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META-ANALYSIS
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Stunting Prevention through Exclusive Breastfeeding in Indonesia: A Meta-Analysis Approach

Pencegahan Stunting *melalui Pemberian ASI Eksklusif di Indonesia: Pendekatan Meta-Analisis*

Demsa Simbolon[1]*, Nurlita Putri[1]

[1]Department of Nutrition, Poltekkes Kemenkes Bengkulu, Bengkulu, Indonesia

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Correspondent:
Demsa Simbolon
demsa@poltekkesbengkulu.ac.id

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ABSTRACT

Background: The direct cause of stunting in toddlers is nutritional intake, one of which is because babies do not receive exclusive breastfeeding for up to 6 months.
Objectives: The purpose of this study is to measure the effect of exclusive breastfeeding on stunting prevention through a meta-analysis approach.
Methods: This study uses a meta-analysis approach by searching for research articles from various databases such as Google Scholar, PubMed, and Science Direct. The keywords used are by the Medical Subject Heading (MeSH), namely "exclusive breastfeeding", "stunting", "infant", "exclusive breastfeeding", "linear growth disorder", and "stunted toddlers". The criteria for the article are publications from 2013 to 2021, can be downloaded in full text, using a cross-sectional and case-control study design, and effect size data is available in the form of Odds Ratio (OR). The process of submitting articles is presented in a PRISMA diagram. Data analysis using the Review Manager 5.4.1 application with a random effect analysis model. Presentation results in the form of forest plots and funnel plots.
Discussions: 26 research articles are worthy of analysis, consisting of 9 from international journals and 17 from national journals. The Heterogeneity test results showed a p-value of 0.00001 and an I^2 value of 85%. The results of the analysis with a random effect model were obtained from the forest plot which showed a pooled Odds Ratio of 2.90 (95% CI: 2.07-4.08), meaning that babies who did not receive exclusive breastfeeding had a 2.9 times higher risk of stunting compared to babies who received exclusive breastfeeding. These findings show a significant influence of non-exclusive breastfeeding on the incidence of stunting (p-value 0.0001 < 0.05).
Conclusions: Exclusive breastfeeding can effectively prevent stunting.

INTRODUCTION

Stunting, a serious impact of malnutrition, is suffered by children when they do not get adequate nutritional intake to meet their dietary needs. Inadequate nutritional intake in the early stages of life can lead to a higher susceptibility to disease, suboptimal body growth, and an increased risk of mortality in children[1]. A child's normal growth in length or height at an early age is a crucial indicator of optimal development, which is directly associated with the development of the nervous system in the brain[2]. Moreover, an imbalanced diet is one of the main causes of stunting. Even though breast milk is widely recognized as the optimal source of nutrition for infants, the prevalence of exclusive breastfeeding in practice remains low due to the early introduction of complementary foods (CF) before the suggested minimum age of 6 months[3]. Infants are considered to receive exclusive breast milk if they are solely breastfed without the addition of any other foods or drinks, such as water, except for medicines and vitamin and mineral supplements, as well as expressed breast milk[4].

Ensuring that infants receive exclusive breastfeeding and are weaned appropriately is essential for supporting their growth and development and protecting them from infectious diseases. Furthermore, key factors in addressing the nutritional needs of infants include breastfeeding frequency and duration, as well as the volume of breast milk given[5]. In contrast, non-exclusive breastfeeding can cause health problems and increase the risk of stunting, which can result in shorter heights for children compared to other children of their age due to inadequate nutritional intake[6]. Stunting has been found to increase the risk of disease, increase mortality rates in children, reduce cognitive ability, and cause degenerative health problems such as diabetes, hypertension, heart disease, and kidney disorders in adulthood[7].

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According to the Indonesia Nutrition Status Study (SSGI), the prevalence of stunting was 27.7% in 2019, which decreased to 24.4% in 2021 and further decreased to 21.6% in 2022[9]. Stunting remains highly prevalent in Indonesia and has not reached the target set by the 2024 National Medium-Term Development Plan, which aims for a rate below 14%[10]. Additionally, the practice of exclusive breastfeeding in Indonesia remains low, with only 48.2% of infants receiving exclusive breastfeeding in 2021, which decreased to 14.6% in 2022[9,11.] Exclusively providing breast milk is the best way to supply infants with essential nutrients, resulting in a decrease in the prevalence of childhood pain and mortality[12]. The World Health Organization (WHO) recommends that infants be exclusively breastfed from their first day of life until 6 months, continuing breastfeeding until the child is two years old or older, and introducing safe and appropriate complementary foods (MPASI) with adequate nutritional intake. The presence of inadequate nutrition is closely related to the high prevalence of malnutrition and can increase health problems and mortality, particularly in low-income countries[13].

