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Research Paper

Relationship Between Environmental Sanitation Factors and Diarrhea Incidences in Toddlers in Kebun Kopi Health Center Area

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Abstract
Diarrhea is a major cause of death in toddlers, with poor housing conditions and inadequate sanitation increasing the risk. This study investigates the relationship between physical housing conditions and environmental sanitation and the occurrence of diarrhea among toddlers in the Kebun Kopi Public Health Center area, Jambi City. The research utilizes a cross-sectional design involving 121 randomly selected participants. Data were gathered through questionnaires and direct observations of housing conditions and sanitation practices. Bivariate analysis using the Chi-square test showed a significant association between the quality of drinking water sources and clean water (p-value = 0.032, PR = 2.026, 95% CI 1.330-3.085) and the presence of sanitary latrines (p-value = 0.002, PR = 2.025, 95% CI 1.351-3.035) with the incidence of diarrhea ($p < 0.05$). In contrast, factors such as flooring, ventilation, wastewater disposal, and waste management did not show significant links. The multivariate analysis indicated that ownership of sanitary latrines is the most significant factor influencing diarrhea incidence among toddlers (p-value = 0.002, PR = 2.025, 95% CI 1.351-3.035). The study concludes that improving sanitation and ensuring access to safe drinking water are crucial for preventing diarrhea in toddlers. It is expected that these findings will inform local health authorities in developing strategies to enhance environmental health and decrease diarrhea rates in young children

Keywords
Toddlers, Diarrhea, Environmental sanitation, Kebun Kopi Public Health Center

1. INTRODUCTION

Diarrheal diseases represent a pressing global health issue with serious implications, particularly for child health. Recent data from the World Health Organization (WHO) in 2024 indicates that diarrhea is a leading cause of mortality among children, accounting for a total of 443,832 annual deaths in children under five years of age. Nearly 7 billion cases of diarrhea are recorded worldwide each year (WHO, 2024). According to the Ministry of Health in 2023, Indonesia reported 189,215 cases of diarrhea, with a prevalence rate of 2% across all age groups (Kemenkes, 2023). In Jambi Province, diarrhea ranks as the seventh most common disease among the ten most prevalent illnesses, comprising 66.6 of the total cases reported at local health centers.

Diarrhea is defined as a medical condition characterized by the frequency of bowel movements exceeding three times per day, where the stools produced are loose or liquid in texture. This condition can be caused by a variety of factors, including viral, bacterial, or parasitic infections, as well as reactions to specific foods or medications. In toddlers, the dangers of diarrhea are significantly heightened due to their increased risk of dehydration from rapid fluid loss. This dehydration can disrupt the electrolyte balance within the body, which is crucial for the functioning of vital organs such as the heart and kidneys. If not addressed promptly and appropriately, diarrhea can potentially lead to severe conditions, including hypovolemic shock or death. Therefore, it is essential to provide special attention and immediate medical intervention for children experiencing diarrhea to avoid more serious complications and restore their health (Kemenkes, 2024).

Environmental factors, including physical housing conditions and sanitation, play a critical role in increasing the risk of diarrhea in children. For instance, floors that do not meet health standards can serve as breeding grounds for disease-causing microorganisms. Research indicates that non-waterproof flooring is associated with an increased incidence of diarrhea among toddlers (Saputri et al., 2019). Additionally, poor ventilation can heighten the risk of illness by creating a damp environment with inadequate air circulation (Kurniajati et al., 2013). Inadequate sanitation,

particularly access to clean water, is one of the primary risk factors for diarrhea. The use of contaminated water can elevate the likelihood of infections, especially in young children (Rimbawati and Surahman, 2019). Furthermore, poor waste management can create unhygienic environments, increasing the risk of infections through pathogen-carrying insects (Tuang, 2021). The ownership of sanitary latrines also significantly influences the occurrence of diarrhea, as access to adequate sanitation facilities can reduce the contamination of water and food sources (Kasman and Ishak, 2020).

In light of this background, this study aims to analyze the risk factors, including individual behaviors, physical housing conditions, and environmental sanitation, associated with the incidence of diarrhea among toddlers in the Kebun Kopi Public Health Center area in Jambi City. The results of this study are expected to serve as a reference for efforts to control diarrheal diseases in young children, focusing on the relationship between housing conditions and the dissemination of healthy housing in the region

2. METHOD

This research employs a quantitative analytical method utilizing a cross-sectional design, which aims to test hypotheses and examine the relationships among variables through statistical techniques. Data were gathered concurrently to explore the connections between risk factors (independent variables) and their effects (dependent variables) on toddlers in the Kebun Kopi Public Health Center area in Jambi City. The target population includes all toddlers aged 12 to 59 months, totaling 836 children. The sample for this study comprises 121 toddlers who satisfied the specified inclusion and exclusion criteria.

