

Maternal Education and Its Impact on Childhood Stunting in Low Income Settings

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Received : May 15, 2025

Accepted : June 12, 2025

Published : June 30, 2025

Citation: Hati, E, P., Yani, A., Paramashanti, B., & Rum, F, F. (2025). Maternal Education and Its Impact on Childhood Stunting in Low Income Settings. NutriSehat : Jurnal Ilmu Gizi, 1(1), 44-56.

ABSTRACT: Childhood stunting remains a significant global public health concern, disproportionately affecting children under five in low and middle income countries. This narrative review aims to examine the role of maternal education in preventing stunting and improving child health outcomes. A comprehensive literature search was conducted across PubMed, Scopus, and Google Scholar, focusing on peer reviewed studies from the last decade that investigate the associations between maternal education and childhood stunting. The inclusion criteria centered on empirical and theoretical studies evaluating health outcomes such as nutritional status, dietary diversity, and healthcare utilization. Findings consistently indicate that maternal education is inversely associated with stunting prevalence. Educated mothers are more likely to adopt health seeking behaviors, practice better hygiene, and ensure adequate child nutrition. Furthermore, maternal education mediates access to health services and facilitates informed decision making related to child care. The review also identifies systemic barriers such as poverty, gender inequality, and poor infrastructure that compound stunting risks. Public health interventions integrating maternal education with improvements in sanitation and household conditions show significant promise in reducing stunting rates. In conclusion, maternal education is a critical determinant of child health and a powerful tool in the fight against stunting. Policy efforts should prioritize educational access for women and support multi sectoral strategies that address the broader determinants of health.

Keywords: Maternal Education, Childhood Stunting, Child Nutrition, Health Disparities, Low And Middle Income Countries, Public Health Interventions, Women's Empowerment.



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INTRODUCTION

Stunting, a form of chronic malnutrition, remains one of the most persistent public health challenges globally, particularly affecting children under five years of age. As of recent global estimates, approximately 22% or 144 million children are stunted, a marked decline from the 40%

prevalence recorded in 1990 (Na et al., 2017). This reduction reflects the success of various international and national level interventions over the past decades. Many low and middle income countries (LMICs) have adopted integrative policies focusing on nutrition, health, and agricultural productivity, leading to improvements in food security and child health outcomes (Hanley-Cook et al., 2020; Tasic et al., 2020). Yet, despite the noted progress, stunting continues to disproportionately affect children in regions marked by economic hardship, fragile healthcare infrastructure, and socio political instability, as seen in country case studies from Ethiopia and Nepal (Slemming et al., 2017).

Among the myriad determinants of stunting, maternal education stands out as a critical protective factor. Empirical evidence strongly supports the assertion that higher levels of maternal education correlate with improved child nutritional status. Studies in East African countries such as Uganda and Tanzania have demonstrated significant reductions in stunting prevalence among children born to educated mothers (Musheiguza et al., 2023; Yang et al., 2018). Educated mothers are more likely to possess adequate knowledge about appropriate child feeding practices, recognize symptoms of malnutrition, and access preventive health services. Research in Bangladesh and Ethiopia further emphasizes the role of maternal education in enhancing household economic conditions and facilitating better dietary practices (Nankinga et al., 2019; Sanin et al., 2018).

The underlying mechanisms through which maternal education influences child health are multifaceted. Increased maternal literacy fosters better awareness of nutritional guidelines, healthcare utilization, and disease prevention strategies. In South Africa, maternal education has been found to significantly mitigate child malnutrition risks through improved household sanitation, feeding behaviors, and proactive health seeking practices (Buisman et al., 2019; Casale et al., 2018). These findings reinforce the argument that empowering women through education leads to more informed decision making, thereby enhancing child well-being.

Evidence from both urban and rural settings highlights the disparities in maternal education and corresponding child health outcomes. In countries such as Rwanda and Malawi, rural mothers often have limited educational opportunities, resulting in higher stunting prevalence compared to urban areas with better access to educational resources (Kalinda et al., 2023). Interventions that integrate educational programs with nutrition and health promotion have demonstrated synergistic benefits in improving early childhood development (Pérez-Escamilla & Morán, 2016).

