

Original Research Article

Burden of undernutrition among children of 12-59 months living in a slum of Kolkata: a cross-sectional study

Aparajita Dasgupta¹, Nidhi Shree^{1*}, Bobby Paul¹, Lina Bandyopadhyay¹,
Soumit Roy², Neelam Maurya¹, Foulisa Pyrbot¹

¹Department of Preventive and Social Medicine, AIHH and PH, Kolkata, West Bengal, India

²Department of Community Medicine, IQ City Medical College, Durgapur, West Bengal, India

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*Correspondence:

Dr. Nidhi Shree,

E-mail: dr.nidhishree23@gmail.com

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ABSTRACT

Background: Children living in slums are often deprived of good health. Their predisposition to malnutrition, makes them vulnerable to various infections and deficiency disorders affecting their growth. The objective of the study was to assess the nutritional status of 12-59 months children using Composite Index of Anthropometric Failure, to find out their morbidity profile, dietary diversity scores and to determine factors associated with CIAF.

Methods: Study was conducted among 115 children of 12-59 months age, living in Chetla slum, Kolkata, West Bengal from July to October 2019. A pre-designed, pre-tested schedule containing their sociodemographic characteristics, morbidity profile, dietary diversity and anthropometric measurements were used to collect the data. World Health Organization (WHO) Anthro. Ink 11 software was used to calculate the z scores Data was analysed in Microsoft Excel 2016 and Statistical package for social sciences (SPSS) version 16.

Results: Mean age (SD) of study participants was 30.77 (7) months. 43.5% children had CIAF. Proportion of underweight, stunting, weight for height and mid upper arm circumference wise malnutrition were 16.5%, 27.8%, 14.8% and 43% respectively. Majority, 87.8% had low dietary diversity and 38% had morbidity.

Conclusions: The proportion of CIAF was found high in the study. Low birth weight, single living child, absence of exclusive breastfeeding practice and dietary diversity were significantly associated in univariate analysis. CIAF gives a single convenient complete picture for malnutrition compared to other conventional interpretation methods, this it can be included in child health programmes. Enlightening the care givers of under-five by health education and health promotional programmes can prevent malnutrition from occurring.

Keywords: CIAF, Dietary diversity, Stunting

INTRODUCTION

Malnutrition is widely recognized as a major public health problem worldwide. In middle income countries the scenario is grimmer. Healthy childhood plays a pivotal role in building healthy foundation for future. And a healthy adulthood ultimately adds on to a country's health economy. Thus the need to focus on the young children becomes more empirical.

Vicious interactions between undernutrition, poor health, and impaired cognitive development set children on lower development paths and leads to irreversible changes.

Globally, one third of the children die (7.6 million) before their fifth birthday and this is primarily due to undernutrition.⁴

Under-nutrition continues to be a serious health problem among the children in India. NFHS-4 data revealed the prevalence of underweight, stunting, and wasting as 35.7%, 38.4%, and 21% when compared to NFHS-3 42.5%, 48%, and 19.8% in India, which reflects slow reduction in the prevalence of malnutrition.^{1,2,4} It also suggests that Indian children suffer from both aspects of undernutrition which means short-term, acute food deficits (as reflected in low weight-for-age) as well as from long-term, chronic undernutrition (as manifested in high rates of stunting).

World Health Organization (WHO) has recommended the use of z-score to grade malnutrition but z-score system does not provide comprehensive magnitude of undernutrition.^{5,6}

Anthropometric indices can serve only as proxies for evaluating the prevalence of undernutrition among children. Therefore, for a comprehensive measurement of overall prevalence of undernutrition there is a need for a single aggregate indicator.

Such an aggregate indicator was proposed by Peter Svedberg called CIAF i.e., Composite Index of Anthropometric Failure.⁷ Svedberg's model identifies six groups, to these subgroups one more subgroup Y has been added by Nandy et al which represents children who are only underweight.⁸

Acute as well as long term micro and macro nutrient deficiencies contributed by the dietary diversity which is further contributed by household food access and food consumption when triangulated with composite anthropometric measurements information can contribute towards providing a holistic picture of the nutritional status among the children in the community.

