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Meta-Analysis
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Meta-Analysis the Effects of Hand Washing Behavior Using Soap and Latrine Availability on the Diarrhea Incidence in Children Under Five

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ABSTRACT

Background: Diarrheal disease is a major problem in developing countries, including Indonesia. Apart from being a cause of death, diarrhea is also a major cause of malnutrition and can cause extraordinary events. This study aimed to analyze and estimate the effect of washing hands with soap and availability of latrines on the incidence of diarrhea in toddlers, with a meta-analysis based on previous primary studies.
Subjects and Method: The meta-analysis was carried out using the PICO format including: (1) Population: Children under five; (2) Intervention: Mother washing hands with soap and having latrines available; (3) Comparison: Mothers who don't wash their hands with soap and don't have latrines available; and (4) Outcome: Incidence of diarrhea. Article searches were performed using several databases such as PubMed, Google Scholar, ScienceDirect, BioMed Central, and PLOS ONE. The keywords used are "Hand Washing OR Hand Hygiene AND "Latrine OR Latrine Availability" AND "Infection" AND "Diarrhea Childhood" AND "Children". The inclusion criteria for the included articles were full text articles with a cross-sectional design, published years from 2013 to 2022. This study was conducted according to PRISMA guidelines (Preferred Reporting Item for Systematic Reviews and Meta-Analysis). Data were analyzed using the Review Manager 5.3 application.
Results: A total of 14 cross-sectional studies were included in this meta-analysis study which contained a total of 12,851 children under five who were at risk of diarrhea. This research article comes from Ethiopia which is on the African continent. The results of this meta-analysis show that mothers who wash their hands with soap can reduce the incidence of diarrhea in toddlers by 0.31 times compared to mothers who do not wash their hands with soap (aOR= 0.31; 95% CI= 0.17 to 0.57; p= 0.001), and the availability of latrines can reduce the incidence of diarrhea in toddlers by 0.38 times compared to the unavailability of latrines (aOR= 0.38; 95% CI= 0.15 to 0.96; p= 0.040).
Conclusion: The behavior of washing hands with soap and the availability of latrines can reduce the incidence of diarrhea in toddlers.

Keywords: hand washing behavior, availability of latrines, child diarrhea.

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BACKGROUND

According to the World Health Organization (WHO), diarrheal disease is a loss of body fluids in 24 hours with a frequency of defecation more than three times a day (WHO, 2013). Diarrhea is a disease that can be prevented and treated easily, but is still a world health problem, especially in developing countries including Indonesia (Irnawati et al., 2018).

Some of the factors that cause diarrheal disease are caused by bacteria through contamination of food and drink contaminated with feces and or direct contact with sufferers. In addition, the most dominant factors contributing to diarrheal disease are water, food sanitation, family latrines, and water (Melvani et al., 2019).

There are 1.7 billion cases of diarrhea worldwide and it causes around 525,000 under-five deaths each year. Diarrhea in children under five generally occurs in developing countries, most of which have poor access to drinking water, sanitation and hygiene (WHO, 2017). The incidence of diarrhea in Indonesia is the number two cause of death in children under five. Nationally, the SDGs target is to reduce the Under-five Mortality Rate in Indonesia in the 2015-2030 period to 25 per 1000 live births. In 2016, the Under-five Mortality Rate in Indonesia was recorded at 26 per 1000 live births (Ministry of Health RI, 2017).

The implementation of clean and healthy living behavior in infants under five depends on the mother's clean and healthy lifestyle, because infants under five cannot do everything independently, which includes defecation habits and hand washing habits. Correct defecation behavior is when residents do it in the latrine and wash their hands properly is when residents wash their hands with soap before eating, before preparing food, after defecating, after cleaning babies or children and after handling poultry or animals (RI Ministry of Health, 2021).

The conditions for washing hands with soap are the availability of running water in the house, the availability of soap for washing hands, the availability of hand washing equipment at home (Fajriyati et al., 2021). Washing hands with soap is proven to prevent transmission of disease and infection (Siswanto et al., 2022).

Factors that cause diarrhea are infections caused by pathogenic microorganisms (viruses, bacteria, and parasites). The main factor causing diarrhea in infants and toddlers is infection of the digestive tract. Infectious factors can affect the nutritional status of children. Environmental factors that can affect the incidence of diarrhea in children under five are the use of clean water and healthy latrines. Contaminated water contains many bacteria, one of which is Escerichia coli which is a bacteria that causes diarrhea. Clean water sources are one of the sanitation facilities that are closely related to diarrheal diseases (Gedamu et al., 2017). This study aimed to analyze and estimate the magnitude of the behavior of washing hands with soap and the availability of latrines on the incidence of diarrhea in children under five with a meta-analysis.

