ORIGINAL ARTICLE

Evaluating Risk Factors for Protein Energy Malnutrition in Severely Malnourished Children Admitted in a Tertiary Care Hospital

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Abstract

Background: Malnutrition the silent emergency is more clearly revealed its impact on children those who are the most vulnerable to suffer.

Objective: The objective of the study was to evaluate the risk factors of protein energy malnutrition of severely malnourished children admitted in a Hospital.

Methods: An open case–control study was carried out between June 2023 and November 2023 at the Pediatric Gastroenterology and Hepatology Unit of Bangladesh Shishu Hospital & Institute in Dhaka. As cases, the study comprised 50 hospitalized children with severe malnutrition, while 50 well-nourished children served as controls. An anthropometric assessment was carried out soon following admission. A semi-structured questionnaire was used to collect data, which included variables including age, gender, nutritional status, socioeconomic and sociodemographic characteristics and psychosocial history, as well as parents' monthly family income. At the outset of the study, demographic and nutritional information was gathered.

Result: This present study showed majority of malnourished children were below 12 months of age more in male, came from urban slum from poor socioeconomic class and majority were partial immunized. Most of the mother and father were none educated and mothers were garments worker and fathers were day labor in case group. In case group 90% did not practice hand washing before feeding and 94% after defecation, 54% used tap water, 84% did not use save drinking water and 70% used Kancha latrine. In control group 92% practice hand washing before feeding and 62% after defecation, 86% used tap water and 78% used sanitary latrine. Sanitation and safe drinking water were poor in case group in comparison to control group.

Conclusion: From the findings of the present study it can be concluded that poverty, illiteracy, immunization, poor sanitation, lack of safe drinking water, bottle feeding with dilute formula milk and poor hygienic situation are the important risk factors of severely malnourished children.

Key words: Protein Energy Malnutrition, Malnourished Children, Risk Factors, Socio-demographic determinants

Introduction

Protein–energy malnutrition (PEM) continues to be the most lethal type of malnutrition, with its impact felt most acutely among children, who are especially at risk. It detracts from national progress by leading to elevated levels of illness, death, cognitive impairment, and diminished productivity.[1] In 2004, approximately 35% of the world's population experienced the consequences of malnutrition,[2] with more than 16% of children under five in developing nations categorized as severely malnourished.[3] It is significant that a staggering 79% of malnourished children are found in the South-East Asia region.[4]

In Bangladesh, the issue of childhood malnutrition is particularly concerning, with the nation representing a significant portion of the global population of malnourished children, despite some gradual progress noted since the 1990s.[5] The UNICEF State of the World's Children Report 2008 reveals that around eight

million children under the age of five, representing 48%, were classified as underweight. Malnutrition is believed to account for approximately half of all childhood fatalities, mainly by compromising the immune system.[6]

In spite of our knowledge and experience about pathophysiology and management of severe malnutrition it is unfortunate that the median case fatality rate all over the world even in last five decades has remain unchanged.[7] Although the frequency of childhood malnutrition in Bangladesh fell significantly from 68% in the late 1980s to 41% in 2007, the rate of reduction was insufficient to fulfill the Millennium Development Goal (MDG) target of 34% in 2015.[8]

The disease pattern varies from one part of the world to the next depending on the interaction of multiple local factors such as poverty, low levels of education, poor access to health services, genetic constitution, associated specific micronutrient deficiencies and infection. [9, 10] The aim of the study was to find out the risk factors contributing to protein energy malnutrition among severely malnourished children admitted into Nutrition Unit of a Dhaka Shishu Hospital.

Materials and Methods

This open case–control study was conducted in the Pediatric Gastroenterology and Hepatology Unit of Bangladesh Shishu Hospital & Institute, Dhaka, from June 2023 to November 2023. The study included 50 hospitalized children with severe malnutrition as cases and 50 well-nourished children as controls. Eligible participants were children of both sexes aged 6 to 36 months who met the diagnostic criteria for severe malnutrition, defined as weight-for-age <60% of the National Center for Health Statistics (NCHS) mean (<−3 SD) and/or weight-for-length <70% of the NCHS mean (<−3 SD). Cases were selected on a non-randomized basis according to inclusion criteria and were admitted to the nutritional unit of the Pediatric Gastroenterology and Hepatology Department.

