The Research of Medical Science Review
ISSN: 3007-1208 & 3007-1216 Volume 3, Issue 3, 2025

IMPACT OF MATERNAL NUTRITIONAL STATUS DURING PREGNANCY ON STUNTING RISK AMONG CHILDREN AGED 24-59 MONTHS

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DOI: https://doi.org/10.5281/zenodo.15004708

Keywords
Stunting,maternal nutritional status,pregnancy,child health,infant feeding practices

Article History
Received on 01 February 2025
Accepted on 01 March 2025
Published on 11 March 2025

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Abstract

Background: *Stunting remains a major public health challenge, particularly in low- and middle-income countries. Maternal nutritional status during pregnancy is a key determinant of child growth and development, yet its impact on stunting risk among children aged 24–59 months is underexplored.*

Objective: *This study aimed to investigate the association between maternal nutritional status during pregnancy and the risk of stunting among children aged 24–59 months.*

Methods: *This retrospective observational study was conducted at the Pediatrics Department and Gynecology & Obs Department of Khyber Teaching Hospital and Obs & Gynae Deptt.of Hayatabad Medical Complex Peshawar from January 2020 to December 2024. A total of 150 mother-child pairs were enrolled, with data collected on maternal nutrition, birth outcomes, and child growth at 24–59 months. Stunting was defined as height-for-age z-score (HAZ) <-2 SD. Multivariate logistic regression was used to identify predictors of stunting.*

Results: *The prevalence of stunting was 24% (n=36). Maternal undernutrition (aOR=2.8, p<0.001), low birth weight (aOR=2.5, p<0.01), inadequate dietary diversity (aOR=1.8, p=0.02), and household food insecurity (aOR=1.6, p=0.04) were significant predictors of stunting.*

Conclusion: *Maternal nutritional status during pregnancy plays a critical role in determining stunting risk. Interventions targeting maternal nutrition, infant feeding practices, and household food security are essential to reduce stunting and improve child health outcomes.*

INTRODUCTION

Stunting, defined as impaired growth and development in children due to chronic malnutrition, remains a significant public health challenge globally, particularly in low- and middle-income countries [1]. It is a critical indicator of child health and well-being, reflecting long-term nutritional deficiencies and environmental adversities. Stunting is associated with increased morbidity, mortality, and long-term consequences such as reduced cognitive development, poor educational outcomes, and diminished economic productivity in adulthood [2]. According to the World Health Organization (WHO), an estimated 149 million children under five were stunted in 2020, underscoring the urgency of addressing this issue [3].

Maternal nutritional status during pregnancy is a key determinant of fetal growth and development, influencing the risk of stunting in early childhood [4]. During pregnancy, the mother's nutritional intake directly affects the availability of essential nutrients required for fetal development, including proteins, vitamins, and minerals. Inadequate maternal nutrition can lead to intrauterine growth restriction (IUGR), low birth weight, and subsequent growth faltering in the first two years of life, which are critical periods for linear growth [5]. Maternal undernutrition, characterized by deficiencies in macronutrients and micronutrients such as iron, folate, and zinc, has been consistently linked to poor birth outcomes and increased stunting risk [6].

Moreover, maternal nutritional status is influenced by a range of factors, including socioeconomic status, access to healthcare, dietary diversity, and environmental conditions [7]. For instance, food insecurity and poverty often limit access to nutrient-rich foods, exacerbating the risk of maternal undernutrition. Additionally, maternal infections, such as malaria and HIV, can further compromise nutrient absorption and utilization, indirectly contributing to stunting in offspring [8]. The intergenerational cycle of malnutrition, where undernourished mothers give birth to undernourished children, perpetuates the burden of stunting across generations [9].

Understanding the relationship between maternal nutritional status during pregnancy and stunting risk among children aged 24–59 months is crucial for designing effective interventions to break this cycle [10]. This age group represents a critical window for assessing the long-term impact of early-life nutritional deficits, as stunting becomes more evident and persistent beyond the first two years of life. By addressing maternal nutrition, policymakers and public health practitioners can target the root causes of stunting and improve child health outcomes.

This study aims to explore the impact of maternal nutritional status during pregnancy on stunting risk among children aged 24–59 months, drawing on evidence from epidemiological studies and public health interventions. The findings underscore the importance of integrated approaches that prioritize maternal health and nutrition as a cornerstone of stunting prevention strategies.

