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# ANALYSIS OF SANITATION AND DIARRHEA FACTORS WITH THE INCIDENCE OF STUNTING IN INDONESIA: A META-ANALYSIS STUDY

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**ABSTRACT**

**Analysis of Sanitation and Diarrhea Factors with The Incidence of Stunting in Indonesia.** Stunting is a significant public health problem for toddlers in developing countries. The prevalence of stunting in Indonesia in 2018 was 30.8%. Referring to the target of the National Medium-Term Development Plan (RPJMN) in 2019, the stunting rate of 28% has yet to be achieved. Determinants of stunting include direct and indirect factors. Direct factors are nutritional intake and infectious diseases. Indirect factors are food adequacy, parenting, sanitation, clean water, and essential health services. This study aims to summarize scientific evidence related to the relationship between sanitation and diarrhea factors and stunting in toddlers. This study uses meta-analysis, and article sources come from Google Scholar, Science Direct, and PubMed. Based on the inclusion requirements of the writing, namely informing about sanitation and diarrhea with stunting cases in toddlers, observational research designs, and publication years 2018–2022, 15 articles were obtained. Based on the meta-analysis results, sanitation (clean water) was the highest risk factor, with a pooled value of PR = 4.437 (95% CI 0.67–2.30). The lowest risk factor was latrines, with a pooled PR = 2.459 (95% CI -0.04–1.39). Analysis of diarrhea variables with pooled value PR = 1,404 (95% CI 0.12–0.56). It was concluded that the most significant risk was the clean water factor. Essential factors to control stunting risk are preparing the availability of clean water, advocating for local governments to take a leading role in providing clean water to areas in need, initiating behavior change, and increasing awareness about stunting risks as part of prevention programs.



## INTRODUCTION

In low-income countries, the range of more than 200 million babies born is at risk of not reaching its full potential [(1)]. In developing countries, stunting is a significant public health problem for toddlers. Estimates place the number of stunted children under five at 21.9%, with 81.7 million in Asia and 58.8 million in Africa falling into this category [(2)]. Chronic malnutrition and recurrent infections cause stunting, a disorder of children's growth and development characterized by their length or height falling below the Minister of Health's standard [(3)].

According to Riskesdas data from 2018, the prevalence of stunting among toddlers in Indonesia is 30.8%, which equates to approximately 7.8 million toddlers. The prevalence of stunting decreased in 2018 compared to 2013, with a percentage of 37.2%, consisting of

18.0% very short and 19.2% short. However, the National Medium-Term Development Plan (RPJMN) in 2019 failed to achieve its target of a 28% stunting rate in children under five [4].
Several determinant factors, including direct, indirect, and fundamental factors, influence the nutritional status of toddlers with malnutrition and poor nutrition, putting them at high risk of stunting. The main cause of malnutrition is a lack of food, and the variety of food does not contain the nutritional value that the body needs. Diseases resulting from the introduction of microorganisms into the body lead to health disturbances that hinder optimal performance and obstruct the absorption of nutrients necessary for toddler growth [5].
The family's economic situation is closely related to home sanitation, nutritious food provision, and access to health services for pregnant women and toddlers. Poor sanitation and a poor-quality food supply increase the risk of infectious diseases. For example, diarrhoea has the effect of disrupting the absorption of nutrients in the digestive process. Due to diarrhoea, the baby or toddler loses weight. If diarrhoea lasts for a long time and is not accompanied by enough nutritious food for the healing process, it has the potential to make children stunted [6].
According to research, the proportion of infants and toddlers with diarrhea for three consecutive months who experience stunting is higher than that of healthy toddlers for three months. For toddlers with diarrhea for 3 months, the risk of stunting is 1,167 times greater than that of healthy toddlers in the last 3 months [7].
Other factors that contribute to stunting include the availability of nutritious food, how to educate children, environmental health and sanitation, clean water, and basic health services. Insufficient food for families can potentially disrupt their nutritional status, as healthy food plays a crucial role in meeting the nutritional needs of family members. How can we educate parents, particularly mothers, about the factors that contribute to the emergence of stunting, such as malnourished feeding habits, a lack of psychosocial activities, poor environmental health sanitation, and limited access to health facilities [5].
Basic sanitation is one of the important government programs to improve its quality to accelerate stunting reduction [3]. A study showed that there was a significant relationship between the availability of latrines that met hygiene and sanitation requirements and stunting in children aged 24-59 months in Bugis Village, Tanjung Pinang City. One of the influencing factors is that inadequate toilets lead to the discharge of faecal contaminants directly into the soil and into seawater. This can then lead to frequent diarrheal diseases that can contribute to children's growth and development, resulting in stunting [4].
Given the context, the researcher aims to investigate the correlation between sanitation and diarrhea factors, as well as the prevalence of stunting in Indonesia, through a meta-analysis study.

