
Nutritional assessment among children (under five years of age) using various anthropometric indices in an urban area of district Rohtak, Haryana, India

Vikas Gupta*, Debjyoti Mohapatra and Vijay Kumar

Department of Community Medicine, Pt. B.D. Sharma, PGIMS, Rohtak, Haryana, India

***Correspondence Info:**

Dr. Vikas Gupta

Department of Community Medicine,

Pt.B.D. Sharma, PGIMS, Rohtak, Haryana, India

E-mail: yckg1987@gmail.com

Abstract

Background: Reduction in child malnutrition is another MDG related to an improvement in child welfare. For India, this would imply a reduction in the child underweight rate from 54.8% in 1990 to 27.4% in 2015. National data on underweight provided under NFHS-3 (National Family Health Survey) (2005-06) revealed underweight prevalence rate around 40%.

Methods: This cross sectional study was conducted in an urban area of district Rohtak during the months of January to March 2014 among children which were under five years of age. The anthropometric measurement and nutritional status categorization among children was done using WHO guidelines.

Results: A total of 654 children participated in study. Around 32% of study participants were having stunting as there nutritional status while taking Composite Index of Anthropometric Failure for nutritional status into consideration nearly 45% participants were undernourished. The stunting and underweight were more prevalent among girls.

Conclusion: Composite anthropometric index provides the actual prevalence or proportion of undernourished children in a community. So the policies should be based on the basis of Composite Index of Anthropometric Failure so to reduce the prevalence of under-nutrition in the community more effectively.

Keywords: Underweight, stunting, wasting, CIAF.

1.Introduction

Reduction in child malnutrition is another millennium development goal related to an improvement in child welfare. Child malnutrition significantly increases the risk of infant and child death, with some estimates suggesting that child malnutrition is responsible for half or more of child deaths in the developing world.[1] The NFHS-3 (2005-06) [2] data analysis showed a strong relationship between under-five child mortality rates and child underweight rates. There is also a large body of evidence from around the world relating under-nutrition in childhood to lower levels of school performance, cognitive development, health, and, ultimately, to lower levels of labor productivity in adulthood. Thus, the economic and human costs of child malnutrition in India are likely to be very high.[3] The millennium development goal is to reduce the percentage of underweight children by one-half between 1990 and 2015. For India, this would imply a reduction in the child underweight rate

from 54.8% in 1990 to 27.4% in 2015[4], which at present moment appear difficult but not impossible to achieve. NFHS-3 (2005-06) [2] data revealed prevalence of underweight, stunting and wasting as 42.5%, 48% and 19.8% in India. Around 16 percent of children are severely underweight and 23.7% are severely stunted in the sense of being more than three Z-score below the relevant.[5] This suggests that Indian children suffer from both aspects of under-nutrition which means short term, acute food deficits (as reflected in low weight-for-age) as well as from longer-term, chronic under-nutrition (as manifested in high rates of stunting). Wasting (low weight-for-height) can be due to either acute or chronic under-nutrition.

The under-nutrition is due multidimensional aspects such as poverty, diseases. Keeping that in mind the rate of decline in under-nutrition is lacking behind and to achieve the pace in the reduction under-nutrition prevalence, Svedberg *et al*

[6] suggested new classification of under-nutrition known as Composite Index of Anthropometric Failure (CIAF). It was revised by Nandy *et al* [7] by addition of one more subgroup “Y” (Underweight only) to existing one. The anthropometric sub-groups of the children are as follows: A – No Failure, B – Wasting only, C - Wasting + Underweight, D - Wasting + stunting + Underweight, E - Stunting + Underweight, F - Stunting only and finally, Y – Underweight only. The sum of the children in groups B to F provides the CIAF. As a single indicator, CIAF provides a single number to the overall estimate of undernourished children in a population, which none of the current indicators do. This classification gave concern that, children can have multiple growth failure and needs special attention. In Haryana the prevalence of underweight, stunting and wasting [8], are low in comparison to national level but the millennium development goal has to be, yet to be achieved. As in Haryana there is paucity of studies based on CIAF, this was conducted to measure the under-nutrition prevalence by both conventional methods and CIAF and to observe the reliability of CIAF.

