

## ARTICLE INFORMATION

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## Association between exclusive breastfeeding history and diarrhea among children under five

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**Background:** Toddlers are a vulnerable age group to diarrhea due to their immature immune system and digestive tract function. Diarrhea remains a major health problem with a high incidence among toddlers, both globally and nationally. One of the preventive efforts against diarrhea is exclusive breastfeeding, as breast milk contains nutrients and immunological components that protect the infant's digestive tract from infection.

**Purpose:** To examine the association between a history of exclusive breastfeeding and diarrhea among children under five.

**Method:** This study employed an analytical cross-sectional design. The study was conducted at the Kemiling Inpatient Community Health Center in Bandar Lampung City. The population in this study was 112 mothers with toddlers, with a sample size of 53 respondents using consecutive sampling technique. Data analysis used the Chi-Square test and Odds Ratio (OR) test.

**Results:** The results showed that 30 respondents (56.6%) provided exclusive breastfeeding and 23 respondents (43.4%) did not provide exclusive breastfeeding. Toddlers who experienced diarrhea were 23 respondents (43.4%). The results of the Chi-Square test analysis obtained a p-value = 0.001 ( $p < 0.05$ ) with an Odds Ratio (OR) value of 0.088 (95% CI: 0.024–0.321), which indicates a significant relationship between the history of exclusive breastfeeding and the incidence of diarrhea in toddlers. Toddlers who receive exclusive breastfeeding have a lower risk of experiencing diarrhea than toddlers who do not receive exclusive breastfeeding.

**Conclusion:** There is a significant relationship between a history of exclusive breastfeeding and the incidence of diarrhea in toddlers. Exclusive breastfeeding is protective against diarrhea in toddlers.

**Keywords:** Diarrhea; Exclusive Breastfeeding; Toddler.

## INTRODUCTION

Diarrhea remains a significant health problem for infants and toddlers, both globally and nationally. Diarrhea is the passage of loose or watery stools more than three times in a 24-hour period, most often triggered by infectious agents including bacteria, viruses, or parasites. Risk factors for diarrhea in infants and children are closely related to poor hygiene and environmental sanitation, gastrointestinal infections, and nutrient absorption disorders such as lactose malabsorption (Maharani & Pambudi, 2024).

Globally, the World Health Organization (WHO) reports that in 2024, there will be approximately 1.7

billion cases of diarrhea in children, with a mortality rate reaching 443,832 children under five years of age. In Indonesia, the number of diarrhea cases among toddlers receiving care at health facilities in 2024 was recorded at 1,001,441. These data show that diarrhea is still classified as a significant public health problem, with a major impact on the toddler group (World Health Organization, 2024; Ministry of Health of the Republic of Indonesia, 2024).

Bandar Lampung City is one of the regions with a relatively high incidence of diarrhea in toddlers. Data from the Lampung Provincial Health Office in 2022 shows that cases of diarrhea in toddlers in Bandar

Lampung City ranked second highest in the province, with 18,660 cases (Lampung Provincial Health Office, 2022). In 2024, the Central Statistics Agency of Bandar Lampung City also reported 5,754 cases of diarrhea across all age groups, with toddlers being the most vulnerable age group (Central Statistics Agency of Bandar Lampung City, 2025). The high incidence of diarrhea in toddlers highlights the need for effective prevention efforts, one of which is exclusive breastfeeding.

Breast milk is the primary source of nutrition for infants and provides protection through immunological processes. The Indonesian Ministry of Health targets 80% exclusive breastfeeding coverage until infants are 6 months old. Early initiation of breastfeeding is crucial, as early breastfeeding allows newborns to ingest colostrum, which is rich in immunoglobulins and other nutrients that provide protection against diarrhea and other infectious diseases. Delayed initiation of breastfeeding is associated with a higher risk of infant mortality and an increased risk of diarrhea-related morbidity. A recent review showed that early and exclusive breastfeeding prevented half of all diarrhea episodes in infants and 72% of hospitalizations (Hamer et al., 2022).

Exclusive breastfeeding is defined as providing only breast milk without any other fluids or solid foods except vitamins, minerals, and medicines, for the first 6 months of life (World Health Organization, 2023). Exclusive breastfeeding has both short- and long-term benefits, particularly in reducing child morbidity and mortality from diarrhea and respiratory infections. A meta-analysis suggests that exclusive breastfeeding has a significant effect on preventing infant death, especially from infectious diseases, even through the first two years of life. During the first six months, exclusive breastfeeding protects infants 6.1 times more against diarrhea than other infectious diseases (Rusyda & Ronoatmodjo, 2021).

## RESEARCH METHOD

This study employed an analytical observational design with a cross-sectional approach to examine the association between a history of exclusive breastfeeding and the incidence of diarrhea among

children under five. The study was conducted at the Kemiling Inpatient Community Health Center, Bandar Lampung, Indonesia, from March to April 2026.

