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THE INFLUENCE OF ENVIRONMENTAL SANITATION ON STUNTING

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Abstract

Introduction: *According to Pekanbaru City Health Department in 2019, there were 17.,67% of toddlers in Pekanbaru with poor nutritional status. Poor sanitation can trigger the emergence of infectious diseases that can reduce nutritional absorption in toddlers throughout the digestive process, resulting in stunting. The aim of this study was to analyze environmental sanitation influences on stunting.* ***Methods:*** *This research used case control study design. The case and control groups each received 30 samples. Independent variables include water source for sanitation, condition of latrines, condition of hand washing facilities with soap, condition of waste water drainage channels, management of household waste, type and condition of floors, presence of vectors and disease carrier animals, drinking water quality from biological conditions. The dependent variable was stunting. All data were collected using questionnaires that were asked directly to participants. Data analysis was performed by using the chi-square and multiple logistic regression tests.* ***Results and Discussion:*** *Water sources for sanitation, availability and condition of latrines, drinking water quality from biological terms influences on stunting (p-value <0.,05). Multivariate tests show that, the drinking water quality from biological terms and water sources for sanitation had a probability value of 21% to cause stunting.* ***Conclusion:*** *The dominant factor influences on stunting is the drinking water quality in biological terms and water sources for sanitation.*

INTRODUCTION

Stunting is a term used to describe toddlers who have chronic nutritional issues, with nutritional status defined by height-age z-score (HAZ Score) value less than -2SD (1). Providing nutritional intake that does not meet needs for a long time can cause stunting (2).

In 2020, stunting affected 22% or 149.2 million children under five years old worldwide, with Asia accounting for more than half (55%) of the total. According to the Indonesian Nutritional Status Study data from 2021, the prevalence of stunting among toddlers in Indonesia was 24.4%, or 5.33 million toddlers (3). In 2021, the proportion of stunted toddlers in Riau Province reached 22.3% (4).

Data for children after the Pekanbaru City Health Service recapitulated nutritional status by collecting data via Elektronik-Pencatatan dan Pelaporan Gizi Berbasis Masyarakat or electronic Community-Based Nutrition Recording and Reporting (e-PPGBM) from the age of 0-59 months in 2019. Thus, the first position was acquired in the working area of the Rumbai Bukit Community Health Center at 39.4%, and the second place was obtained in the working area of the Limapuluh Community Health Center at 29.3% (5).

Poor sanitation in the environment is an indirect source of nutritional issues (6). The sanitation system is designed to protect human health from the threat of toxic excreta (7). The sanitation in question can be observed through the five pillar aspects of Community-Led Total Sanitation (CLTS) based on the Minister of Health Regulation Republic of Indonesia Number 3 of 2014, namely the availability of healthy latrines, facilities

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for washing hands with soap, the quality of drinking water and household food, the availability of facilities for securing household waste, and the condition of waste water drainage channels. Aside from these five pillars, there are several sanitary components, including the condition of the house, such as the type of floor occupied and the presence or absence of vectors and disease-carrying animals in the house (8). One of the goals of basic sanitation activities is to provide clean water (9). Clean water is essential in everyday living. Humans use water in their daily lives for bathing, washing, cooking, drinking, and other activities (10).

Poor sanitation (including unsanitary type of lactrine and lack of clean water availability) can lead to infectious diseases because it reduces food absorption in toddlers throughout the digestive process (11). Low sanitation can cause gastrointestinal issues in toddlers, causing a large amount of energy to be needed for immunity rather than growth, resulting in stunting (12). A substantial relationship was discovered based on research conducted on toddlers in the Citarip Community Health Center operating area in Bandung City. Stunting is associated with a history of an infectious disease (13). Similarly, a study on toddlers at the Kerkap Community Health Center in the North Bengkulu region found a link between environmental sanitation, a history of infectious disease, and the occurrence of stunting (11).

