Risk Factors of Acute Malnutrition Among Under Five Years Children in Northern Bangladesh

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Abstract

Background: The developmental, medical, economic and social impacts of acute malnutrition in children are serious and long lasting for individuals, families, communities and countries. Malnutrition in childhood damages a child's both physical and cognitive development and this damage is largely irreversible. These ultimately perpetuate illness, poverty and inequality. Childhood acute malnutrition is multifactorial in origin and majority of them are preventable. **Objective:** The purpose of this study was to identify the factors associated with acute malnutrition among under five years children in northern Bangladesh. **Methods:** This matched case-control study was carried out in Chapainawabganj general hospitals, Chapainawabganj. Total 180 children aged 6-59 months (90 cases-WHZ < -2 and 90 control-WHZ ≥ -2) were included for this study. Informed written consent was taken from the guardians of all children. Data were recorded by using a semi-structured questionnaire. Height and weight of children and their parents were measured by measuring tape and weight machine. BMI of children and parents, and weight-for-height Z scores of children were calculated. Data were analyzed by the SPSS 24. Chi-squared ($\chi 2$) test and Fisher's exact test were performed to compare frequencies between the groups of each variable. Unpaired t-test was performed to compare the means between the groups. Multivariable logistic regression analysis was used to identify independent risk factors of acute malnutrition. **Results:** The mean age of the acute malnourished children was 25.84±15.09 months with slight male predominance (male female ratio 1.14:1). The mean weight for height Z score of the cases was -2.93±0.41. Monthly family income <10000 BDT, younger mother (age ≤25 years), younger father (age ≤20 years), less educated mother (Illiterate or up to primary), less educated father (Illiterate or up to primary), undernourished mother (BMI <18.50 kg/m2) and predominant breast feeding stop before 4 months had found to be significantly associated with acute malnourishment ($p<0.05$). **Conclusion:** Acute malnutrition is a multifactorial pathological condition. The measures against the associated factors of malnutrition specially risk factors should be taken when we will design a preventive programs for the eradication of acute malnutrition of under 5 children.

Key words: Acute malnutrition, Risk factors, Children under 5 years, Northern Bangladesh.

Introduction

Nutritional status has been defined as an individual's health condition which is influenced by the intake and utilization of nutrients.[1] It is the current body status of a person related to their state of nourishment. Normal health status is determined by complex interaction between different constitutional (age, sex, physical activity, diseases etc.) and external environmental factors (food safety, economic circumstances, cultural circumstances etc.)

Malnutrition is a pathological state resulting from inadequate nutrition, including undernutrition (due to insufficient intake of energy and other nutrients), overnutrition (overweight, obesity - due to excessive consumption of energy) and specific deficiency diseases due to insufficient intake of one or more specific nutrients such as vitamins or minerals.[2] Undernutrition is again classified into acute malnutrition (wasting-low weight for height), chronic malnutrition(stunting-low height for age) and underweight for age.[3]

Directly or indirectly malnutrition contributes to around 45% of child (under five years) deaths each year and majority of these death mostly occur in low and middle income countries.[4] According to UNICEF-WHO-The World Bank Joint Child Malnutrition Estimates, prevalence of underweight have decreased since 1990 while overweight and obesity have increased.[5] Although undernutrition is decreasing gradually but it remains as a major public health concerns especially for developing world. The prevalence of acute malnutrition is still above 15% in South Asia. The estimated prevalence of under five acute malnutrition in South Asia is 15.20%.6 In 2013, globally approximately 33 million children under five years of age are suffered from moderate acute malnutrition (MAM) and 19 million children under five years of age suffered from severe acute malnutrition (SAM).[7] Globally in 2020, approximately 149 million children under 5 years of age were stunted and approximately 45 million were wasted while 38.9 million children under 5 years of age were overweight or obese which are rising alarmingly in recent years.[4]

A long standing prospective cohort studies conducted in India, Brazil, Guetamala, South Africa and Philippines showed that undernutrition in childhood was strongly associated with shorter adult height, reduced economic productivity and less schooling. Undernutrition was also found to be an important risk factor for high glucose concentration, blood pressure, harmful lipid profiles in adult life.[8] Acute malnutrition is associated with several physiological vulnerabilities, including essential nutrient deficits, immune dysfunction, enteric barrier disruption and gut microbiome dysbiosis.[9–11] Children with acute malnutrition are approximately three times more likely to die from diarrhea than children with better nutritional status, and around 200000 diarrheal deaths are attributed to acute malnutrition annually.[12] Tickell *et al. (2020)*[13] found the age, co-infection, and site adjusted odds ratios for moderate-to-severe diarrhea associated with typical enteropathogenic Escherichia coli among children with acute malnutrition aged 6–11 months was 2·08 (95% CI 1·14–3·79) compared with healthy controls.

