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Prevalence and associated factors of nutritional status among children under 5 years: a community-based cross-sectional study in Bhimdatta municipality, Kanchanpur, Nepal

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ABSTRACT

Objective To assess the nutritional status and identify associated factors among children under 5 years residing in Ward 10 of Bhimdatta Municipality, Kanchanpur District, Sudurpashchim Province, Nepal.

Design Community-based cross-sectional study.

Setting Ward 10 of Bhimdatta Municipality, the second-largest ward by population within the municipality.

Participant A total of 248 children aged 6–59 months were selected using simple random sampling from a list of eligible children compiled through the local vitamin A supplementation programme. Children who were ill for more than 7 days, had physical deformities or whose mothers were illiterate were excluded. Data were collected between 2 January and 25 May 2024.

Outcome measures Nutritional status was assessed using anthropometric indicators—height-for-age (stunting), weight-for-height (wasting) and weight-for-age (underweight)—according to WHO Child Growth Standards. Measurements were taken using a ShorrBoard to the nearest 0.1 cm, and WHO Anthro V.3.1.0 was used to generate Z-scores. Data were analysed using EpiData V.3.1 and SPSS V.20. Descriptive statistics were computed, and χ^2 tests identified candidate variables for multinomial logistic regression to determine factors associated with nutritional status.

Results The study found that 35.08% of children under 5 years in Ward 10 were affected by some form of under-nutrition. A significant association was observed between under-nutrition and exclusive breastfeeding practices ($p<0.05$), underscoring the importance of early infant feeding practices. Model adequacy was confirmed using likelihood ratio and Pearson's χ^2 tests.

Conclusions Under-nutrition remains a major public health concern among children under 5 years in Bhimdatta Municipality. Interventions focusing on promoting exclusive breastfeeding, improving maternal education and strengthening household food security are recommended to enhance child nutritional outcomes.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This is one of the few community-based studies assessing the nutritional status of children under 5 years in a semi-urban setting of Nepal.
⇒ A probability-based simple random sampling technique was used, increasing the representativeness of the study population.
⇒ Anthropometric measurements were collected using standard WHO procedures and calibrated equipment to ensure accuracy. The structured questionnaire was adapted from previously validated instruments; however, it was not formally psychometrically validated in the study setting.
⇒ The cross-sectional design limits the ability to infer causal relationships between associated factors and nutritional outcomes.
⇒ The study was confined to a single ward and relied on self-reported feeding practices, which may introduce recall and reporting bias.

INTRODUCTION

Globally, malnutrition remains a critical public health challenge, profoundly affecting the well-being, growth and development of children. It encompasses both under-nutrition, characterised by wasting (low weight-for-height), stunting (low height-for-age) and underweight (low weight-for-age) and over-nutrition, which arises from excessive energy intake relative to expenditure, resulting in overweight or obesity.[1 2] Under-nutrition, caused by inadequate nutrient intake or poor absorption, is particularly concerning in early childhood, as its consequences such as impaired physical and cognitive development are often irreversible. Malnutrition is a leading cause of child mortality worldwide, contributing to nearly half of all child deaths, while also undermining long-term productivity and economic progress.[3 4] Globally, approximately 149 million children under five are stunted, 49.5 million suffer from

wasting and over 690 million people remain undernourished.[1 4]

In Nepal, malnutrition continues to pose a significant public health issue despite years of interventions. The Nepal Demographic and Health Survey (NDHS) 2022 estimates that 25% of children under five are stunted, 19% are underweight, 8% suffer from wasting and 1% are overweight.[5 6] Although these figures indicate some reduction compared with the 2016 NDHS, which reported 36% stunting and 27% underweight, progress remains uneven across regions and socioeconomic groups.[7 8] Contributing factors include poor dietary practices, limited access to safe water, inadequate maternal health and socioeconomic inequalities. In Nepal, caste, ethnicity and gender inequalities further widen the nutritional gap. While public health programmes such as vitamin A supplementation, deworming and iron and folic acid distribution during pregnancy have achieved commendable coverage, they have not adequately addressed the underlying causes of malnutrition.[9]

