

Maternal risk factors in malnourished children: a neglected study

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Abstract

Background: Protein-energy malnutrition is a major health problem in India and affects the growth and development of young children.

Objectives: This study was aimed at identifying maternal risk factors like nutritional status, social and educational status in mothers of malnourished children which is a neglected aspect of management in childhood malnutrition.

Method: This was a cross-sectional study carried out in the Nutrition Rehabilitation Centre, Department of Paediatrics, Mysore Medical College and Research Institute, India, from May to October 2018. Demographic details of mothers were recorded in a questionnaire. Mothers were examined for their weight, height, body mass index (BMI), haemoglobin (Hb), peripheral blood smear and clinical signs of micronutrient deficiencies.

Results: There were 75 mothers of malnourished children (Cases) and 75 mothers of well-nourished children (Controls). Among cases, 37.3% mothers were underweight versus 6.7% mothers in controls ($p=0.01$). Among cases, 58.7% mothers were stunted versus 32% mothers in controls ($p=0.001$). Among cases, 58.7% mothers were anaemic versus 42.7% mothers in controls ($p=0.02$). Among cases, 18.7% mothers were illiterate versus 10.7% mothers in controls ($p=0.001$). Among cases, 40% mothers were <18 years old during conception versus 26.7% mothers in controls ($p=0.002$). Among cases, 53.3% children were first born versus 36% children in controls ($p=0.028$). Among cases, 10.6% mothers had birth spacing of >3 years versus 13.3% mothers in controls ($p=0.15$).

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Conclusions: In this study significantly more mothers of malnourished children were underweight, stunted, anaemic and illiterate compared to mothers of well-nourished children.

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Introduction

Nutritional status of children is an indicator of the nutritional profile of the entire community. Maternal nutrition refers to the nutritional needs of women prior to conception, pregnancy and lactation period. Globally, 3.5 million deaths are caused by maternal and child undernutrition and 35% of the disease burden is borne by under-5 year old children who contribute to 11% of total global Disability Adjusted Life Years (DALYs)¹. Globally, the four most common forms of micronutrient malnutrition are iron, vitamin A, iodine, and zinc deficiencies. Of the global disease burden, 7.3% is due to micronutrient deficiencies, among which iron and vitamin A deficiencies commonly cause the global disease burden².

The first 1000 days of life include 270 days *in utero* and 730 days postnatally, a critical period for nutritional programming. Nutrition in this critical period is entirely dependent on the health, nutrition, and well-being of the mother³. In developing countries marriage commonly occurs in the adolescent period and conception soon after marriage. As one-third of these adolescent girls have undernutrition, the risk of intrauterine growth retardation and subsequent childhood undernutrition develops a vicious cycle of intergenerational transfer of malnutrition⁴. This vicious cycle can be broken by strategies improving women's nutrition, literacy and empowerment². Several studies have been done on malnourished children but very few studies on maternal malnutrition, so in this study we evaluate maternal risk factors contributing to childhood malnutrition.

Objective

The objective of our study was to identify maternal risk factors like nutritional status, social and educational status in malnourished children which is a neglected aspect of management in childhood malnutrition.

Method

A cross-sectional study was carried out in the Nutrition Rehabilitation Centre (NRC), Department of Paediatrics, Mysore Medical College and Research Institute, Mysuru, from May 2018 to October 2018. Mothers of children with severe acute malnutrition (SAM), moderate acute malnutrition (MAM) and well-nourished children admitted in Cheluvamba hospital during the six month period were enrolled for the study.

A total of 150 mothers was enrolled for the study. Case group comprised 75 mothers of children with malnutrition (48 with SAM and 27 with MAM). Comparison group comprised 75 mothers of well-nourished children. Pregnant mothers and mothers with chronic medical illness were excluded from the study. Children from 6-60 months of age with MAM or SAM, determined by weight for height and mid upper arm circumference measurements, as well as their unmatched comparisons, were studied. SAM is defined as children, 6-60 months old, of less than 70% of median weight for height (less than -3 standard deviation) or bilateral pitting oedema or mid-upper arm circumference less than 115 mm. MAM is defined as 70-80% of median weight for height (between -2 to -3 standard deviation) or mid-upper arm circumference 115-125 mm⁵.