Thus, in this study we have tried to find the dietary diversity status and CIAF, which is used to comment on the children's malnutrition status.

METHODS

Study design

A cross-sectional community-based study conducted from June to October 2019 among 12-59 months children living in a slum of Chetla Kolkata, West Bengal.

All the children in the age group 12-59 completed months registered in family folders of Urban Health Unit and Training Centre, Chetla under All India Institute of Hygiene and Public Health of Kolkata, West Bengal, India were included in the study.

Those who were suffering from previously diagnosed severe neurological and musculoskeletal deformities and those whose caregiver did not give informed written consent were excluded.

Sample size and sampling technique

According to NFHS 4 data, prevalence of stunting under-five children was 38.4%.¹

Calculated with Cochran's formula at 95% confidence level, $(N = \frac{Z^2 P.Q}{L^2})$, considering prevalence of undernutrition, $p=38.4\%$ (NFHS-4) and absolute error 10%, the minimum sample size was 92. Taking 20% as non-response, the final sample size came to 111.

The desired sample (i.e., 111 children) was selected by simple random sampling method. List of eligible children was obtained from the family folders maintained in MCH unit of UHU and TC Chetla, thereafter children were approached without replacement method via house to house visits done by the researcher until the desired sample size was achieved. Among all the houses visited for the study, mothers of 115 gave consent for participation in the study, therefore all were included in the study.

Study tools

Pre-designed pre-tested structured schedule containing the sociodemographic characteristics, morbidity profile, dietary diversity questions. Portable weighing machine (properly calibrated). Non-stretchable measuring tape. Handmade cardboard based portable infantometer. Immunization card.

Study techniques

Information was obtained from the caregivers of subjects after gaining proper consent by face to face interview, review of medical and immunization records, anthropometric measurements.

Preparation of schedule

Schedule was prepared in a way to reveal closest possible information as per stated objectives. The content and face validity was checked with the subject expert.

Study variables

Dependent variable

Composite Index of Anthropometric failure (CIAF)

Independent variables

Socioeconomic factors (education and occupation of the parents, and monthly income of the family).

Demographic factors (age and gender of the child, and religion, caste, and type of family).

Biological factors (age of mother at time of the child's birth; birth order of the child; birth spacing; birth weight; and gestational age at birth) Nutritional status of children was assessed using different indices of growth.

Dietary diversity.

Morbidity profile of children.

Operational definitions

Underweight for age: was defined for Z-score <-2.0 SD of the WHO (2006) reference standards. Severe underweight was taken as weight for age Z-score <-3.0 SD.

Stunting: was defined as a Z-score of Height for age (HFA) <-2.0 SD of the WHO (2006) reference standards. Severe stunting was taken as height for age Z-score <-3.0 SD.

Wasting: was defined as a Z-score of Weight for height (WFH) <-2.0 SD of the WHO (2006) reference standards. Severe wasting was taken as weight for height Z-score <-3.0 SD.

Undernutrition: was defined as MUAC of <13.5 cm for children, and a MUAC between 12.5 and 13.5 cm denotes moderate undernutrition, and less than 12.5 cm severe undernutrition.

CIAF classification, was used to measure the anthropometric failure: where

I. Group A: No failure

II. Group B: Wasting only

III. Group C: Wasting and underweight

IV. Group D: Wasting, stunting, and underweight

V. Group E: Stunting and underweight

VI. Group F: Stunting only

VII. Group Y: Underweight only

(From the above classification, total value of anthropometric failure was measured by summation of all the groups except group A)

Dietary Diversity: Dietary diversity scores were calculated by summing the number of 12 food groups (cereals, vegetables, spices/condiments/beverages, oils and fats, fish and other seafood, legumes/nuts/seeds, tubers/roots, fruits, meat, sweets, milk and milk products and eggs) consumed by the children over the 24-hour recall period. Mean score (6) was then used to categorize

subjects into high (score > 6) dietary diversity and low (score ≤ 6) dietary diversity.