The study population consisted of 112 mother-child pairs with children aged 3–59 months registered within the health center's service area. A minimum sample of 53 respondents was determined using the Slovin formula with a 10% margin of error and selected through consecutive sampling by recruiting all eligible participants who met the inclusion criteria until the required sample size was achieved. Mothers with children aged 3–59 months who had complete health records, resided within the study area, and agreed to participate by providing written informed consent were included, whereas children with congenital abnormalities affecting breastfeeding, lactose intolerance, chronic gastrointestinal disorders, or respondents with incomplete interview data were excluded. The independent variable was the history of exclusive breastfeeding, defined as providing only breast milk during the first six months of life without additional food or beverages except medicines, vitamins, and mineral supplements, while the dependent variable was the incidence of diarrhea, defined as the occurrence of three or more loose or watery stools within a 24-hour period based on maternal reports and health records.

Data were collected through face-to-face interviews using a structured questionnaire adapted from Singh and verified using maternal and child health records available at the community health center and integrated health posts. The questionnaire demonstrated acceptable validity, with Pearson correlation coefficients ranging from 0.517 to 0.918 ( $r > 0.361$ ), and good internal consistency, with a Cronbach's alpha coefficient of 0.769. Data were analyzed using IBM SPSS Statistics. Univariate analysis was performed to describe respondents' characteristics using frequencies, percentages, means, and standard deviations, while the association between exclusive breastfeeding history and diarrhea incidence was analyzed using the Chi-square test. The strength of the association was expressed as the Odds Ratio (OR) with a 95% confidence interval (95% CI), and statistical significance was established at  $p < 0.05$ .

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## RESEARCH RESULTS

Table 1. Characteristics of Respondents (N=53)

| Variable                               | Results                | p-value | OR (95% CI)         |
|----------------------------------------|------------------------|---------|---------------------|
| Maternal Age (Mean±SD) (Years) (Range) | (29.37 ± 3.26) (20-35) |         |                     |
| 20-25                                  | 5/9.4                  |         |                     |
| 26-30                                  | 28/52.8                |         |                     |
| 31-35                                  | 20/37.7                |         |                     |
| Education (n/%)                        |                        |         |                     |
| High                                   | 42/79.2                |         |                     |
| Low                                    | 11/20.8                |         |                     |
| Occupation (n/%)                       |                        |         |                     |
| Homemaker                              | 31/58.5                |         |                     |
| Private Employment                     | 9/17.0                 |         |                     |
| Civil Servant                          | 7/13.2                 |         |                     |
| Self-Employed                          | 5/9.4                  |         |                     |
| Other                                  | 1/1.9                  |         |                     |
| Family Income (n/%)                    |                        |         |                     |
| < Regional Minimum Wage                | 36/67.9                |         |                     |
| ≥ Regional Minimum Wage                | 17/32.1                |         |                     |
| Child Age (Mean±SD) (Month) (Range)    | (33.62 ± 14.59) (3-59) |         |                     |
| Infants ≤ 12                           | 5/9.4                  |         |                     |
| Toddlers 12–35                         | 22/41.5                |         |                     |
| Toddlers 36–59                         | 26/49.1                |         |                     |
| Gender (n/%)                           |                        |         |                     |
| Male                                   | 27/50.9                |         |                     |
| Female                                 | 26/49.1                |         |                     |
| Body Weight (n/%)                      |                        |         |                     |
| Severely underweight (<-3 SD)          | 18/34.0                |         |                     |
| Underweight (-3 to -2 SD)              | 14/26.4                |         |                     |
| Normal weight (-2 to +2 SD)            | 21/39.6                |         |                     |
| Height (n/%)                           |                        |         |                     |
| Very short (<-3 SD)                    | 10/18.9                |         |                     |
| Short (-3 to -2 SD)                    | 15/28.3                |         |                     |
| Normal (-2 to +2 SD)                   | 28/52.8                |         |                     |
| Exclusive Breastfeeding (n/%)          |                        | 0.001   | 0.088 (0.024-0.321) |
| Yes                                    | 30/56.6                |         |                     |
| No                                     | 23/43.4                |         |                     |

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|                |         |
|----------------|---------|
| Diarrhea (n/%) |         |
| Yes            | 23/43.4 |
| No             | 30/56.6 |

