Original Article

Nutritional assessment of rural children (6–12 years) of north bihar: A cross-sectional study

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ABSTRACT

Objective: Malnutrition is one of the most common causes of morbidity and mortality among children and adolescent throughout the world. The present study was undertaken to assess the nutritional status in terms of the prevalence of stunting and thinness among rural children of North Bihar. **Methods:** The present community-based cross-sectional study was conducted on 1263 rural children (674 male and 589 female) with the age group of 6–12 years, during the period from January 2018 to March 2018. Age was recorded in completed year; height and weight were measured in centimeter and kilogram, respectively. Body mass index (BMI) was calculated using standard equation. **Results:** The nutritional status in terms of the prevalence of stunting and thinness was found to be 18.2% and 23.8%, respectively, among studied children. Stunting was significantly higher among girls (23.1%) in comparison to boys (13.9%). BMI was significantly associated with age, socioeconomic status and mother's literacy. **Conclusions:** Anthropometric assessment indicates that the malnutrition is still a major problem among children (6–12 years) of North Bihar. The major factors identified for this problem is illiteracy of mother and socioeconomic status of the family.

Key words: *Age, Bihar, Body Mass Index, Children, Stunting, Thinness*

In the present scenario, undernutrition is still a major public health problem among children but the cases of overweight and obesity are also increasing. This paradox is very common in developing countries and is found to increase proportionally with time [1]. According to UNICEF data, 90% of developing world's undernourished children live in Asia and Africa, while 40% of the world's malnourished live in India [2]. The problem of undernutrition is higher in rural areas compared to urban areas [3]. The condition of being underweight may have resulted from (a) low dietary intake, (b) excessive workout, and (c) chronic infections [4]. Nutrition plays a vital role in the growth and development of children. Inadequate nutrition may lead to malnutrition, growth retardation, reduced work capacity, and poor mental and social development [5].

There are several ways of measuring nutritional status. Anthropometry is one of the most useful tools for assessment of the nutritional status of children and adolescents. The anthropometric measurements which are often used to assess nutritional status during childhood stages are height-for-age (stunting), weight-for-height (wasting), weight-for-age (underweight), and thinness (body mass index [BMI] for age) [6]. Most of the research work that has been conducted on nutritional status of children is limited to infants and under-five children only. There is a paucity of information on nutritional status of children of 6–12 years particularly from rural areas of Bihar. Keeping this in view, the objective of the present study was to assess the nutritional status in terms of prevalence of stunting and thinness among rural children (6–12 years) of North Bihar.

MATERIALS AND METHODS

This study incorporates secondary analysis of anthropometric measurements of school children aged between 6 and 12 years obtained while carrying out a survey among them for the prevalence of iodine deficiency disorders (IDDs) [7,8]. The present study was a community-based, cross-sectional study conducted in Gopalganj, East Champaran and West Champaran districts of North Bihar from January 2018 to March 2018. Although the primary study outcome was to study the burden of IDD among children, we performed a complete health checkup as part of our study protocol.

Sample Size Calculation

The sample size studied in IDD study was 1263. The study sample had sufficient power to estimate the prevalence of childhood stunting and thinness at 95% confidence interval, with the expected frequency of stunting as 54% and thinness as 49% based on a previous study [9].

Sampling Method

Cluster sampling technique was adopted for the selection of village as a cluster. In assigned districts, block-wise village list was collected for preparing a sampling frame. Three blocks were randomly selected from each district, and from each block, 10 villages were selected assuming village as cluster. From each selected village, 14 households were selected randomly, and from each household, one child of 6–12 years of age group was selected. If in a house a child of desired age group was not present, the neighboring house was selected for the study.

Study Tools

A pre-tested semi-structured questionnaire was used in every household for collecting information. The questionnaire was pre-tested in 20 households in another area not selected for the actual study. The necessary modifications and corrections were made on the questionnaire before it was finally administered in the study area. Sociodemographic details of study participants such as gender, age, education level of parents and their occupation, and socioeconomic status were obtained. The socioeconomic status was assessed using modified BG Prasad classification.

