

BIBLIOMETRIC ANALYSIS OF RESEARCH ON NUTRITION INTERVENTIONS IN TODDLERS: A FOCUS ON THE ROLE OF MOTHERS AND THE IMPACT OF SUPPLEMENTARY FEEDING PROGRAMS ON STUNTING PREVENTION

Vivin Ary Wijaya^{1*}, Syamsul Arifin², Fauzie Rahman³, Musafaah⁴, Adi Nugroho⁵

¹⁻⁵Faculty of Medicine and Health Sciences, Lambung Mangkurat University

Email Korespondensi: vivinary@gmail.com

Disubmit: 08 Agustus 2024 Diterima: 12 September 2024 Diterbitkan: 01 Oktober 2024
Doi: <https://doi.org/10.33024/mnj.v6i10.16825>

ABSTRACT

Stunting is a significant public health problem in many developing countries, including Indonesia. It affects not only children's physical growth but also their cognitive development and learning ability, ultimately impacting the quality of future human resources. Effective and timely nutrition interventions are essential to prevent stunting and ensure children reach their full potential. This bibliometric study aims to analyze the trends and focus of research related to nutritional interventions in children under five, with an emphasis on the role of mothers and the impact of supplementary feeding programs in stunting prevention. Using the Publish or Perish and VOSviewer applications, this study examined publications from Google Scholar between 2018 and 2024, identifying keywords, journal distribution by year, journal type, number of citations, and country of origin. The results revealed important findings regarding the central role of mothers, the importance of maternal nutrition knowledge, and complementary feeding practices in stunting prevention. The analysis identified four main clusters in the literature, showing a strong focus on the role of mothers, nutrition knowledge and complementary feeding practices. The study also highlighted the trend of increasing publications over the years and the dominant contribution of Indonesian researchers. Overall, the findings suggest that interventions targeting improved maternal knowledge and skills in complementary feeding are essential for effective stunting prevention. This study provides a comprehensive understanding of current research trends and identifies potential research gaps that can be further explored to improve the effectiveness of nutrition interventions and stunting prevention programs.

Keywords: Stunting, Nutrition Interventions, Maternal Role, Complementary Feeding, Bibliometric Analysis

INTRODUCTION

One of the major challenges facing Indonesia's health sector today is chronic childhood malnutrition. Although many health developments and advances have been seen in Indonesia in recent years, the problem of stunting remains significant. Growth stagnation is a linear failure of potential growth to be achieved and is an effect of poor human health and nutrition (Tahar, 2021). Malnutrition in

toddlers can adversely affect their physical, mental and cognitive abilities. Malnourished toddlers can experience a decrease in intelligence (IQ) of up to 10 percent. The worst impact of malnutrition is death at a very young age (Oktavia, Widajanti and Aruben, 2017).

Nutritional status is a measure of the fulfillment of nutritional needs obtained from food and beverage intake

by the body. Malnutrition is a condition when the body experiences a lack or excess of nutrients, although it is often used to describe malnutrition (Mulyaningrum, 2021). Adequate nutrition is needed in early childhood to ensure healthy growth, proper organ function, a strong immune system, and brain and cognitive development (WHO, 2015).

Stunting is one of the nutrition problems that the Government of Indonesia is focusing on. The problem of stunting is one of the nutritional problems faced in the world, especially in poor and developing countries. Stunting is a problem because it is associated with an increased risk of morbidity and mortality, suboptimal brain development so that motor development is delayed and mental growth is inhibited (Rahmadhita, 2020).

The occurrence of stunting is influenced by many factors, namely direct and indirect causes. Direct causes are low nutritional intake and health status, while indirect causes are age, family income level, economic inequality, food system, urbanization. The existence of many factors that cause stunting requires intervention to determine, namely in the First 1000 Days of Life (HPK). In addition, stunting is caused by several other factors, namely maternal knowledge related to nutrition, maternal education, exclusive breastfeeding, accuracy of complementary feeding, adequate levels of iron and zinc, genetics, and history of infection.

Stunting is a condition of growth failure in children under five who are vulnerable to nutritional problems, so that children are shorter for their age. One of the ways to deal with nutritional problems is by providing supplementary food (PMT) high in energy and protein to toddlers according to their nutritional needs. One of the efforts to handle nutritional problems in toddlers, especially with the problem of stunting, is by providing additional food (PMT) high in energy and protein (Iskandar, 2017).

Supplementary feeding (PMT) given to malnourished toddlers aims to provide high intake, high protein and sufficient vitamins and minerals gradually, in order to achieve optimal nutritional status with adequate nutrient composition. Supplementary feeding can also be done homemade as a side dish, but some parents are confused or have difficulty in determining food ingredients and products (Riestamala et al, 2021).

Supplementary feeding (PMT) is an important factor in the high incidence of malnutrition. The PMT program is one of the efforts to improve nutrition that aims to increase public understanding of improving the degree of child nutrition, with efforts to provide additional food to children expected to obtain optimal development. However, there are still many mothers who do not understand how to provide additional food that is not appropriate with the quantity, variant, and schedule. As a result, the growth and development of children are not on par with other children their age and end up in malnutrition (Ministry of Health of the Republic of Indonesia, 2016). Provisions for supplementary feeding (PMT) for children aged 6-24 months have been established by WHO and UNICEF and are referenced by all countries including Indonesia. Too early in providing supplementary food can cause digestive disorders in children such as difficulty defecating, diarrhea, and vomiting. Conversely, if it is too late to provide additional food to children, it can cause children to have difficulty in learning to chew, do not like solid food, and children become malnourished (Desi Evtasari, 2020).

The role of mothers in nutrition interventions for children under five is crucial, as they are the primary caregivers responsible for the daily feeding and care of their children. Maternal nutrition knowledge and practices can directly influence children's nutritional status and health. In addition, supplementary feeding programs have also been identified as an important strategy in

addressing stunting. These programs aim to provide children at risk of malnutrition with the additional nutrition they need.

This bibliometric study aims to analyze the trends and focus of research related to nutritional interventions in children under five with an emphasis on the role of mothers and the impact of supplementary feeding programs in stunting prevention. Using the Publish or Perish and VOSviewer applications, this research examines publications from Google Scholar in the period 2018 to 2024, identifying the main keywords, journal distribution by year, journal type, number of citations, and country of origin of researchers. Through this analysis, it is expected to gain a deeper understanding of the development of research in this field and identify research gaps that can be further explored to improve the effectiveness of nutrition and stunting prevention interventions.

