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Original Research Article

A community-based cross-sectional study to assess the prevalence of undernutrition in 0 to 6 years anganwadi children of Panvel block, Raigad district, Maharashtra

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ABSTRACT

Background: An impaired nutritional status in preschool children significantly Impacts their overall childhood development. Early detection of undernutrition at an early age is crucial for early intervention. Objectives of the study were to conduct nutritional status assessments of preschool children, to detect the overall prevalence and various patterns of undernutrition in these children by applying a composite index of anthropometric failure (CIAF) indicator.
Methods: A community-based, cross-sectional study was conducted in January 2019 to March 2020. The sample size of 8542 was computed by formula $n=4pq/L^2$, by randomly selecting 132 Anganwadi. Nutritional status assessment of the children was done by anthropometrics and clinical examinations. Conventional indices (underweight, stunting, and wasting) and CIAF classification were used to assess. The prevalence of undernutrition. Statistical analysis was done by Microsoft Excel and SPSS version 27 and statistical tests were applied.
Results: 50.6% of children were detected for "anthropometric failure" by the CIAF method. The conventional indices showed the prevalence of underweight at 32.9%, stunting at 35.7%, and wasting at 16.4%. The 13 to 25-month age group was more significantly affected (57%) than its counterparts for undernutrition. Statistically, no significant difference was found between genders across all age groups for undernutrition (χ^2=9.8, χ^{tab}=11.08). Chronic undernutrition seemed highly prevalent than acute one in preschool children.
Conclusions: A more comprehensive policy program is needed to identify and cover single as well as multiple anthropometrical failure children. Special attention is needed towards the 13 to 25 months old children.

Keywords: Anthropometry, Composite index of anthropometric failure, Conventional indicators, Under-nutrition

INTRODUCTION

Undernutrition is a silent killer in preschool children imposing serious health impairments. The nutritional status of the children reflects the nutritional profile of that particular community as a whole. Undernutrition in the early stage of life has long-term negative consequences like susceptibility to infections, diseases, and further undernutrition. It may impede a child's motor, sensory, cognitive, social, and emotional development. A malnourished child is likely to grow as a malnourished adult with a greater risk of having diseases and early death.[1]

Globally, 80% of undernourished children live in 20 countries. In India, 60 million children face being underweight, a leading cause of childhood mortality.[2] Due to an extensive prevalence in India, mild to moderate undernutrition contributes to more deaths (43%) than severe (11%).[3] It's a leading cause of death in 12 to 23 months old children. Most of these children die before reaching their 5th birthday due to undernutrition. In 2019-2021 (NFHS-5) data for India, the prevalence of

underweight, stunting, and wasting were 32%, 35.5%, and 19.3% respectively. It is high in Uttar Pradesh, Bihar, Assam, and Rajasthan. Maharashtra constitutes 36.1% underweight, 35.2% stunting, 25.6% wasting, and 10.9% severely wasting rates. In the Raigad district, the prevalence of underweight, stunting, and wasting is 34.1%, 35.8%, and 19.9% respectively.[4] The first 1000 days of life of every child are very important to give a good start for the physical, mental and social development. Undernutrition as a health problem has deleterious effects on overall childhood development. Hence the study was imperative to assess the single anthropometric failures (underweight, stunting, or wasting) along with CIAF. It showed the various patterns of undernutrition and its overall burden in the said community, thus providing an accurate estimate of the undernourished children. This will help to improve the quality-of-service provision and prevent further damage to the individual, family, and community health. For the assessment of undernutrition, the conventional indices like underweight (low weight for age), stunting (low height for age), and wasting (low weight for height) are in routine practice, which is obtained by WHO-Z score charts.[5]

Stunting reflects the holistic burden of chronic malnutrition, wasting shows acute malnutrition, and underweight reflects both acute and chronic malnutrition. But, none of these three indices will be able to provide a comprehensive estimate of the total number of under-nourished children in the community. The indicator-composite index of anthropometric failure (CIAF) helped to figure out the overall prevalence and the various patterns of undernutrition in children. It was proposed by Svedberg (2000) and later modified by Nandy et al, (2005).[6]

Objectives

To assess the nutritional status of 0 to 6 years age group Anganwadi children of Panvel block, Raigad district, Maharashtra, India. To detect the overall prevalence of undernutrition and its various patterns using the CIAF method.