Height was measured by making the child stand upright, barefoot, on the ground with heels, buttocks, and shoulder touching the wall, with the head in Frankfurt plane. The height was measured using a stadiometer calibrated to an accuracy of 0.1 cm. Weight was recorded using a spring balance calibrated to an accuracy of 0.1 kg. From measuring the height and weight of the participants, the BMI was computed. The WHO classifications were used for the assessment of malnutrition. Stunting was defined as the height-for-age z-score <2 standard deviations below the median of reference population. Thinness was defined as BMI below the 5th percentile for age and overweight–obese was defined as BMI above the 85th percentile for age using the NHANES I reference population [10,11].

Method of Statistical Analysis

Statistical analysis was performed by statistical software R. Frequency distribution and percentages were expressed for categorical variables. Median and interquartile range were calculated for height and BMI, and it was compared with the WHO reference values. Kruskal–Wallis test was applied to see the association of height and BMI with increasing age among boys and girls separately. The association between BMI and height for age with various factors was assessed by applying Chi-square test. In all cases, the level of rejection of a null hypothesis was 0.05.

Ethical Issue

The study was approved by the Institute Ethical Committee of Patna Medical College, Patna. Head of the households was informed about the purpose of the study, and written consent was taken from them.

RESULTS

Of 1263 children participated in this study, 674 were male and 589 were female of 6–12 years' age group. The height for age and BMI of children were calculated. The median values of height for age of boys and girls were below the WHO reference median values. The median height significantly increased with age for both boys and girls (p<0.001). The median values of BMI for boys and girls were also below the WHO reference median values. The median BMI significantly increased with age for both boys and girls (p<0.001) (Table 1).

Table 1: Gender and age wise distribution of weight, height, and BMI among study subjects (n=1263)

Gender	Age	Frequency	Height for Age		BMI	
			Median (IQR)	WHO Reference median	Median (IQR)	WHO Reference median
Boys (n=674)	6	97	112.0 (108.0−118.5)	116.0	14.1 (13.5−15.4)	15.3
	7	98	118.0 (113.0−122.0)	121.7	14.2 (13.4−15.0)	15.5
	8	125	123.0 (119.0−123.0)	127.3	14.3 (13.2−14.9)	15.7
	9	94	128.0 (124.0−133.2)	132.6	14.5 (13.3−15.4)	16.0
	10	96	130.0 (127.0−135.0)	137.8	14.6 (13.8−15.7)	16.4
	11	79	134.0 (131.0−142.0)	143.1	14.7 (13.8−16.1)	16.9
	12	85	140.0 (136.0−143.0)	149.1	15.7 (14.4−17.0)	17.5
	p value		<0.001		<0.001	
Girls (n=589)	6	61	110.0 (102.5−115.2)	115.1	14.0 (13.0−15.5)	15.3
	7	74	116.0 (111.0−122.2)	120.8	14.2 (13.1−15.3)	15.4
	8	80	122.0 (118.0−127.0)	126.6	14.3 (13.6−15.3)	15.7
	9	81	124.0 (120.0−129.5)	132.5	14.4 (13.4−15.1)	16.1
	10	127	130.0 (127.0−135.0)	138.6	14.6 (13.2−15.1)	16.6
	11	77	137.0 (131.5−141.5)	145.0	15.0 (13.9−15.9)	17.2
	12	89	141.0 (136.0−145.0)	151.2	15.6 (14.2−16.9)	18.0
	p value		<0.001		<0.001	

BMI: Body mass index

Stunting was defined as the height-for-age z-score <2 standard deviations below the median of reference population. The prevalence of stunting was 18.2%. Stunting was significantly higher among girls (23.1%) in comparison to boys (13.9%). The total prevalence of thinness was 23.8%; it was 24.6% among boys and 22.8% among girls. The prevalence of overweight and obese was 2.4%; it was 2.7% among boys and 2.0% among girls. (Table 2)

The prevalence of stunting was more among girls (23.1%) in comparison to boys (13.9%), and the association was statistically significant (p<0.001). Other factors such as age, religion, category, socioeconomic status, birth order, and father's and mother's literacy were not significantly associated with stunting (Table 3).