## MATERIALS AND RESEARCH METHODS

This study uses a meta-analysis method to summarize scientific evidence linking sanitation factors and diarrhea with stunting in toddlers. The review question in this meta-analysis study is how sanitation and diarrhea factors relate to the incidence of stunting. The population of the article is the entire age group of toddlers, covering regions in Indonesia and the world, developed into the keyword of disbursement: children OR children OR young. Exposure uses the words sanitation, hygiene, clean water, or diarrhea. The review results indicate a case of stunting.
The literature search for scientific publications utilizes several electronic databases, including Google Scholar, Science Direct, and PubMed, and employs the keywords "stunting," "sanitation," and "diarrhea." Characteristics of inclusion writing: giving rise to elements of sanitation and diarrhea that have the potential to cause stunting in toddlers, observational research design, publication year 2018-2022 with full text format in pdf form. Elements of sanitation include the use of healthy latrines, the status of healthy latrines, the habit of defecating indiscriminately, and the habit of throwing toddler feces in healthy latrines,

including the factor of clean water consumed and the habit of washing hands with soap (CTPS). The focus of diarrhea factors is on the incidence of diarrhea associated with stunting. The steps to trace to the determination of selected articles use the preferred reporting items for the systematic reviews and meta-analysis (PRISMA) method, as shown in the diagram below:

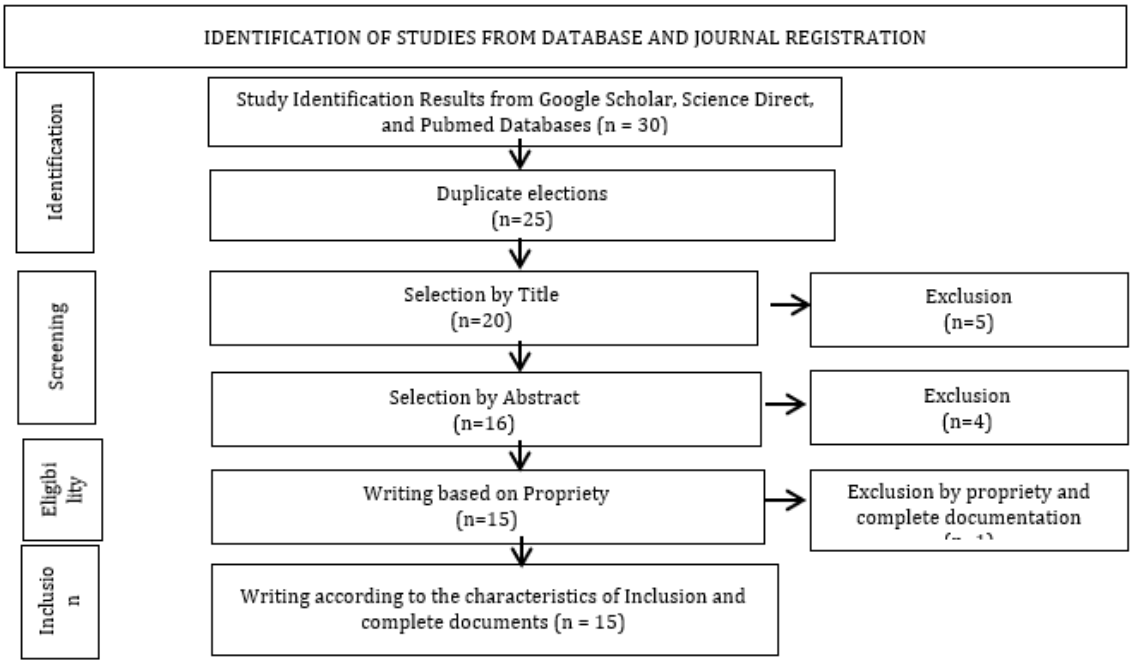


Figure 1. Prisma Flow Diagram Article Search Process

We analyzed secondary data from the search results of selected research articles. Sanitation and diarrhea risk factors are independent variables. The bounding variable is stunting.

