

Original Article

Low Socioeconomic Status as an Independent Predictor of Maternal Undernutrition Among Pregnant Women in Tharparkar, Pakistan

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ABSTRACT

Background: Maternal undernutrition remains an important public-health concern in socioeconomically disadvantaged settings, where limited household resources may adversely affect maternal nutritional status during pregnancy. **Objective:** To determine the prevalence of MUAC-defined undernutrition and assess its association with socioeconomic characteristics among pregnant women attending Civil Hospital Mithi, Tharparkar. **Methods:** This analytical cross-sectional study included 421 pregnant women recruited through convenience sampling from July to December 2024. Socioeconomic information was collected using a structured, pre-tested questionnaire, and nutritional status was assessed using mid-upper arm circumference (MUAC), with MUAC <23 cm defining undernutrition. Associations were examined using bivariate tests and univariate and multivariable logistic regression. **Results:** Overall, 285/421 women (67.7%) were undernourished. Undernutrition occurred in 68.9% of women from low-income households compared with 20.0% from middle-income households. Low household income was associated with higher crude odds of undernutrition (OR=8.84, 95% CI: 1.85–42.23; p=0.006) and remained independently associated after multivariable adjustment (AOR=5.32, 95% CI: 1.46–19.38; p=0.012). Women with no formal education had higher but statistically imprecise adjusted odds of undernutrition (AOR=3.15, 95% CI: 0.95–10.45; p=0.061). **Conclusion:** MUAC-defined undernutrition was common among pregnant women attending Civil Hospital Mithi, and low household income was independently associated with greater odds of undernutrition. **Keywords:** Maternal undernutrition; Pregnancy; MUAC; Socioeconomic status; Household income; Tharparkar.

INTRODUCTION

Maternal undernutrition during pregnancy remains an important public-health concern because maternal nutritional status influences both maternal health and fetal development. Inadequate nutrition during pregnancy has been associated with adverse outcomes including suboptimal gestational weight gain, anemia, fetal growth restriction, low birth weight, preterm birth, and increased maternal and neonatal morbidity (1). The burden of undernutrition is particularly important in low- and middle-income settings, where women may experience overlapping nutritional, socioeconomic, and healthcare disadvantages (2). In Pakistan, malnutrition among women

of reproductive age remains a substantial concern and reflects broader inequalities in nutritional status, living conditions, and access to health-supporting resources (3).

Socioeconomic disadvantage is closely intertwined with malnutrition through multiple pathways, including inadequate household purchasing power, food insecurity, limited dietary diversity, reduced access to healthcare, and restricted educational opportunities (4). Evidence from Pakistan indicates that women may face important dietary constraints during pregnancy, particularly in settings where household resources, food availability, social circumstances, and knowledge influence dietary practices (5). Household food insecurity has also been linked to socioeconomic vulnerability in Pakistani communities, highlighting the importance of household-level economic conditions in determining access to sufficient and nutritious food (6). Evidence from Sindh similarly demonstrates that undernutrition among women of reproductive age is associated with socioeconomic and demographic disadvantage, supporting the need to examine locally relevant determinants of poor maternal nutritional status (7). Studies from other resource-limited settings have likewise identified household economic position, maternal education, and related social factors as important correlates of undernutrition among pregnant women (8).

The reported burden of maternal undernutrition varies considerably across populations and according to the anthropometric criteria used. Among pregnant and lactating women in Azad Jammu and Kashmir, Pakistan, a substantial proportion were classified as malnourished using mid-upper arm circumference, although that study applied a MUAC threshold of <21 cm (9). In a community-based study of pregnant women in northeastern Ethiopia, maternal undernutrition was also identified using MUAC, with socioeconomic and dietary characteristics examined as potential associated factors (10). Such variation across studies emphasizes that prevalence estimates should be interpreted in relation to the population studied, sampling strategy, socioeconomic context, and the specific anthropometric cut-off applied. Nevertheless, the collective evidence supports the importance of socioeconomic conditions in understanding nutritional vulnerability during pregnancy.