OVERVIEW

The incidence of stunting in children is a result of malnutrition during pregnancy and inadequate intake in infants and children, which is correlated with impaired neurocognitive development and is a risk factor for non-communicable diseases and reduced work productivity in adulthood (WHO, 2015). The problem of stunting is one of the Sustainable Development Goals (SDGs) target number 2, which is to eliminate hunger and all forms of malnutrition. Lack of nutrition in the body or called malnutrition experienced by toddlers during growth will affect the level of health and life expectancy (Liansyah, 2015) including the problem of stunting. Stunting, also known as short toddlers, is one of the priority health issues because nutritional problems can have a serious impact on the quality of human resources (Yuwanti et al., 2021).

A toddler is said to be stunted if his/her z-score of body length for age (PB/U) or height for age (TB/U) is less than -2SD/standard deviation (stunted) and less than -3SD (severely stunted). Stunted

toddlers are less intelligent, more susceptible to disease, and may be at risk of reduced productivity in the future. Ultimately, stunting can hinder economic growth and increase poverty (Ramayulis et al., 2018).

Measurement of stunting can be done using nutritional status by paying attention to height or length, age, and gender of toddlers. The habit of not measuring the height or length of toddlers in the community causes the incidence of stunting to be difficult to realize. Malnutrition is an impact of nutritional status both in the short and long term. The cause of stunting can be attributed to malnutrition. Malnutrition and stunting are two interrelated problems. Stunting in children is the result of nutrient deficiencies during the first thousand days of life. This leads to irreversible impairment of the child's physical development, resulting in decreased work performance. Stunted children have an average Intelligence Quotient (IQ) score eleven points lower than the average IQ score of normal children. Growth and development disorders in children due to malnutrition if not intervened early will continue into adulthood (Rini et al., 2017).

Child feeding practices contribute to the incidence of stunting, such as non-optimal exclusive breastfeeding and complementary feeding that is limited in variety and quality. Prevention of stunting requires integrated nutrition interventions, including nutrition-specific and nutrition-sensitive interventions. Global experience shows that the implementation of integrated nutrition interventions must involve cross-sectors and target priority groups in priority locations is the main key to the success of improving nutrition, child growth and development, which will ultimately help prevent stunting. Prevention of stunting can be done in several ways, namely 1) fulfillment of nutrition during pregnancy, 2) exclusive breastfeeding until 6 months of age and providing adequate and quality complementary foods after 6 months of age, 3) monitoring the growth and

development of toddlers at posyandu, 4) improving access to clean water, facilities and maintaining environmental sanitation (Azizah, SN, 2022).

Stunting prevention is carried out through specific nutrition interventions aimed at the first 1,000 days of life (HPK). Specific nutrition interventions address nutrition problems in pregnant women, breastfeeding mothers 0-6 months, breastfeeding mothers 7-23 months, children 0-6 months, and children 7-23 months. These nutrition problems can be overcome when they understand the problem and know how to overcome it according to their own conditions. Providing nutrition counseling to individuals and families can help to recognize nutrition-related health problems, understand the causes of nutrition problems, and help individuals and families solve their problems so that there is a change in behavior to be able to implement changes in eating behavior that have been agreed upon together (Ramayulis et al., 2018).

Stunting can also be prevented by several things such as providing exclusive breastfeeding, providing nutritious food according to the body's needs, getting used to clean living behavior, doing physical activity, balancing energy expenditure and nutrient intake into the body, and monitoring child growth and development regularly (Millennium Challenge Account Indonesia, 2014). In addition, stunting prevention can be done by utilizing existing local potential. Of course, the local potential in one region with other regions will not be the same.

To overcome the nutritional deficiencies that occur in the under-five age group, it is necessary to provide complementary foods (PMT). Complementary feeding is an intervention program for malnourished toddlers to improve the nutritional status of children and meet the nutritional needs of children to achieve good nutritional status and nutritional conditions according to the needs of children. Complementary foods are specially processed foods, which must

be changed to meet the required amount of nutrients, changed to meet the required amount of nutrients according to the needs of protein and micronutrients, safe and clean, not too spicy and salty, easy to eat (Wahyuningsih and Devi, 2017).

One of the efforts to deal with nutritional problems in toddlers, especially with stunting problems, is by providing additional food (PMT) high in energy and protein (Iskandar, 2017). Supplementary Feeding (PMT) given to malnourished toddlers aims to provide high intake, high protein and sufficient vitamins and minerals gradually, in order to achieve optimal nutritional status with adequate nutrient composition. In Supplementary Feeding can also be done homemade as a side dish, but some parents are confused or have difficulty in determining food ingredients and products (Riestamala et al, 2021). Therefore, Karawang Buana Perjuangan University students who are carrying out the Real Work Lecture (KKN) program provide an innovation in Supplementary Feeding (PMT) which will be given directly to parents who have toddlers in nutritional problems.

Supplementary feeding (PMT) given by mothers to their children based on the suitability of children's nutritional needs and the active role of mothers in posyandu activities to see the growth and development of children periodically can affect the nutritional status of children. The mother's activeness in participating in posyandu activities is a factor in whether the nutritional status of children aged 1-5 years is good or not, with participation in posyandu activities can make mothers much more aware of how children's nutritional needs and understand how to regulate children's nutrition according to what is needed during growth so that it remains good and fulfilled (Nila Wati, 2020).

The selection of appropriate food ingredients as PMT needs to consider local food in the local area, presentation, and diversity of food types (Directorate General of Nutrition and Maternal and Child Health, 2011). Utilization of local

food as PMT can facilitate community access to food. In addition, program sustainability can be better ensured as it does not depend on food distribution from outside the region (Adawyah et al., 2022; Irwan et al., 2020; Irwan, 2019). Meanwhile, the presentation aspect of PMT takes into account the age and growth and development of children (acceptability, ability to digest). Recovery PMT can be provided in the form of complementary food for infants 1 year old (Directorate General of Nutrition and Maternal and Child Health, 2011). Another aspect to consider is food diversification (Allen, 2008; Tontisirin et al., 2002). Diversifying the diet will help meet the needs of nutrients that are not fully contained in food ingredients. Therefore, eating a diverse diet will increase the amount of nutrients that the body takes in.

Research conducted by Norsanti (2021) related to the Stunting Reduction Acceleration Program found that the effectiveness of the Stunting Reduction Acceleration Program was influenced by supporting factors and barrier factors. Supporting factors in this program are directed collaboration between health workers, including nutrition officers, village midwives, Posyandu cadres and PMT cadres. Furthermore, the barrier factors of this program are limited budget, parents' education level, the economic situation of families of stunting toddlers and the uneven distribution of counseling on parenting patterns in children.

