BEJ, *VOLUME* 5, *ISSUE* 1, DECEMBER 2024

BORNEO EPIDEMIOLOGY JOURNAL | BEJ

REVIEW ARTICLE Open Access

The Impact of Maternal Nutritional Status on Child Malnutrition: A Systematic Review

Holly Girlchy Jastin [1], Safirah Jaan Jaafar [2*]

Abstract

Stunting, underweight, and wasting significantly affect children under five, especially in low- and middle-income countries (LMICs). Maternal BMI is a key determinant of child nutritional status, as it directly influences fetal growth, breastfeeding quality, and overall maternal health. This systematic review examines the impact of maternal BMI on child stunting and identifies key contributing factors. A comprehensive search was conducted across PubMed, Scopus, Web Science Direct, and Google Scholar for studies published between 2000 and 2024. The inclusion criteria were studies on maternal BMI and child stunting in children under five. Data extraction and risk of bias assessment followed the JBI Critical Appraisal Checklist. Ten studies were reviewed. Findings consistently showed significant associations between maternal BMI and child stunting. Low maternal BMI was linked to nutrient deficiencies and higher risks of stunting. High maternal BMI was associated with metabolic dysregulation and inflammation, also contributing to stunting. Socioeconomic factors like household wealth and maternal education were important determinants. Maternal BMI significantly influences child stunting in LMICs. Integrated nutritional interventions addressing maternal nutrition, socioeconomic factors, and regional disparities are essential to reduce child malnutrition. These findings underscore the need for policy-driven interventions that prioritize maternal nutritional health as a key strategy to improve child growth outcomes and break the cycle of malnutrition. Future research should further explore biological mechanisms linking maternal BMI to child health and develop effective, context-specific interventions.

Keywords: Maternal BMI, Child Stunting, Malnutrition, Low- and Middle-Income Countries, Nutritional Interventions, Socioeconomic Factors.

*Correspondence Email: safirah.jaan@ums.edu.my

[1]*Ministry of Health Malaysia, Communicable Disease Control Unit, Public Health Section, Pahang State Health Department, Jalan IM 4, Bandar Indera Mahkota, 255282, Kuantan, Pahang, Malaysia*

[2]*Department of Public Health Medicine, Faculty Medicine and Health Sciences, Universiti Malaysia Sabah, Jalan UMS, 88400 Kota Kinabalu, Sabah, Malaysia*

Received: 25/07/2024
Accepted: 11/12/2024

Introduction

Maternal nutritional status affects both her well-being and her child's growth and development. Good nutrition before and during pregnancy is crucial, as it helps prevent complications like low birth weight, preterm birth, and child malnutrition. Poor maternal nutrition, whether undernutrition (low BMI, micronutrient deficiencies) or overnutrition (obesity, excessive weight gain) can lead to serious health risks for both mother and baby. It is measured through anthropometric indicators like Body Mass Index (BMI) and mid-upper arm circumference (MUAC**)**, dietary assessments of food intake, and biochemical tests such as haemoglobin levels to check for anaemia. Monitoring maternal nutrition is essential to ensure healthy pregnancies, reduce risks of complications, and support the long-term well-being of both mother and child. Child malnutrition remains a significant global health concern, particularly in low- and middle-income countries (LMICs). In 2022, 149 million children under five were stunted, 45 million experienced wasting, and 37 million were overweight or obese (WHO, 2024). Malnutrition manifests in multiple forms, including undernutrition (wasting, stunting, underweight), micronutrient-related malnutrition, and overnutrition (overweight/obesity), all of which have profound long-term consequences on health, cognition, and socioeconomic outcomes. While food insecurity, inadequate healthcare, and socioeconomic inequalities are widely recognized as key drivers of child malnutrition, maternal nutritional status, particularly maternal BMI, plays a crucial yet often overlooked role. Maternal BMI influences fetal growth, birth weight, breastfeeding quality, and long-term child nutrition outcomes. Low maternal BMI is associated with undernourished offspring who are at higher risk for stunting, wasting, and weakening immunity. Conversely, high maternal BMI has been linked to metabolic complications, gestational diabetes, and childhood obesity (Bourassa et al., 2019).

Despite these associations, there is limited understanding of how maternal BMI contributes to child stunting across different regions, particularly in LMICs, where healthcare disparities persist. Research examining the maternal nutritional status and child malnutrition relationship is crucial for developing targeted interventions that address both maternal and child nutrition simultaneously. Many public health programs focus on child nutrition without adequately addressing maternal health, missing a critical opportunity to break the intergenerational cycle of malnutrition. Figure 1 illustrates this cycle, showing how maternal malnutrition perpetuates poor birth outcomes, leading to childhood stunting and long-term developmental consequences. To effectively combat childhood malnutrition, comprehensive strategies must integrate maternal health interventions, exclusive breastfeeding promotion, and improved access to healthcare and nutrition education. Addressing underlying socioeconomic factors, such as poverty, maternal education, and food security, is equally essential. This systematic review aims to fill the research gap by synthesizing existing evidence on the association between maternal BMI and child stunting, identifying key contributing factors, and proposing targeted intervention strategies. By focusing on maternal BMI as a key determinant of child nutritional outcomes, this review provides insights that can guide public health policies, ensuring maternal nutritional health becomes a central strategy in combating child malnutrition in LMICs. **Figure 1** shows the intergenerational cycle of malnutrition. Malnourished women face inadequate food, health, and care, leading to low birth weight (LBW) babies at higher risk for mortality and chronic diseases. These children often experience stunted growth due to inadequate weaning and frequent infections.