Malnutrition in early life has serious effects for child survival, well-being, economic productivity, and overall personal and national development.

Malnutrition impairs a child's physical and cognitive development. These damages are mostly irreversible, and perpetuates illness, poverty, and injustice. Childhood acute malnutrition is multifactorial in origin and may varies from region to region. Thus, a current categorization of risk factors based on geographical distribution is very much important for combating the issue. In this study, the researchers intended to identify the risk factors of acute malnutrition among under five years children in northern Bangladesh.

Methods

This hospital based matched case-control study was conducted in Chapai Nawabganj General Hospital, Chapai Nawabganj. Children aged 6-59 months attending at the selected hospital constituted the study population. A total of 90 hospital attended children of this age group having acute malnutrition (Weight for height Z-score < -2) were enrolled as cases and equal number of healthy children (Weight for Height Z-score ≥ -2) of the same age group were selected as controls by individual matching of age and sex. Children with physical deformities (which will interfere with or give an incorrect measurement), children who were critically ill, children with congenital anomalies, known chronic diseases like tuberculosis, and chronic heart diseases, and those children whose parents were not present, were excluded from the study. Consecutive sampling was used to select cases and controls. After taking informed written consent data collection was done using semi-structured questionnaire by face to face interview and by clinical examination ensuring privacy and confidentiality. Height of the respondents were measured by measuring tape and Stadiometer, and weight of the respondents were measured by weight machine. Z-scores were calculated using WHO anthropometric calculator (Version 3.2.2).[14] Data were analyzed using the statistical package for social science version 24. Chi-squared Test (χ^2) and Fisher's exact test were performed to compare frequencies among the groups of each variable and Unpaired t-test was performed to compare the means between the groups to find out the factors associated with malnutrition. Multivariable logistic regression analysis was used to control for all possible confounders and to identify independent predictors of Acute malnutrition. A Multivariable logistic regression model was used to identify the determinants of acute malnutrition.

Results

The mean age of the acute malnutrition cases and controls were 25.84±15.09 months and 27.69±14.30 months respectively. Age distribution of cases and controls in different age groups were close to each other, no statistically difference was observed among them and their (cases and controls) mean ages. Among the acute malnutrition cases, 53.30% were male and 46.70% were female. Among the acute malnutrition cases 40.0% were urban resident and 60.0% were rural residents, on the other hand among the controls 46.7% were urban resident and 53.3% were rural residents. Gender and residential differentiation between cases and controls were not statistically significant. Birth order of children was not statistical significantly associated with acute malnutrition. Proportions of acute malnourished cases were higher than controls in monthly family income groups ≤ BDT10000.00, on the other hand proportions of controls were higher than cases in monthly family income groups > BDT10000.00.

Statistically significant association was noticed between nutrition status and monthly family income of the participants (P<0.001). The mean weight, height, and MUAC of the acute malnourished cases were 8.40±2.05 kg, 80.89±11.07 cm, and 12.08±0.69 cm. respectively. The mean weight, height, and MUAC of the cases were statistically significantly lower than control group (P=<0.001, 0.007, and <0.001 respectively). The mean weight for height Z score of acute malnourished cases was -2.93±0.41, which was statistical significantly lower than the mean weight for height Z score of the controls (- 0.58±0.72) (Table I).

The mean age, weight, height and BMI of the mothers of the acute malnutrition cases were 22.80±3.20 year, 47.80±5.71 Kg, 1.51±0.038 m and 20.92±2.51 Kg/m2 respectively, and of the controls were 24.98±3.29 year, 51.62±6.12 kg, 1.52±0.054 m and 22.48±2.91 Kg/m2 respectively. The mean age, weight and BMI of the mothers of acute malnourished cases were significantly lower than the mean age, weight and BMI of the mothers of the controls (P<0.001). Mothers' height was not significantly associated with acute malnutrition of the children. Mothers of acute malnourished cases were significantly less educated than mothers of controls (P=0.044). The mean duration of predominant breast feeding in cases was 3.98±1.54 months and it was 4.63±1.47 months in controls. The mean duration of predominant breast feeding was significantly lower in cases than controls (P=0.004) (Table II).

