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# Analysis of Factors Associated with the Incidence of Diarrhea among Children Under Five

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**ABSTRACT**

Diarrhea remains one of the major public health problems among children under five years of age. In the service area of UPTD Puskesmas Rawat Inap Bumidaya, 304 under-five children were identified with diarrhea in 2025, resulting in a prevalence of 13.86%. This study aimed to analyze factors associated with diarrhea among children under five in the service area of Puskesmas Rawat Inap Bumidaya. This study employed a sample of 184 children under five selected using proportional random sampling. The variables examined included the child's age, nutritional status, immunization status, water quality, latrine ownership, and waste management. Data were analyzed with the Chi-square test and multiple logistic regression. The results showed that the child's age (p = 0.005), nutritional status (p = 0.001), immunization status (p = 0.002), water quality (p = 0.001), latrine ownership (p = 0.008), and waste management (p = 0.000) were significantly associated with the occurrence of diarrhea among children under five. Waste management was the strongest predictor. Both host-related and environmental factors are associated with diarrhea among children under five, with waste management being the most influential factor. Therefore, improving waste management and strengthening promotive and preventive efforts through community education on proper household waste management that meets health standards are necessary, emphasizing the importance of separating organic and inorganic waste, using covered waste bins, and disposing of waste in designated disposal sites to reduce the incidence of diarrhea.



## INTRODUCTION

Diarrhea remains a leading cause of morbidity and mortality among children under five worldwide. In 2024, there were nearly 1.7 billion cases of diarrhea (World Health Organization, 2024). The prevalence of diarrhea in Indonesia has shown an increasing trend and has become one of the top 10 diseases affecting children. The number of children under five with diarrhea who received treatment at healthcare facilities reached 1,014,133, or 33.18% (Ministry of Health Republic Indonesia, 2024). Data on diarrhea cases among children under five in South Lampung Regency recorded 5,329 cases, with a morbidity rate of 843 per 1,000 population in 2024. This indicates that diarrhea incidence in the region is high. Therefore, research is needed to analyze the host and environmental factors causing diarrhea among children under five (South Lampung Regency Health, 2024).

The results of a study Parlin et al. (2025) showed that 18 children under five experienced diarrhea (36%), with the following environmental factors failing to meet health standards: clean water sources (8%), latrine availability (14%), food storage (12%), drinking water provision (16%), handwashing practices (20%), and feces disposal (20%). Meanwhile, data collected by Yani & Wahyuni (2025) from 120 respondents with children under five living in the working area

of Darussalam Community Health Center in 2025 found that the incidence of diarrhea among children under five during the previous two weeks was 32.5% (39 children). The distribution of household environmental factors showed that 60% of respondents used inadequate water sources, 55% did not have sanitary latrines, and 50.8% practiced poor household waste management. Previous studies have shown that most research has focused only on environmental factors, while host factors among children under five have rarely been investigated. Therefore, this study is important to provide evidence to support planning interventions based on both host and environmental factors.

Bumidaya Inpatient Community Health Center (Puskesmas Rawat Inap Bumidaya) has the highest number of diarrhea cases among children under five in the South Lampung Regency service area. In 2025, 304 children under five had diarrhea, resulting in a prevalence of 13.86%. According to the Ministry of Health of the Republic of Indonesia, the epidemiological standard classifies diarrhea incidence as high when the prevalence exceeds 10%, and the incidence rate was calculated at 138.6 per 1,000 children under five (Bumidaya Inpatient Community Health Center Profile, 2025). Meanwhile, in 2026, diarrhea cases among children under five totaled 29 in January and 27 in February, indicating that diarrhea remains relatively high and still requires attention in disease prevention and control efforts (Bumidaya Inpatient Community Health Center, 2026).

Based on data from the Bumidaya Inpatient Community Health Center Profile (Puskesmas Rawat Inap Bumidaya), some clean water sources still do not meet health standards. Of 30 households, 21 had water sources contaminated with Escherichia coli, and 2 had water that was cloudy, tasteless, and odorless. This condition can become a source of diarrhea transmission because water contaminated with pathogenic microorganisms can enter the body through daily consumption. Therefore, the researcher is interested in further analyzing the factors associated with the incidence of diarrhea among children under five in the working area of the Bumidaya Inpatient Community Health Center.

## METHOD

This study will use a quantitative research method. The researcher will examine factors associated with diarrhea incidence among children under five, including the child's age, nutritional status, immunization status, clean water quality, latrine ownership, and household waste management (Sugiyono, 2023). The study will employ a cross-sectional approach. The study population includes all children aged 0–59 months in the research area, totaling 2,193 respondents. The study sample comprises 184 respondents. The sampling technique used is proportional random sampling (Sugiyono, 2023). This study was received ethical approval from Health Research Ethics Committee, Universitas Malahayati with approval number NO. 5376/EC/KEP-UNMAL/V/2026.