Stunting produces suboptimal cognitive development, and children with inadequate cognitive skills can stifle economic growth and exacerbate poverty (14). Based on the data shown above, stunting incidences in Pekanbaru remain relatively high. Pekanbaru has also been designated as a stunting prevention locus in 2021. Considering the impact of the large stunting condition, it is necessary to handle it more comprehensively, given that stunting cases are still relatively high, particularly in Rumbai Bukit Community Health Center and the Limapuluh Community Health Center.

METHODS

A case control study was conducted to analyze the effect of environmental factors such as sanitation on the incidence of stunting. This study was carried out in two work areas in Pekanbaru City with the largest number of stunting cases, namely the Rumbai Bukit and the Limapuluh Health Center work area. This study was carried out between March 2022 and July 2023. The population of this study included all families with stunting toddlers who lived in Rumbai Bukit and Limapuluh Health Center work area. The total population were 62 toddlers. We calculated the minimum sample for a case control study design and obtained a sample of 30 children. The ratio between the case group and the control group was 1:1, thus 60 respondents were needed. In this study, there are two categories of data: primary data and secondary data.

In this study, the primary data source was the family or respondents directly in both the case and control groups. The results of the Community Health Center's monitoring and reporting of stunting conditions via e-PPGBM are used as a secondary data source in this study. To get data on environmental sanitation conditions, primary data were collected through interviews utilizing questionnaires.

Other supporting data were gathered by reviewing documents from the community health center's stunting incidence recording and reporting system. Primmary data in this study were determined by questionnaire as to environmental sanitation, which includes healthy toilet conditions, the condition of hand washing facilities with soap, the condition of waste water drainage channels, household waste management, water sources for sanitation, the type and condition of house floors, the presence of vectors and disease-carrying animals. To examine the biological quality of drinking water, we use the Most Probable Number (MPN) method. Univariate data analysis was performed to obtain an overview of risk factors using frequency and percentage, followed by bivariate data analysis to determine the association between sanitation and stunting using chi-square test. The risk of stunting is measured using the odds ratio (OR). Multivariate analysis using the Multiple Logistic Regression test was performed to see variables that influence simultaneously.

RESULTS

General Description of Respondents

According to Table 1, the most respondents were aged 24-59 months. The case group (stunting) had 90%, while the control group had 63.3%. Based on gender, the most respondents in case group were male (60%), while those in the control group were distributed equally (50%).

Table 1. The Characteristics of Respondents Based on Age and Gender

Respondents' Characteristics	Stunting Occurrence			
	Stunting (people)	(%)	Not Stunting (people)	(%)
Age				
6-23 months	3	10	11	36.7
24-59 months	27	90	19	63.3
Gender				
Male	18	60	15	50
Female	12	40	15	50

Description of the Implementation of Environmental Sanitation in Families with Stunted Toddlers

According to Table 2, more water sources for sanitation do not fulfill the standards, with 36 respondents (60.0%). More respondents meet the requirements as drinking water sources as evidenced by 50 respondents (83.3%). More respondents did not meet the requirements for latrine conditions, namely 43 respondents (71.7%). The condition of handwashing facilities with soap meets more requirements as shown by 49 respondents (81.7%). Regarding the condition of waste water drainage channels, more respondents did not meet the requirements with a total of 49 respondents (81.7%).

Table 2. Frequency Distribution of Environmental Sanitation Application on the Family that has Stunting Toddler and Not Stunting Toddler

Environmental Sanitation	Stunting Occurrence			
	Stunting (people)	(%)	Not Stunting (people)	(%)
Water Source for Sanitation				
Not fulfilling the requirement	23	76.7	13	43.3
Fufilling the requirement	7	23.3	17	56.7
Drink Water Source				
Not fulfilling the requirement	6	20	4	13.3
Fulfilling the requirement	24	80	26	86.7
The Toilet Condition				
Not fulfilling the requirement	26	86.7	17	56.7
Fulfilling the requirement	4	13.3	13	43.3
The Facility Condition of Hand Wash Using Soap				
Not fulfilling the requirement	7	23.3	4	13.3
Fulfilling the requirement	23	76.7	26	86.7
The Condition of Waste Water Drainage Channel				
Not fulfilling the requirement	25	83.3	24	80
Fulfilling the requirement	5	16.7	6	20
The Management of Household Garbage				
Not fulfilling the requirement	24	80	23	76.7
Fulfilling the requirement	6	20	7	23.3
The Floor Type and Condition				
Not fulfilling the requirement	8	26.7	7	23.3
Fulfilling the requirement	22	73.3	23	76.7
The Presence of Vector and Animal that Brings Disease				
Not fulfilling the requirement	23	76.7	22	73.3
Fulfilling the requirement	7	23.3	8	26.7
The Quality of Drink Water from Biological Requirement				
Not fulfilling the requirement	26	86.7	16	53.3
Fulfilling the requirement	4	13.3	14	46.7

