■ *Original Article*

Prevalence and associated risk factors with malnutrition among under-five Nepalese children of Borbote village, Ilam

SR Niraula[1], SP Barnwal[2], S Paudel[2], S Mishra[2], S Dahal[2], S Das[2], S Pradhan[2], S Ghimire[2], S Khanal[2], S Sharma[2], S Rajput[2], S Bhattarai[1], N Jha[1]
[1]School of Public Health and Community Medicine, BPKIHS, Dharan
[2]MBBS 4th year student, BPKIHS, Dharan, Nepal

Abstract

Background: Malnutrition is a major public health & nutrition problem in Nepal. It is associated with many risk factors like low birth weight, multiple birth, short spaced birth, extra diet, and iron supplementation in pregnancy etc. **Objectives:** This study aims at finding out the nutritional status of under-five Nepalese children of Borbote village, Ilam and risk factors associated with malnutrition. **Methods:** A cross sectional study was conducted in Borbote village, Ilam. A total of 186 under-five children was selected by purposive sampling. Non parametric test was applied to find out statistical significance. Logistic regression method was used to identify the factors influencing the malnutrion. **Results:** According to WHO, 20% children were malnourished – of which 14% were moderately undernourished and 6% were severely undernourished. Mothers exclusively breast feeding for 6 months had only 20.0% low weight for age children and those who didn't had 34.8% (P=0.041). Pregnant ladies who took iron supplements had 20.5% of low weight for age children compared to 37.1% (P =0.037) in those who didn't take supplements. Malnutrition was found more in those who were below poverty line 27.94% (P=0.023) compared to those above poverty line 12.00%. **Conclusion:** Significant number of under-five children of Bortbote village was malnourished. Maternal factors have significant association with nutritional status of the children which include extra diet in pregnancy and lactation, iron supplements in pregnancy, exclusive breast feeding for six months. Extra attention should be provided by the Ministry of Health towards maternal and child health.

Keywords: malnutrition, pregnancy, under-five children, exclusive breast feeding, Ilam

Introduction

Under nutrition is a condition in which there is inadequate consumption, poor absorption or excessive loss of nutrients. Over nutrition is caused by overindulgence or excessive intake of specific nutrients. The term malnutrition refers to both under nutrition and over nutrition. However, sometimes the terms malnutrition and protein energy malnutrition (PEM) are used interchangeably with undernutrition.[1]

Address for correspondence
Dr. Surya Raj Niraula, Ph.D.
Additional Professor, School of Public Health and Community Medicine
B P Koirala Institute of Health Sciences, Dharan, Sunsari, Nepal
Email: sniraula@yahoo.com

Childhood malnutrition is an underlying cause in an estimated 35% of all deaths among children under five and 11% of total global Disability Adjusted Life Years (DALYs) lost. According to the recently released National Family Health Survey, NFHS-3, carried out in 2005-06, 40% of India's children under the age of three are underweight, 45% are stunted and 23% are wasted.[1]

The study aims at evaluating nutritional status of under-five children of Borbote VDC Ilam so that actual picture of undernourished under-five children out there can be figured out. Out of many risk factors

of PEM, the major ones to be considered are: low birth weight, lack of or incomplete iron supplementation in pregnancy, inadequate diet intake by mother during pregnancy, illiteracy, poverty, multiple births, closely spaced birth, early stoppage of breast feeding, too early or late weaning, recurrent infections like diarrhea, pneumonia, T.B, measles and so on. Malnutrition in young children affects linear and brain growth and intelligence quotient, and is synergistically associated with child morbidity and mortality.[2]

Foetal growth depends on the uptake of nutrients, which occurs at the end of a complex materno-foetal supply line. This includes intake, i.e., the mother's appetite, diet and absorption. The nutrients arriving at the placenta, and how they are transferred to the fetus, depend on maternal metabolism: her endocrine status, her partitioning of nutrients between storage, utilization or circulation, and her cardiovascular adaptations to pregnancy, such as plasma volume expansion which increases uterine blood flow. These are influenced by maternal nutrition in ways that are poorly understood. The link between maternal and foetal nutrition is thus indirect and explains why the full impact of maternal diet on foetal growth remains unclear.[3] Hence, the prime concern of the study is to trace the relation between the maternal nutritional condition with that of the nutritional status of the children.

