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The Influence of Maternal Factors on the Incidence of Stunting in Toddlers: A Narrative Review

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ABSTRACT

Stunting, a severe challenge in the global public health domain, significantly impacts efforts to improve children's quality of life worldwide. The World Health Organization (WHO) defines stunting as a growth disorder in children's height, based on the height-for-age index with a Z-score of less than -2 standard deviation. This study aims to determine the influence of maternal factors on the incidence of stunting in toddlers. It is a narrative literature review. We studied national and international articles published in ScienceDirect, Google Scholar, and PubMed databases within the past ten years (2014 -2024). The keywords used to search for these articles were stunting and maternal factors. Based on the literature review, eight maternal factors contributed to the incidence of stunting in toddlers: maternal education, maternal knowledge, parenting style, maternal nutritional status, anemia during pregnancy, maternal height, maternal age, and birth spacing. There is evidence that improving these factors is essential for preventing stunting.

Keywords: Stunting; Maternal Factors; Toddlers

INTRODUCTION

Stunting is a condition of growth impairment in children, causing their height to be below the normal range for their age. Assessment of stunting is based on the height-for-age index with a z-score of less than -2 standard deviation. According to the World Health Organization (WHO), stunting is considered a chronic health problem in a population if its prevalence reaches 20% or more. Globally, the prevalence of stunting in children under five years old was 22.3% or 148.1 million children in 2022, with 52% from Asia and 43% from Africa. Despite progress in nutrition worldwide, significant challenges remain. There has been a global decline in the prevalence of stunting over the past two decades, between 2000 and 2022, with the prevalence of stunting in children under five years old decreasing from 33% to 22.3%, i.e., from 206.4 million to 148.1 million children. However, progress has been slower in Africa and Southeast Asia. Therefore, the main goal of WHO in the Global Nutrition Targets 2025 is to reduce stunting by 40% (1,2).

Children who experience stunting not only face obstacles in reaching their maximum height but also have a risk of pathological changes such as physical decline, decreased cognitive performance, disrupted neural development, and increased potential for metabolic diseases in adulthood. Therefore, stunting is considered a severe threat to the quality of human resources, potentially lasting a lifetime and affecting the next generation. Thus, adequate nutrient intake during childhood is essential to ensure

healthy growth, optimal organ development, a robust immune system, and appropriate neurological and cognitive progress (3,4).

Stunting is influenced by various factors, both from the mother and the child. WHO categorises the causes of stunting into household and family factors (maternal and environmental factors), food security, breastfeeding, and infections. These causes are related to the community and social context factors such as economics, politics, health, health services, education, social, cultural, agricultural, food systems, water, sanitation, and environment. Household and family factors are divided into maternal and household environmental factors. Maternal factors include poor nutrition during preconception, pregnancy, and breastfeeding, short stature in mothers, infections, young pregnancy, mental health, history of IUGR (Intrauterine Growth Retardation) and preterm birth, short birth spacing, and hypertension (5).

The role of mothers in child development is crucial, starting from the preconception phase, prenatal phase, to the toddler phase. This involvement is vital because failure in the growth process can impact a child's adult life (5). The period from conception to the first two years of life is considered critical, where the adverse effects of malnutrition can be avoided. The first 1000 days of life are a significant opportunity to improve a child's nutritional status. A mother plays a central role as the primary caregiver for infants and children. To some extent, children's health and well-being depend on the health and well-being of mothers. Improvements in maternal care are recognized as the most vital determinant in reducing the stunting rate in the Sub-Saharan Africa (SSA) region (6).

As a predictor of child health, the quality of maternal health is a critical issue, affecting the child's first days from conception. A healthy mother will grow a healthy child, impacting the child's quality of life. Fetal and infant malnutrition, as well as infections and other epigenetic factors that start in the womb, can lead to genetic changes and cause problems later on. Two factors influence the growth and development of gene diversity, namely biological and nutritional factors and infections. Both factors can lead to inhibited growth in the short and long term (7). Therefore, dietary improvements could be made to mothers during the prenatal period to prevent stunting. This study aims to determine the influence of maternal factors on the incidence of stunting in toddlers.

METHODS

This study is a narrative literature review. In writing this narrative review, the method involved searching for literature from national and international articles using the ScienceDirect, Google Scholar, and PubMed databases to identify articles published within ten years (2014-2024). The keywords used to search for these articles were stunting and maternal factors. The process of selecting the studies reviewed consisted of six steps, as shown in Figure 1. The chosen primary research articles were included in this review and thoroughly examined.