SUBJECTS AND METHOD

1. Study Design

Meta-analyses were performed with PRISMA flowcharts using the PubMed, Google Scholar, ScienceDirect, BioMed Central, and PLOS ONE databases. The keywords used are “Hand Washing OR Hand Hygiene AND “Latrine OR Latrine Availability” AND (Infection OR Transmission) AND “Diarrhea Childhood” AND “Children”. There were 14 studies with a cross-sectional study design that met the

inclusion criteria. Analysis was performed with RevMan 5.3 software.

2. Step of Meta-Analysis

The meta-analysis was carried out in five steps as follows:

1) Formulate research questions in the PICO.
2) Search for primary study articles from various electronic and non-electronic databases. namely PubMed, Google Scholar, ScienceDirect, BioMed Central, and PLOS ONE.
3) Conduct screening and critical assessment of primary research articles.
4) Perform data extraction and synthesize effect estimates into RevMan 5.3.
5) Interpret and conclude the results

3. Inclusion Criteria

This research article is a full-text paper with a cross-sectional study design that analyzes the effect of washing hands with soap and the availability of latrines on the incidence of diarrhea. The influence measure used is the OR. Multivariate analysis was used with adjusted odds ratio (aOR) and 95% confidence interval. The research subjects were toddlers.

4. Exclusion Criteria

Articles published other than in English, non-cross-sectional study design, and articles published before 2013.

5. Operational Definition of Variables

Article search was carried out by considering the eligibility criteria determined using the PICO model. Population: Children under five; Intervention: Mother washing hands with soap and having latrines available; Comparison: Mothers who don't wash their hands with soap and don't have latrines; Outcome: Incidence of diarrhea.

Diarrhea is a disease characterized by a change in the shape and consistency of the stool, which is softer or more liquid and the frequency of bowel movements is more than three times in 24 hours.

The behavior of washing hands using soap is that washing hands using soap is a process of removing dirt, dust, and microorganisms attached to the skin of both hands by using soap and running water. The habit of washing hands is closely related to personal hygiene as an effort to prevent germs and disease which is the easiest to do.

A latrine is a latrine which is a room that has human waste disposal facilities consisting of a squatting place or a seat with a goose neck or without a goose neck (cemplung latrine) equipped with a dirt and water storage unit for cleaning it.

6. Instruments

This review will be analyzed systematically using a meta-analysis guide, namely Preferred Reporting Items for Systematic Reviews and Meta Analysis (PRISMA) and using a critical assessment checklist Critical Appraisal Checklist for Cross-sectional Study (JBI, 2017).

7. Data analysis

The data in this study were analyzed using the Review Manager application (RevMan 5.4). Forest plots and funnel plots are used to determine the effect size and heterogeneity of the data. Data processing was carried out based on variations between studies, namely the random effect model.

RESULTS

The process of searching for articles is done through several journal databases which include PubMed, Google Scholar, ScienceDirect, BioMed Central, and PLOS ONE. The article review process can be seen in the PRISMA flow diagram in Figure 1.

The research related to the effect of washing hands with soap and the availability of latrines on the incidence of diarrhea in toddlers consists of 14 articles. The

initial search process yielded 5,728, after the article deletion process 1,108 articles were obtained, of which 68 met the requirements for further full-text review, 14 articles that met the quality assessment were included in the quantitative synthesis meta-analysis. It can be seen in Figure 2 that the research articles taken as a source of meta-analysis come from the country of Ethiopia which is on the African continent.

