



Review

Association Between The Incidence Of Diarrheal Diseases And Environmental Risk Factors: A Systematic Literature Review

¹Anita Riantina, ²Yuanita Windusari, ³Novrikasari, ⁴Elvi Sunarsih, ⁵Nur Alam Fajar

¹⁻⁵ Faculty of Public Health, Sriwijaya University, Sumatera Selatan, Indonesia

E-mail Corresponding: anita.riantina@gmail.com

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ABSTRACT

Background: Diarrheal disease is the occurrence of feces (bowel movements) whose soft consistency tends to be liquid and occurs more than 3 times a day. The prevalence of diarrhea in Indonesia is 9.8% with 14.5% causing death. Risk factors for diarrhea include food, environmental and human behavior.

Methods: Research design using systematic review method. With the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta Analysis) method through article searches sourced from Google scholar and Pubmed. The inclusion criteria in this writing are original research articles published within the last 5 years, starting from 2018 – 2023.

Results: This study shows that sewage has a close relationship with the incidence of diarrhea ($P = 0.001$), as well as drinking water sources, especially in terms of water sources, availability of water sources and bacteriological quality of water. Unqualified wastewater disposal conditions are 3.7 times greater risk for diarrhea (PR: 3.7, CI: 1.159 – 11.937), there is a significant relationship between family waste management and diarrhea incidence. In addition to environmental risk factors, there are other factors, namely the level of education of middle and upper middle mothers, exposure to information and family income levels also have a relationship with the incidence of diarrhea in both children and the elderly.

Conclusion: Risk factors that have a significant influence on the incidence of diarrhea are environmental factors, exposure to information and family income level. The dominant environmental factors in this study are sewage disposal (latrines), clean water sources/clean water quality, wastewater disposal.

INTRODUCTION

Based on WHO data in 2022, diarrheal disease is the second trigger of death in children aged less than 5 years, and causes 525 deaths. 000 children annually. Diarrhea can occur for several days depending on the condition of the child's body, and can cause the body to lack water and salt

needed for survival. In the past, the majority of people, severe loss of body fluids and fluid depletion as the main trigger of death due to diarrhea. Currently, other triggers such as septic germ inflammation may be a trigger for an increase in the proportion of deaths due to diarrhea. Children who are malnourished or have immune problems such as people with

HIV are a group that is very at risk of developing diarrhea that threatens their lives.

Diarrhea is defined as liquid or mushy bowel movements 3 or more times each day (or defecating more often than usual in a person). Frequent bowel movements are not diarrhea, nor are they watery and "pale" bowel movements by a baby breastfed by his mother.

Diarrhea is generally an indication of inflammation in the intestinal tract, which can be caused by various germs, viruses, and parasites. Inflammation spreads through contaminated food or drinking water, or from contaminated food utensils and from person to person due to poor sanitation.

Intervention as an effort to avoid diarrhea, including by consuming comfortable drinking water, the use of good sanitation and washing hands with soap can reduce the risk of disease, in this case diarrhea. Diarrhea should be treated with oral rehydration solution (ORS), a clean water solution containing sugar and salt (ORS solution). Not only that, other cures can be in the form of dispersible 20-milligram zinc tablets for 10-14 days so as to shorten the time of occurrence of diarrhea.

In Indonesia, diarrhea is an endemic disease and has an effect on the occurrence of extraordinary events that are also often associated with death. Outbreaks of diarrheal disease are generally caused by contaminated clean water sources, and are generally intertwined in residents who use the same water sources such as polluted river water, especially related to the change of seasons from long dry to rainy times. According to basic health research in Indonesia in 2018 shows diarrhea prevalence data in all age groups of 8% and the prevalence rate in infants is 12.3%, while in toddlers, the prevalence of diarrhea is 10.6%. In the Sample Registration System in 2018, diarrhea has always been one of the main triggers of death in toddlers, which is 7% and in toddlers aged 28 days by 6%. Information from Komdat Kesmas for the January-November 2021 period, diarrhea causes