Research conducted in Sleman Regency found that there was a significant relationship between exclusive breastfeeding and stunting incidence[14]. Moreover, research conducted in various places discovered that breast milk was not given exclusively, which has an impact on stunting[15,16,17,18]. However, quite a few research results revealed that there was no relationship between exclusive breastfeeding and stunting [19,20,21]. The existing research results remain limited, as researchers used meta-analysis to summarize and measure the extent to which non-exclusive breastfeeding affected the incidence of stunting in toddlers. The majority of previous studies were based on a literature review approach[22,23,24,25]. Therefore, the researchers aimed to synthesize the results of previous studies and employ a meta-analysis method to examine the effect of exclusive breastfeeding on the incidence of stunting in toddlers. In the preparation of the meta-analysis, searches were carried out from various sources to get access to relevant articles on the topic of this study. The researchers limited the number of research articles published in the last 8 years (2013–2021). This study aimed to investigate the effect of exclusive breastfeeding on the incidence of stunting in toddlers using a meta-analysis method. The results of this study were expected to serve as valuable evidence supporting the importance of exclusive breastfeeding in preventing stunting in toddlers.

METHODS

The application of the meta-analysis method began by conducting a comprehensive search for research articles from reputable national and international journals, which can be accessed through accredited databases such as Google Scholar, Science Direct, and PubMed. Moreover, the independent variable examined in this study was exclusive breastfeeding, while the dependent variable examined was the incidence of stunting in toddlers. Furthermore, the inclusion criteria for conducting research article searches are as follows: the articles must have been published online between 2010 and 2021, must be accessible in full text, and must be downloadable. Article searches were conducted using keywords that were organized using Boolean to either expand or narrow the search, according to Medical Subject Heading (MESH). Keywords used include “exclusive breastfeeding,” “stunting,” “infants,” “exclusive breastfeeding,” “linear growth disorders,” and “stunted toddlers.” Additionally, a total of 32,800 articles were identified from Google Scholar, while a total of 10,006 articles were identified each from PubMed and Science Direct. In the next stage, the articles were filtered based on their abstracts, with the main goal of ensuring that each article meets the specified independent and dependent variables. Articles that were not available in full text or were inaccessible were excluded from the analysis. A total of 26 articles that met the inclusion criteria were selected to be included in the Review Manager Application (RevMan).

This study controlled bias by carefully selecting research articles that met the predetermined inclusion and exclusion criteria. The selection of research articles was carried out using the Population, Intervention, Comparison, Outcome, Time, and Study (PICOTS) approach, in which the population was all mothers with toddlers, the intervention was exclusive breastfeeding, the comparison was non-exclusive breastfeeding, the result was stunting incidence, the time was limited to articles published between 2013 and 2021, and the type of study was cross-sectional and case-control. The data collected was presented in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) chart. Furthermore, data analysis was carried out using the RevMan 5.4 application, with the analysis model selected depending on the variation between the studies found, using a fixed effect model if the variation is not significant or a random effect model if the variation is significant. The results of the analysis were presented in the form of a forest plot and a funnel plot using the odds ratio (OR) effect measure. This study did not require additional ethical approval as it employed a meta-analysis design to review published research results.

DISCUSSIONS

Figure 1 illustrates the sequential steps involved in the process of selecting research articles, starting with the initial identification stage and progressing to the selection of eligible articles for review. Based on the PRISMA diagram, 26 primary research articles that examined the relationship between exclusive breastfeeding and stunting incidence were selected. These articles include research with case-control and cross-sectional study designs. Each article was assessed for quality using a critical assessment checklist tailored for research with a cross-sectional or case-control design. After assessing the quality of the article, statistical data processing and analysis were carried out using RevMan 5.4.1 software.