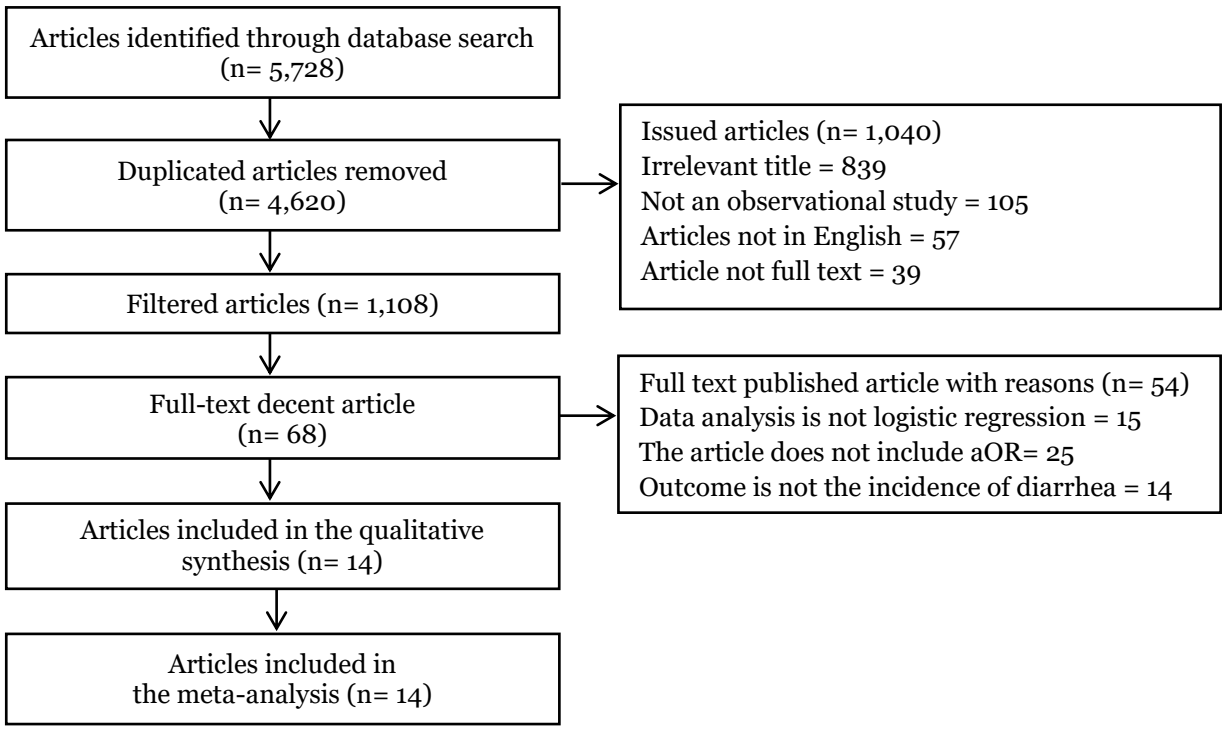

Figure 1. Results of PRISMA Flow Diagrams

Figure 2. Research Distribution Map

Table 1. The Quality Assessment Result of Articles with a Cross-Sectional Study.

Primary Study	Criteria							
	1	2	3	4	5	6	7	Total
Alamayehu *et al.* (2020)	2	2	2	2	2	2	2	14
Alto *et al.* (2020)	2	2	2	2	2	2	2	14
Angasu *et al.* (2022)	2	2	2	2	2	2	2	14
Bitew *et al.* (2017)	2	1	2	2	2	2	2	14
Dagnew *et al.* (2019)	2	2	2	2	2	2	2	14
Degebasa *et al.* (2018)	2	2	2	2	2	2	2	14
Feleke *et al.* (2022)	2	2	2	2	2	2	2	14
Gedamu *et al.* (2017)	2	2	2	2	2	2	2	14
Gizaw *et al.* (2017)	2	2	2	2	2	2	2	14
Hashi *et al.* (2016)	2	2	2	2	2	2	2	14
Mamo *et al.* (2014)	2	1	2	2	2	2	2	14
Melese *et al.* (2019)	2	2	2	2	2	2	2	14
Mengistie *et al.* (2013)	2	2	2	2	2	2	2	14
Mernie *et al.* (2022)	2	2	2	2	2	2	2	14

Description of the question criteria:

1. Is the population in the primary study the same as the population in the PICO meta-analysis??
2. method for selecting research subjects:
   - Descriptive cross-sectional study (prevalence): Is the sample randomly selected?
   - Analytical cross-sectional study: Are samples randomly or purposively selected?
3. Methods for measuring comparisons (intervention) and outcome variables:
   - Are both exposure or intervention and outcome variables measured with the same instruments in all primary studies?
   - If variables are measured on a categorical scale, are the cut-offs or categories used the same across primary studies?
4. Bias of the design:
   - How much is the response rate?
   - Is non-response related to outcomes?
5. Methods to control confounding:
   - Is there any confusion in the results or conclusions of the primary study?
   - Have primary study researchers used appropriate methods to control the effects of confusion?
6. Method of statistical analysis:
   - In the cross-sectional study, is multivariate analysis performed?
   - Multivariate analysis includes multiple linear regression analysis, multiple logistic regression analysis, Cox regression analysis.
7. Is there a conflict of interest with the research sponsor?

Description of scoring:

0= No
1= Hesitate
2= Yes

Table 1 showed quality assessment result of articles with a cross-sectional study included in meta-analysis. Table 2 below describes a summary of primary research on the effect of washing hands with soap on the incidence of diarrhea, a meta-analysis was carried out on 8 articles originating from the country of Ethiopia. The largest research population was found in a study conducted by Gedamu et al. (2017), namely 1,007 children under five, and the study with the smallest population, namely the study conducted by Alto et al. (2020) as many as 310 children under five.

Table 2. Description of the primary study of the effect of washing hands with soap on the incidence of diarrhea.