2. Materials and Methods

2.1 Study design and the participants

This cross sectional study was conducted in an urban health center area of district Rohtak which is a field practice area under the aegis of Department of Community Medicine, PGIMS, Rohtak, Haryana, India; during the months of January to March 2014. The participant involved were children, under five years of age along with their parents/guardians. A total of 15 anganwadi centres (Integrated Child Development Scheme Centres, ICDS centres) under the urban health centre, caters to about 1450 under five children. By simple random sampling 8 anganwadi centres were selected. The line listing of all children enrolled at anganwadi centres was done. Total children enrolled at selected anganwadi centres accounted to 768. Consecutive sampling was applied to select the study participants and to achieve the sample size of 660. About 20 study participants were interviewed and examined on one day to increase the precision of study. This study was approved by the ethical committee and prior consent was taken by parents/guardian of the children before the interview and examination of the child.

2.2 Data collection

A pretested, predesigned questionnaire was used by the investigator to interview study participants and house to house visit was done. The age of children were recorded using birth/delivery records or anganwadi centre (ICDS centres) records

and was estimated to the most recently attained month. The anthropometric measurements of children were done using WHO guidelines (1995).[9] To measure weight, height, MUAC; parents/guardians were suggested to bring their children to respective anganwadi centre (ICDS centres) to increase the accuracy level of respective measuring parameters. The weight of child was measured using Salter’s weighting apparatus developed by UNICEF in collaboration with WHO. The height of children who were more than two years and were able to stand without support were measured using stadiometer; and those below two years or were unable to stand or child length less than 85 cm, recumbent length was measured using infant meter. Sakir’s tape was used to measure mid upper arm circumference at the exact midpoint level of the left arm. The children who were unavailable at two consecutive visits or whose birth records at present not available were excluded from the study. The prevalence of underweight in Haryana is 40% [2] sample size was calculated using prevalence as 40% with allowable error as 10% of prevalence and non-response as rate as 10%, total sample size calculated was 660. Sample size calculation = $(1.96)^2 * p * q / (d)^2$, where p is prevalence = 0.4, q is 1-p = 0.6, d is allowable error which is 10% of prevalence = 0.04.

The participants were classified as stunted, wasted and underweight as their under-nutritional status depending upon the Z-score value [5] which was calculated using WHO Anthro software (version 3.2.2, 2011). If Z-score < -2 = moderately undernourished, Z-score < -3 = severely undernourished. The under-nutritional status of children were also classified on the basis of Composite Index of Anthropometric Failure (CIAF) using Nandy *et al* [7] model of six groups (stunted only, under-weight only, wasted only, wasting and underweight, stunted and underweight and lastly stunted, wasted and underweight) of children was used. Three new indices proposed by Boss K *et al* [10] were also used to assess with the problem of stunting, underweight and wasting relative to the total prevalence of under nutrition. These three indices are: Stunting Index (SI) = Stunting / CIAF; Underweight Index (UI) = Underweight / CIAF; Wasting Index (WI) = Wasting / CIAF.

2.4 Statistical methods

The responses to schedule by each participant were entered into excel sheet and data was tabulated and statistical analysis done using SPSS 16.0 (Statistical Package for the Social Sciences), we calculated percentages and applied the Chi-square test wherever necessary and required.

3. Results

Total 654 children participated in the study. In the study girls and boys frequency (%) accounted as 304 (46.4%) and 350 (53.4%). The age wise of distribution among boys and girls of children can be

well observed in the Table 1, as maximum participants (23.8%) belonged to 48-60 months of age whether participant was girl (21.1%) or boy (26.2%).

Table1: Shows the age and sex wise distribution of study participants

Sex	Age (in months)					Total frequency (%)
	0-11	12-23	24-35	36-47	48-60	
Girl's frequency (%)	62(20.3%)	60(19.7%)	58(19.1%)	60(19.7%)	64(21.1%)	304(46.4%)
Boy's frequency (%)	70(20%)	44(12.5%)	76(21.7%)	64(18.2%)	92(26.2%)	350(53.6%)
Total frequency (%)	132(20.1%)	104(15.9%)	134(20.4%)	128(19.5%)	156(23.8%)	654(100%)

The wasting (severe and moderate) was observed among 13.8% of participants, 31.2% participants were stunted (severe and moderate) and 21.4% were underweight (severe and moderate) (Figure 1).

statistically significantly (chi-square value = 4.31, p = 0.43) higher among girls (Figure 2). CIAF rate (45.25%) as recently suggested one of indicators of under-nutrition was higher than wasting, underweight and stunting rates and also CIAF rate (48.02%) and under-weight rate (22.14%) was higher among girls.

