



A Case Control Study on the Determinants of Behavior towards Diarrhea in Children under Five Years Old

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Authors' contributions

This work was carried out in collaboration among all authors. Author SA was the conceptualizer of the research and writing of the manuscript. Author Maisarah collected the data and wrote the initial draft of the manuscript. Authors SA, DV and JMI managed the data analysis and corrected the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Aims: The aim of this study was to determine the relationship between knowledge of diarrhea, hand washing behavior, toilet use behavior and the incidence of diarrhea in children under five years old.

Study Design: A case control study.

Place and Duration of Study: The study was conducted in October 2022 at area of the Johan Pahlawan Community Health Center, Aceh Barat District, Aceh Province-Indonesia.

Methodology: The sample size was 92, with 46 cases and 46 controls. The subjects of the case and control groups are mothers with children under five years old. SPSS version 20 was utilized to

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conduct statistical analysis on both univariate and bivariate data, with the chi-square test being employed to address the hypothesis.

Results: The results showed that both the case and control groups had more children aged ≤ 2 years. Mothers in the case group were found to have a higher proportion with poor knowledge level (66.2%), poor hand washing behavior (54.3%), and poor toilet use behavior (67.4%) compared to the mothers in the control group. Statistical tests proved that there was a significant relationship between maternal knowledge ($p=0.022$), hand washing behavior ($p=0.020$), and toilet use behavior ($p=0.001$) with the incidence of diarrhea in children under five years old.

Conclusion: Efforts are needed to improve the knowledge and skills of mothers in preventing and managing diarrhea through education by health professionals.

Keywords: Children; diarrhea; handwashing; knowledge; latrine use.

1. INTRODUCTION

A One of the significant health problems affecting children is diarrhea, which can even lead to death in children under five years old [1,2]. Every year, there are 1.7 billion cases of diarrhea worldwide, and WHO reported that 525,000 children under five years old died due to diarrhea in 2018 [3]. Meantime, the mortality rate of children in developing countries is almost ten times higher than in developed countries. Therefore, this disease is considered the second leading cause of death worldwide in the under-five child population [4]. In Indonesia, according to the Basic Health Research (Riskesmas) in 2018, the prevalence of diarrhea was reported to be 6.8%, with the highest incidence of diarrhea occurring in the 1-4 year age group (11.5%) [5].

Meantime, in Aceh in 2021, it was estimated that only 16% (17,063 children under five years old) of the targeted 22% coverage of health services for children under five with diarrhea was achieved [6]. According to the Aceh Health Office, the factors contributing to the occurrence of diarrhea include an unhealthy lifestyle, indiscriminate waste disposal, consuming unboiled water, and not washing hands before meals. Aceh Barat, as one of the districts in Aceh, has achieved a coverage of 24% for diarrhea treatment in children under five years old. The Johan Pahlawan Community Health Service (Puskesmas), which is one of the primary healthcare facilities in Aceh Barat District, had 112 cases of diarrhea utilizing its services, of which 36.6% (41 cases) occurred in the age group under five years old [7].

Diarrhea in children significantly affects their growth and development. This is due to repeated dehydration and disruption of nutrient absorption, despite the fact that nutrients are essential for their growth and development [2]. There are

many factors that contribute to the incidence of diarrhea, including knowledge [8], community behaviors such as hand washing and toilet use [9-11]. Therefore, this study aims to determine the relationship between maternal knowledge, toilet use behavior, hand washing behavior, and diarrhea incidence in children under five years old.

2. LITERATURE REVIEW

Diarrhea can be acute and chronic or infectious and non-infectious [12]. The difference between the two types of diarrhea is usually associated with the duration of the diarrhea episodes. Acute diarrhea is characterized by its sudden onset, with a frequency of three or more bowel movements per day, loose or watery stools, and lasting for 14 days or less. On the other hand, chronic or persistent diarrhea is diarrhea that lasts for more than 14 days. Furthermore, according to WHO [1], there are three clinical types of diarrhea: acute watery diarrhea, acute bloody diarrhea, and persistent diarrhea. Acute watery diarrhea refers to diarrhea that lasts for a few hours or a few days, and this includes cholera. Acute bloody diarrhea is another term for dysentery, while persistent diarrhea is a type of diarrhea that lasts for 14 days or more.