Data were collected utilizing a pre-structured questionnaire. Information on maternal conception age, education, occupation, birth order, and birth spacing were noted in a proforma. All mothers were measured for weight, height, body mass index (BMI) and documented for anaemia through haemoglobin (Hb) % and peripheral blood smear. Mothers were clinically examined for micronutrient

deficiencies. The BMI was calculated and classified in accordance with WHO as underweight (<18.5 kg/m²), normal (18.5-24.99 kg/m²) or overweight (>25 kg/m²). Underweight was further classified as severe thinness (<16 kg/m²), moderate thinness (16.0-16.99 kg/m²) and mild thinness (17-18.49 kg/m²). The overweight was further classified into pre-obese (25-30 kg/m²) and obese (>30 kg/m²)⁶. Stunting or low height for age is defined as less than -2 Z-score or < 3rd percentile⁷. According to WHO, anaemia is defined as Hb <12g/dl in non-pregnant women and classified as mild (11-11.9g/dl), moderate (8.0-10.9g/dl) and severe (<8.0g/dl)⁸. A peripheral blood smear was done to document anaemia. According to United Nations Educational, Scientific and Cultural Organization (UNESCO) a person is illiterate who cannot understand to read and write a short simple statement in daily living⁹.

Statistical methods: Statistical analyses were done utilising SPSS software. Correlation of maternal nutrition and demographic characteristics was done by Pearson's correlational analysis with two-tailed p-value <0.05 taken as significant.

Ethics: Ethical clearance for the study was obtained from the Ethics Committee of Mysore Medical College and Research Institute. Written consent was obtained from parents prior to their inclusion in the study.

Results

Comparison of maternal health and nutrition between mothers of malnourished children and mothers of well-nourished children is shown in Table 1.

Table 1: Comparison of maternal health and nutrition between mothers of malnourished children and mothers of well-nourished children

Characteristic	Case group (n=75) Number (%)	Comparison group (n=75) Number (%)	Pearson Chi-square test
<i>Body mass index (kg/m²)</i>			
Underweight	28 (37.3)	05 (06.7)	<i>p</i> = 0.01
Normal	41 (54.7)	54 (72.0)	
Overweight	06 (08.0)	16 (21.3)	
<i>Haemoglobin (g/dl)</i>			
Normal	31 (41.3)	43 (57.3)	<i>p</i> = 0.002
Anaemia	44 (58.7)	32 (42.7)	
<i>Peripheral blood smear</i>			
Normal	38 (50.6)	53 (70.6)	<i>p</i> = 0.033
Microcytic hypochromic anaemia	36 (48.0)	22 (29.4)	
Dimorphic anaemia	01 (01.4)	-	
<i>Stunting</i>			
Present	44 (58.7)	24 (32.0)	<i>p</i> = 0.001
Absent	31 (41.3)	51 (68.0)	

According to BMI, in 150 mothers, 33 were underweight, 22 were overweight and 95 had normal BMI. Among the 33 underweight mothers, 28 (37.3%) were mothers of malnourished children and 5 (6.7%) were mothers of well-nourished children. Among the 22 overweight mothers, 6 (8%) were mothers of malnourished children and 16 (21.3%) mothers of well-nourished children. Among 95 mothers who had normal BMI 41 (54.7%) were mothers of malnourished children and 54 (72%) were mothers of well-nourished children. By Pearson Chi-square test, a p-value of 0.01 was derived which was statistically significant. Mothers being underweight were more in mothers of malnourished children (37.3%) than in mothers of well-nourished children (6.7%) which had statistical significance. Of the 150 mothers, 68 were stunted of whom 44 (58.7%) were mothers of malnourished children and 24 (32.0%) were mothers of well-nourished children which showed statistical significance ($p=0.01$).

