ORIGINAL ARTICLE
pISSN 0976 3325 | eISSN 2229 6816
Open Access Article
www.njcmindia.org

MAGNITUDE OF UNDERNUTRITION IN URBAN AND RURAL SCHOOL-GOING CHILDREN OF DISTRICT DEHRADUN USING WHO REFERENCE STANDARDS

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Financial Support: None declared
Conflict of interest: None declared

How to cite this article:
Bhargava M, Aggarwal P, Kandpal SD, Semwal J. Magnitude of Under nutrition in Urban and Rural School-going children of District Dehradun using WHO Reference Standards. Ntl J of Community Med 2015; 6(4):452-457.

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Date of Submission: 04-08-15
Date of Acceptance: 01-12-15
Date of Publication: 31-12-15

ABSTRACT

Background: Anthropometry is an inexpensive and non-invasive method of growth and nutritional assessment. The objective of the study was to estimate the prevalence of undernutrition among school-going children belonging to urban and rural area of District Dehradun using WHO standards.

Methods: Nutritional assessment of school-going children was done in urban and rural areas using standard anthropometric measurements of height and weight. A total of 1808 school children were enrolled from 5-19 years of age. Weight-for-age, height-for-age and BMI-for-age z-scores were calculated using WHO AnthroPlus Software.

Results: The prevalence of underweight (<-2SD) was 8% in urban as compared to 23% in rural children. The prevalence of stunting and thinness was 14.8% and 6.1% in urban children and 16.6% and 25.9% in rural children. There were 14% urban children and 10% rural children who were overweight.

Conclusion: Undernutrition remains an ongoing health problem in school going children. WHO AnthroPlus Software can be a very useful for analysis of state and national level.

Key words: Undernutrition, School-going Children, Anthropometry, AnthroPlus Software

INTRODUCTION

Undernutrition continues to be an important cause of ill-health and premature mortality and morbidity among children of developing countries.[1] India has high rates of undernutrition and also has a large population, so it contributes to a huge absolute number of undernourished children in the world. More than half of the under-five mortality is attributable to childhood undernutrition as estimated by Child Health Epidemiology Reference Group (CHERG).[2] The problem is significant in the older children as well, with malnutrition in school children being responsible for 22% of the country's burden of disease. [3] The aggregate level of undernutrition in children more than 5 years of age is very high with stark inequalities between states

and among socioeconomic groups. Within the states, those living in rural area at times are worst affected.[4] Another major issue that exists in India is that of discrimination against the girl child with the result that undernutrition affects girls more than boys.[5] Undernutrition in school going girls can have an intergenerational effect. This has been duly recognized and included in the six important thematic areas of Rashtriya Kishore Swasthya Karyakram.[6] In other parts of the world, economic growth has been associated with decline in levels of undernutrition. In India, however, the available evidence suggests that childhood undernutrition has persisted in the current era of economic liberalization.[7]

Anthropometry is an inexpensive and non-invasive method for growth as well as nutritional assessment. It reflects past and present risk with a role in predicting future risk.[8] The current information on prevalence of undernutrition in school children of Dehradun, using WHO criteria is limited. In the present study, with the objective to study the prevalence of undernutrition, we used anthropometric indicators (height-for-age, weight-for-age and BMI-for-age) among the school going children belonging to urban and rural area of District Dehradun using WHO AnthroPlus Software.[9]

METHODS

The present study, a cross-sectional observational survey was done in the urban and rural school-going children aged 5-19 years (class 1 to 12), of district Dehradun from May 2013 to February 2014. To have representation from upper as well as lower socio-economic status, Government and private schools in urban and rural area of District Dehradun which were willing to participate were contacted and explained about the study. Six schools in rural area (rural schools in the area have lesser strength) and four schools in urban area were included. Within each school, one section from each class (class 1 to class 12) was selected by simple random sampling. Within the selected section all children were included in the study. Verbal assent of the participating child was taken after demonstrating and explaining the procedure. A total of 1808 school children from urban (898) and rural (910) areas were enrolled in the study. The study was done with prior approval of Institutional Ethics Committee.

