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Factors Associated with Diarrhea among Children Aged 1–4 Years

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Abstract

Background: Diarrhea remains a major public health problem and is one of the leading causes of morbidity and mortality among children under five years of age. Multiple maternal and environmental factors, including maternal education, exclusive breastfeeding, drinking water source, and handwashing practices, may influence the occurrence of diarrhea in young children. Identifying these associated factors is essential for developing effective prevention strategies.

Purpose: To identify factors associated with diarrhea among children aged 1-4 years.

Methods: A community-based analytical cross-sectional study was conducted among mothers of children aged 1–4 years in the Jeumpa Primary Health Center catchment area, Bireuen Regency, from February 2 to 21, 2026. A total of 97 respondents were selected using accidental sampling from a population of 3,488 children. Data were collected using structured questionnaires and analyzed using descriptive statistics and the Chi-square test with a significance level of 0.05.

Results: Of the 97 children, 69 (71.1%) experienced diarrhea. Most mothers had secondary education (76.3%), were in early adulthood (78.4%), had provided exclusive breastfeeding (67.0%), used protected drinking water sources (75.3%), and practiced good handwashing with soap (62.9%). Maternal education ($p = 0.044$), exclusive breastfeeding ($p = 0.001$), and handwashing with soap ($p = 0.012$) were significantly associated with diarrhea among children aged 1–4 years. In contrast, maternal age ($p = 0.422$) and drinking water source ($p = 0.546$) were not significantly associated with diarrhea.

Conclusion: Maternal education, exclusive breastfeeding, and handwashing with soap were significantly associated with diarrhea among children aged 1–4 years. Strengthening health education, promoting exclusive breastfeeding, and improving hand hygiene practices are important strategies for reducing the burden of childhood diarrhea in the community.

Keywords: Diarrhea; Children Under Five; Exclusive Breastfeeding; Handwashing With Soap; Maternal Education.

INTRODUCTION

Diarrheal disease remains a leading cause of morbidity and mortality in almost all geographic regions of the world. Diarrhea can occur in all age groups, especially infants and toddlers. Diarrhea is a condition characterized by bowel movements occurring more than three times a day with a liquid stool consistency, sometimes even containing blood (Firmansyah et al., 2021). Diarrhea is the process of defecating with a stool consistency that is more liquid

or softer than usual. This diarrhea generally occurs more than three times in a 24-hour period. However, in infants under one month of age who are breastfed, diarrhea occurs more frequently, occurring five to six times a day (Indriyani & Putra, 2020).

Common symptoms experienced by toddlers with diarrhea include loose or watery stools, which are typical symptoms of diarrhea. Vomiting, which usually accompanies diarrhea in acute gastroenteritis, fever,

which usually occurs before or after diarrhea, and symptoms of dehydration, such as sunken eyes, decreased skin tone, apathy, and even restlessness (Kasman, 2018). Diarrhea is generally a symptom of intestinal infection caused by various organisms, including *Salmonella* sp., *Compylobacter jejuni*, *Staphylococcus aureus*, *Bacillus careus*, *Clostridium perfringens*, and enterohemorrhagic *Escherichia coli* (EHEC) (Putri et al., 2023).

Diarrheal disease is the second-highest cause of death worldwide. The World Health Organization (WHO) reports approximately 525,000 diarrheal deaths annually (World Health Organization, 2024). Diarrheal deaths in children under five years of age are predominantly found in South Asia and sub-Saharan Africa. In low-income countries, diarrhea occurs on average three times a year in children under 3 years of age (Paramasatya, 2023). In the UK, one in five people suffer from diarrheal infections. In Western countries, these cases are caused by foodborne and waterborne infections (UNICEF, 2021).

Diarrhea in Indonesia often occurs in the form of Extraordinary Events (KLB). Diarrhea outbreaks often occur in areas where control of these factors is still very limited. Diarrhea is more prevalent in toddlers due to their weak immune systems, making them highly susceptible to the spread of diarrhea viruses (Pitriyani & Pitriyani, 2019). The 2018 National Basic Health Research Report showed that diarrhea cases in Indonesia, diagnosed by health workers, reached 6.8%. According to data from the Indonesian Ministry of Health, the prevalence of diarrhea cases in toddlers aged 1–4 years, diagnosed by health workers, reached 11.5%. The highest prevalence of diarrhea cases in toddlers was in North Sumatra, at 14.2% (Ministry of Health of the Republic of Indonesia, 2020).

