

Determinants of stunting in children under five: a scoping review

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ABSTRACT

Background: Inadequate diet, socioeconomic condition, and maternal and child characteristics can damage stunted children under five's mental and physical development. As a result, they have difficulty developing physically and cognitively, have low intellectual abilities, are more susceptible to disease, and have less creativity and innovation.

Objective: This study seeks to investigate and summarize the determinants of stunted children under five.

Materials and Methods: The study used a scoping review method. The literature search was carried out on indexed databases of Scopus, PubMed, Google Scholar, Crossref, and Pro-Quest in English and Indonesian. There were 720 research articles, and 18 of them met the inclusion criteria. From the 18 journals, information was collected from the publication year 2015-2021. Relevant study articles related to the topic were analyzed qualitatively using NVIVO-12 Plus.

Results: Our findings identify that maternal education, low birth weight (LBW), gender, exclusive breastfeeding, parental income, parental age, and child age are the dominant determinants of stunting among under-five children.

Conclusion: Higher risk factors of stunting among children are parents' lack of knowledge, low family income, low nutrition, low level of mother's education, and lack of parents' supervision and parenting skills.

Keywords: *children under five; determinants of stunting; scoping review*

BACKGROUND

Stunting becomes a nutritional problem in children, especially for children under five. Stunting is a condition in which a child under the age of 5 has a shorter length or height than his or her age.¹ Children under five who experience stunting will harm the children under five during their growth and development period.² The impact children under five who experience stunting such as they struggle to achieve adequate physical and cognitive development, have lower levels of intelligence, are more susceptible to disease, and reduce productivity.³ Stunting causes a decrease in the immune system of children under five. This condition make they get sick more easy and have higher risk to develop diseases.⁴ Factors that cause stunting both in the world and in Indonesia include lack of knowledge about stunting, food insecurity, premature birth or LBW, exclusive breastfeeding, management of complementary foods for children, sanitation of the environment, and low socioeconomic status of the family.⁵ Other factors that cause stunting are not receiving antenatal care during pregnancy and having a smoking habit during pregnancy.⁶ A study from United Nations International Children's Emergency Fund (UNICEF) in 2018 estimated there were one in 4 children under five worldwide suffered from stunting with the affected children 149 million.⁷ The World Health Organization (WHO) 2022 estimated the prevalence of stunting under five worldwide at 22.3%.⁸

In recent years, a large amount of literature has developed about the causes of stunting among children. One of them is that infants without exclusive breastfeeding will be at greater risk of causing them to experience stunting because exclusive breastfeeding is critical in children's growth to reduce and prevent stunting.⁹ Bad quality of environmental hygiene and sanitation is related to stunting whereas the incidence of children being stunted is smaller in households with access to good sanitation facilities.¹⁰ The mother's education factor is also a factor that has a close relation with the incidence of stunting among children under five. Highly educated mothers will decide to increase their children's nutritional intake and good health.¹¹ The problem of stunting in children must be appropriately handled. However, previous research is still inconsistent, and there is still a lot of uncertainty about the dominant risk factors for stunting. Although studies of various previous findings have supported it, it is important to analyze and summarize the results of previous studies to find out what factors influence the incidence of stunting in children under five. Therefore, this study is expected to contribute to a deeper understanding of the incidence of stunting in children under five. This research aims to analyze and summarize the evidence for the determinants of stunting in children under five so that it can complete the research that has been done previously, and aims to answer research

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questions: 1) What are the dominant risk factors impacting the incidence of stunting from previous studies?; and 2) What are the research designs and sampling techniques used in the previous studies?

MATERIALS AND METHODS

This study uses the methodological framework by Xiao & Watson¹² to conduct a scoping review. Several steps were taken to identify articles, such as formulating problems, developing and validating reviews, searching the literature, detecting relevant literature, extracting data, analyzing and synthesizing data using NVIVO-12 Plus, and making data reports.

This study used a search strategy to find relevant articles on the determinants of stunted children under five. Search articles using indexed Journal databases Scopus, PubMed, Google Scholar, Crossref, Pro-Quest and search strategies with English keywords ("determinant" OR "risk factors" OR "factors associated") AND ("stunting" OR "undernutrition" OR "underweight" OR "nutrition status") AND ("children" OR "child" OR "baby"). On the other hand, search strategy with Indonesian keywords, namely ("determinan" OR "faktor risiko" OR "faktor yang mempengaruhi" AND ("stunting" OR "kekurangan gizi" OR "berat badan kurang" OR "status gizi")) AND ("anak-anak" OR "anak" OR "bayi"). This study's inclusion criteria were papers published between 2015 and 2021, full-text journals in English and Indonesian languages, and study designs in case-control, cross-sectional, and retrospective cohorts. Of the 720 journals that have been identified from various databases, 18 journals meet the inclusion criteria. Journals that are not full text and journals that are preprinted and not peer-reviewed in the background are excluded. Then the journal manuscripts in the proofreading stage are not included because there is a possibility of changes occurring in the research reporting results.