The meta-analysis process involves several steps, including extraction. We convert the selected data into tabular formats, which include the author, year of publication, number of samples, exposure, outcome, and p-value of each article's result. Then the analysis continued. Data analysis uses either a fixed effect model or a random effect model. The software for meta-analysis uses JASP version 0.9.2. A forest plot diagram presents an overview of the study's results, explaining the combined impact of each analysed variable.

## RESEARCH RESULTS AND DISCUSSION

The article selection and propriety determination results yielded 15 original research papers that satisfied the inclusion requirements for further review. The reviewed papers used the observational study research method (*cross-sectional*). The extraction table below compiles a summary of the selected papers.

Table 1. Data Extraction Results

| Author / Year | Research Title | Research Location | Variable (VI and VD) | Research Design | Sample | Results of Analysis | Assessment of Literature |
|---|---|---|---|---|---|---|---|
| Ademas., et al (2021)(2) | Water, sanitation, and hygiene as a priority intervention for stunting in under-five children in northwest Ethiopia: a community-based cross-sectional study | Ethiopia | VI:<br>- Availability of toilet facilities<br>VD:<br>Stunting | Cross-Sectional | 630 children aged 24-59 months | Inadequate drinking water sources, poor sanitation, poor hygiene practices, diarrhea statistically related to stunting (P value = 0.001) | Factors that were significantly associated with stunting in Ethiopia were illiterate fathers and mothers, premarital births, the number of family members more than five, the mother's height was less (<150 cm), poor drinking water sources, poor sanitation facilities and hygiene practices, diarrhoea in toddlers at 2 weeks prior to the data collection period. |
| Ahmadi et al., 2020(4) | Association Between Toilet Availability and HandWashing Habits and the Incidence of Stunting in Young Children in Tanjung Pinang City, Indonesia | Tanjung Pinang | VI:<br>- Availability of toilet facilities<br>VD:<br>Stunting | Cross-Sectional | 82 children aged 24-59 months | The existence of unqualified latrines (P=0.016) is related to cases of stunting of children aged 24-59 months | The Existence of Latrines and Handwashing Behavior is Related to Stunting in Early Childhood in Tanjung Pinang City, Indonesia |
| Beauty Rahayu.,et al, 2019(8) | The Relationship between the Characteristics of Toddlers, Parents, Hygiene and Environmental Sanitation on Stunting in Toddlers | Malay Village | VI:<br>- Environmental sanitation<br><br>VD: Stunting | Cross Sectional | 76 Mothers of toddlers | Environmental sanitation (p value = 0.000) is significantly related to stunting cases of toddlers in sub-districts Malay Village. | Poor environmental sanitation conditions related to stunting cases in toddlers, efforts are needed to improve environmental sanitation to prevent the emergence of sick toddlers who have the potential to reduce the nutritional status of toddlers |
| Dedi Mahyudin.,et al, 2020(9) | The Relationship between Hand Washing Habits, Managing Drinking Water and Food with Stunting in Sulawesi Te | Central Sulawesi | VI:<br>- CTPS<br>- Drinking Water & Food<br><br>VD: Stunting | Cross Sectional | 289 Mothers of toddlers | There is a relationship between hand washing with soap, drinking water and food management and stunting in Central Sulawesi (p = 0.000) | Environmental factors related to stunting in Central Sulawesi are hand washing with soap, drinking water management |
| Fanni Hanifa.,et al, 2021(10) | Relationship between Environmental Sanitation, Birth Weight and Birth Length with Stunting in | Manggarai NTT | VI:<br>- Environmental sanitation<br><br>VD: Stunting | Cross Sectional | 80 Toddler Mothers | There is a relationship between environmental sanitation, birth weight and birth length and | Environmental sanitation factors, birth weight and birth length are related to stunting at the age of 25 – 72 months in the |