The mother's level of education can affect childcare patterns, starting from care and providing healthy and nutritious food. From the results of this screening, there are some mothers who do not want to accept that their children are in the stunting category. This will also make it difficult to provide education to mothers and their families. The incidence of stunting in children is the result of malnutrition during pregnancy and lack of intake in infants and children which correlates with impaired neurocognitive development and is a risk factor for non-

communicable diseases and reduced work productivity in adulthood (WHO, 2015).

The high rate of inability to eat in stunted children will be related to the child's nutritional intake and if it occurs in the golden age period will cause the child's brain and motor development to be inhibited. Mothers who often bring toddlers to the posyandu, the nutritional status of toddlers will be monitored properly and mothers will get a lot of information about fulfilling good nutrition for children, the activeness of the mother herself in utilizing the posyandu is needed to monitor the nutrition of toddlers on a regular basis.

The mother's education level affects children born with stunting. Mothers with basic education tend to have stunted toddlers. This is because mothers who have a low level of education may be less able or difficult to absorb information about nutritious foods, healthy lifestyles, and clean behavior. In line with research conducted (Dessie et al., 2019) shows that children who get exclusive breastfeeding tend not to experience stunting. Exclusive breastfeeding has a major contribution to the growth and development and endurance of children (Tumilowicz et al., 2018). Parents' knowledge and practices in providing balanced nutrition are very important for the prevention of stunting in children. (Ulfah & Nugroho, 2020) Information and knowledge possessed by mothers in feeding their children can affect the feeding behavior of parents to their children.

Low family per capita income is more likely to be experienced by mothers who have stunted children. Per capita income affects the incidence of stunting in toddlers because families with sufficient income will be able to buy nutritious food and easily implement healthy living behaviors (Dewanti et al., 2019). low economic status has an impact on the nutritional status of children which makes them tend to be short or thin (Onis & Branca, 2016).

Optimizing the PMT program aims to increase the impact and achievement of

nutritional status improvement. The PMT program is said to be successful if the PMT is given on target and undernourished children experience an increase in body weight (Sugianti, 2017). In general, there are many obstacles starting from the preparation stage (food storage, funding), distribution, to the implementation of PMT (Anugrahini et al., 2021; Doren et al., 2019; Mauludi et al., 2021; Ortelan et al., 2019; Sugianti, 2017).

RESEARCH METHODOLOGY

This research is a bibliometric study that aims to analyze the literature related to nutritional interventions in toddlers with a focus on the role of mothers and the impact of supplementary feeding programs in preventing stunting. The method used in this study involves several stages starting with data collection using the Publish or Perish application, classification of journals based on various criteria, data analysis with VOSviewer, and interpretation of visualization results to find research gaps that can be further explored.

The first stage of this research is data collection. Data was collected from Google Scholar using the Publish or Perish application with predetermined keywords, namely "education, income, factors, utilisation, utilization, supplementary feeding, toddlers, mothers of toddlers, stunting, knowledge". The search was limited to journals published between 2018 and 2024 to ensure the data obtained were up-to-date and relevant. From the results of this search, 50 journals with the highest rank based on the number of citations were selected for further analysis. The selection of journals based on citations was done with the assumption that these journals have a significant influence in the academic community.

The second stage of the research was journal classification. The selected journals were then classified based on several important criteria. First, the distribution of journals by year of publication was analyzed to see the

research trends related to nutritional interventions in children under five years of age during the period 2018 to 2024. This provides an overview of the development of research interest in this topic over time. Secondly, the types of journals were classified to identify which scientific fields have the most research on this topic, whether from public health, nutrition, pediatrics, or other fields. Third, the number of citations for each journal was analyzed to assess the impact and influence of the research within the academic community. Journals with a high number of citations were considered to have a significant contribution to advancing knowledge in this field. Fourth, the country of origin of the researchers was analyzed to determine the geographical distribution of research related to this topic. This is important to understand how this topic is researched in different countries and whether there are differences in research focus based on geographical context.

The third stage of the research involved data analysis using the VOSviewer application. This application was used to conduct keyword network analysis by setting a minimum occurrence limit of 4 times and selecting the 25 most relevant terms from the search results. The keywords were selected based on an estimated relevance of 70% to ensure that the selected keywords were truly related to the research topic. This analysis helps in identifying keywords that co-occur frequently and how they relate to each other in the existing literature.

In the analysis using VOSviewer, network visualization and overlay as well as visual density were performed to identify the interrelationships between keywords and find research gaps that have not been widely explored. Network visualization helps in seeing how keywords relate to each other, so that clusters of keywords that frequently co-occur can be identified. Overlay visualization provides information about the temporal progression of the research, allowing researchers to see how the focus of the

research changes over time. Density visualizations provide an overview of the concentration of research on a particular topic, showing areas that have been extensively researched and areas that are still under-researched. These visualizations are essential for understanding existing research patterns and finding areas that require further attention.

The final stage of the research is the interpretation of the visualization results. Based on the networking and overlay images and visual density, researchers can understand existing research patterns, find interrelationships between topics, and identify research gaps that can be the focus of further research. For example, if it is found that the topic of "mother's role" in nutrition interventions for children under five is under-researched compared to other topics such as "supplementary feeding programs," then this could be a gap for future research. These interpretations provide insights into the interrelationships between research topics and help in planning more focused and relevant research in the future.

Using this method, this study not only provides an overview of the trends and distribution of research related to nutrition interventions in children under five years of age but also offers in-depth insights into the interconnections between research topics and identifies areas that still require further attention. This research is expected to make a significant contribution to the development of knowledge and practice of effective nutrition interventions for the prevention of stunting in children under five, as well as provide guidance for other researchers interested in exploring this topic further. The results of this study can also assist in

formulating more effective policies in addressing stunting, particularly in the context of the role of mothers and supplementary feeding programs.

RESULTS AND DISCUSSION

The results of this study revealed important findings related to nutrition interventions in children under five, particularly focusing on the role of mothers and the impact of supplementary feeding programs in stunting prevention. Through in-depth bibliometric analysis, we have identified research trends, geographical distribution, and academic influence of the selected journals. Data visualization using VOSviewer provided rich insights into the relationships between keywords, showing existing research patterns and uncovering gaps that still need to be further explored. In this section, we will discuss in detail the results of the journal classification, keyword network analysis, as well as the interpretation of the network, overlay, and density visualizations. This discussion aims to provide a comprehensive overview of the current state of research and potential directions for future research in stunting prevention through nutrition interventions.

Trend Analysis of Publications by Year of Publication

This analysis aims to provide an overview of the development and fluctuations in academic attention to this important topic over the period. The data is expected to provide insight into how research priorities have changed over time and what factors may have influenced the number of publications each year.

