Doi: https://doi.org/10.3329/ewmcj.v13i1.77623

Original Article

FACTORS OF ACUTE MALNUTRITION AMONG UNDER FIVE YEARS CHILDREN IN NORTHERN BANGLADESH

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Article history:
Received: 29 October 2024
Accepted: 21 November 2024

Keywords:
Acute malnutrition, Under 5 years children, Chapainawabganj, Northern Bangladesh

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 of acute malnutrition among under five years children in northern Bangladesh.*

Methods: *This case-control study was carried out from January 2021 to December 2021, 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 based on selection criteria. 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. Collected data were analyzed by the SPSS 24. Chi-squared (χ^2) test and unpaired t-test were performed to compare the frequencies and means between the groups.*

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 ≤20 years), younger father (age ≤25) years, less educated mother (Illiterate or upto primary), less educated father (Illiterate or up to primary), undernourished mother (BMI <18.50 kg/m^2) and predominant breast feeding stop before 4 months had found to be significantly associated with acute malnourishment ($p<0.05$).*

Conclusion: *Acute malnutrition was found to be significantly associated with low monthly family income, younger mother and father, less educated mother and father, undernourished mother and early stop of predominant breast feeding.*

EWMCJ Vol. 13, No. 1, January 2025: 35-42

Introduction

Nutritional status has been defined as an individual's health condition which is influenced by the intake and utilization of nutrients (National Research Council - USA Committee on Diet and health).[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),

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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 Phillipines 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 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.[13]

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.

Methods

This hospital-based case-control study was conducted in Chapainawabganj General Hospital, Chapainawabganj following Ethical approval from Institutional Review board of Sir Salimullah Medical College, Dhaka. Children aged 6-59 months attending at the selected hospital constituted the study population. Hospital attended children (aged 6-59 months) having acute malnutrition (Weight for height Z-score < -2) were enrolled as case, and age and sex matched healthy children (Weight for Height Z-score ≥-2) were enrolled as control. Purposive sampling technique was implemented. After fulfilling inclusion and exclusion criteria 90 cases and 90 controls were enrolled into the study from the study population. 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). Data were analyzed using the statistical package for social science version 24. Chi-squared Test (χ^2) was performed to compare frequencies between the groups and Unpaired t-test was performed to compare the means between the groups.

Results

This Case control study was carried out in Chapainawabganj general hospital, Chapainawabganj. After fulfilling inclusion and exclusion criteria 90 cases of acute malnutrition (Weight for Height Z-score < 2) and, 90 age and gender matched control (Weight for Height Z-score ≥ 2) were enrolled into the study. The main aim of the study was to determine the factors associated with acute malnutrition among under five years children in northern Bangladesh.

The mean age of the acute malnutrition cases was 25.84±15.09 months. Overall, 21.10% of the study malnourished cases were in 6-11 months age group, 34.40% were in 12-23 months age group, 44.40% were in 24-59 months age group. Among the study acute malnutrition cases 53.30% were male and 46.70% were female. Among the study acute malnutrition cases 40% were urban resident and 60% were rural resident. There has no statistically significant association found between the groups regarding residential distribution of the respondents (P=0.452). Statistically significant association was noticed between acute malnutrition with monthly family income of the participants (P<0.001). Among the study acute malnutrition cases 24.40% had monthly family income <7500 BDT, 55.60% had monthly family income between 7500-10000 BDT, 17.80% had monthly family income 10000-15000 BDT, and 2.20% had monthly family >15000 BDT. In control group 11.10% had monthly family income <7500 BDT, 42.20% had monthly family income between 7500-10000 BDT, 33.30% had monthly family income 10000-15000 BDT, and 13.30% had monthly family >15000 BDT. The mean weight, height, and Mid Upper Arm Circumference (MUAC) of the study acute malnourished cases were 8.40±2.05 kg, 80.89±11.07 cm, and 12.08±0.69 cm. The mean weight, height, and Mid Upper Arm Circumference (MUAC) of the study acute malnourished cases were statistically significantly lower in case group 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.

The mean age, weight and BMI of the mother of acute malnourished cases were statistically significantly lower than the mean age, weight and BMI of the mother of the control (P<0.001 respectively). Mothers of acute malnourished cases were statistically significantly less educated than mothers of controls (P=0.044). In case group, 37.80% mothers were illiterate, 14.40% were primarily educated, 28.90% were SSC passed, 14.40% were HSC passed and 4.40% had graduation or above educational qualification. In control group, 17.80% mothers were illiterate, 17.80% were primarily educated, 40% were SSC passed, 15.60% were HSC passed and 8.90% had graduation or above educational qualification. The mean duration of predominant breast feeding was statistically significantly lower in case group than control group (P=0.004). The mean duration of predominant breast feeding in case group was 3.98±1.54 months and the mean duration of predominant breast feeding in control group was 4.63±1.47 months.