| Author / Year | Research Title | Research Location | Variable (VI and VD) | Research Design | Sample | Results of Analysis | Assessment of Literature |
|---|---|---|---|---|---|---|---|
| | Children Aged 25-72 Months | | | | | stunting in children aged 25-72 months in Working Area of Pagal Health Center, Manggarai Regency, NTT in 2020 | working area of the Pagal Health Center, Manggarai Regency |
| Fenti Dewi Pertiwi., et al 2019(11) | isk Actors of tunting in oddlers in illage Iulyaharja Year 019 | Bogor | VI:<br>- CTPS<br>- Diarrhea<br><br>VD:<br>Stunting | Cross-Sectional | 47 Bali | The potential to increase the incidence of stunting in toddlers in Mulyaharja Village includes: sometimes washing hands before eating, history of diarrhea | Conditions that affect stunting of toddlers in Mulyaharja Village: Female gender, MP-Breastfeeding 1 time per day, Mother rarely washes hands before eating, diarrhea, cough in the last 3 months, lack of maternal knowledge, unemployed father, minimal income |
| Livia Amelia Halim Sarah M. Warouw Jeanette I. Ch. Manoppo, 2018 (12) | The Relationship between Risk Factors and Stunting In Children Aged 3-5 Years in Kindergarten/ Early Childhood Tuminting District | Manado | VI:<br>- CTPS<br>- Diarrhea<br><br>VD:<br>Stunting | Cross-Sectional | 80 Toddler Mothers | There is a meaningful connection between the risk factors for parental income and stunting. Where, the lower the income of parents, the higher the risk of stunting. | Based on the results of research conducted at Kindergarten/PAUD in Tuminting Manado District, it is known that the factors related to the incidence of stunting are parents' income and history of diarrhea |
| Mima Salamah.,et al, 2020(13) | actors Affecting ıe Incidence of tunting in the Vorking Area of ıe Sur Health enter | Bukittinggi | VI:<br>- Environmental sanitation<br><br>VD:<br>Stunting | Cross-Sectional | 92 mothers of toddlers | There was a significant relationship between stunting and exclusive breastfeeding (P Value 0.000, CI 1,387-2,722), Sanitation (P Value 0.000, CI 1,213-2,953) and Nutritional Status (P Value 0.018, CI 1,159-1,659) | Stunting was 7,743 times more likely in respondents who had unqualified sanitation facilities compared to respondents who had qualified sanitation facilities |
| Musyayadah.,et al, 2019(14) | Analysis of the Relationship between Family Food Security and Frequency of Diarrhea and Stunting to Toddlers in Surabaya Village | Surabaya | VI:<br>- Frequency of Diarrhea<br><br>VD:<br>Stunting | Cross-Sectional | 52 mothers of toddlers | There is a significant relationship between Frequency diarrhea with stunting (p=0.,01). | This study explains the conclusions that there is a significant relationship between frequencies Diarrhea with stunting in toddlers aged 6-24 months |
| Niswatul Mukarama, Marjan Vahini, | The Relationship between Environmental | Samarinda | VI:<br>- Environmental | Cross-Sectional | 79 mothers under | The Chi-Square test was obtained with a p-value of 0.005, which | This study concluded that there was a significant |