Morbidity profile: was assessed by frequencies and duration of morbidity in last 2 weeks from day of study. The 2-week recall period was thought to be the most suitable for ensuring that there will be an adequate number of cases to analyse and that recall errors will not be too serious.

Standard operating procedures

The data included were weight, recumbent length (if the child was not able to stand without support), standing height, and MUAC (mid-upper arm circumference). Weight was measured to the nearest 0.1 kg using a standard, properly calibrated weighing machine. Height was measured using a non-stretchable measuring tape fixed to a vertical wall, with the participant standing on a firm/level surface, and it was measured to the nearest 0.1 cm. Recumbent length was measured using a portable handmade cardboard based infantometer. Undernutrition was measured by taking MUAC by a non-stretchable measuring tape in the mid-way between the tip of acromion process and the olecranon process of the left (non-dominant arm). Each measurement was taken twice and the mean of the two readings was recorded.

Method of data collection

Ethical approval was obtained from All India Institute of Hygiene and Public Health, Kolkata. After explaining the procedure and importance of the study, informed written consent was obtained from the mothers (primary care givers) of the children and thereafter they were interviewed with help of a predesigned pretested structured schedule. After which children were examined clinically and their anthropometric measurement was taken as per standard operating procedures. Medical records and immunization cards were also reviewed.

Data analysis

All data were compiled and analysed using MS Excel 2016 and Statistical package for the social sciences version 16 (SPSS for Windows, version 16.0, SPSS Inc., Chicago, USA). WHO Anthro. Ink 11 software was used to calculate the z scores. Descriptive and inferential statistics including univariate and multivariable logistic regression were calculated. $P < 0.2$ in univariate model was used as selection criteria for a biologically plausible variable in multivariable model where P value < 0.05 was considered as level of significance.

RESULTS

Background characteristics

More than half 54.8% (63) of the children were females. Mean (SD) age was 30.8 (SD =14.5) months, ranged from

12 to 59 months. Around two third 60.9% (70) of them belonged to joint family and 59.1% (68) were single child. Few 11.3% (13) of them belonged to higher birth order (three or more).

Table 1: Background characteristics of study participants (n=115).

Variables	Number (%)
Age (in months) (mean= 30.8, SD= 14.5, range=46)	
12 to 23	43 (37.4)
24 to 35	24 (20.9)
36 to 47	18 (15.7)
48 to 59	30 (26.0)
Education of mother	
Below primary and Primary	97 (84.3)
Secondary and above	18 (15.7)
Low birth weight (< 2.5 kg)	
Yes	18 (15.7)
No	97 (84.3)
Birth order	
1	68 (59.1)
2	34 (29.6)
≥3	13 (11.3)
Exclusive breastfeeding practice	
No	91 (79.1)
Yes	24 (20.9)
Deworming done in last 6 months	
Yes	38 (33.1)
No	77 (66.9)
Sick in last 15 days	
Yes	28 (24.3)
No	87 (75.7)
Dietary diversity	
Low	101 (87.8)
High	14 (12.2)
Avails anganwadi (ICDS services)	
Yes	107 (93.1)
No	8 (6.9)

Work for pay*housemaid, sweeper, shopkeeper, teacher

Most of the mothers had primary or below primary level of education 84.3% (97) and majority 81.7% (94) were home-maker by profession. As per modified BG Prasad scale 2019 more than two third 63.5% (73) children were from class IV and around one third 31.4% (36) belonged to class III socioeconomic status. Majority 84.3% (97) had normal birth weight (≥ 2.5 kg) and more than two third 79.1% (91) were not exclusive breast-fed. Pre-lacteal feeding was observed in 16.5% (19) subjects. Nearly all 93.1% (107) availed supplementary nutrition from Anganwadi centres under Integrated Child Development Service Scheme. Nearly all 91.3% (105) were completely immunized and only one third of them 33.1% (38) had received mass deworming dosage in last 6 months.

Table 2: Anthropometric indices of study participants (n=115).