Anthropometric measurements: All anthropometric measurements were done by a single investigator. Weight was done after removing heavy warm clothing, belts and shoes using digital weighing machine with accuracy of up-to 100 grams (Omron® Digital Model: HN 286). The weighing machine was standardized using known weight at regular interval during the study period. Height was done using wall mount, easy-to-use and portable staturemeter with accuracy upto 0.1 cm. Child was made to stand without shoes on a flat surface with the back of head, shoulder blades, buttocks and heels touching the wall and head in Frankfurt plane. Age of the child was taken from school register. The WHO Growth reference for school-aged children and adolescents was used for classifying nutritional status of the participants.[9]

Anthropometric Indicators: The analysis was done using the WHO AnthoPlus software for following indicators[10]:

1. Height –for-age (age range: 5-19 years): measures stunting.
2. Weight-for-age (age range: 5-10 years): Used to assess if child is underweight. This measure is for children upto 10 years, as after that age, weight-for-age is not a good indicator when children experience pubertal growth spurt and can be falsely labeled as excess weight.
3. BMI-for-age (age range: 5-19 years): BMI measured as weight in kilogram divided by height in meter squared. It is a preferred indicator for assessing thinness, overweight and obesity in children 10-19 years.

The cut-offs for classification of nutritional status[11, 12]:

- Weight-for-age z-score (WAZ):-3SD (severe underweight), -2SD (underweight)
- Length/height-for-age z-score (HAZ): -3 SD (severely stunted), -2 SD (stunted)
- BMI-for-age: -3 SD (very thin), -2 SD (thin), -1 SD, +1 SD (overweight), +2 SD (obese)

The data were entered in Microsoft Excel and imported in WHO AnthroPlus Software for analysis. Two tailed z-test applied to calculate difference in mean z-scores using STATA 11.1 (StataCorp LP, College Station, TX); P-value of <0.05 considered as significant.

RESULTS

A total of 1808 school going children, 888 boys and 920 girls, in urban and rural areas were assessed for height and weight. There were 898 children from urban schools of which 528 were from government schools and 370 from private schools. Of these 484 (54%) were girls and 414 (46%) were boys. Similarly, there were 910 rural school children in the study; 442 were from government and 480 from private schools. Of these, there were 436 (48%) girls and 474 (52%) boys. The age range varied from 5 to 19 years of age. The distribution of students from

urban and rural schools within age categories is shown in table 1.

Anthropometric assessment of Urban School Children (Table 2): Weight-for-age (Figure 1(a)): The mean Z-score of weight-for-age of the urban sample (upto 9 completed years) was shifted to -0.81 (SD ± 0.99) compared to WHO reference mean. Eight percent of urban children were underweight (CI: 3.5-12.5) i.e. below -2SD. Here girls were marginally more underweight with their mean Z-score being -0.89 (SD ±0.89) compared to mean z-scores of boys at -0.79 (SD ±1.07) though difference not statistically significant (p>0.05).

Height-for-age (Figure 1(b)): The mean Z-scores were at -0.74 (SD ± 1.22) and 14.8% (CI: 12.4-17.2) of children who were stunted (<-2SD). The mean Z-score of girls was at -0.97 (SD ±1.2) and that of boys at 0.47 (SD ±1.19). There was a statistically significant difference in the mean Z-scores of boys and girls (p value <0.0001 using two-tailed z-test). Also, 20.5% girls were stunted as compared to 8.2% boys.

BMI-for-age (Figure 1 (c)): Since BMI is a composite index of weight and height, and both are correspondingly low in both boys and girls, the mean Z-score for boys (-0.31; SD ±1.22) as well as girls (-0.21; SD ±1.13) was found to be not very far from WHO mean; while combined being at -0.26 (SD ±1.17). The difference in BAZ of boys and girls was not found to be statistically significant (p>0.05). Overall, 6.1% of students were in the category of "thin" with their BMI below -2SD. Also more than 14% of the children were overweight (i.e. >+1SD) of which 3.3% were obese (i.e.>+2SD).

