

## POOR BASIC SANITATION IMPACT ON DIARRHEA CASES IN TODDLERS

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### Abstract

**Introduction:** Diarrhea is a disease associated with poor people and mostly suffered by toddlers. The poor environmental quality triggers the growth of pathogenic microorganisms. This study aimed to analyze the relationship between basic sanitation with diarrhea in toddlers. **Methods:** The study was observational analytical study with cross-sectional design. The study was conducted in Leran Village, Bojonegoro, East Java, Indonesia. The sample was toddlers mother, amounting 63 respondents choosing by simple random sampling technique. **Results and Discussion:** The results of data analysis showed that diarrhea in toddlers was related to the type of floor ( $p = 0.026$ ,  $PR = 2.21$ ), latrine condition ( $p = 0.000$ ,  $PR = 3.28$ ), waste management ( $p = 0.000$ ,  $PR = 27.5$ ), clean water source ( $p = 0.000$ ,  $PR = 5.32$ ). **Conclusion:** Several ways to reduce the prevalence of diarrhea including cleaning the floor regularly, providing a mat on the floor; provide a closed and waterproof trash, boiled water before drinking, and washing hands with soap after contacting with the ground.

## INTRODUCTION

Health is a well-being condition, whether it is in terms of physical, mental, spiritual and social which allows each person to live productively in terms of social and economic (1). A person's health is determined by the condition of the individual himself and environment. Factors that contribute to an individual's health status are the socio-economic environment, physical environment, and individual behavior (2). The quality of environmental health is one of the factors of H.L Blum's theory which gives the biggest role for public health, several aspects including access to clean water, access to proper basic sanitation, waste handling, disease vectors (3). The imbalance of environmental health factors will impact on individual health conditions and lead to environmentally diseases such as diarrhea, acute respiratory infections, malaria, dengue hemorrhagic fever, and pulmonary tuberculosis. Environmental risks contribute 23% of the causes of death globally, and as many as 2.5 million deaths related to infectious, parasitic, neonatal and nutritional diseases and have a greater report in children (4).

As an environmental disease, diarrhea is a condition where a person defecates with the consistence of mushy or liquid for more than three times caused by bacteria, virus or parasitic infestations, malabsorption, allergy, poisoned, and immunodeficiency. The most clinical cause found in the field is caused by infection and poisoned. WHO states that diarrhea is the second leading cause of toddlers mortality in the world (5). Diarrhea contributes substantially to toddlers and childhood malnutrition and mortality (6-7).

WHO data showed in 2017, there were 1.7 million cases of diarrhea on children under five years old every year and 525,000 (30.8%) of them died due to diarrhea (5). In Tocantins, Brazil, there is an increase in the prevalence of diarrhea among children under five years old who are hospitalized (8). According to the Basic Health Research of the Republic of Indonesia in 2018, the total prevalence of diarrhea based on diagnosis by health professionals and symptoms was 8%, increase from 7% in 2013, while diarrhea in children under five years old was 18.5% in 2018 and 12.3% in 2013 which means an increase. Based on the health profile of Bojonegoro District in 2018, 33,667 diarrhea cases were found and 31,010 diarrhea cases of them were under five years old or 92.11%. Diarrhea is still an endemic disease in several regions of Indonesia. Children under five years old are very susceptible to infectious diseases, because in the early stages of life, the body's immunity is still in the development stage so that cannot protect the body optimally.

Many factors affect the diarrhea in various worlds, including the age of children, mother's education, household income, clean food serving practices, the status of exclusive breastfeeding, malnutrition, personal hygiene, environmental hygiene, water availability and quality, and the use of toilets (7,9-12). Environmental factors play a big role on the diarrhea disease, such as basic sanitation of the home includes the type of house floor, the availability of healthy latrines, sewerage waste management, and clean water source. The high number of diarrhea is significantly related to the physical condition of healthy house and sanitation of its environment (9-10). Previous research carried out in Nyarugenge District, Rwanda found there was a relationship between house floor condition and diarrhea (13). House with non-waterproof floor (soil, wood/bamboo floor) allows the floor to become a place where dust accumulated then cause diarrhea.

