not become a breeding ground for vectors, bacteria, or parasites. Unqualified waste management can have negative impacts on the environment and humans. Waste can pollute the environment, including water, which can have an impact on infectious diseases such as diarrhea in toddlers. If diarrhea occurs for a long time without adequate nutritional intake, the toddler is at risk of stunting [4].

Based on the results of the Chi-Square test, it was found that there was a difference in waste disposal facilities in the house of stunting and non-stunting toddlers. This is in line with findings at the working area of Yosomulyo Community Health Center that stunting occurs more often in families with unqualified waste disposal facilities. Unqualified waste disposal facilities cause trash to be accessible to vectors such as cockroaches and flies. Vectors have the potential to cause environmental-based diseases and infections, which in the long term can have an impact on stunting in toddlers [32]. Several other studies have also found that waste disposal facilities are associated with stunting [30] - [34]. Open waste disposal facilities can make it easier for vectors to reach the trash inside. This vector will contaminate food with bacteria carried from the trash. Toddlers can get diarrhea and worm infections if they eat these foods, which in the long term can cause stunting.

Based on the results of the assessment of Handwashing with Water and Soap behavior among mothers of toddlers, it is known that 87.5% of mothers of stunting toddlers are not qualified to implement the Handwashing with Water and Soap behavior. They think that washing their hands without soap is enough. The behavior of Handwashing with Water and Soap plays a role in reducing the risk of diarrheal disease by up to 45% and reducing the risk of toddlers experiencing stunting by 15%. The behavior of washing hands without using soap can affect a mother's cleanliness when handling their child. As a result, children are easily infected by the mother's dirty hands. Germs on the mother's hands can cause diarrhea. Diarrhea is an indirect factor in stunting [35].

Based on the results of the Chi-Square test, it was found that there was a difference in Handwashing with Water and Soap behavior of mothers between stunting and non-stunting toddlers. This is in line with findings in Ogan Ilir that mothers of toddlers who do not wash their hands with soap have stunted toddlers. The habit of Handwashing with Water and Soap, especially after defecating and before feeding children, can break the chain of microorganisms that cause diarrhea. According to WHO, Handwashing with Water and Soap behavior helps reduce the risk of diarrhea by 47% [36].

In line with the results of research in Central Sulawesi, the behavior of Handwashing with Water and Soap is related to the incidence of stunting. The behavior of Handwashing with Water and Soap is more often implemented by non-stunting respondents than by stunting respondents [37]. The same results were also obtained at the working area of Rejosari Community Health Center that

Handwashing with Water and Soap behavior was correlated with stunting. Mothers of toddlers who do not implement Handwashing with Water and Soap behavior are at risk of causing stunting in their children [38].

The behavior of washing hands before holding and feeding toddlers without using soap can be related to stunting. Food can contain pathogenic bacteria from the mother's hands, which can cause digestive disorders. This can have an impact on the growth of toddlers, potentially causing stunting [39]. The Handwashing with Water and Soap behavior plays an important role in reducing the prevalence of stunting. Handwashing with Water and Soap behavior is a simple step to reduce the risk of diseases in children such as Acute Respiratory Infection and diarrhea, which are major contributors to child mortality. In washing hands, there are 7 important steps: must be in running water; the parts to be cleaned are between the fingers, palms, and backs of the hands. Then rinse the hands until clean and then dry [40].

Based on the results of the assessment of the drinking water behavior of toddlers, it is known that 70.8% of stunting toddlers are not qualified. They do not treat the water before consumption. The toddler's family thought that consuming water without any treatment tasted fresher. So, toddlers in this family are also used to drinking water without any treatment. The source of drinking water for the stunting and non-stunting toddler groups comes from the spring water and water refill station.

Non-stunting toddlers whose drinking water comes from springs treat the water by boiling it. Mothers of non-stunting toddlers also filter the drinking water both before and after the boiling process. This aims to filter out impurities that might contaminate drinking water, whether obtained from water reservoirs or during the boiling process. So the quality of drinking water for non-stunting toddlers is better than stunting toddlers who do not treat the drinking water before consuming it.

Based on the results of the Chi-Square test, it was found that there was a difference in drinking water behavior between stunting and non-stunting toddlers. This is in line with several studies with the results that drinking water management correlates with stunting [16], [37], [41]. Drinking water that is not qualified is at risk of containing pathogenic bacteria, which can cause cases of diarrhea. Diarrhea is a risk factor for stunting.

Water treatment by boiling can improve the quality of drinking water and eliminate pathogenic bacteria [4]. Drinking water from the water refill station must also be treated by boiling. Cleanliness of equipment, gallons, methods, and storage time for drinking water are factors that can cause dangerous microbiological contamination. If drinking water is stored for more than three days, the Coliform bacteria and E. Coli bacteria in it can harm human health. So drinking water must be boiled before consumption [16].

As a prevention of stunting, the triggering program of the 5 Pillars of Community-Led Total Sanitation aims to change community behavior towards stunting. Based on interviews with Sempol Community Health Center Sanitarian Officers, it is known that the triggering program of the 5 Pillars of Community-Led Total Sanitation was done in Pillar 1 in 2015. But in fact, the mothers of toddlers in both the stunting and non-stunting groups felt that their families had never participated in the triggering program. This can occur due to triggering activities that have been carried out for too long.

To reduce the prevalence of stunting, a triggering program must be carried out comprehensively on the 5 Pillars of Community-Led Total Sanitation. This will enable a reduction in the prevalence of stunting while preventing stunting in toddlers at the community and individual levels. Basic sanitation of house facilities is closely related to the 5 Pillars of Community-Led Total Sanitation. Triggering programs are needed on other pillars in the 5 Pillars of Community-Led Total Sanitation to trigger changes in community behavior. Changes in community behavior after triggering program can influence changes in facilities and infrastructure at house and in public facilities [42].

Conclusions

This research aims to explore the role of basic sanitation of house facilities and Clean and Healthy Living Behavior as determinants of the incidence of stunting among toddlers in the working area of Sempol Community Health Center, Bondowoso. The findings reveal that sanitation factors, such as water supply facilities, latrine facilities, water waste sewerage facilities, and waste disposal facilities, have significant differences between families with stunted and non-stunting toddlers. Apart from that, Clean and Healthy Living Behavior, especially Handwashing with Water and Soap behavior of mothers and drinking water behavior by toddlers, are also important factors that influence the incidence of stunting. Inadequate sanitation quality and poor Clean and Healthy Living Behavior have been proven to contribute to the increased risk of stunting in toddlers. This emphasizes the importance of community-based interventions in improving sanitation facilities and encouraging clean living behavior as an effort to prevent stunting.

For future research, it is recommended to focus on more specific interventions related to improving sanitation and changing Clean and Healthy Living Behavior in the community. Longitudinal research also needs to be carried out to measure the long-term impact of this intervention on stunting prevalence, as well as considering other factors such as nutritional intake, environmental health, and public education.

Funding

Not Applicable.

Informed Consent Statemen

Informed consent was obtained from all subject involved in the study.

Conflicts of Interest

The authors declare no conflict of interest.

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