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RESEARCH ARTICLE

INFLUENCE OF DIET ON THE BODY COMPOSITION OF CHILDREN WITH PEM IN UKHRUL DISTRICT, MANIPUR

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Abstract

Malnutrition in early childhood is always childhood is always the result of numerous factors, and preventive programs have to be individualized. The present study was undertaken to determine the risk factors and intervening factors prevalent that predispose children (4-6years) of age to protein energy malnutrition children of Ukhrul district Manipur. Interview schedule was used to elicit information regarding the demographic profile, socio-economic status, and dietary habits of the children. Anthropometric measurements were recorded and clinical examination was conducted to assess the presence of symptoms protein energy malnutrition. The dietary intake of 100 malnourished children was recorded using the three-day dietary intake, and nutrient intake was calculated. Majority of the undernourished children had typical clinical signs of malnutrition, such as dry and lusterless hair while very few percentages of undernourished children had pale conjunctiva. The mean nutrient intake of the children of all nutrients was less when compared to Recommended Dietary allowance and the decrease is significant at 1% level. Nutrition education program was conducted for the mothers of the children; there was an improvement in the knowledge and awareness of the parents after the nutrition program and this was statistically significant at 1 percent level of significance. It is necessary to educate the mothers of these children on the quantity and quality of food to be given and emphasize the importance of hygiene and sanitation.

INTRODUCTION

Protein energy malnutrition is a public health problem for under developed and developing countries. From 852 million of undernourished estimated by FAO between 2000 and 2002, 815million belonged to under developed countries (Torres et al., 2007). Nearly 150 million children under 5 years in the world and 70-80 million in India suffer from protein energy malnutrition; nearly 20 million in the world and million in India suffer from severe forms of proteins energy malnutrition, viz, marasmus, kwashiorkor, and marasmic kwashiorkor. Early malnutrition and micronutrient deficiencies can adversely affect physical, mental, and social aspects of child's health (Kristanson et al., 2007). Nutrition rehabilitation, psychosocial and psychomotor development of the child should begin in infancy and continue throughout childhood. It should be at all levels, most important being in family, school, community and various intervention programmes, local regional and national(Awolowo, 2006).

Undernutrition increases the case mortality from measles, diarrhea, and other infections diseases. Deficiencies of vitamins A and C have been associated with increased childhood mortality in non-refugee populations. Because malnutrition contributes, greatly, to overall refugee morbidity and mortality, nutritional rehabilitation and maintenance of adequate nutritional levels can be among the most effective interventions (along

with measles immunization) to decrease mortality, particularly for such vulnerable groups as pregnant women, breast feeding mother (Goyet,2004).

Prevention rather than management of malnutrition is very important. For this, food production must be increased and nutrition education must be imparted. Food production can be increased by initiating actions to produce nutrient-rich foods, particularly vegetables and fruits through home, school and community gardens. It is difficult to detect infection clinically as fever and rapid pulse rate may not be present in severely malnourished children. This is attributed to their lowered resistance to infection. Neutrophil function is affected in protein energy malnutrition and could predispose the host to recurrent acute infection (Sachdev and Choudhary, 2004).

Ukhrul District is bounded by Myanmar in the East, Chandel District in the South, Imphal East, and Senapati Districts in the West and Nagaland State in the North. The terrain of the district is hilly with varying heights of 913 m to 3114 m (MSL). The district HQ. Ukhrul is linked with Imphal, the state capital by a NH 150about 84 Km. An Area of 22,000 hectares of the district is under cultivation. Rice, Maize, Potato, Pulse, Cabbage, Leafy vegetable, chillies, Groundnuts etc. are the main agricultural products. Banana, sugarcane, fruits like lemon and orange are also planted. Plantation of cotton is also done for their domestic consumption. Malnutrition varies widely across regions, age gender, and social groups with children under 5 being the worst hit. Protein energy malnutrition is widely prevalent in Ukhrul District Manipur. Maternal malnutrition, geographic and seasonal distribution of food, poverty, large family size, unhygienic living conditions, and lack of maternal knowledge, education, skills, and time are some of the influencing factors affection malnutrition.

