

ANALYSIS OF THE NUMBER OF BACTERIA IN BABY BOTTLES AND THE INCIDENCE OF DIARRHEA IN TODDLERS

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ABSTRAK ANALISIS JUMLAH BAKTERI DALAM BOTOL BAYI DAN KEJADIAN DIARE PADA BALITA

Latar Belakang Diare merupakan salah satu penyebab morbiditas dan mortalitas pada balita di seluruh dunia. *Data World Health Organization* (2023) kejadian diare mencapai 10% dari seluruh kematian anak dibawah lima tahun. Kasus diare Indonesia 2022 prevalensi mencapai 10,2% (Kemenkes RI, 2023). Menurut Survey Kesehatan Indonesia (2023) prevalensi diare pada bayi ≤ 1 tahun 6,4% dan pada Balita 1-4 tahun mencapai 7,4% pada kelompok usia 12-59 bulan terdapat 5,8% kasus. Kota Cirebon mendapatkan 8.563 kasus diare dan 30.706 kasus diare di Kabupaten Cirebon (2021). Tingginya angka ini menjadikan diare sebagai salah satu penyebab kematian balita setelah pneumonia. Salah satu penyebab utama penularan agen penyebab diare adalah melalui kontaminasi botol susu yang dapat menyebabkan infeksi gastrointestinal.

Tujuan Penelitian menganalisis hubungan bakteri pada botol susu dengan kejadian diare pada balita. Metode penelitian ini merupakan Penelitian ini merupakan penelitian kuantitatif observasional analitik dengan pendekatan cross sectional. Tahapan penelitian ini dilakukan mulai dari uji laboratorium swab botol susu, dan pengumpulan data kejadian diare pada balita dalam 2 bulan terakhir. Populasi adalah seluruh Ibu Balita (8-24 bulan) Sampel menggunakan *Acidental Sampling* dengan pengambilan sampel dibatasi pada sampel minimal korelasi sebanyak 30 ibu balita. Teknik analisis data yang digunakan adalah analisis univariat dan bivariate dengan bantuan SPSS.

Hasil penelitian menunjukkan jumlah bakteri dengan kejadian diare diperoleh p-value = 0,200 ($\geq 0,05$). Kesimpulan tidak terdapat hubungan antara jumlah bakteri botol susu dengan kejadian diare. Saran menjaga kebersihan botol susu dengan mencuci dan mensterilkan secara benar serta tetap memberikan ASI eksklusif untuk meningkatkan daya tahan tubuh anak.

Kata kunci: Bakteri, Balita, Bayi, Botol Susu, Diare

ABSTRACT

Background Diarrhea is one of the causes of morbidity and mortality in toddlers worldwide. Data from the World Health Organization (2023) shows that diarrhea accounts for 10% of all deaths in children under five years of age. The prevalence of diarrhea cases in Indonesia in 2022 reached 10.2% (Ministry of Health of the Republic of Indonesia, 2023). According to the Indonesian Health Survey (2023), the prevalence of diarrhea in infants ≤ 1 year was 6.4% and in toddlers 1-4 years old reached 7.4%, with 5.8% of cases in the 12-59 month age group. Cirebon City experienced 8,563 cases of diarrhea and Cirebon Regency 30,706 cases (2021). These high numbers make diarrhea one of the leading causes of infant mortality after pneumonia. One of the main causes of transmission of diarrhea-causing agents is through contaminated milk bottles, which can cause gastrointestinal infections.

The purpose of this study was to analyze the relationship between bacteria in baby bottles and diarrhea in toddlers. This study used a quantitative, observational, and analytical cross-sectional approach. The research phase began with laboratory testing of baby bottle swabs and data collection on diarrhea in toddlers over the past two months. The population was all mothers of toddlers (8-24 months). The sample used acid-identical sampling, with a minimum sample size of 30 mothers. Univariate and bivariate analyses were used using SPSS.

The results showed that the number of bacteria in baby bottles correlated with diarrhea, with a p-value of 0.200 (≥ 0.05). Conclusion: There is no relationship between the number of bacteria in baby bottles and diarrhea. Suggestions include maintaining bottle hygiene by washing and sterilizing them properly, and continuing to provide exclusive breastfeeding to boost children's immune systems.

