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Assessment of nutritional status of children aged 6-59 months in Kanchanpur district, Nepal: Insights from a screening program

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ABSTRACT

Background: Malnutrition is a major global public health issue especially affecting children under five years old, profoundly influencing their survival and overall development.

Objectives: This study evaluates the nutritional status of children aged 6-59 months and explores the determinants of malnutrition in Kanchanpur District, Sudurpaschim Province, Nepal.

Methods: A cross-sectional survey was conducted, including 3,252 children aged 6-59 months from nine municipalities. Anthropometric measurements were collected from May-June 2024. Data was analysed using Emergency Nutrition Assessment (ENA 2020).

Results: Among the 3,252 children (45.6% female, 54.4% male) with a mean age of 31.88 months, the prevalence of global malnutrition was 3.0%, higher in girls (3.8%) than boys (2.2%). The prevalence of underweight was 19.3% (girls: 19.8%, boys: 18.9%). Stunting affected 17.0% of children (boys: 17.2%, girls: 16.7%), while wasting was observed in 14.9% (boys: 15.1%, girls: 14.5%). Older children (48-59 months) had a significantly higher risk of malnutrition compared to younger children (6-11 months), with adjusted odds ratios (AOR) of 2.9 (95% CI: 2.2-3.7) for underweight and 3.3 (95% CI: 2.5-4.3) for stunting. Ethnicity also played a significant role, with Dalit and Janajati children being more likely to be malnourished than Brahmin/Chhetri children.

Conclusion: This study identified age and ethnicity as key determinants of malnutrition in Kanchanpur District, emphasizing the need to address socio-economic and cultural factors especially among marginalized ethnic groups. Policymakers and health practitioners should prioritize tailored nutritional programs to address the specific needs of different age groups and communities, aiming to reduce malnutrition and achieve sustainable development goals.

Keywords: Children under five, Kanchanpur, Malnutrition, Nepal

1. Introduction

Nutrition is a cornerstone of socioeconomic development and a critical component of the Sustainable Development Goals (SDGs) and Primary Health Care [1]. Children's nutritional status reflects household living standards and determines child survival [2]. Early childhood nutrition significantly impacts growth, development, and long-term health outcomes [3, 4]. Malnutrition, caused by an imbalance between nutritional needs and intake, remains a global public health issue affecting children under five, contributing to half of all childhood deaths worldwide and impairing physical and cognitive development [5, 6]. Globally, malnutrition is linked to 3.5-5 million child deaths annually and costs families 22% of their income, while improved nutrition can increase GDP growth by 2-11% [7, 8].

The World Health Organization (WHO) classifies malnutrition into undernutrition (stunting, wasting, and underweight), overnutrition (obesity), and micronutrient-related malnutrition [9]. Factors influencing child nutrition include maternal health, socioeconomic status, and cultural practices [10-14]. According to Nepal Demographic Health Survey (NDHS) 2022, 25% of children under age 5 are stunted, 8% are wasted, 19% are underweight [15]. The decline remains unimpressive due to the wide disparities in childhood malnutrition across different provinces and socio-economic groups. However, disparities persist especially in Sudurpaschim province, where 28% of children are stunted higher than the national average [15]. Kanchanpur district faces additional challenges such as gender discrimination, poverty, and high HIV/AIDS prevalence due to seasonal migration [16-18].

Despite government efforts to meet global nutrition targets, malnutrition remains a significant issue in Nepal particularly in Sudurpaschim province [7, 19]. Limited data on child nutrition in this region highlights the need for studies to assess the nutritional status and its determinants. This study aims to guide policymakers in implementing targeted interventions such as dietary diversification, supplementation, and education programs to prevent malnutrition and support SDG goals for zero hunger.

2. Methods

2.1 Study Area

The screening was conducted across all nine municipalities of Kanchanpur District. One

ward from each municipality was randomly selected for the survey.

2.2 Study Design

This study was designed as a cross-sectional, district-wide survey to assess the nutritional status of children aged 6 to 59 months in Kanchanpur District, Nepal.

2.3 Sample Size and Sampling

All children aged 6 to 59 months within the selected wards were eligible to participate. The data collection was conducted primarily in schools where children within the specified age range could be found.