| Author / Year | Research Title | Research Location | Variable (VI and VD) | Research Design | Sample | Results of Analysis | Assessment of Literature |
|---|---|---|---|---|---|---|---|
| 2019 (15) | Conditions and the Incidence of Stunting in Toddlers at Rt 08, 13 and 14 Mosque Village, Samarinda Seberang District 2019 | | Conditions<br><br>VD: Stunting | | five | means that there is a relationship between environmental conditions and stunting incidence | relationship between environmental conditions and stunting cases in Mosque Village, Samarinda Seberang District in 2019 |
| Novia Susianti, Weni Lestari, 2020 (16) | Predicting Stunting in Toddlers In East Tanjung Jabung Regency | Jambi | VI:<br>- Healthy latrines<br>- CTPS<br><br>VD: Stunting | Cross-Sectional | 165 mothers of toddlers | The strongest predictor factors in predicting stunting events are, those who do not have healthy latrines are at risk 5 times, mothers or caregivers who do not wash their hands in preparing food for toddlers are at risk of suffering from stunting 4 times a p-value of 0.005 | Factors related to the incidence of stunting were found to be health care (behavior of washing hands and weighing toddlers to posyandu) and sanitation (SPAL, family latrines and the availability of clean water) |
| Rani Marianaet al., 2021 (17) | The relationship between basic sanitation and the incidence of stunting in the working area of the health center Yosomulyo, Metro sub-district of Metro city center in 2021 | Metro | VI:<br>- Basic Sanitation<br><br>VD: Stunting | Cross-Sectional | 119 toddlers | There is a healthy latrines relationship (p value = 0.006; OR = 3,895), clean water facilities (p value = 0.015; OR = 3.574), pembuangan sampah (p value = 0.004; OR = 4.884) dan SPAL (p value = 0.041; OR = 2,854). | The condition of latrines that do not meet health requirements, unhealthy clean water facilities, the behavior of throwing / piling up garbage next to the house without treatment and household wastewater disposal facilities do not meet the requirements significantly |
| Sri Wahyuni Abidin, Haniarti, Rasidah Wahyuni Sari, 2021 (18) | Relationship between Environmental Sanitation and History of Infectious Diseases Stunting Incidence in Parepare City | It seems to be | VI:<br>- Environmental sanitation<br>- Infectious diseases<br><br>VD: Stunting | Cross-Sectional | 275 toddlers | There was no significant relationship between the availability of clean water sources (p = 0.319), ownership family latrines (p = 0.588), history of diarrhoeal disease (p = 0.245), and history of ISPA disease (p = 0.988) with Stunting Incidence | There is no relationship in this study because almost all respondents have had good family latrines such as Toilets with strong buildings, gooseneck type, and septic tanks |
| Wulan Angraini., et al, 2021 (19) | Mother's Knowledge, Access to Clean Water and Diarrhea with Stunting at the Mumpo Central Bengkulu Rules Health Center | Bengkulu | VI:<br>- Access to clean water<br>-Diarrhea<br><br>VD: Stunting | Cross-Sectional | 88 toddlers | The Chi-square test showed a P value of 0.038 (p-value < 0.05), meaning that there was a relationship between access to clean water | Maternal knowledge factors and access to clean water are related to stunting events but diarrhea factors are not related to stunting events in the |

| Author / Year | Research Title | Research Location | Variable (VI and VD) | Research Design | Sample | Results of Analysis | Assessment of Literature |
|---|---|---|---|---|---|---|---|
| | | | | | | facilities and the incidence of stunting The Chi-square test showed a P value of 0.237 (p-value > 0.05), meaning that there was no relationship between the incidence of diarrhea and the incidence of stunting | Working Area of the Mumpo Rules Health Center, Central Bengkulu Regency |
| Wulandari., et al, 2019(20) | Relationship between Environmental Sanitation and History of Infectious Diseases and Incidence Stunting in the Working Area of the Kerkap Health Center, North Bengkulu Regency | Bengkulu | VI:<br>- Environmental sanitation<br>- Infectious diseases<br><br>VD:<br>Stunting | Cross-Sectional | 91 mothers of toddlers | There is a relationship between environmental sanitation and stunting incidence. value (0.008) (OR=3.8; 95% CI= 1.5-10.04), and there was a relationship between the history of infectious diseases and the incidence stunting with p value (0.000) (OR=15.21; 95% CI= 4.6-49.4) in the working area of the Kerkap Health Center North Bengkulu Regency | Based on the results of research on environmental sanitation factors and a history of infectious diseases with stunting incidence in the Kerkap Health Center Working Area, North Bengkulu Regency in 2019 |

## Sanitation Variable (Clean Water)

Table 2.1 Heterogeneity Test Matrix of Sanitation (Clean Water) and Stunting Meta-Analysis

Fixed and Random Effects

| | Q | df | p |
|---|---|---|---|
| Omnibus test of Model Coefficients | 12.71 | 1 | <.001 |
| Test of Residual Heterogeneity | 446.82 | 5 | <.001 |

*Note.* *p* -values are approximate.