Author (years)	Country	Sample	P	I	C	O
Alto et al. (2020)	Ethiopia	310	Toddler age	soap or ash	Not with soap or ash	Diarrhea
Dagnew et al. (2019)	Ethiopia	498	Age under five years	Water and soap	Only with water	Diarrhea
Dagnew et al. (2018)	Ethiopia	380	Children under five years old	Soap or ash	Only water	Diarrhea
Feleke et al. (2022)	Ethiopia	455	Less than five years	With water and soap	Only with water	Diarrhea
Gedamu et al. (2017)	Ethiopia	1,007	Children under five years	Soap and water	Only water	Diarrhea
Gizaw et al. (2017)	Ethiopia	367	Less than two years	With soap	Only with water	diarrhea
Melese et al. (2019)	Ethiopia	546	Children under five years old	Water, soap and ashes	Only with water	diarrhea
Mernie et al. (2022)	Ethiopia	448	Age < five years	Water and soap/ash	Only water	diarrhea

Table 3. aOR and 95% CI data of the effect of washing hands with soap on the incidence of diarrhea.

(Author, year)	aOR	95% CI	
		Lower Limit	Upper Limit
Alto et al. (2020)	0.16	0.09	0.28
Dagnew et al. (2019)	0.22	0.12	0.40
Dagnew et al. (2018)	1.06	0.52	2.16
Feleke et al. (2022)	0.34	0.15	0.77
Gedamu et al. (2017)	0.63	0.43	0.92
Gizaw et al. (2017)	0.04	0.01	0.16
Melese et al. (2019)	0.15	0.06	0.38
Mernie et al. (2022)	0.78	0.48	1.27

Table 3 showed the effect sizes of the primary studies used in the meta-analysis, with largest adjusted odd ratio conducted by Dagnew et al. (2018) is 1.06, and the lowest aOR conducted by Gizaw et al. (2017) is 0.04.

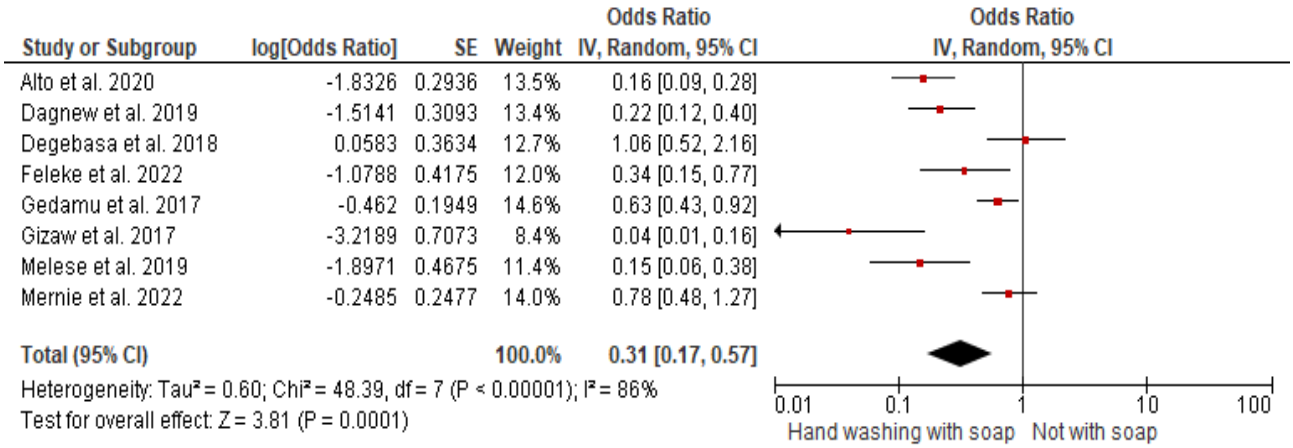

Figure 3. Forest plot of the effect of washing hands with soap on the incidence of diarrhea

Forest plot figure 3 shows that there is an effect of washing hands with soap on the incidence of diarrhea in children under five and this effect is statistically significant. Mothers who wash their hands with soap can reduce the incidence of diarrhea in children under five by 0.31 times compared to mothers who do not wash their hands with soap (aOR= 0.31; 95% CI= 0.17 to 0.57; p= 0.001). The forest plot in Figure 3 shows a homogeneous variation in effect estimates (I^2= 86%; p< 0.001). Thus, the calculation of the average effect estimate is carried out using the random effect model approach.

