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A Cross-Sectional Study on Anthropometrical Parameters and their Correlation with Sociodemographic Factors Amongst Malnourished Children belonging to Urban and Rural Areas of North Maharashtra Region

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ABSTRACT

Malnutrition is the most widespread condition affecting the pediatric age group in India. Malnutrition refers to deficiencies or excesses or imbalances in a person's intake of energy and/or nutrients. Malnutrition is broadly categorized into two groups as under nutrition and over nutrition. Under nutrition mainly includes Protein Energy Malnutrition and Micro nutrient deficiencies. Over nutrition includes overweight (BMI >25) and obesity (BMI >30). We have studied the distribution of malnourished children into different categories of malnutrition in urban and rural regions of Dhule district. We have also studied anthropometric parameters, BMI and age and gender wise distribution of these children. Study subjects included in this study were malnourished children attending the OPD and IPD of pediatric department of Shri Bhausaheb Hire Government Medical College Dhule, Child Health Centers (CHC) at Urban Health Centers, Nutritional Rehabilitation Centre(NRC) and leading private hospitals in Dhule district. Detailed case history was taken and diagnosis was confirmed based on their anthropometry parameters and Body Mass Index (BMI) calculations including radiology and laboratory investigations. The parents of each study subject were well informed and their written consent was obtained. This study was ethically approved by the Institutional Ethical Committee (IEC) and was done over a period of ten months from December 2023 to September 2024. Total 171 children were included. Most common age group of malnutrition was 1-3yrs followed by infant. We found a female preponderance 102/171 (59.6%) over males 69/171 (40.4%). 102 cases belonged to rural area near Sakri, Shirpur and Nandurbar. All of the rural cases fell under the category of under nutrition. All under nutrition cases were enrolled from govt centers like Child Health Centre, Sakri, GMC Dhule, Nutrition rehabilitation centre, Shirpur. 69 cases hailed from urban area. Out of those 69 cases, 51 fell under the category of under nutrition. All the 18 children with over nutrition hailed from urban area. All the over nutrition cases were from private hospitals in Dhule district. In our study 18 children fell in to over nutrition category, 15 having BMI >2 SD(overweight) and 3 having BMI >3SD (Obesity) . 153 children fell in the criteria of under nutrition based on their anthropometry parameters. Out of 153 under nutrition cases 72 cases were without any associated medical illnesses. Rest 81 cases (52.64%) were having associated medical illnesses. From this study we conclude that malnutrition in children is the indicator of poor health in rural area. Over nutrition is seen in urban areas. Most common age group of malnutrition was 1-3yrs and was predominant in female (59.6%) than males (40.4%). Under nutrition was seen in low socioeconomic strata as compared to obesity which is seen in well to do families. Also under nutrition was more commonly seen in tribal population than non tribal. Various Government schemes are launched to overcome the problem of malnutrition as Integrated Child Development Scheme (ICDS), Mid Day Meal program etc. So people should utilize these Government Schemes. Government should spread awareness about these schemes and should take the measurement to improve the living conditions and socioeconomic conditions in rural area.

OPEN ACCESS

Key Words

Malnutrition, over nutrition, protein energy malnutrition (PEM), obesity, severe acute malnutrition (SAM)

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INTRODUCTION

Malnutrition is the most widespread condition affecting the pediatric age group in India. Scarcity of suitable food, poverty, illiteracy, improper family planning and various traditional beliefs and taboos about the baby's food many a times lead to imbalanced diet ultimately resulting in malnutrition[1]. It was estimated in one of the study that 45% of the children who died before the age of 5 years were found to have malnutrition as underlined factor and 80% of newborn mortality occurs in babies who are of low birth weight. At present, in India, 37.5% of children under 5 years of age are underweight, of these, 7.5% have moderate to severe wasting and 38.4% have moderate to severe stunting[1].

Definition: Malnutrition refers to deficiencies or excesses or imbalances in a person's intake of energy and/or nutrients. Malnutrition is broadly categorized into two groups. One is under nutrition which includes stunting (low height for age), wasting (low weight for height), underweight (low weight for age) and micro nutrient deficiencies or insufficiencies (a lack of important vitamins and minerals). The other category is over nutrition which includes overweight, obesity and diet related non communicable diseases.

Various Forms of Malnutrition are as Follows:

Under Nutrition: It is categorized into following types.

Protein Energy Malnutrition (PEM): PEM can be further classified into severe acute malnutrition (SAM) and moderate acute malnutrition (MAM) categories. It is characterized by insufficient intake of both protein and calories. It includes conditions like Kwashiorkor and Marasmus.

- **Kwashiorkor:** There is inadequate protein intake and low concentration of essential amino acids. They have low protein/energy ratio. The main signs and symptoms are: oedema, wasting, liver enlargement, hypoalbuminemia, steatosis and depigmentation of hair and skin.
- **Marasmus:** It is caused by inadequate intake of both protein and energy. It is due to deficiency of all macro nutrients: carbohydrates, fats and proteins. It manifests in the form of severe cachexia, with weight loss. The main signs and symptoms are: failure of weight gain, minimal subcutaneous fat, severe muscle wasting, various skin and hair changes and low serum albumin levels.