The lack of clean environment sanitation causes bacteria such as *E. coli* to develop well. Type of unhealthy latrine causes easy transmission of microorganism which then leads to diarrhea. A previous study conducted at the Bulu Lor Public Health Center in Semarang, Central Java, Indonesia showed an association between the ownership of healthy toilets with diarrhea ( $p = 0.03$ ) (14). The unavailability of healthy family latrines allows a person to defecate openly which can increase the risk of diarrhea (15). Feces which are not properly managed pollute the surrounding environment such as sources of drinking water, soil, or foodstuffs. Based on research conducted in Baina'a Village, Tinombo, Parigi Moutong Regency, Central Sulawesi, Indonesia, waste water disposal facilities had a significant relationship with diarrhea in children under five (16). Household liquid waste must be disposed of through a sewer that meets certain requirements in order not to cause environmental pollution. Improper waste management such as leaving opened trash, not sorting waste can increase the risk of diarrhea for children under five (15,17). Garbage accumulated in open space made it easier for disease vectors to reproduce, such as flies. Clean water sources also play a role in diarrhea, because water is one of media to transmit diarrhea. Several studies have also proven that there was a significant relationship between clean water sources and diarrhea (18-20).

Based on this description, this research aims to examine the relationship of floor types, and basic sanitation with the diarrhea disease on children under five years old in Leran Village, Bojonegoro, East Java, Indonesia.

**METHODS**

The type of this research was analytic observational study with cross sectional design, in which the relationship between exposure and disease was studied by simultaneously observing the status of the individuals or observation units (one measurement) in a single population within a certain period of time. The research was conducted in Leran Village, Bojonegoro, East Java, Indonesia. The research population was all mothers of children under five years old in Leran Village, Bojonegoro, East Java, Indonesia, totaling 357 mothers. The minimum sample size was calculated using simple random sampling, obtained 63 mothers of children under five years old as respondents. The samples were taken using simple random sampling technique.

This research was conducted after an ethical review from the ethics commission. After being declared ethical by the Health Research Ethics Commission of the Nursing Faculty, Universities Airlangga, Surabaya, East Java, Indonesia with the ethics certificate number 1769-KEPK, the research was immediately carried out. The independent variables of this study were the type of house floor, and basic sanitation, including the latrines, sewerage, waste management and clean water source, while the dependent variable of this study was the diarrhea in children under five years old.

The operational definition of house floor type which is divided into two types, the non-waterproof floor and the waterproof floor. There are two types of floors, called permanent which is waterproof and non-permanent which is from the ground or non-waterproof. waterproof floor that met the requirements include plastering, using tiles, ceramics, boards, and houses on stilts, not dusty, and can be kept clean. Healthy latrines are latrines that are not accessible to animal vectors, made from a waterproof floor, and do not cause unpleasant odors (in a closed space), the distance between the toilet and a clean water source must be > 10 meters with a septic tank. In principle, healthy latrines do not lead to direct distribution of materials that are harmful to humans due to the disposal of human waste, and prevent vectors from spreading disease to users and surrounding environment (21). Proper household waste management including sorting waste, applying the 3R principle (reduce, reuse, recycle), using closed trash cans and collecting them to a temporary disposal site. Healthy clean water source are protected water sources (closed, distance from a septic tank>10 meters), so that can protect water from contamination by microorganisms. Data related to independent variables were collected through direct

observation at the respondent's house and interview.

The operational definition of the diarrhea on children under five years old variable is respondents who experienced defecation in the form of soft or liquid feces more than 3 times a day within a month, diarrhea on children under five years old was collected using direct interview method to respondents. Data analysis was performed by the chi-square test method to determine the relationship between the studied variables and the diarrhea in children under five years old when  $p < \alpha$  ( $\alpha = 0.05$ ) and the risk ratio was calculated to determine the risk of experiencing diarrhea among children under five years old in the exposed group. Since the study design of this study was cross sectional, the risk values were presented as prevalence ratios. The results of data analysis were presented in tabular and narrative form.

**RESULTS**

Based on Table 1, the prevalence of diarrhea was 42%. The table showed that the majority of respondents live in houses with watertight floors, and already had healthy basic sanitation, including healthy latrines, healthy sewerage, proper waste management, and clean water sources.