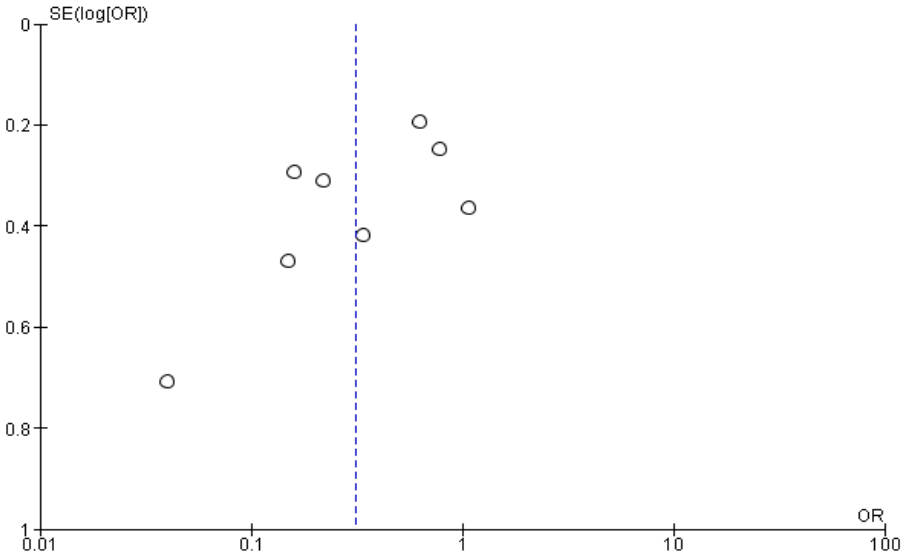

Figure 4. Funnel plot of the effect of washing hands with soap on the incidence of diarrhea

The funnel plot in figure 4 shows a symmetrical distribution of effect estimates. The distribution of effect estimates is mostly located to the left of the average vertical line of estimates, thus indicating publication bias. Because the distribution of effect estimates lies more to the left of the vertical line of the average estimate in the

funnel plot which is the same as the average effect estimate in the forest plot which lies to the right, the publication bias tends to overestimate the true effect.

Table 4. Description of the primary study of the effect of latrines availability on the incidence of diarrhea included in the primary study meta-analysis

Author (years)	Country	Sample	P	I	C	O
Alamayehu et al. (2020)	Ethiopia	722	Toddler	Available	Not available	diarrhea
Angasu et al. (2022)	Ethiopia	2,233	Age under five years	Yes available	Not available	diarrhea
Bitew et al. (2017)	Ethiopia	704	Children under five years old	Available	Not available	diarrhea
Gedamu et al. (2017)	Ethiopia	1,007	Children under five years	Available	Not available	diarrhea
Hashi et al. (2016)	Ethiopia	1,807	Children under five years old	Yes available	Not available	diarrhea
Mamo et al. (2014)	Ethiopia	483	Less than five years	Yes available	Not available	diarrhea
Mengistie et al. (2013)	Ethiopia	1,456	Children aged < years	Available	Not available	diarrhea

Table 5. aOR and 95% CI data of the effect of latrines availability on the incidence of diarrhea.

(Author, year)	aOR	95% CI	
		Lower Limit	Upper Limit
Alamayehu et al. (2020)	0.36	0.21	0.62
Angasu et al. (2022)	0.03	0.02	0.05
Bitew et al. (2017)	0.44	0.20	0.97
Gedamu et al. (2017)	1.61	1.12	2.31
Hashi et al. (2016)	0.24	0.16	0.36
Mamo et al. (2014)	0.52	0.07	3.86
Mengistie et al. (2013)	0.87	0.57	1.33

From table 4 it can be seen the summary of primary research regarding the effect of the availability of latrines on the incidence of diarrhea, a meta-analysis was carried out on 8 articles originating from the country of Ethiopia. The largest research population was found in a study conducted by Angasu et al. (2022), namely 2,233 children under five, and the study with the smallest population, namely the study conducted by Mernie et al. (2022) as many as 448 children under five.

Table 5 showed the effect sizes of the primary studies used in the meta-analysis, with largest adjusted odd ratio conducted by Gedamu et al. (2017) is 1.61, and the lowest aOR conducted by Angasu et al. (2022) is 0.03.

Figure 5 showed that there is an effect of the availability of latrines on the incidence of diarrhea in children under five and this effect is statistically significant. The availability of latrines can reduce the incidence of diarrhea by 0.38 times compared to the unavailability of latrines (aOR= 0.38; 95% CI= 0.15 to 0.96; p= 0.04). The forest plot in Figure 5 shows heterogeneous variations in effect estimates (I^2= 97%; p< 0.001). Thus the calculation of the average

effect estimate is carried out using the random effect model approach.