2.4 Data Collection

Data collection involved measuring the height, weight, and mid-upper arm circumference (MUAC) of the children. The process was conducted in the following steps:

- School-Based Screening: The primary location for data collection was schools within the selected wards. Health workers and trained volunteers conducted a census to identify all eligible children.
- Follow-Up for Missing Children: For children who were absent during the initial school-based screening, follow-up visits were conducted. This included home visits and community visits to ensure comprehensive coverage.

Training and Orientation

To ensure accuracy and consistency in data collection, an orientation on anthropometric measurements was conducted for health workers from the selected wards. This orientation took place at the District Health Office in Kanchanpur and was facilitated by experts in the field of nutrition. Following their training, these health workers further oriented two volunteers in each of their respective wards on the measurement techniques and data collection protocols.

Data Quality and Monitoring

Monitoring and supervision were carried out by a Public Health Officer from the District Health Office to ensure the accuracy and reliability of the data. Regular check-ins and oversight were maintained throughout the data collection period.

Anthropometric Measurements

The following anthropometric measurements were taken:

- Height: Measured using a stadiometer for children who could stand and a length board for younger children.

- Weight: Measured using a calibrated digital scale.
- MUAC: Measured using a MUAC tape at the midpoint of the left upper arm.

2.5 Data Analysis

Data were entered using Microsoft excel. Data analysis was done using ENA for SMART survey version 2020 and SAS 9.4 version. Descriptive statistics were used to summarize the demographic characteristics and nutritional status indicators (stunting, wasting, and underweight) of the children. Prevalence rates were calculated, and associations between nutritional status and various determinants were examined using inferential statistics.

3. Results

3.1 Socio-Demographic Characteristics of Participants

The nutrition screening comprised a sample size of 3,252 individuals, with a gender distribution of 45.6% female and 54.4% male. The mean age was 31.88 months, with a standard deviation of 15.53 months, and the median age was 32 months. Age distribution among the sample showed that the largest group, 24.0%, was aged 24-36 months. Ethnically, the sample was composed of 46.7% Brahmin/Chhetri, 15.0% Dalit, and 38.3% Janajati. The municipality distribution included the largest number of participants, 18.6% from Punarbas, while the smallest number, 6.5%, was from Laljhadi Rural Municipality (Table 1).

Table 1: Sociodemographic characteristics of participants (n=3252)

Characteristics	Number (n)	Percentage (%)
Gender		
Female	1482	45.6
Male	1770	54.4
Age (in months)		
0-12	211	41.2
12-24	144	28.1
24-36	112	21.9
36-48	45	8.8
Mean (±SD)	31.88 (±15.53)	
Median	32	
Ethnicity		
Brahmin/Chhetri	1518	46.7
Dalit	489	15.0
Janajati	1245	38.3
Municipality		
Bedkot	509	15.7
Beldandi	291	8.9
Belouri	281	8.6
Bhimdatta	332	10.2

Characteristics	Number (n)	Percentage (%)
Dodhara	301	9.3
Krishnapur	306	9.4
laljhadi	212	6.5
Punarbas	604	18.6
Suklaphanta	416	12.8

3.2 Prevalence of Malnutrition Based on MUAC

The prevalence of global malnutrition was 3.0% in the overall sample, with boys at 2.2% and girls at 3.8%. Moderate malnutrition was found in 2.6% of the sample, with boys at 1.9% and girls at 3.5%. Severe malnutrition was rare, with a prevalence of 0.3% in both boys and girls. This indicated that malnutrition was slightly more prevalent in girls compared to boys. (Table 2)

Table 2: Prevalence of malnutrition based on MUAC (n=3252)