Year	Total
2018	5
2019	6
2020	10
2021	7
2022	9
2023	8
2024	5

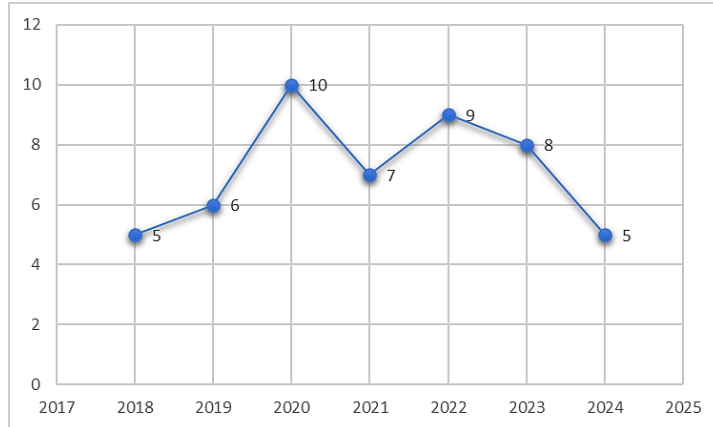


Figure1. Publication Trends by Year of Publication

Publication Trend Analysis by Publisher

In this analysis, we evaluated publication trends by publisher to understand the distribution of publications in the field of under-five nutrition intervention and stunting prevention research. The data collected showed that major publishers such as Springer, Elsevier, and MDPI.com dominated the number of publications with 6 articles each. Other publishers such as Wiley Online Library and Taylor &

Francis also showed significant contributions. This distribution reflects the important role that major publishers play in disseminating research on this topic. The following bar chart provides a visual illustration of the distribution of publications by publisher, highlighting the dominance of some major publishers in the academic literature related to nutrition interventions and stunting prevention.

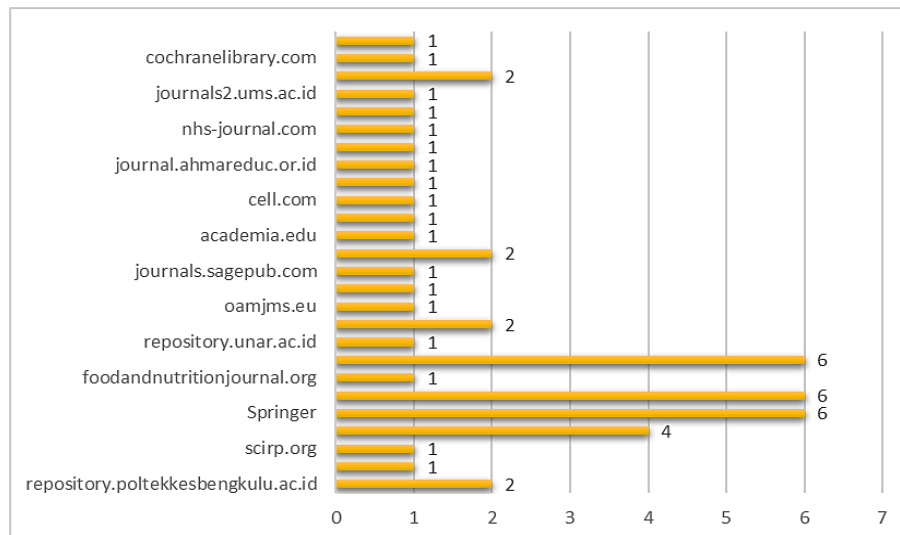


Figure 2. Publication Trends by Publisher

In this analysis, we evaluated publication trends by publisher to understand the distribution of publications in the field of under-five nutrition intervention and stunting

prevention research. The data collected showed significant variations in the number of publications from different publishers. The publishers with the highest number of publications were

Springer, Elsevier, and MDPI.com, each with 6 publications. The high number of publications from these publishers suggests that they play an important role in disseminating research results related to nutrition interventions and stunting prevention.

Wiley Online Library came in second place with 4 publications. This publisher is also widely recognized in the academic community for its quality and global reach, which helps in the dissemination of important research in the field of child nutrition and health. Repository.poltekkesbengkulu.ac.id and Taylor & Francis have 2 publications each, showing their contribution to research related to this topic.

Other publishers listed with 1 publication each include journal.unej.ac.id, scirp.org, foodandnutritionjournal.org, repository.unar.ac.id, oamjms.eu, f1000research.com, journals.sagepub.com, journals.plos.org, academia.edu, synapse.koreamed.org, cell.com, academic.oup.com, journal.ahmareduc.or.id, researchsquare.com, nhs-journal.com, jclmm.com, journals2.ums.ac.id, cochranelibrary.com, Massey University, and researchgate.net. Although the

number of publications from these publishers is relatively small, their existence shows the diversity of information sources and knowledge distribution in the global academic community.

Overall, this analysis shows that research related to under-five nutrition interventions and stunting prevention is published by a wide range of publishers, with some publishers playing a more dominant role. Publishers such as Springer, Elsevier and MDPI.com dominate the publications, which may reflect the high quality and relevance of the research they publish in this field.

Publication Trend Analysis by Country

A bibliometric analysis of the top 50 journals on nutrition interventions in children under five revealed a distribution of publications by country that showed significant geographical variation. Indonesia stood out with the highest number of publications, followed by Ethiopia and the United States. This trend reflects the high level of attention and research efforts undertaken in these countries, especially in regions that face major challenges related to stunting and malnutrition in children under five.

Country	Total
Indonesia	29
Ethiopia	8
USA	3
Thailand	2
Uganda	2
Ghana	1
Taiwan	1
Japan	1
Nigeria	1
Rwanda	1
Kenya	1

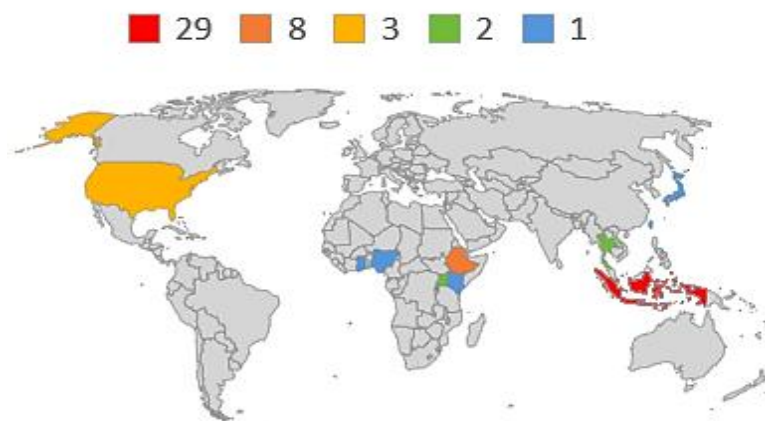


Figure 3. Publication Trends by Country

The results of the bibliometric analysis of the top 50 journals that discuss nutritional interventions in children under

five years old show a quite varied geographical distribution. From the country distribution table, it can be seen

that Indonesia dominates with a total of 29 publications. This dominance shows that the issue of stunting and nutritional interventions in children under five years old has received a lot of attention from researchers in Indonesia, most likely due to the high prevalence of stunting in the country and the strong government policies in addressing this issue.