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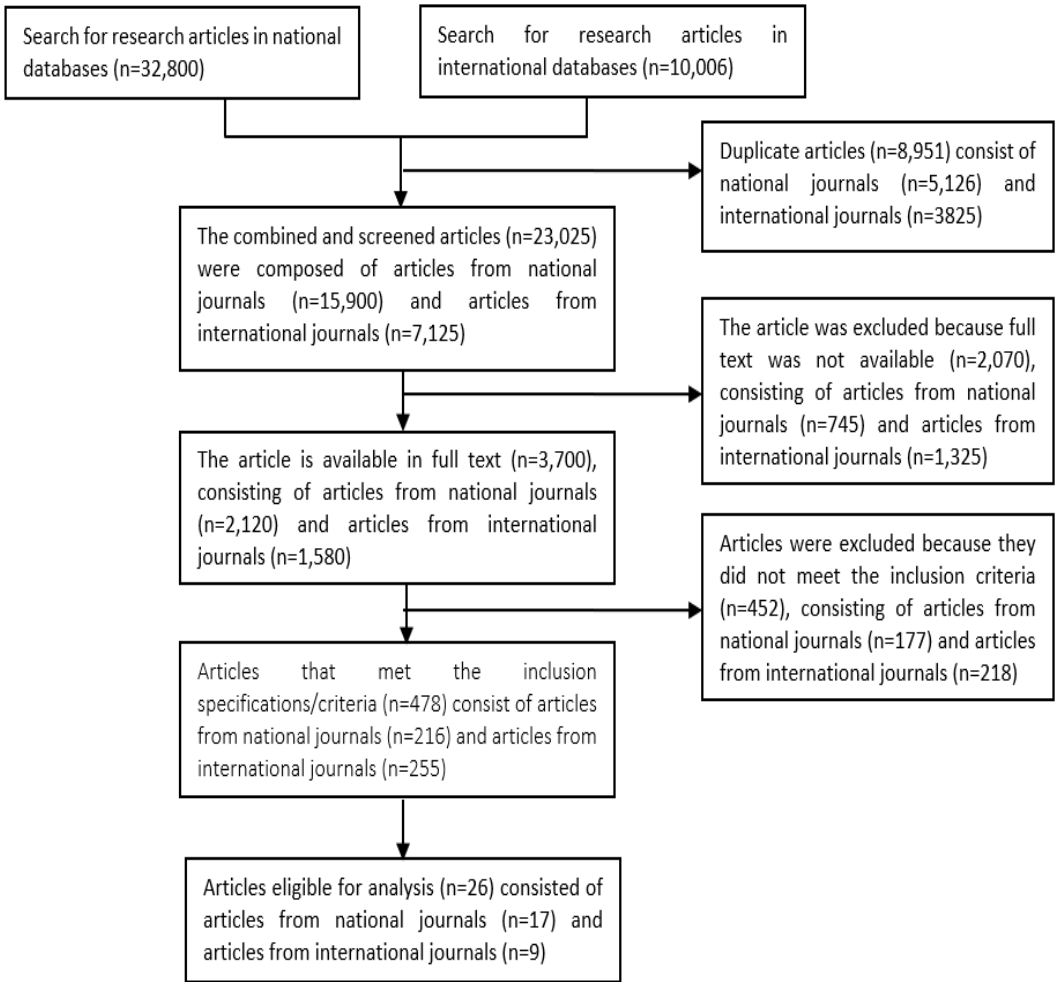

Figure 1. PRISMA Diagram of the Research Article Selection Process

Table 1 shows that 30.61% (95% CI: 7.3%-82.9%) of infants received exclusive breastfeeding, while 53.74% (95% CI: 19.6%-91.7%) of those did not receive exclusive breastfeeding. The research revealed that the *Kawangkoan Public Health Center in Minahasa* Regency had the lowest rate of exclusive breastfeeding, with a percentage of 7.3%, while those who did not receive exclusive breastfeeding reached 43.7%[26]. According to Dini Nugraheni's (2020) research, the largest percentage of exclusive breastfeeding in Central Java Province is 82.9%. Exclusive breastfeeding refers to the practice of giving infants only breast milk, without any additional liquids, for the first six months of their lives. Breast milk contains nutrients that have great benefits for infants, including protecting children from the risk of gastrointestinal infections, reducing the risk of infant mortality due to diarrhea and infectious diseases, meeting sufficient energy needs, and meeting the essential vitamin and nutrient needs of children aged 6 to 23 months[27].