Anthropometric indices	Number (%)
Weight for age	
Normal	96 (83.5)
Underweight (<-2SD)	18 (15.6)
Severe underweight (<-3SD)	1 (0.9)
Height for age	
Normal	83 (72.2)
Stunting (<-2SD)	11 (9.5)
Severe stunting (<-3SD)	21 (18.3)
Weight for height	
Normal	98 (85.2)
Moderate wasting (<-2SD)	12 (10.5)
Severe wasting (<-3SD)	5 (4.3)
MUAC	
Normal	65 (56.6)
Moderate (<-2SD)	42 (36.5)
Severe (<-3SD)	8 (6.9)
CIAF	
Group A (no failure)	65 (56.5)
Group B (wasting only)	9 (7.8)
Group C (wasting and underweight)	7 (6.1)
Group D (Wasting, stunting and underweight)	1 (0.9)
Group E (stunting, underweight)	9 (7.8)
Group F (stunting only)	22 (19.2)
Group Y (underweight only)	2 (1.7)
CIAF (Total)	50 (43.5)

#WZA, Weight for age, HFA, Height for age, WFH, weight for height, MUAC, Mid Upper Arm Circumference, CIAF, Composite Index of Anthropometric Failure

Dietary diversity

Majority 87.8% (101) had low dietary diversity (median score ≤ 6) (Table 1).

Morbidity profile

Around one-fourth 24.3% (28) had history of acute illness in last 15 days. No history of chronic morbidity was found (Table 1). Out of overall acute illness, majority were acute respiratory illness 35.7% (10), diarrhoea 28.6% (8) and fever of unknown origin 35.7% (10). (Figure 1)

Anthropometric characteristics

According to the anthropometric parameters, prevalence of underweight, stunting and wasting were 16.5% (19), 27.8% (32) and 14.8% (17) respectively. However almost half of them 43.4% (50) had undernutrition as per Mid upper arm circumference measurement (MUAC). Overall Composite Index of Anthropometric Failure were observed in 43.5% (50) of the subjects (Table 2).

Univariate and multi-variable logistic regression

In univariate regression model among several independent variables, single living child (OR=3.12, $p=0.004$), absence of exclusive breast feeding (OR=0.29, $p=0.012$), low birth weight (OR=0.17, $p=0.003$) and low dietary diversity (OR=3.19, $p=0.05$) were found significantly associated with CIAF. (Table 3)

These four variables were included in final multivariable model. Odds of dietary diversity status (AOR=3.71, $p=0.06$) was attenuated. Birth weight was also attenuated but lost its significance (AOR=2.89, $p=0.109$). Odds of anthropometric failure among single child (AOR=3.59, $p=0.005$) and absence of exclusive breast feeding (AOR=0.33, $p=0.04$) were increased.

This model fit was good as Hosmer-Lameshow test showed insignificant value and 18.8% to 25.2% variability of dependent variable was explained by the model as revealed by Cox and Snell and Nagelkerke R^2 , respectively.

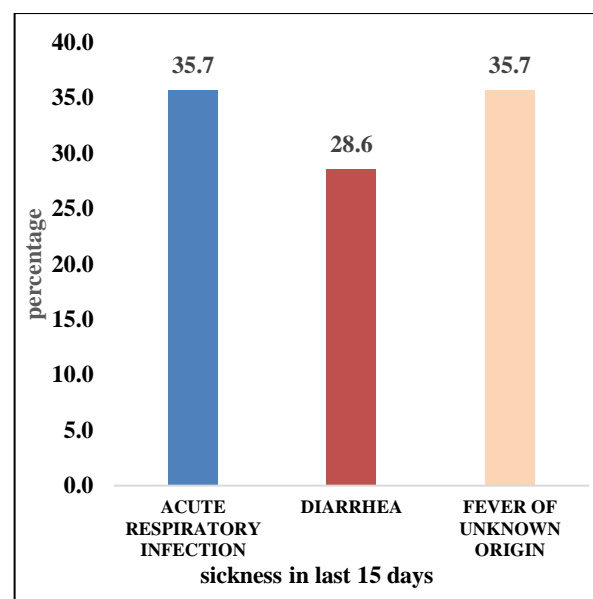


Figure 1: Distribution of children according to history of sickness in last 15 days (n= 28).