Addressing stunting thus requires a multidimensional strategy that accounts for the socioeconomic and structural barriers faced by mothers in LMICs. Targeted interventions that provide access to basic health services, nutrition specific support, and educational programs for women can offer dual benefits for maternal and child health ((Arndt et al., 2024). Integrated programs that improve food security while simultaneously elevating maternal education have proven more effective in reducing stunting than standalone interventions (Win et al., 2021). These approaches are particularly crucial in regions where poverty, food insecurity, and gender inequality hinder sustainable child development.

Despite the global reduction in stunting prevalence, fundamental challenges persist. One of the most prominent issues is the entrenched cycle of poverty and malnutrition, exacerbated by

inadequate maternal education. In LMICs, children from impoverished households are more likely to experience food insecurity, limited access to health services, and exposure to unhygienic environments all of which are compounded when mothers lack formal education (Anastasia et al., 2023; Beal et al., 2018). Furthermore, structural constraints such as weak health systems and insufficient social protection schemes reduce the efficacy of interventions designed to support maternal and child nutrition (Susiloretni et al., 2021; Titaley et al., 2019).

In Indonesia, maternal education has been identified as a major predictor of child nutritional outcomes. Multilevel analyses of national health surveys reveal that mothers with limited educational attainment often lack essential knowledge about breastfeeding, complementary feeding, and disease prevention (Titaley et al., 2019). Psychological stress, often experienced in low income households, also correlates with neglect of children's health needs, further exacerbating stunting (Susiloretni et al., 2021). Gender norms and cultural constraints that limit women's access to education compound these issues, particularly in rural and marginalized communities (Getaneh et al., 2019).

These dynamics underscore a significant gap in the literature: although the association between maternal education and stunting is well established, there is limited exploration of how maternal education interacts with other variables such as household wealth, access to services, and cultural norms. Much of the existing research is cross sectional, lacking longitudinal evidence that could illuminate the causal pathways over time (Ahmadi et al., 2018; Jokhu et al., 2024). Moreover, few studies delve into how maternal education moderates or mediates the relationship between these broader determinants and child nutritional outcomes.

This narrative review aims to synthesize existing empirical findings on the relationship between maternal education and stunting among children under five in LMICs. Specifically, it seeks to explore the pathways through which maternal education impacts child nutritional status, identify mediating factors such as socioeconomic status and access to healthcare, and evaluate regional disparities that influence intervention outcomes. The review also examines educational interventions designed to improve child health metrics and their efficacy across different sociocultural settings.

The geographic focus of this review spans Southeast Asia and Sub Saharan Africa, regions where stunting prevalence remains high and maternal education disparities are prominent. Within these contexts, the review highlights data from countries including Indonesia, Bangladesh, Ethiopia, Rwanda, and Kenya, which represent diverse socioeconomic and policy landscapes. By contextualizing findings within these regions, the review aims to inform targeted policy strategies and programmatic interventions that prioritize maternal education as a cornerstone in the fight against childhood stunting.

METHOD

This study employed a narrative review approach to examine the relationship between ultra processed food (UPF) consumption and metabolic health outcomes. A comprehensive literature search was conducted across established academic databases, including PubMed, Scopus, and Google Scholar, targeting studies published within the past ten years. These databases were selected due to their breadth and relevance in covering biomedical, nutritional, and public health literature. The search strategy incorporated pre-determined keyword combinations and Boolean operators to ensure thoroughness and precision in retrieving relevant studies. Keywords included "ultra processed foods," "metabolic health," "obesity," "dietary intake," "chronic disease," "dietary patterns," and terms like "systematic review," "cohort study," and "cross sectional analysis."