Keywords: Bacteria, Toddler, Baby, Milk Bottle, Diarrhea

INTRODUCTION

Diarrhea is a leading cause of morbidity and mortality in infants and toddlers worldwide. According to the World Health Organization (WHO, 2023), diarrhea accounts for 10% of all deaths in children under five years of age. According to the 2022 Indonesian Health Profile, diarrhea cases in Indonesia remain very high, with a prevalence of 10.2% (Ministry of Health, 2023). According to the 2023 Indonesian Health Survey (SKI), the prevalence of diarrhea in infants under 1 year of age reached 6.4%, and in toddlers aged 1-4 years reached 7.4%. In 2021, Cirebon City reported 8,563 cases of diarrhea, and Cirebon Regency reported 30,706 cases (West Java Provincial Health Office, 2021). These high rates make diarrhea one of the leading causes of child visits and death after pneumonia. One of the main causes of diarrhea-causing agents is contaminated eating and drinking utensils, including baby bottles. A national survey in Indonesia found that 37.9% of children aged 0-23 months use baby bottles, and over 50% do not undergo adequate washing. Suboptimal washing techniques create a breeding ground for pathogenic bacteria, including *Escherichia coli* and *Salmonella*, which can then be swallowed, causing gastrointestinal infections.

The use of baby bottles in toddlers has become an important topic for research in relation to diarrhea. Microbiological studies have shown that residual bacteria in breast milk can reach 103-105 CFU/mL, a level that can cause gastrointestinal infections. This bacterial count stems from the residual milk in the bottle, which promotes rapid bacterial growth. Diarrhea prevention can be achieved through efforts to control bottle hygiene using an educational approach. A preventive approach within midwifery services is a strategic step, particularly in mother-to-toddler classes, which can be held at Independent Midwife Practices (TPMB), Integrated Health Posts (Posyandu), or Community Health Centers (Puskesmas). Based on this background, the researcher is interested in conducting a study entitled "Analysis of the Number of Bacteria in Milk Bottles with the Incidence of Diarrhea in Toddlers at the Arsy Medika Clinic, Cirebon Regency in 2025." This study aims to determine the relationship between the number of bacteria in milk bottles and the incidence of diarrhea

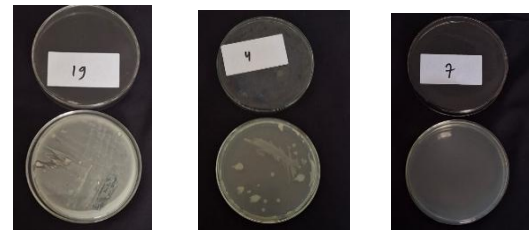
in toddlers, so that the results are expected to be the basis for efforts to prevent diarrhea by improving maternal hygiene behavior in preparing milk bottles.

RESEARCH METHODS

This study was a quantitative, observational, and analytical study with a cross-sectional approach. The research phase began with laboratory testing of baby bottle swabs and data collection on diarrhea incidence in toddlers over the past two months. The population was all mothers of toddlers (8-24 months). The sample used accidental sampling, with a minimum sample size of 30 mothers.



Image tools and process of bacterial analysis



Many Medium Few
Image of bacterial classification

RESEARCH RESULTS

Univariate

Based on the analysis results, it was found that the majority of respondents were aged between 20-35 years, as many as 21 people (70%). From the educational background, the majority of respondents had a junior high school education background, as many as 15 people (50%). Most respondents had incomes <UMR, as many as 28 people (93.3%). Meanwhile, most respondents had children <3, as many as 23 people (76.7%). Most respondents provided exclusive breastfeeding, as many as 16 people (53.3%). Most milk bottles had a lot of bacteria, as many as 20 bottles (66.7%). Most children did not experience diarrhea, as many as 16 people (53.3%).