People who experience diarrhea suffer from reduced water absorption by the intestines or increased water production in the body. Both of these conditions can potentially lead to dehydration in individuals, and dehydration is considered the most serious threat to people with diarrhea. There are three levels of dehydration in individuals with diarrhea, including severe dehydration, mild dehydration, and no dehydration [1]. If there are at least two of the following signs, it is considered severe dehydration: 1) lethargy/unconsciousness, 2) inability to drink or drinking poorly, 3) sunken

eyes, and 4) skin pinch goes back very slowly (≥ 2 seconds). Mild dehydration in diarrhea occurs when there are two or more of the following signs: 1) sunken eyes, 2) irritability or easy anger, and 3) drinks eagerly, thirsty. Furthermore, if there are not enough signs to categorize someone as having mild or severe dehydration, it falls under the category of no dehydration.

The easiest and most cost-effective effort to be taken regarding diarrhea, especially in children, is preventing diarrhea. There are several actions that can be undertaken, including: 1) providing and giving safe drinking water; 2) practicing exclusive breastfeeding from birth to 6 months; 3) improving sanitation; 4) maintaining personal hygiene; 5) ensuring cleanliness of consumed food; 6) washing hands with soap, and 6) healthcare providers can educate mothers or the community about diarrhea and the spread of infections from diarrhea.

In addition to preventive measures, there are several actions that can be taken by families or individuals when diarrhea occurs:

1. Administering oral rehydration solution (ORS), which is a mixture of sugar and salt dissolved in clean drinking water. The purpose of giving ORS is to replace the body fluids and electrolytes lost due to diarrhea through stools.
2. Providing nutrient-rich foods, including continuing to breastfeed or exclusively breastfeeding during episodes of diarrhea.
3. If the condition does not improve or is deemed necessary, the next step is to consult with a healthcare professional. This is especially important in cases of persistent diarrhea or the presence of blood in the stool, or when signs of dehydration are present.

3. METHODOLOGY

3.1 Study Design and Population

This study is an observational case-control design. Mothers who have children under five years old in the working area of the Johan Pahlawan Community Health Center in Aceh Barat District, Aceh Province-Indonesia, are considered as the study population. The sample size is determined based on mothers who have children under five years old and experience diarrhea (as the case group), which is 46 cases.

Furthermore, the control group consists of mothers who have children under five years old and do not experience diarrhea, with the same sample size as the case group (46 mothers). Overall, the total sample size is 92. The case group was selected using a total sampling technique, while the control group was selected randomly.

3.2 Measurement

The independent variables are maternal knowledge, hand washing behavior, and toilet usage behavior, while the dependent variable is diarrhea in children under five years old. The survey was conducted to collect data or assess research variables in October 2022, using a questionnaire as an instrument. Each variable (knowledge about diarrhea, handwashing behavior, and toilet usage behavior) has several questions that need to be answered by the subjects (mothers).

In general, respondents were categorized into two groups based on their level of knowledge, hand washing behavior, and toilet use behavior, both in the case and control groups. The knowledge category was divided into high and low, while the hand washing and toilet use behavior categories were classified as good and poor. Subject grouping into specific categories (high/low or good/poor) referred to the total score obtained for a specific variable compared to the average total score of all subjects for that variable. If the total score of a subject on a particular variable is equal to or below (\leq) the average score, the subject is classified as low or poor. otherwise, if the total score is above the average score, the subject is classified as high or good. To address the research hypothesis, statistical analysis was conducted using the chi-square test with SPSS version 20.

