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Community Section

Nutritional Status of One to Five Year Old Children in Rural Haryana: A Community Based Study

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ABSTRACT

Introduction: Under-nutrition remains one of the major causes of morbidity and premature mortality among one to five-year-old children in India. WHO recommended indicators used in the past for assessment of under-nutrition are overlapping and do not provide a comprehensive estimate of the under-nourished in the community.

Aim: To assess prevalence of under-nutrition among one to five-year-old children of rural Haryana, using conventional indices and Composite Index of Anthropometric Failure (CIAF) and compare the estimated results.

Materials and Methods: A community based cross sectional study was conducted on 1032 children, one to five-year-old (477 boys; 555 girls), in rural field practice area of Department of Community Medicine, AMCH, Shahabad (M), Haryana from January to December 2019. House to house visits were conducted to collect information from the child's mother/primary caregiver using a semi-structured questionnaire followed by anthropometric assessment of the children. The WHO recommended conventional indicators of under-nutrition (stunting, wasting and underweight) as well as the CIAF were used to evaluate the nutritional status of the children following standard procedures. Z-scores were computed separately for boys and girls. Categorical data was presented as percentages (%) and Pearson's Chi-square test was used to evaluate differences between groups for categorised variables. The p-value <0.05 was considered significant.

Results: Our study results revealed 21.5% children as underweight, 30.2% children as stunted and 8.9% children as wasted according to WHO recommended indices. The prevalence of under-nutrition in studied children according to CIAF was found to be 43.7%. Of the studied children, 56.3% of children reported no failure (Group A), 4.1% reported wasting only (Group B), 2.3% reported wasting and underweight (Group C), (4.2%) reported wasting, stunting and underweight (Group D), 7.6% reported stunting and underweight (Group E), 18.4% reported stunting only (Group F) while 7.1% reported underweight only (Group Y).

Conclusion: CIAF may be a better indicator of nutritional status in one to five-year-old children. The apparent advantage lies in the fact that it reveals a comprehensive picture of the severity of the actual burden of under-nutrition in a population.

Keywords: Anthropometric failure, Prevalence, Pre-school children, Under-nutrition

INTRODUCTION

More than half of global deaths in children younger than 5 years of age are attributable to under-nutrition in India. Managing the burden of malnutrition is a major priority in most states of the country. In order to initiate action and monitor progress, WHO Global Nutrition Targets were established for six malnutrition indicators to be achieved by 2025 and targets were set by the UN Sustainable Development Goals (SDGs) with the primary aim of eliminating malnutrition by 2030. Focus on the joint efforts towards reducing malnutrition worldwide, was strengthened by declaring 2016-25 as the Decade of Action on Nutrition by the United Nations (UN) [1].

Malnutrition in Indian children is nearly five times more as compared to China and twice that of Sub-Saharan Africa. Childhood under-nutrition remains a major public health problem in India with 35.7% of under-five children being underweight, about 38.4% stunted (too short for age), 21.0% wasted (low weight for height, indicating acute malnutrition), 75% anaemic and 57% Vitamin A deficient [2].

The early years of life are important nutritionally as this is the period during which the body builds up nutrition stores in preparation for the nutritionally demanding phase of adolescence. Prolonged under-nutrition during these early years of life impacts the cognitive and physical development of the affected child and predisposes them to development of cardio-metabolic diseases that may even be passed on to the next generation [3,4]. Furthermore, under-nutrition impairs children's chances of survival, by making them more susceptible to illness, hampers their ability to learn and perform at school thus affecting overall productivity and quality of life in the later years.

The average levels of malnutrition in India are quite disconcerting with noteworthy inequalities across all states, socioeconomic groups and gender. Girls, rural areas, economically challenged people and scheduled tribes and castes being at-risk and most affected. Almost half of India's malnutrition cases are reported from the six states of Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Rajasthan, and Uttar Pradesh [5].

According to National Family Health Survey-4 (NFHS-4) the prevalence of stunting, wasting and underweight among under-5 children in rural parts of Kurukshetra District, Haryana is 32.4%, 22.0%, and 25.4%, respectively [6]. While the District Level Household and Facility Survey-4, 2012-2013 (DLHFS-4) has shown the prevalence of stunting, wasting and underweight among under-5 children in rural Haryana as 32.1%, 33.5%, and 38.0%, respectively [3].

