Original Research

Role of nutrition rehabilitation center and dietary practices of mother associated with malnutrition and anemia among children

Richa Gupta[1], Balkishan Sharma[2]

[1]Department of Food and Nutrition, New Girls Degree College, Indore, Madhya Pradesh, India, [2]Department of Community Medicine, Sri Aurobindo Medical College & P.G. Institute, Indore, Madhya Pradesh, India

ABSTRACT

Background: Malnutrition has acknowledged and well documented. Optimal nutrient intake contributes significantly to malnutrition and anemia. The authors aimed to assess the significance of nutrition rehabilitation center and knowledge of dietary practices of mother to cope with anemia among severely malnourished children. **Materials and Methods:** A prospective observational study was conducted at different Nutritional Rehabilitation Centers (NRCs). 250 severe under five malnourished children (<−3 standard deviation) selected as subjects. 200 subjects were included in the study group who were counseled in nutrition rehabilitation centers while 50 subjects served as control chosen from different slum areas. Study and control subjects were monitored at the time of admissions and after a follow-up of 3 months. **Results:** No significant ($P > 0.05$) difference and association were detected in control. More than half (62.5%) of mothers in the study group has gained knowledge of nutrition after counseling at NRCs and measured with highly significant association between knowledge of mothers regarding nutrition ($P < 0.001$), about growth elements ($P < 0.001$), hemoglobin enhancer element ($P < 0.001$), and feed during birth ($P < 0.001$) with measurements (baseline and final). Moreover, the knowledge of dietary practices of the mother is significantly influenced the malnutrition and anemic status of children impacted the effectiveness of NRCs. **Conclusion:** NRCs have been playing a prominent role to cope with malnutrition along with anemia. Appropriate counseling of mothers in nutrition rehabilitation center about knowledge of nutrition and dietary practices may be provided potentially to prevent malnutrition and anemia among children.

Keywords: Anemia, iron deficiency, malnutrition, micronutrient deficiencies, mother's knowledge, nutrients

INTRODUCTION

Adequate nutrition is critical to child development. Malnutrition is consequently the most important risk factor for the burden of disease in developing countries.[1,2] Nutritional deficiencies and anemia are most serious and are commonly seen in children, may be due to careless dietary habits. The period from birth to 5 years of age is important for optimal growth, health and development. According to estimates from the World Health Organization, two billion individuals suffer from anemia in the world[3] showed an average of 39% stunting in children under five in the developing world.[4]

The state of Madhya Pradesh has the largest number of malnourished children in India. Anemia continues to be a major public health problem worldwide. The highest prevalence of anemia exists in the developing world where its causes are multifactorial, ranging from micronutrient deficiencies such as iron, folate, vitamin B12 to infectious diseases such as malaria and worm infections.[5] Iron deficiency anemia is thought to affect the health of more than one billion worldwide and it is the most common form of anemia in the developing world.[6] Early enteral nutrition improves nutrition indices and outcomes.[7] Due to inadequate consumption of daily food, the children were suffering from protein-energy malnutrition resulting in several childhood illnesses. Effective measures making availability of adequate calories and proteins to all age groups especially to under-five children through the ongoing nutrition programs needs to be ensured.[8] The high rate of anemia in this population is, therefore, insufficient dietary intake of micronutrients,

Corresponding Author:

Dr. Balkishan Sharma, Department of Community Medicine, Sri Aurobindo Medical College & P.G. Institute, Indore, Madhya Pradesh, India. E-mail: bksnew@rediffmail.com. Mobile: +91-9926049820. Fax: 0731-4231010

especially iron.[9] The community nutrition centers have been providing food supplementation and performing growth monitoring of children with protein-energy malnutrition.[10]

Various studies showed the significance of Nutritional Rehabilitation Centres (NRCs) that functioning under Bal Shakti Yojana programme implemented by Government of Madhya Pradesh in collaboration of United Nation International Children's Emergency Fund to prevent malnutrition. Mothers of severely malnourished children had counseled to improve nutritional status of children in these centers. The authors aimed to assess the effectiveness of nutrition rehabilitation center and knowledge of dietary practices of the mother regarding intake and the risk of anemia associated with malnutrition among children.

MATERIALS AND METHODS

A prospective observational study is designed among severely malnourished children admitted to NRCs. The study was conducted at different NRCs and slum area of Indore district. 250 severe under five malnourished children (<−3 standard deviation [SD]) selected as subjects according to WHO standard 2005. 200 subjects were admitted in different NRCs during specified period that included in the study group whose mother were counseled while control consist of 50 subjects chosen from different urban slum area of Indore city who were not admitted in NRCs.

