PREVALENCE AND FACTORS ASSOCIATED WITH UNDERNUTRITION AMONG CHILDREN AGED 0-59 MONTHS IN MUGU DISTRICT, NEPAL

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ABSTRACT:

Background: Under-nutrition is responsible for the death of more than a third of under-five children globally. The short and long term effects of under-nutrition include delayed developmental milestones, increased risk of infections and greater susceptibility to chronic diseases during adulthood. Prevalence of child under-nutrition in Mugu was the highest among all districts in Nepal. The main objective of this study was to determine the prevalence and factors associated with under-nutrition among children aged 0-59 months in Mugu district, Nepal.

Methods: A cross-sectional study was conducted over two months (July-August 2014) involving 246 children aged 0-59 months residing in two selected Village Development Committee areas in Mugu district. Anthropometric measurements were collected from children participating in the study along with Anthropometric measurements of their mothers. A structured questionnaire was then administered to the mothers. Data analysis was done using chi-square test or Fisher's exact test for bivariate analysis and a final multivariable model was created using logistic regression with statistical significance accepted at a p value < 0.05 in each analysis.

Results: The prevalence of severe wasting (6.1%) and the overall prevalence of stunting (61.8%) and underweight (48.8%) among children in the study were higher than the national average as reported by the Nepal Demographic and Health Survey 2011. Wasting was positively associated with perceived small size at birth (p=0.001), not exclusively breastfed (p=0.007) and history of diarrhea (p=0.007). Stunting was positively associated with a birth interval less than 24 months (p=0.004) and poor dietary diversity (p=0.001). Stunting was negatively associated with more than two growth monitoring visits (p= 0.037). Underweight was positively associated with low maternal Body Mass Index (p<0.001), child age group of 12-35 months (p=0.001), perceived small size at birth (p=0.007) and history of diarrhea (p=0.001).

Conclusions: The prevalence of under-nutrition among children in Mugu district is high. Factors such as poor birth spacing, inadequate number of growth monitoring visits and high levels of fever and diarrhoea among children can be addressed through adequately staffed health facilities and outreach programs with a special focus on health education and promotion that encourage birth spacing and frequent growth monitoring visits.

Keywords: Children aged 0-59 months, Under-nutrition, Nepal

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INTRODUCTION

Under-nutrition is a condition in which the body does not have enough of the right kind of food to meet its energy, macronutrient (proteins, carbohydrates and fats) and micronutrient vitamins and minerals) needs. Under-nutrition is responsible for the death of more than a third of under-five children globally [1]. The short and long-term effects of under-nutrition, include delayed developmental milestones, increased risk of infections and greater susceptibility to chronic diseases as an adult [2]. Malnourished children tend to be physically, emotionally and intellectually less productive and suffer more from chronic illnesses and disabilities compared to healthy children. Child under-nutrition is believed to

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be a consequence of the complex interactions between socio-demographic, environmental, reproductive, institutional, cultural, political and regional factors [3].

Data from Nepal Demographic and Health Survey (NDHS) 2006, NDHS 2001, Nepal Family Health Survey (NFHS) 1996 and the first National Nutrition Survey in 1975 show no significant reduction in child under-nutrition in the last 35 years [4-7]. Figures from NDHS 2011 reports that 41% of children under five years of age are stunted, and 16% are severely stunted. Overall, 11 % of children are wasted and 3 % are severely wasted. Overall, 29% of children are underweight low weight-for-age) and 8% are severely underweight [8]. In the Annual Health Report of 2010 prevalence of under-nutrition among children under five years of age in Mugu was reported to be the highest among districts in Nepal but was calculated only on the basis of weight for age and no research was done to investigate factors which could be associated with under-nutrition [9]. Therefore, the main objective of this study was to determine the prevalence and factors associated with under-nutrition among children aged 0-59 months in Mugu district, Nepal.

