### **Original Research Article**

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## Measuring malnutrition: needs a comprehensive indicator

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#### ABSTRACT

**Background:** There are various classifications for grading the degrees of under nutrition. Different reference values and cut off points has been a major hindrance in comparing data across various studies and countries.

**Methods:** Community based cross sectional study. Children from urban slums were examined. Anthropometric measurements were taken. Data was analyzed with the help of SPSS ver 20 and appropriate tests were applied.

**Results:** 400 children were examined. As per Z score classification, 39.8%, 36.5% and 24.8% of children are underweight, stunted and wasted respectively. As per IAP criteria, 44.7% are undernourished and 3.2% are severely undernourished (Grade III & IV). Compared to this, the Z score system identifies a much higher prevalence of severe undernutrition (15%) compared to IAP system. Composite index of anthropometric failure (CIAF) identifies 42% of underfive children are normal i.e. no failure, while 58% of children are undernourished.

**Conclusions:** The current study suggests that conventional measures of undernutrition may be missing out a considerable proportion of undernourished children present in the population. CIAF can be used to measure overall prevalence of undernutrition.

Keywords: Z score, Malnutrition, Underfive children, Underweight, Stunting, Wasting, CIAF

#### **INTRODUCTION**

Nutritional status of children is an indicator of nutritional profile of the entire community. Adequate nutrition during infancy and early childhood is fundamental to the development of each child's full human potential. It is well known that early childhood is a critical window for the promotion of optimal growth, health and behavioural development. This is the peak age for growth faltering, deficiencies of certain micronutrients and common childhood illnesses.

According to the World Health Organization, malnutrition affects more than a quarter of children worldwide.<sup>1</sup> Under nutrition in children appears in three ways, and it is most commonly assessed through the measurement of weight and height. A child can be too

short for his or her age (stunted), have low weight for his or her height (wasted), or have low weight for his or her age (underweight). A child who is underweight can also be stunted or wasted or both.<sup>2</sup>

Nutrition monitoring is essential to assess nutritional status of the community, in terms of their nature, magnitude and distribution among the population groups as well as geographical areas. This information can be used to evolve policies, to formulate various programmes and implement the same for the prevention and effective control of nutritional deficiency disorders.<sup>3</sup>

There are various classifications for grading the degrees of under nutrition. Weight for age classifications i.e. IAP classification, Gomez classification are the most commonly used. Height for age and weight for height classifications i.e. McLaren, Water lows have been used less frequently.<sup>4</sup>

But these classifications use different cut off points to decide who is normal and who is undernourished. Different reference values and cut off points has been a major hindrance in comparing data across various studies and countries. And none of these classifications address all the three indices of undernutrition i.e. stunting, wasting and underweight.<sup>5</sup>

The current WHO recommendation is to use the Z score or SD system to grade undernutrition. This system allows us to measure all the three indices and express the results in terms of Z scores or standard deviation units from the median of the international reference population.<sup>5</sup>

The main advantage of Z score is that not only it allows comparison across the countries but also it can be subjected to summary statistics, which help us to assess the quality of the data collected. The three indices stunting, wasting and underweight reflect distinct biological processes and their use is necessary for determining appropriate interventions.<sup>5</sup>

The conventional indicators of malnutrition – stunting, wasting and underweight – each individually "miss" large numbers of malnourished children. The CIAF provides an aggregate measure to estimate the overall burden of malnutrition among young children. In its disaggregated form, the CIAF can be used to predict the varying risks of morbidity for different types of anthropometric failure.<sup>6</sup>

#### **Objectives**

- 1) To estimate the prevalence of malnutrition among underfive children using 'Z' score.
- 2) To compare Z score Classification with routinely used IAP classification.
- 3) To determine overall prevalence of undernutrition by using Composite Index of Anthropometric Failure (CIAF).

#### **METHODS**

The present study is a community based cross sectional study aimed at primarily assessing malnutrition status among underfive children residing in urban slums of Bandra.

#### Place of study: Urban slums of Bandra

#### Period of the study: December 2010 to April 2012

*Study population:* This study was conducted among under-five children residing in urban slums of Bandra, Mumbai (Maharashtra).

*Study subjects:* The following criteria determined the selection of study subjects from this population.

#### Inclusion criteria

Inclusion criteria were children up to 5 years of age living in the selected slums will be included in the study.

#### **Exclusion** criteria

Exclusion criteria were children who are not resident of the slum but visiting will be excluded from the study; children of more than 5 years of age will be excluded from the study.

A simple random sampling method was followed to get the sample size calculated as follows:

• Sample size: It is calculated using the formula

$$n = \frac{Z_{1-\alpha/2} \times P(1-P)}{d^2}$$

n→ sample size Z→ 1.96 (at 95% confidence limit) P→ prevalence (40%) d→ Absolute precision (5%)  $\therefore$  n= 370

The total number of study participants was 400.

Data collection was done in the field by going house to house. Actual questionnaire administration and physical examination was done by researcher alone. Informed consent was obtained by parents and other care takers. The questionnaire consists of the personal information, socioeconomic class, child health history and anthropometry.

Data was analysed with the help of SPSS ver 20 and appropriate tests were applied.