Stunted children suffer from reduced mental capacity and continued nutritional deficiencies into adolescence and adulthood. As adults, they are less able to care for the next generation, perpetuating the cycle of malnutrition. This cycle underscores the need to address malnutrition at all life stages to improve future generations' health outcomes. Addressing nutritional deficiencies in one generation can significantly impact subsequent generations' health and well-being. (see Figure 1: Intergenerational Cycle of malnutrition) (Ahmed et al., 2012). Comprehending the intricate interplay between maternal and child health elements and malnutrition in children under five is imperative for guiding focused interventions and policies directed at alleviating the burden of malnutrition in this vulnerable demographic. This systematic review aims to amalgamate the existing evidence concerning the correlation between maternal health practices and status and the prevalence of malnutrition among children under five.

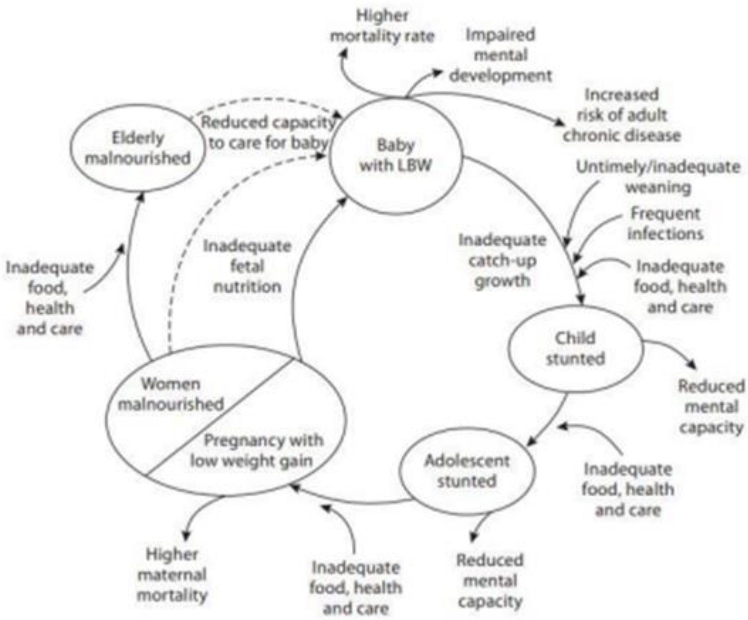

Figure 1: Intergenerational cycle of malnutrition (Ahmed et al., 2012)

Methods

Study Population

The study population includes children under five years of age (0–59 months) and their mothers, focusing on the relationship between maternal nutritional status and child undernutrition.

Study Design

This systematic review investigates the association between maternal nutritional status and child undernutrition. Studies were selected based on their relevance to maternal anthropometric indicators and child growth outcomes.

Eligibility Criteria for Selecting Studies for Review

Inclusion Criteria:

- Studies assessing maternal nutritional status using anthropometric indicators (Body Mass Index - BMI) categorized as normal, underweight, and obese, with corresponding child growth outcomes (stunting in children aged 0–59 months).
- Studies published in English between 2020 and 2024 to ensure the inclusion of recent findings.
- Studies employing cross-sectional study designs, as they provide observational data on maternal BMI and child malnutrition prevalence.
- Studies conducted in low- and middle-income countries (LMICs) where stunting remains a major public health issue.

Exclusion Criteria:

- Studies that do not assess maternal BMI as a primary exposure variable. non-human studies, reviews, case reports, and editorials.
- Studies focused solely on high-income countries, as the public health context differs from that of LMICs.
- Articles published in languages other than English**,** due to translation limitations.

Study Period

The screening and data extraction process completed by May 2024. However, to ensure data completeness and minimize selection bias, an updated search conducted at the end of 2024 to capture newly published studies.

Search Strategy

A comprehensive literature search was conducted using four electronic databases Scopus, ScienceDirect, PubMed and Google Scholar. To maximize study identification**,** Boolean operators and PICO search strategies were used. The primary search keywords included "Maternal Undernutrition and child malnutrition", "Maternal BMI and child undernutrition", "Maternal nutrition and child health".

Data Extraction

All identified records were imported into a reference management software and converted into a CSV file for organization. The screening process followed three sequential steps.