Childhood malnutrition serves as a critical indicator of a nation's overall health and economic conditions. It is associated with diminished intellectual capacity, reduced work productivity and obstetric complications in adulthood, emphasising the importance of early interventions.[10] In Nepal, malnourished children are at higher risk of recurrent infections, delayed school enrolment and impaired cognitive development, particularly in districts such as Kanchanpur, where limited health infrastructure and high poverty levels exacerbate the problem. Research shows that investing as little as US$10 annually per child in nutrition programmes can prevent millions of child deaths and significantly reduce stunting.[11]

Despite global and national efforts, gaps persist in addressing malnutrition, particularly in under-researched geographic and socioeconomic contexts. Bhimdatta Municipality in Kanchanpur District has received limited attention in malnutrition studies, leaving a knowledge gap regarding the prevalence and determinants of child malnutrition in the region. Therefore, the primary objective of this study is to assess the nutritional status of children aged 6–59 months in Bhimdatta Municipality, with a focus on undernutrition. The secondary objectives include identifying sociodemographic and feeding practices contributing to under-nutrition, which is relevant for guiding local interventions and policy decisions.

METHODOLOGY

Study design and setting

A community-based cross-sectional study was conducted between 2 January and 25 May 2024 in Ward 10 of Bhimdatta Municipality, Kanchanpur District, Sudurpashchim Province, Nepal. Ward 10 was purposively selected as it represents one of the most densely populated areas within the municipality, with approximately 17% of the population comprising children under 5 years. The study aimed to assess the nutritional status and associated factors among children under 5 years in this community.

Study population and eligibility criteria

The study population included children aged 6–59 months residing in Ward 10 for at least 6 months prior to data collection. Children who were ill for more than seven consecutive days or had physical deformities affecting anthropometric measurements were excluded from the study. Parents or legal guardians provided written informed consent prior to participation.

Sample size calculation

The required sample size was calculated using Cochran's formula for a finite population:

$$n_o = \frac{Z^2 pq}{d^2}$$

where, Z=1.96 (for 95% confidence level), p=0.28 (prevalence of stunting in Sudurpashchim Province according to NDHS 2022), q=1 − p and d=0.05 (margin of error). The prevalence (p) was chosen based on the most recent NDHS 2022 provincial estimate to reflect the local context, the confidence level of 95% ensures adequate precision and the allowable error (d=0.05) was selected to balance accuracy with feasibility given the sample size.

The initial sample size (n_0) was estimated at 312. After adjusting for the finite population of children under 5 yearsin Ward 10 (n=787) using the finite population correction and accounting for a 10% non-response rate, the final sample size was 248.

Sampling procedure

A simple random sampling technique was used to select participants. The sampling frame was obtained from the vitamin A supplementation programme register maintained by the local health post in coordination with Female Community Health Volunteers (FCHVs). We acknowledge that using this register may introduce selection bias, as children not participating in the vitamin A programme might have different nutritional profiles. A list of eligible children was compiled and assigned unique identification numbers. Random numbers were generated in Microsoft Excel to select participants.

In cases of non-response, the next eligible child on the list was approached. FCHVs assisted field investigators in locating households. A flowchart describing the sampling procedure is provided in online supplemental file 1.

Data collection tools and procedures

Data were collected through face-to-face interviews with mothers or primary caregivers using a structured questionnaire. The self-constructed, structured questionnaire was adapted from validated instruments, including the NDHS 2022 and WHO Child Growth Standards. However, the adapted questionnaire was not formally psychometrically validated in the study setting prior to data collection.

The questionnaire was pretested among 10% of the sample in a neighbouring ward with similar

sociodemographic characteristics to ensure clarity, cultural appropriateness and comprehension. Based on queries raised by participants and observations of the data collectors during pretesting, minor revisions were made, including rewording ambiguous questions, clarifying local terminology and adjusting response categories.

We acknowledge that dietary data collected through food frequency questionnaires and 24-hour dietary recalls may be subject to recall bias. To minimise this, trained interviewers used standardised prompts and visual aids to help caregivers recall dietary intake more accurately.