RESULT

Sixteen articles were selected and included in this review: seven articles were cross-sectional studies, six articles were demographic and health survey reports, two were case-control studies, and one was a cohort study. Based on the location of the studies, there were six studies in Indonesia, two in Vietnam, two in Ethiopia, and the rest in Africa, Congo, Pakistan, Ghana, South and Southeast Asia, and Multi-Countries. Table 1 summarises the sixteen articles and maternal factors that contributed to stunting.

Our review found eight maternal factors contributed to the incidence of stunting in toddlers: maternal education, maternal knowledge, parenting style, maternal nutritional status, anemia during pregnancy, maternal height, maternal age, and birth spacing.

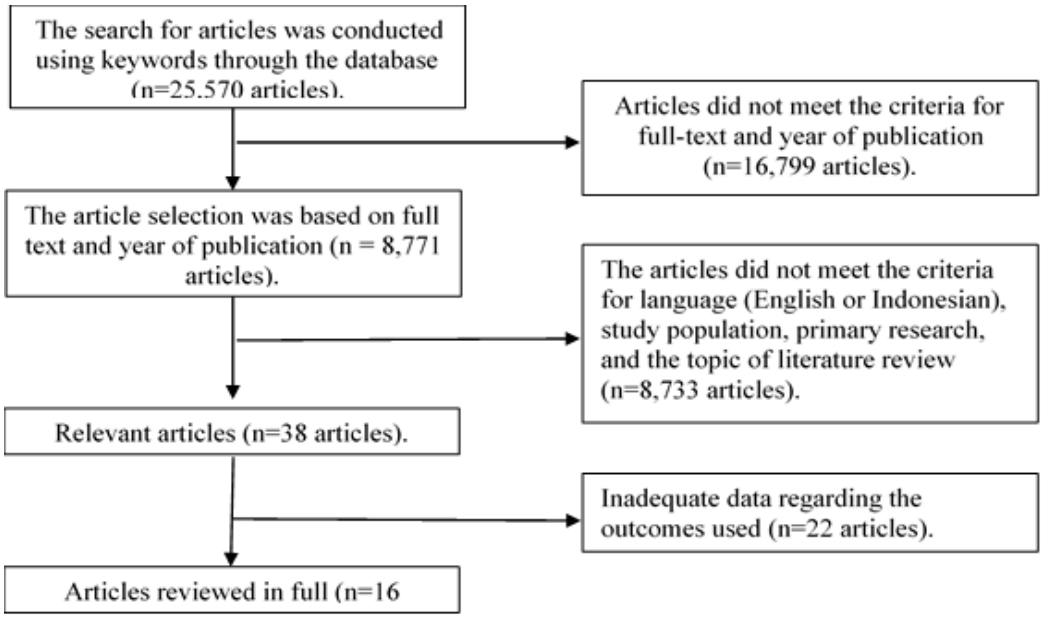

Figure 1. PRISMA Flow diagram

Table 1. Maternal Factors Contributed to Stunting in Toddlers

No	Author/year	Country	Stunting Prevalence	Types of study	Significant Maternal Factors Identified
1	Acharya et al. (2020) (8)	Multi-Countries	2.7%	Demographic and Health Survey and Global Forest Change dataset	Mother's education
2	Aheto (2020) (9)	Ghana	5.30%	2014 Ghana Demographic and Health Survey (GDHS)	Maternal age and education. Number of children under five years in the household, maternal health insurance
3	Anastasia et al., (2023) (10)	Indonesia	41.59% in West Sulawesi Province and 35.74% in South Sulawesi	Secondary data analysis	Maternal BMI, maternal weight and height, Maternal education
4	Beal et al. (2018) (11)	Vietnam	21.4%	Cross-sectional survey	Mother's education, mother's height
5	Berhane et al., (2020) (12)	Ethiopia	19.6%	Cross-sectional population-based survey	Mother's education
6	Fitriani, R and Nurdiana, (2020) (13)	Indonesia	40 cases and 40 controls	Case-control with a retrospective design	Maternal nutritional status during pregnancy
7	Gebru et al. (2019) (14)	Ethiopia	38.39%	2016 Ethiopia Demographic and Health Survey (EDHS)	Mother's BMI, education, occupation, marital status, number of children under 5 in the household
8	Haque et al, (2022) (15)	South And South-East Asian Countries	22.11%	The Demographic and Health Survey (DHS)	Mothers' BMI, maternal age, Mother's education, Age at first marriage, Number of children, Age at first birth, Birth interval
9	Iftikhar et al., (2018) (16)	Pakistan	40.4%	Cross-sectional study	Maternal anemia
10	Makatita & Djuwita (2020) (17)	Indonesia	39.20	Cross-sectional study	Mother's parenting style
11	McKenna et al. (2019) (18)	Democratic Republic of The Congo	35.2%	Cross-sectional study	Mother's education, Mother's age, and Preceding Birth Interval
12	Nshimyiryo et al. (2019) (19)	Rwanda	38%	2014–2015 Rwanda Demographic and Health Survey (RDHS)	Mother's height, educational level, parasite-controlling drugs during pregnancy, and household's wealth
13	Simanjuntak et al., (2019) (20)	Indonesia	29,6%	Cross-sectional study	Knowledge and Practice in Feeding
14	Susilowati, Astria Setiawan and Akbar Budiana, (2019) (21)	Indonesia	37 cases and 37 controls	Case-control	Maternal education level, maternal height, nutritional status of mothers during pregnancy