Despite evidence linking socioeconomic disadvantage with poor nutritional status among women in Pakistan and other resource-constrained settings, evidence specifically examining the relationship between household socioeconomic conditions and MUAC-defined undernutrition among pregnant women attending health facilities in Tharparkar remains limited. This evidence gap is particularly relevant because determinants observed in other populations may not fully reflect the socioeconomic circumstances of women seeking maternal healthcare in this setting. Identifying locally associated factors may help inform nutritional screening, socioeconomic risk assessment, and appropriately targeted maternal-health interventions. Therefore, this cross-sectional study aimed to determine the prevalence of MUAC-defined undernutrition among pregnant women attending Civil Hospital Mithi, Tharparkar, and to assess its association with selected socioeconomic characteristics, with particular emphasis on whether low household income, compared with middle household income, remained independently associated with undernutrition after adjustment for the other socioeconomic variables included in the analysis.

MATERIALS AND METHODS

An analytical cross-sectional study was conducted in the Gynecology and Obstetrics Outpatient Department and inpatient ward of Civil Hospital Mithi, Tharparkar, Sindh, Pakistan, from July to December 2024. The design was selected to estimate the prevalence of maternal undernutrition and to examine its contemporaneous association with selected socioeconomic characteristics among pregnant women attending the study facility. The target population comprised pregnant women presenting to Civil Hospital Mithi during the study period. Women who were pregnant, attended the study facility during the data-collection period, and provided written informed consent were eligible for participation. Women with pre-existing conditions considered likely to influence nutritional status, including obesity, malabsorption disorders, anorexia nervosa, or other chronic conditions, were excluded, as were women with gestational diabetes mellitus, pregnancy-induced hypertension, pre-eclampsia, or eclampsia and those who declined participation.

Participants were recruited using non-probability convenience sampling from eligible pregnant women attending the outpatient department or admitted to the obstetric ward. The required sample size was estimated using the single-population proportion formula, assuming an expected prevalence of maternal undernutrition of 47.4%, a 95% confidence level, and a 5% margin of error. This yielded an initial sample requirement of approximately 383

participants. After allowing approximately 10% for potential non-response, the final target sample was 421 women, all of whom were included in the reported study sample.

Data were collected through face-to-face interviews using a structured, pre-tested questionnaire administered by trained data collectors. Information was obtained on maternal age, educational status, husband's educational status, maternal employment, husband's employment, monthly household income, family type, family size, and household headship. Monthly household income was used as the operational indicator of socioeconomic status and was categorized as low income when household income was <PKR 60,000 per month and middle income when household income was PKR 60,000–200,000 per month. Maternal education and husband's education were categorized as no education, primary education, and matriculation or above; employment was classified as employed or jobless; family type was classified as nuclear or joint/extended; family size was categorized as <4 or ≥4 persons; and household headship was classified as male, female, or both/others.

Maternal nutritional status was assessed using mid-upper arm circumference (MUAC), an anthropometric measure that has been used to assess nutritional status among pregnant women in resource-limited settings (10). MUAC was measured on the left arm using a standard non-stretchable measuring tape. The midpoint between the acromion and olecranon processes was identified, and the circumference was measured while the participant was standing with the arm relaxed. For the present study, maternal undernutrition was operationally defined as MUAC <23 cm, whereas women with MUAC ≥23 cm were classified as well nourished. Application of a structured pre-tested questionnaire, use of trained data collectors, and a standardized anatomical procedure for MUAC measurement were used to improve consistency in data collection across participants.