Children younger than 6 months or older than 36 months, of either sex, with weight-for-length >70% of the NCHS mean and/or weight-for-age >60% of the NCHS mean, were excluded. Patients with malnutrition secondary to non-nutritional causes such as diabetes mellitus, hypothyroidism, septic shock, congenital anomalies, or cerebral palsy, as well as those with edema due to conditions including congestive cardiac failure, nephrotic syndrome, liver cirrhosis, or protein-losing enteropathy, were also excluded from the study.

Age and sex matched children's having weight for length was > 90% of NCHS mean and weight for age > 90% of NCHS mean either or both respectively admitted in different units of Pediatric Gastroenterology Hepatology unit of Bangladesh Shishu Hospital & Institute, Dhaka due to various diseases other than malnutrition like pneumonia, diarrhea etc. were included as control.

A semi-structured questionnaire was developed to collect information on age, sex, nutritional status, immunization history, feeding history, parental education, socioeconomic and sociodemographic characteristics, and psychosocial history, including monthly family income of parents. Prior to enrollment, the study was explained in detail to a parent or caregiver of each child. For immunization status, complete immunization was defined as receipt of all vaccines appropriate for age according to the Expanded Program on Immunization (EPI) schedule, whereas partial immunization referred to children who had not completed the required doses despite having crossed the recommended age.

Anthropometric assessment was performed immediately after admission. Weight was recorded using an electronic scale (Seca model 835; Todd Scales Ltd, New Market, United Kingdom) with a graduation of 20 g. To minimize interpersonal variation, two independent observers confirmed each measurement. Length was measured in the supine position using a locally constructed WHO-recommended wooden infantometer with a fixed headboard and a sliding footpiece. Measurement was performed by the traditional two-person method: one investigator positioned the child supine, aligned the head against the headboard, and held it securely with both hands, tilting it upward until the eyes faced straight and perpendicular to the board, while the other adjusted the sliding footpiece against the child's heels to obtain the length.

For length measurement, the second observer placed one hand on the child's shins or knees and applied gentle but firm pressure to straighten the legs as much as possible without causing discomfort. With the other hand, the footpiece of the infantometer was positioned firmly against the child's feet, ensuring that the soles were flat on the board with toes pointing upward.

Ethical approval for the study was obtained from the Ethical Committee of Daffodil International University, Dhaka. The purpose and procedures of the study were

explained to the parents or caregivers, and written informed consent was obtained prior to enrollment.

Statistical analysis was performed using SPSS version 17.0 (Statistical Package for Social Sciences). Data were analyzed according to standard procedures using the Chi-square test and Fisher's exact test, as appropriate, based on variable type and distribution. A p-value <0.05 was considered statistically significant.

Results

Mean ±SD of weight for age were 48.27 ± 7.58 and z score - 4.71±1, weight for length 68.85 ± 10.42 and z score -2.45 ± 2.89 against weight for age 99.81 ± 4.92 and z score 0.05 ± 0.49, weight for length 99.16 ± 3.18 and z score 0.04 ± 0.33 of control group (Table-I).

Among the study population 04(08%) were severe malnutrition in case group. Severe malnutrition with septicemia was found in 07(14%) cases versus 1(2%) septicemia in control group. Severe malnutrition with diarrhoea was found in 17(34%) cases versus 35(70%) diarrhoea in control group. Severe malnutrition with pneumonia was found in 22(44%) cases versus 14(28%) only pneumonia in control group. Present study reflected that diarrhoea and pneumonia were more common and frequent association with severely malnourished children (Table-II).