Table 1. Exclusive and Non-Exclusive Breastfeeding Proportions from Selected Research Articles

Author	Exclusive Breastfeeding		Non-Exclusive Breastfeeding	
	n	%	n	%
Christin Angelina F, 2018	8	11.4	25	26.6
M Rizal Permadi, 2017	4	9.5	29	50.0
Riza Savita, 2020	30	38.0	50	61.7
Sr. Anita Sampe,SJMJ, 2020	6	8.3	66	91.7
Biruk Bogale, 2020	152	38.7	161	61.7
Fauzan I. Pratama, 2019	17	37.0	29	63.0
Aniqoh Raudlatul Wardah, 2019	39	48.8	41	51.2
Ruri Widyasari, 2018	18	40.1	12	75.0
Hana Ilmi Khoiriyah, 2021	13	24.5	19	63.3
Giyawati Yulilania Okinarum, 2021	13	16.25	27	33.75
Indah Suwartini, 2020	28	65.1	15	34.9
Dini Nugraheni, 2020	271	82.9	429	19.6

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Author	Exclusive Breastfeeding		Non-Exclusive Breastfeeding	
	n	%	n	%
Siti Wahdah, 2015	17	36.2	39	53.4
Khoirun Ni'mah, 2015	4	11.8	30	88.2
Winny Rambitan, 2014	7	7.3	41	43.7
Agus Hendra, 2013	12	25.0	36	75.0
Evi Sri Dahlianti, 2021	23	54.8	18	45.0
Resqita Chayani, 2019	27	49.1	28	50.9
Joko Sugiyanto, 2019	61	29.0	11	73.3
Baroroh Barir, 2019	17	13.9	33	42.3
Sumiaty, 2017	12	26.1	5	26.3
Ivanda Glanny, 2020	31	42.5	26	61.9
Nancy Swanida, 2020	2	3.0	50	36.5
Sri Yuliastini, 2020	58	33.7	187	43.3
Rasyika Nurul, 2021	7	23.3	23%	76.7
Nurhalina Sari, 2021	25	19.7	32	48.5
Sum	**902**	**7.3-82.9**	**1.462**	**19.6-91.7**
Average		**30.6**		**53.7**

n: Number of samples of each research article that performs exclusive breastfeeding and non-exclusive breastfeeding
%: The amount of proportion that provides exclusive breastfeeding and non-exclusive breastfeeding

Figure 2 displays the heterogeneity test results, with a p-value of 0.00001 < 0.05 and an I^2 value of 85%, indicating that the subsequent analysis used a random effect model. The forest plot featured a pooled odds ratio of 2.90 (95% CI 2.07-4.08), which showed that infants who received non-exclusive breastfeeding were 2.9 times more likely to be stunted than infants who received exclusive breastfeeding. The overall effect test results showed that exclusive breastfeeding significantly prevented the incidence of stunting in toddlers (p-value < 0.00001). The findings of this study are in line with previous research showing that exclusive breastfeeding is effective in preventing stunting in infants. According to research conducted at Bintang Sub-district, Central Aceh Regency, the lowest odds ratio is 0.23, which indicates that exclusive breastfeeding can protect against the incidence of stunting in toddlers (p-value = 0.041< 0.05)[28]. Furthermore, research conducted at *Buntu Malangka* Sub-district, Mamasa Regency, obtained the highest odds ratio value of 61.00, indicating that infants who did not receive exclusive breastfeeding are 61 times more likely to experience stunting compared to those exclusively breastfed. In addition, non-exclusively breastfed infants had a 98% risk of suffering from stunting[29].

The results of this study are consistent with the findings of research conducted at the *Manado* City Public Health Center, which show a significant relationship between exclusive breastfeeding and stunting incidence. Good breastfeeding by mothers greatly contributes to maintaining a healthy nutritional balance in children, which in turn supports optimal growth. Extensive research has shown that breast milk contains a variety of macro- and micronutrients, such as vitamins and minerals, which play a crucial role in supporting children's nutrition and growth. The composition of breast milk is highly digestible for the infant's digestive tract. In addition, research conducted at the Selo Public Health Center in *Boyolali* Regency showed a relationship between exclusive breastfeeding and the incidence of stunting in infants aged 6–24 months. This is because breast milk provides various benefits, including increasing the infant's immune system against diseases, reducing the risk of ear infections, and reducing the incidence of diarrhea and chronic constipation[30].

The findings of this study are also in line with the findings of research conducted in the working area of the *Boyolali* Regency Public Health Center, which concluded that there was a significant relationship between exclusive breastfeeding and the incidence of stunting[31]. Furthermore, research conducted in Lampung Province showed a significant relationship between exclusive breastfeeding and the incidence of stunting. Additionally, the incidence of stunting in toddlers can be influenced by exclusive breastfeeding. This is because if infants under the age of six months are given food (MPASI) other than breast milk, their intestines will be more susceptible to infectious diseases. Infants who frequently suffer from infectious diseases will experience stunted growth, thereby preventing them from achieving optimal growth[32].