As per the online supplemental file 2, the questionnaire consisted of four sections:

- *Section A:* sociodemographic characteristics.
- *Section B:* infant and young child feeding practices.
- *Section C:* childhood illness.
- *Section D:* anthropometric measurements.

Data collectors, who were public health graduates, received two days of training on interview techniques and standardised anthropometric measurement procedures. The principal investigator and local supervisors regularly monitored the fieldwork to ensure consistency and accuracy.

Anthropometric measurements

Children's height/length and weight were measured following WHO standard procedures.[12] Height and length were measured using a ShorrBoard to the nearest 0.1 cm, while weight was measured using a calibrated digital scale to the nearest 0.1 kg. Duplicate measurements were taken for 10% of participants and acceptable differences were maintained below 1 cm for height and 0.1 kg for weight. WHO Anthro software V.3.1.0 was used to calculate Z-scores for height-for-age, weight-for-height and weight-for-age.

Study variables and operational definitions

The dependent variable was *nutritional status*, classified into normal, undernutrition or overweight categories based on WHO Z-score cut-offs.

- *Normal:* Z-score between −2SD and +2SD.
- *Under-nutrition:* Z-score below −2SD for any indicator (stunting, wasting or underweight).
- *Stunting:* height-for-age Z-score < −2SD.
- *Wasting:* weight-for-height Z-score < −2SD.
- *Underweight:* weight-for-age Z-score < −2SD.
- *Overweight:* weight-for-height Z-score > +2SD.

Independent variables included child's age, sex, feeding practices, recent illness, maternal education, occupation and household wealth index.

Measurement of independent variables

- *Child age and sex:* reported by the mother or caregiver and confirmed from immunisation or local health records. Age was recorded in months and categorised into 6–23 months and 24–59 months for analysis.
- *Maternal age:* reported by the mother and categorised as <30 years or ≥30 years.
- *Maternal education:* collected via structured questionnaire and categorised as no formal education, basic (primary), secondary or bachelor and above.
- *Maternal occupation:* reported by the mother and classified as housewife/agriculture or non-agriculture/other (business, labour, employed).
- *Household wealth index:* determined using principal component analysis based on household assets (eg, television, motorcycle), housing characteristics (eg, floor material, toilet type) and access to utilities (eg, water source) which were then used to rank households into five wealth quintiles from lowest to highest, providing a composite measure of household socioeconomic status.
- *Infant and Young Child Feeding (IYCF) practices:* collected through structured interviews with mothers using standard NDHS 2022 and WHO guidelines. Variables included:
  - Early initiation of breastfeeding (within 1 hour vs after 1 hour of birth).
  - Exclusive breastfeeding (yes/no for the first 6 months).
  - Continued breastfeeding (yes/no).
  - Minimum dietary diversity (≥five food groups vs <five).
  - Minimum meal frequency (≥four times/day vs <four times/day).

  Childhood illness: mothers reported any illness in the past 2 weeks, including fever, diarrhoea or respiratory infections (yes/no).

Data processing and analysis

Data were checked daily for completeness and consistency. Cleaned data were coded and entered into EpiData V.3.1 and analysed using SPSS V.20.[13] Nutritional status indicators were generated using WHO Anthro V.3.1.0. Descriptive statistics, including frequencies, percentages, median and IQR, were computed.

The Shapiro-Wilk test was applied to assess normality of continuous variables. Bivariate analyses using the χ^2 test were performed to examine associations between independent variables and under-nutrition. Variables with $p \leq 0.05$ in bivariate analysis were entered into a multinomial logistic regression model to identify independent predictors of nutritional status. Multicollinearity among independent variables was assessed using variance inflation factors (VIF) and variables with VIF >10 were carefully reviewed and addressed to ensure model validity. Model adequacy was evaluated using the likelihood ratio test, deviance, Pearson's χ^2 and pseudo R^2 statistics. Statistical significance was set at $p<0.05$.