1. Duplicate removal to avoid redundant studies.
2. Title and abstract screening to exclude irrelevant studies.
3. Full-text review against predefined inclusion and exclusion criteria**.**

Quality Assessment

A comprehensive quality assessment was conducted using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist, specifically designed for cross-sectional studies**.** This tool focusing on study design, sample representativeness, exposure measurement, and statistical analysis quality. The JBI tool evaluates inclusion criteria clarity, study population and setting, measurement validity of maternal BMI and child stunting, and assessment of confounding factors and appropriate statistical analyses. A high-quality rating was required for inclusion, ensuring robust and reliable study selection**.**

Prisma Diagram

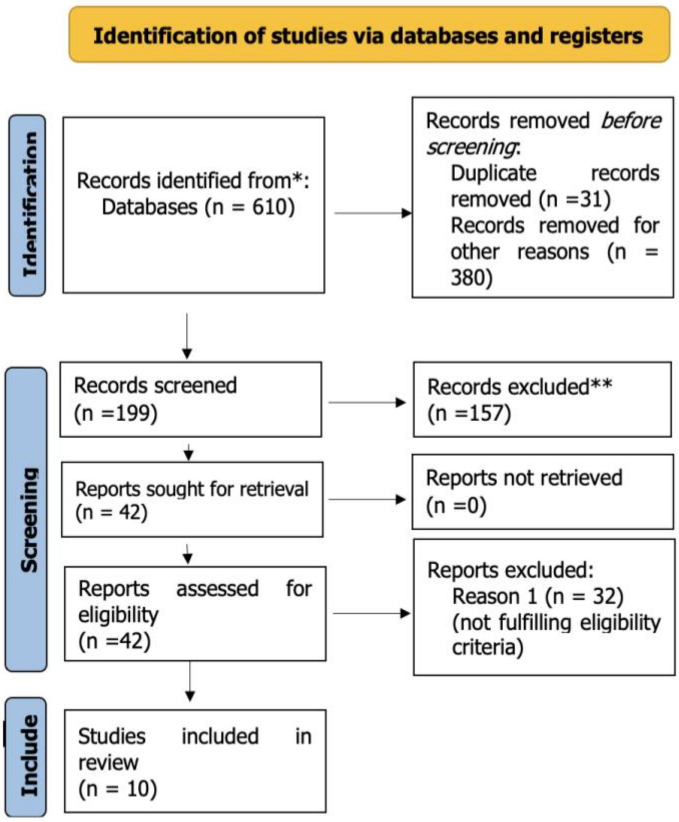

Figure 1: The Prisma flowchart of identified of studies via databases and registers.

Results

Study Selection and Characteristics

A total of 10 studies were included in this review, covering African, Asian, South American, north American, Oceanian continents. The studies analysed the relationship between maternal nutritional status and child malnutrition, particularly focusing on stunting among children under five years old.

Demographic and Regional Distribution

The selected studies covered multiple geographic regions, including Southeast Asia, Africa, and Latin America**,** with varying levels of economic development, healthcare access, and maternal education. The total sample size ranged from 577 to 564,518 participants, with an overall representation of low- and middle-income populations**.** Prevalence rates of stunting, varied across regions but consistently highlighted the impact of maternal nutritional status.

Maternal Nutritional Status and Child Malnutrition

Maternal BMI and height were significant predictors of child stunting, Studies reported that children of underweight mothers (BMI <18.5) had increased odds of being stunted compared to those of normal-weight mothers (Wali et al., 2020). Meanwhile, maternal overweight (BMI ≥ 25) was linked to a paradoxical double burden of malnutrition higher rates of child stunting 25.2% (Blankenship et al., 2020). Short maternal height (<150 cm) was associated with higher odds of child stunting, with pooled ORs ranging from 1.9 to 4.7 (Li et al., 2020).

Socioeconomic and Household Factors

Studies consistently showed that lower maternal education was strongly associated with higher child malnutrition rates**.** Illiterate mothers had 1.58 times higher odds of having a stunted child compared to those with higher education (Kumar & Mohanty, 2022). Household wealth index was a significant determinant; children from the poorest quintile had 2.01 times higher odds of child stunting compared to the richest quintile (Kumar & Mohanty, 2022). Moreover, children from households without piped water have 1.59 times higher odds of being stunted compared to those with piped water (Gebreegziabher & Sidibe, 2024).

Table 1: Summarize of the findings

Reference	Study Area (Country, continent	Sample size	Findings
Li et al., 2020	35 LMICs (Global, multiple continents)	299,353	• Children of underweight mothers (BMI <18.5) had significantly higher odds of being stunted. Prevalence of stunting in children of underweight mothers: 49.7%, (aOR) = 1.6, p < 0.001. • Short maternal height (<145 cm) was the strongest predictor of child stunting. Prevalence of stunting in children of short mothers: 62.2%, aOR = 4.7, p < 0.001. • Children of mothers with no education had significantly higher odds of stunting. Prevalence of stunting in children of mothers with no education: 47.9%, aOR = 1.9, p < 0.001. • Children from the poorest households had the highest stunting prevalence. Prevalence of stunting in the poorest quintile: 51.2%, aOR = 1.7, p < 0.001.
Blankenship et al.,2020	Marshall Islands (Oceania)	581	• Maternal underweight (BMI <18.5) significantly increases the risk of child stunting (aOR = 1.00, prevalence = 43.4%). • Overweight and obese mothers had the lowest odds of stunting (aOR = 0.50 for BMI ≥30, prevalence = 19%). • Short maternal height (<150 cm) is the strongest predictor of child stunting (aOR = 6.62, prevalence = 62.2%). • Higher maternal education significantly reduces child stunting risk (aOR = 0.49 for higher education).