WHO has recommended use of three indicators for assessment of undernutrition: i.e., underweight (low weight-for-age), stunting (low height-for-age), and wasting (low weight-for-height). (WHO, 1995) [7]. These three indicators (stunting, wasting and underweight) are not independent entities; while stunting reflects chronic under-nutrition and wasting acute under-nutrition, underweight is often used to indicate the extent of both acute and chronic malnutrition, but fails to distinguish between them. Another limitation being that underweight (as an indicator) does not identify the sum of those children who are stunted and/or wasted, and thus tends to under estimate the extent of anthropometric failure in a population. Therefore, the need of a means of identifying all under-nourished children, be they stunted and/or wasted and/or underweight. An alternate composite

measure; the CIAF was proposed by Peter Svedberg [8] consisting of six subgroups of anthropometric failure (labelled A-F) thus providing a single measure with which to estimate the overall prevalence of under-nutrition in a population [Table/Fig-1] [8,9]. Using CIAF, the overall prevalence of malnutrition can be determined by summing all of the groups together, but excluding the children in Group A (i.e., those not experiencing any form of anthropometric failure). Classification of malnutrition using CIAF allows an estimate of not just specific failure but also combinations of failures, with relatively higher predictive power than the conventional indicators as children who are stunted, wasted and underweight all at the same time are likely to have a higher risk of mortality. An additional modification by way of addition of another Group Y, comprising children who are only underweight, was recognised and added to Svedberg's model by Nandy S et al., [9].

Group name	Description	Wasting	Stunting	Underweight
A	**No failure:** Children whose height and weight are above the age-specific norm (i.e., above -2 z-scores) and do not suffer from any anthropometric failure.	No	No	No
B	**Wasting only:** Children with acceptable weight and height for their age but who have subnormal weight for height.	Yes	No	No
C	**Wasting and underweight:** Children with above-norm heights but whose weight for age and weight for height are too low.	Yes	No	Yes
D	**Wasting, stunting and underweight:** Children who suffer from anthropometric failure on all three measures.	Yes	Yes	Yes
E	**Stunting and underweight:** Children with low weight for age and low height for age but who have acceptable weight for their height.	No	Yes	Yes
F	**Stunting only:** Children with low height for age but who have acceptable weight, both for their age and for their short height.	No	Yes	No
Y	**Underweight only:** Children who are only underweight [9].	No	No	Yes

[Table/Fig-1]: Classification of children as per Composite Index of Anthropometric Failure (CIAF) [8,9].
*Another theoretical combination would be "wasted and stunted", but this is not physically possible since a child cannot simultaneously experience stunting and wasting and not be underweight

So far, the studies available on under-nutrition in rural Haryana have focussed on providing estimates for malnutrition using the conventional indicators [10,11]. The present study was conducted to compare the prevalence of under-nutrition by conventional methods as well as CIAF so that 'missed' cases of under-nutrition may be identified and a true picture of the pattern of malnutrition is obtained.

MATERIALS AND METHODS

A community based cross-sectional study was conducted among children one to five-year-old in rural field practice areas of Department of Community Medicine, AMCH, Shahabad (M), Haryana from January to December 2019 comprising of four villages. Ethical approval to conduct the study was obtained from the Institutional Ethics Committee (AMCH/BIO/2020/03/05, retrospective due to COVID-19).

Sample size was calculated considering the prevalence of underweight among one to five-year-old children as 29.4% in rural Haryana (NFHS-4) [6] with a confidence level of 95%. Assuming a relative error as 10% of the prevalence, the sample size was calculated to be 927. A nonresponse rate of 10% was added to the calculated sample size to get the minimum target sample size of 1020. Finally, a sample size of 1032 children was taken for this study.

A list of all children one to five-year-old was obtained from the Anganwadi centres of all the four villages of the study area. There were 14 Anganwadi centres in these villages. About 258 children were selected from each village using Simple Random Sampling (SRS) technique to complete a sample size of 1032.

Data Collection

Data was collected using a semi-structured questionnaire, designed and validated by faculty of Community Medicine Department. This questionnaire was tested and modified based on the results of the pilot study. Content validity of questionnaire was done by subject experts who established that the items are representative of the outcome and found the content to be relevant to the objectives of the study. Reliability (Internal consistency) of the questionnaire was estimated using Cronbach's alpha (0.84).