Study and control groups were monitored at the time of admissions and after a follow-up of 3 months. Anthropometric measurements were identified, and a semi-structured questionnaire used to assess the knowledge and dietary practices of the mother. The knowledge of the mother and other parameters of children were re-assessed again after 3 months. The observations for groups, study and control were monitored at the time of admissions in NRCs, treated as baseline observations and after a follow-up of 3 months, treated as final observations and then study group was compared with control group.

Statistical Analysis

The responses of frequencies were analyzed by using statistical software SPSS version 11.0. The descriptive statistics like mean and standard deviation of the data obtained on the ordinal scale were found out. Data obtained on the nominal scale were classified in frequencies and in percentages. The significance of association of frequency distribution of comparative groups has found out by using Chi-square while the difference in mean by using Z-test. The probability value $P < 0.05$ was considered as significant while $P < 0.001$ were considered as highly significant.

RESULTS

The spread of age in the study group was 23.58 ± 12.48 months while in the control group it was 21.22 ± 10.13 months.

The mean height of children in study group was identified 76.20 ± 9.947 cm while 74.86 ± 6.707 cm was in control. The mean difference for study group at baseline and final stage in weight, mid upper arm circumference and weight for height was highly significant ($P < 0.001$) on statistical ground was 0.18 kg, 0.22 cm and 0.12 score respectively while head circumference and chest circumference found statistically insignificant ($P > 0.05$). The control was reported with no significant difference (Table 1).

Table 2 evidenced that at baseline stage 20% children were found moderately malnourished, 48% were severe and 32% were very severely malnourished in control group, but at final stage 12%, 26%, 12% and 50% children were measured with mild, moderate, severe and very severe malnourished. At baseline stage in study group, 3%, 19%, 54% and 24% children were found mild, moderate, severe and very severe category of malnourishment. Mothers of severely malnourished children had counseled to improve nutritional status of children in these centers. The study group at final stage were reported with improved nutritional status as 57% children were normal and 34.5%, 4%, 2.5% and 2% children under mild, moderate, severe and very severe respectively (Table 3).

At baseline, 48% of control subjects measured with moderate anemia while 2% with severe anemia but after follow-up no significant reduction in anemic status. In study group 56.5% children were found normal at final stage and fewer children were detected with moderate (11.5%) and severe (1.0%) anemia in comparison to baseline stage as 25.0% was reported with moderate and 25.5% with severe category of hemoglobin (Table 3).

Table 1: Characteristics of severely malnourished children

Characteristics	Stage	Control (*n*=50)			Study (*n*=200)		
		Mean	SD	P value (LOS)	Mean	SD	P value (LOS)
Weight (kg)	Baseline	6.79	1.58	0.80 (*P*>0.05)*	7.29	1.68	31.08 (*P*<0.001)***
	Final	6.97	1.57		9.49	1.90	
	Difference	0.18	0.01		2.20	0.22	
MUAC (cm)	Baseline	11.76	0.625	1.50 (*P*>0.05)*	11.72	1.008	26.30 (*P*<0.001)***
	Final	11.98	1.134		12.96	1.055	
	Difference	0.22	0.509		1.24	0.047	
Weight for height (Z score)	Baseline	3.12	0.718	0.924 (*P*>0.05)*	2.99	0.743	40.58 (*P*<0.001)***
	Final	3.00	1.125		0.58	0.847	
	Difference	0.12	0.407		2.41	0.104	

*No difference between baseline and final observation. ***A highly significant difference between baseline and final observation. LOS: Level of significance, MUAC: Mid upper arm circumference, SD: Standard deviation

Table 4 shows that the mean difference in hemoglobin level in control was 0.35 g% that confirmed statistically (*P* > 0.05) insignificant while the study group observed with of 2.52 g%, which confirmed strongly (*P* > 0.05) significant on statistical ground. These further showed study and control groups are different as study group served with nutritionally sound diet.

It was identified in Table 5 that in study group after follow-up of 3 months, 62.5% mothers had gained knowledge of nutrition, 78.5% gained knowledge about growth elements, 72.5% were started using iodized salt, 63.5% came to know about hemoglobin enhancer element while only 5% mothers were left in don't know category of tooth eruption element and 84.5% gained knowledge about breast feed at birth. In study group, mother's knowledge of nutrients growth element (*P* < 0.001), uses of salt (*P* < 0.001), hemoglobin enhancer element (*P* < 0.001), tooth eruption element (*P* < 0.001) and feed during birth (*P* < 0.001) was found strongly associated between baseline and after follow-up of 3 months (final) measurements. All variables (of knowledge) in control group found not associated (*P* > 0.05) with mothers knowledge between baseline and after follow-up of 3 months (final) measurements except feed during birth was found associated (*P* < 0.05).

