ORIGINAL ARTICLE
pISSN 0976 3325 | eISSN 2229 6816
Open Access Article
www.njcmindia.org

Assessing Burden of Under-Nutrition among Underfive Children of Urban Slum by Using Composite Index of Anthropometric Failure in Ahmedabad City, Gujarat, India

Swarna Rastogi[1], Chaitanya Maheshwari[1], Santosh Kr Raghav[2], M K Lala[3]

Financial Support: None declared
Conflict of Interest: None declared

How to cite this article:
Rastogi S, Maheshwari C, Raghav SK, Lala MK. Assessing Burden of Under-Nutrition among Underfive Children of Urban Slum by Using Composite Index of Anthropometric Failure in Ahmedabad City, Gujarat, India\. Natl J Community Med 2017; 8(8):496-500.

Author's Affiliation:
[1]Assistant professor; [2]Lecturer cum Statistician, Dept of Community medicine, Muzaffarnagar medical college;
[3]Associate, professor, Dept of Community medicine, B J Medical College

Correspondence:
Dr. Swarna Rastogi
dr.swarnarastogi@gmail.com

Date of Submission: 06-07-17
Date of Acceptance: 09-08-17
Date of Publication: 31-08-17

ABSTRACT

Introduction: Reduction in child malnutrition is another MDG related to an improvement in child welfare. National data on underweight provided under NFHS-4 (National Family Health Survey) (2015-16) revealed underweight prevalence rate around 35.8%.

Objectives: To assess prevalence of under nutrition by composite index of anthropometric failure (CIAF) among under-five children of urban slums, Ahmedabad, Gujarat.

Methods and Materials: It was a Cross-sectional study done among 121 under-fives at anganwadisof B.J. Medical College, Ahmedabad using simple random sampling. Their nutritional status was expressed in Z score for WAZ, [H (L) AZ], and [WH (L) Z] as per WHO international growth standards 2006.

Result: Among 121 under-fives, the prevalence of underweight was 50%, whereas CIAF was 73.4%. 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.

Conclusion: Since CIAF is more than estimated by any of the three conventional indicators, it proves to be a better indicator in assessing the overall burden of under-nutrition in a population.

Keywords: under-nutrition, CIAF, under-five's, slum, India

INTRODUCTION

India has the highest proportion of undernourished children in the world. According to NFHS4 (20152016) prevalence of stunting, wasting & underweight among under-fives in Gujarat is 38.5%26.4%&39.3% respectively. Undernutrition among children under-fives is traditionally assessed using anthropometric indices such as – weight-for-age, height-for-age, weight-for-height and mid-upper arm circumference (MUAC). Stunting or low height-for-age is an indicator of chronic undernutrition which is manifested as poor skeletal growth. Low weight-for-height reflects wasting or acute undernutrition.[1] On the other hand, low MUAC (<11.5 cm) is not only suggestive of severe wasting or severe acute malnutrition but also indicative of morbidity and risk of mortality [2, 3, 4]. Underweight or low weight-for-age, on the other hand, is indicative of both acute and chronic undernutrition[4]. These indices reflect different facets of undernutrition but are not mutually exclusive categories. For instance, a child who is found to be stunted can also be underweight and wasted at the same time. Hence, a sum of the children who are underweight, stunted and wasted in a group does not reveal the overall number of undernourished children in a population. These conventional indic-

es therefore fail to provide the overall prevalence of undernutrition in a group.

There is another concern with the use of conventional indices. Weight-for-age is most commonly used to assess the nutritional status. This may be because underweight indicates both acute and chronic undernutrition. However, underweight is not the summation of children who are wasted and stunted. As a result, we might tend to miss out on children who are stunted and wasted if underweight is used as a sole indicator of nutritional status.

In the year 2000, Swedish Economist Prof. Peter Svedberg [5] suggested an alternative measure to assess the overall magnitude of undernutrition – Composite Index of Anthropometric Failure (CIAF). CIAF identifies seven groups of children including those without any form of anthropometric failure. A summation of the groups B, C, D, E and F gives the total magnitude of undernutrition. At the same time, it can be useful in detecting multiple anthropometric failures. It was revised by Nandyet al [6] 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.

AIM OF STUDY

As in Gujarat there is paucity of studies based on CIAF, this study was conducted to measure the prevalence of under-nutrition by both conventional methods and CIAF among under-five children of urban slums, Ahmedabad, Gujarat and to observe the reliability of CIAF.

MATERIALS AND METHOD

It is a Cross-sectional study done in Anganwadis of slums of urban field practice area of B. J. Medical College, Ahmedabad from March 2015 to june2016.