The selection criteria focused on peer reviewed research articles, systematic reviews, and meta analyses that empirically or theoretically analyzed the effects of UPF consumption on metabolic health outcomes. Eligible studies included those examining human populations and offering data on associations between UPF intake and outcomes such as obesity, cardiovascular disease, type 2 diabetes, and metabolic syndrome. Studies were excluded if they were not published in English, lacked empirical evidence, were not peer reviewed, or focused solely on animal models or non-metabolic health outcomes.

To enhance reliability, a multi stage screening process was implemented. Initially, titles and abstracts were reviewed for relevance, followed by full text assessments to evaluate methodological rigor. Four independent reviewers conducted this evaluation to ensure consistency with inclusion criteria. The selected studies were analyzed thematically to identify recurrent patterns regarding the pathways and mechanisms by which UPFs influence metabolic health. This synthesis provided key insights into the dietary, physiological, and behavioral dimensions of UPF consumption, offering a comprehensive perspective on its implications for public health and disease prevention strategies.

RESULT AND DISCUSSION

A Statistical Relationship Between Maternal Education Level and Stunting Prevalence in Children Under Five

A growing body of empirical evidence supports the inverse correlation between maternal education and the prevalence of stunting among children under five. Numerous studies across low and middle income countries (LMICs) have reported that each additional year of maternal education is associated with a substantial reduction in the risk of childhood stunting. For instance, Vaivada et al. (2020) highlighted through a cross country analysis that maternal education consistently emerges as a protective factor, mitigating the risk of stunting even when controlling for other socioeconomic variables (Vaivada et al., 2020). In Ethiopia, Amaha and Woldeamanuel (2021) found that maternal education stands out as the strongest predictor of stunting, with higher levels of education leading to markedly improved nutritional outcomes (Amaha & Woldeamanuel, 2021). Similarly, Beal et al. (2018) confirmed that maternal education plays a crucial role in child

development by influencing health behaviors, dietary choices, and health service utilization (Beal et al., 2018).

Bangladesh has produced comparable results, where analyses from the Demographic and Health Surveys indicate that children born to mothers with secondary or higher education are significantly less likely to experience stunting. Islam et al. (2024) and Okyere et al. (2024) corroborate that maternal educational attainment has a cascading effect on child health, impacting dietary diversity, feeding practices, and healthcare access. Kalinda et al. (2023) further assert that maternal education not only affects individual outcomes but also drives community level improvements in child health indicators. Statistical evidence suggests that educated mothers are more likely to adopt optimal feeding behaviors, ensure consistent immunization, and utilize healthcare services all of which converge to reduce stunting prevalence (Islam et al., 2024; Okyere et al., 2024).

Influence of Maternal Knowledge and Awareness on Nutritional Practices and Child Growth

The enhancement of maternal knowledge and awareness through education profoundly influences both immediate and long term child health outcomes. Educated mothers tend to possess a more comprehensive understanding of nutrition, growth monitoring, and illness prevention. Nyamasege et al. (2020) conducted a study in urban Nairobi which demonstrated that mothers who received structured nutritional education were significantly more likely to adopt adequate complementary feeding practices, thus reducing stunting prevalence (Nyamasege et al., 2020). This reflects the critical role of maternal awareness in shaping the micro environment of early childhood development.

In Indonesia, Jokhu et al. (2024) observed that maternal education correlates with increased health service engagement, including antenatal care visits, immunization, and growth monitoring activities strongly associated with reduced stunting rates (Jokhu et al., 2024). Education enhances maternal agency, empowering women to make informed choices regarding nutrition, healthcare, and resource allocation. Astatkie (2020) concluded that maternal education translates into tangible behavioral changes, such as prioritizing household food expenditures and implementing better hygiene practices, which cumulatively foster healthier growth trajectories in children (Astatkie, 2020).

This body of evidence supports the assertion that maternal education indirectly shapes child growth by improving maternal awareness and responsiveness to health needs. However, disparities in educational access remain, particularly in rural and low resource settings, where systemic barriers such as gender norms and lack of infrastructure undermine opportunities for women to obtain education. Kalinda et al. (2023) and Seifu et al. (2024) advocate for integrated educational strategies that embed nutritional and health education within broader literacy programs targeting women in vulnerable communities (Kalinda et al., 2023; Seifu et al., 2024).