The questionnaire was designed to collect socio-demographic information, information pertaining to birth, feeding, developmental milestones and anthropometric assessment of children. House to house visits were conducted to collect information from the child's mother or the primary caregiver after obtaining a written informed consent from the parents. The children included in the study were physically normal, without any congenital anomalies or gross deformities and had no chronic illnesses. All children whose parents refused to give consent were excluded from the study. Data was collected by a team comprising of Medical Social Worker (MSW) and Multi-Purpose Health Worker (MPHW) who were trained to translate the questionnaire into Hindi language to collect information and conduct an anthropometric assessment of the children as per the laid protocol. Data collection was conducted under the supervision of one of the Authors. The translated questionnaire was back translated by two independent translators to ensure its accuracy. The back-translated version was approved of by subject experts to determine conceptual equivalence. No discrepancies were found.

The age of children was recorded as per the available birth/delivery records and was estimated to the most recent completed month. In case birth records were not available, the mother/primary caregivers' information was collected. This was followed by an anthropometric assessment. Anthropometric measurement of children was done as per WHO guidelines [12]. Weight of the children was measured by Salter's weighing scale with minimum clothing and without shoes and height was measured using a stadiometer (for children more than 2 years and who were able to stand without support) and infantometer to measure recumbent length (for those below 2 years or were unable to stand or child length <85 cm). Each measurement was taken twice by 2 independent observers and the mean reading was recorded. Z-scores were computed using WHO Anthroplus 2011 software and children were classified according to their nutritional status using WHO Child Growth Standards [12].

Underweight: Z-score of children for a given weight for age is less than -2 SD from median of the WHO Child Growth Standards.

Stunting: Z-score of children for a given height for age is less than -2 SD from median of the WHO Child Growth Standards.

Wasting: Z-score of children for a given weight for height is less than -2 SD from median of the WHO Child Growth Standards.

Moderate under-nutrition: Z-score of children for a given weight for age or height for age or weight for height lies between -3 SD or below -2 SD of the median of the WHO Child Growth Standards.

Severe under-nutrition: Z-score of children for a given weight for age or height for age or weight for height lies below -3 SD of the median of the WHO Child Growth Standards.

The nutritional status of children was also classified on the basis of CIAF using the model suggested by Nandy S et al., [9].

STATISTICAL ANALYSIS

The information collected during the study was entered in MS excel. Anthropometric data was entered in WHO Anthroplus 2011 software (version 3.2.2, 2011, Department of Nutrition, World Health Organisation, Avenue Appia 20, 1211 Geneva 27, Switzerland) [7] and Z scores for anthropometric measurements were computed for boys and girls separately by age groups. All the data were analysed in Statistical Package for Social Sciences (SPSS) version 20.0 (IBM, Chicago, USA). Categorical data was presented as percentages (%) and Pearson's Chi-square test was used to evaluate differences between groups for categorised variables. The p-value <0.05 was considered as significant.

RESULTS

A total of 1032 children were included in the study with boys accounting for 555 (53.7%) and girls 477 (46.2%) of the study subjects. [Table/Fig-2] shows maximum number of girls (41.5%) and boys (37.3%) in the age group of 12-23 months and least number of girls (13.8%) and boys (13.0%) in the age group of 36-47 months.

Age in months	Gender				Total	
	Girls (No.)	%	Boys (No.)	%	No.	%
12-23	198	41.5%	207	37.3%	405	39.2%
24-35	78	16.4%	111	20.0%	189	18.3%
36-47	66	13.8%	72	13.0%	138	13.4%
48-59	135	28.3%	165	29.7%	300	29.1%
Total	477	100.0%	555	100.0%	1032	100.0%

[Table/Fig-2]: Age and Gender wise distribution of studied children.

As far as the prevalence of under-nutrition is concerned, it can be seen that severe wasting was observed in 62 (6%) children. Of these 18 (29%) were girls and 44 (71.0%) were boys (p<0.001).

A total of 102 (9.9%) children were found to be severely underweight comprising 36 (35.3%) girls and 66 (64.7%) boys. This difference in degree of underweight between girls and boys was found to be highly significant (p<0.001).

As regards stunting, 112 (10.8%) children were found to be severely stunted, of which 48 (42.9%) and 64 (57.1%) girls and boys, respectively [Table/Fig-3].