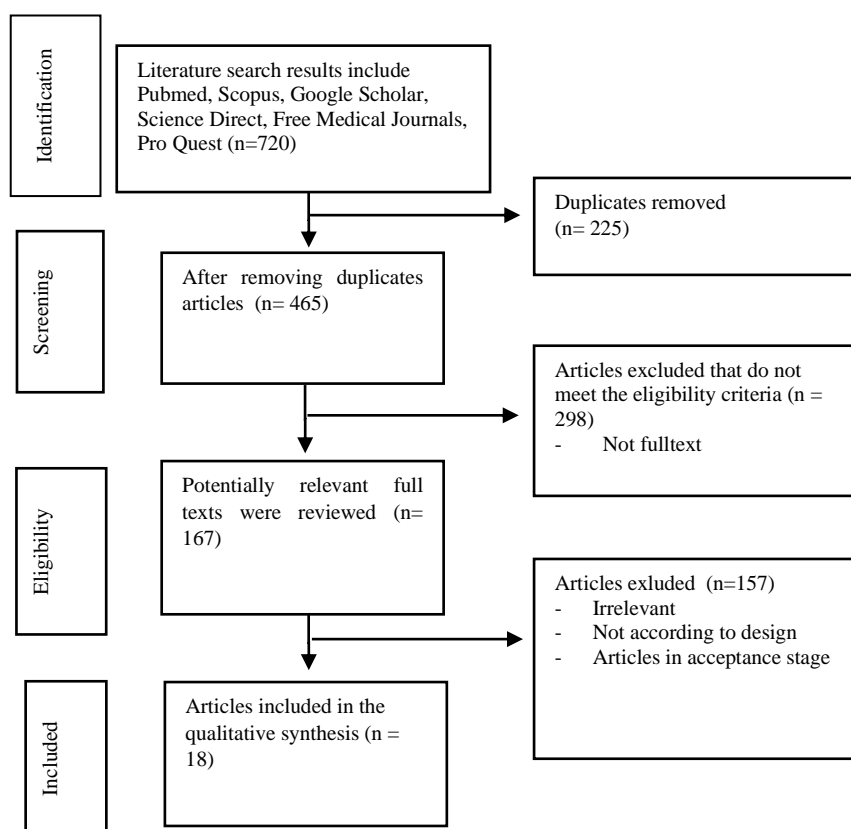


Figure 1. PRISMA Flow Diagram for Database Search of Studies

Relevant study articles related to the identified topics were systematically reviewed and analyzed using NVIVO-12 Plus.

RESULTS

Table 1 shows all the articles included in this research and meet the inclusion criteria published in the 2015-2021 range from various journal databases.

Table 1. Results of Data Extraction

Author and Year	Country	Participant	Study Design	Results	Database
Parenreng et al., 2020 ¹³	Indonesia	858 (6-23 months)	<i>Cross-Sectional</i>	In this study, they found that the presence of a family member who smokes, washes hands and breastfeeding alone become factors associated with locus stunted growth, while in non-locus areas there was a history of diarrhea and hand washing.	<i>Crossref</i>
Kahssay et al., 2020 ¹⁴	Ethiopia	322 (6 to 59 months)	<i>Case-control study</i>	The determinants of stunting obtained from the results of this study were illiterate mothers and the previous birth spacing was < 24 months with AORs of 4.92 and 4.94, respectively. Other factors related to the incidence of stunting in children were no follow-up ANC, no access to the toilet, short mother's baby < 150 cm, no first breast milk or breast milk < 24 months, and nonbreast milk only.	<i>Pubmed</i>
Cruz et al., 2017 ¹⁵	Spain	282 (0-59 months)	<i>Case-control study</i>	Significantly, there were several risk factors of stunting such as birth weight, mother's occupation, education, family size, number of children, charcoal cooking, in wooden or thatched roof houses or apartments without suitable floors, length of life and complete breastfeeding, and exclusive breastfeeding.	<i>Scopus</i>
Berhanu et al., 2018 ¹⁶	Ethiopia	1039 (24-59 months)	<i>Cross-sectional</i>	The prevalence of stunting in preschool children in the research was 39.3% and of the number of stunted children, the incidence was higher in families with food insecurity (42.8%) compared to food security (35.9%).	<i>Scopus</i>
Lobo et al., 2019 ¹⁷	Indonesia	82 (6-59 months)	<i>Case-control study</i>	This study discovered various variables that impact the incidence of stunting, including mother's education, nutrition awareness, and household income, eating habits, family size, environmental hygiene and hygiene practices, parenting style, energy validity level and protein validity level.	Google Scholar
Nkurunziza et al., 2017 ¹⁸	Burundi	6199 (6 to 23 months)	<i>cluster-randomized controlled trial design</i>	The prevalence of stunting and severe stunting in children were 53% and 20.9%, respectively, whereas children aged 12-17 and 18-23 months had an increased risk of stunting compared to children 6-11 months with OR: 2.1 and 3.2.	<i>Scopus</i>
Rakotomanana et al., 2017 ¹⁹	USA	4774 (0 to 59 months)	<i>Cross-Sectional</i>	Girls were at higher risk to experience stunting compared to boys with AOR was 0.69 and p-value <0.01.	<i>Scopus</i>
Abeway et al., 2018 ²⁰	Ethiopia	410 (6-59 months)	<i>Cross-sectional</i>	The general magnitude of stunting was 52.4. Females included the aged between 25-59 months and birth weight <2.5 kg, lack of maternal ANC visits, and the improper start of complementary foods were positively associated with stunted growth in children.	<i>Pubmed</i>

Table 1. Results of Data Extraction (Continue...)