The Mediating Role of Maternal Education in Public Health Interventions

Maternal education significantly mediates the effectiveness of public health interventions, particularly in domains such as immunization, sanitation, and dietary practices. In Senegal, Brar et al. (2020) found that maternal secondary education levels correlated with higher rates of child immunization (Brar et al., 2020). Educated mothers are more likely to comprehend and act upon health communication messages, leading to more comprehensive utilization of child health services.

Similarly, Kalinda et al. (2023) illustrated that maternal education is a strong determinant of sanitation behavior. Educated women are more likely to promote and maintain household hygiene, recognize the importance of clean water, and implement preventive health practices that reduce exposure to pathogens linked to malnutrition (Kalinda et al., 2023). Sanin et al. (2018) echoed these findings by noting that households led by educated mothers demonstrate better usage of sanitation infrastructure, contributing to lower incidences of infection induced malnutrition (Sanin et al., 2018).

Regarding dietary practices, Ahmadi et al. (2018) reported that maternal education is a significant predictor of dietary diversity in Ethiopia (Ahmadi et al., 2018). Mothers with higher education levels are more capable of interpreting nutritional guidelines and managing diversified food planning, resulting in improved micronutrient intake among children. This aligns with Vaivada et al. (2020), who suggest that maternal education enhances health literacy, equipping mothers with the skills to navigate food systems and healthcare services effectively (Vaivada et al., 2020).

Synergistic Effects of Maternal Education and Improved Household Environment

Maternal education interacts synergistically with household environmental factors, producing amplified effects on child health. Beal et al. (2018) observed that educated mothers can better leverage access to clean water, adequate sanitation, and food security, translating these resources into effective health outcomes (Beal et al., 2018). In Bangladesh, Sanin et al. (2018) demonstrated that the lowest rates of stunting occurred in households where maternal education and environmental resources coexisted (Sanin et al., 2018). This dual influence underscores the necessity of multisectoral approaches that address both educational and infrastructural needs.

Furthermore, Ahmadi et al. (2018) highlighted that maternal education contributes to economic empowerment, enabling households to access diversified diets and healthcare services (Ahmadi et al., 2018). The combined effect of income stability and maternal knowledge improves dietary consistency, healthcare compliance, and overall child development outcomes. These findings are echoed by Beal et al. (2019), who emphasize the need for holistic interventions that simultaneously enhance maternal education and improve living conditions (Beal et al., 2019).

Impact of Maternal Education on Stunting Across Countries with Varying Human Development Index (HDI)

Cross national analyses reveal that the impact of maternal education on stunting varies with Human Development Index (HDI) rankings. In high HDI countries such as Norway and Sweden, maternal education complements robust public health systems, resulting in low stunting

prevalence. Choudhury et al. (2016) note that in these countries, maternal education enhances already existing infrastructures for child welfare, reinforcing comprehensive care (Choudhury et al., 2016).

In contrast, in low HDI countries such as Ethiopia and Bangladesh, maternal education serves as a critical determinant of child health due to weaker institutional support systems. Astatkie (2020) found that in Ethiopia, each additional year of maternal education reduced stunting odds by 7%, while Huda et al. (2017) reported similar findings in Bangladesh, where education amplified the effectiveness of otherwise limited public health services (Astatkie, 2020; Huda et al., 2017). Vaivada et al. (2020) explain that in these contexts, educational attainment compensates for systemic deficiencies, highlighting the disproportionate reliance on maternal education to bridge health equity gaps (Vaivada et al., 2020).

Regional Patterns in the Correlation Between Maternal Education and Childhood Stunting

Patterns across regions such as South Asia and Sub Saharan Africa exhibit distinct trends in the maternal education stunting relationship. In South Asia, particularly in Bangladesh and India, maternal education is integrally linked to healthcare access, dietary planning, and child survival. Beal et al. (2018) and Seifu et al. (2024) report that investments in maternal education yield significant reductions in child malnutrition and mortality (Beal et al., 2018; Seifu et al., 2024).