The mean age of the father of the acute malnourished children was statistically significantly lower than mean age of father of controls (P=0.003). The mean age of the father of acute malnourished children was 27.82±4.16 years and the mean age of the father of the control was 29.53±4.50 years. Father of acute malnourished cases were statistically significantly less educated than father of controls (P=0.004). In cases group, 42.20% fathers were illiterate, 17.80% were primarily educated, 20% were SSC passed, 17.80% were HSC passed and 2.20% had graduation or above educational qualification. In control group, 20% mothers were illiterate, 13.30% were primarily educated, 26.70% were SSC passed, 31.10% were HSC passed and 8.90% had graduation or above educational qualification. Multivariate regression analysis of different risk factors of acute malnutrition was done. Monthly family income (<10000 BDT), educational qualification of the mother (primary or below) and predominant breast feeding stop before 4 months were found to be independently associated with acute malnourishment (p<0.05). Monthly family income (<10000 BDT) had OR of 2.710 (95%CI 1.156-6.352; p=0.022), educational qualification of the mother (primary or below) had OR of 2.256 (95%CI 1.003-5.075; p=0.049), and predominant breast feeding stop before 4 months had OR of 2.858 (95%CI 1.192 – 6.851; p=0.019)

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)	42 (46.70)	0.452#
	Rural	54 (60)	48 (53.30)	
Monthly family income (BDT)	<7500	22 (24.40)	10 (11.10)	<0.001#
	7500-10000	50 (55.60)	38 (42.20)	
	10000-15000	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*

Data are expressed as mean ± SD and frequency (percentage); *Unpaired t-test was performed to compare the mean between the groups and #Chi-squared Test (χ^2) was performed to compare frequency between the groups.

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*
Age group	≤ 20 years	20 (22.20)	8 (8.90)	0.011#
	>20 years	70 (77.80)	82 (91.10)	
Weight(Kg)	Mean±SD	47.80±5.71	51.62±6.12	<0.001*
Height (m)	Mean±SD	1.51±0.038	1.52±0.054	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)	82 (91.10)	0.390#
	Businessman	0 (0)	2 (2.20)	
	Private employee	5 (5.60)	4 (4.40)	
	Day laborer	2 (2.20)	0 (0)	
	Government employee	2 (2.20)	2 (2.20)	
Predominant breast feeding (months)	(Mean±SD)	3.98±1.54	4.63±1.47	0.004*

Data are expressed as mean ± SD and frequency(percentage); *Unpaired t-test was performed to compare the mean between the groups and #Chi-squared Test (χ^2) was performed to compare frequency between the groups.

Table-III

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

Baseline Characteristics		Case(N=90)	Control(N=90)	P value
Mean age (months)	Mean±SD	27.82±4.16	29.53±4.50	0.003*
Age group	≤ 25 years	36 (40)	17 (18.90)	0.002#
	>25 years	54 (60)	73 (81.10)	
Height (m)	Mean±SD	1.608±0.049	1.611±0.062	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	Illiterate	38 (42.20)	18 (20)	0.004#
N (%)	Primary	16 (17.80)	12 (13.30)	
	SSC	18 (20)	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)	18 (20)	
	Day laborer	12 (13.30)	10 (11.10)	
	Government employee	2 (2.20)	8 (8.90)	
	Unemployed	4 (4.40)	3 (3.30)	

Data are expressed as mean ± SD and frequency(percentage); *Unpaired t-test was performed to compare the mean between the groups and #Chi-squared Test (χ^2) was performed to compare frequency between the groups.

