ORIGINAL ARTICLE

Can we rely solely on conventional measures to estimate undernutrition among under-fives?

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Citation

Dewan D, Gupta R, Kumar D. Can we rely solely on conventional measures to estimate undernutrition among under-fives?. Indian J Comm Health. 2015; 27, 3: 361-365.

Source of Funding : Nil **Conflict of Interest:** None declared

Article Cycle

Submission: 21/08/2015; **Revision:** 01/09/2015; **Acceptance:** 15/09/2015; **Publication:** 30/09/2015

Abstract

Background: Child under nutrition is still a public health problem adversely affecting the overall development and future productivity of children. **Objectives:** The main purpose of the study was to quantify the burden of undernutrition using both conventional indices of undernutrition and Composite Index of anthropometric failure (CIAF) and demonstrate the reliability of under-assessment by conventional indicators in urban setting. **Methods:** 250 under-five children registered with eight randomly selected anganwadi centres of urban slums of Jammu were studied. Anthropometric measurements were done using standardized tools. Length/height and weight were transformed to Z scores for both conventional indicators and CIAF using WHO Anthro software. CIAF was categorized using Svedberg classification. **Results:** A higher proportion of children were classified as undernourished by CIAF (73.2%). Only 26.8% children were anthropometrically normal. Stunting and underweight was observed in 42.8% and 38.8% under-fives respectively. Wasting was observed in only 20.4% of the children studied. Girls were more often stunted and underweight (65.4% and 66% respectively) while boys were more wasted (72.5%). 32.8% children would have been missed if underweight was used as a sole criterion to estimate undernutrition. Stunting Index (SI), Underweight Index (UI) and Wasting Index (WI) was 0.58, 0.53 and 0.27 respectively. **Conclusions:** CIAF categorized significantly higher percentage of undernourished children compared with conventional indicators. Routine anthropometric assessments in nutrition mitigation programs like ICDS should make use of CIAF for making short term and long term nutritional decisions both for individual children and for guiding policy decisions

Key Words

Anthropometry; CIAF; Community based; Undernutrition; Z-Score

Introduction

Under nutrition is an important determinant of maternal and child health (1) and a worldwide health concern since it kills or disables millions of children every year and prevents millions from reaching their full intellectual and productive potential. Poor foetal growth or stunting in first two years of life leads to irreversible damage, including shorter adult height, lower attained schooling, reduced adult income and decreased offspring weight. (2,3) According to data from World Health Organization (WHO), it is estimated that 60% of the 10.9 million annual deaths among children younger than five years old in low-income and middle-income countries are directly associated with undernutrition. (4).

At present 44% under five children in India are underweight, 20% are wasted and 48% are stunted. (5) Young children in India suffer from some of the highest levels of stunting, underweight, and wasting

observed in any country in the world, and 7 out of every 10 young children are anaemic, (6)

The first Millennium Development goal (7) is 'to halve between 1990 and 2015 the proportion of people who suffer from hunger' and one indicator to monitor progress for this target is the proportion of children who are underweight i.e. low weight compared with that expected for a well-nourished child of that age and sex. This anthropometric indicator can indicate wasting i.e. low weight for height indicating acute weight loss or much more commonly stunting i.e. low height for age indicating chronic restriction of child's potential growth .But it is a composite indicator and does not distinguish between the two, (8) Stunting and underweight are two conditions can have different determinants and respond to different interventions, (9)

In children, there will be different degrees of overlap between each indicator – i.e. some underweight children will also experience stunting and/or wasting, some stunted children might not be underweight and some children might simultaneously experience all three forms of anthropometric failure – stunting, wasting and underweight. As a result none of these conventional indicators used on their own can truly reflect the overall burden of under nutrition. An alternative indicator – the composite index of anthropometric failure (CIAF) – has been proposed, (10) and further modified by Nandy Seta (11) and it was emphasized that it needs to be validated under different circumstances. Three more indices (stunting index, wasting index and underweight index) have been proposed by Bose K *et al* (12) with rationale that CIAF fails to highlight the individual contribution and importance of stunting, wasting and underweight relative to overall prevalence of undernutrition.

Although number of studies have been conducted in the world and different parts of India emphasizing the burden of undernutrition, very few studies have been conducted in community settings using Z score system and CIAF in urban slums and no such study has been conducted in Jammu city.

Aims & Objectives

To estimate the true burden of undernutrition among under-five children living in urban slums

Material and Methods

A cross sectional epidemiological study of undernutrition was conducted on under-five children registered in anganwadi centres of urban slums of Jammu city. 250 children were needed to be studied in order to draw estimates about prevalence of undernutrition within 10 percentage points, with 80% power, 95% confidence (alpha 0.05), non-response rate 10% and design effect of 2. Eight randomly selected anganwadi centers thus provided the desired sample size. All the under-five children registered in these anganwadi centres were considered potential participants. Children whose parents were non-resident of the slum (residing for less than 1 year) were excluded from the study. Exact age of the child was assessed by any of the documents available with the parents like date of birth certificate, delivery discharge slip, immunization cards or horoscope. In case the records were not available, a regional local events calendar was used to assist the mother/caregiver recall.