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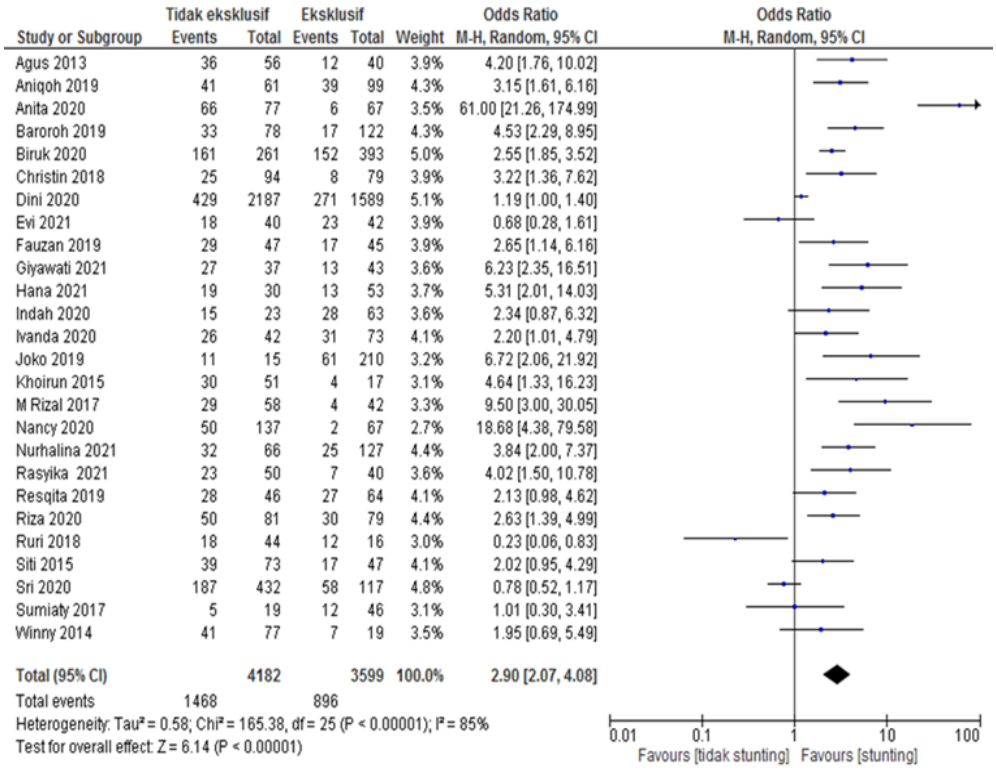
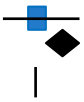


Figure 2. Forest Plot of the Effect of Non-exclusive Breastfeeding on the Risk of Stunting in Infants



: Blue square depicts the weight of each study
: Black diamond depicts the pooled mean difference
: Horizontal lines illustrate 95%

According to research conducted at *Bantargadung* Village, there was a significant relationship between exclusive breastfeeding and the incidence of stunting in toddlers[33]. This research is in line with research by Khoirun Ni'mah (2015), in which she discovered that there was a relationship between exclusive breastfeeding and the incidence of stunting[34]. Moreover, research conducted at Arba Minch Zuria District showed that exclusive breastfeeding is an independent predictor of stunting in toddlers. Exclusive breastfeeding has been identified as an indispensable way to provide ideal food for the healthy growth and development of infants[35]. In contrast, research conducted at the *Pajangan* and *Pleret* Public Health Centers in Bantul Regency discovered that there was no significant relationship between exclusive breastfeeding and stunting. These results suggest a potential correlation between breastfeeding practices and economic conditions, with children from families with lower economic backgrounds being more vulnerable to stunted growth compared to children from families with higher economic backgrounds[36].

Exclusive breastfeeding has been associated with a positive effect on infant growth, particularly in terms of height because the body absorbs calcium more efficiently from breast milk compared to formula milk. As a result, infants who receive exclusive breastfeeding are more likely to have a height that aligns with the expected growth curve, in contrast to those who are only fed formula milk. Breast milk contains more calcium and is more easily absorbed, making it essential for optimal growth, particularly in terms of height, and reducing the risk of stunting. The lack of exclusive breastfeeding increases the risk of stunting, particularly in early life. In addition, inadequate dietary intake is associated with an increased prevalence of malnutrition, which can increase morbidity and mortality rates among children, particularly in low-income countries[37].