The line listing of all under-fives enrolled at anganwadi centersof Girdharnagar UHTC i.e. urban field practice area of B. J. Medical College, Ahmedabad was done. Total children enrolled at selected anganwadi centers accounted to 327. Consecutive sampling was applied to select the study participants and to achieve the sample size of 121. About 30 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 children.

Inclusion criteria: Children who (i) were beneficiaries of the anganwadi, (ii) had authentic records of their date of birth were included in the study. Age was calculated on the basis of their date of birth to the nearest one month.

Exclusion criteria: Children who were – (i) suffering from any chronic illness that influenced their nutritional status, (ii) born with congenital anomalies, (iii) born extremely premature (<28 weeks of gestational age).(iv)The children who were unavailable at two consecutive visits or whose birth records at present was not available were excluded from the study.

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 center records and was estimated to the most recently attained month. The anthropometric measurements of children were done using WHO guidelines (1995). [8] To measure weight, height; parents/guardians were suggested to bring their children to respective anganwadi center to increase the accuracy level of respective measuring parameters. The weight of child was measured using Salter's weighing 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.

Sample size calculation: Sample size for the cross-sectional prevalence study was calculated using the formula, Sample size (n) =$4PQ/d^2$.Considering the prevalence of CIAF [6] as 59.8%, 15% relative precision, 95% confidence level, and 5% non-response rate, the sample size comes to be 121.

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 Nandyet al [6] 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 [9] were also used to asses 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.

Statistical methods used: 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

Also the various other demographic indicators were recorded by interviewing their mother.

M:F Ratio is 1.2:1 in studied under five children out of which 45 (37.2%) female were under nourish compared to 44 (36.4%) of males.

Overcrowding was present in 52 (42.9%) of houses, out of which in 36 (29.7%) there were undernourish children. More 47 (38.8%) of under nourish children were present in families living in semi-pucca houses followed by kutcha10 (8.26%) and pucca 31(25.6%) houses respectively.

RESULTS

The study reveals that out of the 121 studied under-five children, 67 (56.3%) were females and 54 (44.7%) were males. Among studied under-fives 89 (73.4%) children had some form of anthropometric failure, whereas half of them 60(50%) were underweight which means that CIAF is a more sensitive indicator to detect under-nourishment (sensitivity of CIAF=73.4%). Nearly one-fourth of the children i.e. 27(22%) belonged to group E with both stunting and wasting and 13 (10%) of children were stunted (Group F) and 4 (3.34%) underweight (Group Y). In all age group CIAF would diagnose 23.4% more children as undernourished compared with weight for age criteria which is statistically significant ($p<0.05$). A total of 33 (27.5%) children in the study had single anthropometric failure (Group B, F, and Y), whereas 56 (46.7%) children had multiple anthropometric failures (Group C, D, and E). (Table 1).

Table 1: Distribution of study population by CIAF

Age* (months)	A (N)	B (W)	C (W+U)	D (S+W+U)	E (S+U)	F (S)	Y (U)	CIAF (B to Y)	Underweight (C+D+E+Y)	Total
0-11*	4	1	0	1	1	1	0	4 (50)	2 (25)	8
12-23	10	1	0	1	2	2	2	8 (41.2)	5 (29.4)	18
24-35	8	8	1	11	4	5	0	29 (75)	16 (50)	37
36-47	7	5	4	9	9	4	0	31 (81.8)	22 (66.7)	38
48-60	3	1	1	1	11	1	2	17 (85)	15 (75)	20
Total	32 (26)	16 (13)	6 (5)	23 (19)	27 (22)	13 (10)	4 (3)	89 (73.4)	60 (50)	121

Figures in parenthesis indicate percentage; N=normal,W=wasting,U=under-weight,S=stunting.
X^2=18.88, degree of freedom=8,p value=0.01 (S),yates X^2=13.828
*11months completed under-fives are only considered in 0-11 months

Table 2: Distribution of under-fives according to socio-demographic factors

Socio-demographic factors	Normal (n=32) (%)	Under-nourished (n=89) (%)	Total (%)	P value
Gender				
Female	22 (18.1)	45 (37.2)	67 (56.3)	0.075(NS)
Male	10 (08.3)	44 (36.4)	54 (44.7)	
Religion				
Hindu	27 (22.3)	63 (52.1)	90 (74.4)	0.131(NS)
Muslim	05 (04.1)	26 (21.5)	31 (25.6)	
Overcrowding				
Present	16 (13.2)	36 (29.7)	52 (42.9)	0.349(NS)
Absent	16 (13.2)	53 (43.9)	69 (57.1)	
Type of house				
Kutcha	02 (1.65)	10 (8.26)	12 (9.91)	0.041(S) df=2
Semi-pucca	11 (9.1)	47 (38.8)	58 (47.9)	
Pucca	20 (16.6)	31 (25.6)	51 (42.2)	
Type of family				
Nuclear	11 (9.1)	11 (9.1)	22 (18.2)	0.006(S) df=2
Joint	16 (13.2)	70 (57.8)	86 (71.0)	
Three generation	05 (4.19)	8 (6.61)	13 (10.8)	