15	Susyani et al. (2022) (3)	Indonesia	31.2%	Cross-sectional study	Mother's height and mother's education
16	Young et al. (2018) (22)	Vietnam	22.2%	Prospective cohort data	Mother's height and Mother's preconception weight

DISCUSSION

Maternal Education

Parental education is a significant determinant of stunting in children (3,9,10,15,18,19,21). The risk of stunting in children increases with decreasing levels of education. Mothers with at least a secondary education are less likely to have stunted children compared to mothers with lower education levels (8,10–12,14).

Children of uneducated mothers were found to have a higher risk of stunting in four studies in Africa (23). The mother's level of education plays an essential role in the risk of stunting in SSA. Supporting these findings, a review found maternal education was the strongest predictor of stunting in most parental factor studies (24). Therefore, it is recommended that women's education be promoted to prevent stunting (14).

One possible explanation is that higher education is crucial in increasing health awareness, especially for mothers. High literacy enables mothers to access more health information, positively impacting feeding practices and children's nutritional status. Better knowledge of childcare practices, optimal health service-seeking behaviour, and wisdom in managing household resources are some of the benefits gained by highly educated mothers. Therefore, highly educated mothers are expected to have a higher awareness of their children's nutrition and health (3,10,21,25).

Education level is also related to income, as income tends to increase with higher education levels. Sufficient income enables a better quality of life and tends to be more aware of nutritional needs, thus providing more varied and nutritious food. Women with power, especially economic power, tend to be more able to meet the recommended feeding practices for infants and children (19,26,27).

Moreover, adequate education is one way to avoid marriage and pregnancy in adolescence. Women of reproductive age (WRA) with low and medium education tend to marry and become pregnant at a younger age compared to those with higher education. They also have a higher likelihood of experiencing anemia (8). Education level also affects the level of knowledge. Good knowledge helps select food wisely and appropriately and manage health disorders well. Individuals with higher education are more likely to know healthy lifestyles and how to keep their bodies fit, as reflected in the application of healthy lifestyles such as consuming a nutritious diet. Individuals with higher education tend to avoid bad habits such as smoking and alcohol, thus having better health status (9,19,26,27).

Maternal Knowledge

A mother with good nutrition knowledge can reduce stunting in children (20). She can provide the necessary food for her child's growth and development. Information or knowledge about nutrition can be obtained directly or indirectly. Directly, through health workers during counselling sessions, and indirectly through the internet or books (26).

A mother's nutritional knowledge is essential in improving her child's nutritional status. Nutritional knowledge indirectly affects the occurrence of stunting through nutritional intake, meaning that nutritional knowledge influences nutritional intake, which then affects the occurrence of stunting. A mother's nutritional knowledge influences her toddler's food selection and variety. A mother is fully responsible for providing food for her child, providing food for the family, and the child-rearing practices so that each individual in the family follows the nutritional behaviour the mother applies. Knowledge or cognition is an essential aspect and influences the formation of a person's behaviour, in this

case, the mother's nutritional behaviour. Therefore, mothers' understanding and knowledge of nutrition are among the significant factors influencing the occurrence of stunting (20,27).

Mothers' role in preventing stunting can be optimised by strengthening knowledge and parenting aspects. Mothers with good nutritional knowledge prefer to prepare food for their families rather than buy ready-made food whose nutritional content and cleanliness cannot be guaranteed. Improving mothers' knowledge of nutrition plays a significant role in efforts to prevent stunting in children through optimal nutrition. Many studies have shown that mothers with higher nutritional knowledge and practice have children with standard body weights (20,28).