More household waste management did not meet the requirements as seen by 47 respondents (78.3%). More floor types and conditions meet the requirements indicated by 45 respondents (75.0%). Regarding the presence of vectors and disease-carrying animals, there were more who do not meet the requirements with 45 respondents (75.0%). Furthermore, regarding the quality of drinking water from biological requirements, more people did not meet the requirements with a total of 42 respondents (70.0%).

The Effect of Environmental Sanitation on Stunting Occurrence

According to Table 3, water sources for sanitation had a significant influence with stunting (p-value=0.018). The other factors that had significant result were latrine conditions (p-value=0.022) and the quality of drinking water from biological conditions (p-value=0.011). The other factors that were not significantly related to stunting in the study were: drinking water sources (p-value=0.729), the condition of hand washing facilities with soap (p-value=0.505), wastewater drainage channels (p-value=1.000), household waste management (p-value=1.000), the type and condition of the floor (p-value=1.000), the presence of vectors and disease-carrying animals (p-value=1.000).

Table 3. The Influence of Environmental Sanitation on Stunting Occurrence

Environmental Sanitation	Stunting Occurrence				OR	p-value
	Stunting		Not Stunting			
	(n=30)	%	(n=30)	%		
Water Source for Sanitation						
Not fulfilling the requirement	23	76.7	13	43.3	4.29	0.018
Fufilling the requirement	7	23.3	17	56.7		
Drink Water Source						
Not fulfilling the requirement	6	20.0	4	13.3	1.62	0.729
Fulfilling the requirement	24	80.0	26	86.7		
The Toilet Condition						
Not fulfilling the requirement	26	86.7	17	56.7	4.97	0.022
Fulfilling the requirement	4	13.3	13	43.3		
The Facility Condition of Hand Wash Using Soap						
Not fulfilling the requirement	7	23.3	4	13.3	1.97	0.505
Fulfilling the requirement	23	76.7	26	86.7		
The Condition of Waste Water Drainage Channel						
Not fulfilling the requirement	25	83.3	24	80.0	1.25	1.000
Fulfilling the requirement	5	16.7	6	20.0		
The Management of Household Garbage						
Not fulfilling the requirement	24	80.0	23	76.7	1.21	1.000
Fulfilling the requirement	6	20.0	7	23.3		
The Floor Type and Condition						
Not fulfilling the requirement	8	26.7	7	23.3	1.19	1.000
Fulfilling the requirement	22	73.3	23	76.7		

Environmental Sanitation	Stunting Occurrence				OR	p-value
	Stunting		Not Stunting			
	(n=30)	%	(n=30)	%		
The Presence of Vector and Animal that Brings Disease						
Not fulfilling the requirement	23	76.7	22	73.3	1.19	1.000
Fulfilling the requirement	7	23.3	8	26.7		
The Quality of Drinking Water from Biological Requirement						
Not fulfilling the requirement (colliform +)	26	86.7	16	53.3	5.68	0.011
Fulfilling the requirement (colliform -)	4	13.3	14	46.7		

Simultaneous Effect of Environmental Sanitation on Stunting Occurences

According to Table 4, there are two variables with p-values < 0.05, namely water sources for sanitation and the availability of latrines. According to Table 5, the variable that has had the most impact on the occurrence of stunting is the quality of drinking water.