Information on socio-demographic variables, immunization coverage and morbidity pattern, infant and child feeding practices were collected on a predesigned proforma from the mother of the child. Dietary history was collected by 24 hour dietary recall method. All the children were physically examined using a predetermined checklist to elicit any signs of malnutrition. The children requiring attention were further investigated and managed accordingly.

Weight and height of all the study children was taken as per standard WHO Guidelines on Anthropometry. (8) Thereafter for every child, Z scores for weight for age , height for age and weight for height were calculated using WHO Anthro software(version 3.2.2) (13). Children whose z-scores for each indicator fell below −2 standard deviations of the WHO Multicentre Growth reference study (14) reference population median were classified as stunted, wasted or underweight. The composite index of anthropometric failure was constructed. Stunting, wasting and underweight indices (SI, WI and UI) were calculated (12). Appropriate statistical methods were used for data analysis

Results

Table 1 reveals that proportion of underweight children was highest in age group of 13-24 months (80%), while wasting was seen more often in children less than 12 months (35%). Nearly two thirds of children in older age groups i.e., 25-36 and 37-48 months age group were stunted.

As Evident in table 2, stunting and underweight together accounted for nearly 80% of under-nutrition and both types were twice as prevalent in females as compared to their male counterparts. On the other hand, wasting was nearly 2.7 times more common in males even though it constituted only one fifth of the burden of undernutrition

Table 3 & Table 4 reveals distribution of undernutrition according to CIAF category and gender respectively. It is clearly evident that only 26.8% children studied were in the state of no anthropometric failure. As many as 73.2% children suffered from one or the other form of under nutrition with majority belonging to category F (Stunting only) followed by category Y (Underweight only). However, largest gender differentials were noticeable in CIAF category Y (female > males) and CIAF category C (males > females). Differentials with regards to CIAF category F (stunting) were not discernible

Discussion

Childhood malnutrition remains an important public health and developmental challenge in India. The reasons it deserves our concerted attention are various including the moral obligation to protect the weakest in the society. Needless to say, early and accurate assessment of undernutrition detection permits appropriate response and guides policy decisions. Longitudinally collected serial measurements are ideal but not always feasible. Therefore, cross sectional measurements made on children in schools and anganwadis serve as convenient sampling frame for assessment of malnutrition in field based epidemiological studies.

The figures for undernutrition observed in the present study using conventional indicators compares well with the figures reported by NFHS-3(6), UNICEF(5), HUNGAMA report(15). All three reports used conventional methods to assess undernutrition. Male preponderance in our study is reflective of the prevailing skewed sex ratio in general population and do not suggest any bias in assessment. The precision of estimate however could have been affected owing to smaller numbers available for analysis with advancing age. Other workers Mittal A *et al* (16), Sengupta P, (17) Alam Md *et al*, (18) Joshi HS, (19) also reported similar pattern of findings. However Rayhan MI, (20) reported higher prevalence of underweight children.

Maximum proportion of underweight children were in the age group of 13-24 months, wasted children in age group of 0-12 months and stunted in 25-36 months. This may be because breastfeeding during infancy protects infants to some extent and if complimentary food is not started at the right age, undernutrition starts developing Similar findings were reported by Avachat SS *et al*, (21) Rao *et al*, (22). However Sengupta P *et al* (17) observed that highest proportion of undernourished children among 48-59 months old.

In the present study females were more underweight and stunted as compared to males indicating that females suffered more from chronic undernutrition. The reason may be that males were given more preference regarding provision of better quality food and access to health services. These findings were similar to findings of NFHS-2 (23), Sengupta P (17), Luthra M (24), Joshi HS (19), Thakur JS (25) reported more prevalence of malnutrition more among males.

Consistently higher prevalence of stunting reflects that children in diverse settings are suffering from chronic undernutrition more as compared to acute/recent under nutrition. Low weight for age classification as sole criterion identifies children from groups C,D,E and Y (a substantial proportion (101 i.e. 40.4%) in our study was identified) while almost similar proportion falling in groups B and F (82 i.e. 32.8% children) gets missed. These are children who are stunted and wasted but not underweight and therefore would be misclassified as not undernourished. This finding finds consonance with many other studies and concludes that conventional indicators underestimate the true picture of undernutrition in the community, (11, 26, 27, 28).

Only 26.8% were anthropometrically normal i.e. nearly three fourth children were undernourished.

Conclusion

Herein, lies the value of CIAF categorization which not only accurately labels a child but also provides inputs for differential treatment of children with anthropometric failure of various combinations.