Sampling was carried out using a Simple Random Sampling method, where samples were selected at random. Primary data were collected through face-to-face interviews with respondents using questionnaires, as well as through observations of the physical conditions of their housing. The analysis was performed in three phases: univariate analysis to describe the variables, bivariate analysis to investigate the relationships between two variables, and multivariate analysis to assess the impact of various independent variables on the dependent variable. The results of the analysis are presented in tables and graphs to enhance comprehension, along with clear interpretations of the patterns and relationships identified in the data.

3. RESULTS

Univariate analysis was conducted to determine the frequency distribution among variables. According to Table 1, it was found that out of 121 respondents, 58 individuals (47.9%) did not meet the criteria regarding the condition of the flooring in this area. Additionally, 33 individuals (27.3%) failed to meet the established criteria for the ventilation variable, while 9 individuals (7.4%) did not meet the requirements for the physical quality of drinking water sources and clean water. Furthermore, 22 individuals (18.2%) did not satisfy the criteria related to wastewater disposal facilities, and 111 individuals (91.7%) did not meet the established criteria for household waste management. There were also 40 individuals (33.1%) who did not meet the requirements for the ownership of sanitary latrines, and the incidence of diarrhea was reported in 50 individuals (41.3%).

Bivariate analysis was conducted to evaluate the relationship between two or more independent variables, namely the condition of the flooring in the home, ventilation, the physical quality of drinking water sources and clean water, wastewater disposal facilities, and ownership of sanitary latrines, with the incidence of diarrhea among toddlers. The findings from this analysis indicate a significant relationship between the physical quality of drinking water sources and clean water, with a p-value of 0.032, a Prevalence Ratio (PR) of 2.026, and a 95% confidence interval (CI) of 1.330-3.085. Additionally, ownership of sanitary latrines was also found to be associated with the incidence of diarrhea, as evidenced by a p-value of 0.002, a PR of 2.025, and a 95% CI of 1.351-3.035, among toddlers aged 12 to 59 months in the Kebun Kopi Public Health Center area. Conversely, the other variables did not demonstrate a significant relationship with the incidence of diarrhea, with p-values greater than 0.05.

The next stage involves modeling the selected variables for multivariate analysis. This process includes the stepwise elimination of variables, starting from those with the highest p-value to the lowest, with a cutoff of p-value 0.05. The objective is to simplify the model and retain only significant variables. During this process, changes in the Prevalence Ratio (PR) are also monitored; if the change in PR exceeds 10%, the variable will be reintroduced. This step is crucial to ensure that the influence of the variables remains accurate. The following is the multivariate modeling table 3.

Based on the multivariate analysis conducted on various selected variables, the final modeling results indicate that ownership of sanitary latrines is the most significant factor influencing the incidence of diarrhea among toddlers aged 12 to 59 months in the Kebun Kopi Public Health Center area. This variable shows a p-value of 0.012 and an adjusted Prevalence Ratio (PR) of 2.894 with a 95% confidence interval (CI: 1.259 – 6.655). This indicates that children without access to sanitary latrines have a 2.9 times higher risk of experiencing diarrhea compared to those with latrines that meet standards, after accounting for other factors such as the condition of the flooring in the house and the quality of the drinking water source used.

Table 1. Univariate Analysis of Independent Variables and Diarrhea

Variable	Frequency (n)	Percentage (%)
Floor Condition		
Non-watertight	58	47.9
Watertight	63	52.1
Ventilation		
>10%	33	27.3
≤10%	88	72.7
Physical Quality of Drinking Water and Clean Water Sources		
Non-watertight	9	7.4
Watertight	112	92.6
SPAL Facilities		
Non-watertight	22	18.2
Watertight	99	81.8
Household Waste Management		
Non-watertight	111	91.7
Watertight	10	8.3
Healthy Toilet Ownership		
Non-watertight	40	33.1
Watertigth	81	66.9
Incidence of Diarrhea		
Diarrhea	50	41.3
Non-diarrhea	71	58.7

Source : Primary Data, 2024

4. DISCUSSION

This study found a relationship between it was found that there is no relationship between the condition of the flooring in the house and the incidence of diarrhea among toddlers aged 12 to 59 months, with a p-value of 0.094 ($p > 0.05$). This result is consistent with the study conducted by Meutuah et al. (2024), at the Sigli City Health Center in Aceh, which showed similar results with a p-value of 0.896 (Meutuah et al., 2024). However, there is a difference in the study by Rimbawati Surahman (2019), at the Sugi Waras Health Center, which obtained a p-value of 0.004. This indicates that good flooring does not cause diarrhea, as clean and well-maintained floors can reduce the accumulation of germs and pathogens, thereby minimizing the risk of food and environmental contamination (Rimbawati and Surahman, 2019).