death in postneonatal by 14%. The latest information from the results of the 2020 Indonesian Nutritional Status Survey, the prevalence of diarrhea is located at 9.8%. Based on data from the 2020 Indonesia Health Profile, inflammatory diseases, especially diarrheal diseases, are a contributor to death in children aged 29 days-11 months. Just like last year, in 2020, diarrhea was still the main problem causing 14.5% of deaths. In the group of infants under 5 years of age, mortality from diarrhea amounted to 4.55%. In Indonesia, diarrhea is an endemic disease and has a risk for the occurrence of an extraordinary event that is also often associated with death. Outbreaks of diarrheal disease usually occur due to polluted clean water sources, and usually occur in residents who use the same water sources as polluted river water, especially related to seasonal changes from long droughts to rainy seasons. Diarrhea data in Indonesia according to Basic Health Research in 2018 states the prevalence of diarrhea for all age groups is 8% and the prevalence rate for toddlers themselves is 12.3%, while in infants, the prevalence of diarrhea is 10.6%. In the Sample Registration System in 2018, diarrhea remained one of the leading causes of death in infants at 7% and in infants aged 28 days at 6%. Data from Komdat Kesmas for the period January - November 2021, diarrhea causes death in postneonatal by 14%. The latest data from the results of the Indonesian Nutritional Status Survey in 2020, the prevalence of diarrhea is at 9.8%. Based on data from the 2020 Indonesian Health Profile, infectious diseases, especially diarrhea, are a contributor to death in children aged 29 days - 11 months. Just like the previous year, in 2020, diarrhea was still the main problem causing 14.5% of deaths. In the group of children under 5 years old, death due to diarrhea was 4.55%

Some environmental factors that can be a risk for diarrhea, especially in toddlers, include clean water sources where the availability of clean water includes the source whether surface water, open clean water

storage, and the presence of livestock cages and fecal disposal facilities close to water sources are factors that can pollute clean water sources. Next is the fecal disposal site, household waste disposal. Where these factors will be related to human behavior, environmental factors that are not good because they are polluted with germs that cause diarrhea accumulate with unhealthy human behavior that has the potential to cause diarrheal diseases. The availability of inadequate clean water will facilitate the onset of disease in the community, where the average water needs of each individual per day range from 150-200 liters or 35-40 gallons. The needs of each human being will be different and depend on the climate, standard of living and habits of society in general. More than 3.5 million people worldwide die each year from waterborne diseases due to fecal contamination in the environment such as diarrheal diseases. Unqualified fecal discharge will lead to contamination of water sources, soil, or become a source of infection, which will be able to endanger human health.

Another environmental factor is the disposal of garbage and wastewater. Waste should be placed in a safe storage area with strong materials, has a lid and is easy to transport to the final processing site so as not to become a source of pollution to food and beverages. Furthermore, household wastewater management must also have facilities that are closed, flow smoothly, do not cause unpleasant odors and must always be cleaned regularly. By fulfilling these requirements, it is hoped that households, animals and plants that live in water can be protected. Surface water and soil pollution can also be avoided and can eliminate the proliferation of disease-transmitting vectors such as flies, cockroaches.

METHODS

The systematic preparation of this review is carried out by the process of

searching, identifying, reviewing, selecting and collecting studies related to environmental factors and the incidence of diarrhea in Indonesia. The systematic preparation of the review begins with the search for articles relevant to the study on Google Scholar and Pubmed by applying the PRISMA guidelines which contain guidelines for preparation steps consisting of Identification, Screening, Eligibility and Included.

To be eligibility, the article search format in this study uses the PICO (Population, Intervention, Comparator, Outcome) question format:

- P - Population = Communities at risk
- I - Intervention = Personal hygiene, availability of latrines, physical availability of building floors, water sources, waste disposal practices, and garbage disposal practices
- C - Comparator = Environmental factors qualify or not
- O - Outcome = Incidence of Diarrhea

Data analysis in this study used a qualitative descriptive approach. Data analysis was carried out by reviewing various previous studies. Henceforth, the data will be displayed in the form of a table containing descriptive text about environmental variables that affect the incidence of diarrhea and the results of quantitative statistical analysis.

The inclusion criteria in this study are research conducted in the period 2018 – 2023, using a cross-sectional study approach and there is a bivariate analysis which includes environmental variables.

RESULT

Initial search results in the database using the keyword "Diarrhea, environmental factors, personal hygiene, bivariate" yielded 598 from Google Scholar and 7 from PubMed with articles related to environmental risk factors and the incidence of diarrhea in the last 5 years.