Present study show well matched age and sex in both case and control group. 31(62%) of the children were below 6-12 months in both case and control group respectively. Majority of the children 39(78%) were male in both group. 27(54%) children of severely malnourished case group came from urban slum (P<0.001), 15(30%) from urban area (P<0.001) and 8(16%) from rural area. In control group 38(76%) were from urban, 8(16%) from urban slum and 4(8%) from rural area. Most patients belonged to poor socio-economic level with 44(88%) children of cases came off family with monthly income below Tk 3000 (P<0.001). In case group 22(44%) were completely immunized, 28(56%) partially immunized (P<0.001) as per EPI schedule against 39(78%) complete immunized, 11(22%) partially immunized of control group. This present study showed majority of malnourished children were below 12 months of age more in male, came from urban & urban slum from poor socioeconomic class and majority were partially immunize. Most of the mother and father were non-educated (P<0.001) and mothers were garments worker (P<0.001) and also House made (P<0.005). Fathers were day labor (P=0.001) and also Rickshawpullar (P=0.0005) in case group (Table-III).

In case group, none of cases practice Exclusive breast feeding ,54% practice diluted milk formula(P<0.001), 22% practice Cow's milk (P=0.005), and 18% practice breast feeding where as in control group 46% mother breast feeding their child (P=0.005), 42% practice breast feeding with milk formula (P=0.006). This present study showed most of the study population feeding with diluted milk formula but in control group majority of the control population feeding with breast milk (Table IV).

In case group 90% did not practice hand washing before feeding (P<0.001) and 94% after defecation (P<0.001), 54% used tap water and 70% used Kancha latrine (P<0.001) and 84% not use save drinking water (P<0.001). In control group 92% practice hand washing before feeding and 62% after defecation, 92% used tap water and 78% used sanitary latrine. This present study showed that sanitation, hand washing and safe drinking water were poor in case group in comparison to control group (Table-V).

Table-I Mean values with standard deviation of anthropometric assessment of study population n=100 (NCHS %).

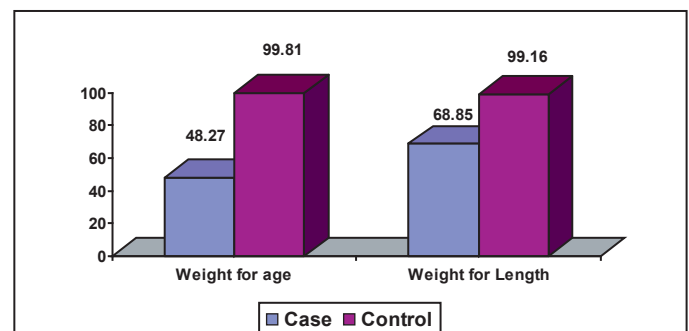|		Weight for age	Weight for age (Z score)	Weight for Length	Weight for Length (Z score)
Case	Mean ±SD	48.27 ±7.58	-4.71 ±1.00	68.85 ±10.42	-2.45 ±2.89
Control	Mean ± SD	99.81 ±4.92	0.05 ±0.49	99.16 ±3.18	0.04 ±0.33

Figure-I Anthropometric assessment of study population n=100 (NCHS %).

Table-II Disease profile of study population (n=100).

Case			Control	
Disease		n=50(%)	Disease	n=50(%)
Severe malnutrition		04(08)	0	0
Severe malnutrition with septicemia		07(14)	Septicemia	1(2)

Case		Control	
Severe malnutrition with diarrhoea	17(34)	Diarrhoea	35(70)
Severe malnutrition with pneumonia	22(44)	Pneumonia	14(28)
Total	**50(100)**	**Total**	**50(100)**

Data within parenthesis are expressed in percentage.

Table-III: Socio-economic and socio demographic characteristics of study population (n=100)