According to Hb levels measured in all mothers, 74 mothers had normal Hb and 76 mothers were anaemic. Forty four (58.7%) mothers of malnourished children and 32 (42.7%) mothers of well-nourished children had anaemia which was statistically significant ($p=0.002$). Anaemia was

classified into mild, moderate and severe. Whilst 20% of mothers of malnourished children had mild anaemia 38.7% had moderate anaemia. Of the mothers of well-nourished children, 29.4% had mild anaemia and 13.3% had moderate anaemia. No mothers were detected with severe anaemia. No anaemia was detected in 31 (41.3%) mothers of malnourished children and 43 (57.3%) mothers of well-nourished children. According to the peripheral blood smear, 36 (48.0%) mothers of malnourished children and 22 (29.4%) mothers of well-nourished children had microcytic hypochromic anaemia and 1.4% mothers of malnourished children had dimorphic anaemia which had statistical significance ($p=0.033$).

Thus, mothers of malnourished children had more chronic malnutrition and anaemia compared to mothers of well-nourished children. In case group, mean Hb was 10.7g/dl and BMI was 20.05 kg/m². In comparison group, mean Hb was 11.6g/dl and BMI was 23.23 kg/m².

Comparison of demographic characteristics between mothers of malnourished children and mothers of well-nourished children is shown in Table 2.

Table 2: Comparison of demographic characteristics between mothers of malnourished children and mothers of well-nourished children

Characteristic	Case group (n=75) Number (%)	Comparison group (n=75) Number (%)	Statistical significance
<i>Mother's Education</i>			
Illiterate	14 (18.7)	08 (10.7)	p = 0.001
Primary & Secondary education	58 (77.3)	49 (65.3)	
Higher education	03 (04.0)	18 (24.0)	
<i>Birth Order</i>			
1 ^o	40 (53.3)	27 (36.0)	p = 0.028
2 ^o	22 (29.4)	38 (50.7)	
3 ^o	13 (17.3)	10 (13.3)	
<i>Mother's conception age</i>			
<18 years	30 (40.0)	20 (26.7)	p = 0.002
18-25 years	44 (58.7)	42 (56.0)	
25-30 years	01 (01.3)	13 (17.3)	
<i>Mother's occupation</i>			
Homemaker	64 (85.3)	56 (74.7)	p = 0.102
Working	11 (14.7)	19 (25.3)	
<i>Birth Spacing</i>			
1 – 2 years	09 (12.0)	09 (12.0)	p = 0.15
2 – 3 years	18 (24.0)	29 (38.7)	
>3 years	08 (10.6)	10 (13.3)	

According to mother's educational status, 22 were illiterate, 107 had primary and secondary education and 21 completed higher education. Among the 22 illiterate mothers, 14 (18.7%) were mothers of malnourished children and 08 (10.7%) were mothers of well-nourished children. Among the 21

mothers who completed higher education, 3 (4%) were mothers of malnourished children and 18 (24%) were mothers of well-nourished children. By Pearson Chi-square test, a p-value of 0.001 was derived which was statistically significant.

According to birth order, 67 mothers were primigravida of whom 40 (53.3%) were mothers of malnourished children and 27 (36%) were mothers of malnourished children which was statistically significant ($p < 0.05$). Thus, first born children were more prone to malnutrition due to the direct impact of maternal malnutrition. In this study, only 3 birth orders were seen, which were more in the case group (17.3%) than in the comparison group (13.3%). In birth spacing, mothers of well-nourished children (13.3%) had better spacing of > 3 years than mothers of malnourished children (10.6%) but this was not statistically significant ($p = 0.15$).

According to mother's occupation, 120 mothers were homemakers and 30 mothers were working which was not statistically significant ($p = 0.102$). According to mother's conception age, 30 (40%) were mothers of malnourished children and 20 (26.7%) were mothers well-nourished children in mothers < 18 years of age at the time of conception. This was statistically significant ($p < 0.01$). Forty four (58.7%) were mothers of malnourished children and 42 (56%) were mothers of well-nourished children in mothers between 18-25 years of age at the time of conception. This was statistically significant ($p = 0.002$). One (1.3%) mother of malnourished children and 13 (17.3%) mothers of well-nourished children were between 25-30 years of age at the time of conception. No mother conceived after 30 years of age.