RESULTS

Table 1 summarises the sociodemographic and socioeconomic characteristics of the participants. Among children aged 6–59 months, the median age was 28 months (IQR: 18–39 months), with 29.8% of children aged 24–35

Table 1 Sociodemographic and socioeconomic information about participants of ward 10 of Bhimdatta Municipality (n=248)

Sociodemographic characters	Category	Frequency %
Age of child (months)	6–11	20 (8.1)
	12–23	71 (28.6%)
	24–35	74 (29.8)
	36–47	47 (19.0)
	48–59	36 (14.5)
Median=28, IQR=39–18, min–max=6–58		
Sex of the child	Female	108 (43.5)
	Male	140 (56.5)
Age of the mother	<30 years	210 (84.7)
	>30 years	38 (15.3)
Median=26, IQR=29–24, min–max=17–40		
Ethnicity	Brahmin/Chhettri	157 (63.3)
	Dalit	86 (34.7)
	Others*	5 (2.0)
Size of the family	Nuclear	47 (19.0)
	Joint	196 (79.0)
	Extended	5 (2.0)
Education of the mother	No education	21 (8.5)
	Basic	21 (8.5)
	Secondary	170 (68.5)
	Bachelor and above	36 (14.5)
Occupation of the mother	Housewife/agriculture	229 (92.3)
	Non-agriculture/ others†	19 (7.7)
Wealth quintile	Lowest	49 (19.8)
	Second	51 (20.6)
	Middle	48 (19.4)
	Fourth	50 (20.1)
	Highest	50 (20.1)

*Denotes Janjati, Muslim.
†Business, labour, employed.

Table 2 IYCF practices and childhood illness among children under 5 years in ward 10 of Bhimdatta Municipality (n=248)

IYCF practices	Category	Frequency %
Early initiation of breastfeeding		
	Within 1 hour	236 (95.2)
	After 1 hour	12 (4.8)
Continued breastfeeding		
	Yes	201 (81.0)
	No	47 (19.0)
Exclusive breastfeeding		
	Yes	37 (14.9)
	No	211 (85.1)
Minimum dietary diversity		
	At least five varieties of food	80 (32.3)
	Less than five varieties of foods	168 (67.7)
Minimum meal frequency		
	At least four times	152 (61.3)
	Less than four times	96 (38.7)
Presence of any illness in last 2 weeks		
	No	226 (91.1)
	Yes	22 (8.9)

Childhood illness: ARI=0, fever and diarrhoea=5, fever only=17.
ARI, acute respiratory infection; IYCF, Infant and Young Child Feeding.

months. Regarding sex, 43.5% of the children were female, and 56.5% were male. The median age of mothers was 26 years (IQR: 24–29), with 84.7% of mothers being under 30 years of age. Ethnically, 63.3% of the participants belonged to Brahmin/Chhetri groups, while 34.7% were Dalit. Most families (79%) were of the joint family type, and 68.5% of mothers had secondary education. Nearly all mothers (92.3%) were engaged in housework or agriculture, and wealth was evenly distributed across the quintiles.

Table 2 outlines the IYCF practices. Early breastfeeding initiation is high at 95.2%, and 81.0% of children continue breastfeeding. However, exclusive breastfeeding up to 6 months is low, at only 14.9%, and just 32.3% of children meet the minimum dietary diversity. While many children achieve the minimum meal frequency, there are significant gaps in complementary feeding practices. Additionally, 8.9% of children under 5 years experienced illness in the past 2 weeks, with fever (17 cases) and fever with diarrhoea (5 cases) being the most common ailments.

Table 3 outlines the nutritional status of children under 5 years in Ward 10 of Bhimdatta Municipality (n=248), assessed through anthropometric measurements. The majority, 59.7% (148 children), have normal nutritional status. However, 35.1% (87 children) are undernourished, while 5.2% are overweight. These findings highlight a higher prevalence of under-nutrition compared with overweight, emphasising the need for targeted nutritional interventions in the community.