4. RESULTS

Based on the analysis of characteristics (Table 1) according to the case and control groups, it was found that in both groups, there were more children under two years old (63% in the case group and 54% in the control group). In terms of gender, there were more females in the case group (54.3%), while the control group had more males (52.2%). Furthermore, when examining the characteristics of mothers, it was found that more mothers did not work in both the case group (67.3%) and the control group (65.2%). In terms of income, more mothers reported an

income below three million rupiahs, both in the case group (76.1%) and the control group (60.9%). Meanwhile, based on the findings of the level of education, the proportion in the case group was the same between mothers with low and high education, while in the control group, there were more mothers with low education (elementary and junior high school) (65.2%).

Table 2 shows that the proportion of mothers with poor knowledge was higher in the case group, totaling 66.2% (30 respondents) compared to the proportion in the control group of 39% (18 respondents). Based on the hand washing behavior variable, it was found that the proportion of mothers with poor hand washing behavior was higher in the case group, with 54.3% (25 respondents) compared to the control group of 28.3% (13 respondents), with a ratio of

2:1. Furthermore, the proportion of respondents with poor toilet use behavior was higher in the case group, with 67.4% (31 respondents) compared to the control group of 30.4% (14 respondents), with a ratio of 2:1.

The test results (Table 3) revealed a p-value of 0.022 ($p < 0.05$), indicating a significant association between mothers' knowledge and diarrheal disease in children under five years old. Meanwhile, the OR value of 2.917 means that mothers with poor knowledge of diarrhea have a 2.9 times higher risk of their children experiencing diarrhea compared to mothers with good knowledge. Referring to the statistical test results, a p-value of 0.020 was obtained, indicating a significant association between hand washing behavior and the occurrence of diarrhea

Table 1. Distribution of maternal and children under five years old characteristics

Variables	Case		Control	
	F	%	f	%
Child's age				
<2 years old	29	63.0	25	54.3
< 3 years old	6	13.0	12	26.1
4- 5 years old	11	23.9	9	19.6
Sex				
Boy children	21	45.7	24	52.2
Girl children	25	54.3	22	47.8
Mother's status of employment				
Unemployed	15	32.6	16	34.8
Employed	31	67.4	30	65.2
Family income				
High (\geq IDR 3,000,000)	11	26.9	18	39.1
Low ($<$ IDR 3,000,000)	35	76.1	28	60.1
Education				
High	23	50.0	16	34.8
Low	23	50.0	30	65.2

Table 2. Results of cross-tabulation of determinants of behavior and the incidence of diarrhea in children under five years old

Behavior		Diarrhea					
		Case		Control		Total	
		N	%	n	%	n	%
Knowledge							
	Low	30	66.2	18	39.1	48	52.2
	High	16	34.4	28	60.9	44	47.8
Hand washing behavior							
	Bad	25	54.3	13	28.3	38	41.3
	Good	21	45.7	33	71.1	54	58.7
Toilet use							
	Bad	31	67.4	14	30.4	45	48.9
	Good	15	32.6	32	69.6	47	51.1

Table 3. The result of the chi-square test for determinants of behavior and the Incidence of Diarrhea in children under five years old

Variables	p-value	OR	95%CI	
			Lower	Upper
Knowledge	0.022*	2.917	1.249	6.809
Handwashing Behavior	0.020	3.022	1.272	7.178
Toilet Use	0.001*	4.724	1.959	11.389

Abbreviations: OR= odd ratio, * = significant p-value

in children under five years old. The OR value was 3.022, meaning that poor hand washing behavior has a 3.1 times higher risk of causing diarrhea in children compared to good hand washing behavior. Lastly, regarding toilet use behavior and diarrhea, the chi-square test result showed a p-value of 0.001 ($p < 0.05$). These results indicate a significant association between toilet use behavior and diarrheal disease in children under five years old. Additionally, a value of OR of 4.724 was found, meaning that poor toilet use behavior has a 4.7 times higher risk of causing diarrhea in children compared to good toilet use behavior.

5. DISCUSSION

5.1 Mother's Knowledge and Diarrhea in Children under Five Years Old

The study results have shown that maternal knowledge is significantly associated with diarrhea incidence in children under five years old. The case group showed a greater number and proportion of mothers with low knowledge levels about diarrhea compared to the control group. This is likely to occur because knowledge levels will affect a mother's attitudes and actions. Inadequate maternal knowledge about prevention methods causes a child to experience diarrhea that could have been prevented [13].