			• Children of working mothers were more likely to be stunted than those of non-working mothers.
Eshete et al., 2020	Ethiopia (Africa)	577	• Prevalence of stunted child-overweight/obese mother (SCOWT): 22.8%. • Overweight/obese mothers had a 23% likelihood of having a stunted child. • Maternal education significantly reduces child stunting risk (aOR = 0.18 for secondary education and above). • Children in rural areas were twice as likely to experience SCOWT compared to urban children (aOR = 2.06). • Older children (≥2 years) were nearly five times more likely to experience SCOWT than younger children (aOR = 4.94).
Kurniawan et al., 2022	Timor-Leste (Southeast Asia)	3,723	• Maternal underweight (BMI <18.5) increases the risk of child stunting. Children of underweight mothers (BMI <18.5) had a higher likelihood of being stunted. Prevalence of stunting in children of underweight mothers: 20.6%. Adjusted Odds Ratio (aOR) = 1.07 (95% CI: 0.87–1.31), p = 0.839. • Children of mothers with short stature (<145 cm) were more likely to experience stunting. Prevalence of stunting: 12.0%, aOR = 0.72 (95% CI: 0.56–0.93), p < 0.001. • Children of mothers with no formal education had a significantly higher risk of stunting. Prevalence of stunting: 42.8%, aOR = 0.8 (95% CI: 0.67–0.96), p < 0.001. • Children from rural households had a higher prevalence of stunting than urban households. Prevalence of stunting in rural areas: 71.5%**,** aOR = 1.036 (95% CI: 0.85–1.26), p = 0.003.

Anastasia et al., 2023	Indonesia (sulawesi)	4,423	• Maternal underweight (BMI <18.5) increases the risk of child stunting (APR = 1.02, p = 0.004). • Short maternal stature (<151 cm) significantly increases the likelihood of child stunting (APR = 1.3, p < 0.001). • Higher maternal education significantly reduces child stunting risk (APR = 1.9 for no education, p = 0.001). • Children from lower-income households have a higher risk of stunting compared to wealthier households (APR = 1.9, p = 0.021). • Increased maternal weight is protective against child stunting (APR = 0.9, p = 0.005).
Kumar & Mohanty, 2022	India (South Asia)	28,817	• Maternal short stature (<145 cm) is the strongest predictor of child stunting (aOR = 2.94, p < 0.001). • Higher maternal education significantly reduces the risk of child stunting (aOR = 1.58 for no education, p < 0.001). • Children from the poorest households had the highest likelihood of being stunted (aOR = 2.01, p < 0.001). • Younger maternal age (15–25 years) increases the risk of child stunting. • Maternal work status was not significantly associated with child stunting.
Gebreegziabher and Sidibe, 2024	Mali (West Africa)	8,908	• Maternal underweight (BMI <18.5) significantly increases the risk of child stunting. • Overweight and obese mothers had the lowest odds of stunting (aOR = 0.50 for BMI ≥30).

			• Higher maternal education significantly reduces child stunting risk. • Anaemic mothers had children with a higher likelihood of stunting. aOR = 1.47 (95% CI: 1.04–2.08), p < 0.05. • Children of pregnant mothers had significantly higher odds of stunting. aOR = 2.04 (95% CI: 1.28–3.26), p < 0.01.
Vijay & Patel, 2024	Nepal (South Asia)	2,381	• Maternal underweight (BMI <18.5) is a major risk factor for child stunting. Prevalence of stunting in children of underweight mothers: 43.4%. • Higher maternal education and longer birth intervals (>3 years) significantly reduce the risk of stunting. Birth interval >3 years significantly reduced stunting risk. Prevalence of stunting: 33.6%. aOR: 0.62, p < 0.001. • Children of working mothers were more likely to be stunted than those of non-working mothers. Prevalence of stunting: 40.2%. aOR**:** 1.26 (95% CI: 0.994–1.594).
Elmighrabi et al.,2024	North Africa (Algeria, Egypt, Sudan, Tunisia)	39,983	• Short maternal stature (<150 cm) is the strongest predictor of child stunting (aOR = 2.94, p < 0.001). • Maternal underweight (BMI <18.5) was unexpectedly associated with lower odds of child stunting (aOR = 0.30, p < 0.001). • Higher maternal education significantly reduces child stunting risk (aOR = 1.30 for no education, p < 0.001). • Children from the poorest households were twice as likely to be stunted compared to the richest households (aOR = 2.01, p < 0.001).

			• Younger maternal age (<20 years) increases the risk of child stunting (aOR = 1.30, $p < 0.001$).
Wali et al., 2020	South Asia (Bangladesh, India, Nepal, Maldives, Pakistan)	564,518	• Maternal underweight (BMI <18.5) significantly increases the risk of child stunting (aOR = 1.36, $p = 0.001$). • Short maternal stature (<150 cm) is the strongest predictor of child stunting (aOR = 3.80, $p < 0.001$). • Higher maternal education significantly reduces child stunting risk (aOR = 1.59 for no education, $p < 0.001$). • Children from the poorest households have a higher risk of stunting compared to wealthier households (aOR = 1.39, $p = 0.002$). • Younger maternal age (<20 years) increases the risk of child stunting (aOR = 1.30, $p < 0.001$).