Table 3 Nutritional status of children under 5 years in Ward 10 of Bhimdatta Municipality (n=248)

Nutritional status	Frequency (%)
Normal	148 (59.7)
Under nutrition	87 (35.1)
Overweight	13 (5.2)

Table 4 Association of nutritional status with sociodemographic and socioeconomic information among participants (n=248)

Sociodemographic characteristics	Nutritional status			P value
	Under-nutrition(%)	Normal (%)	Overweight (%)	
Age of child in months				
6–23	26 (28.6%)	57 (62.6%)	8 (8.8%)	0.067
24–59	61 (38.9%)	91 (58.0%)	5 (3.2%)	*Ref*
Sex of child				
Female	40 (37.0%)	64 (59.3%)	4 (3.7%)	0.583
Male	47 (33.6%)	84 (60.0%)	9 (6.4%)	*Ref*
Age of mother in years				
<30	77 (36.7%)	125 (59.5%)	8 (3.8%)	**0.042***
≥30	10 (26.3%)	23 (60.5%)	5 (13.2%)	*Ref*
Ethnicity				
Non-brahmin/Chhetri	39 (42.9%)	48 952.7%)	4 94.4%)	0.147
Brahmin/Chhetri	48 (30.6%)	100 (63.7%)	9 (5.7%)	*Ref*
Size of family				
Joint/extended	72 (35.8%)	118 (58.7%)	11 (5.5%)	0.802
Nuclear	15 (31.9%)	30 (63.8%)	2 (4.3%)	*Ref*
Educational status of mother				
No education	8 (38.1%)	10 (47.6%)	3 (14.3%)	0.123
Formal education	79 (34.8%)	138 (60.8%)	10 (4.4%)	*Ref*
Occupation of mother				
Non-agriculture/others	4 (21.1%)	14 (73.7%)	1 (5.3%)	0.400
Housewife/agriculture	83 (36.2%)	134 (58.5%)	12 (5.2%)	*Ref*
Wealth quintile				
Lowest	25 (51.0%)	21 (42.9%)	3 (6.1%)	**0.025***
Other than lowest	62 (31.2%)	127 (63.8%)	10 (5.0%)	*Ref*

*Significant association (Pearson χ^2 test below 5% level of significance).
Ref, reference category.

Online supplemental figure 1 presents the prevalence of stunting, wasting and underweight conditions among children in the study, visualised using a Venn diagram to highlight overlaps between these conditions. Among the participants, 26.2% were stunted, 9.6% were wasted and 15.8% were underweight. Specifically, 16.1% were stunted only, 3.2% were wasted only and 1.2% was underweight only. No children experienced both stunting and wasting without other overlaps. However, 4.4% were both wasted and underweight, 8.1% were both stunted and underweight and 2.0% suffered from all three conditions: stunting, wasting and being underweight.

Table 4 examines the relationship between sociodemographic factors and the nutritional status of children. The age of the child shows a borderline significant association with nutritional status (p=0.067). Younger children (6–23 months) have a higher prevalence of overweight (8.8%) compared with older children (24–59 months, 3.2%). No significant association is found between nutritional status and the child's sex (p=0.583), although overweight rates are slightly higher among males (6.4%) than females (3.7%). Maternal age is significantly associated with nutritional status (p=0.042), with children of younger mothers (<30 years) being less likely to be overweight (3.8%) than those of older mothers (≥30 years, 13.2%). Other factors, such as ethnicity (p=0.147), family size (p=0.802), maternal education (p=0.123) and maternal occupation (p=0.400) do not show significant associations. However, wealth quintile is significantly associated with nutritional status (p=0.025), as undernutrition is more prevalent among children from the lowest wealth quintile (51.0%) compared with those from higher wealth quintiles (31.2%).

Table 5 explores the relationship between IYCF practices and children's nutritional status, with χ^2 test p values used to determine significance. Early initiation of breastfeeding shows no significant association with nutritional status (p=0.705). Among children breastfed after 1 hour, 25.0% were undernourished, 66.7% had normal weight and 8.3% were overweight, compared with 35.6%, 59.3% and 5.1%, respectively, for those breastfed within 1 hour. Similarly, continued breastfeeding is not significantly

Table 5 Association between nutritional status and IYCF practices (n=248)