The proportion of wasting was higher among boys, whereas proportion of stunting was

Figure 1: Shows the prevalence of wasting, stunting and underweight among participants

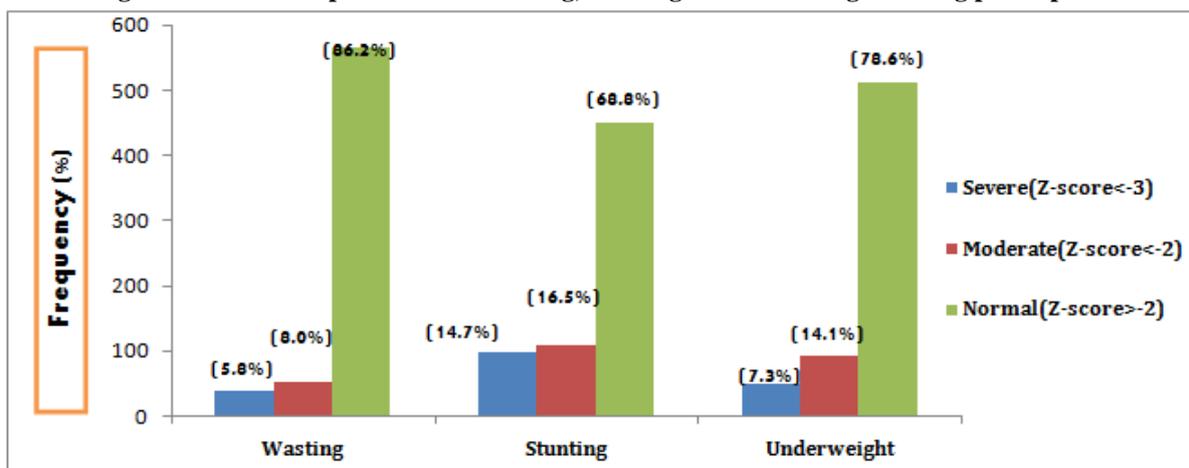
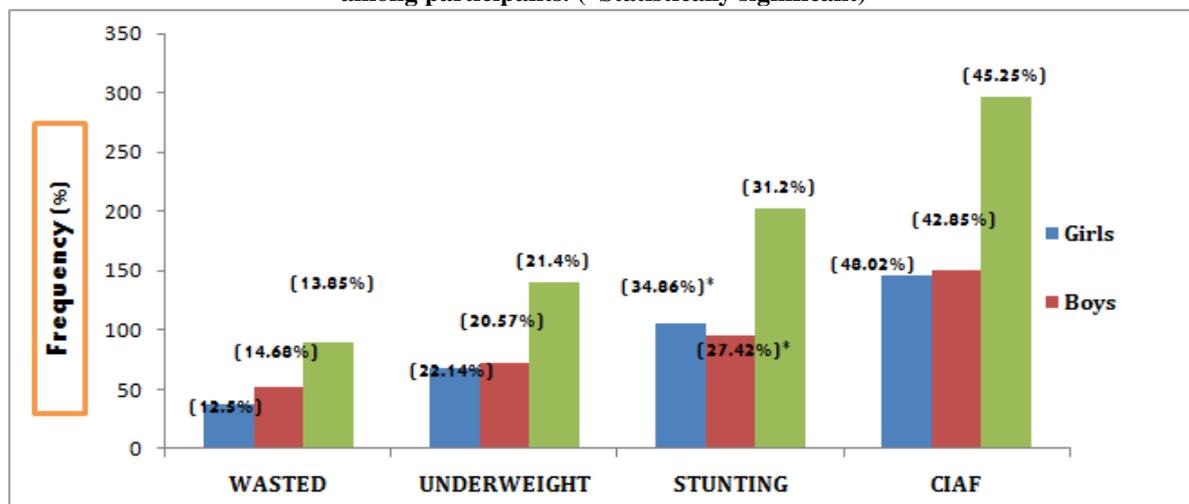


Figure 2: Shows the sex wise distribution of prevalence of wasting, stunting and underweight and CIAF among participants. (*Statistically significant)



The proportion of Stunting was highly statistically significant (Linear-by-Linear Association, chi-square value = 21.7, p = 0.000) when compared in terms of age wise distribution of study participants and maximum stunting was observed 24-35 months (28.43%) of age group (Table 2).