MATERIALS AND METHODS

The present design of the study for the survey was ex-post facto design. This study was undertaken to determine the risk factors and intervening factors prevalent that predispose children (4 -6 years) of age to protein energy malnutrition in Ukhrul District Manipur. Five hundred (N= 500) children of the group (4-6years) were randomly selected to study the risk factors prevalent that predispose child protein energy malnutrition. The study was carried out at the ICDS centers, KTL school children and various part of Ukhrul district in Manipur. The interview schedule was administered to the parents to elicit data regarding demographic profile, socio-economic status and dietary habits and anthropometric measurements of the children. Anthropometric measurements were recorded. Clinical examination was conducted with the help of a qualified medical practioner to assess the presence of symptoms of protein energy malnutrition in relation to general appearance, hair, eyes, ear, mouth, tongue, teeth, gums, skin, edema and abdomen. The following parameters were used to assess the nutritional status of the children in the study.

1. **Height**

Height is affected only by longtime nutritional deprivation. It is considered as an index of chronic or long duration malnutrition. The subjects were made to stand as upright as possible without raising the heel from ground and height was measured in centimeters using an inch tape to record the height of the children. It was recorded to the nearest centimeter.

2. **Body weight**

This was assessed using a portable weighting machine. It was caliberated against known weights. Zero error was checked and removed if present. The weight was measured to the nearest 0.5kg.

3. **Mid arm circumference**

The subject's right arm was used for measurement. It was measured by placing gently and firmly the tape between the acromial process of the scapula (bony protrusion on posterior part of upper shoulder) and the olecranon process of the elbow (bony part of the elbow). The mid arm circumference is measured at this mid point, securing tape singly but not so tightly as to make indentation the measurement is recorded accurately to the nearest tenth of a centimeter.

4. **Chest circumference**

Chest circumference was measured using a non- stretchable measurement tape around the chest of the child at the level of the nipple. The reading was recorded in centimeters.

5. **Head circumference**

Head circumference measurements are useful in children younger than 3 years of age, primarily as an indicator of non-nutritional abnormalities undernutrition must be very severe to affect head circumference. With the aid of an assistant the subject's head is held completely still, the tape is placed over the most prominent part of the occiput

and around the forehead, just above the supraorbital frontal areas, above the ears. The tape is tightened and held securely the measurement noted over the forehead. The reading was taken in centimeters.

6. **Clinical Examination**

Clinical examination was conducted on the 500 children to assess the presence of symptoms of protein energy malnutrition in relation to:-General appearance, hair, eyes, ear, mouth, tongue, teeth, gums, skin, edema and abdomen.

7. **Dietary intake**

The dietary intake of 100 malnourished children was recorded using the three-day dietary intake, and nutrient intake was calculated

Checklist for knowledge and awareness of the mothers on nutrition

A checklist consisting of 15 questions was used to ascertain information regarding the knowledge and awareness of nutrition of the mothers of the malnourished children before and after the nutrition education program.

Statistical Design

SPSS version was used to conduct the statistical analysis. For all the statistical analysis a binomial variable was created. Frequency tables and cross tabulations were generated. The statistical significance between the two groups was tested at the 0.5 and 0.01 level and the results were expressed as mean and standard deviation. Pearson chi square and ANOVA tests were conducted.

RESULTS AND DISCUSSION

General Information

1) Age: Results indicate that most of the undernourished and normal children belong to the age group of 6 years. The least percentage of undernourished children (8.5%) was in the age group of 5years. With regard to the association between age and the occurrence of protein energy malnutrition results indicate that there is a significant association at 1% level. Marie, (2003) state that nutrition plays a critical role in the development and growth of children. The requirement of vitamins and minerals remains high as growth and development progresses, insufficient intake can cause impaired growth and result in deficiency disorders.

2) Gender: With regard to gender it is evident from the table 9 that a greater percentage of boys (55.9 %) were undernourished compared to girls. Results indicate that there is no significant association between gender and occurrence of protein energy malnutrition.

3) Number of siblings: Results of the study indicate that 13.3 percent of the undernourished children and 18.7 percent of the normal children have only one sibling. Majority of the children (34 %) are undernourished children and have more than four siblings. Regarding the number of siblings results, greater the number of sibling, higher the protein energy undernourished in the children. A study done by Nakhara et al., (2006) states that higher birth orders are at higher risk of malnutrition. Long term nutritional status is significantly influenced by educational, birth order and food available. Large family size, birth order, food available, parental educational status and household economy had a greater impact on the nutritional status of the children (Delpauch et al., 2000).

4) Type of family: About 84% of the undernourished children were from nuclear family whereas 14 .4 % of the children were from joint family. Result indicate that there is no association between type of family of the children and the occurrence of protein energy malnutrition .A study done by Swami et al., (2000) states that with increase in family size, the prevalence of malnutrition also significantly increased, and decreased with high literacy rate in parents.