The research findings indicate that there is no relationship between ventilation and the incidence of diarrhea among toddlers aged 12 to 59 months in the working area of Kebun Kopi Public Health Center in Jambi City, with a p-value of 1.000 ($p > 0.05$). These findings are consistent with the study conducted by Aprilia (2024), at Buay Madang Health Center, which also found no significant relationship with a p-value of 0.382. Good ventilation does not contribute to the incidence of diarrhea, as adequate airflow can reduce humidity and prevent the growth of pathogenic microorganisms indoors, thereby minimizing the risk of food and environmental contamination that could potentially cause gastrointestinal infections (Aprilia, 2024).

This study reveals a significant relationship between the physical quality of drinking water and clean water and the incidence of diarrhea among toddlers in the working area of Kebun Kopi Public Health Center, Jambi City, with a p-value of 0.032 and a Prevalence Ratio (PR) of 2.026. This indicates that toddlers using water sources that do not meet the standards have a twofold higher risk of experiencing diarrhea compared to those using compliant water sources. Previous research by Rimbawati Surahman (2019) and Murtiana et al., (2014) also supports these findings, demonstrating a significant relationship between water quality and diarrhea incidence, with p-values of 0.000 each. Poor physical water quality, such as undesirable odor, taste, and color, can lead to diarrhea in toddlers. Poor water quality often indicates contamination by microbes or harmful substances that can disrupt the digestive system, thereby increasing the risk of gastrointestinal infections that result in diarrhea (Rimbawati and Surahman, 2019) (Murtiana et al., 2014).

The findings of this study indicate that there is no significant relationship between sanitary and wastewater facilities (SPAL) and the incidence of diarrhea, with a p-value of 0.845 ($p > 0.05$). These results are consistent with the research conducted by Savitri Susilawati (2022), which obtained a p-value of 0.261, and Vica (2011), with a p-value

Table 2. Relationship Between Independent Variables and Diarrhea

Variable	Diarrhea		Non-diarrhea		Total		PR	95% CI	*p*-value
	n	%	n	%	N	%			
Floor Condition									
Non-watertight	29	50.0	29	50.0	58	100	1.500	0.972–2.315	0.094
Watertight	21	33.3	42	66.7	63	100			
Ventilation									
>10%	14	42.4	19	57.6	33	100	1.037	0.648–1.659	1.000
≤10%	36	40.9	52	59.1	88	100			
Physical Quality of Drinking Water and Clean Water Sources									
Non-watertight	7	77.8	2	22.2	9	100	2.026	1.330–3.085	0.032*
Watertight	43	38.4	69	61.6	112	100			
SPAL Facilities									
Non-watertight	10	45.5	12	54.5	22	100	1.125	0.671–1.886	0.845
Watertight	40	40.4	59	59.6	99	100			
Household Waste Management									
Non-watertight	47	42.3	64	57.7	111	100	1.411	0.534–3.728	0.521
Watertight	3	30.0	7	70.0	10	100			
Healthy Toilet Ownership									
Non-watertight	25	62.5	15	37.5	40	100	2.025	1.351–3.035	0.002*
Watertight	25	30.9	56	69.1	81	100			

Source: Primary Data, 2024.
**significant at a 5% significant level.*

of 0.037, both of which also demonstrate no significant relationship between the condition of SPAL and the incidence of diarrhea (Savitri and Susilawati, 2022) (Wijayanti, 2011). The quality of the wastewater disposal system (SPAL) does not contribute to the occurrence of diarrhea, as an efficient disposal system can prevent environmental pollution and contamination of water sources, thereby reducing the risk of exposure to harmful pathogens. Clean and well-maintained drainage systems help prevent water stagnation, which can be a breeding ground for disease vectors, such as mosquitoes and flies.

The results of this study, which involved 121 respondents, indicated a p-value of 0.521 ($p > 0.05$), leading to the conclusion that there is no significant relationship between household waste management and the incidence of diarrhea. These findings align with the research conducted by Mustari (2021) in Karanggan Village, which reported a p-value of 1.000 (Mustari, 2021), and Rambu and Ilyas (2023), with a p-value of 0.171, both indicating no significant relationship (Rambu et al., 2023). Although the majority of respondents demonstrated inadequate waste management, with 91.7% not meeting the standards, this study highlights the need for increased awareness and concrete actions in waste management. Effective waste management can prevent the occurrence of diarrhea, as proper practices reduce waste accumulation and prevent the proliferation of disease vectors, such as flies and rats, which can contaminate food and water.

