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Research Paper

Association Between Basic Sanitation and Toddler Diarrhea Incidence in 13 and 14 Ulu, Palembang

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Abstract
Diarrhea remains a significant public health issue contributing to high morbidity rates among toddlers, often linked to inadequate domestic basic sanitation. In Palembang City, Nagaswidak Public Health Center reported the highest diarrhea incidence among toddlers in 2025 within the 13 and 14 Ulu Sub-districts, with 184 recorded cases. This study aims to analyze the relationship between basic sanitation and diarrhea incidence among toddlers in these areas. This quantitative analytical study employed a cross-sectional design. The population consisted of toddlers aged 0–59 months, with a sample of 96 respondents selected via proportional random sampling. Data were collected through interviews using questionnaires and observation sheets, then analyzed using univariate and bivariate Chi-square tests. Results indicated significant associations between diarrhea incidence and latrine facilities (p=0.005; PR=1.821), waste management facilities (p=0.000; PR=5.294), and wastewater drainage systems (p=0.002; PR=2.110). Conversely, clean water facilities showed no significant relationship (p=0.613). In conclusion, the high incidence of diarrhea in 13 and 14 Ulu is primarily driven by non-compliant latrines, poor waste management, and inadequate wastewater drainage. These findings underscore the urgent need for improving household sanitation infrastructure to mitigate diarrheal diseases in urban settings.

Keywords
basic sanitation, diarrhea, toddlers, latrines, waste management, wastewater

1. INTRODUCTION

Diarrheal disease remains a leading cause of global mortality, particularly among children under five (Zhu et al., 2025). Clinically characterized by the passage of three or more loose or liquid stools per day, prolonged diarrhea can lead to severe dehydration and electrolyte imbalances (World Health Organization, 2024). Immediate and appropriate intervention is critical, as young children exhibit higher vulnerability to complications compared to other age groups (Hudson et al., 2023). Globally, the World Health Organization (2024) ranks diarrhea as the third leading cause of death in children aged 1–59 months, with approximately 1.7 billion cases occurring annually (World Health Organization, 2024). This data underscores that diarrhea is not merely a mild health issue but a significant threat to child survival, growth, and development (Tag et al., 2025). In Indonesia, diarrhea persists as a major public health challenge, with the 2023 Indonesian Health Survey (SKI) reporting a prevalence of 7.4% among toddlers, affecting approximately 1.667 million children (Downes et al., 2016). In South Sumatra Province, cases increased from 236,075 (2.6%) in 2023 to 244,747 (2.7%) in 2024. Palembang City recorded the highest burden in the province with 48,637 cases (19.88%). Specifically, the Nagaswidak Public Health Center area reported 287 toddler diarrhea cases in 2024, placing it among the significant contributors to the city's morbidity profile. Previous studies have extensively linked diarrhea to environmental factors, such as water quality and latrine availability (Tag et al., 2025) (Getachew et al., 2018). However, most contemporary research in urban Indonesia has focused on macroeconomic factors or general hygiene behaviors, often overlooking the specific synergy between domestic waste management and wastewater drainage in densely populated sub-districts like 13 and 14 Ulu (Satriani et al., 2022). While global trends show a decline in mortality, local data in Palembang indicates a fluctuating trend, suggesting that existing sanitation interventions may not be fully aligned with local household conditions. There is a lack of recent evidence exploring how specific "basic sanitation packages", comprising water, latrines, waste, and drainage, interact to influence diarrhea incidence in this particular urban topography (Satriani et al., 2022). This study is unique as it evaluates these components simultaneously in a high-density area that has remained

a persistent "hotspot" despite ongoing public health programs. Therefore, the objective of this study is to analyze the relationship between basic sanitation facilities (including water supply, latrine quality, waste management, and wastewater systems) and the incidence of diarrhea among toddlers in the 13 and 14 Ulu Sub-districts, Palembang City.

2. METHOD

2.1 Study Design and Setting

This study employed a quantitative analytical approach with a cross-sectional design to examine the correlation between basic sanitation and diarrhea incidence. The research was conducted in the 13 and 14 Ulu Sub-districts, Palembang City, South Sumatra, an area identified with a high prevalence of diarrheal cases.

2.2 Population and Sampling

The target population comprised all toddlers aged 0–59 months residing in the study area. A total sample of 96 respondents was determined using the Lemeshow formula for known populations. Participants were selected via proportional random sampling to ensure representative distribution across different administrative units within the sub-districts. Inclusion criteria included mothers or primary caregivers who had resided in the area for at least six months and signed the informed consent.