Table 3: Distribution of studied under-fives according to their mother'seducation, birth order and birth weight & immunization

Factors affecting CIAF	Normal (n=32) (%)	Under-nourished (n=89) (%)	Total (%)	P value
Mother's education				
Illiterate	9 (07.4)	63 (52.1)	74 (59.5)	0.00002(S)
Literate	23 (19.0)	26 (21.5)	47 (40.5)	
Birth order				
1	5 (4.13)	12 (9.91)	17 (14.1)	0.93613(NS)
2	19 (15.7)	53 (43.8)	72 (59.5)	
>3	8 (6.61)	24 (19.8)	32 (26.4)	
Birth weight				
<2.5kg	14 (11.6)	59 (48.7)	73 (60.3)	0.02539(S)
>2.5kg	18 (14.8)	30 (24.9)	48 (39.7)	
Immunization				
Unimmunized	15 (12.4)	68 (56.2)	83 (68.6)	0.00203(S)
Immunized	17 (14.1)	21 (17.3)	38 (31.4)	

More under nourish children were present in joint 70(57.8%) families followed by nuclear 11(9.1%) andthird generation families 8(6.65%) respectively. (Table 2).

Under-nourish under-fives are more 74(59.5%) among illiterates as compared to literates 47(40.5%). Of them 63(52.1%) are undernourished among ilterates compared to literate mothers 26(21.5%) which is statistically significant. ($p<0.05$) As birth order increases undernourishment increasesi.e 12(9.91%), 53(43.8%) and 24(19.8%) among 1st order, 2nd order and >3 order respectively. Those under-fives who are low birth weight are more prone to get undernourished 59 (48.7%) compared to those who are normal at birth 30(24.9%)which is statistically significant. ($p<0.05$). Unimmunized also are more undernourished 68 (56.2%) compared to completely immunized 21(17.3%) which is statistically significant. ($p<0.05$). (Table 3)

DISCUSSION

Children of literate mothers 26(21.5%) were less likely be undernourished than children of illiterate63(52.1%) which is similar to a study by Shit S,et al[10]where children of literate mothers (68.5%) were less likely to have anthropometric failure than children of illiterate (92.3%) and just literate mothers (89.2%). Literacy status of mothers appeared to be an important factor affecting the prevalence of CIAF as in other studies.[13, 14]

A much higher proportion of under nourishment was found among children with three or more siblings 24(19.8%) compared with those with one 12(9.91%) and two 53(43.8%).A much higher proportion of anthropometric failure was found among children with birth weight <2.5 kg 59(48.7%) than with birth weight >2.5kg 30(24.9%). Out of those children who were unimmunized 68(56.2%) were in a state of more under nourishment compared with completely immunized 21(17.3%).Association between anthropometric failure and more number of siblings was reported in an earlier study.[13]Partially immunized or unimmunized children are more prone to undernutrition was also corroborated in another studyby Shit S,et al[10] where 94.8% unimmunized or partially immunized children were undernourished compared with 53.1% in completely immunized children.

The prevalence of CIAF in the study was higher compared with studies done in urban Coimbatore and rural West Bengal. The study conducted by Mukhopadhyayet al [13]Found a higher prevalence of undernourished children in families with lower monthly income.

In this study, we have attempted to construct three indices of undernutrition, relative to the CIAF. These three indices are: Stunting Index (SI) = Stunting / CIAF Underweight Index (UI) = Underweight /CIAF and Wasting Index (WI) = Wasting / CIAF. Furthermore, we have calculated and compared these indices using our dataset as well as other existing datasets. The sex-combined values of SI, UI and WI in the present study were 0.707, 0.496, and 0.483 respectively. The corresponding values when applied to the all India dataset, the values of SI, UI and WI were 0.756, 0.788 and 0.266, respectively [6]. Similar values (SI= 0.723, UI = 0.681, WI = 0.294) were observed in a study by Seetharam et al [11] and in study by Vishakh C Keri et al.(2016)[12] values were(SI= 0.786, UI =0.714 , WI = 0.286).From the above results we have also been able to infer that stunting and underweight represented by SI and UI respectively highlight that the problem of malnutrition is more chronic which implies improper practices of child rearing, low socioeconomic status etc than wasting which signifies acute malnutrition which forms a smaller percentage.