METHODS

A community-based; cross-sectional study was conducted for the population of Panvel block from January 2019 to March 2020. Out of 300 Anganwadis centres of the Panvel block, 132 Anganwadi centres were selected by simple random technique.

The permission for the study was taken from integrated child development services (ICDS), Panvel block. 0 to 72 months old male and female children attending the Anganwadi centre were the study population.

A sample size of 8542 children was computed by using a formula $n=4pq/L^2$ at a 95% confidence interval. P is the prevalence rate for under-nutrition for preschool children which was taken as 35% from the review of various literature used as references. L is an allowable error, which was taken as 3% for the current study.

Inclusion criteria

Inclusion criteria were the children attending the Anganwadi with a complete age of 0 to 72 months and with authentic birth records.

Exclusion criteria

Exclusion criteria include children suffering from critical illness history and congenital anomalies affecting nutritional health status.

The data were registered in a semi-structured, pretested, and validated health card, by interviewing the individual parent of a child and Anganwadi worker.

The parents were counselled before the study with verbal consent. There was zero risk to the children during the conduct of the study as no interventional investigations were made. A unique “divine mother-child health program” (DMCHP) ID number was generated to safeguard the confidentiality of each child and for the purpose of creating an electronic online database. The qualitative data like the child's name, sex, family history, nutritional status, dietary habits, present and past illnesses history, socioeconomic status, and contact number were recorded in Health cards. A mother of a child was chosen as the preferred responder; in the absence of the mother, grandmother, father, or any elderly was chosen as the responder. The exact age in months was computed from the child’s date of birth and validated with the Anganwadi worker (AWW) records. The assessment of the nutritional status was done by recordings of anthropometry (height/length and weight measurements) and clinical examination. For children from zero to two years old, weight was measured with the nearest accuracy of 0.5 kg on Salter’s weighing scale and for children >2 years old, weights were taken on a digital scale (Crown weighing machine, ISO certified 9001). Zero error was checked and adjusted before every measurement and standardized after every 50 measurements by using known weights. The weighing scale used could measure a maximum of 25 kg weight. The weight of the subject was measured with minimal clothing and bare feet. The height was measured for children <2 years by an infantometer with the supine length and the nearest accuracy of 0.1 cm. For the children aged >2 years, a fixed stadiometer and scale were used with bare feet. The data obtained was uploaded to the customized online software of the institute. The was cleaned and coded for further analysis. The anthropometric measurements like age in months, weight in grams, and height/length in centimeters were considered the main parameters for the study for computing the indicators. The World Health Organization (WHO) 2006, growth standards.

Tables were used to obtain the Z-scores values such as the weight for age (WAZ), height for age (HAZ), and weight for height (WHZ).[5] Underweight, stunting, and wasting are the conventional indices of categories of undernutrition. The child with WAZ, Z score <2 standard deviations (SD), was labelled as underweight. The child with WHZ, Z score ≤2 SD, was labelled as wasted, and with HAZ, Z score ≤2 SD, was labelled as stunting. The SD value between -2 and -3 was considered moderate under-nutrition while the SD value ≥3 was considered severe under-nutrition in the child.

Table 1: Categories of the composite index of anthropometric failure (CIAF).

