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Detection of Malnourished Children Below 5 years in Darchula, Nepal: The Impact of Universal Community-Based Screening

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ABSTRACT

Background: Proper nutrition is vital for health and the wellbeing of children. It supports physical growth, brain development, better immune function, prevent malnutrition and reduces the risk of mortality during the early period of life. However, reduction of malnutrition of the children remains highly concerning challenge globally and a priority (P1) program for the government of Nepal. The proportion of stunted and wasted children below 5 years of age children in Sudurpashchim province were 41 and 14 per thousand live births, respectively, which is significantly higher than the national data, which is 32 and 12 per thousand live births, respectively. These children are at greater risk of morbidity and mortality due to severe acute malnutrition. Hence, it was necessary to conduct a district wide campaign to effectively detect malnourished children.

Methods: The Health Office of Darchula of Sudurpashchim province conducted a district wide campaign reaching out to take anthropometric assessment of children below the age of five years between July 1, 2021, and October 15, 2021. The data collected was analyzed to estimate the prevalence of malnutrition by types and severity among children of the study group.

Materials and Methods: The number of children below five from the Darchula District of Sudurpashchim province 5953. The data collected from these children was analyzed using universal anthropometric assessment. The Emergency Nutrition Assessment (ENA) for Standardized Monitoring and Assessment of Relief and Transitions (SMART) software was used to find out the prevalence of malnourished children in Darchula District of Sudurpashchim province of Nepal. The data was collected between July 1, 2021, and October 15, 2021. The study intended to analyse the findings out of 5953 under 5 children assessed from 43 wards of Darchula district where were done. severe acute malnutrition in terms of z-scores, oedema and 95% confidence intervals were obtained from data of the nutrition assessment campaign.

Results: A total of 5953 children from 43 wards from the Darchula District of Sudurpashchim province were admitted into the study. Analysis revealed the prevalence of Global acute malnutrition (GAM) at 10.6 % (CI 9.8 - 11.4 95%), Severe Acute Malnutrition (SAM) at 2.8 % (CI 2.4 - 3.3 95%), i.e. 162 children, and 450 children with Moderate Acute Malnutrition (MAM). However, before this campaign, only 9 SAM cases (6 in 2019 and 3 in 2020) were detected and treated during the two previous years.

Conclusion: District wide campaigns was found to be highly effective inn detecting GAM, SAM, and MAM cases that were missed in previous limited interventions. This will permit these new cases to be properly managed through early detection and prevention of the complications.

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Introduction

Malnutrition among children remains one of the most pressing public health issues in developing countries, with Nepal being no exception [1]. Manifesting in various forms—stunting (low height for age), wasting (low weight for height), underweight (low weight for age), and micronutrient deficiencies (insufficient intake of essential vitamins and minerals)—this condition jeopardizes the future of millions of young lives [2]. In 2022, the World Health Organization (WHO) estimated that a staggering 149 million children under the age of five were stunted, while 45 million suffered from wasting. Furthermore, according to the WHO Factsheet (2024), nearly half of all deaths in children under five globally can be attributed to undernutrition, with the burden predominantly borne by low- and middle-income countries [3].

Accurate assessment of malnutrition in children is critical for timely intervention. While cases of oedematous malnutrition, such as kwashiorkor, are largely recognizable by physicians, the detection of wasting—a key indicator of acute malnutrition—can easily be overlooked without routine anthropometric measurements. In Nepal, growth monitoring using anthropometry is a standard practice at health facilities. However, a significant challenge arises as many parents tend to discontinue visits to these facilities once their children complete the vaccination schedule by 15 months. This practice results in missed opportunities for continuous nutritional assessment, leading to delays in uncovering cases of acute malnutrition [4].

The situation is particularly dire in regions like Darchula, a mountainous district in Sudurpashchim Province, which remains one of the most underdeveloped areas in Nepal. Despite considerable efforts to improve public health, Sudurpashchim Province continues to experience alarmingly high rates of maternal and neonatal mortality when compared to national averages. More concerning is the prevalence of malnutrition among children in this region [4]. The latest National Demographic Health Survey reveals that in Sudurpashchim Province, 28% of children under five are stunted, 5% are wasted, and 14% are underweight. Notably, the stunting rate in this province surpasses the national average of 25%, highlighting a significant regional disparity that demands urgent attention [4].

