NUTRITIONAL STATUS ASSESSMENT USING WHO Z-SCORES (BMI FOR AGE) IN CHILDREN AGED 6-15 YEARS – A STUDY FROM CENTRAL INDIA

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ABSTRACT

Introduction: National family health survey (NFHS)-3 conducted in India recently has not reported on nutritional status of children in 6 -15 years age group. So this study was carried out to assess the nutritional status of the children aged 6- 15 years of age using WHO z-score for BMI for age and its socio-demographic correlates in urban area of Bhopal, Madhya Pradesh.

Methodology: Cross sectional study was carried out among children of 6-15 years age group residing in field practice area of urban health training centre (UHTC) of a medical college in Bhopal.270 children were enrolled in study 54 children were selected from each one of the five localities catered by UHTC. Data was collected with the interview technique followed by anthropometric measurements by door to door survey.

Results: The prevalence of under nourishment was 51.1% with prevalence of thinness 37.4% and of severely thin 13.7%. Variables such as sex, age, education of mother, occupation of mother, Education & occupation of father, number of siblings were found to be significant on bivariate analysis. When controlling for other variables, sex, Education of mother and occupation of mother were found to be significant and other variables lost their significance on binary logistic regression analysis.

Conclusions: Sex, Mothers education and occupation were some of the correlates which are significantly related with nutritional status of children in 6-15 years age group.

Key-words: Malnutrition, Z-scores, BMI for age, 6-15 years

INTRODUCTION

The World Bank estimates that India is ranked 2nd in the world of the number of children suffering from malnutrition, where 47% of the children exhibit a degree of malnutrition.[1] The prevalence of underweight in children in India (48 percent) is almost twice as high as the average prevalence for the 26 sub-Saharan African countries that have similar data (25 percent).[2]

Under nutrition is caused by inadequate energy and nutrients which have a variety of poor outcomes including growth retardation, nutritional anemia, poor scholastic performance and impaired cognitive development and learning. Waterlow reported that linear growth retardation is multifactorial, but has been explained by three major factors: poor nutrition, high levels of infection and problematic mother-infant interaction,

which is closely related to the socio-economic status of the family.[3]

The school age period is the prime time to build up body stores of nutrients and significant in preparation for rapid growth of adolescence. In this period the emphasis must be given to their high requirements for growth, their eating patterns and their susceptibility to environmental influences.

Nutrition status is determined by variables that range from individual factors (like age, gender etc.) and household variables (mothers education, mothers height, family income etc.) to community specific variables (like provision of health services, etc.). One of the important factors responsible for nutritional status of children is mother's education. Maternal education has a strong inverse relationship with all the measures of nutritional status. A high level of maternal education could lower childhood malnutrition, can lead to increased awareness of healthy behavior, sanitation practices and a more equitable sharing of household resources in favour of the children.[4] Father's education is another important determinant and has a positive impact on child health and nutritional status. Usually father is the main earner and decision maker of a family and so their higher level of education plays an important role to ensure better nutritional status of children.[5]

National family health survey (NFHS)-3 conducted recently has not reported on nutritional status of children in school age group. But for under 5 children the NFHS-3 data show that 48% of children are underweight, and this varies across state ranging from 20% in Sikkim to 60% in Madhya Pradesh. The percentage of underweight children in the country was 53.4 in 1992; it decreased to 45.8 in 1998 and rose again to 48 in 2006.[2]

For assessing the nutritional status anthropometry is one of the important and easy to assess tool, which has become especially important in developing countries. Various measures are calculated using anthropometry including weight for age, height for age, weight for height, BMI for age, etc.

BMI in particular is very useful for approximation in children of school age group. Body mass index is used to assess underweight, overweight, and risk for overweight. Children's body fatness changes over the years as they grow. This is why BMI for children, also referred to as BMI-for-age.[6] The weight-for-stature curve does not show age-related changes while the BMI-for-age chart does show age related changes are more useful.[7]

Since different cutoff values for normality have been used in different systems therefore these cannot be used universally. To overcome this problem World Health Organization has recently recommended the use of Z-score system for classifying malnutrition in children.[8] In the present study an attempt has been made to assess the nutritional status of school children using the Z-score system.

Such data of nutritional assessment is to be gathered from time to time and it is especially important from public health standpoint as it would provide reliable bases for instituting appropriate strategies to identify and combat factors associated with nutritional abnormalities in children and also to monitor the current strategies to combat the malnutrition.

So, this study was conducted to assess the nutritional status of the children aged 6- 15 years of age using WHO z-score for BMI for age and to study some of its socio-demographic correlates in urban area of Bhopal, Madhya Pradesh, the state which has highest proportion of under 5 underweight children in India.