Malnutrition	All n = 3252	Boys n = 1770	Girls n = 1482
Prevalence of global malnutrition (< 125 mm and/or oedema)	(96) 3.0 % (95% CI: 2.4 - 3.6)	(39) 2.2 % (95% CI: 1.6 - 3.0)	(57) 3.8 % (95% CI: 3.0 - 5.0)
Prevalence of moderate malnutrition (< 125 mm and >= 115 mm, no oedema)	(86) 2.6 % (95% CI: 2.1 - 3.3)	(34) 1.9 % (95% CI: 1.4 - 2.7)	(52) 3.5 % (95% CI: 2.7 - 4.6)
Prevalence of severe malnutrition (< 115 mm and/or oedema)	(10) 0.3 % (95% CI: 0.2 - 0.6)	(5) 0.3 % (95% CI: 0.1 - 0.7)	(5) 0.3 % (95% CI: 0.1 - 0.8)

3.3 Prevalence of Malnutrition Based on Z-Scores by Sex

The prevalence of underweight (weight-for-age z-score < -2) in the overall sample was 19.3%, with boys at 18.9% and girls at 19.8%. Moderate underweight (z-score between -2 and -3) affected 16.5% of the overall sample, with boys at 15.5% and girls at 17.6%. Severe underweight (z-score < -3) was observed in 2.9% of the sample, with boys at 3.4% and girls at 2.2%. This indicated that underweight prevalence was slightly higher in girls compared to boys, especially in the moderate underweight category.

The prevalence of stunting (height-for-age z-score < -2) in the overall sample was 17.0%, with boys at 17.2% and girls at 16.7%. Moderate stunting (z-score between -2 and -3) affected 13.0% of the overall sample, with boys at 12.5% and girls at 13.6%. Severe stunting (z-score < -3) was observed in 4.0% of the sample, with boys at 4.7% and girls at 3.1%. This indicated a slightly higher prevalence of severe stunting in boys compared to girls.

The prevalence of global malnutrition (weight-for-height z-score < -2 and/or oedema) was 14.9% in the overall sample,

with boys at 15.1% and girls at 14.5%. Moderate malnutrition (z-score between -2 and -3, no oedema) was observed in 12.2% of the sample, with boys at 12.1% and girls at 12.4%. Severe malnutrition (z-score < -3 and/or oedema) affected 2.6% of the sample, with boys at 3.1% and girls at 2.1%. This indicated that severe wasting is slightly more prevalent in boys compared to girls (Table 3).

Table 3: Prevalence of malnutrition based on z-score by sex (n=3252)

Prevalence of malnutrition	All	Boys	Girls
	n = 3252	n = 1770	n = 1482
Prevalence of underweight based on weight-for-age z-scores by sex			
Prevalence of underweight (<-2 z-score)	(628) 19.3 % (95% CI: 18.0 - 20.7)	(334) 18.9 % (95% CI: 17.1 - 20.8)	(294) 19.8 % (95% CI: 17.9 - 21.9)
Prevalence of moderate underweight (<-2 z-score and >=-3 z-score)	(535) 16.5 % (95% CI: 15.2 - 17.8)	(274) 15.5 % (95% CI: 13.9 - 17.2)	(261) 17.6 % (95% CI: 15.8 - 19.6)
Prevalence of severe underweight (<-3 z-score)	(93) 2.9 % (95% CI: 2.3 - 3.5)	(60) 3.4 % (95% CI: 2.6 - 4.3)	(33) 2.2 % (95% CI: 1.6 - 3.1)
Prevalence of stunting based on height-for-age z-scores and by sex			
Prevalence of stunting (<-2 z-score)	(552) 17.0 % (95% CI: 15.7 - 18.3)	(305) 17.2 % (95% CI: 15.5 - 19.1)	(247) 16.7 % (95% CI: 14.9 - 18.6)
Prevalence of moderate stunting (<-2 z-score and >=-3 z-score)	(422) 13.0 % (95% CI: 11.9 - 14.2)	(221) 12.5 % (95% CI: 11.0 - 14.1)	(201) 13.6 % (95% CI: 11.9 - 15.4)
Prevalence of severe stunting (<-3 z-score)	(130) 4.0 % (95% CI: 3.4 - 4.7)	(84) 4.7 % (95% CI: 3.8 - 5.8)	(46) 3.1 % (95% CI: 2.3 - 4.1)
Prevalence of Wasting based on weight-for-height z-scores and by sex			
Prevalence of global malnutrition (<-2 z-score and/or oedema)	(483) 14.9 % (95% CI: 13.7 - 16.1)	(268) 15.1 % (95% CI: 13.5 - 16.9)	(215) 14.5 % (95% CI: 12.8 - 16.4)
Prevalence of moderate malnutrition (<-2 z-score and >=-3 z-score, no oedema)	(398) 12.2 % (95% CI: 11.2 - 13.4)	(214) 12.1 % (95% CI: 10.7 - 13.7)	(184) 12.4 % (95% CI: 10.8 - 14.2)
Prevalence of severe malnutrition (<-3 z-score and/or oedema)	(85) 2.6 % (95% CI: 2.1 - 3.2)	(54) 3.1 % (95% CI: 2.3 - 4.0)	(31) 2.1 % (95% CI: 1.5 - 3.0)