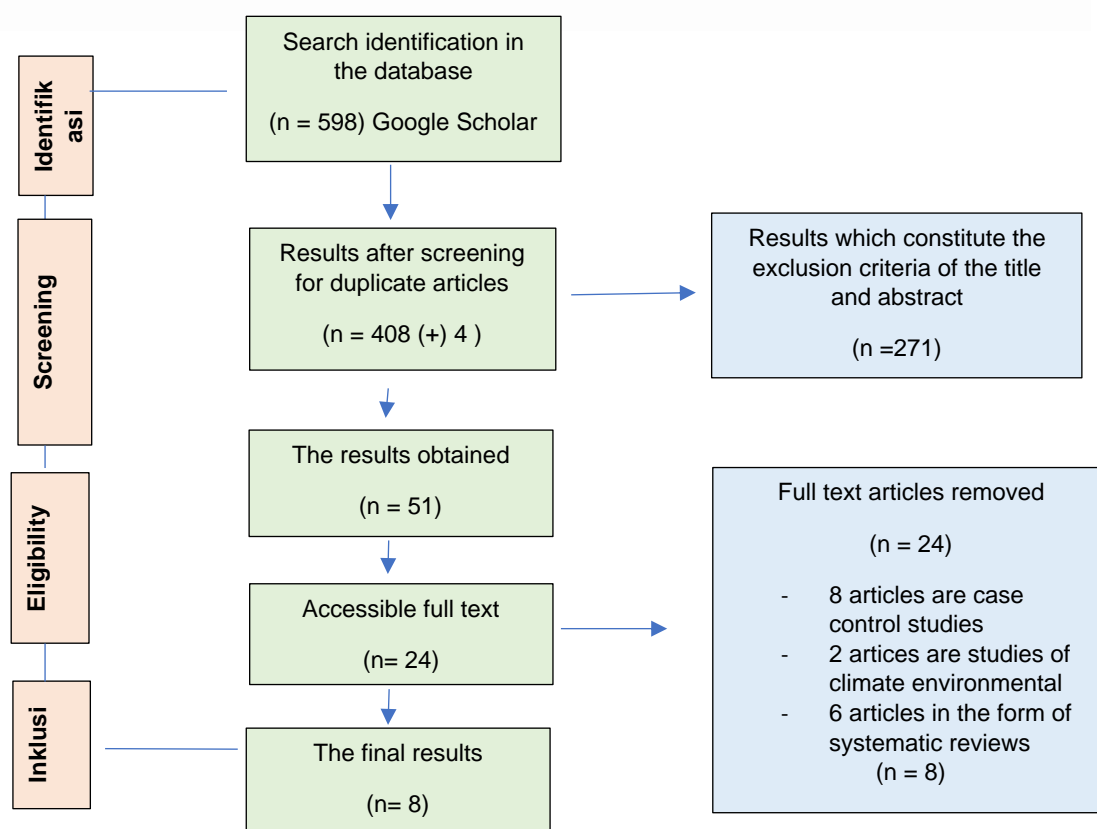


Figure 1. Study selection PRISMA flowchart diagram

After filtering the duplication of articles and exclusion criteria from the title and abstract, the remaining 51 articles can be reviewed. Of the 51 articles, only 24 articles can be accessed for free. After re-analysis, of the remaining 24 articles, 8 articles did not use a cross-sectional study design and 2 articles examined climate

variables and 6 articles were systematic reviews, so only 8 articles were left to be analyzed **Table.1**. From the results of article searches in table 1, it can be grouped based on the results of research variables related to and variables that are not related to the incidence of diarrhea in **Table.2**.

Table.1. Journal description of the relationship of environmental factors to the incidence of diarrhea

No	Author and year of publication	Research title	Study Design and Analysis methods	Variable	Results
1	Siti Hastia, Tarianna Ginting, 2019	Sanitation relations environment and mothers personal hygiene with events Diarheal in Sidorejo Village Sering Health Center often Medan city.	Cross Sectional with Chi-2 Square analysis	1. Insidence of Diarrhea 2. Environmental Sanitation (housing area, waste disposal, fine provision of clean water) 3. Personal Hygiene	There is connection between sanitary conditions an environment that doesn't with events.
2	Erick Ziko, 2020	Risk Factors for Diarrhea in toddlers in Padang City	Cross Sectional with Chi-2 Square analysis	1. Insidence of Diarrhea 2. Information exposure 3. Number of family numbers 4. Preventive behavior	Poor environmental sanitation has a significant relationship with the incidence of