This study's results are consistent with the statement by Wahab and Faris that knowledge of hygiene is a prominent risk factor for diarrhea incidence, particularly in developing countries [14]. Previous research that supports this finding is a study conducted by Hartati and Nuraliza in the working area of the Rejosari Pekanbaru Health Center, Indonesia [15]. Studies in other countries, such as Nigeria, have proven a link between infant diarrhea and a mother's low knowledge of the causes and prevention of diarrhea [16], as well as the research conducted by Lwin and Putra in Myanmar [17].

Diarrhea that occurs more than three times in 24 hours can cause fluid loss or dehydration [2]. In

this condition, mothers with good knowledge can take initial treatment independently, such as giving oral fluids. Besides, they know when to seek professional or health services for further treatment. On the other hand, diarrhea can cause death in children under five years old if their mothers do not have good knowledge. Mumtaz suggested that the death of a child is not caused by diarrhea, but by a mother's poor knowledge and treatment that results in severe dehydration in a child and ultimately leads to death [18]. Knowledge is influenced by several factors, including education, mass media/information sources, social culture and economy, environment, experience, and age [19].

5.2 Hand Washing Behavior and Diarrhea in Children under Five Years Old

Although hand washing is considered a very simple effort to improve health, many people still underestimate this activity. When contaminated hands are not washed before handling and consuming food, pathogens along with the food will enter the body. Therefore, it is highly recommended to wash hands with soap, especially before handling food, after using the toilet, and after cleaning a child's bottom [20]. It is estimated that cholera and dysentery can be reduced by 48% to 59% by washing hands with soap at the aforementioned times [21].

The results of statistical tests on the relationship between maternal hand washing behavior and diarrhea in children have been proven to be significant. It is known that in the case group, there were more mothers with poor hand washing behavior, whereas in the control group, there were fewer mothers with poor hand washing behavior. Previous studies, such as the one conducted by Radhika, also showed similar results to this study [22]. She found a correlation between hand washing with soap and the incidence of diarrhea in children under five years old. A study in Ethiopia also found poor practices among mothers in preventing and treating

diarrhea in young children at home [4]. This study found that 54.3% of mothers in the case group had poor hand washing behavior. Previous research has proven that washing hands with soap is the best way to remove dirt containing pathogenic bacteria compared to just using water [20,23]. In Tanzania, a decrease in diarrhea was found in children who washed their hands before meals [24].

5.3 Toilet Use Behavior and Diarrhea in Children under Five Years Old

Toilets are an essential component that must be present in every household, as they are related to the method of disposing of feces. In developing countries such as Indonesia, the ownership and utilization of toilets remain a major issue that is often encountered. In relation to toilet ownership, the Indonesian Ministry of Health has established a healthy toilet standard, which should not contaminate drinking water sources, the septic tank should be 10-15 meters away from the water source, there should be no foul odor, and the feces should not be accessible to insects and rats. Furthermore, the toilet should be easy to clean, safe and comfortable to use, have a waterproof floor, and be equipped with water and soap [25]. Well-maintained and standard-compliant toilets are more effective in preventing diarrheal diseases in children [26].

Our findings show that in the case group, more individuals exhibit poor toilet use behavior compared to the control group. The significant role of toilet use behavior in the occurrence of diarrhea in children under five years old has been proven, with the risk of diarrhea up to 4 times higher in the group with poor toilet use behavior. This result is supported by previous findings from Melviana et al. [27]. The continued use of rivers as the final disposal site (toilets) and as a means for bathing and washing also contributes to the occurrence of diarrhea in children under five years old [28]. The use of rivers as toilets may be related to the lack of toilets in homes or residential areas, as found by Sidabalok and his colleagues [11].