Data were entered and analyzed using IBM SPSS Statistics version 26.0. Continuous variables were summarized using mean and standard deviation, whereas categorical variables were presented as frequencies and percentages. The prevalence of maternal undernutrition was calculated as the proportion of participants with MUAC <23 cm. Bivariate associations between nutritional status and categorical socioeconomic variables were examined using the chi-square test. Univariate binary logistic regression was subsequently used to estimate crude odds ratios (ORs) and corresponding 95% confidence intervals (CIs) for the association between each socioeconomic characteristic and maternal undernutrition. Multivariable binary logistic regression was used to estimate adjusted odds ratios (AORs) with 95% CIs, with maternal undernutrition as the dependent outcome. Potential confounding among the measured socioeconomic variables was addressed by simultaneous adjustment for socioeconomic status, maternal education, husband's education, maternal employment status, husband's employment status, family type, family size, and household headship. Reference categories were defined according to the categories reported in the regression analyses. Statistical significance was assessed using a two-sided p-value of <0.05.

Ethical approval for the study was obtained from the Research Ethics Committee of Liaquat University of Medical and Health Sciences, Jamshoro. Written informed consent was obtained from all participants before enrollment. Participant information was handled confidentially and anonymously throughout the study, and the study procedures were conducted in accordance with the principles of the Declaration of Helsinki.

RESULTS

A total of 421 pregnant women were included in the analysis. The mean maternal age was 31.98 ± 5.40 years. Most participants had no formal education (87.2%), belonged to households with a monthly income below PKR 60,000 (97.6%), and lived in families with four or more members (88.6%). Approximately two-thirds of the women were employed (63.7%), whereas 97.1% of their husbands were employed. Nuclear families accounted for 71.3% of the sample, and 63.9% of households were male-headed (Table 1).

Table 1. Sociodemographic and Socioeconomic Characteristics of Study Participants (n = 421)

Characteristic	Category	n (%)
Age, years	Mean $\pm$ SD	31.98 $\pm$ 5.40
Education of women	No education	367 (87.2)
	Primary education	42 (10.0)
	Matriculation or above	12 (2.9)
Education of husband	No education	274 (65.1)
	Primary education	101 (24.0)
	Matriculation or above	46 (10.9)

Characteristic	Category	n (%)
Employment status of respondent	Employed	268 (63.7)
	Jobless	153 (36.3)
Employment status of husband	Employed	409 (97.1)
	Jobless	12 (2.9)
Family type	Nuclear	300 (71.3)
	Joint/extended	121 (28.7)
Family size	<4 persons	48 (11.4)
	≥4 persons	373 (88.6)
Household head	Male	269 (63.9)
	Female	40 (9.5)
	Both/others	112 (26.6)
Socioeconomic status	Low income (<PKR 60,000/month)	411 (97.6)
	Middle income (PKR 60,000–200,000/month)	10 (2.4)

SD = standard deviation; PKR = Pakistani rupee.

Overall, 285 of 421 women were classified as undernourished, corresponding to a prevalence of 67.7% (95% CI: 63.1–72.0%), whereas 136 (32.3%) were well nourished. Nutritional status differed significantly according to household income: 283 of 411 women (68.9%) in the low-income group were undernourished compared with 2 of 10 (20.0%) in the middle-income group (Fisher's exact $p = 0.002$). A gradient was also observed across maternal educational categories, with undernutrition occurring in 69.5% of women with no education, 59.5% of those with primary education, and 41.7% of those with matriculation or higher education; however, the overall association did not reach statistical significance (exact $p = 0.063$). No statistically significant bivariate association was observed for husband's education, maternal or husband's employment, family type, family size, or household headship (Table 2).