DISCUSSION

The present study showed the significance of NRCs to cope malnutrition and micronutrient deficiencies like anemia among severely malnourished children and association of dietary practices of mother with malnourishment. It is obtained that mother's knowledge regarding dietary practices plays a very vital role to cope with severe malnutrition and anemia. 62.5% mothers in the study group has gained knowledge of nutrition after counseling at NRC's found with strong significant association between knowledge of nutrition (*P* < 0.001) and measurements (baseline and final). Malnourished children experience developmental delays, weight-loss and illness as a result of inadequate intake of protein, calories and other nutrients.

Child survival programs should assign greater priority to the control of childhood malnutrition. Remarkable advances have been made in the hospital management of severely-malnourished children admitted to NRCs in agreement with Colecraft *et al.*[11] suggested that the prominence of street foods in children's diets warrants re-evaluation of the NRC's educational approaches to enhance their responsiveness to caregivers' needs and effectiveness for the continued recuperation of malnourished children at home. The observed mean value of weight for height for study group statistically reported with strongly significant (*P* < 0.001) difference at baseline and final stages showed effectiveness of NRCs. Diagnosing malnutrition in children involves taking a measurement of their weight and height and then comparing it against what would be the expected average height and weight for a child of that age. Blood tests can also be used to measure levels of protein in the blood. Low levels of protein may suggest that a child is malnourished.

It is measured that mother's knowledge regarding dietary practices plays a key role in overall health improvement of under-five children, found with strong significant association between knowledge about growth elements (*P* < 0.001), use of type of salt (*P* < 0.00), hemoglobin enhancer element (*P* < 0.001), tooth eruption (*P* < 0.001), breast feeding at birth (*P* < 0.001) and measurements while there was no significant difference (*P* > 0.05) found in control group after 3 months of observation. Replication of the findings supported by Mwangome *et al.*[12] suggested that it is important to understand the factors, which affect the child health and nutrition knowledge.

Food assistance programs emerged as an important influence on children's dietary adequacy, especially among mothers describing dire economic situations highlighted in the findings of Lindsay *et al.*,[13] Imdad *et al.*[14] found that education of mother about complementary feeding led to an extra weight gain and a gain in height in the intervention group compared to control and these interventions can significantly reduce the risk of stunting in developing countries. Faruque *et al.*[10] obtained that inappropriate infant and young child-feeding practices (breastfeeding and complementary feeding) have

Table 2: Category of malnutrition

Category (Z-score)	Control group (n=50) (%)		Study group (n=200) (%)	
	Baseline	Final	Baseline	Final
Normal (0)	0 (0.0)	0 (0.0)	0 (0.0)	114 (57.0)
Mild (−1SD)	0 (0.0)	6 (12.0)	6 (3.0)	69 (34.5)
Moderate (−2SD)	10 (20.0)	13 (26.0)	38 (19.0)	8 (4.0)
Severe (−3SD)	24 (48.0)	6 (12.0)	108 (54.0)	5 (2.5)
Very severe (−4SD)	16 (32.0)	25 (50.0)	48 (24.0)	4 (2.0)

SD: Standard deviation

Table 3: Anemic status

Hemoglobin g% (category)	Control group (n=50) (%)		Study group (n=200) (%)	
	Baseline	Final	Baseline	Final
≥11 (Normal)	3 (6.0)	7 (14.0)	26 (13.0)	113 (56.5)
9-11 (Mild anemia)	22 (44.0)	14 (28.0)	73 (36.5)	62 (31.0)
7-9 (Moderate anemia)	24 (48.0)	25 (50.0)	50 (25.0)	23 (11.5)
<7 (Severe anemia)	1 (2.0)	4 (8.0)	51 (25.5)	2 (1.0)

The figures in parenthesis denote corresponding %

Table 4: Comparison in hemoglobin status of severely malnourished children

Variable	Level	Control group (n=50)			Study group (n=200)		
		Mean	SD	P value (LOS)	Mean	SD	P value (LOS)
Hemoglobin (g%)	Baseline	9.02	1.11	1.45 (*P*>0.05)*	8.74	2.21	32.09 (*P*<0.001)***
	Final	8.67	1.80		11.27	1.96	
	Difference	0.35	0.69		2.52	0.25	

*No difference between baseline and final observation. ***A highly significant difference between baseline and final observation. LOS: Level of significance, SD: Standard deviation

Table 5: Knowledge and dietary practices of mothers of severely malnourished children of study group