In India, there is paucity of community based data in children using Z score system. Various classification schemes have only added to confusion. Inaccurate assessment of the undernutrition has led to divergent thinking as to which of the methods should ideally be used to reflect the magnitude. The authors believe that the study inputs can serve to

substantiate the predominant opinion about the utility of CIAF categorization in guiding policy. Accurate knowledge of different forms of undernutrition relative to the total level of undernutrition as well as distribution of children with double or triple failures may encourage focussed attention to such children who are more likely to be from poorer families, have higher morbidity risk and therefore more likely to succumb to death, (11).

Nutritional mitigation Programs based on weight for age therefore are clearly insufficient. Strategic changes akin to Tamil Nadu Integrated Project might be required to accelerate pace of malnutrition decline. Additional efforts to promote immunization, early identification and appropriate treatment of infections , thrust on infant and child feeding practices and the most important one is reduction of poverty are likely to yield huge dividends.

Notwithstanding the above, report by Bhattacharya (2006) (29) has highlighted some conceptual limitations of CIAF , it does not satisfy the long-felt need for a combined clinical and anthropometric classification that would be useful for clinical as well as community health work but accepted the fact that associations exhibited between the types of anthropometric failure and morbidities are useful.

Recommendation

Similarly, the three indices (SI, UI and WI) reported in our study as 0.584, 0.530 and 0.278 although provide information on the significance of the problems of ST, UW and WS with respect to and relative to total undernutrition cannot be considered standalone indicators for guiding policy decisions. Therefore the authors are of the opinion that these three new indices cannot replace the conventional measures of undernutrition; the best option would be to evaluate the problem comprehensively using both new and conventional indices for better policy planning.

Authors Contribution

All authors have contributed equally in the study.

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Tables

TABLE 1 AGE WISE DISTRIBUTION BY TYPE OF UNDERNUTRION AS ASSESSED BY CONVENTIONAL ATHROPOMETRIC ASSESSMENT METHODS

AGE GROUP IN MONTHS (NUMBER OF CHILDREN)	UNDERWEIGHT* n(%)	WASTED ** n(%)	STUNTED*** n(%)	NORMAL n(%)
0-12 (N=80)	18(22.5)	28(35.0)	17(21.2)	18(22.5)
13-24(N=70)	56(80.0)	13(18.6)	30(42.8)	25(35.7)
25-36(N=53)	13(24.5)	7(13.20)	34(64.2)	10(18.8)
37-48(N=34)	8(23.5)	3(8.8)	19(55.9)	8(23.5)
49-60(N=13)	2(15.3)	0(0.0)	7(53.8)	6(46.2)
Total N=250	97(38.8)	51(20.4)	107(42.8)	67(26.8)

*The %ages do not add up to 100% as many children exhibited varying combinations of undernutrition. *Weight for age ** Weight for Height *** Height for Age*

TABLE 2 GENDERWISE DISTRIBUTION BY TYPE OF UNDERNUTRITION AS ASSESSED BY CONVENTIONAL ANTHROPOMETRIC ASSESSMENT METHODS

TYPE OF UNDERNUTRITION	MALES (N=152) n (%)	FEMALES (N=98) n (%)	TOTAL (N=250) n (%)
UNDERWEIGHT	33(34)	64(66)	97(38.8)
WASTING	37(72.5)	14(27.5)	51(20.4)
STUNTING	37(34.6)	70(65.4)	107(42.8)

TABLE 3 DISTRIBUTION OF CHILDREN ACCORDING TO COMPOSITE INDEX OF ANTHROPOMETRIC FAILURE

CIAF CATEGORY	ANTHROPOMETRIC STATE	NUMBER OF CHILDREN n(%)
A	NO FAILURE	67(26.8%)
B	WASTING ONLY	16(6.4%)
C	WASTING AND UNDERWEIGHT	21(8.4%)
D	UNDERWEIGHT,WASTING AND STUNTING	17(6.8%)
E	STUNTING AND UNDERWEIGHT	23(9.2%)
F	STUNTING ONLY	66(26.4%)
Y#	UNDERWEIGHT ONLY	40(16%)
TOTAL	TOTAL ANTHROPOMETRIC FAILURE(CIAF) (B+C+D+E+F+Y)	183(73.2%)

 # Sub group Y Introduced by Nandy et al. [11]

TABLE 4 GENDER-WISE DISTRIBUTION OF CHILDREN ACCORDING TO COMPOSITE INDEX OF ANTHROPOMETRIC FAILURE

CIAF	MALE	FEMALE
CATEGORY	N (%)	N (%)
A	46 (30.2)	21(21.4)
B	8(4.3)	8(8.16)
C	18(11.8)	3(3.06)
D	10(6.5)	7(7.14)
E	16(10.5)	7(7.14)
F	39(25.6)	27(27.5)
Y	15(9.8)	25(25.5)