Table 1
Frequency Distribution of Respondent Characteristics

Respondent Characteristics	Frequency	Percentage (%)
Maternal Age		
< 20 Years	21	70
> 20 Years >35 Years	9	30
Education		
Elementary School	1	3,3
Middle School	15	50
High School	11	36,7
University	3	10
Income		
To the top	0	0
Intermediate	2	6,7
< Minimum wage	28	93,3
Number of children		
< 3	23	76,7
> 3	7	23,3
Exclusive Breastfeeding		
Yes	16	53,3
No	14	46,7
Bacteria Count		
None	3	10
Moderate	7	23,3
Many	20	46,7
Diarrhea Occurrence		
No	16	53,3
Yes	14	46,7

Bivariate

Table 2
Relationship Between Bacterial Count and Diarrheal Incidence

Bacteria Count	Diarrhea Occurrence						<i>p-value</i>
	No		Ya		Total		
	F	%	F	%	F	%	
None	3	10%	0	0%	3	10%	0,200
Moderate	4	13,3%	3	10%	7	23,3%	
Many	9	30%	11	36.7%	20	66.7%	

The research results showed that most respondents owned milk bottles with high bacterial counts and 11 (36.7%) experienced diarrhea. The chi-square test showed a significance value of 0.200 ($p\text{-value} > 0.05$), indicating no significant relationship between bacterial count and diarrhea.

DISCUSSION

Diarrhea is a leading cause of morbidity and mortality in infants in Indonesia. This disease is usually characterized by the passage of more than three loose, watery stools in 24 hours and can lead to severe dehydration if not treated promptly. One

important risk factor for diarrhea is poor hygiene of food and feeding utensils for infants and toddlers, including baby bottles. Bottles that are not properly cleaned or sterilized can become a breeding ground for bacteria pathogens such as *Escherichia coli*, *Salmonella sp.*, and *Shigella sp.* These bacterial contaminations can move to the child's digestive tract and cause infection. Therefore, this study aims to analyze the relationship between the number of bacteria in milk bottles and the incidence of diarrhea in toddlers at the Arsy Medika Clinic, Cirebon Regency in 2025.

The results showed no

significant association between the number of bacteria in milk bottles and the incidence of diarrhea in toddlers at the Arsy Medika Clinic in Cirebon Regency in 2025 ($p = 0.200$). Although most milk bottles contained a high bacterial count (66.7%), only 14 toddlers (46.7%) experienced diarrhea. This indicates that bacterial contamination in milk bottles is not the sole factor causing diarrhea in toddlers.

Based on the results of the univariate analysis, the majority of respondents were mothers aged <20 years (70%), had a junior high school education (50%), had an income below the minimum wage (93.3%), and most had fewer than three children (76.7%).

These characteristics can influence hygiene behavior and how babies' bottles are handled. The Indonesian Ministry of Health (2022) explains that a mother's age and education are important factors influencing knowledge and behavior regarding maintaining the cleanliness of children's food and eating utensils. Young mothers with lower secondary education tend to have limited knowledge of proper hygiene practices, potentially increasing the risk of contamination. However, in this study, some mothers already practiced relatively good hygiene practices, which likely acted as a protective factor, preventing all toddlers from experiencing diarrhea despite the presence of bacteria on baby bottles.

The results of this study align with the findings of Ningsih and Rahmawati (2020) at the Jetis Community Health Center, which showed no correlation between the number of bacterial colonies in milk bottles and the incidence of diarrhea in toddlers ($p > 0.05$). This study explains that the presence of bacteria in milk bottles does not always cause disease because a child's strong immune system can prevent infection. Furthermore, the majority of toddlers in this study received exclusive breastfeeding (53.3%), which is known to provide natural protection against gastrointestinal infections. This is in accordance with the WHO (2020) opinion that breast milk contains antibodies and immunological factors that play a role in protecting infants from diarrhea and other gastrointestinal infections.

Furthermore, the results of this study are also supported by Sari et al. (2022) who examined the relationship between bottle hygiene and diarrhea incidence in the Panjunan Community Health Center, Cirebon City. The results showed no significant relationship between bottle hygiene and diarrhea incidence ($p = 0.142$), but environmental hygiene and water sanitation played a greater role in the occurrence of diarrhea. These findings

confirm that diarrhea is not only caused by contamination from bottles, but also by environmental conditions that support the growth and spread of pathogenic microorganisms.