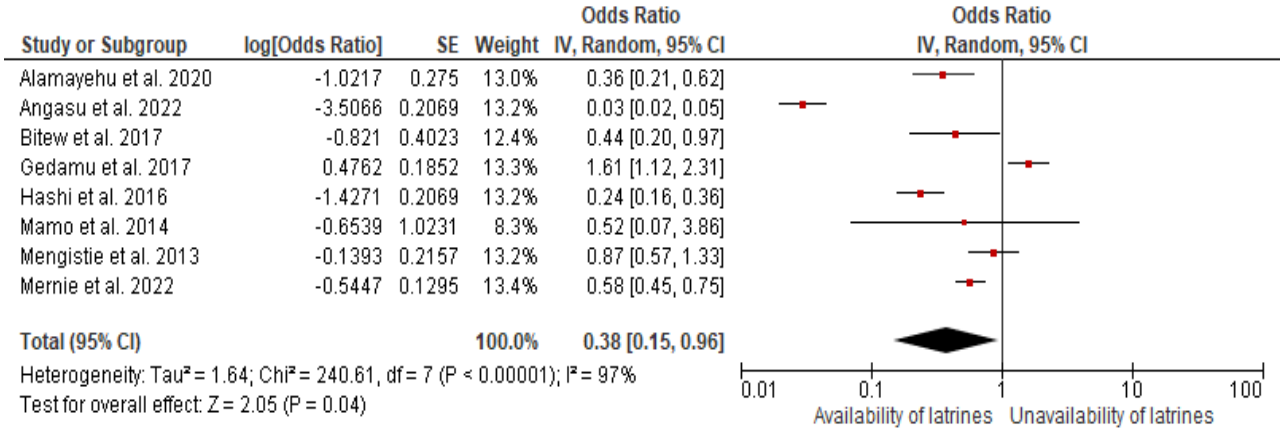

Figure 5. Forest Plot the effect of availability of latrines on the incidence of diarrhea.

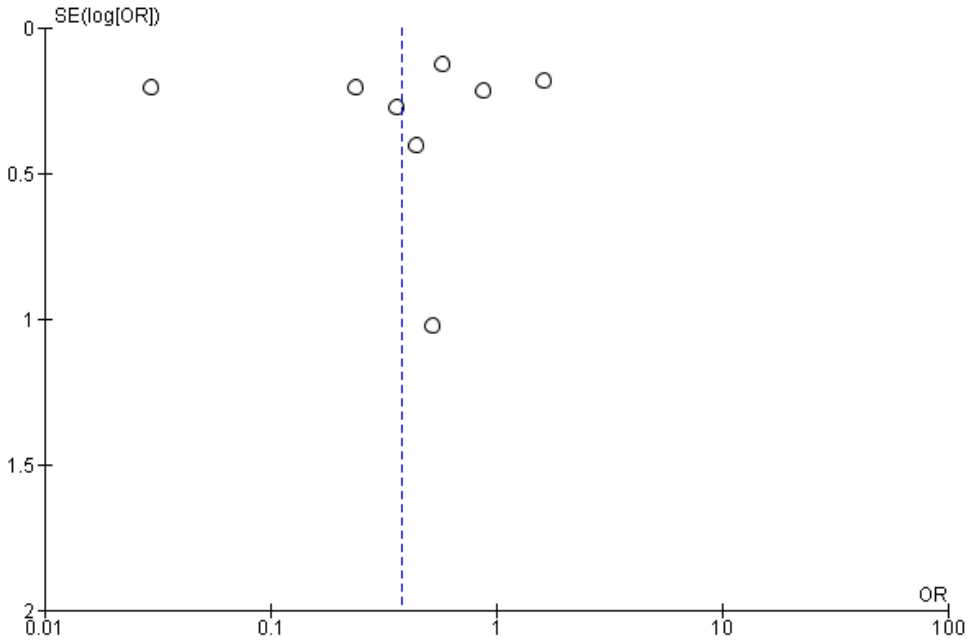

Figure 6. Funnel plot the effect of availability of latrines on the incidence of diarrhea.

The funnel plot in Figure 6 shows the asymmetrical distribution of effect estimates. The distribution of effect estimates lies more to the right of the estimated average vertical line, thus indicating publication bias. Because the distribution of effect estimates is located to the right of the average vertical line in the funnel plot which is the same as the average effect estimate in the forest plot which is located on the left, the publication bias tends to overestimate the true effect.

DISCUSSION

According to the World Health Organization (WHO), diarrheal disease is a disease characterized by loss of body fluids within 24 hours and the frequency of defecation is

more than three times a day (WHO, 2013). Diarrhea is the second leading cause of death in children under the age of five worldwide after pneumonia. There are 1.7 billion cases of diarrhea globally and cause around 525,000 under-five deaths each year (WHO, 2017).

Diarrheal disease is a major problem in developing countries, including Indonesia. Apart from being a cause of death, diarrhea is also a major cause of malnutrition which can cause death and can cause extraordinary events. Some of the factors that cause diarrheal disease are caused by bacteria through contamination of food and drink contaminated with feces and or direct contact with sufferers. In addition, the most dominant factors contributing to diarrheal disease are water, food sanitation, family latrines, and water (Melvani et al., 2019).

This systematic study and meta-analysis research raised the theme of the influence of handwashing with soap and the availability of latrines on the incidence of diarrhea in toddlers. The dependent variable analyzed was the incidence of diarrhea. The independent variables analyzed were the behavior of washing hands with soap and the availability of latrines.

