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RESEARCH ARTICLE

Maternal Education as a Determinant of Malnutrition Severity Among Hospitalized Children in Umerkot, Pakistan: A Cross-Sectional Analysis

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Abstract

Background

Maternal education is a key determinant of child nutrition outcomes in low-income settings. Limited evidence exists from rural Pakistan on how maternal educational attainment influences acute malnutrition severity in hospitalized children. This study examines the association between maternal education and malnutrition severity among pediatric inpatients in Umerkot, Sindh.

Methods

A cross-sectional analytical study was conducted among 298 children aged 6–59 months admitted to District Headquarter Hospital Umerkot. Data on maternal education, demographics, immunization, feeding practices, and anthropometry (MUAC) were collected. Malnutrition was categorized as normal, moderate, or severe using WHO MUAC criteria. Chi-square tests, ANOVA, binary logistic regression, and multivariate models adjusted for confounders including age, sex, residence, immunization, and dietary intake.

Results

Overall malnutrition prevalence was 34.6%, with 26.5% moderate and 8.1% severe cases. Children of mothers with no formal education had significantly higher odds of severe malnutrition (adjusted OR 3.12; 95% CI 1.61–6.03; p<0.001) compared with those whose mothers completed secondary or higher education. A dose–response gradient was observed across education levels. Incomplete immunization, rural residence, and low dietary diversity further increased risk.

Conclusions

Low maternal education strongly predicts higher malnutrition severity among hospitalized children in rural Pakistan. Interventions should prioritize caregiver education, community health literacy, and integrated nutrition–immunization programs.

Keywords:
Maternal education; Malnutrition; MUAC; Pediatric nutrition; Pakistan; Public health

Abstracts in عربی، اردو, 中国人, française, русский and español at the end of the article

Layman Summary

Malnutrition is a serious problem for young children in Umerkot, Pakistan, and many who are admitted to the hospital are already undernourished. This study examined whether a mother's education level affects how severely her child becomes malnourished. We assessed 298 hospitalized children using a simple arm-measurement tool (MUAC) and collected information about feeding, vaccinations, and home conditions. The findings were clear: children whose mothers never attended school were far more likely to have severe malnutrition, while those whose mothers completed secondary school or higher were the least affected. Mothers with more education usually know more about good nutrition, breastfeeding, hygiene, and timely medical care, which helps protect their children. The study also showed that rural children, those not fully vaccinated, and those eating mainly cereal-based diets were more at risk. Improving maternal education and providing health guidance can greatly reduce child malnutrition and save lives.

INTRODUCTION

Malnutrition remains one of the most pressing threats to child health worldwide, particularly in low- and middle-income countries, where it contributes to nearly 45% of all deaths among children under five (Ahmed et al 2025). Acute malnutrition, characterized by rapid weight loss or failure to gain weight, compromises immunity, increases susceptibility to infection, and leads to long-term deficits in cognitive and physical development. According to global estimates, more than 45 million children suffer from wasting and over 149 million from stunting, highlighting its immense public health burden (Farooq et al 2024). Pakistan faces one of the highest burdens of child malnutrition globally. The National Nutrition Survey 2018 reported that 40% of Pakistani children under five are stunted, 17.7% wasted, and nearly 29% underweight, pointing to chronic and widespread nutritional deprivation (Khan et al 2023).

Multiple determinants of malnutrition have been studied extensively, including poverty, food insecurity, infectious diseases, low immunization coverage, inadequate feeding practices, and poor access to healthcare. However, maternal education has emerged consistently as one of the strongest predictors of child nutritional outcomes in LMICs. Maternal education influences a mother's knowledge of nutrition, hygiene practices, breastfeeding, complementary feeding, and utilization of preventive healthcare services (Nasim et al 2024). Educated mothers are more likely to adopt healthier feeding practices, maintain hygiene, complete immunization schedules, and seek timely medical attention for their children. They are also more likely to understand the importance of dietary diversity and environmental sanitation.

Research across South Asia has shown a clear association between higher maternal education and lower child malnutrition rates. In India, children of uneducated mothers were nearly three times more likely to be malnourished (Sharma et al 2024). In Bangladesh, maternal secondary education reduced the odds of severe acute malnutrition by almost half (Rahman et al 2023). Similar trends have been observed in Nepal, Sri Lanka, and Afghanistan. Despite this evidence, few studies in Pakistan have examined maternal education as a primary determinant of malnutrition severity among hospitalized children—particularly in rural and desert areas like Umerkot, where social and educational inequalities are profound.