In light of these challenges, the primary objective of the present study is to identify the factors associated with acute malnutrition among children using secondary data analysis. Furthermore, this research aims to quantify the number of malnourished children who are not being identified due to the lack of a universal, community-based anthropometric measurement program [5]. Such an evaluation is essential because the consistent monitoring of nutritional status at health facilities could serve as a critical intervention point, enabling healthcare providers to implement corrective measures before malnutrition progresses to more severe forms [5].

Addressing this gap in routine nutritional assessment is not only vital for reducing child morbidity and mortality but also for informing public health strategies tailored to local needs. By integrating comprehensive and regular anthropometric evaluations into standard paediatric care, especially in high-risk regions like Darchula, health authorities in Nepal can significantly enhance early detection and intervention efforts. Ultimately, these measures will contribute to reducing the adverse effects of malnutrition, thereby improving the overall quality of life and prospects for children in Nepal.

Materials and Methods

Study Area and Design

The study was conducted in the Darchula district of Sudurpashchim Province, Nepal, from July 1, 2021, to October 15, 2021. Furthermore, secondary data were obtained from the Nutrition Assessment (Z-Zero) among children below five years of age. These data were used to estimate missed malnutrition among these children. However, the health workers involved in the nutrition assessment study entered the data in a formatted design, specifically for study purposes, based on the questionnaires.

In the study, a single format was used during the anthropometric session, and all the formats were compiled at the municipal level by the health section chief of the municipality. Moreover, the data of each individual child were entered in an Excel format at the municipality level and compiled into Excel sheets, which were then forwarded to the district level. At the district level, the district supervisor assembled and compiled data from all municipalities into a single Excel sheet.

The quality of data entry was ensured through validation techniques under the Excel program. Data on age, height, weight, and Mid-Upper Arm Circumference (MUAC) were analyzed using ENA (Emergency Nutrition Assessment for Standardized Monitoring and Assessment of Relief and Transitions), a software tool for data analysis and report development.

Study Population

The study population consisted of children aged 6 to 59 months from the local level of Darchula, whose anthropometric measurements were taken. All children aged 6 to 59 months within the campaign coverage area were included in the study. The sampling unit comprised children aged 6 to 59 months residing near the nutrition assessment campaign area.

Sample Size

The Health Office of Darchula launched the IMAM (Integrated Management of Acute Malnutrition) program in 2020 with the support of the provincial government. It trained health workers from the local (municipal) level on the anthropometric measurement of children and equipped all health facilities with height boards, weighing scales, and Mid-Upper Arm Circumference (MUAC) tapes. The weight and height of children aged 6 to 59 months were recorded in kilograms (kg) and centimeters (cm), respectively. The date of birth of the study children was recorded and used for data analysis.

Furthermore, as part of launching the IMAM program, the health department aimed to estimate the prevalence of acute malnutrition throughout the district. It formed a study team at the district level, which called on local health workers to conduct a z-score campaign to track the anthropometric measurements of the study children across districts.

Health workers from 41 health facilities across the district conducted the nutrition assessment campaign at the ward and community levels of all municipalities. The Health Office set targets for assessing children below five years old in each ward and documented the coverage of children assessed against the target. The campaign reached a total of 8,964 children. However, at the ward level, data on universal anthropometric coverage were available from only 43 wards across nine Local Level Government (LLG) units, covering 5,953 children during the study period.

A total of 152 children were missed from the assessment due to being outside their locality, illness, or other unknown reasons. In addition, the supervision of the anthropometric assessment was conducted by health supervisors, officials from the health directorate, the health section chief, and local-level officials.

The inclusion criterion was children aged 6 to 59 months within the program coverage area, while the exclusion criterion was children who were included in the anthropometric measurement but came from an administrative unit outside the study area.

Data Collection

The Health Office called on the District Coordination Committee, local administrative authorities, journalists, and school administrations to support the campaign. Furthermore, nutrition assessment sessions were conducted at health facilities, community setups, schools, and at the household level (for remotely located households facing difficulties in reaching a health facility). The data were recorded using a hard-copy questionnaire tool.

