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Relationship of Maternal Education with Malnutrition in Children Under the Age of Five Years Presented to A Tertiary Care Hospital

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ABSTRACT

Malnutrition remains a major public health problem among children under five years, particularly in developing countries like Pakistan. Maternal education plays a crucial role in determining child nutritional status through its influence on feeding practices, healthcare utilization, and overall child care. **Objective:** To determine the association between maternal education and the severity of malnutrition among children under five years of age presenting to a Stertiary care hospital. **Methods:** This cross-sectional study was conducted at Khyber Teaching Hospital, Peshawar, including 282 malnourished children aged 6 months to 5 years. Nutritional status was assessed using WHO Z-scores (WAZ, HAZ, WHZ) and categorized into moderate and severe malnutrition. Maternal education was classified into six levels. Data were analyzed using SPSS version 27.0, and associations were evaluated using Fisher's Exact tests, with $p \leq 0.05$ considered significant. **Results:** The mean age was 28.4 ± 11.2 months. The prevalence of malnutrition was high, with 54.8% underweight, 48.8% stunted, and 32.4% wasted. Severe malnutrition was common, particularly among children of illiterate mothers, showing significantly higher rates of underweight (65.4%), stunting (75.0%), and wasting (70.0%)($p \leq 0.002$). On multivariable analysis, maternal illiteracy remained a strong independent predictor of underweight (AOR: 4.89), stunting (AOR: 5.73), and wasting (AOR: 4.12), all statistically significant ($p < 0.001$). Higher maternal education showed a protective effect against all forms of malnutrition. **Conclusions:** Maternal education is associated with reduced severity of childhood malnutrition. Improving female education and implementing targeted nutritional interventions are essential to reduce the burden of malnutrition.

INTRODUCTION

Malnutrition is one of the significant public health issues among children below the age of five, especially in developing nations. Globally, it is estimated that 170 million children are moderately or severely stunted, 110 million underweight, with a high percentage of them living in Asia [1]. Acute malnutrition is a major cause of childhood morbidity, mortality, retarded cognitive growth, and susceptibility to infections [2]. Early childhood nutrition is a crucial component of physical development, the immune system, and intellectual growth [3]. Child malnutrition is a pressing problem in Pakistan. UNICEF (2018) reports that almost forty percent of children under five years of age are stunted, 17.7 underweight, 28.9% overweight, and there is an emerging problem of overweight (9.5%), which suggests a two-fold burden of malnutrition [4]. The survey on nutrition issues in the country also indicates that a quarter of the children are stunted, a third of them underweight, and a fifth wasted, with little improvement over the last 20 years [5]. Pakistan remains one of the countries with the highest prevalence of child malnutrition, and slower improvement in nutritional indicators was registered compared to other South Asian countries [6, 7]. Such continued burden is also a cause of high rates of under-five mortality, which are at 81 per 1,000 live births [8]. Malnutrition is connected with socioeconomic determinants such as poverty, food insecurity, and

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illiteracy. One of them is maternal education, which is a determinant of child health outcomes. Educated mothers tend to practice proper feeding habits, proper nutrition, and seek early healthcare for their children. It has been shown that there is an extremely positive relationship between maternal education, better socioeconomic status, and child health outcomes [9]. The multicountry analyses also support the notion that higher levels of maternal education have a significant relationship with lower rates of childhood stunting, which occurs mainly due to better decision-making, resource use, and health-seeking practices [10, 11]. Maternal illiteracy is still a major challenge in Pakistan. According to the Pakistan Demographic and Health Survey (2017-18), 52.2% of women have no formal education, which is mostly because of socioeconomic and cultural factors [5].

Despite the well-established relationship between maternal education and child nutritional outcomes, limited region-specific evidence is available regarding the association between maternal education and the severity of malnutrition among children under five years in Pakistan, particularly in Khyber Pakhtunkhwa. Most previous studies have focused on the prevalence and determinants of malnutrition at the national level, while fewer studies have specifically examined how different levels of maternal education influence the severity of underweight, stunting, and wasting in children presenting to tertiary care hospitals. Therefore, the present study aimed to determine the association between maternal education and the severity of malnutrition among children under five years of age presenting to a tertiary care hospital in Peshawar.