**Table 1. Frequency Distribution of Diarrhea, Type of Floor of the House, the Availability of Healthy Latrines, Sewerage Waste Management, and Clean Water Source**

Variables	Frequency (f)	Percentage (%)
<b>Diarrhea</b>		
Yes	26	41.3
No	37	58.7
Total	63	100
<b>House Floor</b>		
Non-waterproof	9	14.3
Waterproof	54	85.7
Total	63	100
<b>Latrine</b>		
Unhealthy	23	36.5
Healthy	40	63.5
Number	63	100
<b>Sewerage</b>		
Not eligible	29	46
Qualify	34	54
Total	63	100
<b>Waste Management</b>		
Improper	30	47.6
Proper	33	52.4
Total	63	100
<b>Clean Water Source</b>		
Not eligible	32	50.8
Qualify	31	49.2
Total	63	100

Based on Table 2, the type of floor of the house, the availability of healthy latrines, sewerage waste

management, and clean water source had a significant association with diarrhea except for variable sewerage. It showed that non-waterproof floor, unhealthy latrine, improper waste management, and not eligible clean water source were risk factor of diarrhea with a prevalence ratio (2.21; 3.28; 27.5; and 5.32).

**Table 2. Relationship of Type of Floor of the House, the Availability of Healthy Latrines, Sewerage Waste Management, and Clean Water Source with Diarrhea on the Children**

Independent Variables	Diarrhea		Not Diarrhea		Number (n)		P Value	CI
	n	%	n	%	n	%		
<b>House Floor</b>								
Non-waterproof	7	77.8	2	22.2	9	100		2.21
Waterproof	19	35.2	35	64.8	54	100	0.026	(1.34 – 3.65)
Total	26	41.3	37	58.7	63	100		
<b>Latrine</b>								
Unhealthy	17	73.9	6	26.1	23	100		3.28
Healthy	9	22.5	31	77.5	40	100	0.000	(1.76 – 6.13)
Total	26	41.3	37	58.7	63	100		
<b>Sewerage</b>								
Not eligible	16	47.1	18	52.9	29	100		
Qualify	10	34.5	19	65.5	34	100	0.442	-
Total	26	41.3	37	58.7	63	100		
<b>Waste Management</b>								
Improper	25	83.3	5	16.7	30	100	0.000	27.50 (3.96 – 190.72)
Proper	1	3	32	97	33	100		
Total	26	41.3	37	58.7	63	100		
<b>Clean Water Source</b>								
Not eligible	22	68.8	10	31.3	32	100	0.000	5.32 (2.07 – 13.69)
Qualify	4	12.9	27	87.1	31	100		
Total	26	41.3	37	58.7	63	100		

## DISCUSSION

Environmental factors have a significant role in diarrhea, such as the environment sanitation which includes the type of house floor, the availability of healthy latrines, sewerage waste management, and clean water source. The type of house floor can be an indicator of differentiation between pre-prosperous and prosperous families. This study found that the majority of respondents who live in houses with non-waterproof floors were suffered from diarrhea. Several studies have also stated that there was a relationship between the condition or type of floor of the house with diarrhea (22–26). Research in Rwanda stated that houses with ground floors had a 1.7 times greater risk of having toddler diarrhea than those with cement floors (22). The same result was shown by research conducted in Sugi Waras Primary Health Care, South Sumatera Indonesia that there was an association between the type of floor of the house and diarrhea in children under five (23).

Rooms with non-waterproof floors will get dirty faster, so the risk of microorganism contamination and humidity increases. Toddlers have a tendency to play on the floor so that microorganisms can enter through the body through the digestive tract, respiration and skin contact. Toddlers with high motoric activity will touch a lot of various objects and stick to their mouths so that they become the entry points for various viruses, bacteria, and germs into the body. The caregiver needed to pay attention and always washing hand with soap (24).

Another environmental health factor that affect diarrhea were the availability of healthy latrines. Research conducted in several regions of Indonesia showed that there was a relationship between the availability of healthy latrines and diarrhea for children under five years old (14,23,27). Improper faeces management and unhealthy latrines will increase the risk of diarrhea (27–29). This is because many infectious diseases are transmitted by fecal-oral transmission and through various media (such as water and soil), direct contact with surface of contaminated objects, or through vector (such as flies) when disposing of feces anywhere (30). Therefore, it is important to pay attention to the availability of a latrine in every house, not only whether there is a place to defecate, but it also must meet health requirements. Research in Sebeta City, Ethiopia stated that the availability of healthy toilets is a protective factor against diarrhea in children under five years old (31).