METHODS:

This Community-based cross-sectional study was carried out in field practice area of Urban Health Training Centre (UHTC) of a medical college in Bhopal, Madhya Pradesh. Children of 6-15 years age group were included in this study. The study was carried out between November 2013 and March 2014. UHTC caters the population of 14,597 in its field practice area comprising of five localities namely satnami colony, Indrapuri "c" sector, labour colony, piplani quarters and ramnagar with approximately equal populations.

The sample size was calculated using the prevalence of under-nutrition in Madhya Pradesh (60%) according to NFHS -3[2] and allowable error of 10% using relative precision. The sample size required was 256 but 270 children of 6-15 years of age group were involved in this study. The study sample was obtained using stratified sampling followed by systematic random sampling. In the five localities catered by UHTC, 54 children aged 6 -15 years were selected from each one. Each locality was divided in three parts

with equal population (Approximately). For each part, one house was selected randomly. Starting from this house, every nearest next house was surveyed until 18 study subjects were enrolled for the study. A similar procedure was applied in the remaining parts of the area.

In the study children between completed 6 years of age and up to 14 completed years were included. Study variables included were age, sex, height, weight, BMI, Socio-economic status, mothers education, Fathers education, Mothers occupation, Fathers occupation, No. of siblings, Z- score for BMI for age.

Ethical clearance was obtained from institutional Ethics Committee. The objective of the study was explained to parents or guardians of the children's and informed consent was taken. The data was collected with the help of interview technique using predesigned and pretested questionnaires by house to house visits. The interview was carried out in the local language by the investigators. The detailed history of socio-demography was taken along with present and past illness followed by thorough clinical examination and anthropometric assessment of study subjects. The available health and immunization records were also reviewed. The socio economic status was evaluated using Modified Kuppuswamy Scale (modified for CPI – IW of September 2013)

Anthropometric measurements such as weight, height, were taken using the standard operating procedures. Weight was measured to the nearest 0.1 kg in a standard weighing (bathroom) scale which was standardized time to time during the data collection. Children were instructed to stand on the balance with light clothing and without footwear and with feet apart and looking straight. A stadiometer (measuring rod) capable of measuring to an accuracy of 0.1 cm was used to assess height of the subjects. The subject was made to stand without footwear with the feet parallel and with heels, buttocks, shoulders, and occiput touching the measuring rod, hands hanging by the sides. The head was held comfortably upright with the top of the head making firm contact with the horizontal head piece. Each measurement was done twice and the mean of the two readings was recorded.[9]

For assessing the nutritional status, Z- score of BMI for age was calculated using new WHO growth reference standards separate for boys and girls.[8] Children were categorized as Normal, overweight, thinness and severe thinness according to BMI for z – score.

The definitions used for the study were as follows:

1. Normal: BMI for age z- score of < +1SD to < -2 SD
2. Overweight: BMI for age z- score of > +1SD
3. Obesity: BMI for age z- score of > +2 SD
3. Thinness: BMI for age z- score of <−2SD.
4. Severe thinness: BMI for age z- score of <−3SD.

Statistical Analysis: The data was analyzed using Statistical Package for Social Sciences (SPSS) version 20 and Microsoft Excel. Chi Square test for proportion was used to find out association. Binary logistic regression analysis was also applied.

RESULTS

The data was analyzed according to objectives of the study. Total 270 children in age group of 6-15 years were included, out of which 122 (45.2%) were girls and 148 (54.8%) were boys. Table 1 shows the distribution of various socio-demographic variables according to the nutritional status of children. Among 270 children, 138 (51.1%) were undernourished and 132 (48.9%) were found to had normal nutritional status according to z-score of BMI for age. No child was belonging to overweight or obese category. Among the undernourished children 101 (73.2%) were severely thin and 37 (26.8%) were thin. It was found that proportion of undernourished children was evenly distributed throughout the age group of 6-15 years and it was significantly higher in boys. In the study 147 (54.4%) children were belonging to lower socio economic class while 123 (45.6%) belongs to middle socio economic status. No child was belonging to upper socio economic status. Out of 147 children having lower socio economic status 75 (51.02%) were undernourished as compared to 63(51.2%) undernourished belonging to middle class of socio economic status.

Regarding literacy status of mothers, 26.3% mothers were illiterate while among literate mothers maximum (57.2%) were educated up to middle school level. Maximum, 212 (78.5%) mothers were housewives and undernourishment was significantly higher in mothers who were employed. In this study it was found that 18.1% fathers were illiterate and maximum were educated up to high school.

