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Evironmental sanitation and toddler diarrhea incidence: A cross-sectional study in Kanjilo, Indonesia

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ABSTRACT

Diarrhea remains a significant public health concern in Indonesia, particularly among toddlers, with high morbidity and mortality rates largely influenced by environmental sanitation. Despite extensive efforts, many regions continue to exhibit inadequate sanitation conditions. This study aimed to analyze the association between environmental sanitation factors and the incidence of diarrhea in children aged 12–59 months in the Kanjilo Health Center area, Gowa Regency. Employing a quantitative cross-sectional design, the study involved 331 purposively selected mothers of children under five from a population of 1,906. Data collection utilized structured questionnaires and was analyzed using the chi-square test. Findings revealed a significant relationship between diarrhea incidence and both the source of drinking water (p = 0.018) and waste bin condition (p = 0.033), while the wastewater disposal system was not significantly associated (p = 0.074). Among the participants, 39.9% reported toddlers with diarrhea episodes, indicating substantial exposure to environmental risk factors. These findings highlight the need for targeted interventions to enhance water safety and solid waste management in rural health settings. Strengthening sanitation infrastructure may substantially reduce diarrhea incidence among toddlers, thereby improving child health outcomes in rural Indonesian communities.

ABSTRAK

Penyakit diare masih menjadi masalah kesehatan utama di Indonesia dengan tingkat morbiditas dan mortalitas yang tinggi, terutama pada balita yang dipengaruhi oleh faktor lingkungan dan kebersihan pribadi. Penelitian ini bertujuan untuk menganalisis hubungan antara sanitasi lingkungan dan kejadian diare pada balita usia 12-59 bulan di wilayah Puskesmas Kanjilo, Kabupaten Gowa, menggunakan metode kuantitatif dengan pendekatan cross-sectional. Dari 1.906 ibu yang memiliki balita, 331 responden dipilih dengan teknik purposive sampling, dan data dianalisis menggunakan uji chi-square. Hasil penelitian menunjukkan adanya hubungan signifikan antara sumber air minum (p-value 0,018) dan kondisi tempat sampah (p-value 0,033) dengan kejadian diare pada balita, sementara sistem pembuangan air limbah tidak menunjukkan hubungan yang signifikan (p-value 0,074). Sebanyak 132 responden (39,9%) memiliki balita yang mengalami diare, sedangkan 199 responden (60,1%) tidak. Penelitian ini diharapkan dapat menjadi dasar bagi pengambilan kebijakan untuk meningkatkan kualitas sanitasi lingkungan guna menekan angka kejadian diare pada balita.

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INTRODUCTION

Diarrhea remains a critical public health concern both globally and in Indonesia, particularly among children under five years of age. It is characterized by an increase in bowel movement frequency with watery stool consistency, often accompanied by symptoms such as nausea, vomiting, and abdominal cramps (Kemenkes, 2023). Various factors contribute to the incidence of diarrhea, including bacterial and viral infections, malabsorption, and especially environmental conditions such as inadequate sanitation and poor personal hygiene (Aji Humaedi, 2023). Diarrhea can lead to severe dehydration and even death, particularly among vulnerable populations such as toddlers (Pramana et al., 2023; Jamiatun & Fatmawati, 2023). According to UNICEF (2024), diarrhea was responsible for 9% of global child deaths under five in 2021, with over 1,200 child deaths daily. In Indonesia, the 2020 Nutrition Status Survey reported a diarrhea prevalence of 9.8%, and national health data showed that diarrhea accounted for 14.5% of deaths among children aged 29 days to 11 months, and 4.55% among those aged 12–59 months (P2PM, 2022; Nurul Awalia, 2023).