Based on the table characteristics of the 53 mother-child pairs summarized in Table 1, the mean age of the mothers was  $29.37 \pm 3.26$  years (range: 20–35 years), with the majority falling in the 26–30 age group (52.8%,  $n = 28$ ), having a high level of education (79.2%,  $n = 42$ ), working as homemakers (58.5%,  $n = 31$ ), and coming from families with an income below the Regional Minimum Wage (67.9%,  $n = 36$ ). Among the children, the mean age was  $33.62 \pm 14.59$  months (range: 3–59 months), where 49.1% ( $n = 26$ ) were aged 36–59 months and 50.9% ( $n = 27$ ) were male. Regarding nutritional and health status, 34.0% ( $n = 18$ ) of children were severely underweight ( $< -3$  SD), 18.9% ( $n = 10$ ) were severely stunted ( $< -3$  SD), and 43.4% ( $n = 23$ ) had a history of diarrhea. Furthermore, 56.6% ( $n = 30$ ) of children received exclusive breastfeeding, which demonstrated a statistically significant association with the outcome variable ( $p = 0.001$ , OR = 0.088, 95% CI: 0.024–0.321), indicating that exclusive breastfeeding acts as a significant protective factor.

## DISCUSSION

The results of the study showed that most mothers of toddlers were in the 26–30 age group, which falls within the healthy reproductive age range, with sufficient physical, psychological, and social maturity to fulfill their role as mothers. This finding aligns with previous research, which reported that the majority of mothers of toddlers were in the productive age group of 25–29 years (Yusak et al., 2024). This finding also aligns with previous findings that maternal age had no significant association with the incidence of diarrhea in toddlers ( $p$ -value = 0.536) (Pagisi et al., 2023). This indicates that the incidence of diarrhea is more influenced by other factors, such as exclusive breastfeeding, hygiene practices, environmental sanitation, and nutritional status.

The majority of mothers in this study had a high level of education (79.2%) and worked as housewives (58.5%), with family incomes mostly below the minimum wage (UMR) (67.9%). The characteristics of toddlers showed a nearly balanced gender

distribution, with the largest age group being in the 36–59 month age range.

The study results showed that the majority of toddlers had a history of exclusive breastfeeding (56.6%). This coverage is higher than previous findings, which cited national survey data that showed exclusive breastfeeding coverage was still very low, at only 3.3%. This striking difference is likely due to differences in measurement methods (24-hour recall versus 6-month recall) and different population characteristics (Irwan et al., 2023). Research conducted at the Tanah Kali Kedinding Community Health Center found a higher exclusive breastfeeding coverage (80.2%), which was explained likely because mothers in the area had received and implemented counseling from the community health center (Adhiningsih et al., 2019). Meanwhile, research conducted at the Mangasa Community Health Center found that 56.7% of toddlers had a low history of exclusive breastfeeding (Simunati et al., 2025), a condition similar to this study.

Breast milk contains a series of bioactive components that provide specific protection against diarrhea, including secretory IgA (sIgA) that coats the intestinal mucosa and prevents pathogen adhesion, bacteriostatic lactoferrin, lysozyme that lyses bacterial cell walls, and bifidus factor that stimulates the growth of *Lactobacillus bifidus* in the colon, thereby creating an acidic environment that inhibits the proliferation of pathogenic bacteria. Barriers to achieving optimal exclusive breastfeeding coverage are quite diverse, including lack of family support, working mothers, perceived insufficient breast milk production, lack of maternal knowledge about breastfeeding techniques, and the influence of massive formula milk promotion (Irwan et al., 2023).

The 43.4% diarrhea prevalence in this study far exceeds national data from the 2023 Indonesian Health Survey (SKI), which recorded a diarrhea prevalence among toddlers of 7.4% (Ministry of Health of the Republic of Indonesia, 2023). This large gap indicates the existence of specific conditions in the study area that create an ecosystem with a high cumulative risk of diarrhea. This high prevalence is

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consistent with findings from various studies in areas with limited sanitation; the Mangasa Community Health Center reported a prevalence of 30% (Simunati et al., 2025). Meanwhile, other researchers reported 269 cases of diarrhea among toddlers in the Gorontalo region in one year (Irwan et al., 2023).

From an epidemiological perspective, diarrhea in toddlers is caused by a complex interaction between infectious agents, susceptible hosts, and environmental factors. The main infectious agents include Rotavirus (the most common cause of acute diarrhea in infants in developing countries), enteropathogenic *Escherichia coli*, *Shigella* spp., *Salmonella* spp., *Campylobacter jejuni*, *Vibrio cholerae*, *Cryptosporidium*, and *Entamoeba histolytica*. Host susceptibility is determined by age, nutritional status, immunization status, and the presence or absence of protection from exclusive breastfeeding. Environmental factors include drinking water quality, fecal sanitation, food handling, and personal hygiene (Pagisi et al., 2023; Yusak et al., 2024; Khofifah et al., 2023). This confirms that diarrhea prevention requires a multifactorial approach that simultaneously addresses nutritional vulnerability, limited sanitation, and maternal knowledge deficits. Therefore, diarrhea control programs at the community health center level need to be comprehensive and integrated.