6. CONCLUSION

The research findings can be concluded that maternal knowledge about diarrhea, toilet use behavior, and hand washing behavior have a significant contribution to diarrhea incidence in children under five years old. In the case group, there were more mothers with low knowledge, inadequate hand washing behavior, and poor

toilet use behavior. Therefore, the Community Health Center (Puskesmas) as the forefront needs to improve the knowledge and skills of mothers who have children under five years old about diarrhea, prevention, and treatment. Further research can involve a larger sample size with wider geographical coverage. In addition, a further study with a different design approach can also be considered.

CONSENT

Before collecting data from the respondents, the researchers explained the purpose and details of the study to them. The respondents were given the freedom to choose whether or not to participate in the research. If they agreed to participate after receiving the explanation, the researchers proceeded to conduct the interviews.

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. World Health Organization. Diarrhoeal disease [Internet]. 2017 [August 21, 2022]. Available: <https://www.who.int/en/news-room/fact-sheets/detail/diarrhoeal-disease>
2. Ambarawati R, Ratnasari NY, Purwandari KP. Gambaran Tingkat Pengetahuan dan Sikap Ibu terhadap Kejadian Kejadian Diare pada Anak di Puskesmas Tirtomoyo I Wonogiri. *Jurnal Keperawatan GSH*. 2018; 7(2):1–9.
3. Saputri N, astute YP. Hubungan Faktor Lingkungan dengan Kejadian Diare pada Balita Di Puskesmas Bernung. *Jurnal Ilmu Keperawatan dan Kebidanan*. 2019;10(1): 101.
4. Workie HM, Sharifabdilahi AS, Addis EM. Mothers' knowledge, attitude and practice