METHODS

This cross-sectional study was conducted at the Department of Pediatrics, Khyber Teaching Hospital, Peshawar, from 07-07-2025 to 30-03-2026, after obtaining approval from the hospital IRB committee, under reference no: 692/DME/KMC; dated: 07/07/2025. The sample size was calculated using the single population proportion formula, considering the anticipated frequency of malnutrition among children under five years of age with uneducated mothers as 52.3%, based on a previous study [12]. Using a 95% confidence level, 6% margin of error, and 5% allowance for incomplete responses or dropouts, the minimum required sample size was calculated to be 282 participants using the online sample size calculator. A single population proportion formula was used because the study primarily aimed to estimate the distribution and severity of malnutrition among children presenting to the hospital and subsequently assess its association with maternal education. The inclusion criteria were children of either gender, aged between 6 months and 5 years and presenting with malnutrition, and whose mothers were willing to participate. Children with malignancies or systemic disorders or active infections, presented with diarrhea and gastrointestinal problems, and immigrant children were excluded. Children with acute diarrhea were excluded to avoid temporary fluctuations in body weight and hydration status that could affect anthropometric measurements and potentially misclassify nutritional status. Patients satisfying the study selection criteria were enrolled after obtaining written informed consent, using consecutive non-probability sampling. The study was conducted in accordance with the Declaration of Helsinki and institutional ethical guidelines, ensuring voluntary participation, confidentiality of patient information, and the right to withdraw at any time without affecting medical care. Malnutrition in this research was measured by anthropometric weight and height that were calculated in response to the standardized growth charts based on the child growth standard of the World Health Organization (WHO). In children aged 2 years and below, length was recorded in the supine position, and in children above 2 years, standing height was recorded. Z-score was used to assess nutritional status: weight-for-height Z-score (WHZ), height-for-age Z-score (HAZ), and weight-for-age Z-score (WAZ). Undernutrition was considered a Z-score of less than -2 standard deviations (SD) of the WHO reference median, and severe undernourishment was a Z-score of less than -3 SD. In particular, wasting was defined as WHZ < -2 SD, stunting as HAZ -2 SD, and underweight as WAZ -2 SD. These were further categorized as moderate (–3 SD to < –2 SD) and severe (< –3 SD) [13]. It was divided into six levels of maternal education: illiterate (no schooling), junior primary (education less than 3rd grade), senior primary (education less than 5th grade), junior secondary (education less than 8th grade), senior secondary (education less than 12th grade), and higher education (education greater than 12th grade). Clinical assessment forms, including information about anthropometric measurements, like weight, height/length, and mid-upper arm circumference (MUAC), as well as clinical signs of malnutrition such as edema and visible severe wasting, medical history, and current health status, were filled for every eligible child. Data were collected by trained medical officers experienced in conducting interviews and performing anthropometric measurements. Before data collection, all medical officers received standardized training in anthropometric measurement techniques according to WHO child growth assessment guidelines. Weight, height/length, and MUAC were measured using calibrated instruments following standardized procedures. Duplicate measurements were taken when necessary to minimize measurement error and improve reliability. The mothers of the chosen children were interviewed to obtain information about maternal education and other socio-

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demographic variables. Standardized methods and calibrated instruments were used to weigh, measure height or length, and MUAC of children. A detailed clinical examination was carried out to verify the presence of malnutrition and to record all the clinical manifestations.

Data analyses were performed using SPSS version 27. Means ± standard deviations were computed for numerical variables like age, weight, height, MUAC, head circumference, and child BMI. Frequencies and percentages were calculated for categorical variables, like gender, residence, maternal education, place of delivery, bilateral pedal edema, abdominal distension, and birth order. Fisher's exact test was used to assess the difference in associations between maternal education and child nutritional status (as cell count<5%) with post-stratification to control for possible confounding variables. Binary logistic regression was applied. A p-value ≤ 0.005 was considered statistically significant.