Ethiopia came in second place with 8 publications. Like Indonesia, Ethiopia also faces major challenges related to stunting and malnutrition in children under five, which explains the high number of studies from this country. Followed by the United States (USA) with 3 publications, indicating significant interest from this developed country in global child health issues, despite the relatively low prevalence of stunting in the USA itself. This may be due to their academic concern and contribution to global solutions.

Thailand and Uganda have 2 publications each. These two countries also face child nutrition and health issues similar to Indonesia and Ethiopia, although on a perhaps smaller scale. Other countries such as Ghana, Taiwan, Japan, Nigeria, Rwanda, and Kenya contributed 1 publication each, indicating some attention to this topic, although perhaps not as much as in the previously mentioned countries.

Overall, these data show that stunting and nutrition interventions in children under five are global issues that attract the attention of researchers in different parts of the world, especially in developing countries that face major challenges in child nutrition and health. The variation in the number of publications also reflects the different levels of attention and resources invested by these countries in research related to stunting and under-five nutrition.

Publication Trend Analysis Based on Most Cited

In this analysis, we evaluated publication trends based on the number of citations received by each article to understand its impact and influence in the research field of under-five nutrition intervention and stunting prevention. The data collected showed significant variation in the number of citations, with some articles standing out due to their high number of citations reflecting great influence in the academic literature. These articles cover important topics such as the determinants of stunting, maternal nutrition knowledge, and educational interventions, which are a major focus of global efforts to address stunting. Below is a further analysis and visualization of the number of citations by article.

Table 1. Trends based on Top 10 Citations

Citation	Author	Title	Year	Country
461	CR Titaley, I Ariawan, D Hapsari, A Muasyaroh...	Determinants of the stunting of children under two years old in Indonesia: A multilevel analysis of the 2013 Indonesia basic health survey	2019	Indonesia
242	O Fadare, M Amare, G Mavrotas, D Akerele...	Mother's nutrition-related knowledge and child nutrition outcomes: Empirical evidence from Nigeria	2019	USA
158	D Arikpo, ES Edet, MT Chibuzor...	Educational interventions for improving primary caregiver complementary feeding practices for children aged 24 months and under	2018	Nigeria

107	A Ahmad, S Madanijah, CM Dwiriani...	Complementary feeding practices and nutritional status of children 6-23 months old: formative study in Aceh, Indonesia	2018	Indonesia
104	H Hadi, F Fatimatasari, W Irwanti, C Kusuma...	Exclusive breastfeeding protects young children from stunting in a low-income population: a study from Eastern Indonesia	2021	Indonesia
89	CN Walters, H Rakotomanana, JJ Komakech...	Maternal determinants of optimal breastfeeding and complementary feeding and their association with child undernutrition in Malawi (2015-2016)	2019	USA
77	E Yunitasari, R Pradanie, H Arifin, D Fajrianti...	Determinants of stunting prevention among mothers with children aged 6-24 months	2021	Indonesia
73	HS Mediani, S Hendrawati, T Pahria...	Factors affecting the knowledge and motivation of health cadres in stunting prevention among children in Indonesia	2022	Indonesia
63	MAL Suratni, G Putro, B Rachmat, Nurhayati...	Risk factors for stunting among children under five years in the province of East Nusa Tenggara (NTT), Indonesia	2023	Indonesia
51	O Nkoka, TG Mhone, PAM Ntenda	Factors associated with complementary feeding practices among children aged 6-23 mo in Malawi: an analysis of the Demographic and Health Survey 2015-2016	2018	Taiwan

This study also analyzed publication trends based on the number of citations received by each article. From the data collected, it can be seen that the most cited article is "Determinants of the stunting of children under two years old in Indonesia: A multilevel analysis of the 2013 Indonesia basic health survey" by CR Titaley, I Ariawan, D Hapsari, and A Muasyaroh published in 2019 on mdpi.com, with 461 citations. This article demonstrates the importance of multilevel analysis in understanding the determinants of childhood stunting in Indonesia, and the high number of citations suggests that this research has a significant impact in this field.

The second article with the highest number of citations is "Mother's nutrition-related knowledge and child nutrition outcomes: Empirical evidence from Nigeria" by O Fadare, M Amare, G

Mavrotas, and D Akerele published in 2019 on journals.plos.org with 242 citations. This article highlights the importance of maternal nutrition knowledge in influencing child nutrition outcomes, suggesting that maternal nutrition education has a large effect on child health.

The third highly cited article is "Educational interventions for improving primary caregiver complementary feeding practices for children aged 24 months and under" by D Arikpo, ES Edet, and MT Chibuzor, published in 2018 on cochranelibrary.com with 158 citations. This article discusses an educational intervention to improve primary caregiver complementary feeding practices, which is particularly relevant in the context of stunting prevention.

Other publications showed a lower but still significant variation in citations, such as the articles "Complementary

feeding practices and nutritional status of children 6-23 months old: formative study in Aceh, Indonesia" with 107 citations, and "Exclusive breastfeeding protects young children from stunting in a low-income population: a study from Eastern Indonesia" with 104 citations. Both articles show a focus on complementary feeding and exclusive breastfeeding practices in Indonesia, which is particularly relevant in the context of national efforts to reduce stunting.

This analysis shows that studies examining the determinants of stunting, maternal nutrition knowledge, and educational interventions in complementary feeding have a large impact in the academic literature, reflected by the high number of citations. These articles contribute significantly to our understanding of how best to address stunting through knowledge-based and educational interventions.

