



ORIGINAL ARTICLE

DETERMINANTS OF THE INCIDENCE OF DIARRHEA IN TODDLERS AGED 12-59 MONTHS IN JAYAPURA CITY

Determinan Kejadian Diare Pada Balita Usia 12-59 Bulan di Kota Jayapura

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ABSTRACT

Background: Diarrhea in toddlers can be more deadly compared to other ages because the percentage of fluid in the baby's body is greater. In 2023, data from 14 health centers in Jayapura City showed that diarrhea consistently ranked among the top 10 diseases, particularly at Abepura and North Jayapura Health Centers. **Purpose:** This study aims to analyze the determinants of diarrhea incidence, including risk factors, among toddlers in Jayapura City. **Methods:** A cross-sectional design was applied with a sample of 192 toddlers aged 12–59 months selected through accidental sampling. Inclusion criteria were mothers of toddlers aged 12–59 months, residing in the community health center working area, and willing to participate. Exclusion criteria included toddlers with congenital or chronic diseases, mothers not serving as primary caregivers, and uncooperative respondents. Data were collected using questionnaires and processed with SPSS software. Univariate and bivariate analyses employed the chi-square test, while multivariate analysis used multiple logistic regression. **Results:** Exclusive breastfeeding ($p = 0.00$) and maternal attitude ($p=0.01$) were significantly related to diarrhea incidence. Exclusive breastfeeding was identified as the main determinant, with $p = 0.00$ and an Exp(B) value of 4.32. **Conclusion:** Exclusive breastfeeding is the key determinant of diarrhea incidence among toddlers aged 12–59 months in Jayapura City.

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ABSTRAK

Latar Belakang: Diare pada balita dapat lebih mematikan dibandingkan usia lainnya karena persentase cairan dalam tubuh bayi lebih besar. Pada tahun 2023, data dari 14 puskesmas di Kota Jayapura menunjukkan bahwa diare konsisten menempati 10 besar penyakit, terutama di Puskesmas Abepura dan Puskesmas Jayapura Utara. **Tujuan:** Penelitian ini bertujuan untuk menganalisis determinan kejadian diare, termasuk faktor risiko, pada balita di Kota Jayapura. **Metode:** Penelitian menggunakan desain potong lintang dengan sampel 192 balita usia 12–59 bulan yang dipilih melalui teknik *accidental sampling*. Kriteria inklusi adalah ibu yang memiliki balita usia 12–59 bulan, berdomisili di wilayah kerja puskesmas, dan bersedia menjadi responden. Kriteria eksklusi meliputi balita dengan penyakit bawaan atau kronis, ibu yang bukan pengasuh utama, serta responden yang tidak kooperatif. Pengumpulan data dilakukan dengan kuesioner, sedangkan pengolahan data menggunakan perangkat lunak SPSS. Analisis univariat dan bivariat dilakukan dengan uji chi-square, sementara analisis multivariat menggunakan regresi logistik ganda. **Hasil:** Pemberian ASI eksklusif ($p=0,00$) dan sikap ibu ($p=0,01$) berhubungan signifikan dengan kejadian diare. Pemberian ASI eksklusif merupakan determinan utama, dengan nilai $p = 0,00$ dan $Exp(B)=4,32$. **Simpulan:** Pemberian ASI eksklusif merupakan variabel determinan utama kejadian diare pada balita usia 12–59 bulan di Kota Jayapura.

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INTRODUCTION

According to the World Health Organisation (WHO) and the United Nations Children's Emergency Fund (UNICEF), approximately 2 billion cases of diarrhea occur annually worldwide, leading to the unfortunate deaths of 1.9 million children under the age of five due to this preventable condition. Of all these deaths, 78% occurred in developing countries, especially in the African and Southeast Asian regions. Data from the 2021 Indonesian Health Profile states that diarrhea is the second largest contributor to mortality after pneumonia in the post-neonatal group (age 29 days - 11 months), which is 14%, up from 2020, 9.80% of deaths. In the group of children under five (12 - 5 months), diarrhea is the number one cause of death, which is 10.30%, an increase from 2020 of 4.55%. The prevalence of diarrhea in children under five, based on the 2021 Indonesian Nutrition Status Survey, is 9.80%. From the national data, it appears that diarrhea remains the highest cause of illness and death among toddlers, among other diseases, despite a decrease in the number of cases (1).