MATERIALS AND METHODS

This retrospective observational study was conducted at the Pediatrics Department and Gynecology & Obs Department of Khyber Teaching Hospital, from January 2020 to December 2024. The study population consisted of children aged 24–59 months who were suspected of stunting and presented at the Pediatrics Department. For these children, maternal data during pregnancy were retrospectively retrieved from hospital records maintained by the Gynecology Department. Inclusion criteria for children were: (1) age between 24–59 months, (2) clinical suspicion of stunting based on WHO growth standards, and (3) availability of maternal antenatal records. Exclusion criteria included: (1) children with congenital anomalies or chronic illnesses affecting growth (e.g., congenital heart disease, cystic fibrosis), and (2) incomplete maternal records or loss to follow-up.

Maternal data collected from hospital records included gestational age at first antenatal visit, maternal nutritional status (based on BMI, hemoglobin levels, and dietary history), and any recorded pregnancy complications (e.g., gestational diabetes, preeclampsia). This approach allowed for an assessment of the association between maternal factors during pregnancy and subsequent stunting outcomes in their children.

The sample size was determined based on published literature and statistical considerations. Using data from previous studies on maternal nutrition and stunting prevalence, a sample size of 150 mother-child pairs was estimated to provide sufficient statistical power to detect significant associations. This calculation assumed a 20% prevalence of stunting among children aged 24–59 months, a 95% confidence level, and a 5% margin of error. The sample size was further adjusted to account for a 15% attrition rate over the study period.

1. **Baseline Assessment (Pregnancy):**

Maternal nutritional status was assessed using anthropometric measurements (height, weight and BMI calculated, and mid-upper arm circumference [MUAC]) and biochemical markers (hemoglobin, serum ferritin, and vitamin D levels).

Socioeconomic and demographic data, including maternal age, education, household income, and access to healthcare, were collected using structured questionnaires.

2. **Postnatal Follow-Up (Birth and Infancy):**

o Birth outcomes, including birth weight, length, and gestational age, were recorded from hospital records.

o Infant feeding practices, such as exclusive breastfeeding and complementary feeding, were assessed at 6 and 12 months of age.

o Anthropometric measurements (weight, length, and head circumference) were taken at birth, 6 months, and 12 months.

3. **Follow-Up Assessment (24–59 Months):**

o Child growth outcomes were assessed using height-for-age z-scores (HAZ) to determine stunting status, as per WHO growth standards.

o Additional data on morbidity, dietary intake, and household food security were collected to account for potential confounding factors.

Measurement Tools and Definitions

- **Stunting:** Defined as a height-for-age z-score (HAZ) below -2 standard deviations (SD) from the WHO Child Growth Standards median.
- **Maternal Undernutrition:** Defined as a body mass index (BMI) <18.5 kg/m² or MUAC <23 cm during pregnancy.
- **Low Birth Weight:** Defined as a birth weight <2.5 kg.

Data were analyzed using SPSS 25.0. Descriptive statistics were used to summarize baseline characteristics, while inferential statistics, including logistic regression and multivariate analysis, were employed to examine associations between maternal nutritional status and stunting risk. Potential confounders, such as socioeconomic status, infant feeding practices, and morbidity, were adjusted for in the analysis. A p-value of <0.05 was considered statistically significant.

The study protocol was approved by the Institutional Review Board (IRB) of Khyber Teaching Hospital. Written informed consent was obtained from all participants before enrollment. Confidentiality of data was maintained, and participants were free to withdraw from the study at any time without affecting their access to healthcare services.

RESULTS

Among the 150 pregnant women enrolled, 35% (n=53) were classified as undernourished (BMI <18.5 kg/m² or MUAC <23 cm). D. Biochemical markers revealed that 28% (n=42) of the women had anemia (hemoglobin <11 g/dL), and 22% (n=33) had low serum ferritin levels, indicating iron deficiency. The prevalence of low birth weight (LBW) was 18% (n=27), with a mean birth weight of 2.8 kg (±0.5 kg). Maternal undernutrition was significantly associated with LBW (p<0.01), with undernourished mothers being 2.5 times more likely to deliver LBW infants (OR=2.5, 95% CI: 1.4–4.3). The overall prevalence of stunting (HAZ <-2 SD) among children aged 24–59 months was 24% (n=36). Children born to undernourished mothers had a significantly higher risk of stunting (38%, n=20) compared to those born to well-nourished mothers (16%, n=16) (p<0.001). low birth weight (LBW) was also a strong predictor of stunting, with 44% (n=12) of LBW children being stunted compared to 20% (n=24) of normal birth weight children (p<0.01). Poor dietary diversity during infancy was associated with a 1.8-fold increased risk of stunting (OR=1.8, 95% CI: 1.1–3.0). Household food insecurity was reported in 30% (n=45) of the families and was significantly associated with stunting (p<0.05). Table-1

Table-1: Maternal and Child Characteristics

Variable	Category	Frequency (n)	Percentage (%)	P value
		Maternal characteristics		
Maternal nutritional status	Undernourished (BMI <18.5/MUAC <23 cm)	53	35%	<0.001
	Well-nourished	97	65%	
		63	42%	
Maternal anemia	Present (Hb <11 g/dL)	42	28%	<0.01