Analysis of Vos Viewer Network Visualization Publication

A publication network visualization analysis using VOSviewer provides in-depth insights into the relationships between key terms in research related to under-five nutrition interventions and stunting prevention. This visualization grouped 25 key items into 4 main clusters based on the occurrence and relationship between keywords.

a. Cluster 1 (7 items), marked in red, includes terms such as "age," "complementary food," "education,"

"factor," "food," "maternal knowledge," and "toddler." This cluster shows a focus on aspects such as child age, education related to complementary food, and maternal knowledge about food and nutrition.

b. Cluster 2 (6 items), highlighted in green, includes terms such as "behavior," "child," "complementary feeding," "mother," "nutritional status," and "parent." This cluster focuses on maternal and child behavior, complementary feeding practices, and child nutritional status, showing the close relationship between parental behavior and child nutritional outcomes.

c. Cluster 3 (6 items), in blue, includes terms such as "attitude," "complementary feeding practices," "determinants," "maternal education," "mothers knowledge," and "stunting." This cluster highlights complementary feeding attitudes and practices, maternal education, and determinants of stunting, demonstrating the importance of maternal education in stunting prevention.

d. Cluster 4 (6 items), highlighted in yellow, includes terms such as "knowledge," "nutrition education," "practice," "study," "use," and "young child." This cluster highlights nutrition knowledge and education, practices, and the use of research results in efforts to improve the nutritional status of children.

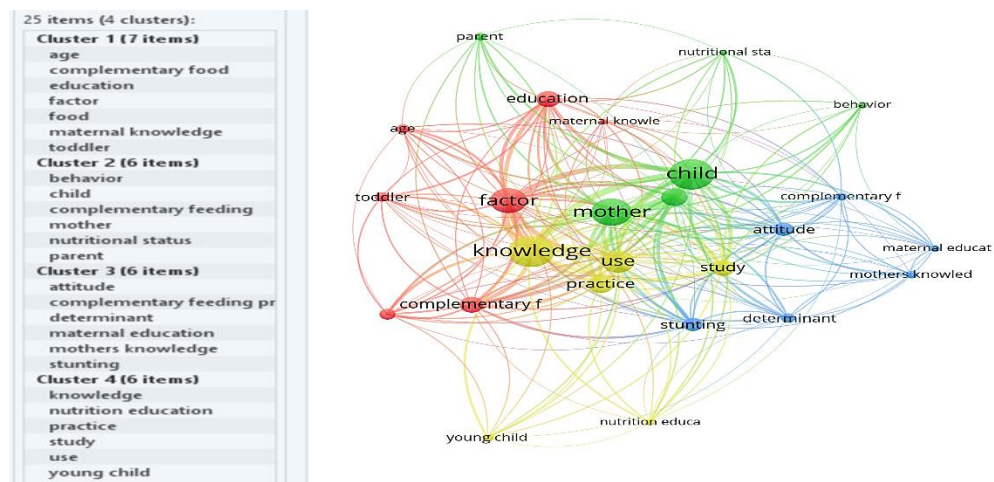


Figure 4. Vos Viewer Network Visualization Publication

The figure places the term "mother" at the center of the network, emphasizing the central role of mothers in research related to under-five nutrition. Terms such as "child," "knowledge," "use," and "complementary feeding" also occupy a central position, demonstrating the close interrelationships between maternal knowledge, complementary feeding practices, and child nutritional status.

This visualization helps in understanding how various factors are interrelated and shows the most researched areas as well as potential gaps in research that can be further explored. For example, the strong focus on maternal knowledge and complementary feeding practices suggests that interventions targeting improved maternal knowledge and skills may be particularly effective in stunting prevention. On the other hand, research gaps may exist in further exploration of the contextual factors that influence complementary feeding practices across different cultures and geographical environments.

Overall, this VOSviewer analysis provides a holistic view of the research

landscape on nutrition interventions in children under five, highlighting key relationships between different aspects that are important for successful nutrition interventions and stunting prevention. This visual analysis provides a comprehensive view of the research landscape related to nutrition interventions in children under five, identifying strong relationships between different aspects and highlighting potential areas for further research development. It also makes it possible to identify trends and tendencies in the literature, and provide direction for future efforts in nutrition interventions and stunting prevention.

Analysis of Vos Viewer Network Overlay Publication

An overlay visualization using VOSviewer provides a deeper look into the temporal dynamics of key terms appearing in research related to under-five nutrition interventions and stunting prevention. In this visualization, colors indicate the year in which these terms appear most frequently in publications, with a color scale from blue (2018) to yellow (2024).

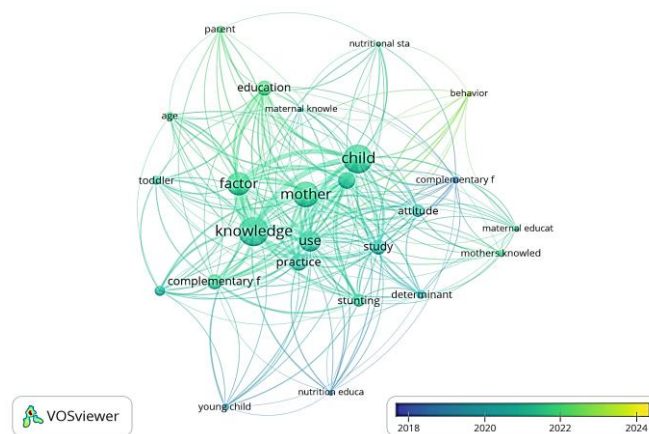


Figure 5. Vos Viewer Overlay Visualization Publication

From this visualization, we can see that the terms "mother," "child," "knowledge," "use," and "practice" are at the center of the network, indicating that these topics were consistently the main focus of research throughout the analysis period. The predominant green color around these terms indicates that research on these topics appeared most frequently in the middle years of the analyzed period (around 2020-2022).

- The red cluster, which includes terms such as "age," "complementary food," and "factor," indicates a focus on aspects of child age and complementary food. These terms are also in the green-to-yellow colored area, indicating that interest in these topics has increased in recent years and is likely to continue to be a focus for the foreseeable future.
- The green clusters of "behavior," "child," "complementary feeding," and "mother" highlight the importance of maternal and child behavior and complementary feeding practices. The presence of these terms in light green signifies that research on this topic has increased recently and is expected to continue to be relevant over the next few years.
- The blue clusters, with terms such as "attitude," "complementary feeding practices," and "maternal education," indicate that research related to complementary feeding attitudes and

- practices and maternal education have peaked in previous years, but remain important and may be experiencing a resurgence of interest.
- The yellow clusters, which include "knowledge," "nutrition education," and "practice," indicate the importance of nutrition education and practices in recent research. The yellow color of these terms signifies that these topics have recently become a major focus and are predicted to continue to be important areas of future research.

Overall, this overlay visualization provides insight into how the research focus has changed and evolved over the past few years. It also helps identify areas that are emerging and may be the focus of more intensive research in the future. The close relationship between maternal knowledge, complementary feeding practices and child nutritional status suggests that interventions targeting maternal education and skills in nutrition are likely to be highly effective in stunting prevention.