METHODOLOGY

A cross-sectional study was conducted over two months including 246 children aged 0-59 months residing in two Village Development Committee (VDC) areas selected from Mugu district. Sample size was calculated by the formula from the study by Suresh and Chandrashekara [10]. Multistage sampling method was used; firstly two VDCs were selected purposively according to population density and geographical access from 24 VDCs in this district. Then two wards out of nine wards with a minimum of 80 households were selected from each VDC. Finally, from each of the four wards, households with children aged 0-59 months were selected based on lists maintained by Female and Child Health Volunteers by simple random sampling using lottery.

Anthropometric data on the nutritional status of the selected children and their mothers were collected by measuring height and weight. This data was used to calculate three indices among the children: weight-for-age, height-for-age, and weight-for-height and the body mass index (BMI) of their mothers. These three indices expressed in standard deviation units from the Multicenter Growth Reference Study median were the dependent variables. A structured questionnaire, based on the NDHS 2011 questionnaire, was then administered to the mothers by the interviewer. The questionnaire included maternal factors (age group, gestational duration, child birth interval, number of ANC visits during pregnancy, nutritional status (BMI), education level of mother, ethnicity/caste, religion, food security score and residence) and child related factors (age group, sex, perceived size at birth, history of acute illness, immunization history, number of growth monitoring visits, dietary diversity score and history of colostrum feeding and exclusive breast feeding) which were the independent variables. The independent variable perceived size at birth was used as a substitute for birth weight. It is defined as the pperception of the mother of the size of her child at birth (very small, small, average or larger). This is used as a substitute for birth weight in situations where this data is unavailable and was also used in the NDHS 2011. Dietary Diversity was scored by giving a point for each of the major nutritionally important types of food, listed under 7 categories, the child may have eaten on the day preceding the interview based on recall by the mother. The maximum possible score was 7; a score of 0-2 was low, 2-4 was middle and 5-7 was a high dietary diversity score. The food security score was calculated based on answers to 2 questions which dealt with limitation in variety of foods consumed and lack of food to eat in the household over the past 12 months. Households could be given a minimum score of 2, indicating high levels of food security, to a maximum score of 8, indicating high levels of food insecurity.

Approval from National Health Research Council, Ethical Review Board (Registration Number 107/2014) and permission from the District Public Health Officer in Mugu were obtained in order to conduct the study and informed written consent was obtained from all participants. Confidentiality regarding participant history and data collected was maintained.

The data were analyzed using the Statistical Package for Social Sciences (SPSS Version 17.0 licensed to Chulalongkorn University). Descriptive statistics were calculated in terms of frequency and percentage as both the independent and dependent variables were categorical. The prevalence of stunting, wasting and underweight in the sample population was reported using descriptive statistics. The significance of association between each independent variable and dependent variable was tested using Chi square test or Fishers Exact test. Bivariate logistic regression analysis was conducted to examine the relationship between various independent variables and the three dependent variables separately which gave us the unadjusted odds ratio and the statistical significance of the

Table 1 Characteristics of mothers (n = 246)

Independent variables	Frequency	%
Religion		
Hindu	243	98.8
Buddhist	3	1.2
Ethnicity		
0	67	27.2
1	179	72.8
Ethnicity 0= Dalit, Tamang and Raut. 1= Chettri, Thakuri and Hill Brahmin.		
Maternal age group in years* (years)		
<20	18	7.3
20-29	180	73.2
30-34	27	11.0
≥35	20	8.1
Missing	1	0.4
Maternal age group at birth (years)		
<20	85	34.6
20-29	136	55.3
30-34	14	5.7
≥35	10	4.0
Missing**	1	0.4
Maternal BMI		
Moderately obese	8	3.3
Overweight- at risk	19	7.7
Normal range	175	71.1
Low	43	17.5
Missing	1	0.4
Moderately obese (BMI 25-29.9) Overweight- at risk (BMI 23-24.9) Normal range (BMI 18.5-22.9) Low (BMI<18.5)		
Maternal education		
No formal edu	150	61.0
≤ Grade 5	24	9.8
≥ Grade 6	18	7.3
≥ Grade10	53	21.5
Missing	1	0.4
No edu= Uneducated. ≤ Grade 5= Primary school. ≥ Grade 6= Some secondary school. ≥ Grade10= Graduated high school		
Birth interval (months)		
First born	94	38.2
<24	33	13.4
24-47	91	37.0
≥48	28	11.4
Food security score		
High 2-3	81	32.9
Middle 4-6	157	63.8
Low 7-8	8	3.3
Gestational duration		
Pre-term	33	13.4
Term	211	85.8
Post-term	2	0.8
Number of ANC visits during pregnancy		
0	27	11.0
1	7	2.8
2	10	4.1
≥3	202	82.1