CONCLUSION

CIAF proves to be a better indicator in assessing the overall burden of under-nutrition in a population. ICDS scheme uses WAZ criteria for prioritizing children for supplementary nutrition. It gives an underestimation of undernourished children and misses a considerable portion of vulnerable children having multiple anthropometric failures without being under-weight.

There was no significant difference among under-fives as per their socio-demographic pattern which may be due to the reason that they were of low socioeconomic status, attending anganwadi and facing the similar situation. So I conclude that due attention should be given to all the under-fives so that they may be detected earliest.

RECOMMENDATION

Community-based, interventional study may be undertaken to assess the feasibility of using this index by the community health and nutrition workers in India.

Nutrition intervention programs coupled with awareness generation, sensitization among the health and nutrition service providers and other supportive strategies like accompanying public health measures are vital in uplifting the nutritional status of under-five children in India.

ACKNOWLEDGEMENT

All participants who participated in the study are gratefully acknowledged. This project would never have been possible without the support and guidance of my post graduate guide Dr.M.K.Lala associate professor, community medicine department, B.J.MedicalCollege. We are thankful to Principal, Head of the department, RHTC staff, as well as PG's of the Department of Community Medicine, BJ Medical College Ahmedabad,Gujarat for completion of this research project article.

REFERENCES

1. UNICEF. The State of World's Children report, 2003.New York: UNICEF; 2003.
2. International Institute for Population Sciences (IIPS) and Macro International. National Family Health Survey (NFHS-4), Mumbai, India: IIPS; 2015.
3. Berkley J, Mwangi I, Griffiths K, Ahmed I, Mithwani S, English M, et al. Assessment of severe malnutrition among hospitalized children in Rural Kenya: comparison of weight for height and mid upper arm circumference. J Am Med Assoc. 2005; 294:591–7. doi: 10.1001/jama.294.5.591. [PubMed]
4. World Health Organization and UNICEF. WHO child growth standards and the identification of severe acute malnutrition in infants and children. A Joint Statement by the World Health Organization and the United Nations Children's Fund. Geneva: World Health Organization; 2009. [PubMed]
5. Svedberg P. Poverty and under-nutrition: Theory measurement and policy. New Delhi: Oxford India paper backs; 2000.
6. Nandy S, Irving M, Gordon D, Subramanian SV, Smith GD. Poverty, child under-nutrition and morbidity: New evidence from India. Bull World Health Organ 2005; 83:210-6.
7. WHO. Physical Status: The use and interpretation of anthropometry- Report of WHO Expert Committee. WHO Technical Report Series-854. Geneva, Switzerland: World Health Organization; 1995.
8. W.H.O. Multicenter Growth Reference Study Group. W.H.O. Child Growth Standards: Length/Height-for-Age, Weight-for-Age, Weight-for-Length, Weight-for-Height and Body Mass Index –for-age: Methods and development. Geneva: World Health Organization; 2006.
9. Boss K, Mandal GC. Proposed new anthropometric indices of childhood under nutrition. Mal J Nutr2010; 16:131-6.
10. Shit S, et al.Assessment of Nutritional Status by Composite Index for Anthropometric Failure: A Study among Slum Children in Bankura, WestBengal.Indian Journal of Public Health, Volume 56, Issue 4, October-December, 2012
11. Seetharam N, Chacko TV, Shankar SLR, Mathew AC. Measuring malnutrition – The role of Z- scores and composite index of anthropometric failure (CIAF). Indian J Community Med. 2007; 1(1):35–9
12. Vishakh C Keri et al.Composite Index of Anthropometric Failure among Anganwadi Children in Rural Field Practice Area of Vydehi Institute of Medical Sciences and Research Centre.IOSR Journal of Dental and Medical Sciences,Volume 15, Issue 3 Ver. VII (Mar. 2016), PP 09-13
13. Mukhopadhyay DK, Biswas R, ChakravortyM,Sadhukhan SK, Bonik KK. Anthropometric Failure, a new approach to measure under nutrition: An experience from a rural community of West Bengal, India. J Indian Med Assoc 2009; 107:211-36.
14. Ray SK, Biswas AB, Das Gupta S, Mukherjee D.- Rapid Assessment of Nutritional Status and Dietary pattern in Municipal area. Indian J Community Med 2000; 25:14-8.