Diarrhea cases among toddlers in Aceh Province were highest in Bireuen Regency, with a prevalence of 21.51%, and Sabang City, with the lowest prevalence of diarrhea in toddlers at 5.4%. These cases were recorded in 2018. Based on 2018 basic health research data, the prevalence of diarrhea among toddlers in Banda Aceh City reached 5.42% (Aceh Provincial Health Office, 2019).

Based on a preliminary study of mothers with toddlers aged 1–4 years in the Jeumpa Community

Health Center coverage area, diarrhea cases decreased annually, starting with 43 cases in 2022 and 30 in 2023. However, this decline was short-lived, with an increase of 31 cases in 2024. According to the Jeumpa Community Health Center data summary, the number of toddlers aged 1–4 experiencing diarrhea in 2025 is expected to increase, with 23 cases recorded from January to September.

Factors that predispose toddlers to diarrhea include unhealthy lifestyles and poor environmental sanitation. Diarrhea can be fatal if not treated seriously, as toddlers are vulnerable and susceptible to various bacteria, viruses, and parasites. Other impacts of diarrhea include death, dehydration, and stunted growth (failure to thrive). Diarrhea is also a leading cause of malnutrition in children under five (Saputra et al., 2024).

Several factors, both directly and indirectly, contribute to diarrhea, including sociodemographic factors, exclusive breastfeeding, environmental factors, and handwashing with soap. Sociodemographic factors include maternal age, parental education and occupation, and socioeconomic status. Factors influencing exclusive breastfeeding include maternal behavior in breastfeeding and not breastfeeding (Unna, 2023).

RESEARCH METHOD

This study employed a quantitative analytical design using a cross-sectional approach to identify factors associated with diarrhea among children aged 1–4 years. The study was conducted in the catchment area of the Jeumpa Primary Health Center, Bireuen Regency, Aceh Province, Indonesia, from February 2 to February 21, 2026.

The target population consisted of 3,488 children aged 1–4 years residing in the Jeumpa Primary Health Center catchment area. The study sample comprised 97 mothers with children aged 1–4 years, selected using an accidental sampling technique. Sample size was determined using the Slovin formula based on the total population.

The dependent variable was the incidence of diarrhea among children aged 1–4 years. The independent variables included maternal age, maternal education level, exclusive breastfeeding history, drinking water source, and handwashing with soap practices. Maternal age was categorized into

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late adolescence (17–25 years), early adulthood (26–35 years), and late adulthood (36–45 years). Maternal education was classified as higher education and secondary education. Exclusive breastfeeding was categorized as yes or no according to the child's breastfeeding history during the first six months of life. Drinking water source was classified as protected or unprotected, while handwashing with soap practice was categorized as good or poor based on respondents' reported hygiene practices.

Primary data were collected through interviewer-administered structured questionnaires, while secondary data were obtained from the Bireuen District Health Office and the Jeumpa Primary Health Center. The questionnaire collected information on respondents' sociodemographic characteristics,

history of exclusive breastfeeding, source of drinking water, handwashing with soap practices, and diarrhea episodes experienced by the child.

Data were processed and analyzed using the Statistical Package for the Social Sciences (SPSS) version 20. Descriptive (univariate) analysis was performed to summarize respondents' characteristics and the distribution of study variables using frequencies, percentages, means, standard deviations, and ranges where appropriate. Bivariate analysis was conducted using the Chi-square test to assess the association between each independent variable and the incidence of diarrhea. Statistical significance was determined at a p-value of less than 0.05 with a 95% confidence level.

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RESEARCH RESULTS

Table Characteristics of Respondents (N=97)

Variable	Result	p-value
Maternal Age (Mean±SD) (Years) (Range)	(30.45±4.56) (17-45)	0.422
Late adolescence (17-25)	11/11.3	
Early adulthood (26-35)	76/78.4	
Late adulthood (36-45)	10/10.3	
Diarrhea Incidence (n/%)		
Yes	69/71.1	
No	28/28.9	
Maternal Education (n/%)		0.044
Higher	23/23.7	
Secondary	74/76.3	
Exclusive Breastfeeding (n/%)		0.001
Yes	65/67.0	
No	32/33.0	
Source of Drinking Water (n/%)		0.546
Protected	73/75.3	
Unprotected	24/24.7	
Handwashing with Soap Practice (n/%)		0.012
Good	61/62.9	
Poor	36/37.1	