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

Malnutrition in children is a major public health concern with 435,071,628 prevalent cases and 52,330,896 new cases in 2019. Additionally, children under the age of five had the highest incidence and prevalence of any age groups.[14] This study was conducted to determine the factors associated with acute malnutrition among under five years children in northern Bangladesh which was conducted in Chapainawabganj general hospital, Chapainawabganj. The mean age of the study malnourished children was 25.84±15.09 months and majority of them aged < 2 years (55.50%). About

53.30% of the acute malnourished cases were male (male female ratio was 1.14:1). Study conducted by Ahmed et al. (2013)[15] and Shams et al (2012)[16] also found maximum of their study acute malnourished cases in <2 years age group.[20] Consistent to the finding of this study Chowdhury et al (2016)[17] and Islam et al (2018)[18] found majority of their study cases male with 1.04:1 and 1.33:1 male female ratio. It is well established that all three arms of the UNICEF conceptual framework of the causes of malnutrition can be impacted by poverty.[19] This study also found statistically significantly higher number of cases in <7500 BDT and 7500-10000 BDT monthly family income group than controls (P<0.001). In case group 24.40% had monthly family income <7500 BDT, 55.60% had monthly family income between 7500-10000 BDT, 17.80% had monthly family income 10000-15000 BDT and 2.20% had monthly family income >15000 BDT. In control group 11.10% had monthly family income <7500 BDT, 42.20% had monthly family income between 7500 BDT-10000 BDT, 33.30% had monthly family income between 10000-15000 BDT and 13.30% had monthly family income >15000 BDT. However, no significant association was noticed between acute malnourishment with occupation and height of the mothers (P>0.05). Musa et al (2017)[20] also found statistically significant association between acute malnutrition with low monthly family income (P=0.005). They found 80.61% of their study cases in <14500 BDT monthly family income group. Consistent to the finding of this study, Chowdhury et al (2016)[17] found mothers education, and wealth index of family as two significant factors for acute malnutrition. Besides, they also observed rural place of residence and working mother as significant factors for acute malnutrition in children. But this study did not find any significant difference regarding the residence of the respondents between the case and control groups (P=0.452).

The mean weight, height and MUAC of the study acute malnourished cases were 8.40±2.05 kg, 80.89±11.07 cm and 12.08±0.69 cm. The mean weight for height Z score was -2.93±0.41. The mean weight-for-height Z score was statistically significantly lower in case group than control group (P<0.001). Fuchs et al. (2014)[21] found weight-for-height Z score of their study acute malnourished cases -3.24±1.01. They also observed statistically significantly lower mean weight-for-height Z score in case group than control group (P<0.001).

This study revealed that both the mothers and fathers of acute malnourished cases were statistically significantly less aged and less educated (P<0.05). Consistent to the findings of this study Hoq and associates (2019)[22] also found less aged and less educated mother as two significant factors of acute malnutrition in children.

The weight and BMI of the mothers of the cases were also statistically significantly lower than mothers of controls (P<0.05). However, no significant association was noticed between acute malnutrition with height, weight, BMI and occupation of the fathers (P>0.05). The mean birth order of acute malnutrition children and healthy control were 1.80±0.89 and 1.77±0.68. The mean birth order of children was not statistically significantly associated with acute malnutrition (P=0.851). However, the mean duration of predominant breast feeding was statistically significantly (P=0.004) lower in case group (3.98±1.54 months) than control group (4.43±1.57 months). Study conducted by Rahman et al (2020)[23] also found significant association between acute malnutrition with undernourished mother and shorter duration of breast feeding practices(P<0.05).

Logistic regression analysis revealed that children with acute malnutrition were more likely to come from a family having a monthly income of less than 10,000 BDT (had OR of 2.710, 95% CI 1.156–6.352; *P* = 0.022; have less educated mothers (illiterate or up to primary) (had OR of 2.256, 95% CI 1.003–5.075; *P* = 0.049); have shorter periods of predominant breastfeeding (had OR of 2.858, 95% CI 1.192–6.851; *P* = 0.019). Fuchs et al(2014)[21] found children with acute malnutrition were more likely to have an undernourished (BMI <18.5) mother (had OR of 2.8 and *P* = 0.017), have a father with no or a low-paying job (had OR of 5.8 and *P*< 0.001), come from a family having a monthly income of less than 10,000 taka (had OR of 2.9 and *P* = 0.008), and have shorter period of predominant breastfeeding (had OR of 2.7 and 5 *P* = 0.013).

Conclusion

This study observed monthly family income (<10000 BDT), younger mother (≤20 years) and father (≤25 years), less educated mother (illiterate or up to

primary) and father (illiterate or up to primary), undernourished mother and predominant breast feeding stop before 4 months as some significant risk factors of acute malnutrition among under five years children (P<0.05). Among these factors monthly family income (<10000 BDT), less educated mother (illiterate or up to primary) and predominant breast feeding stop before 4 months were found to be independently associated with acute malnutrition.

Conflict of Interest:
None to Disclose

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Peer-Review History:
The peer review history for this paper can be accessed here: https://ewmch.com/review/