* Maternal age group is divided along the same lines as the NDHS 2011

** In the study one of the participants did not have a mother and interview was administered to a caretaker. Therefore, the missing data regarding certain Maternal Factors

Table 2 Characteristics of children (n = 246)

Independent variables	Frequency	%
Child gender		
Male	127	51.6
Female	119	48.4
Child age group in months* (months)		
< 6	3	1.2
6-8	8	3.3
9-11	11	4.5
12-17	34	13.8
18-23	34	13.8
24-35	48	19.5
36-47	55	22.4
48-59	53	21.5
Child size at birth		
Very large	4	1.6
Larger than average	46	18.7
Average	164	66.7
Smaller than average	27	11.0
Very small	5	2.0
Exclusively breastfed child (first 6 months of life)		
Yes	221	89.8
No	25	10.2
Colostrum fed child		
Yes	234	95.1
No	12	4.9
History of fever in the past 2 weeks		
Yes	78	31.7
No	168	68.3
History of diarrhoea in the past 2 weeks		
Yes	65	26.4
No	181	73.6
Number of growth monitoring visits during last 2 months		
0	186	75.6
≤2	46	18.7
>2	14	5.7
Immunized as per the National Immunization Program Schedule		
Yes	240	97.6
No	6	2.4
Dietary diversity score		
0-2 Low	30	12.2
3-4 Middle	163	66.3
5-7 High	53	21.5

* Child Age group is divided along the same lines as the NDHS 2011

association (*p*-value). Finally, multivariate logistic regression analysis was conducted in one model including all the relevant independent variables together. Results were considered statistically significant at a 5% ($p < 0.05$) significance level. Those independent variables in the bivariate analysis which showed $p \leq 0.2$ were included in the multivariate analysis to give the adjusted odds ratio along with a *p*-value.

RESULTS

The characteristics of the mothers and children who participated in the study are described in detail in Table 1 and Table 2 respectively. More than half of the mothers (61.1%) had no formal education and more than a third (34.6%) were below 20 years at the birth of their child but observed healthy practices; with 71.1% of the mothers being of normal range BMI, 48.4% spacing their children at an interval of at least 2 years, 82.1% at least having 3 or more ANC visits, 89.8% breastfeeding their children exclusively for 6 months and 95.1% colostrum feeding their children. A majority of the children (97.6%) had been immunized as per the National Immunization Program schedule. Almost a third (32.9%) of the households had high food

Table 3 Prevalence of wasting, stunting and underweight and comparisons with NDHS 2011

Indicator	Level	This study prevalence (%)	NDHS 2011 prevalence (%)
Weight for height (Wasting)	Overall	14.6	14.6
	Wasted (<-2SD & ≥ -3SD)	8.5	11
	Severely wasted (< -3SD)	6.1	3
Height for age (Stunting)	Overall	61.8	57
	Stunted (<-2SD & ≥ -3SD)	25.2	41
	Severely stunted (< -3SD)	36.6	16
Weight for age (Underweight)	Overall	48.8	37
	Underwt. (<-2SD & ≥ -3SD)	30.5	29
	Severely underwt. (< -3SD)	18.3	8

Table 4 Multivariable analysis: weight for height, height for age and weight for age

