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Exploring Factors Contributing to Stunting in Children Under 5 Years: Systematic Review

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Abstract: Stunting is representation of inhibited growth as a result of prolonged insufficient nutrient intake. Around 45% of deaths among children under 5 years of age linked to undernutrition. The purpose of this systematic review is to analyze the factors that play a role in causing stunting in children under the age of 5, by conducting recent research and examining variables as causes of stunting through a literature review of published journal studies. This research is a systematic review based on articles published from 2014 to 2023. The research sample consists of published articles in Scopus, PubMed, and ScienceDirect, and 12 articles that meet the inclusion criteria were obtained. Stunting is caused by several factors, including: Low Birth Weight Child, age child, gender child, age mother, mother education, media exposure, household wealth, family size, residential area, sorce of drinking water, birthing location, and access to sanitation facilities. Currently, stunting remains a health issue in early childhood that requires the best healthcare services. Addressing stunting requires the best health services and serious attention to these factors.

Keywords: Child; Environmental; Household; Mother; Stunting.

Introduction

The nutritional status of children in a country is a potential indicator of socio-economic development (Abdulla, Rahman, and Hossain 2023). Childhood manultrition is often associated with a deficiency of specific vitamins and minerals, both related to micronutrients and certain macronutrients (Sutio 2017). One of the global issues hindering human growth is stunting, which occurs in children with low height due to chronic manultrition (de Onis and Branca 2016). Chronic nutrition problems are caused by a long-term lack of nutrient intake, resulting in unmet nutritional needs and leading to stunting (Soliman et al. 2021) (Verma and Prasad 2021).

Stunting is a representation of inhibited growth as a result of prolonged insufficient nutriet intake. Stunting is a condition in which toddlers experience a lack of nutritional intake for a long period of time so that children experience growth disorders, namely shorter height than the age standard (Khoiriyah and Ismarwati 2023). According to the World Health Organization (WHO) Child Growth Standards, stunting is based on the height-for-age index (HAZ) or length-for-age index (LAZ) with a Z-score of less than -SD (standard deviations) (Loya and Nuryanto 2017). Stunted growth during childhood result in harmful health effects, including decreased cognitive development and performance, poor outcomes, delayed psychomotor development, worse school attendance, the emergence of chronic disease, and ultimately leads tp the loss of economic growth and social development in a country (Mediani 2020) (Vilcins, Sly, and Jagals 2018).

In 2020, according to the WHO, an estimated 149 million or 22% of children under the age of 5 worldwide experienced stunting. Approximately 45% of deaths in

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children under 5 years old were related to manultrition, with the majority occuring in low- and middle-income countries. Based on the 2020 WHO data, Africa had the highest prevalence, with a precentage reaching 31.7%. This wa followed by the Southeast Asia region with a stunting prevalence of 30.1% and the Eastern Mediterranean region with 26.2%.

Under nutrition in the form stunting is the most common type of manultrition in Southeast Asia, affecting some 25% of children under 5 years. Compared to several countries, the prevalence of stunting in toddlers in Indonesia is also the highest when compared to Laos 30.2%, Cambodia 29.9%, Philippines 28.7%, Myanmar 25.2%, and Vietnam 22.3%. Around of deaths among children under 5 years of age linked to undernutrition. These mostly occur in low- and middle-income countries (WHO, 2020). According to WHO, the prevalence of short stature in toddlers becomes a public health issue when it reaches 20% or more. Therefore, low nutritional status in children is not only a public health challenge but also affects the country's economic situation (Mkize, 2020).

The occurrence of stunting in toddlers is influenced by direct causes, including prolonged insufficient nutrient intake, maternal health during pregnancy, childbirth, and maternal short stature, and the failure to provide exclusive breastfeeding. On the other hand, indirect causes encompass low economic factors that affect family food security, social factors influencing community lifestyles, culture, parenting patterns, dietary habits and healthcare services. These factors collectively contribute to the problem of stunting in young children (Dhaifina, 2019). The impact of stunting in children under 5 years of age is twofold. In the short term, it leads to developmental and growth disturbances, resulting in decreased cognitive abilities and a weakened immune system. In the long term, stunting can lead to health problems in adulthood, including conditions such as high blood pressure, diabetes, and stroke. These long-term health consequences highlight the importance of addressing stunting during childhood to prevent health issues in adulthood (Ernawati, 2020). Because it is known that optimal nutritional intake supports early chilhood development both physically, psychologically and motorically, in other words, optimal nutritional intake today is a picture of optimal growth and development in the future as well (Loya and Nuryanto 2017). The purpose of this systematic review is to analyze the factors that play a role in causing stunting in children under the age of 5, by conducting recent research and examining variables as causes of stunting through a literature review of published journal studies. The result of study is expected to provide better insight into the causes of stunting, so as to design more affective prevention and intervention strategies. This information can also be used as a data base to design better health policies, assisting goverments and health organizations in taking more appropriate actions to address stunting in children under 5 years of age. This research utilizes the systematic review method, which allows researchers to compile an overall view of the topic in a systematic and comprehensive way, providing more in-depth and accurate insights to support follow-up actions to improve child health.