The burden of diarrhea in Indonesia varies by region, with the highest prevalence recorded in West Nusa Tenggara at 61.4% and 20.3% in South Sulawesi (Apriani & Putri, 2022). In South Sulawesi, Gowa Regency ranks second after Makassar in diarrhea incidence, with 16,450 cases reported in 2017 (Fattah & Zulfahmidah, 2022). According to the Gowa District Health Office, May 2023 saw the highest number of diarrhea cases among toddlers, with 905 cases in boys and 817 in girls. The Kanjilo Health Center, in particular, reported 554 cases of diarrhea in 2023, of which 260 occurred in children under five, predominantly among those aged 12–59 months (Dinas Kesehatan Kabupaten Gowa, 2023). Environmental factors, including access to clean water, adequate sanitation, and maternal hygiene practices, play a significant role in determining diarrhea outcomes in this population (Rahmania, 2023).

Although diarrhea is widely acknowledged as being strongly influenced by sanitation and hygiene, there is a lack of region-specific studies that examine these factors within high-burden areas such as Kanjilo in Gowa Regency. Previous research confirms a strong association between environmental conditions and diarrhea incidence (Sari & Salasabila, 2024; Arianty, 2023), yet actionable, localized data to guide public health interventions remain scarce. Thus, it is crucial to analyze environmental sanitation as a determinant of diarrhea, using evidence-based findings to inform local policy and community health strategies.

Several studies have highlighted specific environmental and behavioral factors that increase the risk of diarrhea among toddlers. Zulfita (2022) and Nurwahidah (2023) emphasize the role of maternal hygiene, such as handwashing practices and food preparation methods, as key predictors of diarrhea incidence. Poor hygiene practices, especially among caregivers, create a pathway for fecal-oral transmission of infectious agents. Inadequate disposal of waste, open defecation, and lack of clean water access have consistently been reported as amplifiers of diarrheal disease transmission, particularly in rural and peri-urban areas (Jessica Florencia Angelina & Trilianty Lestarisa, 2024).

From a preventive standpoint, interventions focused on improving access to safe water and sanitary facilities, alongside behavior change campaigns targeting personal hygiene, have proven effective in multiple settings. These include community-based sanitation improvements, maternal education programs, and health promotion efforts conducted through local health centers. Despite these insights, implementation gaps remain, particularly in tailoring interventions to specific community conditions and resource constraints.

While the relationship between environmental sanitation and childhood diarrhea has been established in broader contexts, studies focused explicitly on high-incidence localities like Kanjilo Health Center remain unavailable. This lack of localized evidence limits the effectiveness of public health interventions tailored to the unique demographic and environmental conditions of the region. Given the reported 182 diarrhea cases among toddlers aged 12–59 months in 2023 in Kanjilo alone, it is imperative to generate data that reflect the immediate determinants of diarrhea in this community (Dinas Kesehatan Kabupaten Gowa, 2023).

This study addresses a critical research gap by specifically examining the relationship between environmental sanitation factors—including drinking water sources, waste disposal systems, and waste

container conditions—and the incidence of diarrhea in toddlers in Kanjilo, Gowa Regency. Through a cross-sectional approach using locally collected data, this research aims to provide actionable insights that can inform policy-making and community-based health interventions to reduce the prevalence of diarrhea among vulnerable child populations in rural Indonesia

METHODS

This study applied a quantitative method with a cross-sectional design to examine the relationship between environmental sanitation and the incidence of diarrhea in toddlers in the Kanjilo District, Gowa Regency. The study site was selected based on the high prevalence of diarrhea cases in the area. The research was conducted from May 22 to June 22, 2024. The study population consisted of 1,906 mothers with children aged 12–59 months. A total of 331 respondents were selected through purposive sampling based on inclusion criteria that considered the presence of toddlers within the specified age range and the mother's availability during the data collection period.

Data collection was conducted through structured interviews using questionnaires and direct observation of environmental sanitation conditions, which included the source of drinking water, domestic wastewater drainage system (SPAL), and the condition of household waste bins. The variables measured included both independent variables (environmental sanitation factors) and the dependent variable (incidence of diarrhea in toddlers within the last two weeks). Inclusion criteria required respondents to be permanent residents of the area and willing to participate voluntarily, with informed consent obtained from all participants prior to data collection.