Infectious diseases prevalent in children are attributed to the suboptimal functioning of the body's immune system. Consequently, there is an elevated likelihood of developing a wide range of health issues, including stunted growth (2). Among

infectious and parasitic diseases, diarrhea significantly contributes to the overall disease burden, particularly in regions characterised by socioeconomic disparities, inadequate sanitation, and insufficient coverage of public health services. The age group most susceptible to diarrhea is infants between the ages of 6 and 23 months, who have a 101% higher risk of developing diarrhea within the preceding week compared to infants under 6 months. This susceptibility decreases to 40% in children between 24 and 35 months. The relatively lower incidence of diarrhea in infants under 6 months may be closely associated with the protective effect of breast milk against infectious diseases in general and diarrhea in particular (3).

A previous study conducted by the researcher in this research entitled analysis of risk factors for diarrhea in toddlers in the working area of the North Jayapura health center showed that the variables of food/beverage sanitation hygiene (p -value = 0.02, OR = 5.21 (1.28-21.24)) and waste handling (p -value = 0.02, OR = 0.25 (0.08-0.79)) were related to the incidence of diarrhea in toddlers (4). The practice of food/beverage sanitation is critical to be carried out; preventing contamination that can cause health problems is important to be carried out in food and beverage sanitation. Contaminants like bacteria can be found in food, and handling food and beverages, including using equipment and

cleaning, storing, and serving procedures, can spread harmful agents (5).

Research conducted by Machava (6) said that the causes of diarrhea in children are incredibly complicated and that the relative importance of each component varies depending on how behavioral, environmental, and socioeconomic factors interact. Infections (disease germs) including bacteria, viruses, and parasites are typically the cause of diarrhea. It is usually spread through contaminated food/drinks or direct contact with the patient's feces. Spread can also occur due to decreased immunity caused by a lack of breast milk intake in babies up to 2 years or more. In breast milk, some antibodies can protect the baby from disease-causing germs. Malnutrition, especially in malnourished children, is easily affected by diarrhea. The most important thing about the spread of diarrhea depends on behavior and environmental factors. In addition, diarrhea can be prevented by giving children nutritious food, so they have strong disease resistance (7).

According to data from the 2023 SKI results, it is known that five provinces with the highest prevalence of diarrhea in children under five are Central Papua (11.80%), Mountainous Papua (10.70%), East Java (8.80%), Banten (8.70%) and the city of Jayapura ranks 5th at 4.20%, there is a slight difference of 0.70% with the national prevalence (4.90%) (8). Meanwhile, data from the Papua Provincial Health Office, for diarrhea reports in 2023, it is known that 2,735 toddlers are suffering from diarrhea in the city of Jayapura, and in 2024, as many as 967 toddlers from January to April (9). Of the 14 health centers in its work area, it was recorded that diarrhea cases always entered the top 10 diseases, such as the Abepura Health Center and the North Jayapura Health Center. Although the number of cases has decreased in the last 3 years (2021–2023), the number of diarrhea cases recorded is 3,082, 2,332, and 1,416. However, in 2023, the incidence of diarrhea occupies the third position after gastritis and hypertension (10). Meanwhile, at the North Jayapura Health Center in 2022 - 2023 (January–October), there were 457 cases and 349 cases where diarrhea occupied the eighth position (11).

Each of the two health centers serves many toddlers and represents both central and peripheral areas of Jayapura City. Given the high burden of diarrhea in this region, the present study seeks to analyze the determinants of diarrhea incidence among children aged 12–59 months by examining child-related factors such as exclusive breastfeeding and immunization status, as well as

maternal knowledge, attitudes, and hygiene practices concerning household food and water management. While numerous studies have investigated diarrhoea risk factors at the national level, limited research has explored how these combined child and maternal factors influence diarrhoea prevalence within Papua's unique sociocultural and geographical context. This study addresses this gap by focusing on two major health center areas in Jayapura City. The findings are expected to inform targeted, evidence-based interventions tailored to urban-peripheral settings in eastern Indonesia.