Anthropometric indicators that are commonly used to measure malnutrition in a population are stunting, wasting, and underweight. Stunting (extremely low height-for-age) represents cumulative growth and is an indicator of past or chronic malnutrition or illness (WHO Technical Report). Wasting (extremely low weight- for-height) is an indicator of current nutritional status. Underweight (extremely low weight-for-age) reflects both low height-for-age and low weight-for-age and therefore reflects both cumulative and acute exposures.[4]

There is usually a 2 to 3-fold increase in perinatal mortality rate when maternal hemoglobin levels fall below 8.0 g/d1 and 8-10 fold increase when maternal hemoglobin levels fall below 5.0 g/dl. A significant fall in birth weight due to increase in prematurity rate and intrauterine growth retardation has been reported when maternal hemoglobin levels were below 8.0 g/d1.[5] The demand for iron increases about six to seven times from early pregnancy to the late pregnancy.[6]

Among various risk factors associated with malnutrition, implication of maternal health habits to the health of the child has a role to play. Iron supplementation in pregnancy, exclusive breast feeding for six months and extra diet taken in pregnancy and lactation can make significant difference in the nutritional status of the children. The link between malnutrition and infant-feeding practices has been well-established. Incidence of malnutrition rises sharply during 6-8 months of age in most countries, which coincide with period of complementary feeding, and deficits acquired at this age are difficult to compensate later in childhood.[7] Increasing the prevalence of breastfeeding is recognized as a key means of improving the health outcomes of infants. Several studies had suggested that a greater intensity breastfeeding may be accompanied by more positive health outcomes. Notably, Raisler demonstrated a dose/ response relationship between exclusive and predominant breastfeeding, as opposed to little or no breastfeeding, and reduced gastrointestinal and respiratory illnesses, including otitis media, and illness-related office visits in general.[8]

Diet taken by the mother during the period of pregnancy can contribute to the health of the child. Low birth weight (LBW), ie, BW < 2500 g, is a global public health concern. The problem is most prominent in South Asia, where one-half of the world's LBW babies are born. LBW is a reflection of intrauterine growth restriction and of a high frequency of preterm delivery. LBW results in a high occurrence of child morbidity, impaired development, and mortality.[9] Undernutrition among preschool children may be the result of faulty feeding practices rather than the scarcity of the food. It was also assessed that the low status of woman and their lack of nutritional knowledge are important determinants of high prevalence of underweight children.[10]

Nepalese children show evidences of under nutrition as indicated by their stunting, wasting or wasting and stunting combined along with the features of various

micronutrient deficiency disorders.[11] This study was designed to find out the nutritional status of under five children of Borbote village, Ilam and identify the risk factors associated with malnutrition.

Methods

Studydesign: This is a cross sectional, descriptive study. It was done among 186 under-five children of ward number 3, 4 and 7 of Barbote village, Ilam. Children were selected using purposive sampling. Semi structured questionnaire was used. Face to face interviews was conducted with mother and anthropometric evaluation of the children was done by using weighing machine and measuring tape. Anthropometry data so obtained was compared with that of CDC chart and interpretation was made.

Statistics: Chi square test was applied to find out statistical significance between two or more categorical data. Odds ratio (OR) and its confidence interval (CI) were also calculated to examine strength of association between the variables and its' limit. Probability of significance was set at 5% level of significance. The logistic regression analysis was performed only among those predictors whose probability was less than 20% in univariate analysis.

Instrument: The questionnaire consisted of social demographic variables, mother associated risk factors like extra diet in pregnancy, iron supplementation in pregnancy, exclusive breast feeding for six months; environmental and social risk factors like use of latrine, use of soap before and after defecation, use of boiled water, intake of iodised salt, knowledge of oral rehydration solution, intake of vitamin A and deworming medication.

The exclusion criteria were child more than 60 months of age, the parents who didn't give consent and the children whose mother was not available for interview.

Ethics: Ethical consent was taken from institutional review board BPKIHS, from sub-metropolitan office, Ilam and verbal consent was also taken with the mothers prior to interview. The demarcating scale of poverty line was 1.25$ and daily income amounting higher to this was considered to be above poverty line and lower to it was considered to be below the poverty line.