IYCF practices	Nutritional status			P value
	Under-nutrition(%)	Normal (%)	Overweight (%)	
Early initiation of breastfeeding				
After 1 hour	3 (25.0)	8 (66.7)	1 (8.3)	0.705
Within 1 hour	84 (35.6)	140 (59.3)	12 (5.10	
Continued breastfeeding				
Not	14 (29.8)	32 (68.1)	1 (2.1)	0.329
Yes	73 (36.3)	116 (57.7)	12 (6.0)	
Exclusive breastfeeding				
No	80 (37.9)	119 (56.4)	12 (5.7)	**0.042***
Yes	7 (18.9)	29 (78.4)	1 (2.7)	
Minimum dietary diversity				
At least five varieties of food	25 (31.2)	50 (62.5)	5 (6.2)	0.644
Less than five varieties of foods	62 (36.9)	98 (58.3)	8 (4.8)	
Minimum meal frequency				
At least four times	48 (31.6)	94 (61.8)	10 (6.6)	0.221
Less than four times	39 (40.6)	54 (56.2)	3 (3.1)	

*Significant association (by applying Pearson χ^2 test below 5% level of significance)
IYCF, Infant and Young Child Feeding; Ref, reference category.

Table 6 Association of nutritional status and childhood illness (n=248)

Childhood illness	Nutritional status			P value
	Under-nutrition (%)	Normal (%)	Overweight (%)	
No	81 (35.8)	133 (58.8)	12 (5.3)	0.693
Yes	6 (27.3)	15 (68.2)	1 (4.5)	

COR, crude OR; Ref, reference category.

associated with nutritional status (p=0.329), though undernutrition is slightly higher (36.3%) among children who continued breastfeeding compared with those who did not (29.8%).

Exclusive breastfeeding, however, is significantly linked to better nutritional outcomes (p=0.042). Among exclusively breastfed children, 18.9% were undernourished, 78.4% had normal weight and 2.7% were overweight, compared with 37.9%, 56.4% and 5.7%, respectively, among non-exclusively breastfed children.

Minimum dietary diversity does not show a significant association (p=0.644). Children with adequate diversity had 31.2% under-nutrition, 62.5% normal weight and 6.2% overweight, while those with inadequate diversity exhibited 36.9%, 58.3% and 4.8%, respectively. Similarly, no significant link is found for minimum meal frequency (p=0.221), although children fed at least four times daily had slightly better nutritional outcomes (31.6% undernourished, 61.8% normal weight and 6.6% overweight) compared with those fed less frequently (40.6%, 56.2% and 3.1%).

Table 6 analyses the relationship between childhood illness and nutritional status, focusing on the distribution of undernourished, normal weight and overweight children. Among children without illness, 35.8% were undernourished, 58.8% had normal weight and 5.3% were overweight. In comparison, children who experienced illness had corresponding rates of 27.3%, 68.2% and 4.5%. The χ^2 test yielded a p value of 0.693, indicating no statistically significant association between childhood illness and nutritional status. These findings suggest that the presence or absence of illness does not significantly influence whether children are undernourished, of normal weight or overweight in this sample.

Table 7 presents the ORs, 95% CIs and p values for factors influencing the nutritional status of children under 5 years in Ward 10 of Bhimdatta Municipality, focusing on exclusive breastfeeding, maternal age and wealth quintile. For exclusive breastfeeding, children who were not exclusively breastfed had significantly higher odds of undernutrition compared with normal nutritional status (OR=2.936, p=0.018). However, there was no significant association with overweight compared with normal nutritional status (OR=2.788, p=0.337) or between overweight and undernutrition (OR=0.950, p=0.963).

Similarly for maternal age, children of mothers under 30 years had lower odds of being overweight compared with normal nutritional status (OR=0.317, p=0.068), with significantly lower odds of being overweight compared with under nutrition (OR=0.183, p=0.013). However, there was no significant difference in the odds of undernutrition compared with normal nutritional status (OR=1.733, p=0.198).

Along with the wealth quintile, children from the lowest wealth quintile had significantly higher odds of undernutrition compared with normal nutritional status (OR=2.668, p=0.005). No significant differences were observed in the odds of being overweight compared with normal nutritional status (OR=1.447, p=0.611) or in overweight compared with undernutrition (OR=0.542, p=0.403).