Independent Variables	Coefficient (B)	Standard Error (SE)	*p*-value	Odds Ratio (OR)	95% Confidence Interval
Weight for height					
Child size at birth			0.002		
Large				1.00	
Average	0.054	0.609	0.930	1.055	0.320 - 3.480
Small	1.680	0.687	0.014	5.366	1.397 -20.619
Exclusively breastfed child			0.009		
Yes				1.00	
No	1.417	0.541	0.009	4.126	1.429 -11.913
History of diarrhoea in the past 2 weeks			0.020		
Yes				1.00	
No	-0.991	0.427	0.020	0.371	0.161 – 0.856
Height for age					
Maternal BMI			0.037		
Overweight				1.00	
Normal range	0.941	0.467	0.044	2.562	1.026 - 6.399
Low	1.473	0.579	0.011	4.360	1.401 -13.567
Birth interval			0.001		
<24 months				1.00	
24-47 months	-1.386	0.549	0.012	0.250	0.085 – 0.734
≥48 months	-2.531	0.665	<0.001	0.080	0.022 – 0.293
First born	-1.025	0.547	0.061	0.359	0.123 – 1.048
Child age group in months			0.010		
≤ 11				1.00	
12-35	0.771	0.552	0.162	2.163	0.733 – 6.379
36-59	-0.184	0.567	0.746	0.832	0.274 – 2.529
Number of growth monitoring visits			0.022		
0				1.00	
≤2	-0.668	0.376	0.076	0.513	0.245 – 1.072
>2	-1.674	0.709	0.018	0.188	0.047 – 0.753
Dietary diversity score			0.008		
0-2 Low				1.00	
3-4 Middle	0.568	0.474	0.231	1.765	0.697 – 4.470
5-7 High	-0.568	0.530	0.284	0.567	0.201 – 1.601
Weight for age					
Child age group in months			0.056		
≤ 11				1.00	
12-35	-0.553	0.657	0.400	0.575	0.159 – 2.086
36-59	-1.580	0.753	0.036	0.206	0.047 – 0.901
Child size at birth			0.000*		
Large				1.00	
Average	0.151	0.614	0.805	1.163	0.349 – 3.877
Small	1.963	0.686	0.004	7.124	1.856 -27.338

security scores and almost a fifth (21.5%) of the children had high dietary diversity scores. Among the children, 26.4% suffered from diarrhoea and 31.7% of the children experienced fever in the past 2 weeks as reported by their mothers.

Table 3 describes the overall prevalence of wasting, stunting and underweight for this study and compares it to the findings of the NDHS 2011 [8]. Severe wasting, severe stunting and severe underweight were higher in this study compared to the NDHS 2011 [8]. Table 4 describes the multivariable analysis results of adjusted associations between various independent variables and the 3 dependent variables. The Independent variables- Child Size at Birth (p=0.002), Exclusively Breastfed Child (p=0.009) and History of Diarrhoea (p=0.020) remained significantly associated with Weight for Height Being perceived as small at birth had an increased likelihood of wasting, Odds Ratio of 5.366. Not being exclusively breastfed resulted in an increased chance of being wasted, Odds Ratio of 4.126. Children who had not suffering from an acute episode of diarrhoea were less likely to be wasted, Odds Ratio of 0.371.

DISCUSSION

The nearest comparison to this study's results were the most recent Nepal NDHS conducted in 2011 [8]. The prevalence of severe wasting is higher in this study compared to the NDHS 2011, and this could be explained by the high levels of diarrhea and fever acutely experienced by the study area children directly prior to the study. The fact that Mugu district has the highest levels of under-nutrition nationally [8, 9] is reiterated by the findings of higher overall stunting compared to the NDHS findings, caused by chronic under-nutrition coupled with bouts of chronic and recurrent illnesses. Further evidence of both acute and chronic under-nutrition in Mugu district is also provided for by the higher overall underweight prevalence when compared to NDHS 2011 [8].

Perceived size at birth was significantly associated with wasting, a finding echoed both by NDHS 2011 [8] and in a review which found that smaller sized term and preterm babies had 2.4 times and 4.5 times greater likelihood of being wasted [11]. Babies who were of small size or very small size at birth also had a higher prevalence (66.6% and 80%) of being underweight. This prevalence was higher compared to the national average of 43% and 45% for the same categories respectively [8]. In Mugu, the odds of a small size at birth baby to be underweight was 7.124 times compared to a large size at birth baby.