Method

Research Methods

The process of searching for articles using multiple search angines was undertaken to identify petentially relevant analysis related to the occurrence of stunting in children under 5 years. This research followed the PRISMA (Preferred Reporing Items for Systematic Review and Meta-Analysis) flow and the PICO (Population, Intervention, Comparison/Control, Outcome) method.

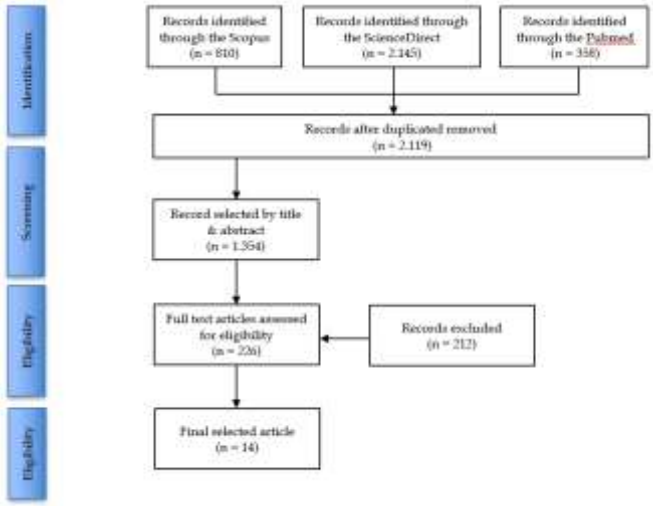

Figure 1. Workflow Research

Search Keywords

The keywords used for this search were "Factors", "Stunting OR Stunted Growth", "Children" and "Under 5 Years". The search was conducted between September 14th and September 20th, 2023. Searching for articles using search engine like Scopus, PubMed, and ScienceDirect. All the articles found were analyzed based on their titles to select potentially relevant articles. Limits and filters were set, including a publication year range from 2014 to the latest in 2023. The desired article format wa full PDF, with data extraction from abstracts using an instrument designed for this research. The characteristic included methodology (Original Review based on Introduction, Method, Result, and Discussion),

articles in English, full text access, and no subscription fees.

Inclusion and Exclusion

The next step involves incorporating the study created based on data extraction. The inclusion criteria are as follows: Population data involving children under 5 years of age, studies that identify and analyze factors contributing to stunting, studies relevant to the topic of stunting in children under 5 years of age. Conversely, the exclusion criteria include: children above the age of 5, lack of quantitative data on risk factors, reporting only cases of manultrition and not stunting occurrence.

Result and Discussion

There were 2.119 articles identified through the database search toinvestigate the factors contributing to stunting in children under the age of 5. Then, through an analysis based on the selection of title abstracs, we managed to filter it down to 1.354 articles. Out of this number, 226 articles were accessible in full text, assessed for eligibility and available for free. Finally, we obtained 14 research articles that reported risk factors for stunting in children under the age of 5 years, which were consistent with the research's title and published in English. The summary of those articles was shown on Table 1.