3.4 Association of Sociodemographic Variable with Underweight, Stunting and Wasting

Gender-wise, 59.2% of females and 56.0% of males were underweight. Although the adjusted odds ratio (AOR) for females was 1.1 (95% CI: 1.0-1.3), the association was not statistically significant (P = 0.06). Age was a significant factor, with the prevalence of underweight increasing with age. The highest prevalence was observed in the 48-60 months age group (66.0%), with an AOR of 2.9 (95%

CI: 2.2-3.7), showing a strong association (P < 0.001). Ethnicity also played a significant role, with the Dalit group showing the highest prevalence of underweight (62.6%) and an AOR of 1.5 (95% CI: 1.2-1.9), followed by the Janajati group with a prevalence of 60.3% and an AOR of 1.2 (95% CI: 1.0-1.5). Both ethnic groups showed significant associations with underweight compared to the Brahmin/Chhetri group (P < 0.001).

The association with gender and stunting, adjusted odds ratios (AORs) for stunting were not statistically significant), with AORs close to 1.0, indicating no significant association between gender and stunting. Prevalence of stunting increased with age. Children aged 48-60 months had the highest prevalence (59.0%) with an AOR of 3.3 (95% CI: 2.5-4.3), indicating a strong association (P < 0.001). Significant differences were observed among ethnic groups. The Dalit group had a higher prevalence of stunting (55.2%) compared to Brahmin/Chhetri (47.8%) and Janajati (46.3%) groups. Adjusted odds ratios show a significant association for Dalit (AOR 1.3, 95% CI: 1.0-1.6, P < 0.001).

The prevalence of wasting is slightly higher among females compared to males, but the association is not statistically significant. Prevalence of wasting was the highest observed in children aged 24-36 months (55.4%) followed by 36-48 months (51.7%). Adjusted odds ratios (AORs) ranged from 1.8 to 2.2, indicating a strong association (P < 0.001). Significant differences were observed among ethnic groups. The Janajati group had the highest prevalence of wasting (55.8%) compared to Brahmin/Chhetri (45.9%) and Dalit (49.7%) groups. Adjusted odds ratios (AORs) were 1.5 (95% CI: 1.3-1.7) for Janajati and 1.3 (95% CI: 1.1-1.6) for Dalit, both indicating significant associations with wasting compared to Brahmin/Chhetri (P < 0.001 for both comparisons (Table 4).

Table 4: Association of sociodemographic variable with underweight, stunting and wasting (n=3252)

Variables	Underweight		P-value	COR (95% CI)	AOR (95% CI)
	Yes (n/%)	No (n/%)			
Gender			0.060		
Male	992 (56.0)	778 (44.0)		1	1
Female	878(59.2)	604 (40.8)		1.1 (1.0-1.3)	1.1 (1.0-1.3)
Age (in months)			<0.001		
6-12	185 (40.7)	270 (59.3)		1	1
12-24	400 (56.0)	314 (44.0)		1.9 (1.5-2.4)	1.8 (1.4-2.3)
24-36	460 (58.9)	321 (41.1)		2.1 (1.7-2.6)	2.1 (1.8-2.9)
36-48	412 (60.9)	265 (39.1)		2.3 (1.8-2.9)	2.3 (1.8-2.9)
48-59	413 (66.0)	212 (34.0)		2.8 (2.2-3.7)	2.9 (2.2-3.7)
Ethnicity			<0.001		