Vos Viewer Network Density Publication Analysis

The density visualization using VOSviewer provides a clear view of the concentration of research in the field of under-five nutrition intervention and stunting prevention. In this visualization, warmer colors (red and yellow) indicate

areas of high concentration of frequently occurring terms, while cooler colors (blue

and green) indicate areas of lower concentration.

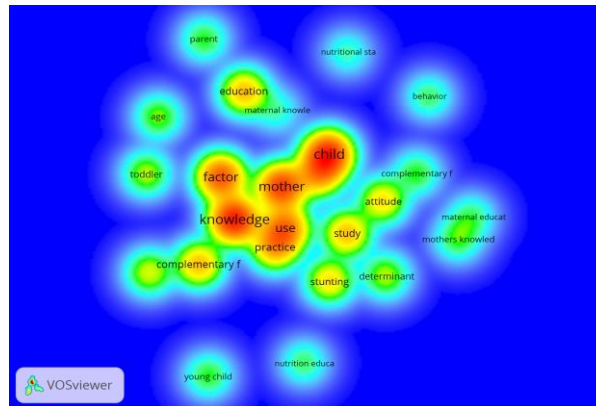


Figure 6. Vos Viewer Density Visualization Publication

From this visualization, it can be seen that the terms "mother," "child," "knowledge," "use," "practice," and "factor" are in the red area, indicating that these topics have a very high concentration of research. This indicates that the main focus of research on under-five nutrition interventions and stunting prevention is on the role of mothers, their knowledge, and complementary feeding practices.

Terms such as "complementary feeding," "education," "attitude," and "stunting" are in the yellow areas, indicating that these topics have also received significant attention in the literature. The focus on complementary feeding, maternal attitude, and nutrition education reflects the importance of these aspects in stunting prevention efforts. Other terms such as "nutritional status," "behavior," "maternal education," and "mothers knowledge" are in the green area, indicating a moderate concentration of research. This indicates that while these topics are important, they may not have received as much attention as those in the red area.

Overall, this density visualization reveals that research on nutrition interventions for children under five has focused heavily on maternal roles and knowledge, as well as complementary feeding practices. This confirms that

interventions that target improving mothers' knowledge and skills in complementary feeding may be highly effective in preventing stunting. In addition, this visualization also helps identify research areas that may require further attention, such as children's behavior and nutritional status, which could be a potential focus for future research.

CONCLUSIONS

The conclusion of this analysis shows that research related to under-five nutrition interventions and stunting prevention has grown rapidly in recent years, with a significant increase in the number of publications from 2018 to 2023. The distribution of publications by country highlights the dominance of Indonesia, reflecting the country's great attention to the problem of stunting, followed by countries such as Ethiopia and the United States. Analysis by citation identified several articles that had a major impact within the academic community, highlighting the importance of maternal knowledge and complementary feeding practices. Network visualization using VOSviewer revealed four major clusters in the literature, with a strong focus on maternal role, nutrition knowledge and

complementary feeding practices. The overlay visualization added a temporal dimension, showing how the research focus has evolved over the years, while the density visualization confirmed that topics related to maternal role and nutritional knowledge have a very high concentration of research.

Overall, these results suggest that interventions targeting improved maternal knowledge and skills in complementary feeding are critical for the prevention of stunting, and there is potential for further exploration of the contextual factors that influence the success of nutrition interventions across different cultural and geographic settings. Future research will also need to consider broader social and economic factors as well as the integration of technology to improve intervention effectiveness. As such, this analysis not only provides an overview of current research trends but also offers valuable insights for the development of more holistic and contextualized intervention strategies in the global effort to address stunting in children under five.

These results suggest that interventions targeting improved maternal knowledge and skills in complementary feeding are critical for stunting prevention. The study also identified potential research gaps, such as further exploration of contextual factors that influence the success of nutrition interventions across different cultures and geographical environments. In addition, this analysis emphasizes the importance of international and interdisciplinary collaboration in efforts to address stunting globally. By understanding current research trends and foci, policymakers and health practitioners can design more effective and sustainable programs to improve under-five nutritional status and prevent stunting in different regions.

LITERATURE

- Adawyah, R., Dekayanti, T., Aslamiah, A., & Wahyu As, M. (2022). Processing Pekmpek Made From Toman Fish And Yellow Pumpkin As A Healthy Supplementary Food Provision (Pmt) In The "Posyandu Persada" Group." *Aquana*, 3(1), 64-70. [Http://Aquana.Ulm.Ac.Id](http://Aquana.Ulm.Ac.Id)
- Allen, L. H. (2008). To What Extent Can Food-Based Approaches Improve Micronutrient Status? *Asia Pac J Clin Nutr*, 17(S1), 103-105.
- Anugrahini, Y. A., Mitra, M., Alamsyah, A., Kiswanto, K., & Zulfayeni, Z. (2021). Evaluation Of The Implementation Of The Pmt-P Program For Wasting Toddlers. *Journal Of Public Health Sciences*, 10(01), 25-37. [Https://Doi.Org/10.33221/Jikm.V10i01.807](https://doi.org/10.33221/jikm.v10i01.807)
- Dessie, Z. B., Fentie, M., Abebe, Z., Ayele, T. A., & Muchie, K. F. (2019). Maternal Characteristics And Nutritional Status Among 6 - 59 Months Of Children In Ethiopia: Further Analysis Of Demographic And Health Survey, 1-10
- Dewanti, C., Ratnasari, V., Rumiati, T., Statistics, D., Mathematics, F., & Data, S. (2019). Modeling Factors Affecting Stunting Status Of Toddlers In Java Province East Using Binary Probit Regression, 8(2) Directorate General Of Nutrition And Maternal And Child Health. (2011). Guidelines For The Implementation Of Supplementary Feeding Recovery For Undernourished Toddlers (Health Operational Assistance). Ministry Of Health Ri.
- Doren, W. K., Regaletha, T. A. L., & Dodo, D. O. (2019). Evaluation Of The Recovery Supplementary Feeding Program (Pmt-P) On Malnutrition Status Of Toddlers At Puskesmas Oepoi Kupang City.