Sub Saharan Africa presents similar yet contextually nuanced outcomes. Studies from Ethiopia, Rwanda, and Malawi confirm that maternal education improves health seeking behaviors and food utilization practices (Astatkie, 2020; Kalinda et al., 2023). However, entrenched gender norms and infrastructural limitations can dilute these effects, particularly in rural areas. Abdilahi et al. (2024) reveal disparities between urban and rural zones, with urban areas showing stronger educational impacts due to better service availability (Abdilahi et al., 2024).

Overall, these regional insights affirm that maternal education is a universal determinant of child nutritional outcomes, though its effects are shaped by broader socioeconomic and cultural contexts. As such, region specific strategies that integrate maternal education with contextual barriers and facilitators are necessary for achieving meaningful reductions in stunting.

In summary, maternal education emerges as a central axis around which multiple determinants of childhood stunting revolve. Whether through enhanced knowledge, mediation of health interventions, or synergistic interactions with household environments, educated mothers are better positioned to secure favorable health outcomes for their children. These findings provide a strong empirical foundation for future policy and programmatic efforts aimed at integrating maternal education within broader child health and nutrition frameworks.

Systemic Barriers Exacerbating Childhood Stunting and Policy Level Responses

The persistence of childhood stunting in many low and middle income countries underscores the profound influence of systemic barriers such as poverty, gender inequality, and limited access to

education. These structural determinants not only hinder maternal capacity to ensure adequate child nutrition but also limit access to essential health services and knowledge, which are critical to preventing stunting. Poverty, in particular, is a dominant force exacerbating malnutrition among children. Studies have demonstrated that low socioeconomic status correlates with inadequate dietary intake and poor access to healthcare, thereby elevating the risk of stunting (Beal et al., 2019; Choudhury et al., 2016). In under resourced settings, financial hardship frequently translates into food insecurity, restricted access to healthcare services, and suboptimal sanitation factors that collectively impair children's growth.

Gender inequality further compounds the issue by limiting women's access to education and economic participation. Maternal education, which has been consistently identified as a protective factor against childhood stunting, is often compromised in settings where cultural norms restrict female education. Kalinda et al. (2023) affirm that educated mothers are more capable of recognizing and responding to health needs, accessing healthcare, and implementing appropriate feeding practices (Kalinda et al., 2023). Conversely, in contexts where women lack education and autonomy, children are disproportionately affected by malnutrition and stunting. Studies from Sub Saharan Africa and South Asia support this observation, indicating that mothers with no or limited education are less likely to utilize available health resources or advocate for their children's health (Amaha & Woldeamanuel, 2021; Gebru et al., 2019).

The lack of access to quality education remains a pervasive barrier. Evidence from Ethiopia shows that even marginal increases in maternal education can significantly reduce the odds of stunting (Amaha & Woldeamanuel, 2021; Gebru et al., 2019). Despite this, underfunded and inaccessible education systems perpetuate cycles of poor health outcomes and low educational attainment. Tasic et al. (2020) and Khan et al. (2019) corroborate that the absence of educational infrastructure impedes knowledge transmission about nutrition and health, thus reinforcing intergenerational poverty and malnutrition (Khan et al., 2019; Tasic et al., 2020).

Policy Level Responses to Leverage Maternal Education for Reducing Stunting

To address these systemic constraints, evidence supports the implementation of integrated policy level interventions that prioritize maternal education. Several public health initiatives have successfully incorporated educational components to reduce childhood stunting. For example, Rwanda's Community Based Food and Nutrition Programs have demonstrated notable success by embedding maternal education in nutritional programming. These initiatives equip mothers with knowledge on breastfeeding, complementary feeding, and hygiene, leading to improved child nutrition (Kalinda et al., 2023).