As the age increases, the proportion of underweight children significantly increases. In OBC category, 30.2% of children were underweight, while in SC/ST category, they were 28.7%, and in general category, they were 12.6%. Overweight and obese children were more present in general category. Underweight children were more present in lower socioeconomic class in comparison to middle and upper socioeconomic class. Overweight and obese children were more present in upper socioeconomic class (p=0.001). Illiterate mothers had more underweight children than literate mothers (p=0.03). Gender, religion, father's literacy, and birth order were not significantly associated with the nutritional status of children (Table 4).

Table 2: Distribution of stunting and BMI among study subjects (n=1263)

Variables	Boy	Girl	Total	Chi-square value
Height for age				
≤3 SD	22 (3.3)	38 (6.5)	60 (4.8)	18.219 (p<0.001)
−3 SD–2SD	72 (10.6)	98 (16.6)	170 (13.4)	
≥2 SD	580 (86.1)	453 (76.9)	1033 (81.8)	
BMI				
Thinness	166 (24.6)	134 (22.8)	300 (23.8)	1.734 (p=0.784)
Normal	490 (72.7)	443 (75.2)	933 (73.9)	
Overweight	14 (2.1)	9 (1.5)	23 (1.8)	
Obesity	4 (0.6)	3 (0.5)	7 (0.6)	

(The figures in parenthesis denote percentage, SD - Standard deviation). BMI: Body mass index

Table 3: Association of stunting with different factors among study subjects

Variables	Stunted	Normal	Chi-square	p-value
Gender				
Male	94 (13.9)	580 (86.1)	17.64	<0.001
Female	136 (23.1)	453 (76.9)		
Age group (years)				
6–7	68 (20.6)	262 (79.4)	5.31	0.07
8–9	55 (14.5)	325 (85.5)		
10–12	107 (19.3)	446 (80.7)		
Religion				
Hindu	181 (17.6)	849 (82.4)	1.52	0.22
Muslim	49 (21.0)	184 (79.0)		
Category				
OBC	150 (18.8)	648 (81.2)	2.43	0.29
SC/ST	53 (15.7)	285 (84.3)		
Others	27 (21.3)	100 (78.7)		
Socioeconomic status				
Upper	15 (12.1)	109 (87.9)	3.45	0.18
Middle	84 (18.8)	362 (81.2)		
Lower	131 (18.9)	562 (81.1)		
Father's literacy				
Illiterate	101 (17.1)	488 (82.9)	0.84	0.36
Literate	129 (19.1)	545 (80.9)		
Mother's literacy				
Illiterate	168 (18.5)	739 (81.5)	0.21	0.65
Literate	62 (17.4)	294 (82.6)		
Birth order				
2 or less	140 (19.4)	581 (80.6)	1.64	0.20
3 or more	90 (16.6)	452 (83.4)		

(The figures in parenthesis denotes percentage)

DISCUSSION

India has registered impressive improvements in some health indicators such as drop in the fertility rate and reduction in infant mortality rate in the past few decades. However, improvements in nutritional status have been less impressive [12,13]. Apart from overall poverty, the health status of the rural population reflects an inequitable distribution of health resources, low purchasing capacity of foods, and unequal food sharing pattern in the families, making them socially and biologically vulnerable [9]. Undernutrition is an indicator of poor nutrition and poor health of a population. However, there was a paucity of data regarding the nutritional status of children from the rural area of North Bihar.

The prevalence of stunting in the present study was 18.2%. Stunting was significantly higher among girls (23.1%) in comparison to boys (13.9%). Pal *et al*. also reported a significantly higher prevalence of stunting among girls (58.4%) than boys (48.7%) [9]. Similar finding was reported by Mondal and Sen that the prevalence of stunting was higher among female (50.1%) than male children (43.1%) from Darjeeling, India [14]. According to the WHO report on the nutritional status of adolescents, the prevalence of stunting among girls is 45% and that among boys is 20% [15]. The basic reason behind stunting indicates the long-term cumulative inadequacies of health and nutrition and an insufficient intake of nutrients during the early stage of childhood [14]. The higher prevalence of undernutrition among girls is another well-known and accepted fact in almost every Indian community [16,17]. Several studies have already reported the discriminations made against the girls in India [14,18].