Variables	Underweight		P-value	COR (95% CI)	AOR (95% CI)
	Yes (n/%)	No (n/%)			
Brahmin/Chhetri	813 (53.6)	705 (46.4)		1	1
Dalit	306 (62.6)	183 (37.4)		1.5 (1.2-1.8)	1.5 (1.2-1.9)
Janajati	751 (60.3)	494 (39.7)		1.3 (1.1-1.5)	1.2 (1.0-1.5)
Stunting					
Gender			0.900		
Female	718 (48.5)	764 (51.5)		1.0 (0.9-1.2)	1.0 (0.9-1.1)
Male	854 (48.3)	916 (51.7)		1	1
Age (in months)					
6-12	138 (30.3)	317 (69.7)	<0.001	1	1
12-24	327 (45.8)	387 (54.2)		1.9 (1.5-2.5)	2.0 (1.5-2.5)
24-36	396 (50.7)	385 (49.3)		2.4 (1.9-3.0)	2.4 (1.8-3.0)
36-48	342 (50.5)	335 (49.5)		2.3 (1.8-3.0)	2.4 (1.8-3.0)
48-59	369 (59.0)	256 (41.0)		3.3 (2.6-4.3)	3.3 (2.5-4.3)
Ethnicity			<0.001		
Brahmin/Chhetri	726 (47.8)	792 (52.2)		1	1
Dalit	270 (55.2)	219 (44.8)		1.3 (1.1-1.7)	1.3 (1.0-1.6)
Janajati	576 (46.3)	669 (53.7)		0.9 (0.81-1.1)	1.0 (0.8-1.2)
Wasting					
Gender			0.400		
Female	757 (51.1)	725 (48.9)		1.1 (0.9-1.2)	1.1 (0.9-1.2)
Male	878 (49.6)	892 (50.4)		1	1
Age (in months)			<0.001		
6-12	168 (36.9)	287 (63.1)		1	1
12-24	369 (51.7)	345 (48.3)		1.8 (1.4-2.3)	1.8 (1.4-2.3)
24-36	433 (55.4)	348 (44.6)		2.1 (1.7-2.7)	2.2 (1.7-2.8)
36-48	350 (51.7)	327 (48.3)		1.8 (1.4-2.3)	1.8 (1.4-2.4)
48-59	315 (50.4)	310 (49.6)		1.7 (1.3-2.2)	1.8 (1.4-2.3)
Ethnicity			<0.001		
Brahmin/Chhetri	697 (45.9)	821 (54.1)		1	1
Dalit	243 (49.7)	246 (50.3)		1.2 (0.9-1.4)	1.3 (1.1-1.6)
Janajati	695 (55.8)	550 (44.2)		1.5 (1.3-1.7)	1.2 (1.0-1.5)

4. Discussion

The overall aim of the study was to assess the nutritional status of children aged 6-59 months in Kanchanpur District of Sudurpashchim Province.

Our analysis indicated that the stunting rate among children under 5 years in Kanchanpur District (17%) was considerably lower than both the national average and the average for Sudurpashchim Province (national: 25%, Sudurpashchim Province: 28.4%) [15]. This suggested that the nutritional and health interventions in Kanchanpur District may be effective. Conversely, the wasting rate in Kanchanpur District (14.9%) was notably higher than the national average and the average for Sudurpashchim Province (national: 8%, Sudurpashchim Province: 5.1%). This elevated rate of wasting among children could be due to poor hygiene and sanitation in the community, leading to disease outbreaks and parasitic infections

[20]. Moreover, the prevalence of underweight children aged 6-59 months in Kanchanpur District (19.3%) was consistent with the national average (19%) but exceeds the average for Sudurpashchim Province (15%) [15]. This suggested that while chronic malnutrition is a national issue, Kanchanpur requires targeted interventions to reduce the burden of underweight children. These disparities underscored the necessity of region-specific health policies and interventions to address the unique nutritional challenges faced by different districts.