Residual Heterogeneity Estimates

| | Estimate | Lower Bound | Upper Bound |
|---|---|---|---|
| $t^2$ | 1.0111 | 0.3786 | 6.0563 |
| $T$ | 1.0055 | 0.6153 | 2.4609 |
| $I^2$ (%) | 98.6149 | 96.3843 | 99.7661 |
| $H^2$ | 72.1965 | 27.6570 | 427.4655 |

The above matrix shows that the *p-value* in the *heterogeneity* test is smaller than 0.05, namely p < 0.01, which indicates that the variation between the studies is heterogeneous, followed by analysis using *the Random Effect Model*. The heterogeneity percentage stands at 98.6%.

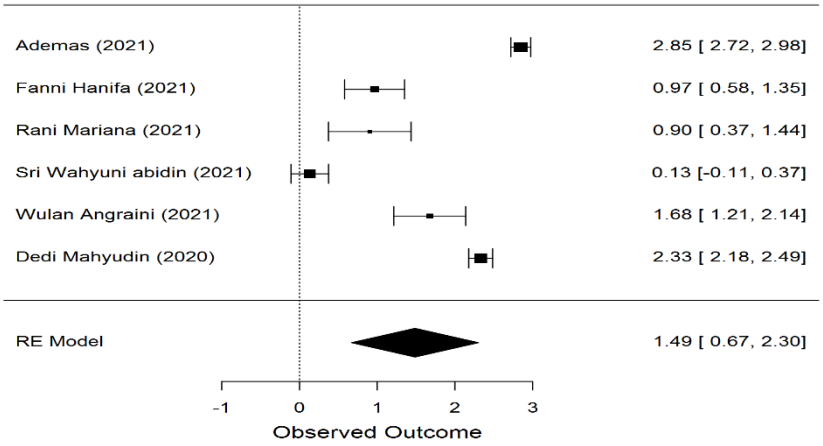


Figure 2 (a) Forest plot of sanitation factor (clean water) with stunting cases.

Figure 2(a) displays the findings of a study that looked at six research articles about sanitation risk factors (clean water) used by family members who had stunting events. The total PR value was 4,437, with a 95% confidence interval of -0.67 to 2.30. Poor availability of clean water has a 4,437 times greater risk of stunting in toddlers than families with easy access to clean water.

**Sanitation Variable (Hand Washing Habits with Soap)**

Table 2.2 Heterogeneity Test Matrix of Sanitation Meta-Analysis (Hand Washing Habits with Soap) with Stunting

Fixed and Random Effects

| | Q | df | p |
|---|---|---|---|
| Omnibus test of Model Coefficients | 16.23 | 1 | <.001 |
| Test of Residual Heterogeneity | 20.43 | 3 | <.001 |

*Note.* *p* -values are approximate.

**Residual Heterogeneity Estimates**

| | Estimate | Lower Bound | Upper Bound |
|---|---|---|---|
| $t^2$ | 0.1985 | 0.0334 | 4.4545 |
| $T$ | 0.4456 | 0.1829 | 2.1106 |
| $I^2$ (%) | 87.5768 | 54.2869 | 99.3718 |
| $H^2$ | 8.0495 | 2.1876 | 159.1826 |

The above matrix shows that the *p-value* in the *heterogeneity* test is smaller than 0.05, namely p < 0.01, which indicates that the variation between the studies is heterogeneous, followed by analysis using *the Random Effect Model*. The heterogeneity percentage is 87.6%.

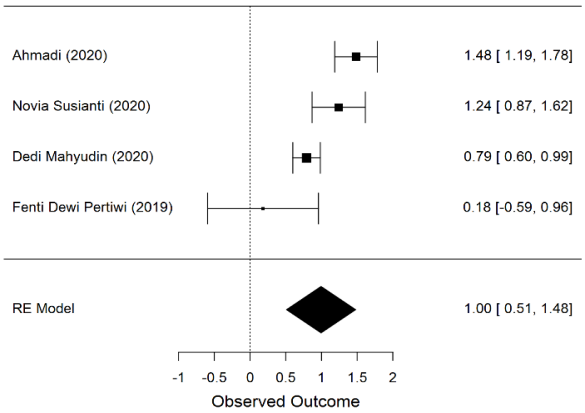


Figure 2 (b) Forest plot of sanitation factors (the habit of washing hands with soap) with stunting incidence.