A master format based on the ENA recording tool was used to capture data at the Health Office to maintain uniformity in data collection. A single questionnaire format was used for each child, and all completed questionnaires were collected at the ward level before being submitted to the health section chief of the local level. The completed questionnaires were then recorded in an Excel sheet at the municipal level and finally sent to the District Health Office in Darchula. ENA software was used to calculate z-score values which were then compared with the WHO reference data 2006 [6].

The secondary data from the campaign were recorded in Excel sheets, maintained at the District Health Office in Darchula, and used for analysis.

Study Variables and Operational Definitions

Global Acute Malnutrition (GAM), Moderate Acute Malnutrition (MAM), and Severe Acute Malnutrition (SAM) were the dependent variables of the study. GAM is defined as children with a weight-for-height z-score of less than -2 and/or the presence of oedema. MAM is defined as children with a weight-for-height z-score between -2 and -3 (inclusive of -2), with no oedema. SAM is defined as children with a weight-for-height z-score of less than -3 and/or the presence of oedema.

The independent variables of the study were local levels (municipality, ward), sex, ethnicity, and nutrition program coverage.

Statistical Analysis

Healthcare workers involved in the nutrition assessment entered the data using an Excel format designed specifically for the study. Data quality was ensured by applying control validation techniques within Excel. A single form was used during each anthropometric session, and all forms were compiled at the municipal level by the municipality's health section chief. The compiled municipal sheets were then forwarded to the district level, where the district supervisor assembled and consolidated the data from all municipalities into one Excel sheet. Data on age, height, weight, and MUAC were imported into ENA (Emergency Nutrition Assessment for Standardized Monitoring and Assessment of Relief and Transitions), and SPSS version 22 was used for data analysis.

Ethical Consideration

Ethical approval was obtained from the Ethical Review Committee of the Nepal Health Research Council (Ref. no.: 2573 of 31 March 2023) for using data collected from district-wide anthropometric measurement campaigns conducted among children under five years of age in Darchula District. The Darchula Health Office provided an official letter authorizing the analysis and publication of the data. The anonymity of the data was maintained by ensuring that no information about the children was disclosed to any individual, authority, or agency.

Results

Characteristics of Participants

The boys-to-girls ratio among children aged 6-59 months who underwent anthropometric measurements was 1.1, with male children comprising 51.3% of the sample. In terms of age distribution, 46% of the children were in the 6-29 months group, 24% were in the 30-41 months group, and 21% were in the 42-53 months group (Table 1).

Table 1: Age-Sex distribution of Children (n=5681)

Characteristics	Boys		Girls		Total		Ratio
AGE (mo)	**no.**	%	**no.**	%	**no.**	%	**Boy: girl**
6-17	696	50.8	673	49.2	1369	24.1	1:0
18-29	678	54.0	578	46.0	1256	22.1	1:2
30-41	669	49.2	691	50.8	1360	23.9	1:0
42-53	617	52.5	559	47.5	1176	20.7	1:1
54-59	256	49.2	264	50.8	520	9.2	1:0
Total	2916	51.3	2765	48.7	5681	100.0	1:1

Anthropometric Results

Prevalence of Malnutrition

The total prevalence of malnutrition amongst the study participants was 10.6%, with moderate acute malnutrition affecting 7.8% and severe acute malnutrition 2.8%. However, overall acute malnutrition, measured as global acute malnutrition (GAM), moderate acute malnutrition (MAM), and severe acute malnutrition (SAM), was higher in boys compared to girls (Table 2).

Table 2: Prevalence of Acute Malnutrition based on Weight-for-Height and by se

	All n = 5766	**Boys** n = 2952	**Girls** n = 2809
Prevalence of global malnutrition (<-2 z-score and/or oedema)	(612) 10.6 % (9.8 - 11.4 95% C.I.)	(405) 13.7 % (12.5 - 15.0 95% C.I.)	(206) 7.3 % (6.4 - 8.4 95% C.I.)
Prevalence of moderate malnutrition (<-2 z-score and >=-3 z-score, no oedema)	(450) 7.8 % (7.1 - 8.5 95% C.I.)	(301) 10.2 % (9.2 - 11.3 95% C.I.)	(148) 5.3 % (4.5 - 6.2 95% C.I.)
Prevalence of severe malnutrition (<-3 z-score and/or oedema)	(162) 2.8 % (2.4 - 3.3 95% C.I.)	(104) 3.5 % (2.9 - 4.3 95% C.I.)	(58) 2.1 % (1.6 - 2.7 95% C.I.)