Tabel 1. Summary of Data Descriptions

Heading	Author	Method	Result
Factors Associated with Stunting Among Children Aged 0 to 59 Months from The Central Region of Mozambique (2017)	(Cruz et al. 2017)	Case-control	The results showed that birth weight, mother's educational status, maternal occupation, living in a rural area, family size, number of children under five years of age in the household, cooking with charcoal, inhabiting wooden or straw housing or housing without proper floors, overall duration of breastfeeding as well as duration of exclusive breastfeeding, and time of initiation of complementary feeding were significantly related to stunting.
Factors Associated with Stunting Among Children Below Five Years of Age in Zambia: Evidence From the 2014 Zambia Demographic and Health Survey	(Mzumara et al. 2018)	Regression analysis	Stunting was associated with sex and age of a child; mother's age and education; residence; wealth and duration of breastfeeding. For instance, children whose mothers had higher education showed a 75% reduction of odds compared to children whose mothers had no education (AOR = 0.35, 95%CI: 0.22, 0.54; $p < 0.05$). Similarly, wealth status showed an inverse relationship. Children who came from rich households showed a 32% reduction of odds compared to children who came from poor households (AOR = 0.68, 95%CI: 0.57, 0.82; $p < 0.05$).
Risk Factors for Stunting Among Children Under Five Years: A Cross-Sectional Population-based study in Rwanda Using The 2015 Demographic and Health Survey	(Nshimyiryo et al. 2019)	Cross-sectional	In adjusted analysis, the following factors were significant: boys (OR 1.51; 95% CI 1.25-1.82), children ages 6-23 months (OR 4.91; 95% CI 3.16-7.62) and children ages 24-59 months (OR 6.34; 95% CI 4.07-9.89) compared to ages 0-6 months, low birth weight (OR 2.12; 95% CI 1.39-3.23), low maternal height (OR 3.27; 95% CI 1.89-5.64), primary education for mothers (OR 1.71; 95% CI 1.25-2.34), illiterate mothers (OR 2.00; 95% CI 1.37-2.92), history of not taking deworming medicine during pregnancy (OR 1.29; 95%CI 1.09-1.53), poorest households (OR 1.45; 95% CI 1.12-1.86; and OR 1.82; 95%CI 1.45-2.29 respectively).
A Multilevel Analysis of Individual, Household and Community Level Factors on Stunting Among Children Aged 6-59 Months in Eswatini: A Secondary Analysis of The Eswatini 2010 and 2014 Multiple Indicator Cluster Surveys	(Simelane, Chemhaka, and Zwane 2020)	Regression analysis	In both 2010 and 2014, lower odds of stunting were observed among female children, in children born to women with tertiary education compared to those born to women with no formal education. Lower odds of stunting were observed among children from rich households compared to poorest households. In both 2010 and 2014, increased odds of stunting were observed among children aged 12-23, 24-35 and 36-47 months compared to children aged 6-11 months. At the household level, higher odds of stunting were observed among children from households with two and more children under five years of age compared to those with only one child and in 2010, among children from households with a pit