The results of the analysis of 4 research articles about sanitation risk factors (like washing hands with soap) are shown in Figure 2(b). The pooled PR value for stunting incidence is 2,718 (95% CI: -0.51 to 1.48). Families who don't regularly wash their hands with soap expose their toddlers to a stunting risk 2,718 times higher than those who do.

## Sanitation Variable (Latrine Access)

Table 2.3 Sanitation Heterogeneity Test Matrix (Latrine Access) and Stunting

Fixed and Random Effects

| | Q | df | p |
|---|---|---|---|
| Omnibus test of Model Coefficients | 12.67 | 1 | <.001 |
| Test of Residual Heterogeneity | 294.79 | 9 | <.001 |

*Note.* *p* -values are approximate.

**Residual Heterogeneity Estimates**

| | Estimate | Lower Bound | Upper Bound |
|---|---|---|---|
| $t^2$ | 0.5970 | 0.2621 | 2.0172 |
| $T$ | 0.7727 | 0.5120 | 1.4203 |
| $I^2$ (%) | 95.3196 | 89.9415 | 98.5677 |
| $H^2$ | 21.3657 | 9.9418 | 69.8155 |

The above matrix shows that the *p-value* in the *heterogeneity* test is smaller than 0.05, namely p < 0.01, which indicates that the variation between the studies is heterogeneous, followed by analysis using *the Random Effect Model*. The heterogeneity percentage is 95.3%.

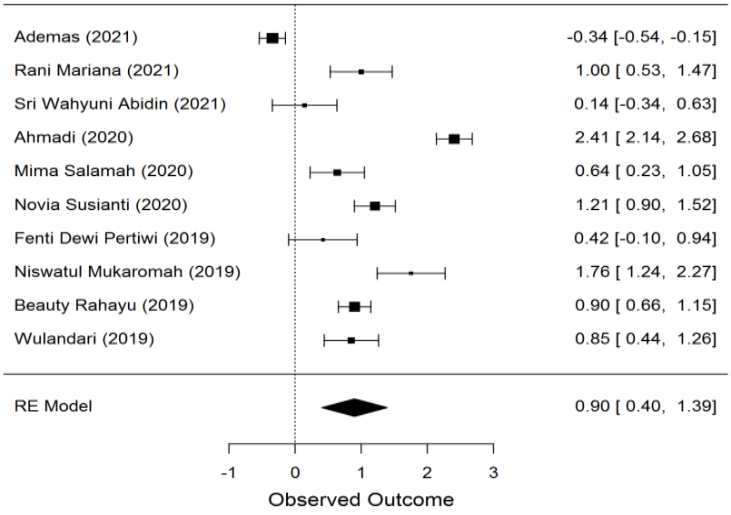


Figure 2 (c) Forest plot of sanitation factors (latrine access) and stunting cases.

There was a pooled PR value of 2.459 (95% CI -0.40–1.39) for the 10 research articles that looked at sanitation risk factors (access to healthy toilets) for family members with stunting events. This is shown in Figure 2(c). Unhealthy latrine access factors have a 2,459 times greater risk of experiencing stunting in toddlers than families who have healthy latrine access.

**Diarrhea Variables**

Table 2.4 Heterogeneity Test Matrix of Meta-Analysis of Diarrhea and Stunting

| Fixed and Random Effects | | | |
|---|---|---|---|
| | Q | df | p |
| Omnibus test of Model Coefficients | 5.134 | 1 | 0.023 |
| Test of Residual Heterogeneity | 5.610 | 3 | 0.132 |

*Note.* *p* -values are approximate.

The above matrix shows that the *p-value* in the *heterogeneity* test is greater than 0.05, namely p = 0.132. This indicates that the variation between studies is homogeneous, followed by analysis using *the fixed effect model.*