Micro Nutrient Deficiencies: Lack of essential vitamins and minerals such as Vitamin A, Iron, Iodine and Zinc leading to conditions like Iron deficiency anemia, Vitamin A deficiency and Goiter.

Hidden Hunger: Micro nutrient deficiencies despite adequate calorie intake. It leads to impaired cognitive functions and academic performance. Increased morbidity and mortality due to weakened immune system and maternal and child heath complications. Consequences of under nutrition are stunted growth and development, increased susceptibility to infections, delayed wound healing and organ dysfunctions, increased morbidity and mortality. Due to other systemic illnesses.

Over Nutrition: Excessive intake of calories leading to obesity and metabolic disturbances like diabetes. It can lead to limitation on physical activities of the child, negative psychological impact including low self esteem and depression. It is of following types:

Obesity: It is defined as an abnormal growth of the adipose tissue. Obesity is often expressed in terms of Body Mass Index (BMI). Overweight is usually due to obesity but can arise from other causes such as abnormal muscle development or fluid retention. Once considered as high income country problem, obesity is now rising in the low and middle income countries, particularly in urban settings. Childhood obesity is associated with a higher chance of obesity, premature death due to metabolic syndromes and disability in adulthood (IHD and Strokes etc). It is also associated with future risk of increased breathing difficulties, increased risk of fractures, hypertension and early markers of cardio-vascular disease, insulin resistance and psychological effects. Consequences of obesity are Hypertension, Hyperlipidemia, Glucose intolerance, Coronary heart disease, type II diabetes and renal failure[2].

Metabolic Syndrome: It includes insulin resistance, dyslipidemia, joint problems, musculoskeletal disorders. Malnutrition can also be classified as[3,4]:

Acute Malnutrition: Rapid onset of severe nutritional deficiency often due to crisis and food shortages. Consequences are:

- Severe health complications such as organ failure and respiratory infections.
- Impaired physical and cognitive development in children.
- Increased mortality risk without timely interventions.

Chronic Malnutrition: Long term inadequacy of nutrition. Consequences are:

- Stunted growth and cognitive impairment.
- Reduced productivity and earning potential in adulthood

- Inter generational cycle of malnutrition perpetuated by maternal and child health complication.

We have studied the age, gender wise distribution, BMI and anthropometric measurement of undernourished children along with their clinical diagnosis in different categories belonging to rural and urban regions of North Maharashtra's Dhule District in both Government and private set up.

Aims and Objectives:

Aims: To study the distribution of malnourished children in to different categories of malnutrition belonging to rural and urban regions of North Maharashtra's Dhule District.

Objectives:

- To study the age and gender wise distribution of malnourished children.
- To measure the anthropometric parameters of malnourished children.
- To measure the BMI of malnourished children.

MATERIALS AND METHODS

The study subjects included in present study were malnourished children attending the OPD and IPD of Pediatric Department of Shri Bhausaheb Hire Government Medical College Dhule along with CHC, Sakri and NRC, Shirpur and leading Private hospitals in Dhule District. The parents of each study subject were well informed and they gave written consent. This study was ethically approved by IEC of Shri Bhausaheb Hire Government Medical College, Dhule and was done over a period of ten months from December 2023 to September 2024. In this study total 171 malnourished children were included. Various parameters like height, weight, head circumference, mid arm circumference, BMI were taken into consideration to assess the status of malnutrition. All available clinical records and laboratory investigations were also taken into account for confirming diagnosis.

RESULTS AND DISCUSSIONS

Table 1: Distribution of Number of Cases According to Different Age Groups

Age	No. of cases	% of cases
Infant(<1yr)	21	12.3
1yr-3 yrs	105	61.4
3yrs-6 yrs	33	19.3
6yrs-9yrs	9	5.2
9yrs-12yrs	3	1.8
Total	171	100

Total 171 participants were included. Most common age group of malnutrition was 1-3yrs followed by infant. Poor socioeconomic conditions, poor weaning practices, scarcity of food, lack of education and non accessibility to government health services and schemes were the contributing factors.

Table 2: Sex Distribution of Cases According to Various Age Groups

Age	Male	Female
Infants	12	9
1yr-3 yrs	27	78
3yrs-6 yrs	24	9
6yrs-9yrs	6	3
9yrs-12yrs	0	3
Total(171)	69	102

We found that malnutrition was predominant in female 102/171 (59.6%) and in males it was 69/171 (40.4%).

Table 3: Distribution of Cases as Urban and Rural Region

Region	No. of cases
Rural	102
Urban	69

102 cases belonged to rural area near Sakri, Shirpur and Nandurbar. All of the rural cases were categorized as under nutrition. All under nutrition cases were enrolled from government centres like Child Health Centre Sakri, GMC Dhule, Nutrition rehabilitation centre Shirpur. 69 cases hailed from urba area. Out of that 51 cases were belonging to under nutrition, most of them from urban slum areas and poor socioeconomic conditions. All the 18 over nutrition children hailed from urban area. All the obesity cases were from private hospitals in Dhule and they were from well to do families and affluent societies.