5) Full term birth: It is evident in table 1 that a higher percentage of 97.8 percent of the normal children and 97.4 percent of the undernourished children were full term. Full term babies are at a greater advantage than preterm babies; since there weight are more than pre term babies they have high immunity towards diseases making them thus less susceptible to diseases. There is a significant association between birth weight with the occurrence of protein energy malnutrition, this shows that the gestational age is important for the baby's growth and helps prevent malnutrition. The association is significant at 5% level.

6) Birth weight: Results presented in table 1 also indicate that there is a significant association birth-weight with the occurrence of protein energy malnutrition; this shows that the birth weight of a child has an influence on the occurrence of protein energy malnutrition. This association is significant at 5% level.

7) Parents education and income status: educational qualification of fathers with the occurrence of protein energy malnutrition at 1% level. This finding confirms that educational status of the parents plays a role in the occurrence of protein energy malnutrition finding in agreement with the study done by Swami et al., (2000). Regarding parents income, it is evident that majority of the undernourished and normal children are from a family with an average monthly income of 1,250-2,650 rupees. Whereas in the high income group only smaller percentage (11%) of the children father.

Table 1
Association of demographic variable of the children with occurrence of protein energy malnutrition

Particulars			Undernourished Children N=270	Normal Children N=230	Chi-Square	Level of Significance
Age	4years	N	37	66	17.359	0.000**
		%	13.7	28.7		
	5 years	N	23	19		
		%	8.5	8.3		
	6 years	N	210	145		
		%	77.8	63.0		
Gender	Boys	N	151	128	.004	0.951 NS
		%	55.9	55.7		
	Girls	N	119	102		
		%	44.1	44.3		
No. of Sibling	1	N	36	43	4.078	0.253 NS
		%	13.3	18.7		
	2	N	62	50		
		%	23.0	21.7		
	3	N	80	73		
		%	29.6	31.7		
	4	N	92	64		
		%	34	27.8		
Family Type	Nuclear	N	227	185	1.193	0.551 NS
		%	84.1	80.4		
	Joint	N	38	39		
		%	14.4	17.0		
	Extended	N	5	6		
		%	1.9	2.6		
Full term birth	No	N	7	5	.093	0.760
		%	2.6	2.2		
	Yes	N	263	225		
		%	97.4	97.8		
Birth weight	<2.5kg	N	10	7	10.717	0.013*
		%	3.7	3.0		
	>2.5-<3kg	N	205	147		
		%	75.9	63.9		
	>3-<3.5kg	N	51	68		
		%	18.9	29.6		
	>3.5-<4kg	N	4	8		
		%	1.5	3.5		
Key-**= significant at p<0.001, NS=non significant						

Dietary Pattern

Association of meal consumption by the undernourished and normal children with occurrence of protein energy malnutrition in shown in table 2

From table 2 it is evident that majority of the undernourished and normal children were non-vegetarians. More than half (78 %) of the undernourished children, and 74 percent of the normal children consume three meals per day, however the quality of consumed by the undernourished children was inadequate or too little. There is no significant association between the diet pattern and the frequency of meal consumption with the occurrence of protein energy malnutrition.

Table 2

Association of diet pattern and meal consumption of the children with occurrence of protein energy malnutrition

Particulars			Undernourished Children N=270	Normal Children N=230	Chi-Square	Level of Significance
Dietary pattern	Vegetarian	N	14	9	.458	0.499 NS
		%	5.2	3.9		
	Non- Vegetarian	N	256	221		
		%	94.8	96.1		
Meal Frequency	Only one meal per day	N	0	0	4.860	0.088 NS
		%	0	0		
	2 meals per day	N	2	8		
		%	.7	3.5		
	3 meals per day	N	211	172		
		%	78.1	74.8		
	4 meals per day	N	57	50		
		%	21.1	21.7		

Anthropometric Measurements

Table 3 and figure 1 shows the comparison of mean anthropometric measurement of the undernourished and normal children using a one way analysis of variance (ANOVA). It is clear that there was no significant difference in the BMI of the children in both groups. Data regarding to the weight, height, head circumference chest circumference and mid arm circumference revealed that there was a statistically significant less at 1 % level when compared to the median or reference values. Poor of protein and calcium has an impact on the head and chest circumference of malnourished children, it is thus very essential to educate the mothers and prevent the onset of malnutrition (Miller,1999).