In the present study, BMI for age was utilized as an indicator of thinness. The participants of the present study were divided into three nutritional categories, thinness, normal, and overweight-obese, according to the WHO recommended BMI cutoff value for children and adolescents. The WHO expert committee has recommended that BMI is the best indicator for the children to assess thinness [19]. The total prevalence of thinness was 23.8%;

Table 4: Association of BMI with different factors among study subjects

Variables	Underweight	Normal	Overweight/obese	Chi-square	p-value
Gender					
Male	166 (24.6)	490 (72.7)	18 (2.7)	1.266	0.53
Female	134 (22.8)	443 (75.2)	12 (2.0)		
Age group (years)					
6–7	62 (18.8)	256 (77.6)	12 (3.6)	11.396	0.02
8–9	87 (22.9)	287 (75.5)	6 (1.6)		
10–12	151 (27.3)	390 (70.5)	12 (2.2)		
Religion					
Hindu	249 (24.2)	775 (73.3)	26 (2.5)	1.186	0.55
Muslim	51 (21.9)	178 (76.4)	4 (1.7)		
Category					
OBC	187 (30.2)	595 (74.6)	16 (2.0)	21.186	<0.001
SC/ST	97 (28.7)	235 (69.5)	6 (1.8)		
Others	16 (12.6)	103 (81.1)	8 (6.3)		
Socioeconomic status					
Upper	16 (12.9)	100 (80.6)	8 (6.5)	19.217	0.001
Middle	103 (23.1)	336 (75.3)	7 (1.6)		
Lower	181 (26.1)	497 (71.7)	15 (2.2)		
Father's literacy					
Illiterate	154 (26.1)	421 (71.5)	14 (2.4)	3.518	0.172
Literate	146 (21.7)	512 (76.0)	16 (2.4)		
Mother's literacy					
Illiterate	232 (25.6)	656 (72.3)	19 (2.1)	6.622	0.03
Literate	68 (19.1)	277 (77.8)	11 (3.1)		
Birth order					
2 or less	172 (23.9)	532 (73.8)	17 (2.4)	0.011	0.99
3 or more	128 (23.6)	401 (74.0)	13 (2.4)		

(The figures in parenthesis denote percentage). BMI: Body mass index

it was 24.6% among boys and 22.8% among girls. Various studies from different parts of India reported the prevalence of thinness from 9% to 41% [20-22]. The present study revealed that the prevalence of thinness was slightly higher among male (24.6%) than female children (22.8%). Mansur *et al*. also reported that the prevalence of thinness was slightly higher among male (11.25%) than female children (9.27%) in Nepal [23]. A similar trend has been reported by researchers from India [24,14].

In the present study, illiterate mothers had more thin or undernourished children than literate mothers (p=0.03). Women having higher education are more aware of preventive, promotive, and curative health care than that of uneducated or less educated women. Education could be related to increased productivity, better personal hygiene, enable women to make independent decisions, and to have greater access to household resources that are vital for nutritional status [25-27]. Our results were also consistent with this study.

Social class difference too had also found in child undernutrition. The risk of being undernourished was significantly higher among lower social class compared to the upper or middle social class. This may be because availability and accessibility of health-care services in poor and lower socioeconomic group are not in par with the upper class. As the socially backward groups have little exposure to the outside world, they probably stick to their traditional beliefs related to food preparation methods, child care, feeding practices, etc., which have important implications for child nutrition [28].

CONCLUSIONS

The major factors identified for the problem of undernutrition are illiteracy of mother, lower social as well as economic status of family. Government should make policy and programs for upliftment of economically deprived families. Furthermore, it has been seen that child nutrition status has a close connection with the mother's education reflecting again the importance of women empowerment and their educational status.

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