Parenting Style

There is a relationship between family social support and parenting patterns to prevent toddler stunting. The better the family social support for the mother, the better the parenting patterns for the toddler to avoid stunting. Evidence shows that poor maternal parenting contributes to the high prevalence of stunting in toddlers, so efforts to prevent stunting are significant based on the mother's parenting factors (17,29). Thus, there is a need to increase education for prospective mothers, especially adolescent girls, and to increase the knowledge of pregnant women with low education about good parenting patterns for toddlers (28). Parenting patterns greatly influence the food intake given to babies and children. This plays a significant role in efforts to increase children's height through optimal nutrition. Furthermore, parenting patterns are also related to the stimulation provided to children. Suboptimal stimulation can inhibit children's growth and development (20,30).

Maternal Nutritional Status

The mother's nutritional status during preconception and pregnancy significantly affects fetal growth and development. Physiological processes during early pregnancy, which are greatly influenced by the mother's nutritional status and well-being, are crucial for the linear growth of the baby and have long-term effects (31). The nutritional status of parents, especially the mother, is closely related to the occurrence of stunting in toddlers (10,13,15,21,22).

A mother's poor nutritional status can reduce the baby's height at birth. A mother unable to meet the fetus's protein needs will inhibit chondrocyte cell proliferation in the proliferation zone, thus reducing the thickness of the proliferation zone. Furthermore, a mother unable to meet the fetus's calcium and zinc needs will cause a decrease in the formation of hydroxyapatite crystals in the maturation zone, which ultimately inhibits the mineralisation and calcification process of the cartilage model. In addition, a mother unable to meet the fetus's serum mineral needs, including Ca, Ph, and Mg in the mineralisation zone, will cause a decrease in the thickness of the mineralisation zone. Overall, unmet nutrition causes a reduction in the thickness of the epiphyseal plate. The insufficient thickness of the epiphyseal plate will reduce the fetal length and decrease the potential fetal length after birth. Thus, a mother's poor nutritional status during pregnancy can potentially lead to stunting in children (13).

Improving a mother's nutritional status before and during pregnancy is a prerequisite for a healthy pregnancy outcome. Maternal underweight has been proven to be associated with low birth weight. Compared to mothers with normal BMIs, underweight mothers are more likely to give birth to low-birth-weight babies. Intrauterine malnutrition causes developmental deficits that can reduce energy expenditure through changes in the regulation of the endocrine system. These changes are necessary to support life initially, but in the long term, this will have negative consequences at the expense of growth reduction. Thus, short stature is an essential indicator of long-term nutrition deficit (10,15).

Maternal nutrition is crucial in fetal growth, infant health and survival, and long-term child health and development. During the first half of the critical 1000-day period (conception to 6 months), which is an essential period for growth, the mother is the sole source of nutrition for the developing child, first in the womb and then during the first six months of life when exclusive breastfeeding is recommended (22,28).

Optimal maternal nutrition is a critical component of fetal and infant development. Most mothers with high nutritional knowledge can practice feeding methods to meet their dietary needs. Preconception conditions, including the mother's nutritional status before pregnancy, energy intake, and the mother's nutritional status during and after birth, affect early growth and development (20). Mothers are responsible for meeting the fetal nutrition needs during the prenatal period. Essential nutrients that mothers need to pay attention to during the prenatal period are omega-3 fatty acids, iron, iodine, calcium, zinc, magnesium, and vitamins (folic acid/folate, vitamins A, B6, B12, C, D, E) (32). Therefore, the responsibility of mothers during the prenatal period is not only to provide optimal nutrition for the fetus but also to provide a conducive environment that can enhance maternal factors so that mothers are ready for fetal development until childbirth, ensuring optimal fetal growth and avoiding stunting (28).

Anemia during Pregnancy

Anemia is a condition characterised by a decreased average hemoglobin (Hb) level. Anemia in the first and third trimesters of pregnancy is defined by the Centers for Disease Control and Prevention in 1989 as Hb or hematocrit levels below 11 g/dL or 33%, and in the second trimester of pregnancy when Hb or hematocrit levels are below 10.5 g/dL or 32%. According to the WHO, anemia during pregnancy is considered present when Hb levels are below 11 g/dL in any trimester. This definition was established in 2001 and is still valid today. Many factors can contribute to anemia, but in more than 50% of cases, anemia is directly caused by a decrease in the intake of the iron nutrient, commonly known as iron deficiency anemia (33).