Characteristics	Girls (n=477)	Boys (n=555)	Total (n=1032)
Weight-for-Height (Z-score)	**n (%)**	**n (%)**	**n (%)**
No wasting (>-2 SD)	435 (46.3)	505 (53.7)	940 (91.1)
Moderate wasting (<-2 SD)	24 (80.0)	6 (20.0)	30 (2.9)
Severe wasting (<-3 SD)	18 (29.0)	44 (71.0)	62 (6.0)
χ^2, df, p-value	6.14, 2, <0.001*		
Weight-for-age (Z-score)			
No underweight (>-2 SD)	363 (44.8)	447 (55.2)	810 (78.5)
Moderate underweight (<-2 SD)	78 (65.0)	42 (35.0)	120 (11.6)
Severe underweight (<-3 SD)	36 (35.3)	66 (64.7)	102 (9.9)
χ^2, df, p-value	6.422, 2, <0.001*		
Height-for-age (Z-score)			
No stunting (>-2 SD)	327 (45.4)	393 (54.6)	720 (69.8)
Moderate stunting (<-2 SD)	102 (51.0)	98 (49.0)	200 (19.4)
Severe stunting (<-3 SD)	48 (42.9)	64 (57.1)	112 (10.8)
χ^2, df, p-value	0.256, 2, 0.282		

[Table/Fig-3]: Prevalence of under-nutrition among children using WHO growth standard.
*p<0.05 statistically significant

Distribution of study participants according to subgroups of anthropometric failure using modified CIAF classification by Nandy S et al., It is seen that 56.3% of studied children showed no failure (subgroup A) [9].

A total of 43 (4.2%) children were found to be Wasted, stunted and underweight (Group D), of which 27 (62.8%) were girls and 16 (37.2%) were boys. Stunting only was seen in 190 (18.4%) children (Group F). Stunting and underweight were reported in 79 (7.6%) children with 39 (49.4%) girls and 40 (50.6%) boys. CIAF is a single indicator comprising sum of children in categories from B-F and Y expressed as percentage (excluding A). The overall CIAF was found to be 43.7% [Table/Fig-4] .

Group and anthropometric status	Gender			CIAF
	Girls (n=477)	Boys (n=555)	Total (n=1032)	
A (No failure)	267 (46.0%)	314 (54%)	581 (56.3%)	43.7%
B (Wasting only)	12 (28.6%)	30 (71.4%)	42 (4.1%)	
C (Wasting and underweight)	12 (50%)	12 (50%)	24 (2.3%)	
D (Wasting, stunting and underweight)	27 (62.8%)	16 (37.2%)	43 (4.2%)	
E (Stunting and underweight)	39 (49.4%)	40 (50.6%)	79 (7.6%)	
F (Stunting only)	84 (44.2%)	106 (55.8%)	190 (18.4%)	
Y (Underweight only)	36 (49.3%)	37 (50.7%)	73 (7.1%)	

[Table/Fig-4]: Distribution of study participants according to subgroups of anthropometric failure.

The proportion of children with underweight, stunting and wasting (21.5%, 30.2% and 8.9%) as per WHO criteria is well below the CIAF measure of 43.7% [Table/Fig-5].

Weight for age	No.	%		CIAF
Normal	810	78.5	**Underweight**	43.7%
Underweight	120	11.6	21.5%	
Severely underweight	102	9.9		
Height for age				
Normal	720	69.8	**Stunted**	43.7%
Stunted	200	19.4	30.2%	
Severely stunted	112	10.9		
Weight for height				
Normal	940	91.1	**Wasted**	43.7%
Wasted	30	2.9	8.9%	
Severely wasted	62	6.0		

[Table/Fig-5]: Comparison of under-nutrition indices as per WHO and CIAF.

DISCUSSION

The present study was conducted to assess the prevalence of under-nutrition in children one to five-year-old in rural Haryana comparing the WHO indices with CIAF. In the current study prevalence of underweight in children one to five-year-old of age was found to be 21.5% (with 9.9% children severely underweight), Stunting was found to be 30.2 % (with 10.9% children severely stunted) and wasting was seen among 8.9% of studied children (with 6.0% severely wasted).

The NFHS-4 findings for rural Haryana show under-5 children who are stunted (height for age) as 34.3%, wasted (weight for height) 21.3%, and underweight (weight for age) as 29.9% [6]. The prevalence of under-nutrition is declining as is evident from the NFHS-3 (Haryana) data from the previous decade [13]. A recent study conducted in rural Haryana by Gupta V et al., showed the highest prevalence for stunting (41.3%), followed by underweight (38.3%) and least for wasting (18.4%) [14].