There are different classifications for grading malnutrition among which Indian Academy of Pediatrics (IAP) and WHO classification are widely accepted. According to IAP the grading of malnutrition can be dealt as follows: [12]

Grade of malnutrition	Weight for age of the standard (median)%
Normal	>80
Grade1	71-80 (mild malnutrition)
Grade2	61-70 (moderate malnutrition)
Grade3	51-60 (severe malnutrition)
Grade4	<50 (very severe malnutrition)

According to WHO, malnutrition in under-five children is classified as:[12]

	Moderate malnutrition	Severe malnutrition (type)
Symmetrical edema	No	Yes (edematous malnutrition)
Weight for height	SD score between -2 to -3	SD score <-3 (severe wasting)
Height for age	SD score between -2 to -3	SD score <-3 (severe stunting)

Results

The result of present study shows that 54.84% were male children and 45.16 were female children. Age wise 9.67%, 16.1%, 17.74% and 56.45% were 0-11 months, 12-23 months, 24-35 months and 36-59 months respectively. Around 26.88% of the respondents was above poverty line (per capita income e"1.25$). Considering the maternal education, 26.9% were illiterate. Remaining 31.2%, 37.1% and 4.8% of mothers had received primary, secondary and higher secondary level of education respectively.

The study reveals that according to IAP classification 23.7% were malnourished. Based on WHO classification, 20% were malnourished of which 14% were moderately undernourished and 6% were severely undernourished in which 10.75 % were wasted and 10.21% were stunted (Table 1). The univariate analysis shows that mothers exclusively

breast feeding for 6 months had only 20.0% low weight for age children which peaked to 34.8% for who didn't (OR=0.47, CI=0.22-0.98, P=0.041) (Table 2). In the study, pregnant ladies who took iron supplements had 20.5% of low weight for age children compared to 37.1% in those who didn't take supplements (OR=0.44, CI=0.19-0.96, P=0.037). In our study, the women who took extra diet in pregnancy and lactation 21.9% had low weight for age children and in those who didn't had 30.0%. Malnutrition was found to be more in those who were below poverty line which accounted to 27.94% than those above poverty line 12.00%. (OR=2.84, CI=1.05-8.10, P=0.023). Malnutrition was found to be more in females (27.7%) compared to males (20.4%). The parents who had birth spacing of 5 years or more had 17.4% of low weight for age which increased to 26.1% who had birth spacing of less than 5 years.

Table 1: Nutritional Status (%)of under-five children of Borbote village, Ilam according to IAP classification. (n=186)

Classification	Percentage
IAP Classification	
Malnutrion	23.7%
Normal	76.3%
WHO Classification	
Normal	80%1
Moderately Undernourished	4%
Severely Undernourished	6%

Table 2: Prevalence and risk factors associated with malnutrition of under-five children of Borbote village (3, 4 & 7). (n=186)

Possible Risk factors	Categories	Low weight for age, % (n=44)	Normal, % (n=142)	Total, % (n=186)	OR (CI)	χ^2 value	P value
Iron supplementation in pregancy	*Taken (n=151)*	20.5	79.5	81.2	0.44 (0.19-0.96)	4.34	0.037
	Not taken (n=35)	37.1	62.9	18.8			
Exclusive breast feeding for six months	*Done (n=140)*	20.0	80.0	75.3	0.47 (0.22-0.98)	4.19	0.041
	Not done (n=46)	34.8	65.2	24.7			
Extra diet in pregnancy	*Taken (n=146)*	21.9	78.1	78.5	0.65 (0.30-1.43)	1.13	***
	Not taken (n=40)	30.0	70.0	21.5			
Poverty line	*<1.25$ (n=136)*	27.94	72.06	73.12	2.84 (1.05-8.10)	5.14	0.023
	>=1.25$ (n=50)	12.00	88.00	26.88			
Age at first pregnancy	*<=21 years(n=105)*	20.95	79.05	56.45	0.71 (0.34-1.48)	0.98	***
	>21 years (n=81)	27.16	72.84	43.55			
Sex	*Male (n=103)*	20.4	79.6	55.4	0.67 (0.34-1.32)	1.36	***
	Female (n=83)	27.7	72.3	44.6			
Birth spacing*	*< 5 years (n=92)*	26.1	73.9	80.0	1.68 (0.52-5.43)	0.75	***
	>= 5 years (n=23)	17.4	8.26	20.0			
Literacy	*Illiterate** (n=50)*	28.0	72.0	26.9	1	-	-
	Primary level (n=58)	17.2	82.8	31.2	1.87 (0.74-4.68)	1.79	***
	Secondary level (n=69)	23.2	76.8	37.1	1.29 (0.56-2.96)	0.36	***
	Higher secondary (n=9)	44.4	55.6	4.8	0.49 (0.11-2.08)	0.97	***