- Journal Of Community Health, 1(3), 111-118.
- Evitasari, D. 2020. The Effectiveness Of Feeding Tambhan On Toddlers Below The Red Line. *Campus Journal Of Stikes Ypib Majalengka*. Vol. 8, No. 1. Page 9-17.
- Irwan, I. (2019). Providing Modified Pmt Based On Local Wisdom In Stunting And Undernourished Toddlers. *Sibermas Journal (Synergy Of Community Empowerment)*, 8(2), 139-150. <https://doi.org/10.37905/Sibermas.V8i2.7833>
- Irwan, Mery T, Kadir, S., & Amalia, L. (2020). The Effectiveness Of Providing Modified Pmt Based On Local Wisdom On Improving The Nutritional Status Of Undernourished And Stunted Toddlers. *Journal Health And Science; Gorontalo Journal Health & Science Community*, 4(2), 59-67.
- Iskandar, I. (2017). Effect Of Modified Supplementary Food Provision On The Nutritional Status Of Toddlers. *Action: Aceh Nutrition Journal*, 2(2), 120- 125.
- Liansyah, T. M. (2015). Malnutrition In Children Under Five. *Journal Of Buah Hati*, 1(1), 1-12.
- M. Damanik¹, E. Sitorus², And I. M. Mertajaya³, "Socialization Of Stunting Prevention In Toddlers In Cawang Village, East Jakarta," 2021.
- Mauludi, Alwi, & Alfiady, T. (2021). Evaluation Of Supplementary Feeding (Pmt) Program For Treatment Of Poor Nutrition To Children In North Aceh District. *International Journal Of Public Administration Studies*, 1(1), 30-37. <http://www.acehportal.com/2728-2/>
- Mulyaningrum M, S. F. M. M. (2021). Factors Affecting Stunting In Toddlers In Grobogan Regency. *Journal Of Nursing And Public Health*, 10(1), 74-84.
- Norsanti, N. 2021. Effectiveness Of The Stunting Reduction Acceleration Program In Batumandi Subdistrict, Balangan Regency (Case Study Of Mampari Village And Banua Hanyar Village). *Jpp: Journal Of Public Administration And Development*. Vol.3 No. 1. Page 10 - 21.
- Oktavia, S., Widajanti, L. And Aruben, R. (2017) "Factors Associated With Malnutrition Status Among Toddlers In Semarang City In 2017 (Study At Banyumanik Nutrition Recovery House, Semarang City)", *Journal Of Public Health (E-Journal)*, 5(3), Pp. 186- 192. Doi: <https://doi.org/10.1016/J.Lwt.2014.04.042>
- Onis, M. De, & Branca, F. (2016). Review Article Childhood Stunting: A Global Perspective, 12, 12-26. <https://doi.org/10.1111/Mcn.12231>
- Ortelan, N., Augusto, R. A., & De Souza, J. M. P. (2019). Factors Associated With The Evolution Of Weight Of Children In A Supplementary Feeding Program. *Revista Brasileira De Epidemiologia*, 22, 1-14. <https://doi.org/10.1590/1980-549720190002>
- Pillai, V. K. (2019). Women's Education And Child Stunting Reduction In India Women's Education And Child Stunting Reduction In India, 46(3).
- Rahmadhita, K. (2020). Stunting Problems And Prevention. *Scientific Journal Of Health Sandi Husada*, 11(1), 225-229. <https://doi.org/10.35816/Jiskh.V10i2.253>
- Ramayulis, R., Kresnawan, T., Iwaningsih, S., & Rochani, N. S. (2018). Stop Stunting With Nutrition Counseling. *Penerbar Plus+ (Penebar Swadaya Group)*.

- Riestamala, E., Fajar, I., & Setyobudi, S. I. (2021). Formulation Of Catfish And Green Spinach On Nutritional Value, Organoleptic Quality, Acceptability
- Rini, I., Rahayuning Pangestuti, D., & Zen Rahfiludin. (2017). The Effect Of Supplementary Food Recovery (Pmt-P) On Changes In Nutritional Status Of Malnourished Toddlers In 2017 (Study In Semarang City Nutrition House). *Journal Of Public Health*, 5, 2356-3346. [Http://Ejournal3.Undip.Ac.Id/Index.Php/Jkm](http://Ejournal3.Undip.Ac.Id/Index.Php/Jkm)
- Fresh Bread Risoles As Toddler Snack. *Journal Of Nutrition College*, 10(3), 233-242
- S. Nur Azizah Ahmad And S. Latipah, "Stunting Socialization In Tangerang City Community," *Selaparang: Journal Of Progressive Community Service*, Vol. 6, No. 2, Pp. 704-708, 2022.
- Sugianti, E. (2017). Evaluation Of Supplementary Feeding Recovery (Pmt-P) For Malnourished Toddlers In Tuban District. *Cakrawala Journal*, 11(2), 217-224.
- Tahar, T. N. L. (2021) "Nutritional Status Of Toddlers", *Endurance Journal*, 3(1), Pp. 146-152, Doi: [Http://Doi.Org/10.22216/Jen.V3i1.2074](http://Doi.Org/10.22216/Jen.V3i1.2074)
- Tumilowicz, A., Beal, T., & Neufeld, L. M. (2018). A Review Of Child Stunting Determinants In Indonesia, (October 2017),1-10. [Https://Doi.Org/10.1111/Mcn.12617](https://Doi.Org/10.1111/Mcn.12617)
- Ulfah, I. F., & Nugroho, A. B. (2020). Looking At The Challenges Of Health Development In Indonesia: Factors Causing Stunting In Jember Regency, 8090, 201-213
- Vilcins, D., Sly, P. D., & Jagals, P. (2018). Environmental Risk Factors Associated With Child Stunting: A Systematic Review Of The Literature, 84(4), 551-562.
- Wahyuningsih, S. And Devi, M. I. (2017) "Evaluation Of The Supplementary Feeding Program (Pmt) For Malnourished Toddlers At Puskesmas Jakenan, Pati Regency", *Journal Of Nursing And Public Health, Stikes Cendekia Utama Kudus*, 6(2), Pp. 1-81. Doi: [Https://Doi.Org/10.24239/Abulava.Vol2.Iss2.40](https://Doi.Org/10.24239/Abulava.Vol2.Iss2.40)
- Wati, N. 2020. Analysis Of The Supplementary Feeding Program (Pmt) On The Nutritional Status Of Children At Posyandu Sembungharjo Semarang Village. *Tematik Journal Of Early Childhood Thought And Research*. Volume 6 Number 2.
- Who. (2015). Stunting In A Nutshell. [Https://Www.Who.Int/News/Item/19-11-2015-Stunting-In-A-Nutshell](https://Www.Who.Int/News/Item/19-11-2015-Stunting-In-A-Nutshell).
- Yuwanti, Y., Mulyaningrum, F. M., & Susanti, M. M. (2021). Factors Affecting Stunting In Toddlers In Grobogan Regency. *Journal Of Nursing And Public Health Cendekia Utama*, 10(1), 74. [Https://Doi.Org/10.31596/Jcu.V10i1.704](https://Doi.Org/10.31596/Jcu.V10i1.704)