Author and Year	Country	Participant	Study Design	Results	Database
Titaley et al., 2019 ²¹	Indonesia	24.657 under two years	Cross-sectional	Stunting is for households with 3 or more children under five, households with 5 to 7 household members, mothers who used less than 4 antenatal care services during pregnancy, boys, 12–23 months old children, and children’s weight was less than 2500 g at birth.	Google Scholar
Masereka et al., 2020 ⁵	Western Uganda	372 6 - 59 Months	Cross-sectional	Food storage used during the dry and child anthelmintics is significantly associated with absenteeism being stunted.	Pubmed
Semali et al., 2015 ²²	Tanzania	678 households with under-five children	Cross-sectional	This study showed the relationship between the head of the family is young or <35 years old, the young mother, and the economy of the family to the incidence of stunting. The AORs were 0.67, 1.54, and 0.66, respectively.	Scopus
Wali et al., 2020 ²³	South Africa	564,518 children aged 0–59 months	Cross-Sectional	The factors that have a strong possibility of causing stunting in children in the 3 different age groups of children evaluated by the researcher found low maternal education with an AOR in the 0-23 month age group 1.65, the 24-59 month age group 1.46 and the 0-59 month age group. 1.34.	Pubmed
Chirande et al., 2015 ²⁴	Tanzania	7324 children aged 0-59 months	Cross-Sectional	Risk factors were evaluated for the incidence of stunting and severe stunting in children aged 0-23 and 0-59 months. This study found that mothers who had no education, perceived small size infants at birth, and water sources or unsafe drinking were the close factors of incidence of stunting.	Scopus
Rahmawati et al., 2018 ²⁵	Indonesia	174 children < 5 years	Retrospective cohort study	The risk of stunting went down with birth and the mother’s height. On the other hand, the risk of stunting went up with the mother’s age < 20 years. Birth length went up with maternal height (b = 1.07) and higher family income (b = 0.93). Birth length went down with the mother’s age <20 years or 35 years old during pregnancy (b = -0.74).	Crossef
Derso et al., 2017 ²⁶	Ethiopia	587 mother-child	Cross-Sectional	In this study, several factors that have the possibility of increasing the incidence of stunting were low income of the family with AOR = 2.20, unavailability of toilets AOR = 1.76, children aged 12-24 months AOR = 3.24, did not receive vitamin A supplementation postnatal mother AOR = 1.541 and poor family food sources with AOR = 1.71.	Pubmed
Hendraswari et al., 2021 ²⁷	Indonesia	60 children aged 24–59 months	Case-control	There is a significant relationship between stunted children and energy intake factor (p-value = 0.030; = 0.05; 95% confidence interval = 95%).	Google scholar

Table 1. Results of Data Extraction (Continue...)

Author and Year	Country	Participant	Study Design	Results	Database
Khan et al., 2019 ²⁸	Pakistan	3071 aged 0–59 months	Cross-Sectional	About 44.4% of children under the age of 5 years of age are underdeveloped, 29.4% are underweight, and 10.7% are affected by waste. A mother who lives in a rural area, marriage in young age, and has been to a maternity hospital three or more times during pregnancy was less likely to cause growth retardation.	Pro Quest
Habimana & Biracyaza, 2019 ²⁹	Rwanda, Central Africa	1905 children aged 6–59 months	Cross-sectional	Mother's education, age of the mother, mother's occupation, income, child's gender, and fortification feeding patterns statistically have a strong relationship to the incidence of stunting.	Pro Quest

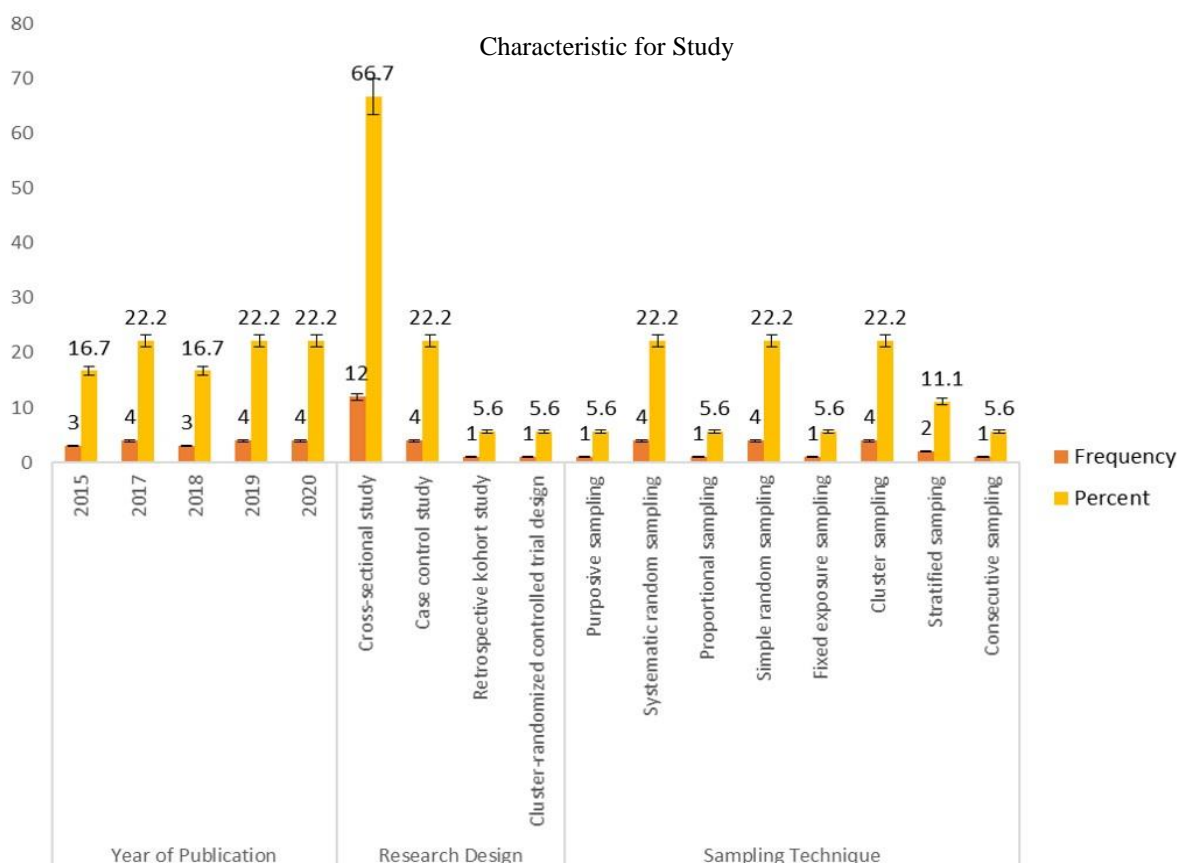


Figure 2. General Characteristics for Study Selection (n=18)