				5. Family Income 6. Social capital 7. Environment Sanitation	diarrhea in toddlers
3	Getachew Yismaw Workie, 2019	Environmental Factors Affecting Childhood Diarrheal Disease Among Under Five Children in Jamma District, South Meila Zone, Northeast Ethiopia	Cross Sectional with Chi-2 Square analysis for bivariate analysis and logistic regression for multivariate analysis	1. Incidence of Diarrhea 2. There are no latrines 3. There are no hand washing facilities 4. Unprotected drinking water sources 5. Improper waste disposal	The child's age, place of residence, availability of latrines, physical availability of handwashing stations, water sources and waste disposal practices are closely related to the incidence of diarrheal diseases
4	Pintu Paul, 2020	Socio-demographic and Environmental Factors Associated With Diarrhael Disease Among Children Under Five in India	Cross Sectional with Chi-2 Square analysis for bivariate analysis	1. Incidence of Diarrhea 2. Environmental factors (fecal discharge of children, flooring material) 3. House roofing material (straw) 4. Socio-demographic factors: place of residence (rural/urban), caste (scheduled/-underdeveloped), religion (Islam/Hinduism), maternal education, father's education, mother's body mass index, mass media access, economic level, region, child's age	Environmental factors including child fecal discharge, floor material and thatched roofing are significantly associated with diarrhea in children under five years
5	Dewi Anissa, 2021	Analysis of Environmental and Behavioral Aspects of the Incidence of Diarrhea in Toddlers in Tanah Sareal Kota Bogor	Cross Sectional with Chi-2 Square analysis	1. Incidence of Diarrhea 2. Healthy Home Criteria 3. Water Sources 4. Ownership & Quality of Clean Water Sources 5. Healthy Latrine Ownership	There is a significant relationship between the bacteriological quality of clean water and the incidence of diarrhea
6	Zidni Fauziyah, 2023	Basic Sanitation Conditions with the Incidence of Diarrhea in Tridonorejo Village, Demak Regency	Cross Sectional with Chi-2 Square analysis	1. Incidence of Diarrhea 2. Latrine conditions 3. Condition of clean water sources 4. The condition of garbage disposal facilities, the condition of wastewater sewerage channels	There is a relationship between the condition of latrines and wastewater sewerage to the incidence of diarrhea in Tridonorejo Village
7	Sabela Fitria Febriana, 2020	The Relationship between Sanitation and Feeding Behavior on the Incidence of Diarrhea in Toddlers in the Kedung Banteng Health Center Area	Cross Sectional with Chi-2 Square analysis	1. Incidence of Diarrhea 2. Clean Water (dug wells, piping) 3. Healthy Latrines (good, bad)	There is a relationship between the availability of clean water and sanitation of healthy latrines with the incidence of diarrhea.
8	Andik Setiyono, 2019	Risk Factors for Diarrhea in the People of Tasikmalaya City	Cross Sectional with Chi-2 Square analysis	1. Incidence of Diarrhea 2. Level of Education 3. Type of Clean Water Source 4. The distance of dug wells to fecal disposal 5. Types of fecal disposal sites	There is a relationship between the type of fecal disposal site and the incidence of diarrhea in the people of Tasikmalaya City

Table 2. Risk factors for diarrhea under study

Author	Faktor Risiko								
	Waste Disposal (Latrine)	Clean Water Source/ Quality of Drinking Water Sources	Personal Hygiene	Hand washing facilities	waste water disposal	waste disposal facilities	Level of Education	Information Exposure	Family Income
Sitia Hastia, et al, 2019	V	V	V	---	---	---	---	---	---
Erick Ziko, 2020	---	V	---	---	---	---	---	V	V
Getachew Yismaw Workie, 2019	V	V	---	---	V	---	---	---	---
Pintu Paull, 2020	V	---	---	---	---	---	X	V	V
Dewi Anissa,et al, 2021	V	V	---	---	---	---	---	---	---
Zidni Fauziyah, 2023	V	V	---	---	V	X	---	---	---
Sabela Fitria Febriana, 2020	V	V	---	---	---	---	---	---	---
Andik Setiyono, 2019	V	---	---	---	---	---	---	---	V