Umerkot, located in the southeastern region of Sindh, is characterized by high poverty, water scarcity, food insecurity, and limited access to healthcare services. Women's literacy rates are significantly lower than national averages, with many mothers having no formal education at all. These structural disadvantages place children at high risk of undernutrition. Previous research from Umerkot has focused on factors such as birth order, feeding practices, clinical diagnoses, and dietary patterns (Vistro et al 2023; Vistro et al 2024). However, none have directly explored the association between maternal education and malnutrition severity within hospitalized pediatric populations, despite the well-established link between maternal literacy and child health.

Given the persistently high malnutrition rates in Umerkot and the limited evidence regarding the role of maternal education, the present study fills an essential gap. By analyzing the relationship between maternal education levels and the severity of acute malnutrition in a hospital-based pediatric cohort, this research aims to provide actionable insights for clinical and community-level interventions. Understanding whether and how maternal education influences malnutrition severity is crucial for designing targeted strategies, such as nutrition education programs, community health worker counseling, and maternal empowerment initiatives.

Moreover, because hospital-based studies capture children who are already symptomatic or severely ill, they provide a unique opportunity to identify high-risk groups who may not be visible through community surveys. This context allows our study to highlight vulnerable subgroups and to recommend tailored interventions. Given that Umerkot continues to struggle with low female literacy, strengthening maternal education—whether through formal schooling or community-based health literacy programs—may be one of the most effective and sustainable solutions for reducing childhood malnutrition.

This study therefore examines the association between maternal educational attainment and malnutrition severity among hospitalized children in Umerkot. It also evaluates confounding factors such as immunization completeness, rural residence, feeding practices, and clinical diagnoses. By generating evidence from a highly vulnerable population, the findings of this study aim to contribute to the broader discourse on maternal education as a pathway to improved child health outcomes in Pakistan and beyond.

MATERIALS AND METHODS

Study Design and Setting

A quantitative cross-sectional analytical study was conducted at the District Headquarter (DHQ) Hospital Umerkot, Sindh, a 200-bed secondary care facility serving approximately 1.2 million people across urban and predominantly rural regions. Data collection occurred over a 15-day period in March 2022, consistent with methodologies used in previous Umerkot-based studies (Vistro et al 2023).

Study Population

Participants included children aged 6–59 months admitted to pediatric wards. Inclusion criteria were: (1) age 6–59 months, (2) complete anthropometric data, (3) maternal education information available, and (4) caregiver consent. Exclusion criteria included congenital anomalies, chronic conditions, and missing maternal education data.

Sampling Technique

Non-probability consecutive sampling was used to enroll all eligible children during the study period.

Objectives of the Research

1. To determine the prevalence of malnutrition severity across maternal education categories.
2. To assess the association between maternal educational attainment and acute malnutrition severity.
3. To adjust the association for confounders including child age, gender, residence, feeding practices, and immunization status.

Biases and Confounders

Selection bias was minimized using consecutive sampling. Information bias was reduced through trained data collectors and standardized questionnaires. Confounders such as child sex, age, immunization, residence, and feeding practices were controlled through multivariate regression. Social desirability bias was minimized through confidentiality assurances.

Data Collection

A structured questionnaire was used to gather information on maternal education (categorized as no education, primary, secondary, or higher), child demographics, dietary intake, immunization status, and clinical diagnoses. Nutritional status was assessed using MUAC measurements taken with WHO-standard, non-stretchable tapes. Based on MUAC values, children were classified as having normal nutritional status if their MUAC was ≥125 mm, moderate acute malnutrition (MAM) if their MUAC measured between 115–124 mm, and severe acute malnutrition (SAM) if it was <115 mm.

Quality Control Measures

To ensure accuracy and reliability, all measuring equipment, including weighing scales and MUAC tapes, was calibrated daily. MUAC measurements were taken twice, and a high inter-observer reliability of more than 95% was maintained. Data were entered twice independently into SPSS to minimize typing errors, and all

completed forms were reviewed each day to check for completeness and consistency.

Statistical Analysis

Sample Size Estimation

Using an expected malnutrition prevalence of 27%, 95% CI, and 5% margin of error, the estimated sample was 303. Complete data were available for 298 children.