RESULTS

A total of 282 children aged 6 months to 5 years were included in the study, with a mean age of 28.4 ± 11.2 months, and showed generally poor nutritional status, with low mean weight, height, BMI, and MUAC. The average birth weight was also low (2.6 ± 0.7 kg), indicating early-life vulnerability. Clinically, 9.5% had bilateral edema and 14.9% had abdominal distension, suggesting a notable burden of acute and chronic malnutrition (Table 1).

Table 1: Clinical and Anthropometric Characteristics (n=282)

Variables	Mean ± SD / n (%)
Age (months)	28.4 ± 11.2
Weight (kg)	9.1 ± 2.6
Height/Length (cm)	77.9 ± 11.1
MUAC (cm)	12.4 ± 1.7
Head Circumference (cm)	44.9 ± 3.7
BMI (kg/m^2)	13.8 ± 2.2
Birth Weight (kg)	2.6 ± 0.7
Skinfold Thickness	8.8 ± 2.7
Bilateral Edema	27 (9.5%)
Abdominal Distension	42 (14.9%)

The socio-demographic profile of participants showed that 58.9% were male and 61.0% resided in rural areas. Regarding birth order, 45.4% were first-born children, followed by middle (34.4%) and last-born (20.2%) children. Maternal education was generally low, with 33.0% of mothers being illiterate, while only 8.2% had higher education (Table 2).

Table 2: Socio-demographic Characteristics of Study Participants (n=282)

Variables	Category	n (%)
Gender of Children	Male	166 (58.9%)
	Female	116 (41.1%)
Residence	Rural	172 (61.0%)
	Urban	110 (39.0%)
Birth Order	First	128 (45.4%)
	Middle	97 (34.4%)
	Last	57 (20.2%)
Maternal Education	Illiterate	93 (33.0)
	Junior Primary	55 (19.5%)
	Senior Primary	41 (14.5%)
	Junior Secondary	43 (15.2%)
	Senior Secondary	27 (9.6%)
	Higher Education	23 (8.2%)

More than half of the children (54.8%) were underweight, including 36.3% moderately and 18.5% severely affected, highlighting it as the most critical nutritional issue. Stunting was also highly prevalent (48.8%), with 31.7% moderate and 17.1% severe cases, indicating a substantial level of chronic malnutrition and long-term growth impairment. Wasting, which reflects acute malnutrition, affected 32.4% of children, including 21.7% moderate and 10.7% severe cases, showing a considerable proportion experiencing recent or acute nutritional deficiency. Importantly, since underweight, stunting, and wasting are not mutually exclusive conditions, some children experienced more than one form of malnutrition simultaneously. Therefore, the reported prevalences may overlap and should not be interpreted as independent categories. This overlap reflects the complex and multidimensional nature of child undernutrition in the study population (Table 3).

Table 3: Nutritional Status of Children

Nutritional Indicators	Moderate, n (%), 95% CI	Severe, n (%), 95% CI	Total, n (%), 95% CI
Underweight (WAZ)	102 (36.3%), (30.7–41.9%)	52 (18.5%), (14.0–23.0%)	154 (54.8%), (49.0–60.6%)
Stunting (HAZ)	89 (31.7%), (26.2–37.2%)	48 (17.1%), (12.7–21.5%)	137 (48.8%), (42.9–54.6%)
Wasting (WHZ)	61 (21.7%), (16.9–26.5%)	30 (10.7%), (7.1–14.3%)	91 (32.4%), (26.9–37.9%)

*Children may have more than one type of malnutrition

Children of illiterate mothers had the highest rates of severe malnutrition, with 65.4% underweight (p<0.001), 75.0% stunted (p<0.001), and 70.0% wasted (p=0.002). In contrast, children of mothers with senior secondary or higher education had no severe malnutrition across all indicators. Moderate malnutrition also decreased with increasing maternal education. These findings show an inverse relationship between maternal education and malnutrition severity, highlighting that higher

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maternal education protects against child undernutrition (Table 4).