Information :

V : researched and significant

X : conscientious and insignificant

--- : Not researched

DISCUSSION

Sewage (Latrine)

The problem of human feces (feces) is an important problem because human waste can be a source of causes that will contaminate water, hands, insects and soil. Fecal disposal sites that do not meet health requirements will facilitate the transmission of diseases such as diarrheal diseases. Efforts to fulfill qualified latrines, especially in marginalized community groups, will greatly help reduce the incidence of diarrheal diseases, especially in toddlers. Research conducted by Siti Hastia, et al, 2019 on the relationship between environmental sanitation and maternal personal hygiene with the incidence of diarrhea.¹

concluded that environmental sanitation, one of which includes sewage problems, has a relationship ($p = 0.001$) with the incidence of diarrhea. Likewise, according to Getachew Yismaw Workie,

2019, concluded that there is a close relationship between the availability of latrines and the incidence of diarrhea² And in line with research conducted by Pintu Paull, 2020, where researchers concluded that children's fecal discharge is significantly related to diarrheal diseases in children under five³. Furthermore, according to in her research entitled basic sanitation conditions with the incidence of diarrhea in Tridonorejo Village, Demak Regency concluded that there is a relationship between the condition of latrines and the incidence of diarrhea in the village⁴.

Clean Water Source (Clean Water Quality)

The need for water is very important for the survival of human life and other living things such as animals and plants. Humans will need a lot of water not limited to the need for drinking water but very broadly related to the needs of daily life, cooking, washing,

bathing, and so on. So in order to avoid the risk of exposure and transmission of humans from the causes of disease that contaminate water sources, the water sources we use must meet health requirements, namely:

- 1) Physical Requirements: water other than clean must be clear, odorless, tasteless, and not any color.
- 2) Chemical Requirements: Clean water does not contain harmful chemicals such as heavy metals, pesticides, and other chemicals.
- 3) Microbiology Requirements: Clean water does not contain bacteria, viruses, or parasites that can cause disease.

In addition, clean water must also meet drinking water quality standards set by the government. Some parameters regulated in drinking water quality standards include pH, turbidity, heavy metal content, and bacterial content.^{5,6}

In some studies, it can be concluded that clean water sources or clean water quality are related to diarrheal events, such as prevalence of diarrheal diseases is high among children in research areas where drinking water sources are related to children's diarrheal diseases. Therefore, increasing the supply of pure water will be able to minimize the burden of diarrheal diseases. The use of clean water is one behavior that can prevent a person from developing several diseases such as diarrheal diseases, especially at the age of children.⁷ in line with research conducted Sabela Fitria Febriana, 2020 and Dewi Annisa, et al, 2021 where there is a significant relationship between the use of water sources, the availability of water sources and the bacteriological quality of water on the incidence of diarrhea.^{8,9}

Wastewater Disposal

Based on the results of the analysis of the relationship between the condition of wastewater disposal facilities and the incidence of diarrhea, through statistical tests with the Chi-square test, a p-value of 0.039

was obtained so that it was concluded that there was a significant relationship between the condition of waste disposal facilities and the incidence of diarrhea. The value of Prevalence Ratio (PR) = 3.7 (95% CI = 1.159 –11.937), shows that respondents with unqualified wastewater disposal facilities are at 3.7 times greater risk of experiencing diarrhea events when compared to respondents with qualified wastewater disposal facilities. The results of this study are also corroborated or in line with the results of research conducted in Jamma District, Ethiopia, which found that improper waste disposal practices have a significant effect on the incidence of diarrheal diseases in children. The study concluded that improved handwashing practices, availability of clean water, proper waste disposal, and availability of latrines will minimize the incidence of diarrheal diseases². Based on Permenkes RI Number 3 of 2014 concerning Community-Based Total Sanitation, to prevent waterlogging that can cause environment-based diseases, it is necessary to secure liquid waste. The waste security efforts are in the form of wastewater sewerage channels and infiltration wells to distribute liquid waste at the household level. Securing liquid waste at the household level involves several basic things, including not causing odor and not being flooded, not mixing with latrine sewers, not being a place for vectors to live like mosquitoes, and connected to infiltration wells or public sewage channels (Ministry of Health RI, 2014). Domestic wastewater is defined as wastewater sourced from various human activities such as bathing, cooking, washing clothes, and other activities other than human feces and is estimated to contain a small number of pathogenic microorganisms that can endanger human health.