Maternal Height

The review found a strong correlation between low maternal height and increased risk of child stunting, particularly in low- to middle-income nations. Low maternal height, a common risk factor for stunting, varies greatly across countries and is also linked to underweight children. The relationship between short maternal height and stunting has a biological basis, as chronic undernutrition and poor health during the mother's childhood lead to suboptimal fetal growth and development (Özaltin et al., 2010; Ahmed et al., 2012).

Maternal Education

Maternal education was significantly associated with stunting. This might be due to mothers with higher education having good nutritional knowledge and the ability to make better decisions and healthier choices when caring for their children (Tamir et al., 2022). Supported by other study that show result women with less than ten years of schooling are more likely to have malnourished children than their counterparts with more years. Higher rates of stunting correlated with lower maternal education levels, larger family sizes, and poorer sanitation conditions (Ndagijimana et al., 2024). Results also showed that improving housing quality reduces the likelihood of a child being malnourished by about nine percentage points. There was evidence of the mediating role of housing quality on the relationship between child maternal education and malnutrition (Tangwa et al., 2024).

Maternal education is significantly associated with child stunting. Higher education levels in mothers lead to better nutritional knowledge and healthier choices for their children (Tamir et al., 2022). Studies show women with less than ten years of schooling are more likely to have malnourished children. Higher stunting rates correlate with lower maternal education, larger family sizes, and poor sanitation (Ndagijimana et al., 2024). Improved housing quality can reduce child malnutrition by about nine percentage points, indicating its mediating role in the relationship between maternal education and child malnutrition (Tangwa et al., 2024).

The results revealed that women's decision-making significantly positively affects children's weight-for-age and weight-for-height (Adediran, 2024). Education empowers women to make rational choices regarding education, career, health, and relationships, leading to better health outcomes for themselves and their children (Dhiman, 2023; Kabeer, 2005). Addressing time constraints on caregivers is crucial for improving child feeding practices, emphasizing the need to reduce women's workloads and promote task-sharing within households (McClintic et al., 2022). Children under two in urban areas with working mothers are more likely to experience stunting than those in rural areas, partly due to increased consumption of processed and high-fat foods (Supadmi et al., 2024).

Geographical Variance

To address wealth disparities and geographical variations in malnutrition, all children must have equal access to essential nutrition and healthcare services, regardless of socio-economic status or location. Efforts to reduce wealth disparities and address geographical variations in malnutrition should include the following, firstly, governments and policymakers must prioritize and implement policies that target vulnerable populations in remote rural communities and urban slums.

Additionally, healthcare systems need to be strengthened to provide equal access to nutrition and healthcare services for all children. This includes improving healthcare infrastructure, increasing the availability of healthcare facilities, ensuring healthcare professionals are adequately trained, and utilizing mobile clinics and outreach programs to reach underserved areas.

Education and awareness campaigns are essential to raise awareness about the importance of nutrition and healthcare among parents, caregivers, and communities, enabling them to make informed decisions. Furthermore, efforts should be made to improve the availability and affordability of nutritious food. This can be achieved by promoting sustainable agriculture, supporting local food production, and implementing food assistance programs.

Overall, addressing wealth disparities and geographical variations in malnutrition requires a comprehensive approach involving policy changes, healthcare system improvements, education, and better access to nutritious food. By ensuring equal access to essential nutrition and healthcare services, we can strive to eliminate malnutrition disparities among children (Liou et al., 2020).

Socioeconomic

Poor living conditions, inadequate sanitation, and unsafe drinking water increase the risk of infections and diseases, impairing nutrient absorption and contributing to child malnutrition. Strengthening water and sanitation systems is crucial for improving early childhood nutrition and development outcomes (Leah Richardson et al., 2024). Access to clean water, adequate sanitation, and proper hygiene practices (WASH) prevents infections that impair nutrient absorption. Integrating WASH with nutrition programs creates safer environments, reducing malnutrition risks and supporting healthy growth.

Transformative WASH approaches ensure comprehensive and safe service delivery by promoting safe disposal of feces, handwashing with soap, clean play spaces, and safe food preparation. Case studies show that integrated WASH and nutrition interventions significantly improve child health outcomes. Investing in WASH systems is essential for sustainable improvements in child nutrition and overall public health.

Higher household wealth is linked to better access to nutritious food, healthcare, and education, improving child nutritional status. Lower household wealth limits these opportunities, increasing malnutrition risks. Household assets can impact child health outcomes, making them key targets for policy interventions in regions like India. Standardizing processes and interventions to meet regional standards is crucial as globalization and urbanization change the nutrition landscape (Nguyen et al., 2023). A One Health approach, recognizing the interconnectedness of human, animal, and environmental health, is proposed to tackle child stunting. Coordinating efforts across these sectors can more effectively reduce stunting in LMICs (Tyagi & Joshi, 2022).

Chinese government nutrition policies during the Millennium Development Goals period significantly improved maternal and child nutrition, particularly reducing undernutrition among children. These policies fostered a supportive environment for nutrition improvement, focusing primarily on reducing undernutrition through enhanced breastfeeding, with less emphasis on addressing overweight and obesity (Huang et al., 2020). Overall, China has made substantial progress in reducing undernutrition, contributing to a rapid decline in malnutrition rates. With ongoing efforts, China is well on its way to achieving the Sustainable Development Goals (SDGs) related to child wasting, stunting, low birth weight, and anemia in women of reproductive age. Nevertheless, there is a need for targeted policies and interventions to further improve breastfeeding rates and to prevent and control childhood obesity in the future.