Table 4: Association of Maternal Education with Severity of Malnutrition Indicators

Maternal Education	Underweight (WAZ=154)			Stunting (HAZ=137)			Wasting (WHZ=91)		
	Moderate, (n=61)	Severe, (n=30)	p-value	Moderate, (n=61)	Severe, (n=30)	p-value	Moderate, (n=61)	Severe, (n=30)	p-value
Illiterate	40 (39.2%) [29.8–48.6%]	34 (65.4%) [52.5–78.3%]	<0.001	32 (36.0%) [25.9–46.1%]	36 (75.0%) [62.7–87.3%]	<0.001	25 (41.0%) [28.6–53.4%]	21 (70.0%) [53.6–86.4%]	0.002
Junior Primary	24 (23.5%) [15.3–31.7%]	10 (19.2%) [8.4–30.0%]		20 (22.5%) [13.8–31.2%]	7 (14.6%) [4.5–24.7%]		13 (21.3%) [10.9–31.7%]	7 (23.3%) [8.2–38.4%]	
Senior Primary	16 (15.7%) [8.7–22.7%]	5 (9.6%) [1.6–17.6%]		13 (14.6%) [7.2–22.0%]	6 (12.5%) [3.0–22.0%]		9 (14.8%) [5.9–23.7%]	5 (16.7%) [3.4–29.9%]	
Junior Secondary	12 (11.8%) [5.8–17.8%]	3 (5.8%) [0.0–12.1%]		15 (16.9%) [9.0–24.8%]	3 (6.3%) [0.0–13.1%]		7 (11.5%) [3.7–19.3%]	1 (3.3%) [0.0–9.6%]	
Senior Secondary	5 (4.9%) [0.7–9.1%]	0 (0.0%) [0.0–0.0%]		5 (5.6%) [0.9–10.3%]	0 (0.0%) [0.0–0.0%]		3 (4.9%) [0.0–10.3%]	0 (0.0%) [0.0–0.0%]	
Higher Education	5 (4.9%) [0.7–9.1%]	0 (0.0%) [0.0–0.0%]		4 (4.5%) [0.2–8.8%]	0 (0.0%) [0.0–0.0%]		2 (3.3%) [0.0–7.8%]	0 (0.0%) [0.0–0.0%]	

*Fisher's Exact test was used to calculate p-value. p-value <0.05 is significant

After adjusting for child age, residence, and household income, maternal illiteracy remained the strongest and most consistent predictor of severe malnutrition, significantly increasing the odds of underweight (AOR: 4.89, 95% CI: 2.61–9.16), stunting (AOR: 5.73, 95% CI: 3.01–10.91), and wasting (AOR: 4.12, 95% CI: 2.01–8.41). Low household income was also an independent risk factor for all outcomes, while rural residence showed a modest but significant association with underweight and stunting. Child age was positively associated with underweight and stunting but not wasting. All models demonstrated good fit, indicating acceptable explanatory power and reliability of the adjusted associations (Table 5).

Table 5: Adjusted Binary Logistic Regression for Severe Malnutrition

Variables	Underweight AOR (95% CI)	p-value	Stunting AOR (95% CI)	p-value	Wasting AOR (95% CI)	p-value
Illiterate vs Any Education	4.89 (2.61–9.16)	<0.001	5.73 (3.01–10.91)	<0.001	4.12 (2.01–8.41)	<0.001
Rural vs Urban	1.68 (1.05–2.69)	0.031	1.61 (1.03–2.53)	0.037	1.49 (0.94–2.37)	0.090
Child Age (Months)	1.03 (1.01–1.05)	0.018	1.07 (1.04–1.11)	<0.001	0.99 (0.96–1.02)	0.410
Household Income (Low vs High)	2.74 (1.66–4.51)	<0.001	2.31 (1.38–3.87)	0.001	2.19 (1.21–3.96)	0.009

Underweight model (Nagelkerke R^2 = 0.36, Hosmer–Lemeshow p = 0.640), Stunting model (R^2 = 0.43, p = 0.720), and Wasting model (R^2 = 0.27, p = 0.550)