Data analysis indicates a significant relationship between the ownership of sanitary latrines and the incidence of diarrhea among toddlers in the working area of Kebun Kopi Public Health Center, Jambi City, with a p-value of 0.002. This finding demonstrates that the condition of latrines has a strong impact on toddler health, with a Prevalence Ratio (PR) of 2.025 (95% CI 1.351-3.035), suggesting that toddlers using non-compliant latrines have twice the risk of experiencing diarrhea compared to those using sanitary latrines. This study aligns with previous research by Kasman and Ishak (2020) in Banjarmasin, which found a p-value of 0.038 (Kasman and Ishak, 2020), as well as research by Ariani et al., (2024), which reported a p-value of 0.001 and an Odds Ratio (OR) of 11.386 (Ariani et al., 2024). Although the majority of respondents have sanitary latrines, there are concerns regarding the distance between septic tank absorption wells and water sources, which do not meet the minimum standard of 10-15 meters, potentially leading to contamination. The Ministry of Health of the Republic of Indonesia (2017) emphasizes that the own-

Table 3. Final Multivariate Analysis of the Physical Condition of the House and Environmental Sanitation with Diarrhea Incidence

Variable	*P*-Value	PR	95%CI (Lower–Upper)
Healthy Toilet Ownership	**0.012**	**2.894**	**1.259 – 6.655**
Floor Condition	0.098	1.976	0.882 – 4.425
Physical Quality of Drinking Water and Clean Water Sources	0.055	5.403	0.392 – 30.364

Source: Primary Data, 2024.

ership of sanitary latrines plays a crucial role in preventing the spread of pathogens that can cause diarrhea.

4.1 Interpretation of Key Findings

The findings from the analysis indicate that the most significant variable influencing the occurrence of diarrhea in children is the ownership of a sanitary latrine. This variable has a p-value of 0.012 and an adjusted Prevalence Ratio (PR) of 2.894 with a 95% confidence interval (CI: 1.259 – 6.655). This indicates that respondents without access to a sanitary latrine have a 2.9 times higher risk of experiencing diarrhea compared to those who possess a compliant sanitary latrine, after controlling for the variables of floor condition and the physical quality of drinking water sources as confounding factors.

4.2 Comparison with Previous Studies

When compared to previous research, this study confirms and expands upon the findings of Rimbawati and Surahman (2019) and Kasman and Ishak (2020), which highlight the importance of sanitation and water quality in preventing diarrhea among young children. For instance, this study found a significant relationship between the physical quality of drinking water and the incidence of diarrhea, aligning with Rimbawati's results, while contrasting with Kasman's findings, which did not reveal a significant relationship. Possible reasons for these discrepancies may include differences in study design, sample characteristics, or methodological approaches employed. This comparison strengthens the understanding of environmental factors in child health and provides a broader perspective on the research topic concerning diarrhea among young children.

4.3 Limitations and Cautions

This study has a significant limitation, as it only assessed the quality of drinking water and clean water through physical inspections, without incorporating chemical, biological, or physical analyses. Consequently, the potential factors contributing to diarrhea stemming from the water used remain under-identified.

4.4 Recommendations for Future Research

It is essential for future research to conduct more comprehensive analyses, including laboratory testing of various water quality parameters, to provide a better understanding of the relationship between consumed water and the incidence of diarrhea.

5. CONCLUSION

The research findings indicate a relationship between the physical quality of drinking and clean water sources and the ownership of sanitary latrines with the incidence of diarrhea among toddlers. The variable concerning the physical quality of water sources has a p-value of 0.032, with a Prevalence Ratio (PR) of 2.026, indicating that toddlers using non-compliant water sources are at double the risk of experiencing diarrhea. Additionally, the ownership of sanitary latrines demonstrates a significant relationship, evidenced by a p-value of 0.002 and a Prevalence Ratio (PR) of 2.025, suggesting that toddlers lacking access to sanitary latrines are more susceptible to diarrhea. Findings from the multivariate analysis reveal that the ownership of sanitary latrines is the most influential factor in the incidence of diarrhea among toddlers. With a p-value of 0.012 and a Prevalence Ratio (PR) of 2.894, these results highlight the critical importance of access to health-compliant latrines in preventing diarrhea.

From these findings, it is recommended that Kebun Kopi Public Health Center enhance community education efforts regarding the importance of access to clean water and adequate sanitation facilities. Additionally, routine inspections of water source quality and monitoring of latrine conditions in the community should be conducted to ensure they meet health standards. The community should also be encouraged to maintain environmental cleanliness and adopt good sanitation practices to reduce the risk of diarrhea incidence among toddlers, particularly in raising awareness about healthy and safe environmental sanitation. Furthermore, the community is advised to promptly repair or relocate septic tanks that are too close to absorption wells, in accordance with the safe minimum distance standard of 10-15 meters, to prevent water contamination by pathogens. Lastly, it is crucial for the community to regularly ensure access to clean and safe water and to manage water appropriately for daily consumption.

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CONFLICT OF INTEREST

The authors declare that they have no conflicts of interestrest.

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