The measurement instruments used in this study are a structured questionnaire and an observation checklist, which will be used to collect data on the dependent variable (incidence of diarrhea) and the independent variables (child's age, nutritional status, immunization status, water quality, latrine ownership, and waste management). This study uses direct observation to assess environmental conditions, including water quality, latrine ownership, and waste management. Observations are conducted using a standardized observation checklist, allowing each variable to be assessed objectively and consistently. This study uses bivariate analysis to determine the relationship between each factor and the incidence of diarrhea among children under five. Since all variables are categorical (nominal), the statistical test used is the Chi-square test (Sugiyono, 2023). For multivariate analysis, the test used is Multiple Logistic Regression.

## RESULTS

Table 1 shows the majority of children under five did not experience diarrhea (62.5%), were in the ≥24 months age group (55.4%), had good nutritional status (81.5%), and had received complete immunizations (80.4%). These results indicate that most children under five in this

study had relatively good age, nutritional, and immunization status. However, there was still a proportion of children under five with poor nutrition (18.5%) and incomplete immunizations (19.6%), which potentially increased susceptibility to various infectious diseases, including diarrhea. From an environmental health perspective, most respondents used water that met health standards (53.8%) and had adequate latrines (65.8%), but had poor waste management (58.2%). This condition indicates that environmental factors remain a problem that requires attention because it can increase the risk of diarrhea in children under five. Therefore, efforts to improve environmental sanitation, provide clean water, improve waste management, and maintain nutritional status and immunization coverage must be continuously strengthened as part of the strategy to prevent diarrhea in children under five.

**Table 1. Distribution of diarrhea incidence and independent variables**

| Variable | n | % |
|---|---|---|
| Diarrhea incidence | | |
| Diarrhea | 69 | 37.5 |
| No diarrhea | 115 | 62.5 |
| Age | | |
| <24 months | 82 | 44.6 |
| ≥24 months | 102 | 55.4 |
| Nutritional status | | |
| Good nutrition | 150 | 81.5 |
| Poor nutrition | 34 | 18.5 |
| Immunization status | | |
| Complete | 148 | 80.4 |
| Incomplete | 36 | 19.6 |
| Water quality | | |
| Meets requirements | 99 | 53.8 |
| Not meets requirements | 85 | 46.2 |
| Latrine ownership | | |
| Meets requirements | 121 | 65.8 |
| Not meet requirements | 63 | 34.2 |
| Waste management | | |
| Good | 77 | 41.8 |
| Not good | 107 | 58.2 |

**Table 2. Factors associated with the incidence of diarrhea among children under five**

| Variable | Category | Diarrhea incidence | | | | p-value | OR | 95% CI |
|---|---|---|---|---|---|---|---|---|
| | | No Diarrhea | | Diarrhea | | | | |
| | | n | % | n | % | | | |
| Age | ≥24 months | 73 | 71.6 | 29 | 28.4 | 0.005 | 2.397 | 1.302-4.414 |
| | <24 months | 42 | 51.2 | 40 | 48.8 | | | |
| Nutritional status | Good nutrition | 102 | 68.0 | 48 | 32.0 | 0.001 | 3.433 | 1.586-7.429 |
| | Poor nutrition | 13 | 38.2 | 21 | 61.8 | | | |
| Immunization status | Complete | 100 | 67.6 | 48 | 32.4 | 0.004 | 2.917 | 1.382-6.154 |
| | Incomplete | 15 | 41.7 | 21 | 58.3 | | | |
| Water quality | Meets requirements | 73 | 73.7 | 26 | 26.3 | 0.001 | 2.875 | 1.550-5.330 |
| | Not meet requirements | 42 | 49.4 | 69 | 50.6 | | | |
| Latrine ownership | Meets requirements | 84 | 69.4 | 37 | 30.6 | 0.007 | 2.344 | 1.251-4.388 |
| | Not meet requirements | 31 | 49.2 | 32 | 50.8 | | | |
| Waste management | Good | 64 | 83.1 | 13 | 16.9 | 0.000 | 5.406 | 2.666-10.959 |
| | Not Good | 51 | 47.7 | 56 | 52.3 | | | |

The Chi-Square test showed $p < 0.05$, indicating a significant relationship between age and the incidence of diarrhea; OR value = 2.397 (95% CI: 1.302–4.414) indicates that children aged <24 months have 2.397 times the odds of experiencing diarrhea compared to children aged ≥24 months. Nutritional status is associated with diarrhea in children under five; OR = 3.433 (95% CI: 1.586–7.429) indicates that children under five with poor nutritional status have 3.433 times the risk of diarrhea compared with those with good nutritional status. Immunization status is

significantly associated with diarrhea in children under five; OR = 2.917 (95% CI: 1.382–6.154), indicating that children under five with incomplete immunization have a 2.917 times higher risk of diarrhea than those with complete immunization. There is a significant relationship between water quality and the incidence of diarrhea in children under five; the OR value = 2.875 (95% CI: 1.550–5.330) shows that children under five who live in households with water quality that does not meet the requirements have a risk of experiencing diarrhea 2.875 times compared to children under five who live in households with water quality that meets the requirements.