METHODS

The research methodology employed is observational analytics, employing a cross-sectional design. The data in this study were measured using a modified questionnaire from the Indonesian Health Survey and Minister of Health Regulation No. 3 of 2014, where each variable was divided into two criteria. The dependent variable was the incidence of diarrhea, with a yes or no criterion. The independent variables are exclusive breastfeeding with the criteria of no and yes, completeness of immunization with the criteria of no complete and complete, maternal attitudes with the criteria of negative and positive, while knowledge about diarrhea, as well as household drinking water and food management, use the criteria of bad and good. The research period will take place from August to October 2024. This research was carried out in the Abepura and North Jayapura Health Centers.

The study population includes households with toddlers aged 12-59 months visiting Abepura and North Jayapura Health Centres. The sample size will be calculated based on the sample size formula determined using the Lemeshow formula, and 96 respondents were obtained from each community health center, resulting in a total sample of 192 respondents. Sampling using the accidental sampling technique involves selecting respondents based on chance. This study included mothers with toddlers aged 12-59 months residing in the working area of the health centre (research location) and willing to participate as respondents. Exclusion criteria included toddlers with congenital/chronic diseases, mothers who were not the primary caregivers, and uncooperative respondents.

Data processing and analysis are carried out computerized using data processing software, namely SPSS. Univariate analysis was carried out to see the overview of each variable's frequency and

the respondent's characteristics as additional variables. Using the chi-square test, bivariate analysis is employed to discern the correlation between variables. In a multivariate test, logistic regression analysis will be conducted to determine the determinants. This study obtained ethical approval from the Health Research Ethics Committee of the Faculty of Public Health, Universitas Cenderawasih, with ethical certificate number 097/KEPK-FKM UC/2024.

RESULTS

Based on Table 1, it shows that of the 192 toddlers, the proportion of toddlers who experience diarrhea is less compared to toddlers who do not have diarrhea around 35.90%, the gender of toddlers is known to be the most with the male category, namely 107 respondents (55.70%), non-Papuan tribes as many as 106 respondents (55.20%), for the education of respondents (mothers of toddlers) with the high school category as many as 110 respondents (57.30%), and not working as many as 159 respondents (82.80%).

Table 1

Frequency Distribution of Research Respondent Characteristics

Variable	n (192)	%
Characteristics of Toddlers		
Diarrhea among Toddler		
Yes	69	35.90
No.	123	64.10
Tribe		
Non Papuan	106	55.20
Papuan	86	44.80
Characteristics of Toddler Mothers		
Education		
Primary school	4	2.10
Junior High School	17	8.90
High School	110	57.30
Diploma III/IV	11	5.70
Bachelor/	50	26
Master degree		
Work		
Not Working	159	82.80
Working	33	17.20

Based on Table 2, it is known that among toddlers who were not exclusively breastfed, the proportion with and without diarrhea was the same (50%). In contrast, most toddlers who received exclusive breastfeeding did not suffer from diarrhea

(80.70%). Statistical analysis revealed a significant association between exclusive breastfeeding and diarrhea incidence ($p = 0.00$). For immunization status, 69.30% of fully immunized toddlers did not suffer from diarrhea, compared to 56.4% of toddlers with incomplete immunization. However, this association was not statistically significant ($p=0.09$). Regarding maternal knowledge, 62.20% of mothers with good knowledge had toddlers without diarrhea, while 75% of mothers with poor knowledge also had toddlers without diarrhea, showing no significant association ($p=0.28$). Maternal attitudes showed a significant correlation with diarrhea incidence ($p=0.01$), where 76.90% of mothers with negative attitudes had toddlers without diarrhea, compared to 57.50% among those with positive attitudes. Household drinking water management ($p=0.57$) and food management ($p=0.81$) showed no significant association with diarrhea incidence.