The association between the lack of breastfeeding and wasting in this study was mirrored by that of two other studies in Nairobi, Kenya [12] and Bangladesh [13], which found higher prevalence of wasting among children who were not breastfed compared to those who were. The association of acute episodes of illness such as fever and diarrhoea and wasting seen in this study was also similar to that in other previous studies such as in a Malawian study of 6-18 month olds [14] and an Indian study of 2-5 year olds [15]. Episodes of acute illnesses also caused children to be underweight compared to those who did not have these episodes, as seen both in this study and in the study conducted in Malawi with greater durations of disease causing greater levels of underweight [14].

Maternal factors associated with stunting were low maternal age and low maternal BMI. An analysis of data from 55 countries concluded that mothers younger than 27 years old had an elevated risk of having stunted children [16] a finding which was echoed by this study with the association between low maternal age and stunting. Another study among Brazilian squatters found a twice as high prevalence of stunting among adolescent mothers compared to adult mothers [17] but this difference was not seen in this study. The association between low maternal BMI and stunting in this study was similar to that of the whole country whereby mothers with poor nutritional status (BMI < 18.5) were found to have children with the highest levels of stunting [8]. The prevalence of underweight children was also highest (69.8%) among mothers with low BMI (<18.5), a finding equivalent to the national DHS study of 2011 which also had the highest prevalence of underweight children (52.8%) among mothers with low BMI [8]. Another maternal factor seen in this study to be associated with stunting was a short birth interval (<24 months). This was also a finding in a study carried out in the Philippines among 18,544 children younger than 30 months old which found that a short birth interval (<24 months) for mothers were among the two largest risk factors for stunting in their children [18].

Difficulty in obtaining food, as determined by low food security scores, as well as low variety in the types of food being eaten, as described by a low dietary diversity score, have been associated with higher levels of stunting and underweight in studies of the populations of various countries, including Nepal [19, 20]. This was also a relationship that was found to hold true in this study. The Nepal Thematic Report on Food Security and Nutrition 2013 showed children with a score of less than 4 had a higher

prevalence of stunting (76.2%) and underweight (55.7%), stating that there were significant associations between dietary diversity score and both stunting and underweight among children [21]. Even in the earlier NDHS 2011 a relationship between food insecure households and underweight children had been clearly established with the highest prevalence of underweight children (50%) coming from severely food insecure households [8].

The beneficial effects of healthcare services on reducing under-nutrition and stunting were seen in as evidenced by the protective influences of growth monitoring visits and maternal ANC visits discovered in this study. Despite this good effect, it was still seen that the rates of growth monitoring visits were low, reflective perhaps of a lack of promotion of this program amongst mothers. These findings were also seen in a study that reported significant reduction in stunting rates in 16 projects involving growth monitoring and growth monitoring promotion over 3 decades [19]. Similarly, a study in 3 Andean countries found that maternal ANC visits were strongly associated with a reduction in the level of child stunting [22].

This study focused on a remote area of Nepal which has poor accessibility and by carrying out the study here, the true situation of the problems pertaining to undernutrition were realized. The thorough sampling strategy of this study allowed for a more complete representation of the sample as well the usage of valid, reliable and standard comparable measures allowed for comparisons to be made against national data and highlight the depth of the problems easily for policymakers. Despite these strengths, this was still a cross-sectional study which by its design was susceptible to recall bias. The lack of important data such as birth weight (as many mothers did not even have birth documentation) and maternal BMI during pre-pregnancy necessitated these measures be modified and thus their accuracy of estimation also partly reduced.

CONCLUSION

It can be determined that the prevalence of under-nutrition among children aged 0-59 months in Mugu district is high as reflected by the indices of wasting, stunting and underweight. Factors such as growth monitoring visits and high levels of fever and diarrhoea among children can be countered through adequately staffed health facilities and outreach programs with a special focus on health education and promotion. Further research into additional factors associated with under-nutrition such as household wealth, access to clean drinking water and toilets, proper hygienic practices, intestinal parasitic infestations and prevalence of micronutrient intake deficiencies will be crucial to formulate effective tailored interventions which can successfully reduce the levels of under-nutrition in Mugu in the future.

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