Clinical Examination

Figure 2 presents the percent distribution of undernourished and normal according to presence of clinical symptoms of malnutrition. Severe protein energy malnutrition predisposes affected children to various infections, which either worsens their nutritional status or causes malnutrition, hence complicating their management and outcome. (Sunguya et al., 2006). Children with protein energy malnutrition lose their resistance to infections because of a disordered immune system. Undernutrition can be attributed as the major reason for nutritional anemia (Suganya and Estherlydia, 2013). Changes in eating behavior could have potentially affected the iron bio-availability (George et al., 2000). Majority of the undernourished children had typical clinical signs of malnutrition, such as dry and lusterless hair while very few percentages of undernourished children had pale conjunctiva. Majority of both undernourished and normal children had dental caries.

Table 3
Analysis of variance in anthropometry measurements among various age groups

		Sum of Squares	df	Mean Square	F	Sig.
BMI	Between Groups	6.541	2	3.270	1.711	0.182 ^{NS}
	Within Groups	950.142	497	1.912		
	Total	956.683	499			
Weight	Between Groups	3965.223	2	1982.611	261.157	0.000 **
	Within Groups	3773.042	497	7.592		
	Total	7738.264	499			
Height	Between Groups	33552.558	2	16776.279	487.787	0.000**
	Within Groups	17093.152	497	34.393		
	Total	50645.710	499			
Head circumference	Between Groups	397.552	2	198.776	18.606	0.000**
	Within Groups	5309.771	497	10.684		
	Total	5707.324	499			
Chest circumference	Between Groups	777.072	2	388.536	23.418	0.000**
	Within Groups	8245.740	497	16.591		
	Total	9022.812	499			
Mid arm circumference	Between Groups	54.947	2	27.473	10.211	0.000**
	Within Groups	1337.230	497	2.691		
	Total	1392.177	499			
Key-**= significant at p<0.001, NS=non significant						

Nutrient Intake of The Children

As growth during infancy is rapid, meeting the nutritional requirements is very important. Nutritional requirements for infants is based on the composition and intake of breast milk of well nourished population combined with the contribution from supplementary foods introduced around 4-5 months of age as mothers milk alone is adequate after that. Table 4 shows the mean values of the nutrient intake of protein energy undernourished children compared with the Recommended Dietary Allowance

It is clear that the mean nutrient intake of energy, protein and iron, were 1037.67 kcal, 16.04 g and 4.61 mg respectively. Whereas the Recommended dietary allowances of energy, protein and iron were 1600kcal, 25 g and 18mg according to National Institute of Nutrition, 2003. The mean nutrient intake of the children of all nutrients was less when compared to Recommended Dietary allowance and the decrease is significant at 1% level. Inadequate growth in poor countries is generally the consequences of low nutrient intake, especially inadequate energy and protein intake ,relative to nutritional requirements.

Table 4
Mean nutrient intake of the undernourished compared children with the Recommended Dietary Allowances

Nutrients	N	Mean	RDA	S.D	't' value	Level of Significance
Energy (kcal)	100	1037.67	1600.00	234.78	-23.95	0.00**
Fat (g)	100	13.18	30.00	4.62	-36.42	0.00**
Protein (g)	100	16.04	25.00	5.01	-17.88	0.00**
Carbohydrate (g)	100	192.97	340.00	32.46	-45.30	0.00**
Calcium (mg)	100	271.03	400.00	82.24	-15.68	0.00**
Iron (mg)	100	4.61	18.00	1.66	-80.74	0.00**
Vitamin A (mg)	100	237.44	400.00	84.14	-19.32	0.00**
Vitamin C (mg)	100	6.40	40.00	3.39	-99.11	0.00**
Thiamine (mg)	100	0.15	0.90	0.11	-70.11	0.00 **
Key- **= 1 % significant						

Correlation Analysis

Correlation between the Nutrient intake and the Anthropometric measurements of the undernourished children.

The correlation of nutrient intake revealed that, there was a statistically significant correlation at 1% level for the protein and fat intake with weight and height of the children.