Table 2 shows the factors influencing the incidence of stunting from numerous reference sources. The research of Parenreng et al.³⁰ and Cruz et al.¹⁵ indicates the incidence of children who experience stunting caused by nonexclusive breastfeeding. Infants who were not exclusively breastfed are 6.6 times higher to be stunted. This can happen because breast milk that is given exclusively contains colostrum, which is very good for children under five' health.¹⁴ Energy and protein adequacy levels also affect the incidence of stunted children. If the energy and protein adequacy level is less, the risk of stunting is 4,319 times compared to children whose protein adequacy level is sufficient.³¹ Birth weight also has a very close relation to the incidence of stunting.^{20,21,24,28} Low birth-weight babies are born with deficient nutritional reserves.¹⁵ This can

be attributed to the incorrect assessment of the nutritional status of the mother before and during the mother's pregnancy.^{18,31} Not receiving vitamin A supplementation after delivery and attending less than four antenatal care services will affect the nutritional health of children.²⁶

Table 2. The Related Factors Affecting Stunting in Children Under Five

Related Factors	Significant Risk Factors	Main Empirical Sources
Smoking family members, Exclusive breastfeeding, duration of complementary feeding and hand washing practice.	exclusive breastfeeding (p = 0.001), family members smoking (p = 0.005)	Parenreng et al. ³⁰
Mother's education, birth spacing, no follow-up ANC, children born to short mothers < 150 cm, not given colostrum, breastfeeding below 24 months, and non-exclusive breastfeeding.	education of mother (AOR = 4.92, 95%CI (1.94, 12.4), not fed colostrum (AOR = 4.45, 95% CI (1.68, 11.8), non-exclusive breast feeding (AOR = 6.68, 95% (3.1, 14.52), preceding birth interval less than 24 months (AOR = 4.94, 95% (2.17, 11.2),	Kahssay et al. ¹⁴
Birth weight, mother's education, mother's occupation, residential area, number of children under the age of five in the family, charcoal cooking.	birth weight [AOR = 19.99, 95% CI = (5.8–68.85), p < 0.001], urban areas [AOR = 138.0, 95% CI = (32.38–587.80), p < 0.001]	Cruz et al. ¹⁵
Uneducated mother, Number of family members, and gender.	education of mother (AOR= 5.24, 95% CI; 2.30-11.91) and (AOR= 4.2, 95% CI; 1.77-9.97),	Berhanu et al. ¹⁶
Mother education, parent income, maternal nutrition knowledge, number of families, feeding practice, environment sanitation, energy adequacy rate, and protein adequacy rate.	Mother with low education (AOR= 3.07, 95%CI; 1.40-6.75), have a big number of family (AOR= 3.47, 95% CI; 2.62, 4.60)	Lobo et al. ¹⁷
Uneducated mothers, incorrect assessment of the nutritional status of their children, giving birth at home.	mother without education (AOR=1.6; 95% CI: 1.2-2.1), delivering at home (AOR=1.4; 95% CI: 1.2-1.6)	Nkurunziza et al. ¹⁸
Gender, and region of residence.	girls have higher risk than boys (p < 0.01)	Rakotomanana et al. ¹⁹
Birth weight, gender, older age, duration of breastfeeding, and lack of maternal ANC visits.	female (AOR: 2.8, 95% CI: 1.503–5.099), age group of > 25 months (AOR: 4, 95% CI: 1.881–8.424) , weight of <2.5 kg (AOR: 5, 95% CI: 1.450–17.309), mothers' lack of ANC visits (AOR: 3.2 95% CI: 1.40–7.10)	Abeway et al. ²⁰
Children whose mothers attended < 4 antenatal care services during pregnancy, boy, children aged 12–23 months, and children weighing <2500 g at birth.	mothers used less than 4 antenatal care services during pregnancy (AOR = 1.22, 95% CI: 1.08–1.39), children's weight < 2,5 kg at birth (AOR = 2.55; 95% CI: 2.05–3.15)	Titaley et al. ²¹
Children aged 6-59 months, boys, insufficient food in the household.	Food storage (AOR = 0.23, CI = 0.08-0.62, p = 0.004)	Masereka et al. ⁵
Households where the head of the family is young (<35 years), the mother's age is still young, and family income.	Economic (AOR = 0.66, 96% CI 0.46–0.94, p = 0.023)	Semali et al. ²²
Mother who does not go to school, mother is short (height < 150 cm).	uneducated mother and maternal stature < 150 cm (p < 0.001)	Wali et al. ²³
Low education levels of mothers, sons, small babies, and households with unsafe drinking water.	aged 0-23 months = 1.37; 95% CI: (1.05, 2.14)], aged 0-59 months = 1.42	Chirande et al. ²⁴
The age of mother, body length at birth, the education of mother, family income.	education of mother (b= 1.08; 95% CI= 0.41 to 1.75; p= 0.001), mother's age <20 years b= 0.73; 95% CI= -0.03 to 1.46; p=0.051)	Rahmawati et al. ³²

Table 2. The Related Factors Affecting Stunting in Children Under Five (Continue...)

Related Factors	Related Factors	Related Factors
Family income, unavailability of latrines, children's age: 12-24, did not receive maternal vitamin A supplementation after giving birth.	family income AOR= 2.20; 95%, CI (1.42, 3.40)	Derso et al. ²⁶
Energy intake and protein intake, patients with ARI and diarrhea.	energy intake factor (p= 0.030; α = 0.05; CI = 95%)	Hendraswari et al. ²⁷
The mother's low status of education, the size of the baby at birth, and the mother's BMI.	low education of mother (AOR = 3.61, 95%CI 1.33–9.82), BMI < 18.5 (AOR = 1.78, 95%CI 1.00–3.17)	Khan et al. ²⁸
Mother's education, age, work, child's gender, fortifying feeding, and prenatal care.	gender of child [OR=1.08; 95% CI (1.057–1.093), p=0.008], household wealth index [OR=0.386; 95% CI (0.357–0.414)] and breastfeeding [OR=0.02; 95% CI (0.004–0.036), p=0.013]	Habimana & Biracyaza ²⁹