Most of the respondents had latrine with waterproof floor so that it can be cleaned easily, used comfortably and not slippery. Some respondents still have a “cemplung” toilet that does not fill a healthy latrine because they do not have a septic tank. They also did not have private latrine, but rather belong to neighbors or relatives. Families who do not have private latrines will cause children under five to have 4 times the risk of experiencing diarrhea than those who have private latrines (32).

The wastewater can be a useful medium for the growth of pathogenic microorganisms. Therefore, we need a special drain made of waterproof material so as not to pollute the environment around the house. The environment around the house that is usually a breeding place for flies or other disease vector animals is a garbage dump and sewerage. Based on the results of the analysis, it can be concluded that there was no correlation between the availability of sewerage in Leran Village, Bojonegoro with diarrhea on children under five years old. The same result was stated in another study that there was no relationship between sewerage conditions with diarrhea in children under five years old

in Tumpapa Indah Village, Balinggi Sub-District, Parigi Moutong District, Central Sulawesi, Indonesia (22). The principle of handling household liquid waste according to Regulation of Ministerial Health No.3 of 2014 concerning Community-Based Total Sanitation is that bathroom and kitchen wastewater should not be mixed with water from latrines, must not be a place for vector breeding, must not cause odors, must not be stagnant which causes the floor to be slippery and prone to accidents, and is connected to public sewers/drains or infiltration wells (21). Based on the observation result at respondents' house, the household waste water was disposed through open and non-waterproof sewerage along the front of the house. The sewerage also produced bad odor, stagnate and dirty so that it can trigger the growth of various pathogenic microorganism or disease vector, and will cause environmental diseases in the future, such as diarrhea.

This study proved that improper waste management was also a risk factor for diarrhea on children under five years old. This is in line with previous research (15,17,33). Based on the results of observations and interviews, respondents burn garbage, allowing organic and inorganic waste to be mixed, and the garbage is allowed to pile up and rot in an open area such as a field. This can make disease vectors such as flies easy to breed and the risk of diarrhea on children under five years old increases. Proper waste management can be started by providing a closed trash in each house and not mixing organic and inorganic waste. Some respondents who have managed their waste properly live near roads, so they have easy access to temporary disposal sites. In a study conducted in Dangla City, Northwest Ethiopia, it was concluded that proper waste management can reduce soil contamination and reduce the risk of diarrheal disease (17).

This study proves that water sources that do not meet the requirements are a risk factor for diarrhea on children under five years old. Several previous studies have also proven the same results (18-19). The source of clean water used is very important to note, because it determines the quality of clean water that is used for daily purposes such as bathing, washing, and cooking. Clean water sources that do not meet the requirements, that are unprotected, close to latrines and septic tanks, can easily pollute the water produced. Contaminated water increases the risk of diarrhea for children under five, because one of the transmission media for this disease is through water. Research conducted in Jamma City, Northeastern Ethiopia, states that unprotected water sources are a risk factor for diarrhea on children under five years old (18). Based on observations, the water

source used by the respondents came from dug wells that were not closed, and near to a latrine or septic tank, so that the incidence of water pollution is very possibly. Respondent also admitted that the drinking water used to take it from the same source and not boiled first. This can be the cause of diarrhea on children under five years old. When using clean water from unprotected sources for drinking, the minimum water handling should be to prevent water contamination is to boil it first.

## CONCLUSION

Based on the results of the analysis that have been carried out, it can be concluded that the variables of the housing conditions and family toilet conditions of children under five years old in Leran village, Bojonegoro are significantly related to diarrhea. Diarrhea on children under five years old can occur when direct contact with dirty floors and soil contaminated with feces due to poor fecal management. Some ways to reduce the prevalence of diarrhea include cleaning the floor of the house regularly, providing a mat on the floor that is still made of soil, provide a closed and waterproof trash can, collect garbage in the nearest temporary dump, and washing hands with soap and running water after coming into contact with the ground.

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