Data analysis involved univariate analysis to describe the characteristics of respondents and research variables, and bivariate analysis using the chi-square test to determine associations between environmental sanitation factors and diarrhea incidence. Data processing followed standard procedures including editing, coding, scoring, cleaning, and analysis using Microsoft Excel and SPSS software. Ethical considerations, including confidentiality, informed consent, and voluntary participation, were strictly maintained throughout the research. The findings are expected to enhance the understanding of environmental sanitation's role in toddler diarrhea and to support more targeted and effective public health interventions in the Kanjilo Health Center area.

RESULTS AND DISCUSSION

Based on Table 1, the frequency distribution of respondents shows that environmental sanitation in the aspect of drinking water sources, as many as 310 respondents (93.7%) use bottled water or PDAM, while 21 respondents (6.3%) still use wells as a source of drinking water. As for the condition of sewerage, 324 respondents (97.9%) had unqualified channels, while only 7 respondents (2.1%) had qualified channels. Similarly, 322 respondents (97.3%) had trash bins that did not meet the requirements, while only 9 respondents (2.7%) had trash bins that met the requirements.

Table 1
Distribution of respondents based on environmental sanitation

Environmental Sanitation	Frequency (n)	Percentage (%)
Drinking Water Source		
Well	21	2.3
Bottled Water/PDAM	310	93.7
Wastewater Drainage System (SPAL)		
Does Not Meet Requirements	324	97.9
Meets Requirements	7	2.1
Waste Bin Condition		
Does Not Meet Requirements	322	97.3
Meets Requirements	9	2.7

Table 2
Relationship between environmental sanitation and diarrhea incidence

Variable	Diarrhea Incidence				Total	P-Value
	Diarrhea		No Diarrhea			
	n	%	n	%		
Drinking Water Source						
Well	14	66.7	7	33.3	21	0,018
Bottled Water/PDAM	118	38.1	192	61.9	310	
Wastewater Drainage System (SPAL)						
Does Not Meet Requirements	132	40.7	192	59.3	324	0,074
Meets Requirements	0	0	7	100	7	
Waste Bin Condition						
Does Not Meet Requirements	132	41	190	59	322	0,033
Meets Requirements	0	0	9	100	9	

Based on the results of the analysis presented in Table 2, the source of drinking water was associated with the incidence of diarrhea (p-value = 0.018), with mothers who used well water having more diarrhea in toddlers (66.7%) than those who used bottled water (38.1%). Meanwhile, there was no significant association between sewerage and the incidence of diarrhea (p-value = 0.074), although the incidence of diarrhea was higher among mothers with unqualified sewerage (40.7%) than those with qualified sewerage (0.0%). Finally, the condition of the waste bin had a significant association with the incidence of diarrhea (p-value = 0.033), where mothers with unqualified waste bin conditions experienced more diarrhea (41.0%) than mothers with qualified waste bins (0.0%).

Drinking water is water that meets quality standards and can be consumed directly. According to the Regulation of the Minister of Health No. 492/MENKES/PER/IV/2010, drinking water is water that, with or without a treatment process, meets health requirements and is safe for direct consumption. Drinking water is considered safe for health if it meets physical, microbiological, chemical, and radiological requirements as outlined in mandatory and additional parameters (Ministry of Health, 2010).

The results of this study indicate a significant relationship between the source of drinking water and the incidence of disease in children aged 12–59 months in the working area of the Kanjilo Health Center, Gowa Regency, with a p-value = 0.018. This indicates that drinking water that does not meet standards can increase the risk of disease in children. This finding is consistent with the study by Luthfiah (2023), which found that non-hygienic drinking water systems are correlated with increased incidence of disease due to bacterial contamination and harmful substances in the water. Furthermore, research by Nanda & Putri (2023) also showed that access to clean water plays an important role in preventing health issues related to falls, as found in Tangkahan Village, Medan Labuhan, with a p-value = 0.037. The Indonesian Ministry of Health (2023) also emphasized that purified drinking water sources are crucial for preventing disease and protecting public health. Therefore, it is important for the community to ensure the availability of clean and safe drinking water sources in order to reduce the risk of illness in young children and improve overall health.