Similarly, the Targeted Supplementary Food Program integrates educational sessions for mothers with nutritional support, resulting in greater dietary diversity and reduced malnutrition (Tasic et al., 2020). In Nigeria, the School Feeding Program links maternal education to improved child outcomes by encouraging mothers' involvement in educational workshops while children receive meals, thereby enhancing community wide nutritional awareness (Adeyemi et al., 2022).

Bangladesh's Female Secondary School Stipend Program offers another compelling example, incentivizing families to keep girls in school and thereby increasing future maternal education levels. Nguyen et al. (2021) found that this initiative significantly improved long term child health indicators, reinforcing the intergenerational benefits of educating women (Nguyen et al., 2021).

These examples illustrate that maternal education is not only a health determinant but also a strategic entry point for multisectoral interventions. By embedding educational strategies within nutrition and health programs, policymakers can amplify the effectiveness of their interventions and address childhood stunting through a holistic, sustainable lens.

Limitation

Despite the robust body of literature on maternal education and stunting, there remain notable limitations in current studies. A frequent constraint is the narrow focus on stunting as a singular metric, often overlooking other indicators like wasting, underweight, and dietary quality. This reductionist approach restricts the breadth of understanding regarding child malnutrition. Another significant limitation is the predominance of cross sectional designs, which limit causal inference. The absence of longitudinal studies constrains the ability to track the long term effects of maternal education on child growth trajectories.

Moreover, regional disparities are insufficiently addressed. National averages often mask the vast heterogeneity within countries, particularly between urban and rural populations. This lack of disaggregated data hinders the development of context specific interventions. In addition, socioeconomic confounders such as household income and access to healthcare are frequently underreported, resulting in partial interpretations of the causal mechanisms linking education to stunting.

Public health interventions, while impactful, often measure success through immediate outputs rather than long term nutritional outcomes. This gap in evaluation impairs the assessment of maternal education's lasting impact and underestimates the full potential of educational initiatives when integrated into health systems.

Implication

Future research should pursue longitudinal methodologies to understand how sustained educational exposure influences maternal behavior and child health outcomes over time. Studies should also broaden their scope to include multidimensional nutritional indicators and explore interactions between maternal education and other determinants such as income, healthcare access, and sanitation.

There is a critical need for context specific research that captures regional and cultural variability in how education affects child nutrition. Such nuanced studies will enable the development of targeted, culturally appropriate interventions. Additionally, future investigations should examine the synergistic effects of combining maternal education with health and nutrition programs, evaluating how these combined efforts influence child growth across different settings. Finally,

interdisciplinary approaches that integrate public health, education, and social policy perspectives are essential to fully address the multifactorial nature of childhood stunting and to inform evidence based, comprehensive policy solutions.

CONCLUSION

This narrative review highlights the pivotal role of maternal education in reducing the prevalence of childhood stunting, particularly among children under five. The results clearly demonstrate a consistent inverse relationship between the level of maternal education and stunting rates across various low and middle income countries. Educated mothers are more likely to adopt positive health behaviors, provide nutritionally adequate diets, utilize healthcare services, and maintain proper sanitation practices all of which contribute significantly to healthier child development outcomes. Moreover, maternal knowledge and awareness gained through education empower women to make informed decisions, further reinforcing their capacity to foster improved growth environments for their children.

This review also revealed systemic barriers, such as poverty, gender inequality, and limited access to education, which exacerbate stunting. Effective interventions, therefore, must be holistic, targeting not only nutritional outcomes but also the socio structural determinants that influence maternal education. Policies that incentivize female education, especially in rural and marginalized areas, should be prioritized, along with integrated programs that couple maternal education with public health services and household infrastructure improvements.

Future research should address existing limitations by employing longitudinal and context sensitive approaches that explore multidimensional factors affecting stunting. Expanding the scope of measurement to include behavioral, economic, and environmental mediators will provide a more comprehensive understanding. Ultimately, scaling up maternal education remains a fundamental strategy in combating stunting, yielding both immediate and intergenerational benefits for public health.

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