The mean age of the fathers of children was 27.82±4.16 years for cases while it was 29.53±4.50 years for controls. The mean age of the fathers of the acute malnourished children was significantly lower than mean age of fathers of controls (P=0.003). Father of acute malnourished cases were significantly less educated than father of controls (P=0.004) (Table III).

Multivariate logistic regression analysis showed that the children of parents whose monthly family income <10000 BDT were almost 2.7 times more likely to develop acute malnutrition (odds ratio [OR] 2.710, 95% confidence interval [CI] 1.156–6.352); children of mothers, who attended formal education maximum up to primary were more than two times more likely to develop acute malnutrition (OR 2.256, 95% CI 1.003–5.075), and stopped predominant breast feeding before 4 months were nearly three times more likely to suffer from acute malnutrition (OR 2.858, 95% CI 1.192–6.851) (Table IV).

Table I: Baseline characteristics of the study participants (n=180).

Baseline Characteristics		Case (N=90)	Control (N=90)	P value
Age groups (Yeas)	06 -11	19 (21.10)	16 (20)	0.491#
	12-23	31 (34.40)	26 (28.89)	
	24-59	40 (44.40)	48 (51.11)	
Mean age	Mean±SD	25.84±15.09	27.69±14.30	0.401*
Sex	Male	48 (53.30)	46 (51.10)	0.881#
	Female	42 (46.70)	44 (48.90)	
Area of residence	Urban	36 (40.0)	42 (46.70)	0.452#
	Rural	54 (60.0)	48 (53.30)	
Monthly family income (BDT)	<7500	22 (24.40)	10 (11.10)	<0.001#
	7500-10000	50 (55.60)	38 (42.20)	
	10001-15000	16 (17.80)	30 (33.30)	
	>15000	2 (2.20)	12 (13.30)	
Anthropometric measurement	Weight (Kg)	8.40±2.05	11.23±2.67	<0.001*
	Height (cm)	80.89±11.07	85.37±11.11	0.007*
	MUAC (cm)	12.08±0.69	14.50±0.99	<0.001*
Weight for height Z score		-2.93±0.41	- 0.58±0.72	<0.001*
Birth order of children (Mean±SD)		1.80±0.89	1.77±0.68	0.851*

*Unpaired t-test was performed #Chi-squared Test (X2) was performed

Table II: Association between different Maternal factors with acute malnutrion (n=180).

Maternal factors		Case (N=90)	Control (N=90)	P value
Mean age (Year)	Mean±SD	22.80±3.20	24.98±3.29	<0.001*
Weight (Kg)	Mean±SD	47.80±5.71	51.62±6.12	<0.001*
Height (m)	Mean±SD	1.51±0.04	1.52±0.05	0.400*
BMI (Kg/m^2)	Mean±SD	20.92±2.51	22.48±2.91	<0.001*
Educational qualification N(%)	Illiterate	34 (37.80)	16 (17.80)	0.044#
	Primary	13 (14.40)	16 (17.80)	
	SSC	26 (28.90)	36 (40)	
	HSC	13 (14.40)	14 (15.60)	
	Graduation and above	4 (4.40)	8 (8.90)	
Occupation N(%)	Housewife	81 (90.0)	82 (91.10)	0.390##
	Businessman	0 (0.0)	2 (2.20)	
	Private Employee	5 (5.60)	4 (4.40)	
	Day laborer	2 (2.20)	0 (0.0)	
	Government employee	0 (0.0)	2 (2.20)	
Predominant breast feeding (months)	(Mean±SD)	3.98±1.54	4.63±1.47	0.004*

* = Unpaired t-test was applied
# = Chi-squared Test (⊠2) was applied
= Fisher's exact test was applied

Table III: Association between different paternal factors with acute malnutrion (n=180).

Baseline Characteristics		Case (N=90)	Control (N=90)	P value
Mean age (Year)	Mean±SD	27.82±4.16	29.53±4.50	0.003*
Height (m)	Mean±SD	1.608±0.05	1.611±0.06	0.793*
Weight (Kg)	Mean±SD	57.36±8.19	59.76±8.77	0.058*
BMI (Kg/m^2)	Mean±SD	22.18±3.19	23.01±3.03	0.076*
Educational qualification N(%)	Illiterate	38 (42.20)	18 (20.0)	0.004#
	Primary	16 (17.80)	12 (13.30)	
	SSC	18 (20.0)	24 (26.70)	
	HSC	16 (17.80)	28 (31.10)	
	Graduation and above	2 (2.20)	8 (8.90)	
Occupation N(%)	Farmer	28 (31.10)	29 (32.20)	0.510##
	Businessman	26 (28.90)	22 (24.40)	
	Private employee	18 (20.0)	18 (20.0)	
	Day laborer	12 (13.30)	10 (11.10)	
	Government employee	2 (2.20)	8 (8.90)	
	Unemployed	4 (4.40)	3 (3.30)	

* = Unpaired t-test was applied
# = Chi-squared Test ($\chi 2$) was applied
= Fisher's exact test was applied

Table IV. Multivariate logistic regression analysis of risk factors for acute malnutrition (n=180).