2.3 Data Collection and Instruments

Primary data were collected through structured interviews and direct field observations using two main research instruments. The first was a validated questionnaire designed to assess respondent demographics and the incidence of diarrhea, which was clinically defined as ≤ 3 watery stools within a 24-hour period occurring in the last three months. The second instrument was a standardized observation checklist based on the Ministry of Health's environmental health guidelines, employed to evaluate the quality of basic sanitation facilities, including latrine types, waste management systems, and wastewater drainage (SPAL).

2.4 Statistical Analysis

Data were processed using statistical software. Univariate analysis was performed to describe the frequency distribution of all variables. Bivariate analysis utilized the Chi-Square test to determine the association between independent variables (sanitation factors) and the dependent variable (diarrhea incidence). The strength of the association was measured using the Prevalence Ratio (PR) with a 95% Confidence Interval (CI). A p-value < 0.05 was considered statistically significant.

2.5 Ethical Considerations

The study was conducted in accordance with the Declaration of Helsinki. Ethical clearance was obtained from the Health Research Ethics Committee Faculty of Public Health, Universitas Sriwijaya. All participants were informed about the study's objectives and provided written informed consent prior to data collection. Anonymity and confidentiality of the respondents' data were strictly maintained throughout the research process.

3. RESULTS

The findings of this study are divided into univariate analysis, describing the distribution of diarrhea incidence and basic sanitation facilities, and bivariate analysis, examining the correlation between these variables.

3.1 Univariate Analysis

As shown in Table 1, out of 96 toddlers studied, 47 (49.0%) experienced diarrhea, while 49 (51.0%) did not.

The evaluation of basic sanitation facilities in households is presented in Table 2. The data reveals that while clean water supply is largely adequate (97.0%), significant gaps remain in other sanitation components. Specifically, 59.4% of households had non-compliant wastewater drainage systems, 53.1% had inadequate waste management, and 29.2% lacked compliant latrine facilities.

3.2 Bivariate Analysis

The bivariate analysis using the Chi-Square test (Table 3) identified several environmental factors significantly associated with diarrhea incidence.

Statistical analysis confirmed that latrine facilities are significantly correlated with diarrhea (p=0.005; PR=1.821), suggesting that toddlers in households with non-compliant latrines are 1.8 times more likely to experience diarrhea. Waste management showed the strongest association (p=0.000; PR=5.294), indicating a 5.2-fold increase in risk for those with poor waste disposal. Similarly, wastewater drainage systems (SPAL) were significantly linked to the disease (p=0.002; PR=2.110). Conversely, clean water supply did not show a significant relationship with diarrhea incidence (p=0.613) in this study area.

4. DISCUSSION

The findings of this study offer valuable insights into the critical role of household environmental factors in child health. This research demonstrates that while basic sanitation is often viewed as a single entity, different components have varying degrees of influence on diarrheal disease. Notably, waste management, latrine quality, and wastewater drainage (SPAL) were found to be significant determinants of toddler diarrhea in the 13 and 14 Ulu Sub-districts. These results emphasize that the physical infrastructure of a household directly dictates the level of exposure to fecal-oral pathogens. The observed patterns indicate that environmental non-compliance creates a high-risk habitat for disease vectors, which aligns with the study's objective to identify specific local sanitation gaps.

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Table 1. Frequency Distribution of Diarrhea Incidence among Toddlers

Diarrhea Incidence	Frequency	Percentage (%)
Yes (Experienced Diarrhea	47	49.0
No (Did Not Experience Diarrhea	49	51.0
Total	96	100

Table 2. Distribution of Basic Sanitation Facilities in 13 and 14 Ulu Sub-districts

Variable	Category	Frequency (n)	Percentage (%)
Clean Water Supply	Non-compliant	3	3.1
	Compliant	93	96.9
Latrine Facilities	Non-compliant	28	29.2
	Compliant	68	70.8
Waste Management	Non-compliant	51	53.1
	Compliant	45	46.9
Wastewater Drainage	Non-compliant	57	59.4
	Compliant	39	40.6