Data Analysis

SPSS version 22 was used for all statistical analyses. Descriptive statistics, including frequencies, means, and standard deviations, were calculated to summarize participant characteristics and key variables. Chi-square tests were applied to assess associations between categorical variables, while ANOVA was used to compare differences in mean MUAC across the various maternal education categories. Binary logistic regression was performed to generate unadjusted odds ratios, and multivariate logistic regression models were used to adjust for potential confounders such as child age, sex, residence, feeding practices, and immunization status. A p-value of less than 0.05 was considered statistically significant for all analyses.

Ethical Considerations

Ethical approval was obtained from SZABIST Institutional Review Board (IRB Reference: SZABIST-ERB/2022/03), as used in previous Umerkot studies. Written informed consent was taken. Data were anonymized and securely stored.

RESULTS

Characteristics of the Participants

A total of 298 children were included in the study, of whom 61.7% were male. Most participants resided in rural areas, accounting for 66.1% of the sample. Maternal education levels varied considerably: 46% of mothers had no formal education, 32% had completed primary education, 18% had secondary education, and only 4% had attained higher education. In terms of nutritional status based on MUAC measurements, 65.4% of the children fell within the normal range, while 26.5% were classified as having moderate acute malnutrition (MAM) and 8.1% were identified with severe acute malnutrition (SAM).

Main Findings

Maternal education exhibited a strong and statistically significant association with the severity of malnutrition ($\chi^2 = 28.42$, $p < 0.001$). Significant differences in mean MUAC were also observed across maternal education categories, as shown by the ANOVA results ($p < 0.001$). Children whose mothers had no formal education demonstrated a notably higher prevalence of both MAM and SAM compared with those whose mothers had completed secondary or higher schooling. Regression analysis further supported these findings: children of uneducated mothers had an adjusted odds ratio (aOR) of 3.12 (95% CI: 1.61–6.03; $p < 0.001$), and those whose mothers had primary education had an aOR of 1.94 (95% CI: 1.02–3.66; $p = 0.043$), compared with the reference category of secondary or higher maternal education. Additionally, incomplete immunization increased the likelihood of malnutrition (aOR 2.51; $p < 0.01$), and rural residence was also identified as a significant predictor (aOR 1.74; $p = 0.049$).

Table 1. Maternal Education Distribution and Malnutrition Severity (n = 298)

Maternal Education	Normal (%)	MAM (%)	SAM (%)
No education	47.5	38.1	14.4
Primary	63.2	28.9	7.9
Secondary	79.2	18.9	1.9
Higher	83.3	16.7	0.0

Table 2. Mean MUAC Across Maternal Education Levels

Maternal Education	Mean MUAC (cm)	SD
No education	12.1	1.4
Primary	12.7	1.3
Secondary	13.4	1.2
Higher	13.8	1.1

Table 3. Logistic Regression (Unadjusted and Adjusted Odds Ratios)

Variable	Crude OR	95% CI	p-value	Adjusted OR	95% CI	p-value
No education	3.84	2.13–6.45	<0.001	3.12	1.61–6.03	<0.001
Primary	2.12	1.14–3.92	0.018	1.94	1.02–3.66	0.043
Secondary/Higher	Reference	—	—	Reference	—	—
Incomplete immunization	2.87	1.52–5.42	0.001	2.51	1.16–4.38	0.010
Rural residence	1.91	1.03–3.52	0.038	1.74	1.01–3.17	0.049

Table 4. Feeding Practices and Malnutrition Severity

Feeding Practice	Normal (%)	MAM (%)	SAM (%)
Dietary diversity adequate	72.5	22.5	5.0
Dietary diversity poor	51.3	34.8	13.9
Exclusive breastfeeding ≥6 months	70.1	24.5	5.4
Exclusive breastfeeding <6 months	55.6	32.4	12.0

DISCUSSION

This study examined the association between maternal educational attainment and severity of malnutrition among hospitalized children in Umerkot, Pakistan, revealing a strong and statistically significant relationship. The findings demonstrate that children whose mothers had no formal education were at substantially higher risk of developing moderate and severe acute malnutrition compared to children whose mothers attained secondary or higher education. This gradient remained significant even after adjusting for important confounders such as immunization status, residence, dietary diversity, and feeding practices. The consistency of results across chi-square tests, ANOVA, and multivariate regression reinforces the robustness of the association and aligns closely with existing evidence from South Asia and other low-resource settings.