Table 1: Nutritional status of children according to Socio-demographic profile with bi-variate analysis

Variables	Nutritional Status				χ^2 (df) for Normal (n=132) vs Under Nourished (n=138)@	P value
	Normal (n=132) (%)	Severe Thinness (n=101) (%)	Thinness (n=37) (%)	Total (n=270) (%)		
Sex						
Female	82 (62.1)	38 (37.6)	2 (5.4)	122 (45.2)	29.9 (1)	<0.001*
Male	50 (37.9)	63 (62.4)	35 (94.6)	148 (54.8)		
Age (Years)						
6	10 (7.6)	10 (9.9)	3 (8.1)	23 (8.5)	25.1 (8)	<0.001*
7	7 (5.3)	11 (10.9)	2 (5.4)	20 (7.4)		
8	16 (12.1)	12 (11.9)	2 (5.4)	30 (11.1)		
9	25 (18.9)	4 (4.0)	2 (5.4)	31 (11.5)		
10	4 (3.0)	18 (17.8)	2 (5.4)	24 (8.9)		
11	15 (11.4)	12 (11.9)	7 (18.9)	34 (12.6)		
12	13 (9.8)	13 (12.9)	0 (0.0)	26 (9.6)		
13	17 (12.9)	5 (5.0)	10 (27.0)	32 (11.9)		
14	25 (18.9)	16 (15.8)	9 (24.3)	50 (18.5)		
Education of Mother						
Graduate/ Post Graduate	6 (4.5)	0 (0.0)	0 (0.0)	6 (2.2)	12.8 (5)	0.025*
Intermediate	21 (15.9)	20 (19.8)	0 (0.0)	41 (15.2)		
High School	16 (12.1)	8 (7.9)	14 (37.8)	38 (14.1)		
Middle School	22 (16.7)	27 (26.7)	4 (10.8)	53 (19.6)		
Primary School	37 (28.0)	15 (14.9)	9 (24.3)	61 (22.6)		
Illiterate	30 (22.7)	31 (30.7)	10 (27.0)	71 (26.3)		
Occupation of Mother						
Semi-profession	6 (4.5)	2 (2.0)	0 (0.0)	8 (3.0)	5.341 (1#)	0.021*
Clerical/ShopOwner/Farmer	2 (1.5)	2 (2.0)	3 (8.1)	7 (2.6)		
Skilled Worker	6 (4.5)	17 (16.8)	0 (0.0)	23 (8.5)		
Semi-Skilled Worker	0 (0.0)	6 (5.9)	0 (0.0)	6 (2.2)		
Unskilled Worker	9 (6.8)	5 (5.0)	0 (0.0)	14 (5.2)		
Unemployed/ House-wife	109 (82.6)	69 (68.3)	34 (91.9)	212 (78.5)		
Education of Father						
Graduate/ Post Graduate	15 (11.4)	30 (29.7)	5 (13.5)	50 (18.5)	20.6 (5)	0.001*
Intermediate	37 (28.0)	12 (11.9)	9 (24.3)	58 (21.5)		
High School	27 (20.5)	28 (27.7)	8 (21.6)	63 (23.3)		
Middle School	18 (13.6)	8 (7.9)	6 (16.2)	32 (11.9)		
Primary School	14 (10.6)	4 (4.0)	0 (0.0)	18 (6.7)		
Illiterate	21 (15.9)	19 (18.8)	9 (24.3)	49 (18.1)		
Occupation of Father						
Semi-profession	13 (9.8)	2 (2.0)	0 (0.0)	15 (5.6)	21.4 (4)	<0.001*
Clerical/ShopOwner/Farmer	38 (28.8)	13 (12.9)	10 (27.0)	61 (22.6)		
Skilled Worker	31 (23.5)	20 (19.8)	12 (32.4)	63 (23.3)		
Semi-skilled Worker	6 (4.5)	16 (15.8)	3 (8.1)	25 (9.3)		
Unskilled Worker	44 (33.3)	50 (49.5)	12 (32.4)	106 (39.3)		
Socio- Economic Status						
Upper Middle	12 (9.1)	4 (4.0)	0 (0.0)	16 (5.9)	5.1 (2)	0.08
Lower Middle	48 (36.4)	40 (39.6)	19 (51.4)	107 (39.6)		
Upper Lower	72 (54.5)	57 (56.4)	18 (48.6)	147 (54.4)		
No. of siblings						
0	2 (1.5)	0 (0.0)	0 (0.0)	2 (0.7)	4.6 (1##)	0.03*
1	8 (6.1)	2 (2.0)	0 (0.0)	10 (3.7)		
2	34 (25.8)	26 (25.7)	15 (40.5)	75 (27.8)		
3	73 (55.3)	51 (50.5)	14 (37.8)	138 (51.1)		
4	8 (6.1)	19 (18.8)	8 (21.6)	35 (13.0)		
5	7 (5.3)	3 (3.0)	0 (0.0)	10 (3.7)		

@ 'Sever thinness' and 'thinness' categories were pooled together under single category 'Undernourished' and compared to 'normal' category and chi square was calculated; # Housewife/unskilled v semiskilled/ skilled/ semi profession/clerical/shop owners; ## <2 siblings vs ≥2 siblings; * Significant