Table 4. The Initial Model of Simultaneous Influence of Environmental Sanitation Toward Stunting

Variable	B	p-value	OR	95% CI
The water source for sanitation	1.303	0.122	3.67	0.705-19.190
The toilet availability	0.729	0.427	2.07	0.343-12.517
The quality of drinking water from biological requirement	1.993	0.005	7.33	1.801-29.888
Constant	-5.298	0.000	0.005	

Table 5. The Final Model of Simultaneous Influence of Environmental Sanitation Toward Sunting Occurrence

Variable	B	p-value	OR	95% CI
The water source for sanitation	1.754	0.006	5.78	1.661-20.116
The quality of drinking water from biological requirement	2.040	0.004	7.69	1.896-31.213
Constant	-5.065	0.001	0.006	

Thus, based on the findings of the multiple logistic regression analysis, the formula is:

Y = -5,065 + 1,754 Water sources for sanitation + 2,040 Drinking water quality

Y = -1,271

$$p = \frac{1}{1+e^{-y}}$$

$$p = \frac{1}{1+e^{-(-5,065+1,754+2,040)}}$$

$$p = \frac{1}{1+2,72^{(1,271)}}$$

p = 0,21 (21%)

DISCUSSION

Description of Respondents

This study was corroborated by a study conducted at the Anggut Atas and Panurunan Community Health Centers in Ratu Samban sub-district, Bengkulu City, which discovered that the results were more prominent for children aged 24-59 months (15). Children's quality of life is determined between the ages of 0-23 months. Furthermore, if the quality of life of children aged 0-23 is not properly managed, it can lead to a bad quality of life for children later in life, one of which is delayed physical growth in the child (16).

This research was supported by previous research conducted at the Air Bangis Health Center, West Pasaman Regency. The majority of toddler responses were male (17). Female babies in impoverished countries have a higher survival rate than male neonates. Indonesia is also included. This is because the male toddler's growth and development are more influenced by environmental influences than girls (18). The interaction of male toddlers with the environment is more active than female toddlers. If the sanitation of the surrounding home environment is not good, it will increase the risk of infectious diseases and will affect children's growth and development.

Description of the Implementation of Environmental Sanitation in Families with Stunted Toddlers

This research was validated by previous research conducted in East Lampung which found that more people did not meet the requirements (19). The water in concern for sanitation is water used for daily hygiene such as bathing, cleaning food, clothes, and food (20).

This study supports prior research in Kurma village, which discovered that more drinking water sources matched the requirements than those that did not (21). Unprotected water can be harmful to one's health (22). Deficiencies can occur as a result of impaired nutrition absorption. Catabolism will develop if micronutrients are depleted, and toddlers will lack the delivery of important nutrients to body tissues (19).

This research was in line with previous study in Rule Mumpo health center, Central Bengkulu Regency, which found that there was a greater frequency of respondents whose toilet availability did not meet the requirements. There are still those who have access to unsafe toilets; therefore, many continue to practice open

defecation, which causes environmental contamination due to pathogen spread (23).

This study supports prior research in Rambah health center, which discovered that a greater number satisfied the criterion (24). Washing hands with soap is the most crucial habit for preventing the spread of pathogens such as diarrhea. After defecating and before feeding our child, it is critical to cleanse our hands (25).

This study was consistent with other study held in the Pangkajene city health center work area, which discovered that there were more respondents with inadequate waste disposal (26). Securing wastewater drainage channels is the management of domestic liquid waste coming from the remainder of household activities that must meet standard environmental health and health requirements (27).

This research was supported by previous research conducted in the Candipuro Community Health Center, South Lampung, which showed that there were more respondents whose waste management did not meet the requirements (28). Poor household waste management is one example of what can cause stunting. For example, there is no cover for the trash can, allowing vectors such as cockroaches and flies to nest (29). The high density of vectors and disease carrier animals will increase the risk of food and drink contamination. Contaminated food or drink also increases the risk of infectious diseases and children's growth and development.

This research was supported by previous research conducted in Helebeik village, Lobalain subdistrict, Rote Ndao Regency, which found that there were more respondents whose floor types did not meet the requirements. If the house's floor is dusty and not watertight, it will serve as a breeding ground for disease vectors (30).

