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Z score and CIAF – A comprehensive measure of magnitude of under nutrition in a rural school going population of Kashmir, India

Fazili Anjum*, Pandit M I*, Mir A A*, Bhat I A*

*Department of Community Medicine, Sheri Kashmir Institute of Medical Sciences, Soura, JK, India

ABSTRACT

WHO has recently recommended the use of Z-Score or SD system to grade undernutrition as this system allows us to measure all the three indices i.e. weight for age, height for age, weight for height. 438 school children in the age group of 5-9 years were clinically and anthropometrically assessed in order to estimate the prevalence of undernutrition using the Z-Score system of classification and the recently introduced Composite Index of Anthropometric Failure (CIAF). Only 112 (25.58%) of these children were in a state of anthropometric failure as per the Z-Score system, 10.73% of them being underweight, 15.29% wasted and 8.90% stunted. The most common anthropometric failure in these children was wasting while 30.35% of these undernourished children had more than one anthropometric failure. Using underweight as the sole criteria for assessing the magnitude of undernutrition in this study would give us an underestimate and we would miss about 58% of the undernourished children in our study population.

Key words : Z-Score, stunting, wasting, underweight, anthropometric failure, CIAF, undernutrition. Integrated Child Development Services (ICDS), Indian Academy of Pediatrics (IAP).

Corresponding Author: Anjum Fazili, Associate Professor, Department of Community Medicine, SKIMS, JK, India

E-mail: anjumbfazili@gmail.com

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Introduction:

In any community children are one of the most vulnerable groups for nutritional deficiencies. This is due to a number of factors ranging from low birth weight, maternal ill health, socioeconomic and environmental factors¹. Undernutrition in young children is conventionally determined by age and through the measurement of height, weight, skin fold thickness. The most commonly used indices derived from these measurements are height for age, weight for height and weight for age. Stunting is an indicator of chronic under nutrition, the result of prolonged food deprivation or illness. Underweight is used as a composite indicator to reflect both acute and chronic under nutrition although it can not distinguish between them². A number of attempts have been made in grading the degrees of under nutrition. Weight for age classifications (Gomez, Indian Academy of Pediatrics {IAP}) are the most commonly used. Height for age and weight for height

(McLaren & Reed, Wills & Waterloo) have been used less frequently³. Each of these classifications uses a different set of reference data and each system employs a different cut off to decide who is normal and who falls under mild, moderate or severe under nutrition. These cut off points are usually a certain percentage of the reference of the mean /median or a percentile of the reference population. Use of these different reference values and cut off points is an obstacle in comparing data across various studies and countries and none of these classifications addresses all the three indices of under nutrition. WHO has therefore recently recommended the use of z-score or SD system to grade under nutrition as this system allows us to measure all the three indices (wt/ht, ht/age and wt/age) and express the results in terms of z-scores or standard deviation units from the median of the international reference population developed from the anthropometric data collected in the US by NCHS. Children below the reference median (i.e. <-2

z score) are considered to be undernourished (i.e. stunted , wasted or underweight) The advantages of the z-score system are that besides being sex specific and able to measure all the three indices, it allows comparison across indicators and countries. Since these indices do overlap , none of them is able to provide a comprehensive estimate of the number of undernourished children in a population. Therefore for a comprehensive measurement of overall prevalence of under nutrition there is a need of a single aggregate indicator which would incorporate all undernourished children be they stunted and/ or wasted and/or underweight. Such an aggregate indicator was proposed by development economist Peter Svedberg and was named CIAF i.e Composite Index of Anthropometric Failure . Svedberg argued that the conventional indices are not sufficient for measuring the overall prevalence of under nutrition in young children⁴. He suggested that children with wasting , stunting or who are underweight are all considered undernourished and are said to be in a state of anthropometric failure and thus proposed the new index i.e. CIAF. Svedberg's model identifies six groups of children namely

- A- Children with height and weight appropriate for their age [normal or no failure]
- B- With wasting only
- C- Wasting and underweight
- D- Wasting, stunting and underweight
- E- Stunting and underweight
- F- Stunting only

To these subgroups one more subgroup Y has been added by Nandy et al which represents children who are only underweight⁵.

Aim and Objective

The present study was an attempt to estimate the overall magnitude of undernutrition using the Z score system and the CIAF in the school going children aged 5-9 years in the rural area of Block Hajin, the field practice area of Department of Community Medicine, SKIMS that is socioeconomically backward.

Material and Methods:

The study was done as a part of the School Health Program being implemented by the Department of Community Medicine, SKIMS in its rural health block .The study population comprised of randomly selected 438 school children in the age group of 5-9 years using multistage sampling process. A thorough history and a detailed clinical and anthropometric examination of the subjects was done by the school health team from the department. The children were weighed and measured as per the WHO guidelines on anthropometry(3).Weight was measured to the

nearest 500 grams .The z-score for different nutritional indices were calculated in reference to NCHS international reference population and the prevalence of underweight ,stunting and wasting were calculated at cutoff level < 2SD or z-score < - 2.The children on the basis of the z-score were then categorized as per the subgroups of Svedberg's model in order to arrive at the CIAF to get the overall prevalence of under nutrition .