Heading	Author	Method	Result
			latrine and no toilet facility compared to households with a flush toilet.
Determinants of Stunting Among Under-Five Years Children in Ethiopia from the 2016 Ethiopia Demographic and Health Survey: Application of Ordinal Logistic Regression Model Using Complex Sampling Designs	(Fenta et al. 2020)	Regression analysis	Children with illiterate mothers were 2 times more likely to be moderately and severely stunted compared with their counterparts with secondary education. The odds of being stunted for children whose age group 24–35 months respectively as compared to children 0–5 months of age were 4.71 times higher. Being female children were 9.66 times more likely to be in normal nutrition status as compared to male. Children of families in the highest wealth quintile were 7.92 times more likely to have normal stature compared with children from poorest ones.
Factors Associated with Stunted Growth in Children Under Five Years in Antananarivo, Madagascar and Bangui, Central African Republic	(Vonaesch et al. 2021)	Case-control	In both sites, formal maternal education lowered the risk of being stunted and restricted access to soap, suffering of anaemia and low birth weight were associated with higher risk of stunting. Short maternal stature, household head different from parents, diarrhoea and coughing were associated with an increased risk and continuing breastfeeding was associated with a lower risk of stunting in Antananarivo. Previous severe undernutrition and dermatitis/ fungal skin infections were associated with higher and changes in diet during pregnancy with lower risk of stunting in Bangui.
The Prevalence of Stunting and Associated Factors among Children Under Five years of age in Southern Ethiopia: Community Based Cross-Sectional Study.	(Mengesha et al. 2021)	Cross-sectional	Factors: family size less than five [AOR = 0.59; 95% CI (0.37, 0.97)], age less than 11 months [AOR = 0.17; 95% CI (0.08, 0.4)] and rich wealth status [AOR = 0.46; 95% CI (0.27, 0.79)] had a protective effect, while source of drinking water like river water [AOR = 5.11; 95% CI (1.6, 16.4)], presence of two or more under five children in the household [AOR = 1.72; 95% CI (1.07, 2.77)], undiversified diet [AOR = 1.82; (1.17, 2.83)] and household food insecurity [AOR = 1.83; 95% CI (1.13, 2.96)] increased the risk of stunting.
Pooled Prevalence of Stunting and Associated Factors Among Children Aged 6-59 Months in Sub-Saharan Africa Countries: A Bayesian Multilevel Approach	(Takele, Gezie, and Alamneh 2022)	Regression analysis	The pooled prevalence of stunting in Sub-Saharan Africa was about 35% (95%CI: 34.87, 35.31). Of the sub-regions, the highest prevalence of stunting was in East Africa, 37% (95%, CI: 36.96, 37.63) followed by Central Africa, 35% (95%CI: (34.93, 35.94). Being male (AOR = 1.27, 95% CrI 1.25, 1.30), small birth size (AOR = 1.29, CrI 1.25, 1.32), home delivery (AOR = 1.17, CrI 1.14, 1.20), and no education of mothers (AOR = 3.07, CrI 2.79, 3.39) were some of the significant predictors of stunting of children
Predictors and factors associated with stunting among under- five-year children: a cross-sectional population-based study in Rwanda of the 2014-2015 demographic and Health Survey.	(Rugema et al. 2022)	Regression analysis	The demographic characteristics: age ($p< 0.001$), sex ($p<0.001$), and place of residence ($p< 0.001$) and Household wealth index ($p <0.001$) were associated with stunting. Age, sex, and household wealth index were predictors of stunting.
Determinants of stunting in children under five years in dibate district of Ethiopia: A case-control study	(Fufa 2022)	Case-control	Factors significantly associated with stunting were poor household dietary diversity (AOR = 10.37, 95% CI; 5.39–19.94), middle household dietary diversity (AOR = 3.78, 95% CI; 1.38–10.38), family size ≥5 (AOR = 6.27, 95% CI; 3.37–11.66) and have no consumption of animal food source (AOR = 7.43, 95% CI; 4.3–12.8)
Applied nutritional investigation spatial variation and determinants of stunting among children aged less than 5 y in Ethiopia: A spatial and multilevel analysis of Ethiopian	(Tamir et al. 2022)	Regression analysis	The national prevalence of stunting was 36.81% (95% CI, 35.48%–38.15%), with significant spatial variations across Ethiopia. Spatial clustering of stunting was detected in the northern, northwestern, northeastern, and southwestern parts of Ethiopia. Age and sex of the child, birth interval, birth type, household wealth status, maternal education, region, and

Heading	Author	Method	Result
Demographic and Health Survey 2019			community-level illiteracy were factors significantly associated with stunting.
Determinants of Stunting among Children under Five in Pakistan.	(Soofi et al. 2023)	Cross-sectional	In the multivariable logistic regression, male children (AOR = 1.08, 95% CI [1.04-1.14], p < 0.001) from rural areas (AOR = 1.07, 95% CI [1.01-1.14], p = 0.014), with the presence of diarrhea in the last two weeks (AOR = 1.15, 95% CI [1.06-1.25], p < 0.001) and mothers who had no education (AOR = 1.57, 95% CI [1.42-1.73], p < 0.001) or lower levels of education (primary: AOR = 1.35, 95% CI [1.21-1.51], p < 0.001; middle: AOR = 1.29, 95% CI [1.15-1.45], p < 0.001), had higher odds of stunting. Younger children aged < 6 months (AOR = 0.53, 95% CI [0.48-0.58], p < 0.001) and 6-23 months (AOR = 0.89, 95% CI [0.84-0.94], p < 0.001), with mothers aged 35-49 years (AOR = 0.78, 95% CI [0.66-0.92], p = 0.003), had lower odds of stunting. At the household level, the odds of child stunting were higher in lower-income households (AOR = 1.64, 95% CI [1.46-1.83], p < 0.001) with ≥ 7 members (AOR = 1.09, 95% CI [1.04-1.15], p < 0.001), with no access to improved sanitation facilities (AOR = 1.14, 95% CI [1.06-1.22], p < 0.001) and experiencing severe food insecurity (AOR = 1.07, 95% CI [1.01-1.14], p = 0.02).
Risk Factors Associated with Atunting among Childreen Under Five in Timor-Leste	(Nomura et al. 2023)	cross-sectional	Compared to women of <145 cm of height, those of ≥145 cm height had lower likelihood of having a stunted child (OR: 0.62, 95% CI: [0.48–0.80], p < 0.001). It was also interesting to note that the risk of stunting was lower among female children than male children [OR: 0.75, 95% CI: (0.64–0.88), p < 0.001] in our adjusted model. Similarly, other factors such as wealth index, postnatal care visits, currently breastfeeding, age of the child, and size of the child at birth were also associated with stunting.
Determinants of Stunting in Children aged 24-59 months: a case-control study	(Muliani et al. 2023)	Regression analysis	Infants who are not exclusively breastfed have a 9.44 times higher risk of stunting (OR=9.44; 95% CI=4.28 to 20.7), according to an analysis with a CI of -95%. Chronic energy deficiency and low birth weight during pregnancy are associated with an increased risk of growth disorders by 5.98 (OR=5.98; 95% CI=2.47 to 14.43) and 4.6 times (OR=4.6) respectively; 95% CI=1.73 to 12.42). In addition, the R-square logistic regression analysis of 0.374 indicates that the overall influence of the variables is 37.4%.