Table 2

Bivariate Analyze

Variable	Diarrhea				p-value
	Yes		No		
	n	%	n	%	
Breastfeeding					
No	52	50	52	50	0.00
Yes	17	19.30	71	80.70	
Immunization					
Not complete	34	43.60	44	56.40	0.09
Complete	35	30.70	79	69.30	
Knowledge					
Bad	7	25	21	75	0.28
Good	62	37.80	102	62.20	
Mother Attitude					
Negative	15	23.10	50	76.90	0.01
Positive	54	42.50	73	57.50	
Drinking-Water Management					
Bad	26	39.40	40	60.60	0.57
Good	43	34.10	83	65.90	
Food Management					
Bad	9	32.10	19	67.90	0.81
Good	60	36.60	104	63.40	

Based on Table 3, the multivariate logistic regression analysis included variables with $p \leq 0.25$ in the bivariate analysis. The final model identified exclusive breastfeeding as the main determinant of diarrhea incidence in toddlers aged 12–59 months ($p=0.00$; $\text{Exp}(B)=4.32$). Maternal attitude also showed a significant effect ($p=0.01$; $\text{Exp}(B)=0.38$).

Table 3

Final Model Results: Determinants of Diarrhea Incidence

No	Variable	p-value	Exp(B)
1	Breastfeeding	0.00	4.32
2	Mother Attitude	0.01	0.38

DISCUSSION

Diarrhea is a disease that often attacks toddlers, especially in developing countries, not only that diarrhea is also a public health problem that until now is caused more by factors, one of which is the environment (12), Such as the consumption of food and drink contaminated with various pathogens or through people-to-people with poor sanitation conditions and also hygiene when processing food (13). This study found that toddlers who experienced diarrhea were around 35.90%, with an average age of 12 months. Similar things were found from a study conducted in Africa, where the average child affected by diarrhea was about 2,879 years old (14).

Breast milk has a complex carbohydrate content that acts as a prebiotic that promotes the growth of beneficial intestinal bacteria, which act to prevent pathogenic bacteria from attaching to the intestinal mucosa and strengthen the intestinal barrier by increasing the production of short-chain fatty acids, so that exclusive breastfeeding up to six months of age can prevent diarrhea in toddlers. The findings of this study stated that exclusive breastfeeding provided a relationship with the incidence of diarrhea in toddlers. Several previous studies are also relevant, including infants who do not consistently receive exclusive breast milk from their mothers are about 3.30 times more likely to have diarrhea compared to children who are consistently given exclusive breast milk by their mothers (15).

Bioactive factors in breast milk provide immunity for children's health, such as preventing the occurrence of diarrhea in children (16). Studies conducted in Indonesia also stated that exclusive breastfeeding can prevent the risk of diarrhea in toddlers (17). Exclusive breastfeeding consistently is the right step to improve the child's immune system, as we know that breast milk has various benefits besides immunity. Breastfeeding can also increase the bond between mother and child; for that, mothers must have knowledge and understanding regarding the benefits of breastfeeding toddlers. The results of this study found that about 25% of children from mothers who had less knowledge experienced diarrhea. Toddlers

between the ages of 7 and 24 months enter a critical developmental stage. At this age, they will experience a transition from exclusive breastfeeding to complementary foods (MP-ASI), which increases their exposure to pathogens due to the introduction of solid foods and reduced maternal antibodies (18).

Because the vaccination contains a weakened virus that is injected into the body to strengthen the immune system, it can reduce the risk of diarrhea in infants (19). This study elucidates a distinct phenomenon where no correlation was discovered between the completeness of fundamental immunisation and the incidence of diarrhea in infants. Numerous preceding studies have consistently affirmed the absence of an association between the administration of comprehensive basic immunisation and the incidence of diarrhea (20). Research in Indonesia has also consistently found that immunization is also related to the incidence of diarrhea in toddlers (21). This can happen because the number of samples in this study has not been able to eradicate the relationship between the two, besides that there are several vaccines given to toddlers that cannot prevent diarrhea in toddlers, where diarrhea itself is more due to factors, one of which is the environment (12), Such as the consumption of food and drink contaminated with various pathogens or through people to people with poor sanitation conditions and also hygiene when processing food (13).

Mothers with good knowledge of managing and preventing diarrhea will cause a very low rate of diarrhea in toddlers (22). This is in line with the results of this study, which did not find a relationship between maternal knowledge and the incidence of diarrhea in toddlers. Another consistent study found that 40.8% of mothers under five in Nigeria had poor knowledge about diarrhea (23). Likewise, a study in Al Hamza City found that most (45.60%) mothers had poor knowledge about the prevention and management of diarrhea in toddlers (24). P Knowledge of the critical signs of diarrhea is very important for mothers to have to identify the harmful impact of diarrhea on children if not immediately addressed, for that the importance of mothers' knowledge about the signs of diarrhea in children, from this study we found that about 25% of mothers under five have less knowledge about diarrhea that causes their children to experience diarrhea.