Variables	Odds ratio	95% CI	p-value
Monthly family income (<10000 BDT)	2.710	1.156 - 6.352	.022
Mothers age (≤20 Years)	1.475	0.440 – 4.948	.529
Father age (≤25 Years)	2.264	0.986 – 5.196	.054
Mothers education (Illiterate or below primary)	2.256	1.003 – 5.075	.049
Working mother	3.311	0.916 – 11.967	.068
Fathers education (Illiterate or below primary)	1.545	0.710 – 3.361	.273
Unemployed father	1.876	0.320 – 10.999	.486
Undernourished mother (BMI <18.50 kg/m^2)	2.078	0.753 – 5.731	.158
Undernourished father (BMI <18.50 kg/m^2)	1.699	0.609 – 4.739	.311
Predominant breast feeding stop before 4 months	2.858	1.192 – 6.851	.019

Discussion

The basic characteristics analysis of cases and controls suggested that the case and control groups were nearly homogenous because the two groups were similar on age, sex, residence and birth order but dissimilar on monthly family income, anthropometric parameters and Weight for height Z score. Significantly higher number of cases were in <7500 BDT and 7500-10000 BDT monthly family income group than controls (P<0.001). Multivariate logistic regression analysis also identified low monthly family income as a risk factor of acute malnutrition. Similarly, studies[15,16] in ICDDRB, Dhaka and Tamil Nadu, India also found that children of low monthly family income / the low paid income group were more likely to have suffered from acute malnutrition. These studies suggested that this low income led to food insecurity, forcing family members to consume food of poor quality and/or quantity, led to acute malnutrition. The anthropometric parameters like height, weight, MUAC and BMI, and Weight for height Z score of the two groups were significantly differed due to selection criteria of the case and control group in this study.

In bivariate analysis Younger mothers, mothers having low weight, BMI and duration of predominant breast feeding, and less educated mothers were significantly associated with acute malnutrition. These present study findings were in accordance with the findings of several other studies.[17,18] No significant association was noticed between acute malnourishment with occupation and height of the mothers. Similar findings have been reported by other studies.[19,20] This current study suggests that the low educational status of the mother is a risk factor leads to develop acute malnutrition of the children. This finding is in agreement with different studies in different regions of Ethiopia, India and Bangladesh.[18, 21-24] This could be due to the fact that the more educated mothers have great awareness and knowledge on child caring and feeding practice, and also, they can involve in various economic activity. Therefore, they can provide the most diversified food to their children which decreases the risk of being malnourished. The mean duration of predominant breast feeding was significantly (P=0.004) lower in cases (3.98±1.54 months)

than controls (4.43±1.57 months). Study conducted by Fuchs et al (2020)[15] also found a significant association between acute malnutrition of under five children and shorter duration of predominant breast feeding practices before 4 months of their birth . Same as the present study, several studies[25,26] from Bangladesh and others revealed that shortening of the predominant breast feeding by introduction of supplementary food like, infant formula or cow's milk, semisolid complementary foods were important risk factors for malnutrition in children.

The fathers of acute malnourished cases were significantly younger as well as less educated than that of controls. But multivariate logistic regression analysis did not identified the younger as well as less educated fathers as risk factors of acute malnutrition. These present study findings were in consistent with the findings of several studies.[15,18] However, no significant association was noticed between acute malnutrition with height, weight, BMI and occupation of the fathers.

The findings of the study suggest that acute malnutrition is a multifactorial pathological condition/state/problem. Multiple factors associate with the problem, but all of them are not identified as the risk factors or individual determinants of acute malnutrition, they are act as confounding factors . This study identified low monthly family income, low educational status of the mother and Predominant breastfeeding stopped before 4 months as the risk factors of acute malnutrition which independently led to develop acute malnutrition. So we should take measures against the associated factors specially risk factors when we will design preventive programs for the eradication of acute malnutrition of under 5 children.

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