Nutrition-specific interventions include micronutrient supplementation, fortification, optimal breastfeeding, complementary feeding practices, and disease prevention to improve maternal, infant, and child health outcomes (Christian et al., 2015; Kinshella et al., 2021). The First 1,000 Days approach aims to reduce child stunting, with mothers playing a crucial role by improving their nutritional status during pregnancy and lactation (Kinshella et al., 2021).

Strengths and Limitations

This review's strength is its comprehensive search strategy, capturing a broad range of studies with large sample sizes, which helps reduce bias. However, limitations include study heterogeneity, variations in BMI and stunting measurements, potential publication bias, and reliance on self-reported data, introducing recall bias. The cross-sectional nature of many studies limits causal inference.

Conclusion

A systematic review found that children of mothers with low or high BMI had an increased risk of stunting. Household wealth and maternal education significantly contributed to regional disparities in child nutritional status. The complexity of malnutrition is highlighted by inconsistencies across studies, and limitations include potential publication bias and the inability to infer causality due to observational designs. These findings underscore the need for integrated approaches to maternal and child nutrition within a larger socioeconomic context. Strategies should be comprehensive, targeting both maternal and child nutrition to reduce stunting and improve long-term health outcomes.

Recommendation

To mitigate child undernutrition through enhanced maternal nutritional status, several interventions and policies are recommended. Firstly, nutritional programs targeted at pregnant and nursing mothers with low BMI should be implemented. These programs should provide individualized nutritional counseling and essential supplements like iron, folic acid, and multivitamins to improve maternal and child health outcomes. Education is crucial, so access to educational resources on balanced diets, breastfeeding, and nutrition before and after pregnancy should be enhanced. Utilizing multimedia technologies and local languages can ensure broad reach and comprehension. Socioeconomic support is also vital. Developing policies to reduce poverty and improve socioeconomic conditions for families will help. Providing low-income families with healthcare access, food vouchers, and financial assistance can alleviate the effects of poverty on child nutrition.

Addressing geographic differences in undernutrition involves developing nutritional interventions tailored to local food patterns and economic conditions. Establishing regional nutritional surveillance systems will help monitor and address areas with high rates of undernutrition. Researching environmental and cultural factors affecting nutrition is essential for tailoring interventions to local contexts, ensuring they are effective and culturally appropriate. Integrating maternal and child health services into existing healthcare systems is necessary. Routine nutritional assessments and interventions should be ensured during prenatal and postnatal care visits. Advocating for policies that support maternal health, such as maternity leave and workplace accommodations for breastfeeding, is also important.

Promoting community-based seminars and support networks involving mothers, fathers, and caregivers can enhance maternal and child nutrition. Utilizing community health professionals and local leaders can increase participation and provide practical nutritional guidance and cooking demonstrations. These comprehensive strategies aim to improve maternal nutritional status and reduce child undernutrition by addressing both immediate needs and broader socioeconomic

Further Research

It is crucial to carry out additional research that investigates the causal processes connecting mother nutritional status to child undernutrition in order to fully address the issue of undernutrition in children. Gaining a greater understanding of these systems will help us better understand how maternal health influences children's nutritional outcomes, both directly and indirectly. To follow the nutritional state of a mother during her pregnancies, pregnancy, and breastfeeding, as well as the nutritional results of her offspring, longitudinal studies should be conducted. This entails investigating the effects on prenatal development and early childhood growth of the mother's BMI, micronutrient levels, and total dietary intake.

References

Adediran, O. A. (2024). The effect of women's decision-making on child nutritional outcomes in South Africa. *Economics and Human Biology*, *53*. https://doi.org/10.1016/j.ehb.2024.101355

Ahmed, T., Hossain, M., & Sanin, K. I. (2012). Global burden of maternal and child undernutrition and micronutrient deficiencies. *Annals of Nutrition and Metabolism*, *61*, 8–17. https://doi.org/10.1159/000345165

Akter Mishu Assistant Professor, A., Chowdhury, S., Professor, A., & Sharmila Raisa, T. (2020). Article ID: IJM_11_08_001 Age 5 in Bangladesh: A Multivariate Approach. *International Journal of Management (IJM*, *11*(8), 1–9. https://doi.org/10.34218/IJM.11.8.2020.001

Anastasia, H., Hadju, V., Hartono, R., Manjilala3, S., Sirajuddin, Salam, A., & Atmarita. (2023). Determinants of stunting in children under five years old in South Sulawesi and West Sulawesi Province: 2013 and 2018 Indonesian Basic Health Survey. *PLoS ONE*, *18*(5 May). https://doi.org/10.1371/journal.pone.0281962

Black, R. E., Victora, C. G., Walker, S. P., Bhutta, Z. A., Christian, P., De Onis, M., Ezzati, M., Grantham-Mcgregor, S., Katz, J., Martorell, R., & Uauy, R. (2013). Maternal and child undernutrition and overweight in low-income and middle-income countries. In *The Lancet* (Vol. 382, Issue 9890, pp. 427–451). Elsevier B.V. https://doi.org/10.1016/S0140-6736(13)60937-X