Another variable also showed the results of the Chi-Square test $p < 0.05$, there is a significant relationship between latrine ownership and the incidence of diarrhea in children under five; the OR value = 2.344 (95% CI: 1.251–4.388) shows that children under five who live in households with latrine that do not meet the requirements have a risk of experiencing diarrhea 2.344 times compared to children under five who live in households that have latrine that meet the requirements. Waste management is significantly associated with the incidence of diarrhea in children under five; OR = 5.406 (95% CI: 2.666–10.959) indicates that children under five living in households with poor waste management have a 5.406-fold higher risk of diarrhea than those living in households with good waste management.

**Table 3. Initial logistic regression model Analysis of factors related to the incidence of diarrhea in children under five**

| Variable | B | p-value | Adjusted OR (Exp(B)) | 95% CI |
|---|---|---|---|---|
| Age | 0.764 | 0.042 | 2.147 | 1.029–4.476 |
| Nutritional Status | 1.072 | 0.023 | 2.921 | 1.161–7.348 |
| Immunization Status | 1.023 | 0.022 | 2.781 | 1.160–6.670 |
| Water Quality | 0.996 | 0.006 | 2.709 | 1.328–5.524 |
| Latrine Ownership | 0.823 | 0.029 | 2.277 | 1.088–4.766 |
| Waste Management | 1.599 | 0.001 | 4.949 | 2.252–10.878 |

Table 3 shows that all variables entered into the model were significantly associated with diarrhea incidence in children under five ($p < 0.05$). Significant variables in the model include age ($p = 0.042$), nutritional status ($p = 0.023$), immunization status ($p = 0.022$), water quality ($p = 0.006$), latrine ownership ($p = 0.029$), and waste management ($p < 0.001$).

**Table 4. Interaction test of factors related to the incidence of diarrhea in children under five**

| **Variable** Interaction | p-value | Information |
|---|---|---|
| Nutritional status × w | 0.269 | No interaction |
| Water quality × latrine ownership | 0.912 | No interaction |
| Water quality × waste management | 0.810 | No interaction |

The interaction test results showed that the interaction between nutritional status and age had a p-value of 0.269, the interaction between water quality and latrine ownership had a p-value of 0.912, and the interaction between water quality and waste management had a p-value of 0.810. All p-values were greater than 0.05, indicating no statistically significant interaction between these variables and the incidence of diarrhea in children under five.

These results indicate that the influence of each independent variable on the incidence of diarrhea was not influenced by the presence of the other independent variables tested in the model. Therefore, the multiple logistic regression model showed no effect modification. Therefore, the logistic regression model did not include any interaction variables.

**Table 5. Final multivariate modeling results of variables associated with diarrhea incidence in children under five**

| Variable | B | p-value | Adjusted OR (Exp(B)) | 95% CI |
|---|---|---|---|---|
| Age | 0.764 | 0.042 | 2.147 | 1.029–4.476 |
| Nutritional status | 1.072 | 0.023 | 2.921 | 1.161–7.348 |
| Immunization status | 1.023 | 0.022 | 2.781 | 1.160–6.670 |
| Water quality | 0.996 | 0.006 | 2.709 | 1.328–5.524 |
| Latrine ownership | 0.823 | 0.029 | 2.277 | 1.088–4.766 |
| Waste management | 1.599 | 0.001 | 4.949 | 2.252–10.878 |

Multivariate analysis was conducted using multiple logistic regression with the enter method to determine the simultaneous influence of independent variables on the incidence of diarrhea in children under five. The results showed that all variables in the model were statistically significantly associated with the incidence of diarrhea in children under five ($p<0.05$). The interaction test results also showed no significant interaction between the tested independent variables. Therefore, all variables were retained in the final multiple logistic regression model.

All independent variables studied were significantly associated with the incidence of diarrhea in children under five. Among the variables studied, waste management had the highest odds ratio (OR), at 4.949. Waste management was the dominant factor associated with diarrhea incidence, with a risk almost five times higher than in households with good waste management. These results demonstrate the importance of improving environmental sanitation, especially household waste management, to prevent diarrhea in children under five.

## DISCUSSION

Based on the multiple logistic regression results, all variables studied continued to show a significant association with diarrhea incidence in children under five: age, nutritional status, immunization status, water quality, latrine ownership, and waste management. Waste management was the variable most strongly associated with diarrhea incidence in children under five, with the largest odds ratio (OR) of 4.949. This indicates that poor waste management increases the risk of diarrhea incidence almost five times compared to good waste management, after controlling for other variables in the model.