Results:

Table1: Age and Sex wise distribution of study population

Age (Years)	Male n (%)	Female n(%)	Total n(%)
5	32(14.54)	46(21.10)	78(17.80)
6	51(23.18)	39(17.89)	90(20.55)
7	28(12.73)	38(17.43)	66(15.07)
8	44(20.00)	36(16.51)	80(18.26)
9	65(29.55)	59(27.07)	124(28.32)
Total	220(100.00)	218(100.00)	438(100.00)

As depicted in the table the distribution of males and females was almost equal i.e. 50.22% males and 49.78% females. Highest number of children was seen in the 9 years age group (28.32%) followed by 6 year age group (20.55%).

Table 2: Classification of children by anthropometric status (n-438).

Group	Anthropometric status	N (%)
A	No failure	326 (74.42)
B	Wasting only	44 (10.04)
C	Wasting and underweight	16 (3.65)
D	Wasting Underweight stunting	07 (1.59)
E	Stunting and underweight	11 (2.51)
F	Stunting Only	21 (4.79)
Y	Underweight only	13 (2.96)
	Total	438 (100.00)

Table 2 shows that overall almost 3/4 th (74.42%) of the children had a normal anthropometric status while only 1/4th (25.58%) of the children were in a state of anthropometric failure i.e. stunted, wasted, underweight, stunted and underweight, wasted and

underweight, or stunted, wasted and underweight. More than one anthropometric failure (i.e. wasting and underweight, stunting and underweight, underweight, stunting and wasting) were seen in 30.35% of the undernourished children which formed 7.76% of the study population. Proportionally among the undernourished group of children 39.28% had wasting only (44/112) followed by stunting in 18.75% (21/112) while 11.6% (13/112) were underweight only. All forms of undernutrition were more prevalent in males.

Discussion:

Except for the study which recommended the use of CIAF (5) very few studies have been reported from India which have dealt with CIAF especially in school going children.

In view of this, the present study was undertaken to evaluate the prevalence of underweight, stunting and wasting and especially to find the overall magnitude of undernutrition using the CIAF among 5-9 year old school children belonging to a rural block of Kashmir valley. It was observed that wasting was the most prevalent (15.29%) form of undernutrition in the study population followed by underweight (10.73%) and stunting (8.90%) while as the prevalence of overall undernutrition (by CIAF) was found to be 25.53%. These findings are contradictory to those of Jaydip Sen et al observed in Bengalee children aged 5-11 years where underweight (47%) was the most common form of undernutrition followed by stunting (38.5%) and wasting (17.6%). However, the higher prevalence of all forms of undernutrition in boys observed in the present study was in accordance with that observed by Jaydip Sen et al. The NFHS 3 (National Family Health Survey -3) revealed a still different picture showing stunting (45%) as the most common form of undernutrition in children less than 3 years followed by underweight (40%) and wasting (23%). The present study further revealed that by using the conventional growth monitoring based on weight for age for assessing the magnitude of undernutrition, we can only identify children belonging to groups C, D, E and Y (Svedberg and Nandy's model) which form about 10.7% of the study population and less than 42% of the undernourished children in our study but will miss the children in Group Band F (those wasted and stunted but not underweight) which form about 14.8% of the study population and about 58% of the undernourished children in our study. Therefore these 65 children (14.8% of study population) who are actually undernourished as per the Z score system will be labeled as normal if weight for age is used as the sole criteria as is done with the growth monitoring

system presently being practiced in our ICDS centres and most of the under five clinics. Thus, by using Z score system we have an advantage of identifying children with wasting and stunting in addition to the children who are underweight.

The findings of the present study are in accordance with those of Nandy (5) and Seetharaman (6) who also reported higher rates of CIAF compared to the other three (underweight, stunting and wasting) more conventional measures of undernutrition. However, the prevalence of overall undernutrition in this study (25.53%) was much lower than that reported by Nandy and colleagues (59.8%) on a data from NFHS-3 in children aged below 3 years as well as the prevalence (73.1%) reported by Mandal et al and that (68.6%) reported by Seetharaman et al in Coimbatore, Tamil Nadu (6). A similar observation was made as far as the prevalence of wasting, stunting and underweight was concerned which were also much lower than those reported by Mandal et al in 2-6 year old children from West Bengal where 26.6% were stunted, 50% were wasted and 63.3% were underweight and those reported by Bose et al from West Bengal (showing 23.9% stunting and 31% underweight). However, the prevalence of wasting in the present study was higher than that reported by Bose et al (9.4%).

Conclusion and recommendations : In our study we were encouraged to observe that almost 75% of the study population was anthropometrically normal but what is needed is an effort to sustain it. At the same time findings from our study suggest that if we use weight for age as the only yard stick for assessing undernutrition, we are liable to miss a considerable proportion of undernourished children in our population. This, in other words, means that the growth monitoring system presently in practice in the ICDS scheme gives an underestimate of the overall magnitude of undernutrition in our population. Besides this, the present study, by disintegrating the undernourished children into different groups, helps in identifying children with multiple anthropometric failures and these children with multiple failures form the priority group for planners and policy makers.

It is therefore recommended that the CIAF be incorporated in our presently existing growth monitoring activities because for computing the CIAF the only additional data that is needed is the height of the child which can easily be made a part of the growth monitoring system. It is further recommended that nutritional intervention programs be implemented to improve the nutritional status of children with a priority towards children with multiple anthropometric failures.

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