** Data of not applicable (the family having only one child) have been removed.*
***Reference category ***Not significant value.*

The logistic regression with enter strategy was carried out among the malnutrition and the associated potential risk factors to assess the association between them. The final model developed after the assessments of confounding and interaction showed exclusive breast feeding practice (OR=2.32, 95% CI=1.08–4.96, P=0.031) and poverty (OR=0.35, 95% CI=0.13–0.91, P=0.031) remained the significant correlates of malnutrition (Table 3).

Table 3: Logistic regression on risk factors associated with malnutrition, having significant relation, of under-five children of Borbote village (3, 4 & 7). (n=186)

Variables	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.	
							Lower	Upper
Iron supplementation in pregancy	.754	.416	3.284	1	.070	2.125	.940	4.800
Exclusive breasfeeding	.840	.389	4.664	1	.031	2.316	1.081	4.962
Above poverty line (≥1.25$)	-1.052	.487	4.672	1	.031	.349	.135	.907
Constant	-1.350	.253	28.553	1	.000	.259		
-2loglikelihood=190.09, Chi square=1.17, P=0.759								

Discussions

The study reveals that according to IAP classification 23.7% were malnourished. Based on WHO classification, 20% were malnourished of which 14% were moderately undernourished and 6% were severely undernourished (Table 1) in which 10.75 % were wasted and 10.21% were stunted. This value is comparatively little lower compared to the national data. The reasons behind this could be practice of good sanitation and health habits of mother in the village. More than 96% participants boiled water before drinking, 95.69% used latrine and 95.69% residents used soap for washing hand after defecation. A study has shown variation in under-nutrition according to different geographical regions. Mountain region children are found significantly higher for all forms of stunting whereas hill region children have significantly more likelihood in moderate and mild stunting as compared to terai.[11] The place where the present study was conducted, lies in the hill region that could be another reason. One in every three malnourished children in the world lives in India.[13] The nutritional level of under-five children has a wide variation.

The univariate analysis (Table 2) shows that mothers exclusively breast feeding for 6 months had only 20.0% low weight for age children which peaked to 34.8% for who didn't (OR= 0.47and CI=0.22-0.98, P=0.041). It has a significant role in malnutrition as shown in Table 3. Those who were exclusively breastfed had less risk for malnutrition compared to those who had not done (OR= 2.32, CI=1.08-4.96, P=0.031). Successful breastfeeding has been associated with improved health outcomes for both infants and their mothers.[8] Our study also pointed to the same direction. The nutrition of the child is solely derived from mother. This way mother's milk is of utmost important source of nutrition to the child. Complementary feeding is recommended to start only after six months.

In our study, the women who took extra diet in pregnancy and lactation 21.9% had low weight for age children and in those who didn't had 30.0% (OR=0.65, CI=0.30-1.43). However there is no association in between the variables. What mother eats is implicated to her offspring. There are many good reasons for improving the diets of undernourished mothers. The Gambia supplement produced an impressive reduction in perinatal

mortality, and in Guatemala, early-life exposure to Atole improved childhood growth and adult economic productivity.[3] The prime concern for the intrauterine development and gain of weight after the intake of required diet is important. There is also a wealth of data showing that poor intrauterine and infant growth and nutrition are associated with reduced capacity in adult life, including reduced stature, lower physical work capacity, impaired cognitive function and educational attainment, and (for women) an increased risk of low birth weight in the next generation[3]