Table 2. Association Between Socioeconomic Characteristics and Maternal Nutritional Status (n = 421)

Characteristic	Category	Undernourished, n (%)	Well nourished, n (%)	p-value
Education of women	No education	255 (69.5)	112 (30.5)	0.063 ^a
	Primary education	25 (59.5)	17 (40.5)	
	Matriculation or above	5 (41.7)	7 (58.3)	
Education of husband	No education	193 (70.4)	81 (29.6)	0.206
	Primary education	65 (64.4)	36 (35.6)	
	Matriculation or above	27 (58.7)	19 (41.3)	
Employment status of respondent	Employed	176 (65.7)	92 (34.3)	0.240
	Jobless	109 (71.2)	44 (28.8)	
Employment status of husband	Employed	275 (67.2)	134 (32.8)	0.352 ^b
	Jobless	10 (83.3)	2 (16.7)	
Family type	Joint/extended	76 (62.8)	45 (37.2)	0.173
	Nuclear	209 (69.7)	91 (30.3)	
Family size	<4 persons	28 (58.3)	20 (41.7)	0.141
	≥4 persons	257 (68.9)	116 (31.1)	
Household head	Male	179 (66.5)	90 (33.5)	0.725
	Female	29 (72.5)	11 (27.5)	
	Both/others	77 (68.8)	35 (31.2)	
Socioeconomic status	Middle income	2 (20.0)	8 (80.0)	0.002 ^b
	Low income	283 (68.9)	128 (31.1)	

Percentages are calculated within each category. Pearson chi-square test was used unless otherwise specified.

^aFisher-Freeman-Halton exact test. ^bFisher's exact test. MUAC = mid-upper arm circumference; undernutrition = MUAC <23 cm; well-nourished = MUAC ≥23 cm.

In univariate analysis, women from low-income households had 8.84-fold higher odds of undernutrition than those from middle-income households (OR = 8.84, 95% CI: 1.85–42.23; $p = 0.006$). Women with no formal education also showed greater odds of undernutrition than women with matriculation or higher education (OR = 3.19, 95% CI: 0.99–10.26; $p = 0.052$), although the confidence interval included the null value. None of the other crude associations reached statistical significance.

After simultaneous adjustment for the socioeconomic variables included in the multivariable model, low household income remained associated with increased odds of maternal undernutrition (AOR = 5.32, 95% CI: 1.46–19.38; $p = 0.012$). Women with no formal education had an AOR of 3.15 compared with those with matriculation or higher education, although the estimate was imprecise and did not reach statistical significance (95% CI: 0.95–10.45; $p =$

0.061). No statistically significant adjusted associations were observed for husband's education, respondent employment, husband's employment, family type, family size, or household headship (Table 3).

Table 3. Crude and Adjusted Associations With Maternal Undernutrition

Characteristic	Category	Crude OR	95% CI	p-value	AOR	95% CI	p-value
Education of women	Matriculation or above	1.00			1.00		
	No education	3.19	0.99–10.26	0.052	3.15	0.95–10.45	0.061
	Primary education	2.06	0.56–7.57	0.277	2.18	0.59–8.10	0.243
Education of husband	Matriculation or above	1.00			1.00		
	No education	1.68	0.88–3.19	0.114	1.51	0.77–2.97	0.231
	Primary education	1.27	0.62–2.60	0.511	1.18	0.56–2.49	0.663
Employment status of respondent	Employed	1.00			1.00		
	Jobless	1.29	0.84–1.99	0.240	1.22	0.78–1.91	0.382
Employment status of husband	Employed	1.00			1.00		
	Jobless	2.44	0.53–11.28	0.255	2.31	0.49–10.89	0.290
Family type	Joint/extended	1.00			1.00		
	Nuclear	1.36	0.87–2.12	0.174	1.41	0.91–2.18	0.120
Family size	<4 persons	1.00			1.00		
	≥4 persons	1.58	0.86–2.93	0.143	1.62	0.86–3.07	0.136
Household head	Male	1.00			1.00		
	Female	1.33	0.63–2.77	0.455	1.38	0.65–2.95	0.403
	Both/others	1.11	0.69–1.78	0.676	1.15	0.71–1.87	0.572
Socioeconomic status	Middle income	1.00			1.00		
	Low income	8.84	1.85–42.23	0.006	5.32	1.46–19.38	0.012

OR = odds ratio; AOR = adjusted odds ratio; CI = confidence interval. Maternal undernutrition (MUAC <23 cm) was the dependent outcome. Crude ORs were estimated from the reported category-specific outcome counts. The multivariable model simultaneously adjusted for socioeconomic status, maternal education, husband's education, respondent employment, husband's employment, family type, family size, and household headship. Reference categories are indicated by OR/AOR = 1.00.