Characteristics	Case	Control	
	n=50 (%)	n=50(%)	P value
Age(in months)			
6-12	31(62)	31(62)	
13-24	17(34)	17(34)	
25-36	02(04)	02(04)	
Sex			
Male	39(78)	39(72)	
Female	11(22)	11(22)	
Residence			
Urban	15(30)	38(76)	<0.001
Urban Slum	27(54)	08(16)	<0.001
Rural	08(16)	04(08)	0.35
Monthly family income in Taka			
Poor <3000	44(88)	5(10)	<0.001
Lower middle (3000-5000)	14(28)	10(20)	0.48
Middle (>5000-10000)	02(04)	30(60)	<0.001
Upper middle (>10000)	00(0)	05(10)	0.02
Immunization			
Completely Immunized	022(44)	39(78)	
Partially Immunized	28(56)	11(22)	<0.001
Mother education			
No education	25(58)	05(10)	<0.001
Primary	16(32)	11(22)	0.36
<SSC	05(10)	19(38)	0.09
SSC	02(04)	08(16)	0.15
>SSC	02(04)	07(14)	0.04
Father Education			
No education	23(46)	02(04)	<0.001
Primary	12(24)	06(12)	0.11
SSC	03(06)	07(14)	0.18
HSC	01(02)	17(34)	0.001
>HSC	01(02)	18(36)	0.001
Mother occupation			
House wife	11(22)	33(66)	0.0002
Garments worker	24(48)	04(08)	<0.001
House made	13(14)	02(04)	0.005
Service	02(04)	13(26)	0.005
Father occupation			
Ricsha puller	18(36)	03(06)	0.0005
Day labour	21(42)	02(04)	0.001
Small shop	05(10)	12(24)	0.06
Service(privet)	03(06)	25(50)	<0.001
Govt. Job	02(02)	08(16)	0.09

p value was done by chi-squares and Fisher exact test

Table-IV: Type of milk feeding practice

Type of feeding	Case	Control	
	n=50 (%)	n=50(%)	P value
Exclusive breast feeding	00(00)	5(10%)	0.05
Breast feeding	09(18)	23(46)	0.005
Breast feeding with milk formula	03(06)	21(42)	0.006
Diluted milk formula	27(54)	00(00)	<0.001
Cow's milk	11(22)	01(02)	0.005

P value was done by chi-squares and Fisher exact test

Data within parenthesis are expressed in percentage.

Table-V: Characteristic of sanitation

Sanitation	Case	Control	
	n=50 (%)	n=50(%)	P value
Hand washing before feeding			
Done	5(10)	46(92)	
Not done	45(90)	4(08)	<0.001
Water use			
Tap water	27(54)	43(86)	0.001
Tubewel water	13(26)	4(08)	0.03
Pond water	10(20)	03(06)	0.07
Save drinking water			
use	8(16)	31(62)	
Not use	42(84)	19(38)	<0.001
Latrine			
Sanitary	15(30)	39(78)	<0.001
Kancha latrine	35(70)	11(22)	<0.001
Hand washing after defecation			
Done	2(02)	31(62)	
not done	47(94)	19(38)	<0.001

p value was done by chi-squares and Fisher exact test

Data within parenthesis are expressed in percentage.

Discussion

Malnutrition continues to be one of the leading causes of childhood morbidity and mortality worldwide. It is estimated to contribute, directly or indirectly, to 60% of the 10.9 million annual deaths among children under five years of age.[11] More than two-thirds of these deaths, frequently associated with inappropriate feeding practices, occur within the first year of life.[12] In the present study, the age range of participants was 6–36 months. Findings are consistent with those of Amin et al.[13], who reported that the majority of malnourished children were below three years of age. Similarly, Roy et al.[14] demonstrated a significant age-related trend, showing that the prevalence of severe malnutrition decreased as age increased. In line with these observations, the current study found that 31 (62%) of severely malnourished children were under

12 months of age. Furthermore, severe malnutrition was more frequently observed among male children, and hospital admissions for severe malnutrition were also higher in males compared to females.[13] This disparity may reflect a greater parental tendency to seek medical care for male children, resulting in higher hospital representation.