This is different from the research results of Lestari (2021) in the Jebres Community Health Center work area, Surakarta, which found a significant relationship between the cleanliness of baby eating utensils and the incidence of diarrhea ($p < 0.05$).

They explained that poor bottle hygiene and inappropriate washing methods increased the risk of *Escherichia coli* and *Salmonella* sp. contamination, which can trigger diarrhea. These differences in results could be due to variations in environmental sanitation conditions, sterilization methods, and differences in respondents' knowledge levels across the study areas. The lack of a significant relationship in this study could also be due to the quantitative bacterial count measurement method, which did not identify the type of bacteria that causes diarrhea.

According to WHO (2017), not all bacteria found on eating utensils are pathogenic; only certain bacteria, such as enteropathogenic *E. coli*, *Shigella* sp., and *Vibrio cholerae*, have been shown to cause diarrhea. Therefore, further testing to identify specific bacterial types is needed to more accurately determine the relationship between bottle contamination and diarrhea.

Furthermore, the majority of respondents had incomes below the minimum wage (93.3%), indicating limited access to clean water and sanitation facilities. Fitriani and Handayani (2021) stated that low family income can impact the ability to maintain household hygiene, including clean water use and storage of children's eating utensils. However, the lack of a significant relationship in this study may be because most mothers had already implemented basic hygiene practices such as boiling water, sterilizing bottles, and maintaining hand hygiene, which help reduce the risk of diarrhea even in limited economic conditions.

Another supporting finding is research by Putri and Anisa (2023), which examined the relationship between bottle hygiene and diarrhea incidence at the Cilimus Community Health Center in Kuningan Regency. The results showed no significant association ($p = 0.318$), but found that mothers who regularly sterilized bottles had a lower risk of diarrhea. This research confirms that maternal hygiene behavior is a crucial factor in preventing diarrhea in children.

Furthermore, Amalia's (2022) research in

Sleman Regency also found similar results, namely no association between the number of bacteria on eating utensils and the incidence of diarrhea ($p = 0.227$). They explained that the number of bacteria found was not always pathogenic, as some were normal flora that did not cause digestive problems. This aligns with the WHO (2017) theory that only certain types of bacteria, such as enteropathogenic *E. coli*, *Shigella* sp., and *Vibrio cholerae*, can directly cause diarrhea.

Research by Hidayah and Mulyani (2021) also supports these findings. They found that mothers' handwashing behavior before preparing milk had a greater influence on diarrheal disease incidence than the cleanliness of the milk bottles themselves. This suggests that overall hygiene behavior plays a crucial role in preventing diarrheal disease, not just the cleanliness of a single type of eating utensil.

Overall, the results of this study indicate that preventing diarrhea in toddlers should not only focus on bottle hygiene, but also consider factors such as maternal hygiene behavior, environmental sanitation, water quality, and exclusive breastfeeding. Health education on how to wash bottles with hot water, use sterilizers, and avoid storing milk for too long should be continuously provided to mothers of toddlers. This aligns with the recommendations of the Indonesian Ministry of Health (2022) and the WHO (2020) that implementing Clean and Healthy Living Behaviors (PHBS) in households is key to reducing the incidence of diarrhea in toddlers.

Thus, although the results of this study did not show a statistically significant association, they are still important for diarrheal disease prevention efforts. These results can also serve as a basis for further research to expand the sample size, use more specific bacterial identification methods, and control for confounding factors such as water hygiene, maternal behavior, and toddler nutritional status to more accurately determine the relationship between variables.

CONCLUSION

There was no relationship between the number of bacteria in baby bottles and the incidence of diarrhea in toddlers at the Arsy Medika Clinic in Cirebon Regency in 2025.

SUGGESTIONS

Mothers of toddlers are advised to maintain the cleanliness of baby bottles by washing and sterilizing them properly and to continue providing exclusive breastfeeding to boost their immune

systems. Health workers need to strengthen education on clean and healthy living behaviors (PHBS) in the community, while further research is recommended to examine specific types of bacteria and other environmental factors that have the potential to influence the incidence of diarrhea.

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