The results of the bivariate analysis revealed a very significant relationship between exclusive breastfeeding and diarrhea incidence in infants. Of the 23 toddlers who were not exclusively breastfed, 17 (73.9%) experienced diarrhea, a high and clinically concerning proportion. In contrast, of the 30 toddlers who were exclusively breastfed, only 6 (20.0%) experienced diarrhea. This striking difference in proportions (73.9% versus 20.0%) descriptively indicates a strong relationship between the two variables, even before formal statistical testing was conducted.

The Chi-Square test yielded a p-value of 0.001 ( $p < 0.05$ ), indicating a statistically significant association between exclusive breastfeeding and diarrhea in toddlers. The Chi-Square test assumptions were met because there were no cells with an expected count of less than 5 (minimum expected count of 9.98), thus ensuring the validity of the statistical test. The Odds Ratio (OR) of 0.088 with a 95% CI of 0.024–0.321 has an important clinical

interpretation: an OR of less than 1 with a confidence interval entirely below 1 confirms that exclusive breastfeeding is a significant protective factor, not simply a statistical coincidence. These results align with a previous study using a case-control design with 152 samples and obtaining a p-value = 0.001 with an OR = 12.065 (95% CI: 5.231–27.827), indicating that toddlers who are not exclusively breastfed have a 12.065 times greater risk of diarrhea (Irwan et al., 2023). Although the OR values in this study differ numerically due to differences in variable coding, the direction of the conclusions of both studies is identical, namely that exclusive breastfeeding significantly protects toddlers from diarrhea. The consistency of these findings is reinforced by a number of studies from various geographic settings in Indonesia. In the Seba Community Health Center Work Area found a significant association between exclusive breastfeeding and the incidence of diarrhea ( $p = 0.003$ ) (Lado et al., 2026). At the Mangasa Community Health Center also found a significant association ( $p < 0.05$ ) and cited a meta-analysis showing that exclusive breastfeeding can reduce the risk of diarrhea by up to 43% (Simunati et al., 2025). A logistic regression analysis found that a history of exclusive breastfeeding had an OR of 0.023, confirming the role of breast milk as a strong protective factor against various adverse health conditions in infants (Sari, 2022).

Mechanistically, the protective effect of exclusive breastfeeding against diarrhea is mediated through complementary immunological and ecological pathways. In the immunological pathway, sIgA contained in breast milk coats the intestinal mucosal surface and inhibits the attachment and penetration of pathogens without triggering an inflammatory response that damages intestinal tissue, a mechanism known as immune exclusion. Lactoferrin binds iron, which bacteria need for growth, effectively inhibiting the proliferation of pathogenic bacteria in the intestinal lumen. In the ecological pathway, breast milk provides oligosaccharide substrates that selectively support the growth of beneficial bacteria such as *Bifidobacterium* and *Lactobacillus*, which then dominate the gut microbiome of exclusively breastfed infants, creating colonization resistance against enteric pathogens.

One study warrants careful scrutiny due to its seemingly inconsistent results. The Oesapa

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Community Health Center in Kupang City reported that a history of exclusive breastfeeding was not significantly associated with diarrhea ( $p = 0.224$ ;  $OR = 1.784$ ). Although toddlers are exclusively breastfed, mothers' failure to wash their hands before breastfeeding and preparing food can potentially transmit pathogens, thus overriding the protective effect of exclusive breastfeeding due to poor hygiene practices. This suggests that exclusive breastfeeding is not a sole guarantee of diarrhea-free survival but needs to be integrated with good hygiene practices to achieve optimal protection (Yusak et al., 2024).

Overall, the results of this study support evidence that exclusive breastfeeding is an effective, measurable, and low-cost health intervention in preventing diarrhea in toddlers. The  $p$ -value of 0.001 and  $OR = 0.088$  obtained, corroborated by consistent findings from various previous studies across Indonesia, underscore the urgency of strengthening exclusive breastfeeding programs across all health service levels.

## CONCLUSION

The characteristics of mothers and toddlers showed that most mothers were aged 26–30 years (52.8%), had a high education (79.2%), worked as housewives (58.5%), and had family income below the minimum wage (UMR) (67.9%). The distribution of exclusive breastfeeding history showed that most toddlers received exclusive breastfeeding (56.6%), while diarrhea was found in 43.4% of toddlers. There was a significant relationship between the history of exclusive breastfeeding and the incidence of diarrhea in toddlers at the Kemiling Inpatient Health Center, Bandar Lampung City in 2026, with a  $p$ -value = 0.001 ( $p < 0.05$ ) and an Odds Ratio of 0.088 (95% CI: 0.024–0.321), so it can be concluded that exclusive breastfeeding is a protective factor against diarrhea in toddlers.

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