Groups	Description of the groups	WAZ	WHZ	HAZ
A	No anthropometric failure	Normal	Normal	Normal
B	Wasting only	Normal	≤2	Normal
C	Wasting and underweight	≤2	≤2	Normal
D	Wasting, underweight and stunting	≤2	≤2	≤2
E	Stunting and underweight	≤2	Normal	≤2
F	Stunting only	Normal	Normal	≤2
Y	Underweight only	≤2	Normal	Normal

WAZ denotes weight for age Z score. WHZ denotes for weight for height Z score. HAZ denotes height for age Z score.

The composite index of anthropometric failure (CIAF) classification was used to derive the various patterns and overall prevalence of undernutrition in the study population (Table 1). The method included seven subgroups A, B, C, D, E, F, and Y. The subgroups from B to Y showed different patterns of anthropometrical failures in children such as single, double, or triple failures. The total of B to Y showed children's overall prevalence of undernutrition.[7] The method helped to detect all undernourished children, which would have been otherwise missed out by conventional indices. The data were analyzed by Microsoft Excel and by SPPSS version 27 software. Statistical tests like the standard error of proportion and chi-square test were applied to test the significance of the difference between the genders and age groups. The results were computed using a 95% confidence interval.

RESULTS

Table 2 shows a total of 8542 children were included in the study. The males were 52% and the female children constituted 48% were divided into six age groups zero to six years. Of which 37 to 48 months age group children constituted the majority in the study at 23%.

Table 3 presents the age and gender-wise distribution of undernutrition among the children as per the CIAF indicator. There was a statistically high prevalence found (58%) in the age group of 13 to 24 months compared to their counterparts. Gender-wise no significant difference was noticed across all the age groups in males and females in the study population.

Table 2: Age and gender wise distribution of the study population (n=8542).

Age group in months	Male		Female		Total	
	N	%	N	%	N	%
0-12	280	6	235	6	515	6
13-24	546	12	509	12	1055	12
25-36	834	19	766	19	1600	19
37-48	989	22	957	23	1946	23
49-60	956	22	854	21	1810	21
61-72	814	18	802	19	1616	19
Total	4419	52	4123	48	8542	100

Table 3: Age and gender-wise undernutrition patterns in the study population (CIAF classification, n=8542).

Age in months	Female	Female undernourished		Male	Male undernourished		Total	Total under-nourished	
	N	N	%	N	N	%	N	N	%
0-12	235	107	46	280	140	50	515	247	48
13-24	509	287	56	546	321	59	1055	608	58
25-36	766	368	48	834	462	55	1600	830	52
37-48	957	478	50	989	517	52	1946	995	51
49-60	854	394	46	956	424	44	1810	818	45
61-72	802	424	53	814	404	50	1616	828	51
Total	4123	2058	50	4419	2268	51	8542	4326	51

N is the study population. CIAF denotes composite index of anthropometric failure.

Table 4: Prevalence of under-nutrition- conventional method (n=8542).

Age in months	Total children		Underweight (%)			Wasting (%)			Stunting (%)		
	N	%	-2 SD	-3 SD	Total	-2 SD	-3 SD	Total	-2 SD	-3 SD	Total
0-12	515	6	13	6	19	9	8	17	18	11	30
13-24	1055	12	18	8	26	7	7	14	28	18	47
25-36	1600	19	25	8	33	9	5	14	25	13	38
37-48	1946	23	25	11	36	10	6	16	26	13	39
49-60	1810	21	21	10	32	11	4	15	23	10	33
61-72	1616	19	29	11	40	16	5	21	20	7	27
Total	8542	100	23	10	33	11	6	16	24	12	36

Table 5: Composite index of anthropometric failure classification- undernutrition patterns (CIAF) (n=8542).

Group	Anthropometric status	Male		Female		Total children	
		N	%	N	%	N	%
A	No failure	2151	49	2065	50	4216	49
B	Wasting only	180	4	166	4	346	4
C	Wasting+underweight	296	7	277	7	573	7
D	Wasting + stunting + underweight	290	7	187	4	477	6
E	Stunting+ underweight	708	16	694	17	1402	16
F	Stunting only	633	14	536	13	1169	14
Y	Underweight only	161	4	198	5	359	4
Total failure rate		4119	51	4123	50	4326	51

Table 4 shows that the conventional indices detected the total number of children having underweight (33%), wasting (16%), and stunting (36%). The age group of 61 to 72 months showed a high prevalence of being underweight (40%) and wasting (21%), while (47%) stunting. But the data did not reflect the overall estimate for undernutrition in the said community as compared to CIAF.