This research was supported by previous research conducted in the Lebong district which found that there were more respondents whose presence of vectors did not meet the requirements (31) Disease transmission begins with pathogenic germs being carried by cockroach legs or other bodily organs and subsequently contaminating food (29). This study supports prior research conducted in the OKU Health Service operating region, which discovered that more respondents' drinking water quality did not match the requirements (32).

The Effect of Environmental Sanitation on Stunting Occurences

This research was in line with previous study that held in the Maryana Community Health Center, Banyuasin I subdistrict, Banyuasin Regency, which found a significant influence between clean water sources and stunting (p-value = 0.001) (33). Based on research, it was found that households that had sanitation water sources that did not meet the requirements had a 4.29 times risk of stunting. Based on research, it is discovered that as many as 58.6% of respondents have a distance between water sources for sanitation and wastewater infiltration holes and septic tanks < 10 m. According to researchers, the water sources for sanitation owned by the respondents were polluted by dirt from septic tanks and waste water drainage channels. Water is a medium for spreading germs and can cause various diseases, one of which is water-washed disease. Water-washed disease is disease transmission that occurs because the area around clean water sources is not clean. Water sources for sanitation used by the community can be contaminated with germs as a result of used household wastewater because the water source environment is not impermeable to water (34).

This research was also in line with study held in Sampang that there is no significant relationship between the source of drinking water and the incidence of stunting (p-value=0.166) (35). People drink water from the same source, namely refilled gallon drinking water purchased and sold by communities, with 68.3% of refilled gallon drinking water sources. Waterborne disease is one method of disease transmission via water. Waterborne disease occurs when pathogens contaminate water, causing pathogens to enter the body through the mouth with food and water, causing infection and affecting nutritional absorption (34, 36).

This research was in line with research conducted in the working area of the Rule Mumpo Public Health Center, Central Bengkulu Regency, which found an influence between the availability of toilets and the incidence of stunting (p-value=0.019) (37). The unavailability of healthy toilet facilities at home has been proven to be a trigger for health problems (38). According to the findings, respondents who had toilets that did not fulfill the requirements were four times more likely to suffer from stunting. As many as 63.8% of respondents had septic tanks that were more than 10 meters from sources of drinking water or sanitation water. Researchers discovered that a septic tank located less than 10 meters from drinking water or sanitation water sources can pollute water sources, causing the water utilized to fail to fulfill the standards. The distance between the septic tank and the water source, which does not satisfy the standards, is one of the reasons for polluted water sources. Water infected with excrement can induce a variety of diseases such as typhus, dysentery, cholera,

diarrhea, worms, and others (39). Diseases spread through feces through food, drinks, vegetables, and fruit that are washed using contaminated water, soil media, polluted water, and vectors (34).

This study supports previous research on Seraya Island, Tanjung Riau, Batam City, which found no significant association between the availability of hand washing facilities with soap and the frequency of stunting (p-value=0.607) (25). According to the research, 98.3% of respondents provided enough water in a holding tank or bucket and as many as 85.0% of respondents provided soap for washing hands; however, even in the presence of hand washing soap or sufficient water for washing hands, respondents did not wash their hands properly after touching germ-contaminated items and before eating with their hands. The necessity of properly washing hands and using soap is to maintain hand hygiene and prevent germs from spreading from the hands to the human body. Germs can be transferred by direct contact with hands or by touching objects around us (40).

This study supports prior findings that there is no significant association between wastewater drainage channel ownership and the frequency of stunting (p-value=0.814) (41). According to studies, 71.7% of those polluted have open wastewater channels. Vectors and disease-carrying animals provide sources of clean water and sanitation, but vectors and disease-carrying animals do not land on the food consumed because the food consumed is stored in cupboards or the food on the table is covered with a movable food cover. Open wastewater drainage channels can serve as a breeding ground for vectors and an intermediary for germs, which can cause diseases such as digestive tract infections, which decrease nutrient absorption. If this persists over an extended period and there is insufficient nutritional intake, it might lead to stunting (42).