Table 1: Demographic characteristics of study participants

Age group (years)	Urban (n=898)	Rural (n=910)
Boys		
5-9	80 (30.3)	184(69.7)
10-14	267 (60.1)	177 (39.9)
15-19	67 (37.2)	113 (62.8)
All ages (5-19)	414 (46%)	474 (52%)
Girls		
5-9	82 (36.3)	144 (63.7)
10-14	303 (61.0)	194 (39.0)
15-19	99 (50.3)	98 (49.7)
All ages (5-19)	484 (54%)	436 (48%)

*Figures in parenthesis indicate percentages

Table 2: Anthropometric assessment of urban school children

Sex	N (%)	Mean z-scores (SD)	% of <-2SD (95% CI)	Z-test
Weight-for-age z-scores*#				
Boys	80 (49.4)	-0.72 (1.07)	7.5 (1.1-13.9)	P=0.272
Girls	82 (50.6)	-0.89 (0.89)	8.5 (1.9-15.2)	
Both	162	-0.81 (0.99)	8 (3.5-12.5)	
Height-for-age z-scores@				
Boys	414 (46.6)	-0.47 (1.19)	8.2 (5.4-11)	P<0.0001
Girls	474(53.4)	-0.97 (1.2)	20.5 (16.8-24.2)	
Both	888	-0.74 (1.22)	14.8 (12.4-17.2)	
BMI-for-age z-scores$				
Boys	414 (46.6)	-0.31 (1.22)	6.3 (3.8-8.7)	P=0.207
Girls	474 (53.4)	-0.21 (1.13)	6.0 (3.8-8.2)	
Both	888	-0.26 (1.17)	6.1 (4.5-7.7)	

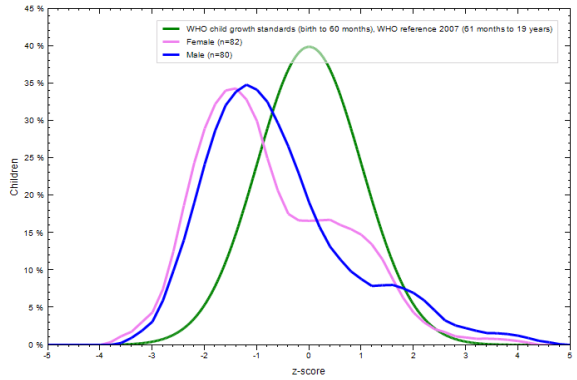
SD: Standard Deviation; CI: Confidence Interval; * Weight-for-age is available for children upto 10 years of age
#<-2SD indicates underweight; @<-2SD indicated Stunted; $<-2SD indicates thin

Table 3: Anthropometric assessment of rural school children

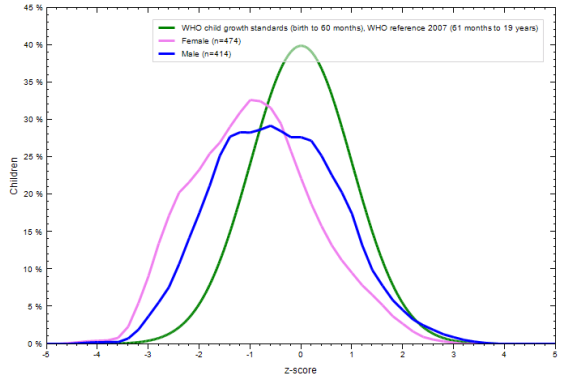
Sex	N (%)	Mean z-scores (SD)	% of <-2SD (95% CI)	Z-test
Weight-for-age z-scores*#				
Boys	184 (56.1)	-0.65 (1.36)	18.0 (12.2-23.9)	P=0.0005
Girls	144 (43.9)	-1.15 (1.23)	31.0 (23-38.9)	
Both	328	-0.87 (1.33)	23.7 (18.9-28.5)	
Height-for-age z-scores@				
Boys	470 (51.9)	-0.5 (1.27)	13.0 (9.8-16.1)	P<0.0001
Girls	436 (48.1)	-1.03 (1.11)	20.4 (16.5-24.3)	
Both	906	-0.75 (1.23)	16.6 (14.1-19)	
BMI-for-age z-scores$				
Boys	470 (51.9)	-0.84 (1.54)	25.3 (21.3-29.4)	P=0.0007
Girls	436 (48.1)	-1.16 (1.31)	26.6 (22.3-30.9)	
Both	906	-0.99 (1.44)	25.9 (23-28.8)	