Knowledge of	Indicators	Observations at (%)		P value (LOS)
		Baseline	Final	
Nutrients	Yes	15 (7.5)	125 (62.5)	132.97 ($P<0.001$)***
	No	185 (92.5)	75 (37.5)	
Growth element	Cereal and pulses	60 (30.0)	157 (78.5)	95.24 ($P<0.001$)***
	Fruits and vegetables	46 (23.0)	17 (8.5)	
	Don't know	94 (47.0)	26 (13.0)	
Uses of salt	Non iodized salt	50 (25.0)	19 (9.5)	40.12 ($P<0.001$)***
	Whole salt	67 (33.5)	36 (18.0)	
	Iodized salt	83 (41.5)	145 (72.5)	
Hemoglobin enhancer element	Iron sources	42 (21.0)	127 (63.5)	74.03 ($P<0.001$)***
	Don't know	158 (79.0)	73 (36.5)	
Tooth eruption element	Milk and milk product	46 (23.0)	107 (53.5)	90.74 ($P<0.001$)***
	Honey/gutty	95 (47.5)	83 (41.5)	
	Don't know	59 (29.5)	10 (5.0)	
Feed during birth	Brest feed	85 (42.5)	169 (84.5)	76.11 ($P<0.001$)***
	Honey/gutty	115 (57.5)	31 (15.5)	

***The association is highly significant at the 0.001 level of significance. LOS: Level of significance

been identified as a major cause of malnutrition. Bangladesh is one of the countries with the highest rate of malnutrition. Malnutrition is a broad term which refers to both under nutrition (sub-nutrition) and over-nutrition. Causes of malnutrition are multispectral, embracing food, health and caring practices. Children suffer from under-nutrition if their diet does not provide them with adequate calories and protein for maintenance and growth, or they cannot fully utilize the food they eat due to illness. Malnourished children have a wide range of appearances from ill and emaciated to well but small, depending on the cause. The daily diet of malnourished children at NRCs consisted of therapeutic feeding diets (F-75, F-100 and ready to use therapeutic feed) prepared using locally available foodstuff. Nutritional and medical intervention (antibiotics, de-worming tablets, iron supplementation, and micronutrients) has been provided to the children at NRCs.

The findings of study group in final stage were reported with more normal children who were none at the beginning of the study as 57% children normal and 34.5% under mild (<−1SD) category. After intervention in NRCs, in study group very few, 4%, 2.5% and 2% children were left under mild (<−1SD), moderate (<−2SD), severe (<−3SD) and very severe malnourished (<−4SD) category respectively while there was no significant change is detected in the malnourished categories of control group while in a study, Urke et al.[15] reported with the odds of stunting were significantly lower in children of mothers working at home compared with mothers in professional occupations.

The study conducted by Collins et al.[16] suggested that severe acute malnutrition programs use new, ready-to-use, therapeutic foods. Rao et al.[17] reported in his tribal base study that cereal intake was highest in Bastar (210 g) and Sarguja (193 g) among children 1-3 years old. These areas had higher intake of cereals and millets than the recommended dietary allowances of ICMR. Malnourishment was 11.7% in Sarguja, 23.5% in Bastar, and 26.0% in Jhabua; stunting was respectively 50%, 48%, and 59%. 33.6% in Sarguja, 27.1% in Bastar, and 17.3% in Jhabua were normal based on Waterlow's Classification.

Due to the multifactorial nature of the anemia, an integrated prevention and treatment approach is warranted. Future goals include administration of iron, multivitamins, and zinc supplements, improvements in water and sanitation, and evaluation of the impact of greenhouses on anemia status. A significant rise was measured in follow-up in category of hemoglobin with 56.5% found normal and a decrease in percentage was detected in rest categories. Only 2 (1.0%) children were left in severe category of anemia, highly influenced the effectiveness of NRCs. The findings supported by Choi et al.[18] as a contributor to socioeconomic status, maternal education is important in reducing the risk of anemia and iron deficiency and in increasing children's consumption of animal food sources. Multivariate logistic regression analysis revealed a significant and inverse relationship between the presence of anemia and the level of maternal knowledge found by Bilenko et al.[19] Furthermore, the presence of iron deficiency anemia in infants in southern Israel is inversely affected by the level of maternal knowledge of anemia and adherence to iron supplementation.

Recent research indicates that severe malnutrition along with iron deficiency has important implications, which include less learning ability, behavioral abnormalities, and lower ability to work hard; distraction in learning, lower quality of life, poor appetite and slow growth. Henceforth, it is reported that the severely malnourished children admitted to NRCs found with significant improvement in deficiencies regarding malnutrition, and anemia.

CONCLUSION

Malnutrition is an important global public-health problem. Severely malnourished (−4SD) children has modified the risk of anemia and produce changes in all body parameters, which may affect their well-being. NRCs have been playing a prominent role to cope with malnutrition and anemia along children. Appropriate counseling of mothers in nutrition rehabilitation center about knowledge of nutrition and dietary

practices may be provided potentially to prevent malnutrition and anemia among children.

PEER REVIEW

Double blinded peer reviewed.

CONFLICT OF INTEREST

Nil

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