1. **The Effect of Handwashing with Soap Behavior on the Incidence of Diarrhea**

A total of 8 observational research articles with a cross-sectional study design as a source of meta-analysis of the effect of hand washing with soap on the incidence of diarrhea. This study shows the results of the analysis that mothers who wash their hands with soap can reduce the incidence of diarrhea in children under five by 0.31 times compared to mothers who do not wash their hands with soap (aOR= 0.31; 95% CI= 0.17 to 0.57; p= 0.001). The forest plot in Figure 4.3 shows a homogeneous variation in effect estimates (I2=86%; p<0.001). The heterogeneity of the research data shows I^2= 86% so that the spread of the data is stated to be heterogeneous (random effect model).

According to Feleke et al. (2022) found that mothers who had a habit of washing their hands with soap tended to reduce the incidence of diarrhea in children under five by 0.34 times compared to mothers who washed their hands only with water (aOR= 0.34; 95% CI= 0.15 to 0.77; p= 0.001). Apart from washing hands with soap, there are several factors that can reduce the incidence of diarrhea in toddlers, such as feeding children immediately after cooking, how to wash hands, and sources of drinking water.

Another similar study conducted by Dagnew et al. (2019) children under five who have mothers with the habit of washing hands with soap both before feeding and after feeding their children tend to be less likely to develop diarrhea, which is 0.22 times. Hand washing with soap is proven to be effective in reducing the incidence of diarrhea in children under five because it can kill germs and bacteria and viruses that can cause diarrhea in children.

This research is not in line with the research conducted by Degebasa et al. (2018), who found that washing hands with soap or ash can increase the risk of diarrhea by 1.06 times compared to washing hands only with water. This can happen due to poor hand washing and lack of knowledge about how to wash hands properly and correctly.

2. **The Effect of Availability of Latrines on the Incidence of Diarrhea**

A total of 8 observational research articles with a cross-sectional study design as a source of meta-analysis of the effect of the availability of latrines on the incidence of diarrhea. This study shows that the availability of latrines can reduce the incidence of

diarrhea by 0.38 times compared to the unavailability of latrines (aOR= 0.38; 95% CI= 0.15 to 0.96; p= 0.04). The forest plot in Figure 4.5 shows heterogeneous variations in effect estimates (I^2= 97%; p< 0.001). The heterogeneity of the research data shows I^2= 94% so that the spread of the data is stated to be heterogeneous (random effect model).

According to Alamyehu et al. (2020) explained that children who have latrines available around their homes have a lower risk of developing diarrhea than children who do not have latrines around their homes, so the risk of diarrhea can decrease. There is a significant relationship between the availability of latrines and the incidence of diarrhea in children (Angasu et al., 2022).

This is supported by research by Mengistie et al. (2013) children who have facilities at their homes tend to be less likely to get diarrhea, the availability of latrines can reduce the incidence of diarrhea in children under five. The results of this study are in line with research conducted by Hashi et al. (2016) which stated that the availability of latrines can reduce the risk of diarrhea in children under five (aOR= 0.24; 95% CI 0.16 to 0.36; p < 0.001). The research is in line with that conducted by Bitew et al. (2017) which explains that children whose homes do not have latrines have a 2.27 times greater risk of developing diarrhea compared to children whose homes have latrines.

This research is not in line with the research conducted by Gedamu et al. (2017) which explains that the availability of latrines alone does not make a major contribution to preventing diarrhea in children, but it is their proper use that is important. The availability of latrines can increase the risk of diarrhea in children by 1.61 times (aOR = 1.61; 95% CI 1.12 to 2.31; p <0.001).

AUTHOR CONTRIBUTION

Dyah Ayu Fatmawati as a researcher who selects topics, searches for and collects research data. Sumardiyono and Bhisma Murti analyzed the data and reviewed research documents.

FUNDING AND SPONSORSHIP

This study is self-funded.

CONFLICT OF INTEREST

There is no conflict of interest in this study.

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REFERENCES

Alemayehu M, Alemu T, Astatkie A (2020). Prevalence and determinants of diarrhea among under-five children in Benna Tsemay District, South Omo Zone, Southern Ethiopia. Adv. public health. 2020: 1–11. Doi: 10.1155/2020/423¬7368.

Alto AA, Godana W, Gedamu G (2020). Impact of community-led total sanitation and hygiene on prevalence of diarrheal disease and associated factors among under-five children: a comparative cross-sectional study in selected woredas of Gamo Gofa Zone, southern Ethiopia. Adv. Public Health, 2020: 1-12. doi: 10.1155/2020/8237101.

Angasu K, Dame KT, Negash A (2022). Diarrheal morbidity and associated factors among under-five children in Southwest Ethiopia . Institution based cross-sectional study. Europe PubMed Central, 22: 1-22 doi: 10.21203/rs.3.rs-1210060/v1.

Bitew BD, Woldu W, Gizaw Z (2017).