Gender is another factor of stunting in children less than 5 years. Habimana & Biracyaza²⁹ said boys were more prone to stunting (53.3%) compared to girls (32.2%). This is thought to be a consequence of the enlarged vulnerability of boys to infectious diseases that can interfere with the growth of children under five.²¹ Thus, boys were more likely to be stunted [AOR] = 0.84 [0.72–0.97] and $p < 0.01$ 0.69 [0.55– 0.88] compared to girls.¹⁹

Parental age also affects the incidence of stunting among children.^{22,29,32} If the parent's age is less than 25 years, the child is prone to be stunted.²² Because the mother's age at pregnancy was less than 20 years, the stunting logit score increased by 0.73 (b = 0.73; 95% CI = -0.03 to 1.46; $p = 0.051$).²⁹ Children with age 12-23 months have a higher likelihood of experiencing stunting than those children aged <12 months.²¹ This research supported with another study by Derso et al.²⁶ which states the probability of stunting in children aged 12-24 months [AOR = 3.24; 95% CI: 2.24, 4.69] is bigger than infants aged 6-11 months.

Parental income is also very influential on the incidence of stunting.^{22,26,31} The level of family income will affect household purchasing power, impacting food consumption. If the level of family income is very low due to the work of parents who are still low^{15,29} then there is a shortage or insufficient food in the household, causing stunted growth and development of children. Children with high family incomes are 0.34 times smaller to experience stunting compare to families with low incomes.³²

The area of residence is also related to the incidence of stunted children.^{15,19} Families living in rural areas are more likely to experience stunting. This is because places and access to health services in villages are more difficult to reach than in cities.³¹ So that there are still many pregnant women giving birth alone at home or elsewhere without medical assistance.¹⁸ Using charcoal for cooking [AOR = 3.10, 95% CI = (1.53–6.26), $p = 0.002$] was also associated with stunting.

The number of the family number who smoked also influence the incidence of stunting ($p = 0.005$) with the frequency of complementary feeding ($p = 0.027$), and the practice to wash hand ($p = 0.001$).³⁰ The study of Kahssay et al.¹⁴ also said that the previous birth spacing was less than 24 months, no follow-up, no access to latrine, not given colostrum, and non-exclusive breastfeeding (are very influential on the incidence of stunting in children under five. Cleanliness and environmental sanitation also affect the incidence of stunting in children among children less than 5 years.³¹ Poor environmental sanitation will increase the incidence of infectious diseases in children under five, such as ARI and diarrhea.^{24,27}

Mother's educational status also has an important influence on stunted children.^{15,16,18,23,24,28,29,31,32} If a child is born to a mother who is not highly educated, the baby is 4.9 times risk to experience stunting compared to a child born from a mother who has a high education (AOR = 4.92, 95%CI (1.94, 12 ,4).¹⁴

DISCUSSION

All studies included in this review assessed the factors influencing the incidence of stunting among children under five. One of them is maternal education, low birth weight (LBW), gender, exclusive breastfeeding, parental income, the parents' age, and the child's age. This risk factors reflected in the millions

of children worldwide resulting the children not achieve their full potential of growth due to suboptimal health conditions and insufficient nutrition and childcare.

Maternal Education

Among the 18 journal articles in the literature review, ten articles show that maternal education factors greatly influence the incidence of under-five child stunting.^{15,16,18,23,24,28,29,31,32} A mother's education level will affect the absorption of nutritional information, impacting the process of choosing and providing nutritious food to children under five. The selection and provision of nutritious food will affect children under five's growth and nutritional status. This should be used as a precautionary measure for mothers to routinely care for children under the age of five.³³ Mothers with better knowledge about nutrition, supportive attitudes, and good behavior will affect the growth and development of children to achieve good health status. One of the efforts that can be made is to increase the mother's knowledge under five about stunting and nutrition.³⁴

Birth Weight

Among the 18 journal articles in the literature review, five articles showed the birth weight affects stunted children.^{16,20,21,24,29} From each of these articles, most infants with low birth weight are related to the incidence of stunting. Low birth weight (LBW) is a birth weight that is less than 2500 grams, and usually, babies with low birth weight have a very thin body and look very small and different from babies whose bodies are normal. Babies with low birth weight experience developmental disorders while in the womb, such as high blood pressure, malnutrition, infection during pregnancy, genetic disorders or birth defects in the baby, born to mothers with low body weight during pregnancy, maternal age during pregnancy is less of 17 years or over 35 years and multiple pregnancies. If the baby fails to thrive at an early age within 2 months, the risk of failure to thrive in the next period will be even greater. This research is supported by previous research conducted by Rukmana et al.³⁵ that babies with low birth weight below 2,500 grams will be at risk of 4.192 times stunting compared to children with normal birth weight, which is above or equal to 2,500 grams. Low birth weight is caused by consuming less nutritious food during pregnancy, infection during pregnancy, genetic disorders or birth defects in the baby, inadequate health services, and being born to mothers with low body weight during pregnancy. Thus, birth weight is an important measurement in newborns and is the best indicator to measure children's nutritional status and growth and development. The impact of LBW in general is closely related to fetal death, death in infants aged 0-28 days (neonatal), death in infants after the age of 1 month to 1 year (post-neonatal), as well as long-term growth and development in children. If children under five have a record of low birth weight, then they have a greater risk to be stunted than children with normal body weight. So, birth weight cannot be ignored and should be an important thing in the health and survival of the baby.