Table 5

Correlation between nutrient intake with anthropometric measurements of the undernourished children

Measurement	Energy	Protein	Fat	Fiber	Calcium	Iron	Vitamin A	Vitamin C	Thiamine
Weight	-.066	**-.277****	**-.262****	-.037	**-.219***	-.149	-.181	-.027	.061
Height	-.021	**-.231***	**-.235***	-.047	-.183	-.111	-.134	-.053	.089
BMI	-.100	-.157	-.144	.027	-.135	-.103	-.153	.051	-.017
Head circumference	-.095	-.144	-.087	-.050	-.105	**-.200***	.005	-.053	.115
Chest circumference	-.050	-.051	-.059	-.080	-.103	-.176	.069	-.022	.128
Mid arm circumference	-.125	-.115	-.044	.014	-.153	-.172	-.017	-.069	**.200***
Key- *= 5% significant, **= 1 % significant									

Nutrition education program

The nutrition education sessions were designed so that common nutrition topics such as spreading awareness among the mothers of the malnourished children about protein energy malnutrition, deficiency diseases and dietary modifications. Knowledge and awareness of the mothers before after the nutrition education program is presented in table 6

We observed that the mean score obtained by the parents of the undernourished children before nutrition education was low. The increase was significant improvement in awareness and knowledge at 1% level after the conduct of the nutrition education programme. Nutrition education is important in the children, because lifetime food habits are established during childhood, teaching good nutrition at this stage influence children permanently. Effective nutrition education should help children to choose a healthy diet through the establishment of positive dietary practices and habits Nutrition knowledge is one of the factors that could influence an adolescent's eating behavior Nutrition education shares many of the key goals of other health education content areas such as responsibility for one's health (Fiona, 2004).

Table 6

Comparison of mean pre-test and post-test value on Awareness of mothers of the undernourished children

Nutrition Education Programme		Mean	S.D.	S.E.	't' value	Level of significance
Awareness	Before the education programme	5.21	1.09	0.11	31.026	0.000**
	After the education programme	8.2	0.53	0.05		
Knowledge	Before the education programme	3.00	0.75	0.07	40.402	0.000 **
	After the education programme	5.75	0.47	0.04		
Key -** significant at p<0.001						