Discussion

In this study according to maternal health and nutrition, 58.7% mothers of malnourished children had stunted growth and 37.3% mothers of malnourished children were underweight, which depicts maternal chronic malnutrition. Maternal undernutrition ($BMI < 18.5 \text{ kg/m}^2$) constitutes more than 20% in sub-Saharan Africa, south-central and south eastern Asia¹. A similar finding was seen in 50.6% of mothers in the study by Rai R, *et al* in 2015¹⁰. More than 33% mothers were underweight in the study by Nagabhushan BM, *et al* in 2017¹¹ and 57.7% mothers were underweight in the study by Bhatia P, *et al* in 2018¹².

In our study, 58.7% mothers of malnourished children had maternal anaemia in the form of microcytic hypochromic anaemia and dimorphic anaemia. Similarly, maternal anaemia was seen in 70% in the study by Rai R, *et al* in 2015¹⁰, 88% in the study by Nagabhushan BM *et al* in 2017¹¹ and 90% in the study by Bhatia P, *et al* in 2018¹².

According to maternal demographic characteristics, 18.7% mothers of malnourished children were illiterate compared to 10.7% mothers of well-

nourished children. Similarly, maternal illiteracy was found in 14% in the study by Tette EMA, *et al* in 2013¹³, 49.3% in the study by Rai R, *et al* in 2015¹⁰ and 60.9% in the study by Mittal A *et al* in 2018¹⁴. Illiteracy was found more in mothers of malnourished children and higher education was found higher in mothers of well-nourished children. Thus, education of mother significantly influences the nutritional status of their children. According to mother's age, 40% of mothers of malnourished children conceived a malnourished child before 18 years of age. In the study by Tette EMA, *et al* in 2013¹³, 11.1% mothers conceived in the teenage group. Children born at a young maternal age were more prone for malnutrition if mother was also malnourished.

According to mother's occupation, 85.3% mothers of malnourished children were homemakers. In the study by Tette EMA, *et al* in 2013¹³, 37.6% mothers who stayed at home had malnourished children compared to mothers of well-nourished children. Working mother's decision-making power has a strong and positive effect on the nutritional status of herself and their children than mothers who stay at home. The firstborn child of malnourished mothers was also malnourished giving rise to a generational transfer of malnutrition. Proper birth spacing was noticed in mothers of well-nourished children than mothers of malnourished children. Although we did not establish statistical significance in these demographic characteristics it calls for a close link with nutritional services for both mothers and children. On clinical examination, two mothers of malnourished children had signs of vitamin B deficiency.

Association between malnutrition and multiple factors such as parent's education, mother's occupation, mother's age at the time of marriage, birth order, and mother's BMI, have been reported in a study by Moestue H *et al* in 2008¹⁵. Similarly, the International Food Policy Research Institute explored the relationship between women's status and children's nutrition in three developing regions: South Asia, Sub-Saharan Africa, and Latin America and the Caribbean. They summarized that malnourished women will deliver low birth weight babies and this in turn increases the risk of being malnourished throughout their childhood. Finally, malnourished mothers will have low energy levels and reduced cognitive abilities which will effect in inadequate care of their young children¹⁶.

Bhutta *et al.* in 2004,¹⁷ showed underlying determinants of undernutrition such as female illiteracy, poverty, and lack of empowerment of women as major barriers to improvement in

maternal nutrition in South Asia. A study conducted in Bangladesh also confirms that women's education, exposure to media, and domestic decision making play a significant role in the nutritional status of women. Similarly, a study by Ahmed T, *et al* in 2013² showed that poverty, food insecurity, ignorance, lack of appropriate infant and young feeding practices, a heavy burden of infectious illness, and poor hygiene and sanitation are among the factors which are responsible for maternal and child undernutrition in developing countries.

A limitation of our study is that results could not be generalized to the community since the present study was a facility-based study conducted in NRC. We recommend implementing strategies like iron and folic acid supplementation to mothers with anaemia during a hospital stay in NRC and keeping track of Hb status on follow-up. Mothers with underweight should be provided with proper diet and emphasis on health education of mothers in counselling

Conclusions

In this study significantly more mothers of malnourished children were underweight, stunted, anaemic and illiterate compared to mothers of well-nourished children.

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