In our study underweight prevalence was higher in girls compared to boys 51.3% and 48.7% respectively. However, prevalence of severe underweight was higher in boys 64.7% as compared to girls 35.3%. Similar results were observed by William RF et al., and Berger M et al., study but not in agreement with other studies [6,15-18].

According to CIAF the prevalence of under-nourished children in the present study was observed to be 43.7%, which is higher than the overall prevalence rates of stunting, wasting, and underweight calculated using conventional methods. Our findings were in agreement with the observations of other studies [16,18-20].

The CIAF of 43.7% in the present study was lower as compared to previous studies by Gupta V et al., (54.4%), Nandy S et al., (59.9%), Seetharaman N et al., (65.25%), Mandal GC and Bose K, (71.7%) [14,9,18,21]. However, studies conducted in West Bengal by Roy K et al., showed a lower CIAF (36.1%) [22]. Comparison has been shown in [Table/Fig-6] [9,14,18,21-26]. Dasgupta A et al., have also observed a low CIAF (32.7%), wherein the prevalence of underweight was also lower (17.7%) as compared to our study [26]. The CIAF classification is all inclusive and takes all three indicators of under-nutrition into consideration i.e., Height for Age (HA), Weight for Height (WH) and Weight for Age (WA). This classification additionally incorporates two new groups (Group B and Group C); group B with normal HA and WA but low WH and group C (with higher HA but low WH and WA) [23]. The concurrent existence of specific nutritional conditions makes the affected children vulnerable to detrimental health, growth and developmental conditions further impacting their morbidity and mortality thus making it relevant to recognise these conditions early for possible interventions.

Name of the study	Place of study	Prevalence of under weight	Prevalence of under nutrition according to CIAF
Current study	Haryana	21.5%	43.7%
Gupta V et al., [14]	Haryana	38.3%	54.4%
Roy K et al., [22]	West Bengal	2.8%	36.1%
Boregowda GS et al., [23]	Chhattisgarh	45.2%	62.1%
Dasgupta A et al., [26]	Rural W. B	17.7%	32.7%
Shit S et al., [24]	Bankura (W.B)	38.5%	78.1%
Das S et al., [25]	West Bengal	41.25%	48.3%
Mandal GC and Bose K, [21]	West Bengal	60.9%	71.7%
Seetharaman N et al., [18]	Coimbatore	46.6%	65.25%
Nandy S et al., [9]	India	47.1%	59.9%

[Table/Fig-6]: Comparison of two indices from several studies [9,14,18,21-26].

The conventional indicators are inept at providing a single figure of the overall estimate of malnutrition among children in a given population when such information can be extremely valuable for countries like India to reduce malnutrition. It is relevant to mention here that even though the percentage decline in prevalence of underweight children in India is around 6.8% (from NFHS 3 to NFHS 4), the rate of decline is far from the targets expected to be met by SDGs for the country. It would thus be only appropriate for the policy-makers to take a relook at the use of 'underweight' (weight-for-age) as an indicator for monitoring growth in children to establish priorities directed towards strategic nutritional interventions for achieving the nutrition related SDGs. The present study had certain strengths, i.e., standard operative procedures were followed for all anthropometric assessments and the use of CIAF for comprehensive estimation of under-nutrition in children.

Limitation(s)

Limitations included use of a cross-sectional study design that provided a snapshot of the current estimates of underweight, stunting and wasting in under-5 children. A follow-up study design would have provided a better reflection of the nutritional status of the studied children.

CONCLUSION(S)

Despite the apparently declining tendency of under-nutrition in India in the last few years, malnutrition in preschool children ought to be considered as a public health crisis. CIAF is capable of giving a better estimate of the burden of under-nutrition in the community compared to conventional indicators and should be utilised as a tool for monitoring of nutritional programmes and framing policy decisions to achieve nutritional goals. The burden of malnutrition in the children can be effectively decreased by collaborative efforts through governmental and non-governmental coordination and community participation. A multipronged approach encompassing maternal and child health care, nutritional education, intensive IEC activities on exclusive breast feeding and promotion of family planning methods is the need of the hour with focussed and targeted short-term as well as long-term sustainable strategies to alleviate childhood malnutrition.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]
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