In the study, pregnant ladies who took iron supplements had 20.5% of low weight for age children compared to 37.1% in those who didn't take supplements (OR=0.44, CI=0.19-0.96, P=0.037). Premature births are more common in women with moderate anaemia. They deliver infants with lower birth weight and perinatal mortality is higher in these babies.[11] Lower birth weight is directly related to malnutrition of the children as they have difficulty in coping up with the growth pattern as compared to term and children of normal weight. This way iron supplementation during pregnancy plays a vital role. The National Demography and Health Survey (NDHS, 2006) measured anemia level among women 15-49 years. The findings indicate that there has been an improvement in the anemia level among women since 1998, when two-thirds of all women were anemic. Also, about one in three women in Nepal are anemic, a decline by 47 percent (from 68 percent to 36 percent).[14] In children, iron deficiency causes developmental delays and behavioral disturbances, and in pregnant women, it increases the risk for a preterm delivery and delivering a low-birth weight baby.[15]

Malnutrition was found to be more in those who were below poverty line which accounted to 27.94% than those above poverty line 12.00%. (OR=2.84, CI=1.05-8.10, P=0.023). Below poverty line is found to be an associated risk factor as suggested by our model (Table 3). The relationship between poverty, undernutrition and underdevelopment has been acknowledged and understood for many years.[16] If the source of income is less in the family, then it is obvious that the family cannot afford good nutrition for the family members which finally imposes the family members to be affected. This has been revealed by our study as well. Inadequacy of both macronutrient and micronutrient intake was commonly detected in developing countries in contrast to the study from USA.[17] Diarrheal diseases, less vaccination coverage , malnutrition , chronic intrauterine under-nourishment low birth weight, premature birth, high infant mortality rate, serious behavioural problems and post-traumatic stress disorders are also more likely to occur in slum areas.[18]

In this study, malnutrition was found to be more in females (27.7%) compared to males (20.4%). Male and female fetuses have different growth priorities, and adapt differently to undernutrition, reflected in sex differences in associations with neonatal body proportions.[3] This can be well correlated with the findings in our study. This is important for the developing countries like Nepal as gender inequality still persists in various corners of the country. This could be one of the factors playing major role in the nutritional status of the children. Eliminating gender inequality could reduce the underweight rate among children less than three years old by 13 percentage points in South Asia, equal to 13.4 million fewer malnourished children.[10]

The parents who had birth spacing of 5 years or more had 17.4% of low weight for age which increased to 26.1% who had birth spacing of less than 5 years. Contraceptive use in rural areas nearly doubled from 24 percent in 1996 to 43 percent in 2006, while use in urban areas increased by 20% from 45% to 54% over the same period. Similarly, contraceptive use among women with no education increased nearly two-fold while there was little change in use among women with SLC and higher level of education.[19] Use of contraceptive to avoid pregnancy imparts major role in the birth spacing and the latter is related to the nutritional status of the family members. More the family members, the lesser the chance for better nutrition as evident by the current research. Short inter-pregnancy intervals have been identified as a risk factor for poor pregnancy outcomes, particularly infant mortality, in low- and middle-income countrie.[20] Women in Nepal marry at a much earlier age than women in most other South and Southeast Asian countries. The median age at first marriage among women age 25-

49 years was lowest in Bangladesh (14.5 years) followed by Indian (16.8 years) and Nepal (17.0 years).[21]

Nearly 83% of children got vitamin A and de-worming medication. Vitamin A deficiency is one of the causes of blindness in our part of world. It may not be directly associated with undernutrition but it can be considered as one of the factors that contributes to the health of the under-five children. Even in many other studies its' role has been indirectly defined. Although the vitamin A capsule distribution activities were not associated with reduced community risk for wasting, they were associated with a reduced risk for those children who participated in the programme.[22]

Conclusion

Significant number of under-five children of Bortbote village was malnourished. Considering various risk factors, maternal factors have significant association with nutritional status of the children which includes iron supplements in pregnancy, exclusive breast feeding for six months. Economic condition of the family has also been proved to have significant association with the nutritional status of children. Beside these, sex of the child, birth spacing, and maternal education had some role to play. The nutritional status of the children can be improved if proper attention is given to the health of mother. Extra attention should be provided by the Ministry of Health towards maternal and child health.

Acknowledgements

Had there been no initiation and support from School of Public Health and Community Medicine, B.P. Koirala Institute of Health Sciences, Dharan, the research would not have been that successful. We would like to express our gratitude to Dr Prakash Poudel (Department of Pediatrics, BPKIHS) for his kind support and guidance. We are thankful to all family members of Borbote village, Ilam who helped us giving their valued information.