Blankenship, J. L., Gwavuya, S., Palaniappan, U., Alfred, J., deBrum, F., & Erasmus, W. (2020). High double burden of child stunting and maternal overweight in the Republic of the Marshall Islands. *Maternal and Child Nutrition*, *16*(S2). https://doi.org/10.1111/mcn.12832

Bourassa, M. W., Osendarp, S. J. M., Adu-Afarwuah, S., Ahmed, S., Ajello, C., Bergeron, G., Black, R., Christian, P., Cousens, S., de Pee, S., Dewey, K. G., Arifeen, S. el, Engle-Stone, R., Fleet, A., Gernand, A. D., Hoddinott, J., Klemm, R., Kraemer, K., Kupka, R., … Vosti,

S. A. (2019). Review of the evidence regarding the use of antenatal multiple micronutrient supplementation in low- and middle-income countries. In *Annals of the New York Academy of Sciences* (Vol. 1444, Issue 1). https://doi.org/10.1111/nyas.14121

Christian, P., Mullany, L. C., Hurley, K. M., Katz, J., & Black, R. E. (2015). Nutrition and maternal, neonatal, and child health. In *Seminars in Perinatology* (Vol. 39, Issue 5, pp. 361–372). W.B. Saunders. https://doi.org/10.1053/j.semperi.2015.06.009

Dhiman, Dr. B. (2023). Education's Role in Empowering Women and Promoting Gender Inequality: A Critical Review. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.4556375

Elmighrabi, N. F., Fleming, C. A. K., & Agho, K. E. (2024). Factors Associated with Childhood Stunting in Four North African Countries: Evidence from Multiple Indicator Cluster Surveys, 2014–2019. *Nutrients*, *16*(4). https://doi.org/10.3390/nu16040473

Eshete, T., Kumera, G., Bazezew, Y., Marie, T., Alemu, S., & Shiferaw, K. (2020). The coexistence of maternal overweight or obesity and child stunting in low-income country: Further data analysis of the 2016 Ethiopia demographic health survey (EDHS). *Scientific African*, *9*. https://doi.org/10.1016/j.sciaf.2020.e00524

Gebreegziabher, T., & Sidibe, S. (2024). Determinants of household-, maternal- and child-related factors associated with nutritional status among children under five in Mali: Evidence from a Demographic and Health Survey, 2018. *Public Health Nutrition*, *27*(1). https://doi.org/10.1017/S1368980024000363

Hastuti, V. N., Afifah, D. N., Sugianto, D. N., Anjani, G., & Noer, E. R. (2024). Socio-demographics, dietary diversity score, and nutritional status of children aged 2–5 years: A cross-sectional study of Indonesian coastal areas. *Clinical Epidemiology and Global Health*, *27*. https://doi.org/10.1016/j.cegh.2024.101599

Huang, X., Yang, B., Liu, Q., Zhang, R., Tang, S., & Story, M. (2020). Improving maternal and child nutrition in China: an analysis of nutrition policies and programs initiated during the 2000–2015 Millennium Development Goals era and implications for achieving the Sustainable Development Goals. *Journal of Health, Population and Nutrition*, *39*(1). https://doi.org/10.1186/s41043-020-00221-y

JME-2023-United-Nations-regions. (2023). *Hild Malnutrition Estimates: Key Findings of the 2023 Edition. Nw York: UNICEF and WHO; 2023. CC BY-NC-SA 3*.

Kabeer, N. (2005). Gender equality and women's empowerment: A critical analysis of the third Millennium Development Goal. *Gender and Development*, *13*(1), 13–24. https://doi.org/10.1080/13552070512331332273

Karlsson, O., Kim, R., Joe, W., & Subramanian, S. V. (2020). The relationship of household assets and amenities with child health outcomes: An exploratory cross-sectional study in India 2015–2016. *SSM - Population Health*, *10*. https://doi.org/10.1016/j.ssmph.2019.100513

Kinshella, M. L. W., Moore, S. E., & Elango, R. (2021). The missing focus on women's health in the First 1,000 days approach to nutrition. In *Public Health Nutrition* (Vol. 24, Issue 6, pp. 1526–1530). Cambridge University Press. https://doi.org/10.1017/S1368980020003894

Kumar, M., & Mohanty, P. (2022). Does maternal overnutrition carry child undernutrition in India? *PLoS ONE*, *17*(6 June). https://doi.org/10.1371/journal.pone.0265788

Leah Richardson, Harmonie Bucher, Michael Emerson Gnilo, & Linda Shaker Berbari. (2024). *STRENGTHENING WATER AND SANITATION SYSTEMS TO IMPROVE CHILD NUTRITION AND DEVELOPMENT OUTCOMES Brief Technical Guidance*.