Based on systematic review studies, data was obtained from several studies that have conducted research on the factors that cause stunting in children.

Child Factors

First, low birth weight child. Several studies from settings such as Central-East Africa (Kenya), Turkey, and East Africa, place low birth weight children at a 20% risk of stunting. In this study, children born with low birth weight are at a higher risk of developing stunting. Infants with low birth weight are born with low reserves of vital growth nutrients such as vitamin A, zinc, and iron. Therefore, it is crucial to provide good exclusive breastfeeding to children (Cruz et al., 2017). Children born with low birth weight are often born to families with low socioeconomic status and poor health. In this study, it also confirms that birth size was found to be statistically significant (Fenta et al., 2020). Based on statistical test, the value obtained (p=0.001) indicates that there is a significant effect that low birth weight can experience growth and development disorders in children aged 0-60 months, with a risk of stunting by 3.64 times which has a significant impact on child growth and development compared to infants who are not low birth weight (Karmany et al., 2020).

Second, age child. The age of the child has a significant relationship with stunting. Stunting in children aged 24 to 35 months has a 7 times higher likelihood of being affected compared to children under 6 months old (Mzumara et al., 2018). The age group under 5 years is also vulnerable to disease such as diarrhea, intestinal parasites, and other acute infections, making them more likely to experience stunting (Mengesha et al., 2021).

Last, gender child. Stunting during childhood portrays that gender plays a strong role. Some studies suggest that males are more affected by manultrition compared to females. The majority of families are below the poverty line, which might explain why males are more malnourished. Furthermore, epidemiological evidence indicates that biologically, boys are more vulnerable to morbidity, where in this study, the is a high incidence of morbidity and it has a significant impact on boys (Cruz et al., 2017; Nshimyiryo el al., 2019).

Mother Factors

First, age mother. The age of mothers during pregnancy who are not at risk ranges from 20-35 years, because this age is the productive age of women where the maturity of the reproductive organs and mentally to undergo pregnancy and childbirth is ready (Susilawati and Ginting 2023). Children with mothers who are younger (< 20 years old) are at a higher risk of stunting compared to those with older mothers. Older mothers are assumed to have better knowledge and may respond more effectively, enabling them to meet the nutritional and essential health needs of their children (Soofi et al., 2023).

Second, mother Education. The level of maternal education generally influences employment opportunities, with higher education levels often leading to better job prospects. This, in turn, can result in lower income and suboptimal childcare and attention given to children. Another aspect is the ability to receive and comprehend information, which tends to be easier for those with higher levels of education to seek consultation (Syakur, Musaidah, and Handayani 2023). Studies conducted in Zambia, Nigeria and Rwanda have reported that the risk of stunting is lower among children born to mothers with an education (Simelane et al., 2020). The importance of maternal education lies in it serving as an alternative to ensure proper and healthy feeding practices for children. Higher levels of maternal education can help reduce stunting in children by increasing maternal knowledge about sanitation practices and healthy behaviors. This knowledge, in turn, can lead to improved child nutrition and overall health (Fentaa et al., 2020).

Third, media exposure. Media plays a crucial role in shaping health and nutrition-related behaviors, attitudes, and practices, as well as in promoting socio-cultural and economic development, which can contribute to improved nutrition outcomes. Research conducted in Pakistan and Bangladesh indicates that maternal media exposure has a significant association with stunting in children (Takele et al., 2022).