The overall fit of the model was evaluated using a likelihood ratio test, which showed a significant difference between the model with explanatory variables and the model without (χ^2 =40.126; p<0.001). This suggests that the explanatory variables significantly influence the outcome. Furthermore, both the Pearson and deviance χ^2 tests were not significant (p>0.005), indicating that the model estimates fit the data well. To assess the predictive power of the model, Nagelkerke R^2 (pseudo R^2) was used.

Table 7 Factors associated with nutritional status among children under 5 years (n=248)

	Overweight with reference to normal		Under-nutrition with reference to normal		Overweight with reference to under-nutrition	
Variables	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value
Exclusive breastfeeding						
No	2.788 (0.344 to 22.591)	0.337	2.936 (1.202 to 7.169)	**0.018***	0.950 (0.105 to 8.615)	0.963
Yes						*Ref*
Age of mother in years						
<30	0.317 (0.092 to 1.087)	0.068	1.733 (0.750 to 4.003)	0.198	0.183 (0.048 to 0.695)	**0.013***
≥30						*Ref*
Wealth quintile						
Lowest	1.447 (0.349 to 5.998)	0.611	2.668 (1.354 to 5.256)	**0.005***	0.542 (0.129 to 2.274)	0.403
Other than lowest						*Ref*

Log likelihood ratio model fit test: χ^2=40.126; p value <0.001 Pearson and deviance χ^2 test p value ≥0.005.
Cox and Snell R^2=0.078, Nagelkerke R^2=0.096.
*Significant association.

DISCUSSION

The findings from this study revealed that 35.1% of children under 5 years of age in Ward 10 of Bhimdatta Municipality were affected by some form of under-nutrition, while 5.2% were overweight. This pattern indicates that under-nutrition remains a prominent public health concern in this semi-urban setting. The prevalence observed in this study is comparable with findings from studies conducted in India, Indonesia, South Africa, South Ethiopia and the western and hill communities of Nepal.[4 11 14 15] However, a study from Kenya reported a substantially higher prevalence of under-nutrition, exceeding 50%,[16] which may reflect contextual differences in socioeconomic conditions, health service access and study settings.

In terms of specific forms of under-nutrition, 26.2% of children were stunted, 9.6% were wasted and 15.8% were underweight. These estimates closely align with findings from the NDHS 2022 for Sudurpashchim Province, which reported stunting at 28.4%, wasting at 5.1% and underweight at 13.9%.[5 6] The similarity suggests that the nutritional status of children in Bhimdatta Municipality reflects broader provincial and national trends. Minor variations may be attributable to local factors such as household food security, caregiving practices, access to health services and sociocultural norms influencing child feeding.

Exclusive breastfeeding was identified as a significant determinant of child nutritional status. Children who were not exclusively breastfed had nearly threefold higher odds of under-nutrition compared with those who were exclusively breastfed (OR=2.94; 95% CI 1.20 to 7.17). This finding is consistent with evidence from Nepal and India,[9 17] as well as other South Asian contexts, underscoring the protective role of exclusive breastfeeding against under-nutrition. Although early initiation of breastfeeding was high in the study population, the prevalence of exclusive breastfeeding for 6 months was notably low. Similar declines have been reported in other Nepali settings.[1] Possible explanations include early introduction of complementary foods, maternal workload, cultural beliefs regarding infant feeding and limited sustained counselling support.[5 6] While local maternal counselling and FCHV-led activities may encourage early initiation, they may be insufficient to support continued exclusive breastfeeding for the recommended duration.

Maternal age showed a significant association with child nutritional outcomes, particularly overweight status. Children of mothers younger than 30 years were less likely to be overweight compared with those born to older mothers. Although this finding contrasts with some studies from India and Kenya,[11 16] such differences may arise from variations in maternal dietary practices, caregiving behaviours, household food environments and socioeconomic characteristics across settings. Given the cross-sectional design of the study, causal interpretations cannot be established, but the association highlights the need to consider maternal characteristics when addressing both under-nutrition and emerging over-nutrition among children.