Breastfeeding plays a crucial role in providing children with essential nutrition in the early phases of life because it has immunological and hormonal benefits that promote optimal growth and protection. Breast milk contains antibodies that boost the immune system and help expedite the recovery process from illness. The oligosaccharides in breast milk can inhibit pathogens and toxins from binding to host receptors, thus aiding in the prevention of infections[38]. Breast milk is an ideal nutritional choice to meet children's nutritional needs. In low-income countries, breastfeeding is essential to ensuring the survival of children. Breast milk is also rich in high-quality protein that is easily absorbed by the body and contains essential amino acids necessary for child development. Children who do not receive exclusive breastfeeding have a higher risk of stunting compared to those who do[39]. According to various studies, it is crucial to prepare every pregnant woman for breastfeeding. This preparation will ensure that mothers are adequately prepared to provide exclusive breastfeeding, which plays a vital role in preventing stunting[40].

In Figure 3, the plot funnel shows the standard error of the left plot between 0.1 and 0.6, while the standard error of the right plot is between 0.3 and 0.7.

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The funnel plot shows the distribution of research results that are asymmetrical or unbalanced between the left and right sides of the center line, which indicates the existence of publication bias. Publication bias is one of the limitations of meta-analysis research. This happened because researchers published significant research results, so studies with results that did not show a significant or negative relationship were not published. However, by carefully selecting research articles with the right method (PICOTS) and employing the correct statistical method, a large number of samples, and an in-depth explanation of the discussion, the results of the meta-analysis research can be accepted. In addition, for further research, it was suggested to use both online and manual searches to access research articles available in the libraries of the universities or institutions conducting the research.

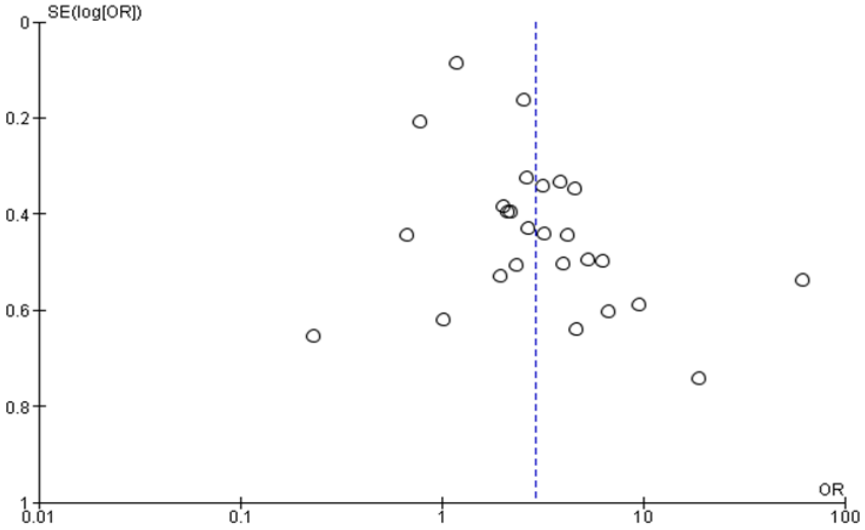

Figure 3. The Funnel Plot of the Effect of Non-exclusive Breastfeeding on the Risk of Stunting

SE : Standard Error
O : Representing Articles
------- : Center Line to See Plot Symmetry

CONCLUSIONS

The results of the meta-analysis proved that exclusive breastfeeding can significantly prevent the incidence of stunting in toddlers. Furthermore, it was discovered that an overall decrease in the incidence and prevalence of stunting among toddlers will be achieved by implementing exclusive breastfeeding. In order to reduce the stunting rate, it is crucial to implement policies and programs that focus on nutrition education and provide assistance through healthcare workers, which aim to promote exclusive breastfeeding and provide active support for pregnant and lactating women through maternal and child health service activities. In addition, for future studies, it was suggested to employ meta-analysis methods that include a larger number of articles from various countries, thereby providing a strong evidence basis for policymakers in designing strategies aimed at promoting exclusive breastfeeding.

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CONFLICT OF INTEREST AND FUNDING DISCLOSURE

All authors state that there is no conflict of interest. This research did not receive financial assistance.

AUTHOR CONTRIBUTIONS

DS: *conceptualization, data curation, investigation, methodology, supervision, validation, visualization, writing–review and editing*; NP: *project administration, methodology; resources, formal analysis, software, writing–original draft*; *writing–review and editing*.

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