Mothers who have a positive attitude towards preventing and managing diarrhea in toddlers will usually be more responsive if their children experience diarrhea symptoms (25). This study

elucidates a correlation between maternal attitudes and the incidence of diarrhea in toddlers. A study conducted in Nigeria revealed that a significant portion of mothers, 44.2%, held negative attitudes towards the occurrence of diarrhea in their children (23). In line with the research results, Thobari et al (26) found that the mother's attitude has a relationship with the incidence of diarrhea in toddlers. Mothers with a positive attitude about preventing and handling diarrhea will be more agile in taking preventive measures so that their babies do not get diarrhea. This can be seen from a study that shows that around 57.50% of mothers with a positive attitude do not have babies affected by diarrhea. Mothers' attitudes are indeed correlated with knowledge, where the better the mothers' knowledge is, the more positive the mothers' attitudes will be. It is important to foster a positive attitude towards hygiene and health practices to reduce diarrhea in toddlers.

Unsafe access to clean water, poor basic sanitation, and poor hygiene contribute to the transmission of diarrhea (12,13). This study does not describe the relationship between household drinking water treatment and the incidence of diarrhea in toddlers. Previous research has also consistently stated the same thing, including: The study in Jahrom also found the same thing (27). Studies in Indonesia also stated that there was no link between household drinking water treatment and the incidence of diarrhea (21). Drinking water treatment is a factor in preventing diarrhea in toddlers (25). Diarrhea can occur if pathogens contaminate the drinking water used by households and are not cooked correctly. The results of this study show that most (65.90%) households have treated drinking water properly, so no occurrence of diarrhea in toddlers is found.

Improper handling and storage of food significantly affects foodborne diseases (28). However, this is slightly different from the results of this study, which did not find a link between household food processing and the incidence of diarrhea in toddlers. This is consistent with the results of several previous studies, including: food and beverage processing in households has no relationship with the incidence of diarrhea (29). A meta-analysis of a study conducted by Firmansyah et al (30) also did not find a link between food processing and the incidence of diarrhea in toddlers. Food processing is usually related to the mother's knowledge and attitude regarding preventing diarrhea in toddlers, which can be seen from how mothers process food and drinks so that the food and drinks are feasible and safe for their family to

consume. Therefore, food hygiene practices are essential in reducing the prevalence of diarrhea in toddlers. From the results of this study, around nine mothers who do poor food processing with children who have diarrhea, this certainly cannot be replicated, considering that the number of people affected by diarrhea is minimal.

Research Limitations

This study has several limitations that should be considered when interpreting its findings. The cross-sectional design restricts the ability to infer causal relationships, capturing only associations at a single point in time. The study's scope was limited to two public health centers in Jayapura City, which may affect the generalizability of the results due to differences in regional and service access. The three-month data collection period may not fully account for seasonal variations that could influence diarrhea incidence. Additionally, the sampling method may introduce representational bias, and the reliance on self-reported data from mothers increases the potential for recall bias or inaccuracies in the information provided.

CONCLUSION

The authors found that exclusively breastfeeding toddlers can prevent the occurrence of diarrhea and is the right step in improving the immune system in toddlers. Breastfeeding needs to be carried out continuously until six months to provide more immunity to toddlers. Researchers also found that good maternal knowledge and positive maternal attitudes can reduce the incidence of diarrhea in toddlers. The researcher hopes that the results of this study can be used as reference material by health workers to educate mothers to cultivate a good attitude and provide exclusive breastfeeding to their toddlers consistently.

CONFLICT OF INTEREST

There is no conflict of interest in this research.

AUTHOR CONTRIBUTIONS

All authors actively contributed to this study. MI researchers are responsible for compiling backgrounds, collecting references, writing designs, developing research concepts, conducting data analysis, and compiling research results. AI researchers and authors help collect research data, provide research consultation and revision, and manage research data. MSF authors contribute to

compiling discussions, sourcing articles that align with discussions, and looking for journals that align with research. IL writers play a role in editing, reviewing, and adjusting the destination journal template.

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