Based on table 1, the distribution of respondents shows that the majority of toddlers do not suffer from diarrhea as many as 68 toddlers (70.1%), the level of maternal education is secondary (76.3%), the age of the mother is early adulthood (78.4%), exclusive breastfeeding is (67.0%), using protected drinking water sources is (75.3%), handwashing behavior with soap is not good (55.7%). Bivariate analysis was carried out using the chi-square test with a significance level of $\alpha = 0.05$ and a confidence level of 95% in 97 respondents. Based on the results of the chi-square test, there is a significant relationship (p-value <0.05) between the level of maternal education, exclusive breastfeeding, and handwashing behavior with soap on the incidence of diarrhea in toddlers aged 1-4 years.

DISCUSSION

This study found a relationship between maternal education level and the incidence of diarrhea in toddlers. The proportion of toddlers experiencing diarrhea in the Jeumpa Community Health Center working area was higher among mothers with low education (25 respondents), compared to mothers with higher education (3 respondents). Educational level plays a significant role in community health. Low levels of education make it difficult for them to be informed about the importance of personal hygiene and environmental sanitation to prevent infectious diseases, including diarrhea. This difficulty in receiving education leads to their indifference towards infectious disease prevention efforts (Arini et al., 2021). Educational level plays a significant role in community health. Low levels of education make it

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difficult for them to be informed about the importance of personal hygiene and environmental sanitation to prevent infectious diseases, including diarrhea. This difficulty in receiving education leads to their indifference towards infectious disease prevention efforts (Ulya, 2022). The results of this study align with previous research, which showed a relationship between education level and the incidence of diarrhea in toddlers, with a p-value of 0.012. A mother's education level influences a person's attitude, meaning that the higher the mother's education level, the better her attitude in providing first aid for children with diarrhea. Conversely, the lower the mother's education level, the worse her attitude in providing first aid for children with diarrhea (Prastiwi, 2022).

In this study, there was no relationship between maternal age and the incidence of diarrhea in toddlers. The proportion of toddlers with diarrhea in the Jeumpa Community Health Center work area was higher among mothers in early adulthood, namely mothers aged 26-35 years (20 respondents), compared to mothers in late adolescence (17-25 years) and late adulthood (36-45 years), which had the same proportion, namely four respondents. Maternal age is not a measure of a mother's ability to care for children and receive preventive treatment for diarrhea. Maternal age is a factor in determining maternal behavior, but it is not the most important determinant of good or bad maternal behavior in preventing childhood diarrhea (Christy, 2019). Age is a sequential phase in different periods of human life. The older a person is, the more knowledge they acquire. Age is also an individual factor, where a person absorbs more information as they grow older. Increasing age also influences a person's understanding and tendencies. As a person ages, their understanding and mindset expand, and their personal ability to cope with problems can grow (Kharisma et al., 2022).

The results of this study align with previous research, which found no association between maternal age and the incidence of diarrhea in toddlers (p-value 0.091). This suggests that a mother's age does not guarantee her ability to care for children or prevent diarrhea (Ulfi, 2025).

This study found a relationship between exclusive breastfeeding and the incidence of diarrhea in toddlers. The proportion of toddlers experiencing diarrhea in the Jeumpa Community Health Center

working area was higher among toddlers who were not exclusively breastfed (17 respondents), compared to toddlers who were exclusively breastfed (11 respondents). Some toddlers who were not exclusively breastfed did not experience diarrhea. This is due to minerals and vitamins, especially vitamin D, found in non-breast milk nutrients, which play a role in slowing down the growth of gut microbiota. In addition to minerals and vitamins, probiotics also play a role in stimulating the growth of gut microbiota, such as *Bifidobacterium* sp. and *Lactobacillus* sp., which can reduce intestinal disorders in children, such as diarrhea and intestinal colic (Khearni et al., 2025). Breastfed toddlers are healthier than formula-fed toddlers, as formula feeding can increase the risk of urinary tract, gastrointestinal, and ear infections. Toddlers also experience diarrhea, (chronic) stomach aches, food allergies, asthma, diabetes, and chronic digestive disorders. Conversely, breastfed toddlers help optimize the development of the baby's nervous system and brain (Verli, 2021).