Variable	Category	Frequency (n)	Percentage (%)	P value
	Absent	108	72%	
Child characteristics				
Birth weight	Low Birth Weight (<2.5 kg)	27	18%	<0.01
	Normal Birth Weight (≥2.5 kg)	123	82%	
Household Food security	Food Insecure	45	30%	<0.05
	Food Secure	105	70%	
Stunting at 24–59 months	Stunted (HAZ <-2 SD)	36	24%	
	Not Stunted	114	76%	

Multivariate logistic regression analysis was performed to identify independent predictors of stunting. The results are summarized below:

Table 2: Multivariate Analysis of Stunting Predictors

Predictor	Adjusted Odds Ratio (aOR)	95% Confidence Interval (CI)	p-value
Maternal Undernutrition	2.8	1.6–4.9	p<0.001
Low Birth Weight	2.5	1.3–4.8	p<0.01
Household Food Insecurity	1.6	1.0–2.5	p=0.04

DISCUSSION

The findings of this study highlight the critical role of maternal nutritional status during pregnancy in determining the risk of stunting among children aged 24–59 months. The results align with existing literature and provide valuable insights into the multifactorial nature of stunting, emphasizing the importance of addressing maternal and child nutrition as part of comprehensive public health strategies.

In our study Maternal undernutrition during pregnancy was significantly associated with an increased risk of stunting in children (p<0.001). Undernourished mothers were nearly three times more likely to have stunted children compared to well-nourished mothers. This finding is consistent with previous studies that have identified maternal undernutrition as a key predictor of poor fetal growth and subsequent stunting [11]. Maternal undernutrition limits the availability of essential nutrients required for fetal development, leading to intrauterine growth restriction (IUGR) and low birth weight, both of which are strong predictors of stunting [12]. These results underscore the need for targeted interventions to improve maternal nutrition during pregnancy, particularly in resource-constrained settings.

Low birth weight (LBW) was another significant predictor of stunting in this study, with 44% of LBW children being stunted compared to 20% of normal birth weight children (p<0.01). This finding is consistent with global evidence that LBW is a major risk factor for impaired linear growth and development [13]. Low birth weight often results from maternal undernutrition, infections, and other pregnancy-related complications, which disrupt fetal growth and predispose children to stunting [14]. Addressing the root causes of LBW, such as improving maternal nutrition and access to prenatal care, is essential for reducing the burden of stunting.

Inadequate dietary diversity during infancy and household food insecurity were independently associated with stunting in this study. Children from households with poor dietary diversity were 1.8 times more likely to be stunted (p=0.02), while food insecurity increased the risk of stunting by 1.6 times (p=0.04). These findings are consistent with studies that highlight the importance of dietary diversity and food security in ensuring optimal child growth and development [15]. Poor dietary diversity limits the intake of essential nutrients, while food insecurity exacerbates the risk of chronic malnutrition. Interventions aimed at improving household food security and promoting diverse diets are critical for preventing stunting.

Maternal anemia during pregnancy was also significantly associated with stunting in this study (p<0.01). Anemia, often caused by iron deficiency, impairs oxygen delivery to the fetus and disrupts fetal growth, increasing the risk of stunting [16]. This finding highlights the importance of addressing maternal anemia through iron supplementation and improved dietary practices during pregnancy.

The findings of this study have important implications for public health policies and programs aimed at reducing stunting. Interventions should focus on improving maternal nutrition during pregnancy, promoting exclusive breastfeeding, ensuring adequate dietary diversity during infancy, and addressing household food insecurity. Integrated approaches that combine nutrition-specific interventions (e.g, micronutrient supplementation) with nutrition-sensitive strategies (e.g., poverty alleviation and women's empowerment) are likely to be most effective in reducing stunting [17,18].

The strengths of this study include its retrospective design, comprehensive assessment of maternal and child nutrition, and long follow-up period. However, the study has some limitations. The reliance on self-reported dietary data may introduce recall bias, and the relatively small sample size may limit the generalizability of the findings. Future studies with larger sample sizes and objective measures of dietary intake are needed to confirm these findings.

CONCLUSION

This study underscores the critical role of maternal nutritional status during pregnancy in influencing the risk of stunting among children aged 24–59 months. Maternal undernutrition, low birth weight, inadequate dietary diversity, and household food insecurity were identified as significant predictors of stunting. These findings highlight the need for integrated, multisectoral interventions that prioritize maternal nutrition, improve infant feeding practices, and address household food security to break the intergenerational cycle of malnutrition and reduce the burden of stunting.

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