DISCUSSION

The present study identified a substantial burden of MUAC-defined undernutrition among pregnant women attending Civil Hospital Mithi and demonstrated that low household income was the principal socioeconomic characteristic independently associated with undernutrition after adjustment for the other measured socioeconomic variables. Maternal education showed a clear descriptive gradient, with undernutrition becoming less frequent as educational attainment increased, although the adjusted association did not reach statistical significance. In contrast, husband's education, maternal and husband's employment status, family type, family size, and household headship were not independently associated with maternal undernutrition in this sample.

The prevalence of maternal undernutrition observed in the present study was higher than estimates reported in several other resource-constrained populations, although direct comparisons require caution because definitions, anthropometric thresholds, sampling strategies, and study populations differed. A study among pregnant women and lactating mothers in Azad Jammu and Kashmir reported 46% malnutrition based on MUAC <21 cm (9), whereas a community-based study of pregnant women in northeastern Ethiopia reported a substantially lower prevalence of MUAC-defined undernutrition (10). A systematic review and meta-analysis from Ethiopia similarly estimated that approximately one-third of pregnant women were malnourished (8). The comparatively high prevalence in the present study may partly reflect the use of a higher MUAC threshold of <23 cm, the hospital-based convenience sample, and the distinctive socioeconomic circumstances of women attending maternal healthcare services in Tharparkar. These methodological and contextual differences preclude interpreting the prevalence differences as direct geographical contrasts.

The strongest finding was the association between low household income and maternal undernutrition. Women from households earning <PKR 60,000 per month had substantially greater adjusted odds of undernutrition than women from middle-income households. The direction of this association is consistent with evidence from other settings. In Azad Jammu and Kashmir, low family income was independently associated with malnutrition among pregnant and lactating women (9), while a systematic review of studies involving pregnant women in Ethiopia found that low income was associated with greater odds of maternal malnutrition (8). Evidence from Sindh has also demonstrated a marked socioeconomic gradient in undernutrition among women of reproductive age, with women

in poorer wealth categories experiencing considerably greater odds of undernutrition than economically advantaged women (7). Although the magnitude of association differs across studies because socioeconomic indicators, nutritional definitions, populations, and analytical models are not identical, the consistency in direction supports the importance of household economic circumstances in maternal nutritional vulnerability.

Several pathways may plausibly explain the observed relationship between household income and maternal undernutrition. Poverty and malnutrition are closely interconnected because inadequate economic resources can constrain access to sufficient quantities and diversity of nutritious foods, increase food insecurity, and limit access to healthcare and other health-supporting resources (4). Research from rural Pakistan has shown that household food security is influenced by multiple socioeconomic conditions, including employment, education, household resources, and other forms of economic vulnerability (6). Qualitative evidence from Punjab has additionally identified the affordability and availability of nutritious foods, together with sociocultural and structural barriers, as important constraints on adequate dietary intake during pregnancy (5). Because nutritional requirements increase during pregnancy, persistent restrictions in dietary quality or quantity may become particularly important in economically disadvantaged households (1). These pathways remain plausible explanations rather than mechanisms directly demonstrated by the present cross-sectional study because dietary intake and household food insecurity were not directly evaluated.