Li, Z., Kim, R., Vollmer, S., & Subramanian, S. V. (2020). Factors Associated with Child Stunting, Wasting, and Underweight in 35 Low- And Middle-Income Countries. *JAMA Network Open*, *3*(4). https://doi.org/10.1001/jamanetworkopen.2020.3386

Liou, L., Kim, R., & Subramanian, S. V. (2020). Identifying geospatial patterns in wealth disparity in child malnutrition across 640 districts in India. *SSM - Population Health*, *10*. https://doi.org/10.1016/j.ssmph.2019.100524

Martorell, R., Kettel Khan, L., Hughes, M. L., & Grummer-Strawn, L. M. (2000). Obesity in women from developing countries. *European Journal of Clinical Nutrition*, *54*(3). https://doi.org/10.1038/sj.ejcn.1600931

Maulina, R., Qomaruddin, M. B., Kurniawan, A. W., Fernandes, A., & Astuti, E. (2022). Prevalence and predictor stunting, wasting and underweight in Timor Leste children under five years: An analysis of DHS data in 2016. *Journal of Public Health in Africa*, *13*(2). https://doi.org/10.4081/jphia.2022.2116

McClintic, E. E., Ellis, A., Ogutu, E. A., Caruso, B. A., Ventura, S. G., Arriola, K. R. J., Kowalski, A. J., Linabarger, M., Wodnik, B. K., Muga, R., Freeman, M. C., & Girard, A. W. (2022). Application of the Capabilities, Opportunities, Motivations, and Behavior (COM-B) Change Model to Formative Research for Child Nutrition in Western Kenya. *Current Developments in Nutrition*, *6*(7). https://doi.org/10.1093/cdn/nzac104

Nguyen, T. T., Huynh, N. L., Huynh, P. N., Zambrano, P., Withers, M., Cashin, J., Chin, S., & Mathisen, R. (2023). Bridging the evidence-to-action gap: enhancing alignment of national nutrition strategies in Cambodia, Laos, and Vietnam with global and regional recommendations. In *Frontiers in Nutrition* (Vol. 10). Frontiers Media SA. https://doi.org/10.3389/fnut.2023.1277804

Owino, V. O., Murphy-Alford, A. J., Kerac, M., Bahwere, P., Friis, H., Berkley, J. A., & Jackson, A. A. (2019). Measuring growth and medium- and longer-term outcomes in malnourished children. In *Maternal and Child Nutrition* (Vol. 15, Issue 3). Blackwell Publishing Ltd. https://doi.org/10.1111/mcn.12790

Saito, A., & Kondo, M. (2024). Continuum of care for maternal and child health and child undernutrition in Angola. *BMC Public Health*, *24*(1). https://doi.org/10.1186/s12889-024-18144-2

Santa-Ramírez, H. A., Otálvaro-Castro, G. J., Joost, S., Melgar-Quiñonez, H., Bilal, U., & Stringhini, S. (2023). Small area vulnerability, household food insecurity and child malnutrition in Medellin, Colombia: results from a repeated cross-sectional study. *The Lancet Regional Health - Americas*, *23*. https://doi.org/10.1016/j.lana.2023.100521

Soofi, S. B., Khan, G. N., Ariff, S., Ihtesham, Y., Tanimoune, M., Rizvi, A., Sajid, M., Garzon, C., De Pee, S., & Bhutta, Z. A. (2022). *Effectiveness of nutritional supplementation during the first 1000-days of life to reduce child undernutrition: A cluster randomized controlled trial in Pakistan*. https://doi.org/10.1016/j

Supadmi, S., Laksono, A. D., Kusumawardani, H. D., Ashar, H., Nursafingi, A., Kusrini, I., & Musoddaq, M. A. (2024). Factor related to stunting of children under two years with working mothers in Indonesia. *Clinical Epidemiology and Global Health*, *26*. https://doi.org/10.1016/j.cegh.2024.101538

Tamir, T. T., Techane, M. A., Dessie, M. T., & Atalell, K. A. (2022). Applied nutritional investigation spatial variation and determinants of stunting among children aged less than 5 y in Ethiopia: A spatial and multilevel analysis of Ethiopian Demographic and Health Survey 2019. In *Nutrition* (Vols. 103–104). Elsevier Inc. https://doi.org/10.1016/j.nut.2022.111786

Tangwa, M. W., Epo, B. N., & Baye, F. M. (2024). Maternal education and child malnutrition in Cameroon: Does housing quality matter? *Social Sciences and Humanities Open*, *9*. https://doi.org/10.1016/j.ssaho.2024.100901

Tyagi, A., & Joshi, A. (2022). Child Survival Crisis Due to Maternal Undernourishment During the COVID Era. *Cureus*. https://doi.org/10.7759/cureus.31823

Victora, C. G., Adair, L., Fall, C., Hallal, P. C., Martorell, R., Richter, L., & Sachdev, S. (2008).

Maternal and Child Undernutrition 2 Maternal and child undernutrition: consequences for adult health and human capital. *Www.Thelancet.Com*, *371*. https://doi.org/10.1016/S0140

Vijay, J., & Patel, K. K. (2024). Malnutrition among under-five children in Nepal: A focus on socioeconomic status and maternal BMI. *Clinical Epidemiology and Global Health*, *27*. https://doi.org/10.1016/j.cegh.2024.101571

Wali, N., Agho, K. E., & Renzaho, A. M. N. (2020). Factors associated with stunting among children under 5 years in five south asian countries (2014–2018): Analysis of demographic health surveys. *Nutrients*, *12*(12), 1–27. https://doi.org/10.3390/nu12123875

World Health Organization. *WHO guideline on the prevention and management of wasting and nutritional oedema (acute malnutrition) in infants and children under 5 years*. (2023). (2024, June 12). *Malnutrition*. 2024.