Table 4: BMI of Cases

BMI	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-20	20-25	>25	Total
Infant	3	3	6	3	3	3					21
1yr-3 yrs		6	21	36	33	3	6				105
3yrs-6 yrs		6	6	9	3	3	3	3	3	3	
6yrs-9yrs										9	9
9yrs-12yrs										3	3
Total	3	15	33	48	39	9	6	3	3	12	171

In our study 18 children fell in to overnutrition category having BMI >2SD. 153 children fell in the criteria of undernutrition having BMI <2SD.

Table 5: Head Circumference of Under Nutrition Cases

Head Circumference.	No. of cases
Normal to within 2 SD	51
<2 SD	102

Above table shows the undernutrition has negative effect on Brain growth. Out of 153 undernutrition cases only 51 cases showed head circumference normal to their age.

Table 6: Distribution of Children on Measurement of Mid Arm Circumference (MAC) of Cases

Mid arm circumference (MAC)	No. of cases
>13.5 cm	18
< 12.5 cm	102
< 11.5 cm	51
Total	171

We found that out of 18 over nutrition cases, 15 had MAC in median range. 3 obese cases had MAC >2SD. All the under nutrition cases had MAC below normal. 102 cases had MAC below 12.5cm and cases had MAC

<11.5cm, All the under nutrition cases were hailing from low socioeconomic strata and having poor educational background. Out of 171 cases 144 cases were residing at home having 2 rooms or less. Rest 27 cases were residing at home having 3 rooms or more. Out of 171 study subjects, 48 cases were having Pucca house. Rest 133 cases were having Kuccha house.

Table 7: Clinical Diagnosis and Distribution of Cases

Clinical Diagnosis	No. of cases
SAM without any associated medical illness	72
Overweight	16
Overweight with hypothyroidism	2
SAM with Severe Anemia	27
SAM with SA With Beta Thalassemia Trait	3
SAM with bronchopneumonia	12
SAM with AGE	7
SAM with AGE with dehydration	6
SAM with AGE with pneumonia and pleural effusion	3
SAM with Tuberculosis	5
SAM with Kwashiorkar	3
SAM with convulsions	3
SAM with Bronchiolitis	6
SAM with LRTI with septicemia	3
SAM with thrombocytopenia	3
Total	171

Above table shows that undernutrition is major risk factor for systemic illness.

Table 8 : Distribution of Under Nutrition Cases

Sr No	Type of undernutrition	No of cases
1	SAM	51
2	MAM	102
Total		153

In our study we found that under nutrition was more common in age group 1-3 yrs followed by 0-1yrs. Our results are comparable with a study by Sahu et al showed that the prevalence of under nutrition among under five children was high[5]. This might be due to lack of knowledge of importance of breast feeding or misconception about weaning of children. So it is clear that first 3 yrs of life are more vulnerable for malnutrition and its related complications. So more care should be given to these age group children to reduce malnutrition cases. Malnutrition was more prevalent in female(59.6%) as compared to male. India is still a male dominant country and still more attention regarding the food is given to male member of family. This might be reason for female predominance in this study. Under nutrition was the most common form of malnutrition (89.48%). Obesity was seen in 18 cases (10.52%). All the cases of under nutrition belonged to low socioeconomic strata. A large study done on malnutrition in children in India also shows that the burden of malnutrition was disproportionately concentrated among poor children[6]. A study done on Indian preschool children showed a significant difference in growth and nutrition status in rural-urban population[7]. All the cases of obesity were from private Hospitals in Dhule. When inquired about their diet habits, tendency to eat junk food, high calorie foods, lack of exercise and sports activities, use of mobiles and prolonged watching television were noted. Eating while watching television may cause excessive eating causing obesity. Out of 153 undernutrition cases 72 cases were without any medical illness. Rest 81 cases (52.64%) were showing associated medical illness. This shows that undernourished children are more prone to infections and complications. Severe malnutrition is a major factor causing influence on metabolic and organ function as well as children's overall growth. About one 1/3rd of deaths of under five children are contributed by malnutrition[8,9]. Only 3 cases in obese showed hypothyroidism. Parental knowledge and education on malnutrition plays important role in prevention of malnutrition[10].

CONCLUSION

At the end we conclude that Malnutrition in children is the indicator of their poor health. Most common age group of malnutrition was 1-3 yrs followed by infant. Malnutrition was more prevalent in female(59.6%). Under nutrition was seen in low socioeconomic strata as compared to obesity. Also Under nutrition was more commonly seen in tribal population than non tribal. Various govt Schemes like Integrated Child Development Services (ICDS), National Health Mission (NHM), Mid-Day Meal Scheme, Indira Gandhi Matritva Sahyog Yojna (IGMSY), National Nutrition Policy 1993, Pradhan Mantri Matru Vandana Yojana are launched to overcome the problem of malnutrition. So people should take optimum use of Govt Schemes to overcome malnutrition and help these children for their growth and well-being which will ultimately help to build future of our nation.

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