The results of this study align with previous research, which revealed a relationship between exclusive breastfeeding and diarrhea in toddlers, with a p-value of 0.053. Breast milk has immunological preventive properties due to the antibodies and other substances it contains. Breast milk not only provides unique protection against infection and allergies but also stimulates adequate development of the toddler's immune system. In newborns, exclusive breastfeeding has four times greater protection against diarrhea than breastfeeding combined with bottle feeding. Breast milk is sterile, unlike other milk sources such as formula or other liquids prepared with water or ingredients that can be contaminated in dirty bottles (Unna, 2023).

This study found no association between drinking water sources and the incidence of diarrhea in toddlers. The proportion of toddlers experiencing diarrhea in the Jeumpa Community Health Center working area was higher among respondents using protected water sources (23 respondents), compared to respondents using unprotected water sources (6 respondents). Drinking water sources play a role in the spread of various infectious diseases. Drinking water sources are one of the channels associated with diarrhea. Some infectious germs that cause diarrhea are transmitted through the visual-oral route. This can

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be transmitted through the mouth in the form of fluids or objects mixed with feces (Marini et al., 2020). Unprotected drinking water sources, such as wells, must meet sanitation requirements, just like rivers for household use. Therefore, the water must be protected from pollution. Damaged wells must meet sanitation requirements, including the distance between the well and the pit latrines, the distance between the well and waste excavations, sewers, and other sources of contamination. The distance between the hole and the fecal drainage channel is better than 10 meters or more (Yustati, 2021).

The results of this study align with those of other studies, which found no association between drinking water sources and diarrhea in toddlers (p-value 0.372). With an OR of 1.26 (0.7-2.1), the use of low-risk well water only increases the risk of diarrhea by 1.26. This is because diarrhea is more often caused by germs such as viruses and bacteria. Mothers of toddlers often neglect the proper storage of drinking water and the proper boiling process to kill bacteria, thus preventing diarrhea in children (Safitri et al., 2025).

This study found a relationship between handwashing with soap and diarrhea in toddlers. The proportion of toddlers experiencing diarrhea in the Jeumpa Community Health Center (Puskesmas) area was higher among respondents with poor handwashing practices (21 respondents), compared to those with good handwashing practices (7 respondents). Handwashing should be done before and after activities. Without realizing it, we touch objects or even objects that contain disease-causing bacteria. Washing hands with water alone will not kill bacteria (Wandhani et al. 2024).

The correct way to wash hands is to wet them by splashing them with water and then applying soap. Rubbing the hands evenly over the entire surface of the hands, from the thumbs to the wrists. Then, alternately move your hands to the palms and backs of your hands. Use clenched and closed movements to clean between your fingers and nails for at least 20 seconds. Repeat this process with all your fingers, rubbing your fingertips. Then, rinse with running water and dry with a cloth, clean tissue, or air dry (Mildawati et al. 2023).

The results of this study align with previous research showing a relationship between

handwashing with soap and the incidence of diarrhea in toddlers, with a p-value of 0.013 (Utami et al., 2024). These results indicate that people who wash their hands frequently and always with soap are less likely to experience diarrhea. It was also explained that respondents sometimes washed their hands with soap before or after activities. Although the disease can enter the digestive tract orally through dirty hands, it could be because of touching food when the hands are dirty so that bacterial contaminants stick to the food that is eaten.

CONCLUSION

This study demonstrated that maternal education level, exclusive breastfeeding, and handwashing with soap were significantly associated with the incidence of diarrhea among children aged 1–4 years in the Jeumpa Primary Health Center catchment area, Bireuen Regency. In contrast, maternal age and drinking water source were not significantly associated with diarrhea incidence.

These findings emphasize the importance of strengthening maternal health education, increasing the coverage of exclusive breastfeeding, and promoting proper handwashing with soap as key strategies for reducing the burden of diarrhea among young children. Community-based health promotion and preventive interventions targeting these modifiable factors should be prioritized to improve child health outcomes in the study area.

SUGGESTION

Primary Health Centers should strengthen health education programs promoting exclusive breastfeeding, maternal education, and proper handwashing with soap to reduce the incidence of diarrhea among young children. Future studies are recommended to include larger sample sizes and additional risk factors, using multivariable analyses to provide stronger evidence for diarrhea prevention strategies.

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