A qualified drinking water source is a clean water source that has undergone treatment or meets health standards and can be consumed directly. Unprotected water sources can be contaminated by human activities such as waste discharge, including feces and wastewater. Therefore, water sources must meet health requirements both in terms of quality and quantity for household use to prevent contamination (Musli, 2016).

This study also found no significant relationship between wastewater drainage conditions (SPAL) and the incidence of falls in children aged 12–59 months in the working area of the Kanjilo Health Center, Gowa Regency, with a p-value = 0.074 (p > 0.05). This finding is in line with the study by Miswan (2018), which found that SPAL ownership was not associated with falls in Tumpapa Indah

Village, Parigi Moutong Regency, with a p-value = 0.637. However, a study by Sengkey & Joseph (2020) showed that the presence of water filtration systems had a significant relationship with the prevention of falls in young children (p-value = 0.008), with children living in homes without water filtration systems having a 0.615 times higher risk of accidents compared to those with such systems. In addition, research by Kasih & Nurlila (2020) highlighted that environments lacking proper canal systems can become breeding grounds for insects such as mosquitoes, which can increase the risk of disease. Wulandari (2014) also emphasized that inadequate wastewater treatment can contaminate clean water sources used daily, thereby increasing the risk of disease due to poor sanitation. Therefore, although this study did not find a direct relationship between SPAL conditions and the incidence of falls in young children, proper waste management is still necessary to maintain environmental cleanliness and public health.

According to Siahaan et al. (2024), proper trash bins must meet technical health standards: they should be made of strong, lightweight, waterproof materials and have a smooth inner surface. They should also have lids that are easy to open and close without dirtying the hands, especially for bins containing decaying waste, and should be easy to fill, empty, and clean.

This study found a significant relationship between the condition of trash bins and the incidence of disease in children aged 12–59 months in the working area of the Kanjilo Health Center, Gowa Regency, with a p-value = 0.035. This indicates that unhygienic trash bins can become a source of disease transmission, particularly through flies that carry bacteria causing diarrhea. This finding is consistent with the study by Endawati & Sitorus (2021), which found that ownership of mesh-covered trash bins had a strong relationship with falls in children, with p-values ranging from 0.0000 to 0.05. Additionally, the study by Hastia & Ginting (2019) showed that uncontrolled environments with scattered trash attract disease-carrying insects like flies, increasing the risk of health problems. Poorly managed trash can contain biological particles that become breeding grounds for bacteria and cause environmental pollution (Kurniasari, 2019). Furthermore, Luthfiah (2023) found a relationship between poor sanitation conditions and increased risk of fall-related illnesses in children, reinforcing the importance of waste management in disease prevention.

In contrast, a study by Langit (2016) found no relationship between waste disposal sites and the incidence of diarrhea in children. This was attributed to the fact that most respondents already had covered trash bins. Therefore, efforts to improve environmental cleanliness, including better waste management, are essential to reducing the risk of disease and improving public health, especially for young children.

CONCLUSION

This study identified a significant relationship between the source of drinking water and the condition of waste bins with the incidence of diarrhea among toddlers in Kanjilo District, Gowa Regency. Conversely, no association was found between the wastewater disposal system and diarrhea incidence. These findings underscore the critical role of environmental sanitation—particularly the quality of drinking water and solid waste management—in influencing toddler health outcomes. Improvements in these areas are essential to reduce the burden of diarrheal diseases in rural communities.

To enhance prevention efforts, there is an urgent need to raise awareness among mothers and the broader community about the importance of handwashing with running water and soap. Strengthening health education programs through social media campaigns, community meetings, and practical training on proper handwashing techniques is vital. Ensuring widespread access to affordable handwashing facilities and soap is equally important for promoting sustainable hygiene practices. Furthermore, environmental interventions such as closing disused wells should be implemented to prevent the proliferation of diarrhea-causing pathogens. Future research should explore additional environmental and behavioral risk factors to develop more comprehensive intervention strategies and to assess the long-term impact of targeted sanitation improvements on child health in rural areas.

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