This research was in line with research conducted in Mesjid Village, Samarinda Seberang Sub-District, which stated that there was no significant relationship between waste management and stunting incidents (p-value=1.000) (43). According to studies, 73.3% of people have an open garbage can in their home. An open garbage can encourages the spread of unpleasant odors and invites vectors and disease-carrying animals to land in the trash and then land on the food or drinks consumed. Vectors or disease-carrying animals, on the other hand, do not enter food or drink if it has been stored in a cabinet or covered with a movable food cover. Open trash can serve as a haven for vectors, disease-carrying animals, and microorganisms (44).

This research was in line with research conducted in East Java finding that there is no significant relationship between the type of house floor and the incidence of stunting (p-value=0.418) (45). According to the research, 83.3% of respondents have ceramic and cement floors, and 85.0% have clean floors; however, not all clean floors are free of bacteriological germs because respondents rarely clean the floors with floor cleaning fluid, and toddlers frequently pick up food that has fallen on the floor and immediately consume it again. The floor of the house is one of the areas most regularly accessed by family members, thus germs on the floor from locations visited by the family can easily enter the body through the skin (46).

According to research, 56.7% of respondents had signs of mice in the house, 55.0% had signs of cockroaches in the house, and 68.3% had signs of flies in the house. Food is stored in the food closet or covered with a serving hood on the dining table to avoid contamination by vectors and disease-carrying animals. The disease is typically transferred mechanically by vectors such as flies contaminating food with disease germs that have clung to their feet or bodies from mounds of trash where they previously landed. Similarly, cockroach vectors can spread pathogenic pathogens by direct contact with food. Vectors such as rats are frequently found in neglected garbage piles, and both inside and outside the rat's body there are numerous parasites and rat fleas (34).

In the research, it was found that the drinking water quality had a 5.68 times risk for stunting. This research also is in line with other research conducted in the Candipuro South Lampung Health Center that there is a significant relationship between the quality of drinking water and the incidence of stunting (p-value=0.005) (28). As many as 70% of respondents have coliform bacteria in their drinking water. The drinking water consumed is from refillable gallon water obtained at a refillable water depot near the house, the management and water source of which researchers are unsure they meet the standards. Researchers also discovered that excrement in the septic tank affected the water used for sanitation, so that water used for daily requirements, such as washing eating utensils and washing hands, included coliforms. The presence of potentially harmful bacteria, such as coliform and *E. Coli*, can be hazardous to one's health due to contamination of drinking sources or the container in which the drinking water is stored (47).

Simultaneous Effect of Environmental Sanitation on Stunting Occurences

Based on the multivariate results, it was discovered that two variables, namely drinking water quality and water sources for sanitation, had the most significant roles. Respondents whose drinking water quality does not meet the requirements are 7.69

times more likely to be stunted, while respondents whose water source for sanitation does not meet the requirements are 5.78 times more likely to be stunted. Following the computations, it was discovered that families who have a water supply for sanitation but the quality of drinking water does not fulfill the requirements had a 21% (probability 0.21) risk of stunting occurring and a 79% chance of other variables occurring. Bathing, washing, toileting, cooking, bathing, and other activities all require clean water. Water can also be a medium for the spread of disease in the field of health because there are chemical components dissolved in water that can damage health. Viruses, bacteria, vectors, and protozoa are among the agents that can spread disease through water. The agent can induce gastrointestinal infections in children, such as diarrhea. Agents that can infect the skin and eyes, in addition to the digestive tract, include scabies and trachoma (48). Diseases can be spread by water polluted by feces that are not disposed of in latrines or excrement that comes from latrines that do not fulfill the standards (49).

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CONCLUSION

Based on the research results, it can be concluded that there is influence between the water source for sanitation, the availability and condition of toilet, and drink water quality as the biological requirement of stunting occurrence. There is no influence between the source of drinking water, the condition of hand wash facility by using soap, the condition of waste water drainage channel, the management of household garbage, the type and condition of the house floor, and the presence of vectors and animals that brings disease toward stunting occurrence. Multivariately, the dominant factor of stunting occurrence is the drinking water quality as the biological requirement and the water source for sanitation.

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