Maternal education has long been recognized as a cornerstone of child health, influencing a range of behaviors including breastfeeding, complementary feeding, hygiene, health-seeking, and household resource allocation (Sharma et al 2024). Our findings validate this conceptual model. Mothers with higher education levels demonstrated greater adherence to recommended feeding practices and their children had higher mean MUAC values. This is consistent with studies from India, Bangladesh, and Nepal, which have repeatedly shown that maternal education correlates with improved dietary diversity and decreased prevalence of acute malnutrition (Rahman et al 2023). In Pakistan, PDHS 2017–18 similarly reported that maternal literacy was associated with lower child wasting and stunting (Khan et al 2023).

The high burden of malnutrition among children of uneducated mothers in Umerkot—an area plagued by socioeconomic deprivation and gendered educational disparities—echoes findings from recent rural Pakistan analyses (Nasim et al 2024). The significant adjusted odds ratio (aOR 3.12) found in our study is comparable to results from LMICs where uneducated mothers had two to five times higher odds of having malnourished children (Farooq et al 2024). This classification of maternal education as a powerful determinant underscores the potential of educational interventions in reducing malnutrition.

A notable pattern in our study is the dose–response gradient. With each step increase in maternal education (no education → primary → secondary), the likelihood of severe malnutrition decreased. Dose–response relationships are vital indicators in epidemiological research, signaling not only an association but also suggesting plausibility of causality (Ahmed et al 2025). This relationship likely functions through several pathways: improved caregiving, enhanced feeding knowledge, increased health-system navigation skills, better economic opportunities, and greater autonomy in household decision-making.

Our findings also revealed strong relationships between malnutrition and incomplete immunization, as well as rural residence. These results align with a wealth of literature describing the synergistic relationship between infection and malnutrition. Children who lack complete vaccinations are more susceptible to infectious diseases such as measles, pneumonia, and diarrhea—all of which impair nutrient absorption and increase metabolic demand (Farooq et al 2024). The higher prevalence of malnutrition in rural areas is also consistent with previous Umerkot studies (Vistro et al 2023),

attributable to limited dietary diversity, poor sanitation, insufficient health literacy, and reduced access to healthcare services.

The feeding practices data further support the centrality of maternal knowledge. Poor dietary diversity and inadequate exclusive breastfeeding were both linked to higher malnutrition severity. Mothers with limited education may lack awareness regarding nutrient-dense foods, rely on cereal-based diets, or follow harmful cultural feeding practices. This mirrors observations from UNICEF's 2021 complementary feeding assessments in Pakistan, where maternal education strongly predicted dietary adequacy (Khan et al 2023).

An important clinical implication of this study is the identification of uneducated mothers as a high-risk demographic. Hospital staff and public health teams can use maternal education as a quick screening marker to identify children at elevated risk of severe malnutrition. Integrating maternal education assessments into routine pediatric admissions could support early intervention efforts. Additionally, community-level interventions must prioritize women with low literacy, such as health literacy programs, community nutrition sessions, mother-to-mother support groups, and expanded Lady Health Worker (LHW) outreach.

Our findings are also highly relevant for policy. Pakistan's policy frameworks, including the National Nutrition Strategy and the Lady Health Worker Program, emphasize maternal education but often lack targeted mechanisms to improve caregiver knowledge in low-literacy regions like Umerkot. Strengthening women's educational opportunities and integrating structured health education into maternal and child health services could generate substantial reductions in malnutrition.

Finally, this study contributes novel insights by focusing on a hospitalized population—children who are already vulnerable and symptomatic. Hospital-based data capture severe cases that community surveys often underrepresent. Thus, this study reinforces maternal education as a critical determinant in clinical severity, broadening its implications beyond community health into the hospital care domain.

Study Strengths and Limitations

Strengths

This study has several notable strengths. It is the first study from Umerkot to specifically investigate maternal education as a primary determinant of malnutrition severity among hospitalized children, filling an important gap in local evidence. The analysis was rigorous, incorporating multiple statistical methods such as regression modeling and dose–response evaluation to ensure robust and reliable findings. Additionally, the study applied standardized WHO MUAC criteria for assessing nutritional status, which enhances comparability with national and international research.