Gender

Among the 18 journal articles in the literature review, 6 articles show that gender has an effect on the incidence of stunting among children less than 5 years.^{5,16,19,20,24,29} From several literature reviews, it is explained that boys are more prone to be stunted compared to girls. This happens maybe as a result of the high vulnerability of boys to get an infection of disease. Thus, boys showed an effect of chronic malnutrition, especially in environments of playing groups, such as repeated infections and exposure to toxins and air pollutants.^{24,36} In addition, boys tend to have more active than girls, so a lot of energy comes out.³⁷ If it is show the non-balancing with adequate nutrition and food intake, it can cause children to become stunted. The prevalence of stunting is higher in boys under the age of 5 due to the high risk of malnutrition in boys due to their high protein energy requirements.³⁸

Exclusive Breastfeeding

From the literature review of 18 journal articles, 3 articles explained that exclusive breastfeeding affected the incidence of stunting.^{14,15,30} The study showed that 57.1% of children not get an exclusive breastfeeding experience stunting. On the other hand, infants who are exclusively breastfed are lower to experience stunting. The success of exclusive breastfeeding has a very positive impact on the growth and development of children because breast milk can meet the nutritional needs of infants.^{39,40} This is due to the presence of calcium in breast milk which is more and more easily absorbed by the body than the calcium found in formula milk.⁴¹ The study by Parenreng et al³⁰ showed that children aged 6 to 24 months who do not receive breast milk alone have a 1,282 times higher risk of stunting compared to children who receive breast milk alone.

Family Income

There are 4 from 18 journal articles in the literature review that apply the family income factor that greatly influences the incidence of stunting among children less than 5 years old namely.^{22,26,31} Low family income will certainly affect the level of consumption expenditure for lower food needs. Low family incomes have more difficulty meeting their daily needs and balanced nutritional needs. Children under five from families with less per capita income have a 5.385 times risk of experiencing stunting than children under five from families with sufficient income. Stunting that occurs in families with low incomes is due to the family's low understanding of nutrition and management of family diets and hygiene practices.⁴² Family income related to fulfilling energy and protein intake for children can be an indirect factor related to stunting. Low family income will affect the purchasing power of food so spending on food is also low.⁴³

Mother's Age

Among the 18 journal articles in the literature review, there are 3 articles apply the parental age factor which greatly influences the incidence of stunting among children less than 5 years old.^{22,29,32} In the literature review, more stunting came from the group of mothers aged < 20 years. Women at the age <20 years still need adequate nutrition to grow to adulthood and not ready to be a mother. This is because adolescent mothers may have limited access to face multifaceted socioeconomic and difficult to meet nutritional needs during pregnancy. Mothers who are still teenagers (<20 years) during pregnancy have a higher risk to have a stunted child compared to mothers aged 20-24 years.³² Pregnancy at the age of less than 20 years and above 35 years can cause anemia, because at fewer than 20 years of pregnancy, biologically, their emotions are not optimal, they tend to be unstable, and mentally immature so that they are easily shaken which results in a lack of attention to the fulfillment of nutritional needs during pregnancy.

Children Age

There are 4 articles that discuss the child's age factor in the incidence of stunting among children <5 years of age from the 18 journal articles in the literature review.^{5,20,21,26} In a literature review, children are more prone to stunting at the age of 13-24 months. Another study found that children aged 6-11 months experienced less stunting than children aged 12-24 months.⁴⁴ This can happen because the Basal Metabolic Rate (BMR) is higher in older children compared to the younger ones.⁴⁵ Research in Ethiopia also showed the same results where stunting was more dominant in the 6-11 month age group.⁴⁶ This can be explained because this period is a transition period from infancy and there are many changes in lifestyle, diet (exclusive breastfeeding to solid food), and social or environmental interactions. Boys under two years of age experienced stunting more in boys than girls. Male children have a higher BMR than female children, so they need more energy which can affect stunting nutritional status. Usually, children aged <11 months are more susceptible to getting an infection. compared to children aged > 11 months. This must be considered immediately by providing regular immunizations and nutritious food for children to have strong immunity.

CONCLUSIONS

The negative impact on children under five with stunting will be shown in their impaired growth and development due to the result of long-term inadequate nutrient intakes. This will lead the child's height to be shorter than the standard age. Several journals that meet the eligibility criteria, there are several causes or risk factors of stunting, including maternal education, low birth weight (LBW), gender, exclusive breastfeeding, parental income, mother's age and child age. Lack of mother's knowledge, low family income, inadequate fulfillment of family nutrition, low maternal education, and lack of supervision and parenting of children become the risk factors linked with stunting. There are 5 articles discuss about the prevalence of stunting in Indonesia indicates that Indonesia still have a lot of cases of stunting. It is important to support healthcare providers related to stunting prevention for increasing knowledge and meet the information needs of families. Thus, with the support of health care workers, public understanding of stunting will be better. It is crucial to provide education about the nutritional status to increase the mother's knowledge regarding the fulfillment of nutrition for their families in preventing stunting in children under five. These factors should be addressed within the scope of health or across sectors so that stunting events in Indonesia and the world do not occur again so that the future of children is not hampered because of nutritional problems.