Using Nandy et al[7],CIAF classification for participants (Table 3),it was observed that frequency

of sub-group ‘‘F’’(Stunting only) among growth failure (B-Y) sub-groups, was highest (17.1%), which accounted for 14.2% and 20.3% in respective proportion of boys and girls participants; followed by sub-group ‘‘E’’ (Stunting and underweight); and sub-group ‘‘D’’ (Wasting and underweight and stunting) was having statistically significantly (chi square value = 4.37, p = 0.037) lowest frequency when compared to all sub-group (A-Y).

Table 2: Shows the age wise distribution of stunting among study participants.

Nutritional status	Age(in months)					Total frequency (%)
	0-11	12-23	24-35	36-47	48-60	
Stunted frequency (%)*	42(20.5%)	40(19.6%)	58(28.4%)	30(14.7%)	34(16.6%)	204(31.2%)
Normal frequency (%)	90(20.0%)	64(16.8%)	76(56.8%)	98(21.7%)	122(27.1%)	450(68.8%)
Total frequency (%)	132(20.1%)	104(15.9%)	134(20.4%)	128(19.5%)	156(23.8%)	654(100%)

(*Statistically significant)

Table 3: Shows Nandy et al., CIAF sub-group of anthropometric failure among children participants.

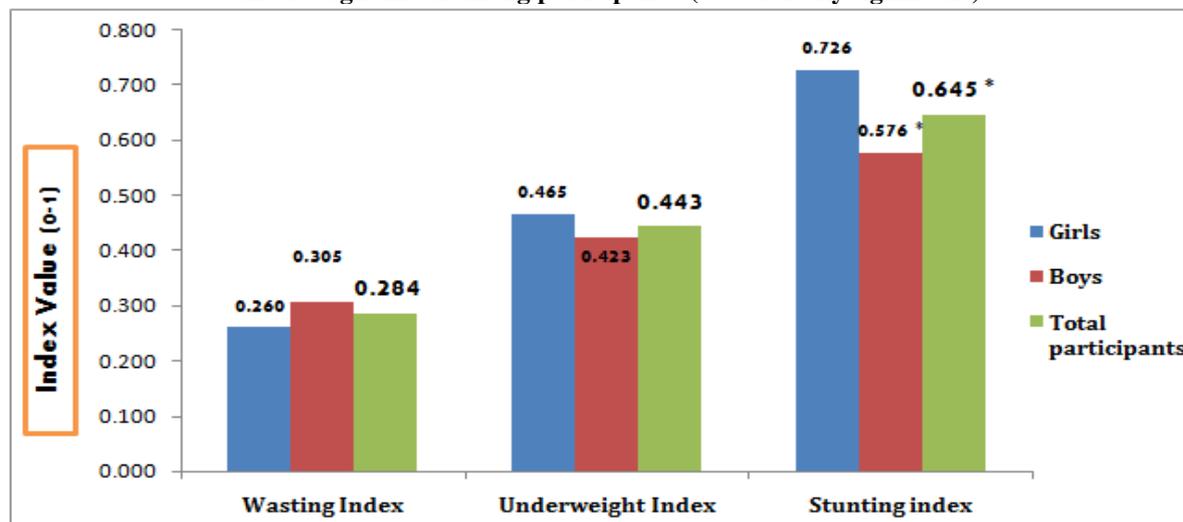
Group name	Description	Boys	Girls	Total
A	No failure	200(57.1%)	158(51.9%)	358(54.7%)
B	Wasting only	28(8%)	16(5.2%)	44(6.7%)
C	Wasting and underweight	14(4%)	20(6.5%)	34(5.1%)
D*	Wasting and underweight and stunting	10(2.8%)	2(0.6%)	12(1.8%)
E*	Stunting and underweight	38(10.8%)	42(13.8%)	80(12.2%)
F	Stunting only	50(14.2%)	62(20.3%)	112(17.1%)
Y	Underweight only	10(2.8%)	4(1.3%)	14(2.1%)

(*Statistically significant)

While taking BMI into consideration 12.2 percent of participants were classified as having moderate (6.4%) and severe (5.8%) under-nutrition status. The MUAC parameter calculated only 1.6 percent of participants as severely undernourished and 6.5 percent as having moderate under-nutrition.