SD: Standard Deviation; CI: Confidence Interval; * Weight-for-age is available for children upto 10 years of age
#<-2SD indicates underweight; @<-2SD indicated Stunted; $<-2SD indicates thin

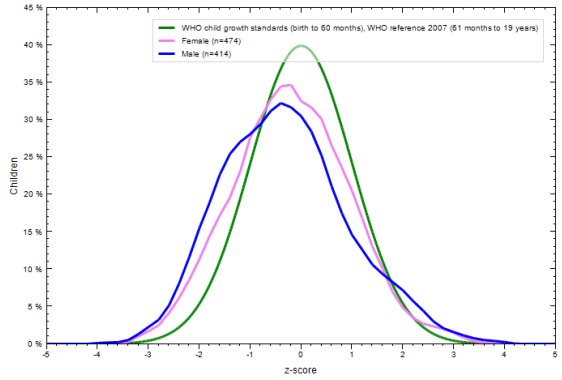
Figure 1: Anthropometric assessment of urban school children



1.a: Weight-for-age Z-scores (urban girls and boys)

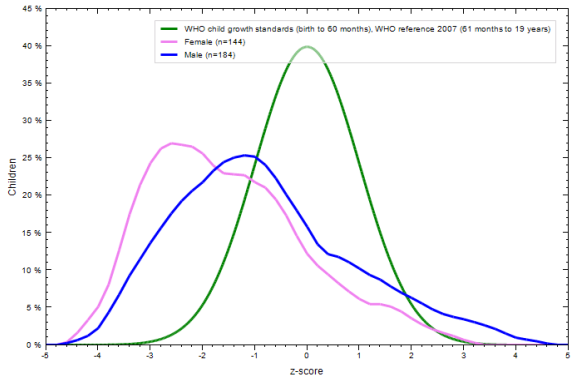


1.b: Height-for age Z-scores (urban girls and boys)

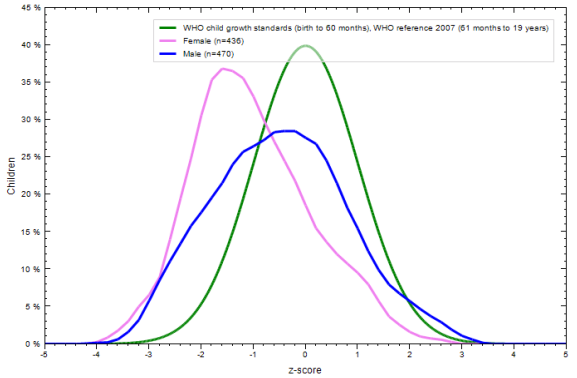


1.c: BMI-for-age Z-scores (urban girls and boys)

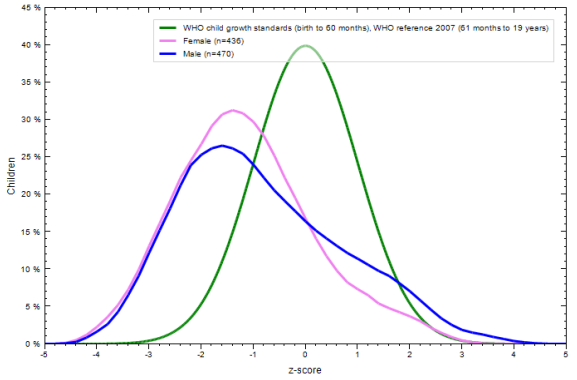
Figure 2: Anthropometric assessment of rural school children



2.a: Weight-for-age Z-scores (rural boys and girls)



2.b: Height-for-age Z-scores (rural boys and girls)



2.c: BMI-for-age Z-scores (rural boys and girls)

Anthropometric assessment of Rural School Children (Table 3): Weight-for-age (Figure 2 (a)): The mean Z-score of weight-for-age of the rural sample (upto 9 completed years) was at -0.87 (SD ± 1.33) compared to WHO reference mean. More than 23% children were under weight (CI: 18.9-28.5). The difference in mean Z-scores between boys (-0.5, SD±1.27) and girls (-1.03, SD ±1.12) was statistically significant (p value < 0.0001 using two tailed z-test).