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REFERENCES

1. Pertiwi FD, Hariansyah M, Prasetya EP. Faktor Risiko Stunting Pada Balita Dikelurahan Mulyaharja Tahun 2019. *Promotor*. 2019;2(5):381. DOI:10.32832/pro.v2i5.2531
2. Kurniadi. Determinan Penyebab Kejadian Stunting Pada Balita: Tinjauan Literatur. *Din Kesehat J Kebidanan Dan Keperawatan*. 2019;11(1):172–86. DOI: 10.33859/dksm.v11i1.559
3. Umiyah A, Hamidiyah A. Karakteristik Anak Dengan Kejadian Stunting Characteristics of Children with Stunting. *Jurnal Ilmiah Kebidanan*. 2021;8(1):66–72. DOI:10.35316/oksitosin.v8i1.1157
4. Imelda I, Rahman N, Nur R. Faktor Risiko Kejadian Stunting Pada Anak Umur 2-5 Tahun Di Puskesmas Biromaru. *Ghidza J Gizi dan Kesehatan*. 2020;2(1):39–43. DOI:10.22487/ghidza.v2i1.6
5. Masereka EM, Kiconco A, Katsomyo E, Munguiko C. The Prevalence and Determinants of Stunting among Children 6 - 59 Months of Age in One of the Sub-Counties in the Rwenzori Sub-Region, Western Uganda. *Open J Nurs*. 2020;10(03):239–51. DOI:10.4236/ojn.2020.103016
6. Fitriami E, Huriyah T. Determinan kejadian Stunting pada Anak di Indonesia : A Literature Review. *J Smart Keperawatan*. 2019;6(2):113. DOI:10.34310/jskp.v6i2.190
7. Rakotomanana H, Gates GE, Hildebrand D, Stoecker BJ. Determinants of stunting in children under 5 years in Madagascar. *Matern Child Nutr*. 2017;13(4). DOI:10.1111/mcn.12409
8. World Health Organization. Joint child malnutrition estimates [Internet]. 2022. Available from: <https://www.who.int/data/gho/data/themes/topics/joint-child-malnutrition-estimates-unicef-who-wb>
9. Pamungkasari EP, Wekadigunawan C. The Biopsychosocial Determinants of Stunting and Wasting in Children Aged 12-48 Months. *J Matern Child Heal*. 2018;03(02):105–18. DOI:10.26911/thejmch.2018.03.02.03
10. Kwami CS, Godfrey S, Gavilan H, Lakhanpaul M, Parikh P. Water, sanitation, and hygiene: Linkages with stunting in rural Ethiopia. *Int J Environ Res Public Health*. 2019;16(20). DOI:10.3390/ijerph16203793
11. Setiawan E, Machmud R, Masrul M. Faktor-Faktor yang Berhubungan dengan Kejadian Stunting pada Anak Usia 24-59 Bulan di Wilayah Kerja Puskesmas Andalas Kecamatan Padang Timur Kota Padang Tahun 2018. *J Kesehat Andalas*. 2018;7(2):275. DOI:10.25077/jka.v7i2.813
12. Xiao Y, Watson M. Guidance on Conducting a Systematic Literature Review. *J Plan Educ Res*. 2019;39(1):93–112. DOI:10.1177/0739456X17723971
13. Mabe K, Hadju V, Bahar B, Jafar N, Hidayanty H, Saleh LM. Determinants of Stunting Events in Children Aged 6-23 Months in Locus and Non-Locus Areas in East Luwu Regency. *J La Medihealthico*. 2020;1(6):7–16. DOI:10.37899/journallamedihealthico.v1i6.163
14. Kahssay M, Woldu E, Gebre A, Reddy S. Determinants of stunting among children aged 6 to 59 months in pastoral community, Afar region, North East Ethiopia: Unmatched case control study. *BMC Nutr*. 2020;6(1):1–8. DOI:10.1186/s40795-020-00332-z
15. García Cruz LM, González Azpeitia G, Reyes Suárez D, Santana Rodríguez A, Loro Ferrer JF, Serra-Majem L. Factors associated with stunting among children aged 0 to 59 months from the central region of Mozambique. *Nutrients*. 2017;9(5):1–16. DOI:10.3390/nu9050491
16. Berhanu G, Mekonnen S, Sisay M. Prevalence of stunting and associated factors among preschool children: A community based comparative cross sectional study in Ethiopia. *BMC Nutr*. 2018;4(1):1–16. DOI:10.1186/s40795-018-0236-9
17. Lobo WI, Talahatu AH, Riwu RR. Faktor Penentu Kejadian Stunting pada Anak Balita di Wilayah Kerja Puskesmas Alak Kota Kupang. *Media Kesehatan Masyarakat*. 2019;1(2):59–67. DOI:10.35508/mkm.v1i2.1953
18. Nkurunziza S, Meessen B, Van geertruyden JP, Korachais C. Determinants of stunting and severe stunting among Burundian children aged 6-23 months: Evidence from a national cross-sectional household survey, 2014. *BMC Pediatr*. 2017;17(1):1–15. DOI:10.1186/s12887-017-0929-2
19. Rakotomanana H, Gates GE, Hildebrand D, Stoecker BJ. Determinants of stunting in children under 5 years in Madagascar. *Matern Child Nutr*. 2017;13(4). DOI:10.1111/mcn.12409
20. Abeway S, Gebremichael B, Murugan R, Assefa M, Adinew YM. Stunting and its determinants among children aged 6-59 Months in Northern Ethiopia: A cross-sectional study. *J Nutr Metab*. 2018;2018. DOI:10.1155/2018/1078480
21. Titaley CR, Ariawan I, Hapsari D, Muasyaroh A, Dibley MJ. Determinants of the stunting of children under two years old in Indonesia: A multilevel analysis of the 2013 Indonesia basic health survey. *Nutrients*. 2019;11(5). DOI:10.3390/nu11051106