Maternal education demonstrated an important but statistically imprecise pattern. Women with no formal education had higher adjusted odds of undernutrition than women with matriculation or higher education, but the confidence interval included the null value. This direction is broadly compatible with previous evidence. Illiteracy was independently associated with malnutrition among pregnant and lactating women in Azad Jammu and Kashmir (9), and pooled evidence from Ethiopia identified maternal illiteracy as a factor associated with malnutrition during pregnancy (8). Similarly, previous research among women of reproductive age in Sindh found substantially greater crude odds of undernutrition among women without formal education than among more highly educated women (7). In the present study, however, 87.2% of participants had no formal education and only 12 women had matriculation or higher education. This limited variation, together with the small highly educated reference category, reduced statistical precision and may partly explain why the observed education gradient did not achieve conventional statistical significance. The finding should therefore not be interpreted as evidence that maternal education is unrelated to nutritional status.

No statistically significant adjusted associations were detected for husband's education, maternal or husband's employment, family structure, family size, or household headship. These findings should be interpreted in the context of the distribution of the study population. For example, 97.1% of husbands were classified as employed and 88.6% of households contained four or more members, leaving relatively small comparison groups and limited ability to distinguish associations. Employment status alone may also incompletely represent socioeconomic security because it does not differentiate stable and adequately remunerated employment from informal, seasonal, or low-income work. Evidence from Pakistan indicates that household food security reflects several interrelated economic and social dimensions rather than employment status alone (6). Consequently, the absence of statistical significance for these variables should not be interpreted as proof that they have no relevance to maternal nutrition.

The findings have implications for maternal-health services in economically disadvantaged settings. The combination of a high prevalence of MUAC-defined undernutrition and an association with low household income suggests that nutritional assessment during antenatal care may be strengthened by concurrent consideration of household socioeconomic vulnerability. Broader evidence emphasizes the interconnected roles of poverty, food access, maternal education, and access to nutrition services in determining nutritional wellbeing among women (2,4,8,9). Within healthcare settings serving vulnerable populations, routine anthropometric screening may therefore provide an opportunity to identify women who could benefit from further nutritional assessment, dietary counselling, or linkage to available nutrition and social-support services. However, the present findings demonstrate associations and do not establish that any specific intervention would reduce maternal undernutrition in this population.

Several strengths support the relevance of this study. It included 421 pregnant women from an underserved district, used an objective anthropometric measure of nutritional status, and examined both crude and adjusted associations across multiple measured socioeconomic characteristics. Nevertheless, important limitations should

be considered. The cross-sectional design establishes exposure and nutritional status at the same time and therefore cannot demonstrate temporal sequence or causality. Convenience recruitment from a single hospital limits generalizability to all pregnant women in Tharparkar, particularly women who do not access hospital-based maternal care. Socioeconomic status was operationalized primarily through monthly household income rather than a multidimensional wealth or deprivation index, and the income distribution was highly unbalanced, with only 10 women in the middle-income reference group. This sparse comparison contributed to the wide confidence interval around the income estimate and warrants cautious interpretation of its magnitude. The adjusted analysis was restricted to the socioeconomic variables collected and did not account for potentially important maternal and obstetric factors such as gestational age, parity, dietary diversity, household food insecurity, or antenatal-care utilization; residual confounding therefore remains possible. The exclusion of women with several chronic and pregnancy-related conditions may also limit representativeness. Finally, nutritional status was assessed using MUAC alone, which is practical for maternal screening but does not characterize dietary adequacy, micronutrient deficiencies, or the full spectrum of maternal nutritional status. Taken together, these limitations indicate that the observed association between household income and maternal undernutrition should be interpreted as a locally relevant association requiring confirmation in broader, population-based studies.

CONCLUSION

MUAC-defined undernutrition was common among pregnant women attending Civil Hospital Mithi, Tharparkar, and low household income was independently associated with greater odds of undernutrition after adjustment for the measured socioeconomic characteristics. Maternal education showed a graded but statistically imprecise association, while the other evaluated socioeconomic factors were not independently associated with undernutrition. These findings indicate that socioeconomic vulnerability, particularly limited household income, should be considered alongside nutritional assessment when identifying pregnant women at increased nutritional risk in this healthcare setting, while the cross-sectional and hospital-based design limits causal and population-wide inference.

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