The insignificant association between clean water supply and diarrhea (p=0.613) contrasts with many traditional environmental health theories. This can be explained by the high coverage of the municipal waterworks (PDAM) in the study area, which ensures a relatively uniform quality of water among respondents (Irshabdillah and Widyastuti, 2020). Consequently, the primary risk of diarrhea in this urban setting shifts from water source quality to household-level hygiene and sanitation. This aligns with the previous study, suggesting that when water access is stabilized, other factors such as waste and excreta disposal become the dominant transmission routes (Irawati et al., 2021). In contrast, latrine facilities showed a significant correlation (p=0.005; PR=1.821). Non-compliant latrines fail to isolate human waste effectively, facilitating the transmission of pathogens via mechanical vectors or direct contact. This is further exacerbated by poor waste management, which showed the highest risk factor in this study (PR=5.294). The prevalence of open, non-watertight containers creates breeding sites for flies and rodents (Krystosik et al., 2020). As noted by Okolimong et al. (2026), inadequate solid waste handling in high-density urban areas acts as a catalyst for diarrheal outbreaks by bridging the gap between waste and food preparation areas (Okolimong et al., 2026). Furthermore, the significant relationship between wastewater drainage (SPAL) and diarrhea (p=0.002) highlights a critical urban infrastructure failure. Stagnant water in open ditches near households produces foul odors and serves as a reservoir for bacteria (Ye et al., 2020). The high proportion of non-compliant SPAL observed in 13 and 14 Ulu indicates that liquid waste management is frequently neglected compared to water supply, despite its equal importance in preventing environmental contamination (Kitole et al., 2024).

When compared to previous research, this study confirms the findings of Gaffan et al. (2025), which emphasized that latrine ownership alone is insufficient if the facility does not meet sanitary standards (Gaffan et al., 2025). The significant correlation found in this study reinforces the theory that the quality of excreta disposal is more critical than mere access, as non-compliant latrines fail to break the chain of pathogen transmission (Bose et al., 2024). This finding highlights a persistent challenge in urban sanitation where infrastructure exists but often lacks the technical specifications required to protect public health effectively.

However, this study contrasts with several rural-based research projects where the water source is typically identified as the primary predictor of diarrhea. This discrepancy is likely due to the specific urban characteristics of Palembang, where piped water from municipal providers is more accessible and regulated, thereby neutralizing it as a dominant risk factor. In this context, the limited space for proper waste management and drainage systems becomes the more pressing environmental threat (Ahmad et al., 2023). This comparison strengthens the understanding that diarrhea prevention strategies must be tailored to the specific geographical and infrastructural context of the community rather than applying a one-size-fits-all approach.

Despite its contributions, this study has certain limitations. First, the cross-sectional design only captures a "snapshot" in time, making it difficult to establish a definitive causal relationship between sanitation and diarrhea. Second, the reliance on self-reported data for diarrhea incidence may be subject to recall bias by the mothers or caregivers. Caution is needed when generalizing these results to rural populations with different water and soil

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Table 3. Bivariate Analysis of Basic Sanitation and Diarrhea Incidence

Variable	Diarrhea (n=47)	No Diarrhea (n=49)	Total (N=96)	p-value	PR (95% CI)
Clean Water Supply	1	2	3	0.613	0.646 (0.129–3.239)
	46	47	93		
Latrine Facilities	21	7	28	0.005	1.821 (1.276–2.599)
	26	42	68		
Waste Management	42	9	51	0.000	5.294 (2.649–10.581)
	5	40	45		
Wastewater Drainage	37	20	57	0.002	2.110 (1.269–3.506)
	10	29	39		

characteristics.

Future studies should address these limitations by adopting longitudinal designs to observe seasonal variations in diarrhea incidence. Further research is also needed to explore the interaction between sanitation infrastructure and maternal handwashing behavior, as behavioral factors may mediate the relationship between environment and health. Additionally, interdisciplinary approaches that integrate urban planning and public health may provide a more comprehensive solution to the persistent drainage and waste issues in densely populated sub-districts.

5. CONCLUSION

This study concludes that the incidence of diarrhea among toddlers in the 13 and 14 Ulu Sub-districts remains high, affecting 49.0% of the population. Statistical evidence confirms that diarrhea incidence is significantly associated with non-compliant latrine facilities (p=0.005; PR=1.821), inadequate waste management (p=0.000; PR=5.294), and substandard wastewater drainage systems (p=0.002; $=2.110). Conversely, clean water supply showed no significant correlation (p=0.613), as 93.0% of households already utilized compliant water sources. These findings demonstrate that poor waste and liquid disposal are the primary environmental drivers of diarrhea in this urban area. Therefore, it is recommended that the Palembang City Health Office and local stakeholders prioritize the rehabilitation of household drainage and the implementation of closed-bin waste management systems. Furthermore, public health interventions should focus on educating caregivers about the importance of maintaining sanitary latrines to reduce the high risk of pathogen transmission and improve overall toddler health outcomes in densely populated sub-districts.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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