Prevalence of Wasting by Age

Severe wasting was more prevalent in the 6 – 17 months age group, while moderate wasting was most common among children aged 30 – 41 months (Table 3).

Table 3: Prevalence of Wasting (Acute Malnutrition) by age, based on Weight-for-Height z-scores and/or oedema

		Severe wasting (<-3 z-score)		**Moderate wasting (>= -3 and <-2 z-score)**		**Normal (> = -2 z score)**	
Age (mo)	**Total no.**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6-17	1342	44	3.3	98	7.3	1200	89.4
18-29	1225	33	2.7	91	7.4	1101	89.9
30-41	1340	36	2.7	124	9.3	1180	88.1
42-53	1162	27	2.3	90	7.7	1045	89.9
54-59	510	5	1.0	32	6.3	473	92.7
Total	5579	145	2.6	435	7.8	4999	89.6

Prevalence of Stunting by Sex based on Height-for-Age z-scores

Based on height-for-age z-scores, stunting was observed in 32% of children, with 22% classified as moderately stunted and 10.2% as severely stunted. Notably, moderate stunting was more prevalent among boys (24.2%) than girls (21.2%), and severe stunting was also higher in boys (10.2%) compared to girls (7.5%) (Table 4).

Table 4: Prevalence of Stunting based on Height-for-Age z-scores and by Sex

	All **n = 5752**	**Boys** **n = 2946**	**Girls** **n = 2801**
Prevalence of stunting (<-2 z-score)	(1812) 31.5 % (30.3 - 32.7 95% C.I.)	(1047) 35.5 % (33.8 - 37.3 95% C.I.)	(762) 27.2 % (25.6 - 28.9 95% C.I.)
Prevalence of moderate stunting (<-2 z-score and >=-3 z-score)	(1268) 22.0 % (21.0 - 23.1 95% C.I.)	(714) 24.2 % (22.7 - 25.8 95% C.I.)	(552) 19.7 % (18.3 - 21.2 95% C.I.)
Prevalence of severe stunting (<-3 z-score)	(544) 9.5 % (8.7 - 10.2 95% C.I.)	(333) 11.3 % (10.2 - 12.5 95% C.I.)	(210) 7.5 % (6.6 - 8.5 95% C.I.)

Severe and Moderate Stunting Across Age Groups

Furthermore, severe stunting was highest among children aged 42 – 53 months (12.4%), followed by those in the 30 – 41 months group (10.3%). Moderate stunting was most prominent in the 42–53 months age group (29.3%), with the 54–59 months group reporting the next highest prevalence at 24.4% (Table 5).

Table 5: Prevalence of Stunting by Age based on Height-for-Age z-scores

		Moderate stunting (>= -3 and <-2z-score)		Moderate stunting (>= -3and<2 zscore)		Normal (> = -2 z score)	
Age (mo)	**Total no.**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6-17	1333	80	6.0	200	15.0	1053	79.0
18-29	1230	109	8.9	238	19.3	883	71.8
30-41	1341	138	10.3	352	26.2	851	63.5
42-53	1163	144	12.4	341	29.3	678	58.3
54-59	513	52	10.1	125	24.4	336	65.5
Total	5580	523	9.4	1256	22.5	3801	68.1

Discussion

The present study provides insights into the prevalence of malnutrition among children aged 6 – 59 months, highlighting variations by sex and age. The findings indicate that malnutrition, particularly acute malnutrition and stunting, remains a significant public health concern. These results underscore the need for targeted nutritional interventions to address the observed disparities and improve child health outcomes [7].

The boys-to-girls ratio among the assessed children was 1.1, with boys constituting 51.3% of the sample. This nearly equal distribution suggests a relatively balanced representation of both sexes in the study population. Age-wise, nearly half (46%) of the children belonged to the 6 – 29 months category, indicating that early childhood constitutes a major proportion of the study cohort. Given that the first two years of life are critical for growth and development, the high proportion of young children in the study has implications for the need to prioritize interventions during this window of opportunity to prevent long-term adverse effects of malnutrition [8].