Table 3: Factors associated with Composite index of anthropometric failure: univariate and multi-variable logistic regression (n=115).

Covariates		Total (n)	CIAF Number (%)	OR (95% CI)	AOR (95% CI)	P value
Low birth weight	Yes	18	14(77.7)	0.17 [0.08-1.93]	0.36 [0.097-1.377]	0.137
	No	97	36 (37.1)	1	1	
Absence of exclusive breast feeding	Yes	91	34(37.4)	0.29 [0.12-0.77]	0.33 [0.11-0.99]	0.04*
	No	24	16(66.6)	1	1	
Single child	Yes	68	37(54.4)	3.12 [1.41-6.93]	3.59 [1.46-8.86]	0.005*
	No	47	13(27.6)	1	1	
Dietary diversity	Low	101	47(46.5)	3.19 [0.84-12.13]	3.79 [0.94-15.34]	0.06
	High	14	3(21.4)	1	1	

*Model is adjusted with other demographic Socioeconomic and Biological factors variables. Model fitting is good (omnibus test P value<0.001, Hosmer-Lemeshow test P value=0.76, Cox & Snell R^2 =0.188, Nagelkerke R^2 = 0.257).

DISCUSSION

In the present study, child under-nutrition has been explained in the terms of CIAF, aiming to evaluate the association of this index with their socio-economic and behaviour characteristics.

In this study, prevalence of underweight among 12-59 months old children were 16.5 %, and that of wasting was 14.5 %, as compared to 31.6 % underweight and 20.3% wasting in West Bengal and 26.2 % underweight and 16.7% wasting in urban West Bengal.¹

However, the proportion of stunting in this study was 27.8% which was consistent with stunting 28.5% in urban West Bengal lower than that reported in India 38.4% and in West Bengal 32.5%.¹

Similarly, the prevalence of undernutrition using CIAF was found to be 43.5% in this study, which is more than that observed by Roy et al 36.1% in rural area of Singur, West Bengal but is much less than that observed by Mukhopadhyay and Biswas 69.1% and Shit et al (80.3%) in Bankura district of West Bengal, and Sen et al 63.6% in Darjeeling district of West Bengal to have anthropometric failure.⁹⁻¹²

Shit et al also observed similar findings regarding education level of mother, type of family, and number of siblings in the family [higher birth order (>3) taken into consideration in this study].¹¹ Nandy et al¹³ analysed the NFHS-2 data and observed an overall prevalence of 59.8% anthropometric failure in our country.

Prevalence of CIAF in other countries were 38.7% in Bahawalpur region of Pakistan, 33.3% in Nyanza Province of Kenya, and 55.5% in Zambia.¹⁴⁻¹⁶

In this study, children who had less birth weight, who were not exclusively breast feed, or were of single living child were more likely to have anthropometric failure. Similar findings were observed in the study by Anjali et al.¹⁷

Different standardized methods are available for assessing nutritional status such as WZA, WFH, HFA, and MUAC. CIAF consolidates all methods of assessment of nutritional status and, therefore, it is felt that it gives the true measurement and complete picture of malnutrition.

Our study had certain strength, namely, this was a community-based study, standard operative procedures followed for all measurements, and it focused simultaneously on assessment of undernutrition using CIAF and dietary diversity and their association.

Certain limitations in our study were like use of small sample size and limited study period, so the children were not followed up. Thus, a longitudinal study may prove more useful in this regard.

CONCLUSION

The proportion of CIAF wise malnutrition was found high in the study and single living child and exclusive breastfeeding practice were significantly associated with presence of CIAF in multivariate analysis. Low dietary diversity was associated with CIAF, in univariate analysis. Also CIAF gives a single convenient complete picture for malnutrition as compared to other conventional methods of interpretation, it can be included in upcoming child health programmes. Appropriate health education focused on growth and nutrition must be given to the care givers of under five children residing in slums, not only to generate their awareness on the problem but also to bring a positive future impact on the health of the child, and will also promote preventive measures to avoid malnutrition.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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