Anemia in mothers significantly affects the nutritional status of children, leading to stunting and low birth weight (16). According to the WHO, anemia during pregnancy, mainly due to iron deficiency, is often associated with an increased risk of prematurity and Low Birth Weight (LBW). The flow of nutrients, including ferritin, to the fetus during pregnancy decreases, resulting in lower iron reserves in newborns than in babies born to mothers without anemia during pregnancy. This condition makes it easier for children under two (toddlers) to develop iron deficiency anemia. However, iron is required to accelerate growth and development in the first 1000 days of life. Anemia in the first trimester of pregnancy can increase the risk of premature birth, low birth weight for gestational age, and intrauterine growth restriction (16,34).

The most common cause of anemia in pregnant women is iron and folic acid deficiency. Iron requirements and absorption are low in the first trimester and increase progressively, reaching a maximum in the final trimester with an average daily iron requirement of 6-7mg/dl (35). The estimated daily iron requirement for pregnant women weighing 55 kg is 0.8 mg in the first trimester, 4-5 mg in the second trimester, and over 6 mg in the third trimester (36). Iron deficiency can affect linear growth because iron is a type 2 nutrient needed in growth and development as a primary material in tissue formation. Iron can also increase the amount of insulin-like growth factor (IGF), which accelerates bone growth and improves nutrient transport and intake from the mother to the fetus. Therefore, if pregnant women have iron deficiency anemia, which results in decreased IGF concentration, the nutrient

transport obtained by the fetus from the mother may not be optimal, leading to suboptimal fetal growth and development (37,38).

Maternal Height

Short-statured mothers are more at risk of having stunted children (3,10,11,19,21,22). This could be due to genetic and environmental factors, such as nutritional intake, eating patterns, and culture, which influence the mother during childhood and then her child's growth and development (10,21). A mother's short stature is closely related to genetic factors that reflect the transmission of poor nutrition and health across generations (3,10,22). Maternal height is an indicator of preconception nutritional status closely related to the child's linear growth, which can reflect the combination of the mother's genetics and the nutritional and environmental factors she experienced during her childhood (22,28).

Genetic factors play a role in achieving the outcome of a child's growth and development. However, genetics is not the primary factor determining a person's height. Environmental and nutritional factors are more significant (10,27). Although genetic factors cannot be changed, strengthening nutrition in children during growth can improve their height (22,28). Research is needed to determine which nutritional interventions can be given to short-statured mothers to improve infant health and prevent infants from having the same condition as their mothers (11).

Maternal Age

The article review results indicate that maternal age is one of the maternal factors influencing child stunting. Three articles show that stunting in children is influenced by the mother's age at childbirth (9,15,18). The high risk of pregnancy at the age of 14-16 years for the occurrence of stunting is 9.26 times higher than pregnancy at the age of 20 years, while for pregnancy at the age of 17-19 years, the risk is 2.12 times higher. Young mothers tend to have less knowledge about proper health services and feeding practices for their children. In teenage pregnancies, there is competition to meet the nutritional needs between the fetus and the mother. As a result, the mother does not grow optimally as an adult woman, and the fetus born tends to be small and short because its nutritional needs are not met (9,39).

Birth Spacing

The number of children under five years old in the same household increases the risk of stunting, according to several studies (9,14,40). Additionally, a shorter interval than the recommended 24-36 months increases the risk of stunting (18). This is further supported by studies in sub-Saharan Africa, which found that a longer interval than recommended reduces the risk (41).

Households with multiple young children living together increase the risk of stunting in those children. This is reasonable because the available food must be shared among family members, which increases malnutrition risk in less affluent households. Having twins or more also increases the risk because it naturally puts additional strain on caregivers and household resources compared to a single child. Short intervals between pregnancies contribute to having more young children in the same household and are also independently associated with a higher risk of stunting. If a mother is malnourished after pregnancy, a short birth interval will hinder her nutritional recovery. This could jeopardise the dietary needs of the growing fetus (42). Moreover, short intervals between pregnancies can be associated with low-income family planning or less decision-making power for the mother. Both could indicate fewer available resources and lower household wealth, thus providing another explanation for the increased risk of stunting (23).

CONCLUSION

This narrative review identified eight maternal factors that contribute to the incidence of stunting in toddlers: mother's

education, mother's knowledge, parenting style, mother's nutritional status, anemia during pregnancy, mother's height, mother's age, and birth spacing. Knowledge about these factors can help in developing targeted prevention and management strategies. Therefore, efforts are needed to increase knowledge, especially for prospective mothers, adolescent girls, and pregnant women with low education, about pregnancy preparation and good parenting practices to prevent stunting. These factors have a significant impact on the growth and development of children, and efforts to educate and raise awareness in the community need to be enhanced to reduce the rate of stunting in toddlers.

Declaration by Authors

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