Fourth, maternal height. Maternal height is significantly associated with stunting in children. Many researchers in the past have demonstraded a strong link between maternal height and child stunting. The fact is that a mother's short stature affects the growth of children, meaning this condition can be inherited from the mother. Some researchers have indicated that Timor-Leste is a country with the shortest height for both men and women (Nomura et al. 2023).

Last, exclusive breastfeeding. When exclusive breastfeeding is not provided during the first six months, stunting and nutritional problems can affect a child's future growth and development. This also applies to children over the age of five. Breastfeeding ensures a healthy and productive future generation by providing the best nutrition to infants during the first six months of their lives (Hadi et al., 2021). The crucial period in the first 1.000 days of life has a long-term impact on a child's life cycle who experiences stunting. If exclusive breastfeeding is not provided, the risk of poor growth is four times higher. Child manultrition is a direct sources of this condition, with short-term implications for increased morbidity (Muliani et al., 2023).

Household Factors

First, household wealth. The likelihood of stunting among children under the age of 5 from wealthy families is lower compared to those from poor families. Families with lower economic status experience more economic pressures, making them more likely to face food insecurity, where improverished families may struggle to adequately meet their children's nutritional needs (Mengesha et al., 2021). Wealthy households may exhibit health-seeking behaviors and promptly seek healthcare facilities when their children are ill which could have a positive contribution to the health, growth, and development of children (Takele et al., 2022). There is a significant relationship between economic status and stunting, where the lower the family's economic status, the higher the occurrence of stunting (Amalo and Davidz 2023).

Second, family size. Children exposed to large family sizes are significantly associated with stunting, consistent with research conducted in Armenia, Mozambique, and North Sudan. This may be due to an imbalance between food demand and supply within the household. As the number of family members increases, the family may struggle to provide adequate nourishment for all family members, particularly those with lower incomes (Fufa 2022).

Third, consumption of iron supplements. The quantity of iron supplement consumption during pregnancy is one of the risk factors for child stunting. This means that mothers who do not meet the standard iron supplement consumption are at 11 times higher risk of having children with stunting compared to mothers

who adhere to the recommended iron supplement intake, and this shows statistically significant result (Fikri and Komalyna 2023).

Environmental Factors

First, residential area. Children whose parents live in rural or slum areas have a higher likelihood of experiencing stunting compared to urban areas. Urban populations typically have higher levels of education, economic status, and more employment opportunities (Fenta et al. 2020).

Second, source of drinking water. Access to clean water and sanitation also has a significant impact on the nutritional status of children. The lack of water in households can impede basic hygiene practices. Children whose source of drinking water is not safe are more likely to be stunted compared to children with access to safe drinking water (Mzumara et al. 2018). Children under the age of 5 who drink water from unsafe sources are more likely to experience secondary malnutrition, leading to infections such as diarrhea and other comorbidities (Mengesha et al. 2021). Water quality that does not meet the standards will lead to children under the age of 5 suffering from infectious disease, resulting in stunting (Raharini and Yuniarti 2023)

Third, birthing location. Children born in healthcare facilities are less likely to experience stunting compared to those born at home. A child born in a healthcare facility is more likely to receive proper postnatal care, such as crucial vaccinations for their development and growth. This can prevent several diseases and provide essential nutrition for the child (Takele, Gezie, and Alamneh 2022).

Fourth, access to sanitation Facilities. In a study across 137 low- and middle-income countries (LMICs). poor sanitation has been identified as the second-largest global burden of stunting in children (Vonaesch et al. 2021). Households that lack toilet facilities altogether are more likely to have children who experience stunting. Health in developing countries demonstrates that improved access to sanitation can reduce the likelihood of stunting in children under 5 years of age (Simelane et al., 2020).

Conclusion

This systematic literature review identifies several articles discussing factors related to stunting in children under 5 years old. It can be concluded that the causes of stunting are not solely child-related but also involve external factors such as maternal factors, household factors, and environmental factors. Currently, stunting remains a health issue in early childhood that requires the best healthcare services. Therefore, it is hoped that healthcare professionals can promote and prevent actions related to the causes of stunting, allowing for the prevention of stunting in children as early as possible.

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Author Contributions

Conceptualization, data curation, writing - original draft preparation, D. N. A.; writing-original draft preparation, formal analysis, methodology, investigation, resources, D. N. A, M. Z. R.; writing-review and editing, D. N. A, M. Z. R, S. W.

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Conflicts of Interest

The authors say they have no conflict of interest.

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