22. Semali IA, Tengia-Kessy A, Mmbaga EJ, Leyna G. Prevalence and determinants of stunting in under-five children in central Tanzania: Remaining threats to achieving Millennium Development Goal 4. *BMC Public Health*. 2015;15(1):4–9. DOI:10.1186/s12889-015-2507-6
23. Wali N, Agho KE, Renzaho AMN. Factors associated with stunting among children under 5 years in five south asian countries (2014–2018): Analysis of demographic health surveys. *Nutrients*. 2020;12(12):1–27. DOI:10.3390/nu12123875
24. Chirande L, Charwe D, Mbwana H, Victor R, Kimboka S, Issaka AI, et al. Determinants of stunting and severe stunting among under-fives in Tanzania: Evidence from the 2010 cross-sectional household survey. *BMC Pediatr*. 2015;15(1):1–14. DOI:10.1186/s12889-015-2507-6
25. Rahmawati VE, Pamungkasari EP, Murti B. Determinants of Stunting and Child Development in Jombang District. *J Matern Child Heal*. 2018;03(01):6–13. DOI:0.26911/thejmch.2018.03.01.07
26. Derso T, Tariku A, Bikis GA, Wassie MM. Stunting, wasting and associated factors among children aged 6-24 months in Dabat health and demographic surveillance system site: A community based cross-sectional study in Ethiopia. *BMC Pediatr*. 2017;17(1):1–10. DOI:10.1186/s12887-017-0848-2
27. Hendraswari CA, Purnamaningrum YE, Maryani T, Widyastuti Y, Harith S. The determinants of stunting for children aged 24-59 months in Kulon Progo District 2019. *Kesmas*. 2021;16(2):71–7. DOI:10.21109/kesmas.v16i2.3305
28. Khan S, Zaheer S, Safdar NF. Determinants of stunting , underweight and wasting among children < 5 years of age : evidence from 2012-2013 Pakistan demographic and health survey. 2019;1–16. DOI:/10.1186/s12889-019-6688-2
29. Habimana S, Biracyaza E. Risk Factors Of Stunting Among Children Under 5 Years Of Age In The Eastern And Western Provinces Of Rwanda: Analysis Of Rwanda Demographic And Health Survey 2014/2015. *Pediatr Heal Med Ther*. 2019;Volume 10:115–30. DOI:10.2147/PHMT.S222198
30. Parenreng KM, Hadju V, Bahar B, Jafar N, Hidayanty H, Saleh LM. Determinants of Stunting Events in Children Aged 6-23 Months in Locus and Non-Locus Areas in East Luwu Regency. *J La Medihealtico*. 2020;1(6):7–16. DOI:10.37899/journallamedihealtico.v1i6.163
31. Lobo WI, Talahatu AH, Riwu RR. Faktor Penentu Kejadian Stunting pada Anak Balita di Wilayah Kerja Puskesmas Alak Kota Kupang. *Media Kesehatan Masy*. 2019;1(2):59–67. DOI:10.35508/mkm.v1i2.1953
32. Rahmawati VE, Pamungkasari EP, Murti B. Determinants of Stunting and Child Development in Jombang District. *J Matern Child Heal*. 2018;03(01):68–80. DOI:10.26911/thejmch.2018.03.01.07
33. Ernawati R. Hubungan Jarak kehamilan dan Kehamilan Remaja dengan kejadian Stunting di Puskesmas Harapan Baru Samarinda. *J Midwifery Reprod*. 2021;4(2):56–63. DOI:10.35747/jmr.v4i2
34. Fauzi M, Wahyudin, Aliyah. Hubungan Tingkat Pendidikan dan Pekerjaan Ibu Balita dengan Kejadian Stunting di Wilayah Kerja Puskesmas X Kabupaten Indramayu. *Pros Semin Nas Kesehat*. 2020;9–15. DOI:10.48186/v2i01.257.9-15
35. Rukmana E, Briawan D, Ekayanti I. Faktor Risiko pada Stunting pada Anak usia 6-24 Months in Bogor. *J MKMI2*. 2016;12(3):192–9. DOI:10.30597/mkmi.v12i3.1081
36. Asfaw M, Wondaferash M, Taha M, Dube L. Prevalence of undernutrition and associated factors among children aged between six to fifty nine months in Bule Hora district, South Ethiopia. *BMC Public Health*. 2015 Dec;15(1). DOI:10.1186/s12889-015-1370-9
37. Anggraeni ZEY, Kurniawan H, Yasin M, Aisyah AD. Hubungan Berat Badan Lahir, Panjang Badan Lahir dan Jenis Kelamin dengan Kejadian Stunting. *Indones J Heal Sci*. 2020;12(1):51–6. DOI:10.32528/ijhs.v12i1.4856
38. Damayanti RA, Muniroh L, Farapti F. Perbedaan Tingkat Kecukupan Zat Gizi Dan Riwayat Pemberian Asi Eksklusif Pada Balita Stunting Dan Non Stunting. *Media Gizi Indones*. 2017;11(1):61. DOI:10.20473/mgi.v11i1.61-69
39. AL Rahmad AH, Miko A, Hadi A. Kajian Stunting Pada Anak Balita Ditinjau Dari Pemberian ASI Eksklusif , MP-ASI, Status Imunisasi Dan Karakteristik Keluarga Di Kota Banda Aceh. *J Kesehat Ilm Nasuwakes Poltekkes Aceh*. 2013;6(2):169–84.
40. Putri AD, Ayudia F. Hubungan Pemberian Asi Eksklusif Dengan Kejadian Stunting Pada Anak Usia 6-59 Bulan Di Padang. *J Kesehat Med Sainatika*. 2020;11(1):33–8. DOI:10.30633/jkms.v11i1.598
41. Domili I, Suleman SD, Arbie FY, Anasiru MA, Labatjo R. Karakteristik ibu dan pemberian ASI eksklusif dengan kejadian stunting di Kelurahan Padebuolo Kota Gorontalo. *AcTion Aceh Nutr J*. 2021;6(1):25. DOI:10.30867/action.v6i1.359

42. Mohammed SH, Muhammad F, Pakzad R, Alizadeh S. Socioeconomic inequality in stunting among under-5 children in Ethiopia: A decomposition analysis. *BMC Res Notes*. 2019;12(1):1–5. DOI:10.1186/s13104-019-4229-9
43. Maulina C, Rachmayanti RD. Risk Factors for Stunting under Two-Year-Old Children in Surabaya. *J Promosi Kesehat Indones*. 2021;16(1):1–6. DOI:10.14710/jpki.16.1.1-6
44. Nasution D, Nurdiati DS, Huriyati E. Berat badan lahir rendah (BBLR) dengan kejadian stunting pada anak usia 6-24 bulan. *J Gizi Klin Indones*. 2014;11(1):31. DOI:10.22146/ijcn.18881
45. Kleinman RE, Coletta FA. Historical overview of transitional feeding recommendations and vegetable feeding practices for infants and young children. *Nutr Today*. 2016;51(1):7–13. DOI:10.1097/NT.000000000000137
46. Malako BG, Asamoah BO, Tadesse M, Hussien R, Gebre MT. Stunting and anemia among children 6-23 months old in Damot Sore district, Southern Ethiopia. *BMC Nutr*. 2019;5(1):1–11. DOI:10.1186/s40795-018-0268-1