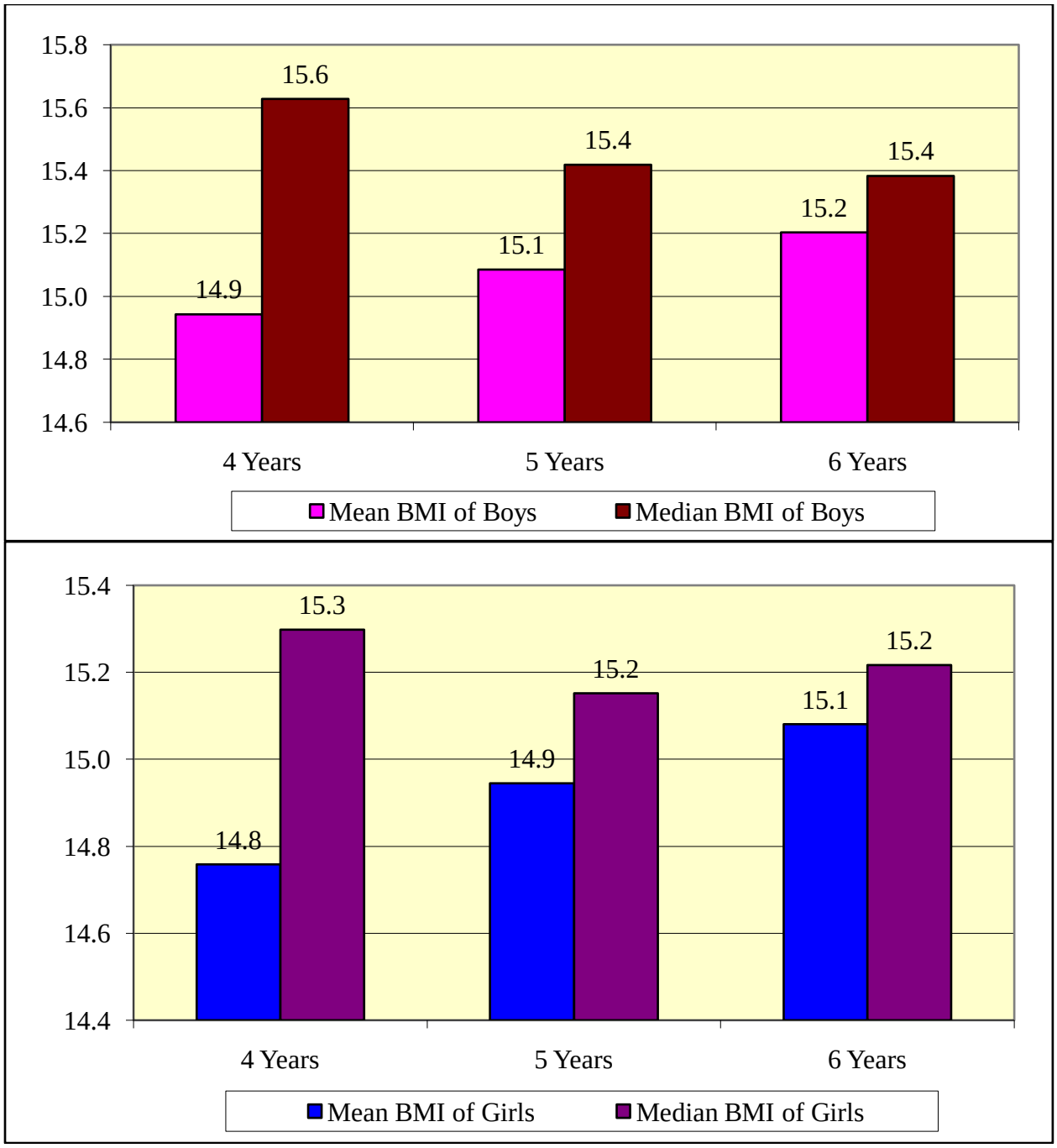

Figure 1: Mean vs. Median Body Mass Index of the Children

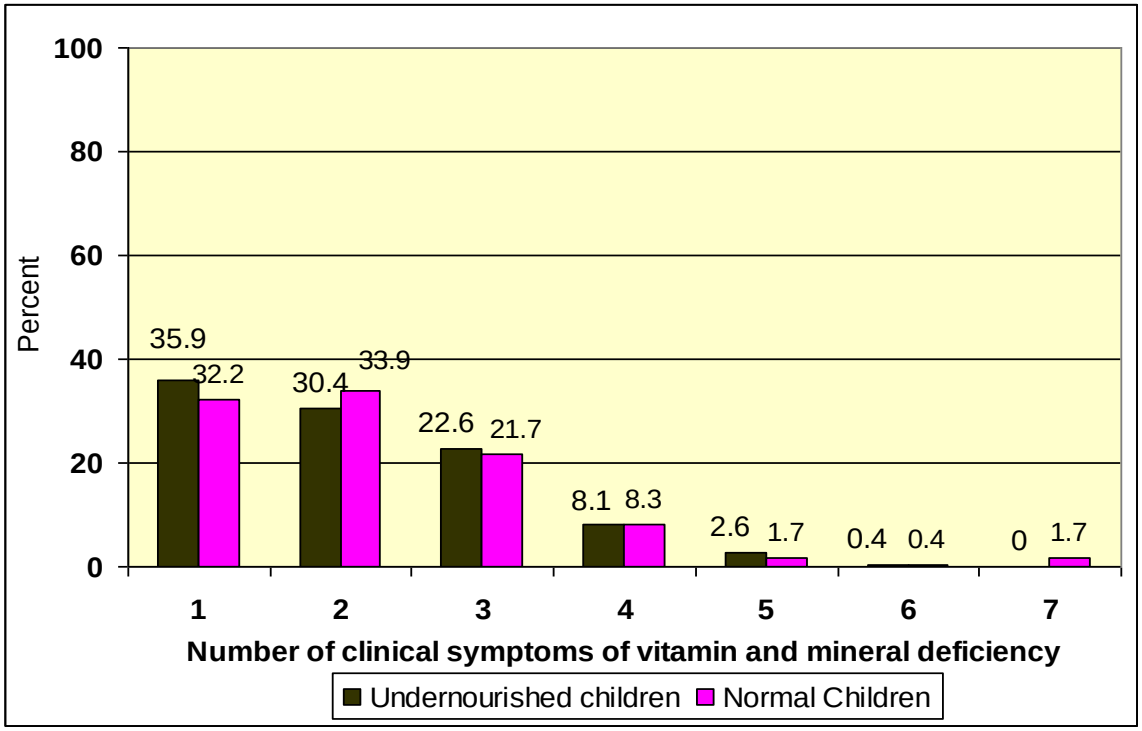

Figure 2 Percent distribution of the children according to presence of clinical symptoms

CONCLUSION

Malnutrition is highly prevalent among the children of 4-6 years in Ukhrul district Manipur, it is necessary to educate the mothers of these children on the quantity and quality of food to be given and emphasize the importance of hygiene and sanitation. Since only a small area was covered in this study, it is highly necessary to extend this nutrition program to all the surrounding areas where the incidence of protein energy malnutrition is high.

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