Socioeconomic status remained an important determinant of child undernutrition. Children from households in the poorest wealth quintile had significantly higher odds of undernutrition compared with those from higher quintiles (OR=2.67; p=0.005), consistent with findings from Ethiopia, Nepal and Pakistan.[4 6 18] This study has several strengths, including its community-based design, use of probability-based simple random sampling and collection of anthropometric data using standard WHO procedures and validated tools, enhancing comparability with national data. However, the cross-sectional design limits causal inference, and the study was confined to a single ward. Additionally, reliance on self-reported feeding practices may have introduced recall and reporting bias. Despite these limitations, the findings provide valuable

evidence to inform locally tailored nutrition interventions targeting socioeconomically vulnerable households in Bhimdatta Municipality.

CONCLUSION AND RECOMMENDATION

This study identified a notable prevalence of undernutrition among children under 5 years in Ward 10 of Bhimdatta Municipality, with stunting being the most common form, followed by underweight and wasting. A significant association was found between children's nutritional status and exclusive breastfeeding practices under IYCF guidelines.

To address under-nutrition, targeted strategies should be implemented at the ward level. Nutritional counselling for mothers, especially those without formal education, should be prioritised to improve feeding practices and dietary diversity. Promoting exclusive breastfeeding remains a key strategy for improving child health outcomes.

Future studies are recommended to explore other potential factors influencing childhood nutrition such as sanitation, food security and healthcare access, to provide a more comprehensive understanding and guide context-specific interventions.

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REFERENCES

1 WHO. Malnutrition. World Health Organization; 2023.
2 World Health Organization. WHO Child Growth Standards: Growth Velocity Based on Weight, Length and Head Circumference: Methods and Development. Geneva: WHO, 2006.
3 Report GN. The global burden of malnutrition. 2020.
4 Fufa DA, Laloto TD. Factors associated with undernutrition among children aged between 6-36 months in Semien Bench district, Ethiopia. *Heliyon* 2021;7:e07072.
5 Ministry of Health and Population, Nepal, New ERA, ICF. Nepal demographic and health survey 2022. Kathmandu, 2022.
6 Ministry of Health and Population, Nepal, New ERA, ICF. Child nutritional status. nepal demographic and health survey 2022: key indicators report. 2022.32–9.
7 Bishwakarma R. Spatial Inequality in Child Nutrition in Nepal: Implications of Regional Context and Individual/Household Composition. University of Maryland, College Park, 2011.
8 Chataut J, Khanal K. Assessment of nutritional status of children under five years of age in rural Nepal. *Kathmandu Univ Med J* 2016;14:73–7.
9 Tontisirin K. Improving nutritional status at national and community levels: Lessons from South Asia. *Asia Pac J Clin Nutr* 2009;30.
10 Joshi HS, Gupta R, Joshi MC, *et al*. Determinants of nutritional status of school children: A cross-sectional study in the western region of Nepal. *BMJ* 2011;2:1–13.
11 Kanjilal B, Mazumdar PG, Mukherjee M, *et al*. Nutritional status of children in India: household socio-economic condition as the contextual determinant. *Int J Equity Health* 2010;9:19:1–13:.
12 World Health Organization. WHO Child Growth Standards: Growth Velocity Based on Weight, Length and Head Circumference: Methods and Development. Geneva: World Health Organization, 2006.
13 IBM Corp. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp, 2011.
14 Mkhize M, Sibanda MJ. A Review of Selected Studies on the Factors Associated with the Nutrition Status of Children Under the Age of Five Years in South Africa. *IJERPH* 2020;17:7973.
15 Hs J. Determinants of nutritional status of school children: A cross-sectional study in the western region of Nepal. *Med J Armed Forces India* 2011;2:1–13.
16 Olack B, Burke H, Cosmas L, *et al*. Nutritional status of under-five children living in an informal urban settlement in Nairobi, Kenya. *J Health Popul Nutr* 2011;29:357–63.
17 Saha S, Pandya A, Raval D, *et al*. Nutritional Status of Children Under Two Years of Age in the Devbhumi Dwarka District, Gujarat: A Descriptive Cross-Sectional Study. *Cureus* 2022;14:e27445.
18 Tariq J, Sajjad A, Zakar R, *et al*. Factors Associated with Undernutrition in Children under the Age of Two Years: Secondary Data Analysis Based on the Pakistan Demographic and Health Survey 2012–2013. *Nutrients* 2018;10:676.