Present study reflected that most of the study case group belonged to poor socio-economical class whereas majority of control group was middle class. Among study population, majority of case group came from urban slum and their monthly family income was below 3000 takas. In control group majority came from urban area. This might be due to easier availability and accessibility to hospital service of urban dwellers. This finding is consistent with previous reports by Shakur et al.[15], Khan et al.[16], and Awwal et al.[17], who demonstrated that the relationship between malnutrition and poverty exists in a vicious cycle, whereby poverty contributes to malnutrition and, in turn, malnutrition perpetuates poverty and disease. In the present study, the immunization status was poorer in the case group compared to the control group, a result that aligns with the observations of Islam et al.[18]

Most of the mothers and fathers were non-educated. Mothers were garments worker and fathers were day labor in case group. Illiteracy and ignorance also play major role in the causation of PEM.[19] Improper management of the microenvironment at the family level undoubtedly plays a major role in the causation of malnutrition. The limited economic sources are often further strained by large family size.[20] This present study showed most of the study population feeding with diluted milk formula but in control group majority of the control population feeding with breast milk. In regions where malnutrition is widespread, breastfeeding plays a crucial role in improving survival outcomes for children up to three years of age.[21] However, inadequate maternal and child care practices, including suboptimal breastfeeding and inappropriate complementary feeding, place infants and young children at a greater risk of developing malnutrition.[22]

The decline in breast-feeding is further intensified by misleading commercial advertising, which influences young mothers to perceive formula milk as a modern, convenient, and seemingly superior alternative in terms of nutrition and desirability for infant feeding.[23] Identified some serious problems in practice of infant feeding like mothers discarding colostrums, delay in initiation of breast milk and giving newborn pre-lacteal feeds like honey, sugar or even water.[24] Maternal illness like nipple problems (i.e. retracted, cracked and flat nipple) and medication together causes of lactation failure.[25]

This present study showed that sanitation, hand washing before feeding and after defecation and safe drinking water were poor in case group in comparison to control group. The unavailability of safe water, sanitary latrine, poor immunization and personal unhygienic condition increases the chance of infection and hence malnutrition.[26]

In the present study, diarrhoea and pneumonia emerged as the most frequent comorbidities among severely malnourished children. According to Black et al.[27], both diarrhoea and malnutrition are highly prevalent in young children from developing countries, where a bidirectional relationship has been suggested—diarrhoea contributing to nutritional depletion and malnutrition increasing susceptibility to diarrhoeal disease. Consistently, James et al.[28] reported that infections persisted for longer durations in malnourished children compared to their well-nourished counterparts.

Conclusion

From the findings of the present study it can be concluded that poverty, illiteracy, immunization, poor sanitation, lack of safe drinking water, bottle feeding with dilute formula milk and poor hygienic situation are the important risk factors of malnutrition, the promotion of breast feeding can reduce the high incidence of malnutrition among children in our community to a great deal. However broad base, population base, multi-center study and meta-analysis of the study are needed to validate our findings that poverty, illiteracy, immunization, poor sanitation, lack of safe drinking water, bottle feeding with dilute formula milk and poor hygienic condition are the important risk factors of severely malnourished children.

Limitations Of The Study

Since data were collected from a single children's hospital, there was a possibility of over-representation, which may not accurately reflect the general population or represent the situation across the entire country. Moreover, as this was a non-randomized case–control study, the findings are subject to inherent methodological limitations. A broader, longitudinal cohort design would provide more robust evidence. Furthermore, replication of similar results through

adequately powered multicenter studies and meta-analyses would be valuable to validate and strengthen the findings of the present study.

Recommendation

Breast feeding is an important part of global security, too. It is, therefore, absolutely essential to increase effort to support, encourage and promote breast feeding. Every strata of the society need to learn about the advantage of breast feeding.

To reduce childhood malnutrition, priority should be given to enhancing parental knowledge and practices regarding appropriate infant and young child feeding. Favorable demographic conditions—such as improvements in maternal health and adequate birth size—together with higher socioeconomic status, including parental education, household income, and media exposure, were important factors associated with lower prevalence of malnutrition. Likewise, effective health system interventions, such as ensuring timely immunization, micronutrient supplementation, improved living standards, and access to quality health facilities, as well as urban residency, were found to contribute positively.

The government should take necessary steps to expand opportunities for education, particularly for girls and women. Education has multiple pathways to improving nutritional outcomes: it can delay age at marriage and first childbirth, reduce desired family size, and empower women to make informed decisions about health, food, and child development.

Finally, active involvement of the community, non-governmental organizations, and the use of mass media to disseminate essential health and nutrition information could play a vital role in improving the nutritional status of children.

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