#### RESULTS

Total 400 children were examined; maximum children belong to less than one year of age (Table 1). Out of 400 children, 226 (56.5%) were male while 174 (43.5%) were female (Table 2). Most of the participants were Hindu by religion followed by Muslims (Table 3).

Z score classification of malnutrition among underfive children, showing distribution of children as underweight, stunted and wasted. It also gives an idea of moderate or severe malnutrition (Figure 1).

According to IAP classification 55.2% children have normal nutritional status, while 44.8% study participants have some degree of malnutrition. 29%, 12.5% and 3.3% children have mild (Grade I), moderate (Grade II) and severe (Grade III & IV) undernutrition respectively.

#### Table 1: Age distribution.

Age groups (Months)	Number	Percentages (%)
<12	126	31.5
12-23	69	17.2
24-35	84	21
36-47	59	14.8
48-59	62	15.5
Total	400	100

#### Table 2: Gender distribution.

Gender	Number	Percentages (%)
Male	226	56.5
Female	174	43.5
Total	400	100

#### Table 3: Religion distribution.

Religion	Number	Percentages (%)
Hindu	299	74.7
Muslim	82	20.5
Buddhist	19	4.8
Total	400	100

Although the overall prevalence of undernutrition is higher (by 5%) as per the IAP criteria, the Z score system identifies a much higher prevalence of severe undernutrition compared to IAP system. 45 out of the 60 children graded as "Severely undernourished" (by Z score system) seem to fall under Grade II (the "Moderately undernourished" category) of the IAP system (Table 4). Composite index of anthropometric failure (CIAF) permits us disaggregation of the undernourished children in to different subgroups. Overall, only 42% of the children studied were anthropometrically normal; 58% of the children were suffering from one or other form of 'anthropometric failure' (Figure 2).



# Figure 1: Z score classification of malnutrition among under five children.





#### Table 4: Comparison of Z score and IAP classification.

IAP	Z Score System				
	Normal	<b>Undernutrition</b> (<-2SD)	Severe undernutrition (<-3SD)	Total	
Normal	204	17	0	221 (55.3)	
Mild (Grade I)	37	77	2	116 (29)	
Moderate (Grade II)	0	5	45	50 (12.5)	
Severe (Grade III & IV)	0	0	13	13 (3.2)	
Total	241 (60.3)	99 (24.7)	60 (15)	400 (100)	

#### DISCUSSION

Using the Z score classification, 39.7% were underweight out of which 24.7% were moderately underweight while 15% were severely underweight; 36.4% were stunted out of which 18.2% were moderately as well as severely stunted; 24.7% were wasted out of which 15% were moderately wasted while 9.7% were severely wasted.

Seetharaman et al studied the role of Z scores and the composite index of anthropometric failure (CIAF) in measuring malnutrition and observed that only 31.4% of

the children were normal; 68.6% were in a state of 'anthropometric failure'. As per the Z score system, 49.6% were underweight (21.7% severely); 48.4% were stunted (20.3% severely) and 20.2% were wasted (6.9% severely). Whereas, as per IAP criteria, 51.4% were undernourished and 3.2% were severely undernourished. The IAP system identifies 4.8% more children as undernourished, whereas the Z score system identifies significantly more children as severely undernourished.<sup>7</sup>

Hien et al evaluated the nutritional status and the characteristics related to malnutrition in children

underfive years of age in Nghean, Vietnam. It was found that mean Z-scores for weight for age, height for age and weight for height were -1.46 (95% CI=-1.57,-1.35), -1.44 (95% CI=-1.56,-1.32) and -0.71 (95% CI=-0.82,-0.60) respectively. In this study, 31.8% were underweight, 44.3% were stunted and 11.9% were wasted.<sup>8</sup>

Khattak et al assessed malnutrition and associated risk factors in pre-school children (2-5 years) in district Swabi (NWFP), Pakistan. It was found that 49% children were underweight and 53% were stunted.<sup>9</sup>

Kumar et al evaluated influence of infant feeding practices on nutritional status of underfive children and observed that 36.4% children were underweight, 51.6% children were stunted and 10.6% were wasted.<sup>10</sup>

Sengupta et al studied epidemiological correlates of under-nutrition in underfive years children in an urban slum of Ludhiana and found that overall prevalence of underweight children was 29.5%, stunting 74% and wasting 42%. Significantly more females (37%) than males (23.1%) were found to be underweight (p=0.033).<sup>11</sup>

A similar study in West Bengal comparing the IAP and the Z score systems, found comparable results-61% of the children were undernourished (3.9% severely) as per IAP criteria, whereas 46.6% were undernourished (6.9% severely) as per Z score system.<sup>12</sup>

Nandy and Miranda demonstrated in their short report, the potential of an alternative indicator, the composite index of anthropometric failure (CIAF), which can be used to show the overall extent of undernutrition among children.<sup>13</sup>

#### CONCLUSION

The current study concludes that, conventional measures of undernutrition may be missing out a considerable proportion of undernourished children present in the population. The proportion of children identified as severely undernourished receive additional nutritional supplementation under the ICDS. Hence, underestimating this proportion might prevent undernourished children from receiving the benefit of the extra supplementation they deserve.

Current measures of undernutrition are, unable to give a reliable estimate of the overall number of undernourished children in a population. This issue has been solved with the construct of the new indicator, CIAF.

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