References

1. Ghai, Paul, Bagga. Ghai Essential Pediatrics; seventh edition: 62.
2. Reyes H, Pérez-Cuevas R, Sandoval A, et al. The family as a determinant of stunting in children living in conditions of extreme poverty: a case-control study. BMC Public Health 2004; 4: 57. [doi:10.1186/1471-2458-4-57].
3. Fall C. Maternal nutrition: Effects on health in the next generation – Review Article. Indian J Med Res 2009;130 : 593-9.
4. Janevic T, Petrovic O, Bjelic I, Kubera A. Risk factors for childhood malnutrition in Roma settlements in Serbia. BMC Public Health 2010; 10: 509 [http://www.biomedcentral.com/1471-2458/10/509].
5. Kalaivani K. Prevalence & consequences of anaemia in pregnancy. Indian J Med Res 2009; 130: 627-33.
6. Karaoglu L, Pehlivan E, Egri M, et al. The prevalence of nutritional anemia in pregnancy in an east Anatolian province, Turkey. BMC Public Health 2010; 10: 329 .
7. Garg A, Chadha R. Index for Measuring the Quality of Complementary Feeding Practices in Rural India. J Health Popul Nutr 2009; 27(6): 763-71.
8. Pager SR, Davis J, Harrigan R. Prevalence of Breastfeeding Among A Multiethnic Population in Hawaii. NIH Public Access Author Manuscript Ethn Dis. ; 2009.
9. Shaheen R, Francisco AD, Arifeen SE, et al. Effect of prenatal food supplementation on birth weight: an observational study from Bangladesh. [http://hinari- gw.who.int/ whalecomwww.ajcn.org/whalecom0/content/ 83/6/1355.long].
10. Antony GM & Laxmaiah A. Human development, poverty, health & nutrition situation in India. Indian J Med Res 2008; 128: 198-205.
11. Pradhan Amita. Factors associated with nutritional status of the under five children. Asian Journal of Medical Sciences 2010; 1: 6-8.
12. Ghai, Paul, Bagga. Ghai Essential Pediatrics; seventh edition: 63-4.
13. Espie E, Pujol CR, Masferrer M, et al. Acute Malnutrition and Under-5 Mortality, Northeastern Part of India. Journal of Tropical Pediatrics: 2010.
14. Nepal Trend Report. Trends in Demographic and Reproductive Health Indicators in Nepal. Further analysis of the 1996, 2001 and 2006 Demograhic and Health Surveys Data, 2008; Part 9.3.1: 58 p.

15. Retrieved from http://hinari-gw.who.int/whalecomwww.cdc.gov/whalecom0/mmwr/preview/mmwrhtml/00051880.htm on 16th January, 2011.
16. Vorster HH, Kruger A. Poverty, malnutrition, underdevelopment and cardiovascular disease: a South African perspective: Review article. CardiovascularJournal of Africa 2007: 18 (5).
17. Sukchan P, Liabsuetrakul T, Chongsuvivatwong V, et al. Inadequacy of nutrients intake among pregnant women in the Deep South of Thailand. BMC Public Health 2010, 10: 572.
18. Khan MH, Kraemer A. Socio-economic factors explain differences in public health-related variables among women in Bangladesh: A cross-sectional study. BMC Public Health 2008; 8: 254. [doi:10.1186/1471-2458-8-254].
19. Nepal Trend Report. Trends in Demographic and Reproductive Health Indicators in Nepal. Further analysis of the 1996, 2001 and 2006 Demograhic and Health Surveys Data, 2008; Part 6.2 : 30 p.
20. Yakoob1 MY, Menezes1 EV, Soomro1 T, et al. Review of interventions Reducing stillbirths: behavioural and nutritional interventions before and during pregnancy BMC Pregnancy and Childbirth 2009, 9(Suppl 1): S3 [doi:10.1186/1471-2393-9-S1-S3].
21. Nepal Trend Report. Trends in Demographic and Reproductive Health Indicators in Nepal. Further analysis of the 1996, 2001 and 2006 Demograhic and Health Surveys Data, 2008; Part 5.2: 27p.
22. Pant CR, Pokharel GP, Curtale F, et al. Impact of nutrition education and mega-dose vitamin A supplementation on the health of children in Nepal. Bull World Health Organ 1996; 74(5): 533-45.