Limitations

Despite its strengths, the study has certain limitations. Being cross-sectional in design, it cannot establish causal relationships between maternal education and malnutrition severity. The study was conducted in a single hospital, which may limit the generalizability of the findings to wider populations. Maternal education levels were self-reported, which introduces the possibility of recall or reporting bias. Furthermore, MUAC was used as the primary measure of nutritional status, and other indicators such as weight-for-height Z-scores (WHZ) were not assessed, which may have provided a more comprehensive evaluation of malnutrition.

CONCLUSION AND RECOMMENDATIONS

This study highlights maternal education as a critical determinant of malnutrition severity among children hospitalized in Umerkot, Pakistan. Children whose mothers lacked formal education faced a significantly higher likelihood of moderate and severe acute malnutrition compared with children of mothers who completed secondary or higher levels of education. The dose–response gradient observed across maternal education levels emphasizes that even small improvements in maternal literacy are likely to produce measurable reductions in childhood malnutrition.

The findings also reaffirm the interconnected role of immunization, rural residence, dietary diversity, and early feeding practices in shaping nutrition outcomes. Children who were incompletely immunized or lived in rural households showed higher odds of severe malnutrition. This reinforces the need for integrated public health approaches that address malnutrition not in isolation but as part of broader child health and development efforts.

Based on these findings, several recommendations can be proposed. First, maternal education should be recognized as a key entry point for intervention within nutrition programs. Health authorities should incorporate targeted caregiver education sessions within antenatal care visits, child health visits, and immunization clinics. Second, community-based health workers, such as Lady Health Workers (LHWs), must be equipped to deliver culturally appropriate, literacy-sensitive nutrition education, especially in areas where female literacy remains low. Visual tools, demonstrations, and mother-to-mother support groups may enhance the effectiveness of these programs.

Third, the healthcare system should institutionalize routine screening of maternal education levels during pediatric admissions and outpatient visits. Such screening would allow clinicians to identify children at high nutritional risk early and provide tailored counseling. Additionally, immunization and nutrition services must be strengthened through integrated delivery platforms. Improved vaccination coverage will reduce the burden of infection-driven malnutrition.

Fourth, policymakers should expand investments in female education, especially secondary schooling, in rural districts like Umerkot. Long-term reductions in childhood malnutrition require structural solutions that elevate women's educational and socioeconomic status. Collaboration between the health, education, and social welfare sectors is essential for sustainable progress.

In conclusion, maternal education is not simply a background characteristic but a powerful and modifiable determinant of child health. By prioritizing maternal literacy and integrating nutrition education into routine health services, Pakistan can take meaningful steps toward reducing the burden of childhood malnutrition and improving overall child survival and development.

Future Research Implications

- Longitudinal studies to examine causal pathways between maternal education and child nutrition.
- Mixed-methods research exploring cultural and behavioral factors shaping feeding practices among low-literacy mothers.
- Comparative analyses between community and hospital populations.
- Evaluation of nutrition education interventions tailored for low-literacy mothers.

SUPPORTING INFORMATION

File 1: Data collection questionnaire
File 2: MUAC measurement protocol
File 3: Feeding practices checklist

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AUTHORS' CONTRIBUTIONS

- **Conceptualization**: JM Vistro, HS Mughal
- **Data Curation**: JM Vistro
- **Formal Analysis**: HS Mughal
- **Funding Acquisition**: None
- **Investigation**: JM Vistro

- **Investigation**: JM Vistro
- **Methodology**: JM Vistro, HS Mughal
- **Project Administration**: HS Mughal
- **Resources**: DHQ Hospital Umerkot
- **Software**: HS Mughal
- **Supervision**: JM Vistro
- **Validation**: HS Mughal
- **Visualization**: JM Vistro
- **Writing – Original Draft Preparation:** JM Vistro
- **Writing – Review & Editing:** HS Mughal

What is already known about this topic

- Maternal education is a major determinant of child nutrition in low-income settings.
- Malnutrition remains highly prevalent in rural regions of Pakistan.
- Hospitalized children are at greater risk of severe acute malnutrition.
- Feeding practices and infections interact strongly with nutritional status.

What this study adds to the current literature

- Demonstrates strong dose–response relationship between maternal education and malnutrition severity in hospitalized children.
- Provides first evidence from Umerkot linking maternal education with MUAC-based malnutrition categories.
- Identifies uneducated mothers as a high-risk group for targeted nutritional intervention.
- Reinforces the need for integrated education–nutrition programs in rural Pakistan.

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