On the basis of stunting index (SI) (0.726) was highly statistically significantly (chi-square value = 15.8, p = 0.000) higher among girls and; wasting index (WI) was higher among boys (0.359).

Figure3: Shows the total and sex wise distribution (percentage) of wasting index, stunting index and underweight index among participants. (*Statistically significant)



4. Discussion

The time trend of undernourished children in India is showing declining pattern, but the pace of reduction is not matching the criteria set by UNDP (United Nation Development Project) under millennium developmental goals for India. This is matter of concern as under-nutrition causes a significant contribution in under-five year children mortality.[1] The present study conducted in urban area showed the prevalence of stunting, underweight and wasting among study participants as 31.2%, 21.4% and 13.8% respectively, which when compared to latest available data of DLHS-4(Urban 2012-13)[8], the prevalence of stunting (31.8%) was similar, but it differed for wasting (30.3%) and underweight (32.9%) rates. As the prevalence of under-nutrition is declining and NFHS-3(2005-06) [2] provides a decade back scenario, the prevalence rate of stunting, underweight and wasting calculated in it were of higher range when compared with our study. The prevalence of stunting, underweight and wasting were coming out to be on lower side in our study in comparison to other studies [10,11]. Based on the WHO standards (2006)[5] classification of severity of under-nutrition, our study revealed overall high prevalence of stunting, underweight and wasting, whereas study done by Dasgupta *et al*[13] showed medium prevalence of underweight and stunting.

Present study showed highest prevalence for stunting (31.2%), followed by underweight (21.4%) and least for wasting (13.85%). Similar trends for prevalence were noticed in NFHS-3(2005-06)[2](stunting 45.7%, underweight 34.6% and wasting 17.3%) and other studies [11,14,15],but differed from Bose *et al*[16] observation. In our study the prevalence of stunting (34.8%) and underweight (22.1%) was higher among girls than boys (stunting, 20.5%; underweight, 20.1%), which again followed similar pattern of NFHS-3 (2005-06) data[2] and Berger *et al* study[17], but not in agreement with other studies. [13,16]

When taking CIAF into consideration for calculating prevalence of undernourished children, it was coming out to be 45.25%,which tends to be higher than the overall prevalence rates of stunting, wasting and underweight calculated using conventional methods and this tendency was in agreement with the observations of other studies.[11,12,17,18] CIAF prevalence calculated in other studies[11,12,16] were elevated than the prevalence calculated in present study, on other hand CIAF prevalence estimation concerned with Dasgupta *et al* study[13] was lower than present study. It was also observed that Group F (Stunting

only) was largest among our study and was comparable to Anwar *et al.* study.[12] Underweight as the only criterion for identifying undernourished children may underestimate the true prevalence of under-nutrition, by as much as 23.85% in the present study. As far as SI, UI and WI are concerned studies of Nandy *et al.*, and Anwar *et al* [5,12] found higher value for SI, WI and UI than the present study. From above discussion, CIAF classification seems to be welcomed by various authors but Bhattacharya [19] has criticized it and raised issues regarding its usefulness.

Due to time constraints, paucity of studies in urban areas and as the main objective of study was to calculate under-nutrition burden using current conventional indicators and CIAF classification, the information regarding calorie and protein intake, morbidity history and SES of participants were not gathered in the present study which can be considered as its limitation.

5. Conclusion

In speeding up to decline the rate of under-nutrition in community, additional steps have to be taken. CIAF must be included under routine growth monitoring at the community level as it requires inclusion of measurement of height at anganwadi centres (ICDS centres) in addition to weight measurement. Underestimating this proportion might prevent undernourished children from receiving the benefit of the extra supplementation they deserve. It must be emphasized, however, that conventional indices reflect distinct biological processes and cannot be disregarded, but this issue has been addressed with the construct of the new indicator CIAF and it merits further consideration as a policy and monitoring tool for planning purposes. The disaggregation of undernourished children in to different sub-groups as done in CIAF allows the researchers to further examine the relationship between particular combinations of under-nutrition and poverty or morbidity/ mortality data. This is a very serious problem, by any scale. Under such conditions, our intervention efforts need to be broader than providing supplementary nutrition alone.

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