DISCUSSION

The present study revealed a high prevalence of malnutrition among children under 5 years of age, with underweight, stunting, and wasting being prevalent. The severity and complexity of malnutrition in this hospital-based population seem to be higher than in community-based populations, which may be because tertiary care centers receive more complicated and severe cases. This suggests that children admitted to the hospital are more severely malnourished, as seen in previous studies [14]. The demographic profile revealed that most affected children were in early childhood, especially below 2 years of age, known to be a very susceptible age for growth faltering. This is attributed to the increased nutritional demands, poor complementary feeding, and increased vulnerability to infections during this period of development [15, 16]. A gender difference was also noted for malnourished cases, with a higher proportion of males, which has also been seen in other studies [17, 18]. This could be attributed to biological susceptibility and also to potential gender differences in child care practices. The higher proportion of children in this study living in a rural area reflects the ongoing association between malnutrition and disadvantaged circumstances. Living in a rural area is often linked to food insecurity, poor sanitation, and limited access to healthcare, all of which have a detrimental impact on children's nutrition status [17, 19]. The presence of both acute and chronic malnutrition was also suggested by clinical symptoms including bilateral oedema and abdominal distention, which occurred in a substantial number of children, indicating the severity of the disease at a late stage [15, 17]. A crucial result of this study was that there was a negative relationship between the level of education of the mother and the degree of malnutrition observed. Across all indicators, children of illiterate mothers were the most undernourished, and children of highly educated mothers were never severely undernourished. This gradient was similar at all levels of education and indicates that maternal education has a protective effect. Low level of maternal education has been linked in previous studies with high risk of

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undernutrition, which was found to stem from poor feeding practices, insufficient health awareness, and delayed health-seeking behaviour [18-20]. Maternal illiteracy was the most consistent predictor of severe malnutrition, even after accounting for other factors, suggesting that it is a factor other than socioeconomic conditions alone. Household income and rural living, however, were also important determinants and confirmed that malnourishment of children is a multifactorial problem, and these factors are educational and economic disadvantage [21-23]. The results indicate that maternal education has an interaction effect on other socioeconomic factors that determine nutritional outcomes of the child. Being younger than age 5 was significantly associated with underweight and stunting, suggesting that the deficits are cumulative with age, especially when dietary intake is suboptimal and repeated infections occur. This reinforces the notion that chronic malnutrition is a process and not an event [15, 16]. The study only concentrated on maternal education, but a number of other factors affect the nutritional status of children, such as feeding practices, infection history, maternal health, and household food insecurity. All this would likely combine with variations in maternal education and socioeconomic status to shape the nutrition of children in this context [20, 21].

This study has certain limitations. Since this was a single-centre, hospital-based, cross-sectional study, the results may be representative only of the hospital systems where the study was conducted; not generalizable to the broader population; and may not infer a cause-and-effect relationship. Furthermore, key variables like maternal diet, breastfeeding and maternal nutritional status were not adequately evaluated and could have affected the reported associations. There was probably underestimation of wasting, as children with acute diarrhoea were excluded from analysis, and the results may be limited to children without acute diarrhoea. Longitudinal studies of nutrition status in large, community-based populations should be conducted in the future to further demonstrate causation and track long-term trends in nutrition status. Detailed behavioural, dietary and maternal health variables should also be added to further studies in order to gain a more complete understanding of the determinants of childhood malnutrition in similar settings.

CONCLUSIONS

This study illustrates that children under 5 years of age are severely under-nourished and there is a significant level of wasting, under-weight and stunting, often co-occurring. Maternal education level was one of the factors identified as affecting the nutritional status of the children, with a higher degree of malnutrition seen in the children of illiterate mothers and a better nutritional status in cases of educated mothers. Improving the health outcomes of children requires improvement in the education of women, in targeted nutrition awareness-raising activities, and in poverty reduction policies. Combined interventions that tackle the educational and socio-economic determinants of childhood malnutrition should be given specific consideration by policymakers to be effective in reducing the burden of childhood malnutrition in similar settings.

Authors' Contribution

Conceptualization: SA
Methodology: AU, SA, FZ, NK
Formal analysis: SA, RG
Writing and Drafting: AU, SA, SFA, MI, SS
Review and Editing: AU, SA, RG, SFA, FZ, SS, NK

All authors approved the final manuscript and take responsibility for the integrity of the work

Conflicts of Interest

All the authors declare no conflict of interest.

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