Thus, as per the CIAF study, reflected a total burden of (51%) for undernutrition vs conventional indices in the children (Table 5). The CIAF classification permits the disaggregation of undernourished children into different subgroups.

Overall, only (49%) of the children studied were anthropometrically normal; (51%) of the children were suffering from one or other form of "anthropometric failure" (groups B, C, D, E, Y, and F). The children are suffering from either single or dual, or triple failure for their undernutrition. The single failure includes group B (wasting only), group F (stunting only), and group Y (underweight only) having prevalence rates at (4%), (4%) and (14%) respectively. The dual failure constitutes group C (wasting and underweight) and group E (stunting and underweight) with the prevalence rate of (7%) and (16%) respectively. Triple failure has a combination of wasting, stunting, and underweight children with an overall prevalence rate of 6%. Group E (stunting and underweight) showed a high prevalence (16%) for undernutrition in the study group, followed by group F, stunting only pattern (14%) a second high. There was no statistically significant difference found in females and males for undernutrition age-wise (50 % vs 51%) as per the chi-square test (χ^2=9.8, χ^{tab} = 11.08), p>0.05, not significant.

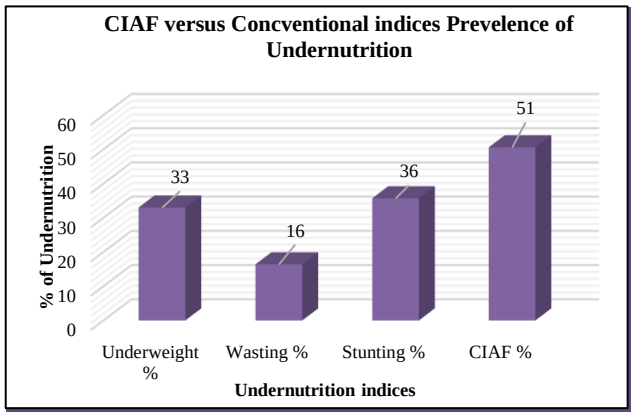

Figure 1: Under-nutrition comparison: CIAF versus conventional indices (n=8542).

Figure 1 showed the data comparisons between conventional and CIAF indices. The conventional method gave standalone data for underweight, stunting, and wasting. It does not reflect the overall prevalence of undernutrition in preschool children. On the other hand, the CIAF method reflected the overall prevalence of undernutrition in preschool children (51%) in the community.

DISCUSSION

The current study is a cross-sectional study aimed to detect the overall prevalence of undernutrition and its various patterns by CIAF classification to understand its magnitude in preschool children. The conventional indices reflected the light on the individual pattern of under-nutrition (underweight, stunting, and wasting) with moderate and severe categories. This method is important for clinicians and field workers, so as to deal with specific undernutrition as well as, children with triple anthropometric failures, who are more vulnerable, carrying the greatest morbidity (and potentially mortality) risk. The current study provided an estimation for the single, dual, and triple failures as well as the total prevalence of undernutrition in 0 to 72 months age group children by the CIAF method. In the study, CIAF classification observed a total of (51%) of children in an anthropometric failure state. While the conventional indices showed the prevalence of underweight (33%), stunting (36%), and wasting (16%). A similar prevalence rate was observed in NFHS-5 data for Raigad district, Maharashtra state for undernutrition.[4] As per the reviewed works of literature, the studies showed a high prevalence of undernutrition in preschool children as per the CIAF indicator than conventional ones.