Height-for-age (Figure 2 (b)): The mean Z-scores were at -0.75 (SD ± 1.23) with mean Z-score of girls being at -1.03 (SD ±1.31) and that boys at 0.5 (SD ±1.27). There were more than 16% (CI: 14.1-22.2) children who were stunted. Here in subgroup analysis maximum stunting was in the age group 15-19 years; more than 30% were less than -2SD. On comparing mean Z-scores of boys (-0.5; SD ±1.27)

and girls (-1.03; SD ±1.12), it was found statistically significant (p value <0.0001 using two-tailed z-test).

BMI-for-age (Figure 2 (c)): The mean Z-score for rural boys was at -0.84 (SD ±1.54) but that of girls was significantly farther from WHO mean, at -1.16 (SD ±1.31). This difference in mean z-scores was found to be statistically significant (p<0.001). There were more than 25 % boys and girls who were thin i.e. <-2SD. There were 10% children who were overweight (>+1SD) of which 3.4% were obese (>+2SD).

DISCUSSION

In the present study, nutritional assessment of school children from age 5 to 19 belonging to urban and rural area of District Dehradun was done using standard WHO cut-offs. It was found that there was a wide range of variation in the overall prevalence of underweight, stunting and thinness. Overall prevalence of underweight (23.7%), stunting (16.6%) and thinness (25.9%) in school children was high in rural areas as compared to urban areas (8%; 14.8% and 6.1%). Although these are high, they are lower than those found in rural area of Baroda district in Gujarat, where there were 70% children who were underweight and 32% stunted.[13] But this study was done only in government schools of the region and it did not include children from high socio-economic status unlike that in the present study. Stunting in the present study was also low as compared to indices in tribal children of Chhattisgarh (50%) and of West Bengal (45.8%).[14, 15] One study indicated that under nutrition in middle-income children aged 6-16 years in Hyderabad was 10-13%, but using NCHS growth standards.[16] In a study in Himalayan villages of Garhwal region, underweight, stunting, and wasting were present in 60.9%, 56.1%, and 12.2% of schoolchildren, respectively.[17]

Assessment of undernutrition in school going children is very important in developing countries like India. School children are not thought of as "at risk" population and little attention is paid to their nutritional assessment, but it is an important intervention point in the life cycle of a person.[18] But at the same time, use of different growth standards can give rise to difference in prevalence of undernutrition.[19] It is important, therefore to follow a single standard for comparability and uniformity in a country.

The present study includes school children from both government and private schools, there is representation of both upper and lower socio-economic class. Therefore the overall percentages of undernutrition are much lower as compared to the other studies. Another possibility that cannot be ignored is of the changing trends in height and weight patterns of developing country like India. It is time to focus on the double edged problem of malnutrition, where there is increasing problem of overweight and obesity alongside the problem of pre-existing undernutrition.[20] This tends to pull the mean indices towards normal but with co-existing extreme situations of undernutrition and overnutrition. This can be seen in our study where it was found that there were 14% children in urban and 10% children in rural schools were more than +1SD and thus overweight.

CONCLUSION

The problem of undernutrition as found in this study is still significant in district Dehradun when assessed using WHO cut-offs. The prevalence of undernutrition in terms of weight-for-age, height-for-age and BMI-for-age was 8%, 14.8% and 6.1% in urban area and 23%, 16.6% and 25.9% in rural area. The difference in mean z-scores for weight-for-age and BMI-for-age did not differ between boys and girls in urban school going children, but height-for-age was better in urban boys as compared to the girls. On the other hand, there is a significant gender difference in anthropometric indices in rural boys and girls in the study population. The rural girls are performing worst according to the present study. There seems to be an emerging problem of overweight in urban school children which needs to be examined more closely using standard cut-offs.

RECOMMENDATIONS

The state of Uttarakhand has School Health Program in place since financial year 2010-11.[21] Presently the school health teams are examining children from class 1 to 8. There is regular anthropometry being done and health cards being issued, although many shortcomings that have been reported.[22] This will be a great opportunity to collect anthropometric information at state level and identify vulnerable districts. WHO AnthroPlus Software is a very useful inexpensive tool for standardized anthropometric assessment of children of all age groups. Authors recommend that it can be used not only for individual child assessment but also for performance of districts and state.

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