The overall prevalence of malnutrition, as indicated by global acute malnutrition (GAM), was 10.6%, which aligns with malnutrition rates observed in other low-resource settings. Moderate acute malnutrition (MAM) accounted for 7.8%, while severe acute malnutrition (SAM) was found in 2.8% of children. These figures suggest that while most malnourished children are moderately affected, a significant proportion still suffers from severe malnutrition, which poses higher risks of morbidity and mortality. This is similar to the results obtain by De Sanctis and colleagues [8]. The higher prevalence of GAM, MAM, and SAM in boys compared to girls suggests potential biological or behavioural factors influencing nutritional vulnerability. Several studies suggest that male children may have higher energy and micronutrient requirements and may be more susceptible to infections, which could contribute to increased malnutrition rates [9-11]. However, cultural factors such as differential feeding practices and care-seeking behaviours could also play a role and warrant further investigation [12].

Severe wasting, characterized by a weight-for-height z-score below -3, was most prevalent in the 6 – 17 months age group, while moderate wasting was highest in the 30–41 months group. This pattern highlights two critical phases of vulnerability: infancy and the transition into early childhood. The high prevalence of severe wasting among younger children may be linked to inadequate breastfeeding practices, early cessation of exclusive breastfeeding, and poor complementary feeding practices [13]. Studies have demonstrated that early nutritional deficits have lasting effects on health and development, making it crucial to implement interventions targeting proper infant and young child feeding practices [14-16]. Moderate wasting peaking at 30 – 41 months could be associated with cumulative dietary inadequacies, recurrent infections, and insufficient healthcare access. This age group represents a stage where children are increasingly exposed to household food insecurity and environmental risks, which may exacerbate undernutrition [17]. Programs that promote community-based management of acute malnutrition (CMAM) and improve dietary diversity in this age range are essential to mitigate these trends [18].

The overall prevalence of stunting, a measure of chronic malnutrition, was 32%, with 22% classified as moderately stunted and 10.2% as severely stunted. These figures indicate that nearly one-third of children in the study suffer from long-term nutritional deficits, which can have irreversible consequences on cognitive and physical development. Boys exhibited a higher prevalence of both moderate (24.2%) and severe stunting (10.2%) compared to girls (21.2% and 7.5%, respectively). This male disadvantage in stunting has been observed in various other studies and may be due to biological susceptibility, differences in energy metabolism, or sociocultural factors that influence feeding practices and healthcare utilization. While boys may have higher energy requirements, it is also essential to examine household-level gender disparities in resource allocation and caregiving practices [19].

The prevalence of severe stunting was highest in children aged 42–53 months (12.4%), followed by the 30–41 months group (10.3%). Similarly, moderate stunting peaked in the 42–53 months group (29.3%), with the 54–59 months group reporting the second-highest prevalence at 24.4%. This trend suggests that the cumulative effects of early-life nutritional deficiencies manifest more prominently as children grow older. Stunting at this stage indicates prolonged exposure to inadequate nutrition, repeated infections, and possible socioeconomic constraints that limit access to adequate food and healthcare [20,21]. Interventions must, therefore, focus on both preventive and corrective measures, including improved dietary practices, infection control, sanitation, and maternal education.

The findings of this study highlight the persistent burden of malnutrition among young children, necessitating comprehensive and multi-sectoral interventions. Strategies to address acute malnutrition should include improved maternal and child nutrition programs, promotion of exclusive breastfeeding, and community-based treatment of wasting. The higher prevalence of malnutrition in boys suggests that sex-specific approaches may be needed to ensure equitable nutritional outcomes [22].

In conclusion, this study provides critical insights into the patterns of malnutrition among children aged 6–59 months, emphasizing the need for targeted interventions across different age groups and sexes. While wasting is a pressing concern in infancy

and early childhood, stunting remains a significant long-term challenge. Addressing these issues requires a holistic approach involving healthcare, nutrition, education, and social protection sectors to achieve meaningful improvements in child health and development.

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Conflict of Interest
The authors declare that they have no conflict of interest.

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