Garbage disposal facilities

In research conducted by Zidni Fauziyah, 2023, results were obtained based on statistical test results with the Fisher's Exact Test, namely a p-value of 0.175.

Therefore, it can be concluded that there is no significant relationship between the condition of waste disposal facilities and the incidence of diarrheal diseases in Tridonorejo Village, Demak Regency.¹⁰ This research is not in line with research conducted by Nurhaedah, 2019 where the conclusion of her research stated that there is a significant relationship between family waste management and the incidence of diarrhea.⁽¹¹⁾ There is no relationship or correlation between waste disposal facilities and diarrhea events in the research conducted by Zidni Fauziyah is because most residents of Tridonorejo Village already have good waste management with the existence of a waste transportation system managed by the village which is taken approximately every 2-3 days so that this variable is not a dominant factor in the incidence of diarrhea^{10,12,13}. Based on Permenkes RI Number 3 of 2014 concerning Community-Based Total Sanitation, waste security in households consists of collecting, transporting, processing, recycling, or disposing of waste in a way that is not harmful to the environment and the health of the surrounding community. Waste security on a household scale can be implemented by disposing every day and not allowing waste to be stored in the house^{7,10,14}

Education Level

There are several studies that show a relationship between the mother's education level and the incidence of diarrhea in children. A study conducted Oleh Pintu Paull, 2020 stated that mothers who had an upper secondary education level were associated with 9% causing a decrease in the likelihood of diarrhea (cOR: 0.92: 95% CI: 0.88-0.97) when compared to mothers who had no formal education or had a basic education level only. Mothers with low education tend not to understand the importance of sanitation and hygiene, so this will risk increasing the risk of diarrhea in children, especially children living in marginalized areas.^{3,15}

Information Exposure

Research conducted by Erick Zicof, 2020 shows results based on statistical tests by obtaining p values $< \alpha$ ($0.001 < 0.05$) so that it can be concluded that there is a relationship between exposure to information and the incidence of diarrhea. Where from the results of the analysis obtained OR = 4.2, it means that mothers whose exposure to information is less at risk of 4.2 times their toddlers can experience diarrhea than mothers who have sufficient information exposure. The results of this study show that there is an influence of exposure to health information on the incidence of diarrhea. Mothers of toddlers with less information exposure can increase the risk of their toddlers getting diarrhea. The provision of health information about how to live a healthy life, maintain health, avoid disease transmission and so on will increase the knowledge of individuals, groups or communities. So that with the increase in maternal knowledge, it is expected to increase understanding and bad behavior can slowly experience changes in a good and healthy direction.^{7,16,17}

Mass media exposure to mothers was found to be a protective factor for childhood diarrhea. In an unadjusted analysis, this study found that children whose mothers had access to mass media were less likely to have diarrheal diseases.³

Family Income

According to the results of statistical tests in research conducted by Erick Zicof, 2019 obtained p value $< \alpha$ which is $0.001 < 0.05$ so that it can be concluded that there is a relationship between family income and the incidence of diarrhea. Where the results of the analysis obtained OR = 5.2 which means that toddlers with low family income have a 5.2 times chance of developing diarrhea when compared to families with high income. This result is also in line with the findings of research conducted by Pintu Paull, 2020 where it was revealed that the possibility of diarrhea was reduced by 26% in

children from family groups who have the richest level of wealth compared to those from groups who are not wealthy.^{3,7}

CONCLUSION

According to the results of this study, it was found that there are several risk factors associated with the incidence of diarrhea in toddlers and the elderly. The factors that have a significant influence on the incidence of diarrhea are environmental factors, exposure to information and income / family wealth. The dominant environmental factors in this study are sewage (latrine), clean water

sources/clean water quality, wastewater disposal. It is expected that these household environmental factors must meet health requirements to prevent the emergence of diseases, especially diarrhea in toddlers.