In our research, boys exhibited higher rates of all three types of malnutrition (wasting, stunting, and underweight) compared to girls. However, the association was not statistically significant. This finding aligned with previous research conducted in Nepal, Ethiopia, and Iran, which reported that male children are more vulnerable to malnutrition than their female counterparts [21-23]. This may be because male children require comparatively more calories for growth and development compared to female children. One reason for low caloric intake in children could be their low socioeconomic status. However, the biological reason is still unknown [24, 25].

Our research indicated that the likelihood of stunting and being underweight increased significantly with the age of the child. Specifically, children aged 48-60 months were more prone to stunting compared to those younger than 12 months. This observation aligned with findings from other studies in developing nations [26-30]. The elevated rates of stunting and underweight among children aged 48-60 months may be linked to inadequate food supplementation during the weaning phase [30-32]. Children between 24 and 59 months need more calories and nutrients for proper growth and development. As children grow, their energy needs increase, necessitating a corresponding rise in calorie intake to maintain appropriate weight for their age. Therefore, it is essential that they receive a varied, healthy, and balanced diet daily. Failure to meet these increasing energy and nutrient requirements results in underweight children [25]. This correlation may also be due to the higher susceptibility of low birth weight children to infections such as diarrhoea and acute respiratory infections, which can lead to complications associated with stunting and underweight [33].

Moreover, our study found that children older than 24 months had a significantly higher risk

of wasting compared to those younger than 12 months. This contrasted with other studies that reported a decline in wasting as children aged, which are related to the introduction of supplementary foods alongside breast milk after six months [21, 34, 35]. Our findings are plausible considering that 55% of children in Nepal begin breastfeeding early and continue until they are 24 months old [36]. Semi-solid foods are typically introduced around the fifth or sixth month. As children grow, their protein needs increase, which may not always be adequately met. While the National Nutrition Program's Infant and Young Child Feeding (IYCF) initiative effectively supports nutrition for children under two years old, there are limited programs targeting the nutritional needs of children aged 24 to 59 months [37]. Our study highlighted the significant impact of ethnicity, with Dalit and Janajati children showing higher incidences of underweight, stunting, and wasting compared to their Brahmin/Chhetri peers. This disparity can be attributed to the generally lower socio-economic status of the Dalit and Janajati communities, which restricts their access to nutritious food [38-40]. The study's findings highlighted the need for comprehensive and targeted public health interventions to improve child nutrition in Kanchanpur District and similar regions. Future efforts should enhance nutritional programs for children aged 24-59 months. Targeted support for socio-economically disadvantaged groups, particularly Dalit and Janajati communities, will help address disparities in access to nutritious food and healthcare. Ongoing research and innovation are necessary to develop sustainable solutions, such as bio-fortification and community gardening projects. Implementing these strategies inclusively and sensitively will contribute to significant and lasting improvements in child nutrition.

While this study provides valuable insights into the nutritional status of children in Kanchanpur District, several limitations should be considered. The cross-sectional design restricts the ability to establish causal relationships between variables. Moreover, the reliance on data from a single screening program may not fully capture seasonal variations or long-term trends in nutritional status.

5. Conclusion

The results identified the influence of age and ethnicity as key predictors for all forms of malnutrition in children aged 6-59 months in Kanchanpur District in Nepal. The findings

of this study highlight the urgent need for targeted nutritional interventions, especially among older children and marginalized ethnic groups. Addressing these issues requires coordinated efforts from policymakers, health practitioners and the community. Further research is needed to explore the underlying causes of malnutrition and to evaluate the effectiveness of intervention programs.

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Author contributions

GB: Conceptualization, data curation, formal analysis, methodology, writing original draft, writing review and editing. RM: Conceptualization, methodology, writing original draft, writing review and editing. OPJ: Conceptualization, methodology, supervision, writing original draft, writing review and editing. MV: Conceptualization, methodology, supervision, writing review and editing. AR: Conceptualization, methodology, writing original draft, writing review and editing.

Declaration

Ethics approval and consent to participate

This screening program was conducted as a public health initiative by a government institution and approval from Health office, Kanchanpur (Ministry of Social Development-Sudurpaschim Province Ref no 11/2081).

Competing interests

We declared that we have no competing interests

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