- towards the prevention and home-based management of diarrheal disease among under-five children in Diredawa, Eastern Ethiopia, 2016: a cross-sectional study. *BMC Pediatr.* 2018;18(1):358. DOI: 10.1186/s12887-018-1321-6.
5. Kementerian Kesehatan Republik Indonesia. Profil kesehatan Indonesia 2019. Jakarta: Kementerian Kesehatan R.I; 2020.
 6. Dinas Kesehatan Aceh. Profil kesehatan Aceh tahun 2021. Banda Aceh: Dinas Kesehatan Aceh; 2022.
 7. UPT Puskesmas Johan Pahlawan. Laporan UPT Puskesmas Johan Pahlawan; 2022.
 8. Fattima ET, Mutyara K, Ermaya YS, Setiawati EP. Mother's Knowledge, Attitude and Practice toward Safe Water Usage in Baleendah, Bandung District, West Java from September–October 2012. *Althea Medical Journal.* 2015; 2(3).
 9. Fahrunnisa, Fibriana AI. Pendidikan Kesehatan dengan Media Kalender "Pintare" (Pintar Atasi Diare). *Jurnal of Health Education.* 2017;2(1):39–46.
 10. Agaro A, Hareru HE, Muche T, Sisay W, Tsadik D, Ashuro Z dkk. Predictors of Hand-Washing Practices at Critical Times Among Mothers of Under-5 Years Old Children in Rural Setting of Gedeo Zone, Southern Ethiopia. *Environ Health Insights.* 2022;16:11786302221120784. DOI: 10.1177/11786302221120784.
 11. Sidabalok DL, Samsudin, Djaja IM. Relationship between environmental factors and personal hygiene with diarrhea among children under five in West Kota Waringin, Central Kasntan. The 6 International Conference on Public Health [Internet]. 2019. Available: <https://doi.org/10.26911/the6thic-ph-FP.01.05>.
 12. Nemeth V, Pflieghaar N. Diarrhea. [Updated 2022 Nov 21]. In: StatPearls [Internet]. Treasure Island (FL): Stat Pearls Publishing; 2023. Available: <https://www.ncbi.nlm.nih.gov/books/NBK448082/>
 13. Rehan SH, Gautam K, Gurung K. KAP of Mothers Regarding Diarrhea. *Indian Journal of Prevention and Social Medicine.* 2003;(34):1-6.
 14. Wahab MJ, Faris SH. Mother's knowledge about prevention of diarrhea in children under five years at the Eastern AL Hamza City. *International Journal of Health Sciences.* 2022;6(S1):10408-10416. Available: <https://doi.org/10.53730/ijhs.v6nS1.7260>
 15. Hartati S, Nurhaliza. Faktor yang Mempengaruhi Kejadian Diare pada Balita di Wilayah Kerja Puskesmas Rejosari Pekan Baru. *Jurnal Endurance.* 2018;3(2).
 16. Dairo MD, Ibrahim TF, Salawu AT. Prevalence and determinants of diarrhea among infants in selected primary health centers in Kaduna north local government area, Nigeria. *Pan African Medical Journal.* 2017;28(109).
 17. Lwin KZ, Putra IGNE. Mothers' knowledge of the causes and prevention associated with diarrhea among under-five children in Hlaing Thar Yar Township, Yangon, Myanmar. *Global Health Management Journal.* 2018;2(3):76-83.
 18. Mumtaz Y, Zafar M, Mumtaz Z. Knowledge attitude and practices of mothers about diarrhea in children under 5 years. *J Dow Uni Health Sci.* 2014;8(1):3-6.
 19. Notoatmodjo S. Metodologi Penelitian Kesehatan. Jakarta: Rineka Cipta; 2018
 20. Momoh FE, Olufela OE, Adejimi AA, Roberts AA, Oluwole EO, Ayankogbe OO, Onajole AT. Mothers' knowledge, attitude and home management of diarrhoea among children under five years old in Lagos, Nigeria. *Afr J Prim Health Care Fam Med.* 2022;14(1):e1-e10. DOI: 10.4102/phcfm.v14i1.3119
 21. Dagne H, Bogale L, Borchha M, Tesfaye A, Dagne B. Hand washing practice at critical times and its associated factors among mothers of under five children in Debark town, northwest Ethiopia, 2018. *Ital J. Pediatr.* 2019;45:1-7.
 22. Radhika A. Hubungan Tindakan Cuci Tangan Pakai Sabun dengan Kejadian Diare pada Balita di Rw Xi Kelurahan Sidotopo, Kecamatan Semampir, Kota Surabaya. *Medical Technology and Public Health Journal.* 2020;4(1):16-24.
 23. UNICEF. Hand Washing with Soap: a simple gesture that saves lives but is not always accessible to everyone [Internet]. 2021 [February 8, 2023]. Available: <https://www.unicef.org/madagascar/en/press-releases/hand-washing-soap-simple-gesture-saves-lives-not-always-accessible-everyone>
 24. Bennion N, Mulokozi G, Allen E, Fullmer M, Kleinhenz G, Dearden, dkk. Association between WASH-related

- behaviors and knowledge with childhood diarrhea in Tanzania. *International Journal of Environmental Research and Public Health*. 2021;18:4681.
25. Kementerian Kesehatan Republik Indonesia. *Profil Kesehatan Indonesia 2017*. Jakarta: Kemenkes RI; 2018.
26. Cha S, Lee JE, Seo DS, Park BM, Mansiangi P, Hwang JS, Lee J. Associations between Household Latrines and the Prevalence of Diarrhea in Idiofa, Democratic Republic of the Congo: A Cross-Sectional Study. *Am J Trop Med Hyg*. 2017;97(2):460-468. DOI: 10.4269/ajtmh.16-0361
27. Simatupang MM, Dharma S, Naria E. Hubungan Sanitasi Jamban dan Air Bersih dengan Kejadian Diare pada Balita di Kelurahan Terjun Kecamatan Medan Marelan Kota Medan Tahun. Medan: Fakultas Kesehatan Masyarakat. USU. (Online); 2014. Available: <https://media.neliti.com/media/publications/14517-ID-hubungan-sanitasi-jamban-dan-air-bersih-dengan-kejadian-diare-pada-balita-di-kel.pdf>
28. Zairinayati, Sumadi A. Analisis Kejadian Diare Berdasarkan Sanitasi Lingkungan. *Jurnal Ilmiah Multi Science Kesehatan*. 2020;12(1):4-5.

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