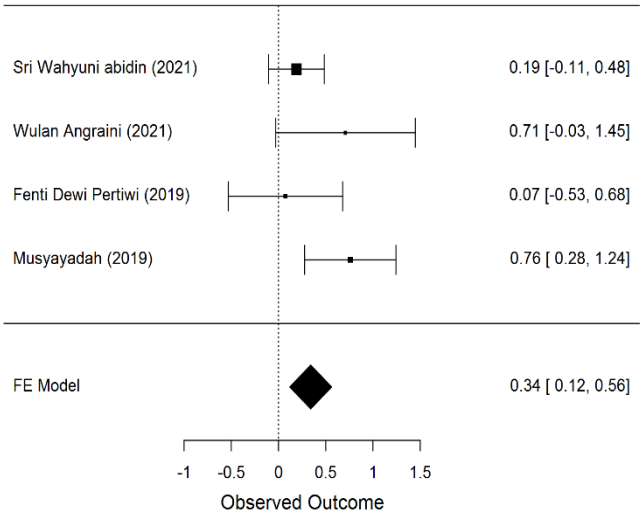


Figure 2 (d) Forest plot of diarrhea factors with stunting incidence.

The results of looking at data from 4 research papers about diarrhoeal factors are shown in Figure 2(d). The pooled PR value for stunting incidence is 1,404 (95% CI: -0.12 to 0.56). Diarrhoea factors have a 1,404 times greater risk of experiencing stunting in toddlers than toddlers who do not experience diarrhoea.

The factor of unavailability of clean water has a 4,437 times greater risk of experiencing stunting events compared to those who have access to clean water. This factor exerts the most significant influence on stunting in this study. This is consistent with a study showing that OR has a value of 5.99 times. This means that families without access to clean water sources and their toddlers have a higher risk of stunting compared to families with access to clean water sources (19). Numerous articles have concluded that the incidence of stunting in toddlers significantly correlates with the source and access to clean water and drinking water [21].

This study shows that the unusual behavioural factor of washing hands with soap has a 2,718 times greater risk of experiencing stunting events compared to those who usually wash their hands with soap. Another supporting study shows that poor hygiene practices increase the risk of stunting by 4,808 times in toddlers aged 24-59 months [23].

Another sanitation factor, namely the lack of access to healthy latrines, has the potential to cause 1,174 times more people to experience stunting than residents who always use healthy latrines. Research (24) aligns this condition with the correlation between the incidence of stunting in East Lampung Regency and access to healthy latrines. Another study also showed that toddlers who lived in communities that were habituated to not defecating indiscriminately during a critical period of growth had a 10% lower risk of stunting than toddlers who were in communities that defecated indiscriminately [25].

Diarrhoea factors have a 1,404 times greater risk of experiencing stunting events compared to those without diarrhoea, according to this study. According to research, there is a significant correlation between the frequency of diarrhoea and stunting in toddlers (p = 0.01). This means that toddlers who have experienced diarrhoea more frequently (>6 times) in the last 3 months are at a higher risk of stunting compared to those who have only experienced diarrhoea fewer than 6 times. This explains why toddlers who have never experienced diarrhoea will reduce the incidence of tunting [14]. Another study supports that a history of frequent diarrhoea in the last 3 months increases the risk of stunting events by 3,619 times in toddlers aged 24-59 months [23].

The study's findings are the relationship between sanitation and diarrhea factors, as well as the incidence of stunting. This study's material review aligns with the research findings. A meta-analysis of several articles from developing countries reveals a significant relationship between the occurrence of stunting and sanitation, which is a component of water, sanitation, and hygiene [26]. Therefore, it is crucial to focus on the issue of housing, ensuring that it meets the necessary health requirements to maintain the health of its residents. Infrastructure and related facilities, including clean water, sanitation, waste disposal, transportation, and social services, are essential for healthy housing [27].

## CONCLUSIONS AND RECOMMENDATIONS

The sanitation variable (clean water) is the highest risk factor, followed by the sanitation variable (latrines). The diarrhoea variable is also a risk factor that affects the incidence of stunting in toddlers. The results and discussions revealed that the water and sanitation factors were unsuitable, and the presence of diarrhoea cases was associated with a rise in the incidence of stunting in toddlers.

Efforts that can be made to minimise the risk factors for stunting include striving for the availability of clean water for families and advocating for local governments to take a leading role in providing clean water for areas where the percentage of stunting is significant. We aim to instigate a shift in behavior by preventing stunting. By conditioning the environment, the community aims to reduce the factors that contribute to the incidence of stunting. It is crucial to raise awareness among citizens about the significant risk that the environment contaminated with human faeces poses as a source of infectious diseases. These diseases can easily affect children, making them susceptible to illness and leading to impaired growth and development.

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