Table 2: Crude Odds ratio and Binary Logistic Regression analysis of various variables and nutritional status of children

Variables	Crude OR	B	Adjusted OR	Pvalue
Sex				
Male	4.02 (2.41 - 6.68)	0	4.38 (2.54 - 7.53)	<0.001
Female		-1.508		
Education of mother				
Middle school and higher	0.65 (0.38 - 1.12)	0	0.57 (0.28 - 1.14)	0.113
Illiterate/primary		0.586		
Occupation of Mother				
Semiskilled/skilled/ clerical/ shop owner/professional	2.34 (1.18 - 4.65)	0	3.99 (1.74 - 9.14)	0.001
Unemloyed/housewife/unskilled		-1.251		
Education of Father				
Middle school and higher	1.01 (0.56 - 1.82)	0	0.95 (0.421 - 2.157)	0.909
Illiterate/primary		-0.023		
Occupation of father				
Semiskilled/skilled/ clerical/ shop owner/professional	0.61 (0.37 - 1)	0	0.31 (0.128 - 0.739)	0.008
Unskilled		0.889		
Socio-economic status				
Lower Middle/ Upper Middle	1.008 (0.62 - 1.63)	0	0.942 (0.509 - 1.744)	0.849
Upper Lower		-0.707		
No. of Siblings				
≥ 2	1.105 (-)	0	0.81 (0.426 - 1.534)	0.515
<2	1 (0.663 - 1.84)	1.311	1 (-)	
Constant		-1.703		0

*Significant # factor entered by "Enter Method"

Among fathers, 39.3% were unskilled workers. Undernourishment was significantly higher in children whose fathers were unskilled and semiskilled worker. Majority of children, 258 (95.6%) had >1 siblings and significant relationship found between number of siblings and nutritional status.

Table 1 also shows the bivariate analysis of various variables and nutritional status of children. Variables such as sex, age, education of mother, occupation of mother, Education of father, occupation of father and number of siblings were found to be significant on bivariate analysis.

Table 2 shows crude odds ratio on bivariate analysis. Factors which found significant then entered into binary logistic regression model by "Enter" method (Table 2). When controlling for other variables, sex, Occupation of mother, and occupation of father were found to be significant and other variables lost their significance.

DISCUSSION

Malnutrition was caused by various intervening factors which results in formation of web of causation. Some of the factors were studied in this study. The age group involved in study is 6-15 years of age which was school going age and many changes were occurring in this period re-

garding growth and development of child particularly the pubertal changes also occurring during this phase. In the present study prevalence of under nutrition was found to be 51.1% out of which 73.2% were severely thin and 26.8% were thin. This was quite higher than that observed by Fazili A et al (2012)[10] in a study carried out in North India, who reported overall prevalence of thinness as 29.0%, also they did not find any significant difference between males and females, while our study reported the significant difference between two sexes, with higher prevalence in boys. Similarly lower prevalence of under nutrition was reported by Handa R et al (2008)[11] and Chowdhary S et al (2008)[12]. This difference in prevalence might be due to the higher proportion of individuals belonging to lower socio economic strata in the study. However the prevalence of under nutrition was comparable with results of Mendhi et al (2006)[13] who reported prevalence of 51.8% in males and 56.8% in females and Hasan et al (2011)[14]who reported 58.2% prevalence from Bangalore city.

Mandal S et al (2014)[15] stated overall prevalence of thinness as 43.3% in age group of birth to 14 years of age in a study carried out in slums of Kolkata. Significant higher proportion of underweight in boys as compared to girls (32.3% vs 28.3%) was observed by Shivaprakash N et al

(2014)[16] in a study carried out among school children of 6 – 12 years of age at Mandya Karnataka. In this study variables such as sex, occupation of mother and occupation of father were found significantly related with the nutritional status on multivariate analysis. These findings were similar to those observed by Babar N et al (2010)[17]. Literacy of mother had positive impact on the nutritional status might be due to change in traditional beliefs and attitude towards the health of children which leads to increased awareness and improved practices in them. Father's education might be important as certain health-seeking decisions & household income were influenced by it. Also socioeconomic status might play important role as many practices, seeking and access to health care might be dependent on socio economic status. But in our study it was found insignificant, this may be due to predominant involvement of children from lower and middle socio economic status and no representation from upper socio economic status.

CONCLUSION AND RECOMMENDATION

The present study found prevalence of under nourishment 51.1% with prevalence of thinness 37.4% and of severely thin 13.7%. It was also concluded that undernourishment was significantly associated with sex, occupation of mother and occupation of father. It was significantly higher in male and in children whose fathers were having unskilled occupation or unemployed and in children of working mothers. It is recommended that there is need to improve the maternal literacy as it has influence over the health care seeking behavior and attitude towards health care of children.

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