Childhood diarrheal morbidity and sanitation predictors in a nomadic community. Ital. J. Pediatr. 43: 1-8. doi: 10.1186/s1305¬2-017-0412-6.

Degebasa MZ, Weldemichael DZ, Marama MT (2018). Diarrheal status and associated factors in under five years old children in relation to implemented and unimplemented community-led total sanitation and hygiene in Yaya Gulele in 2017. Pediatric Health Med. Ther. 2018(9): 109-121. doi: 10.2147/-PHMT.S159366.

Dagnew AB, Tewabe T, Miskir Y, Eshetu T, Kefelegn W, Zerihun K (2019). Prevalence of diarrhea and associated factors among under-five children in Bahir Dar city, Northwest Ethiopia, 2016. BMC Infect. Dis. 19 (417): 1–7. Doi: 10.1186/s12879-019-4030-3.

Fajriyati A, Rany N, Yunita J, Dewi O, Leonita E (2021). The Relationship of Community-Based Total Sanitation with Stunting Incidences in Toddlers. J Health Promot Behav. 06(03): 224-232. Doi: 10.26911/thejhpb.2021.06.-03.06.

Feleke Y, Legesse A, Abebe M (2022). Prevalence of diarrhea, feeding practice, and associated factors among children under five years in Bereh District ,2022. Infect Dis Obstet Gynecol. 2022: 1-13. Doi: 10.1155¬/2022-/4139648.

Gedamu G, Kumie A, Haftu D (2017). Magnitude and associated factors of diarrhea among under five children in Farta Wereda. Qual Prim Care. 25(4): 199–207. Doi: 10.0430/s77261.

Gizaw Z, Woldu W, Bitew BD (2017). Child feeding practices and diarrheal disease among children less than two years of age of the nomadic people in Hadaleala District, Afar Region, Northeast Ethiopia. Int. Breastfeed. J. 12 (24): 1–10. Doi: 10.1186/s13006-017-0115-z.

Hashi A, Kumie A, Gasana J (2016). Prevalence of diarrhoea and associated factors among under-five children in Jigjiga District, Somali Region, Eastern Ethiopia. Open J. Prev. Med. 6: 233–246. Doi: 10.4236/ojpm.2016.-610022.

Irnawati PY, Salimo H, Dewi YLR (2018). Health Belief Model on the Choice of Medical Doctor among Mothers of Children with Diarrhea. J Health Promot Behav. 3(2): 100-108 Doi: 10.-26911/thejhpb.2018.03.02.03.

Kementerian Kesehatan RI (2017). Profil Kesehatan Indonesia 2016 (Indonesia Health Profile 2016). Jakarta: Kementerian Kesehatan.

Kementerian Kesehatan RI (2021). Cuci tangan pakai sabun turunkan kasus penyakit diare dan ISPA. (Accessed June, 2023).

Mamo A, Hailu A (2014). Assessment of prevalence and related factors of diarrheal diseases among under-five year's children in Debrebirehan Referral Hospital, Debrebirehan Town, North Shoa Zone, Amhara Region, Ethiopia. OALibJ. 1(1): 1-14. doi: 10.4236/oalib.-1100283.

Melvani RP, Zulkifli H, Faizal M (2019). Analisis faktor yang berhubungan dengan kejadian diare balita di Kelurahan Karyajaya Kota Palembang (Analysis of factors related to the incidence of toddler diarrhea in Karyajaya Village, Palembang City). Jumantik (jurnal ilmiah penelitian kesehatan), 4(1): 57-68.

Melese B, Paulos W, Astawesegn FH, Gelgelu TB (2019). Prevalence of diarrheal diseases and associated factors among under-five children in Dale District, Sidama zone, Southern Ethiopia: a cross-sectional study. BMC Public

Health. 19 (1235): 1–10. Doi: 10.118-6/s12889-019-7579-2.

Mengistie B, Berhane Y, Worku A (2013). Prevalence of diarrhea and associated risk factors among children under-five years of age in Eastern Ethiopia : A cross-sectional study. Open J. Prev. Med. 3(7): 446–453. Doi: 10.423-6/ojpm.2013.37060.

Mernie G, Kloos H, Adane M (2022). Prevalence of and factors associated with acute diarrhea among children under five in rural areas in Ethiopia with and without implementation of community-led total sanitation and hygiene. BMC pediatr. 22(1):1-16. doi: 10.1186/-s12887-022-03202-8.

Siswanto A, Murti B, Prasetya H (2022). Face Mask Wearing and Hand Washing Behavior on the Prevention of COVID-19 Infection: A Meta-Analysis. J Health Promot Behav. 07(03): 182-196. Doi: 10.26911/thejhpb.2022.07.-03.02

WHO (2013). Diarrhoeal disease. World Health Organization. (Accessed April 2023).

WHO (2017). Diarrhoeal disease. World Health Organization. (Accessed May, 2023).