According to John E. Gordon's epidemiological theory (in Irwan 2017), disease results from the interaction among three main components: the host, the agent (disease-causing agent), and the environment. Disease occurs when these three components are imbalanced. In the case of diarrhea in children under five, the host is children under five with characteristics such as vulnerable age, poor nutritional status, and incomplete immunization. The agent is the diarrhea-causing microorganism, such as bacteria, viruses, or parasites, that enter the body through contaminated food and drink. Meanwhile, the environment includes physical and sanitary conditions that can facilitate or inhibit disease transmission (Irwan, 2017).

The results align with research by Kurniawan et al. (2022), which analyzed 2018 Riskesdas data on 93,448 children under five in Indonesia. The study found that household waste management was the strongest environmental factor associated with diarrhea in children under five, with the highest Odds Ratio (OR) of 1.298 and a 95% Confidence Interval of 1.180–1.427. The researchers explained that poorly managed household waste can become a breeding ground for flies and other vectors, which help spread diarrhea-causing microorganisms. Furthermore, waste accumulation can pollute the environment and the water sources the community uses, increasing the risk of diarrhea in children under five.

This aligns with previous research identifying waste management as the most dominant predictor of diarrhea incidence among children under five, surpassing the influence of factors such as age, immunization status, and the availability of clean water and latrines (Kurniawan et al., 2022; Maulidah & Siwiendrayanti, 2022). This mechanism likely stems from waste piles serving as breeding grounds for disease vectors—such as flies—that mechanically transmit pathogens to children's food or eating utensils (Wandira, 2019). These findings align with literature confirming that accumulating solid waste without adequate management significantly increases vector density, which serves as a crucial transmission pathway for environmental pathogens (Faradilla et al., 2026; Raihan & Mahmudiono, 2022).

Based on field observations during the research, these conditions still exist in the work area of the Bumidaya Inpatient Health Center. Some residents still dispose of waste in yards, vacant lots, gardens, and drainage channels because of limited health promotion, resulting in a lack of understanding of proper waste management. In several locations, piles of household waste were found left open, potentially becoming breeding grounds for disease vectors. This situation indicates that waste management remains a major challenge in efforts to control environmental-based diseases, particularly diarrhea in infants.

Accumulated household waste, especially that containing food scraps and organic materials, can become a breeding ground for flies. Flies are mechanical vectors that help spread pathogenic microorganisms that cause diarrhea, such as bacteria, viruses, and parasites. After landing on waste or materials contaminated with feces, flies can carry these microorganisms on their legs, wings, and body surfaces. The flies can then transfer them to food, drinks, eating utensils, or surfaces frequently touched by family members. This contamination can then spread to food and drinks consumed by children under five.

As a result, diarrhea-causing microorganisms can enter the digestive tract and cause infection. This mechanism is known as fecal-oral transmission, which is the transfer of disease agents from feces to the human mouth through intermediaries such as flies, food, drinks, hands, or contaminated environments. This situation is exacerbated by the lack of verification of the achievement of the five pillars of Community-Based Total Sanitation (STBM) in the work areas of community health centers (Puskesmas). Consequently, efforts to control household waste, manage household drinking water, and control liquid waste are not optimal. This situation maintains a high risk of environmental contamination and may contribute to the high incidence of diarrhea in children under five.

Public health programs cannot rely solely on individual factors such as immunization status; an integrated approach that incorporates community-based control of environmental factors is required (Azhim & Lestari, 2025; Herawati et al., 2024). Thus, improving basic sanitation infrastructure collectively is a more effective preventive mitigation measure for reducing diarrhea morbidity than intervening in individual health behaviors (Miswan et al., 2023; Savitri & Susilawati, 2022).

## CONCLUSION

The most dominant factor associated with diarrhea in children under five is waste management. This indicates that poor waste management increases the risk of diarrhea nearly five times compared with good waste management, after controlling for age, nutritional status, immunization status, water quality, and latrine ownership. Therefore, improving waste management and strengthening promotive and preventive efforts through community education on proper household waste management that meets health standards are necessary, emphasizing the importance of separating organic and inorganic waste, using covered waste bins, and disposing of waste in designated disposal sites to reduce the incidence of diarrhea.

## AUTHOR'S DECLARATION

### Authors' contributions and responsibilities

**LJ**: Research conceptualization, data collection (data acquisition), formal analysis, original draft writing, research result visualization, editing; **DM, KA, DFP, IM**: Supervision of primary research, data validation, review of drafts, methodological guidance.

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### Availability of data and materials

All data are available from the authors.

### Competing interests

The authors declare no competing interests.

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