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REFERENCES

1. Prima J, Sains M, Hastia S, Ginting T. Hubungan sanitasi lingkungan dan personal hygiene ibu dengan kejadian diare pada balita di Kelurahan Sidorejo Puskemas Sering Kota Medan.
2. Workie GY, Akalu TY, Baraki AG. Environmental factors affecting childhood diarrheal disease among under-five children in Jamma district, South Wello zone, Northeast Ethiopia. *BMC Infect Dis.* 2019 Sep 13;19(1):804.
3. Paul P. Socio-demographic and environmental factors associated with diarrhoeal disease among children under five in India. *BMC Public Health.* 2020 Dec 1;20(1).
4. Eldysta E, Ernawati K, Mardhiyah D, Maulana I, Farizi F. Hubungan Perilaku Cuci Tangan Dan Faktor Risiko Lingkungan Terhadap Kejadian Penyakit Diare. *Public Health and Safety International Journal* Oktober. 2022;2(2):2715–5854.
5. Eldysta E, Ernawati K, Mardhiyah D, Maulana I, Farizi F. Hubungan Perilaku Cuci Tangan Dan Faktor Risiko Lingkungan Terhadap Kejadian Penyakit Diare. *Public Health and Safety International Journal* Oktober. 2022;2(2):2715–5854.
6. Nurmarastri D, Sidqi S, Anasta N, Mufidah K. Analisis Spasial Kasus Diare pada Balita di Kabupaten Banyumas Tahun 2019. Vol. 1. 2021.
7. Erick Zi, Padang K. Faktor Risiko Kejadian Diare Pada Balita Di Kota Padang. *Jurnal Bidang Ilmu Kesehatan [Internet].* 2020;10. Available from: <http://ejournal.urindo.ac.id/index.php/kesehatan>
8. Sabela B, Febriana F, Amelia VL. Perilaku Cuci Tangan Dan Faktor Risiko Lingkungan Terhadap Kejadian Penyakit Diare. Vol. 5, *Jurnal Keperawatan Muhammadiyah.* 2020.
9. Anisa D. ANALISIS ASPEK LINGKUNGAN DAN PERILAKU TERHADAP KEJADIAN DIARE PADA BALITA DI TANAH SAREAL. *Jurnal Inovasi Penelitian.* 2021;6.
10. A Fauziyah Z. asic Sanitation Conditions with the Incidence of Diarrhea. (*Journal of Public Health Research and D evelopment.* 2023;7.
11. A Nurhaedah N. 4. The relationship between environmental sanitation and the incidence of diarrhea in the elderly. *Health Scientific Journal Sandi Husada .* 2019;8.
12. Samiyati M, Peminatan Kesehatan Lingkungan M, Kesehatan Masyarakat F, Diponegoro U, Peminatan Kesehatan Lingkungan D. HUBUNGAN SANITASI LINGKUNGAN RUMAH DENGAN KEJADIAN DIARE PADA BALITA DI WILAYAH KERJA PUSKESMAS KARANGANYAR KABUPATEN PEKALONGAN [Internet]. Vol. 7. 2019. Available from: <http://ejournal3.undip.ac.id/index.php/jkm>
13. Dharmayanti I, Tjandrarini DH. PERAN LINGKUNGAN DAN INDIVIDU TERHADAP MASALAH DIARE DI PULAU JAWA DAN BALI. *JURNAL EKOLOGI KESEHATAN.* 2020 Sep 23;19(2):84–93.
14. Setiyono A. FAKTOR RISIKO KEJADIAN DIARE PADA MASYARAKAT KOTA TASIKMALAYA. Vol. 15, *Jurnal Kesehatan Komunitas Indonesia.* 2019.
15. Wahyuni NT. FAKTOR RISIKO KEJADIAN DIARE PADA BALITA SYSTEMATIC REVIEW BIDANG KESEHATAN MASYARAKAT. Vol. 8, *Jurnal Ilmu Kedokteran Dan Kesehatan.* 2021.
16. Oktavianisya N, Yasin Z, Aliftitah S, Kesehatan FI. *Jurnal Ilmiah STIKES Yarsi Mataram Kejadian Diare Pada Balita dan Faktor Risikonya [Internet].* Vol. XIII. 2023. Available from: <http://journal.stikesyarsimataram.ac.id/index.php/jik>
17. Agus Iryanto A, Joko T, Raharjo M. Literature Review : Faktor Risiko Kejadian Diare Pada Balita Di Indonesia Literature Review : Risk Factors For The Incidence of Diarrhea in Children Under Five in Indonesia. *Jurnal Kesehatan Lingkungan.* 2021;11(1):1–7..