Nandy et al, study showed a prevalence rate of 60%, Sen et al, the study found the rate as 63.6%, and Stiller et al, estimated the prevalence rate in West Bengal as 61.6%.[6-8] The study of Deshmukh et al, in rural Wardha, India observed a 59.6% of prevalence rate for undernutrition by CIAF.[9] Similarly, Anwar et al, in rural India, estimated 62.5% and Seetharaman et al, in Tamil Nadu state found a prevalence rate of 68.6% for undernutrition.[10,11] These all studies showed a relatively high prevalence of undernutrition by the CIAF method than the conventional indices. Anwar et al showed a higher rate in group F (stunting only) i.e., 16.1%, and for children with triple failures, group F was found to be 12.4%.[10]

Figure 2 showed the patterns and extent of undernutrition in the community. Amongst 6 subgroups, the underweight and stunting pattern, group "E" has the highest prevalence of 16%, which is indicative of high acute and chronic undernutrition in preschool children. The stunting-only pattern, group "F" at 14%, the second-highest rate of chronic undernutrition in the children. Whereas, the most severe pattern "group D", constituted 5.6% with triple anthropometric failures in the children.

This group of children in the community needs immediate nutritional intervention. In Anwar et al, and Sitharaman et al, studies we observed 16.1% and 24.7% of the highest undernutrition prevalence for underweight and stunting, group "E".[10,11] The study of Savanur et al showed a low prevalence of 47.8% in the slums of Mumbai city statistically no significant difference for both genders as observed in the present study.[12]

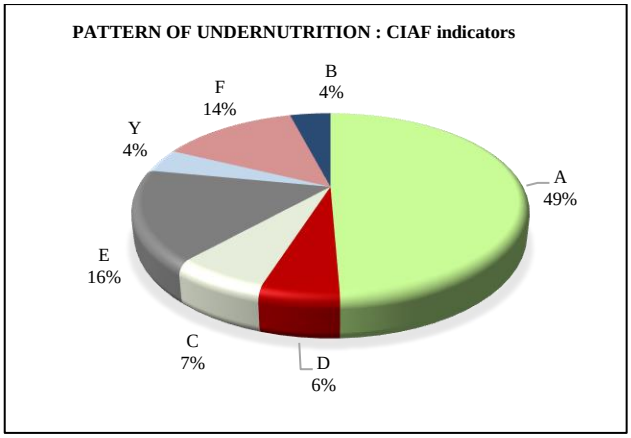

Figure 2: A pattern and the extent of Under-nutrition in the study population.

Group "A" denotes anthropometrically "normal" study population. Group "B" denotes wasting only the study population. Group "C" denotes the combination of "wasting and underweight" study population. Group "D" denotes the combination of "wasting, stunting and underweight" study population. Group "E" denotes the "stunting and underweight" study population. Group "F" denotes the "stunting only" study population. Group "Y" denotes the "underweight only" study population. CIAF denotes composite index of anthropometric failure.

Strengths and limitations

The strong sample size of the study population (8542) for the community-based study is the strength of the study. An allowable error applied was just 3%, hence increasing the precision of the study. The method of CIAF applied to detect the prevalence of undernutrition, provided a better estimation of undernutrition in the study population along with its various patterns.

Standard procedures of measurements were followed during the study, but inter-observer variation in the measurement of anthropometry could be a possibility.

Various factors such as socioeconomic status, educational level, living conditions, maternal health, birth weight, feeding practices, and rates of infections affect the nutritional status of the child. However, we have not studied the factors influencing the overall prevalence of undernutrition as a part of this paper for the selected study area.

CONCLUSION

CIAF method gives in-depth statistics of undernutrition showing its pattern in the said community for preschool children. The study emphasizes the need for comprehensive policy programs to cover up children with single as well as multiple anthropometric failures. Special attention is needed towards the 13 to 25 months age group of children. For the attainment of the best possible nutrition and growth in these children, the utilization of optimum ICDS services is needed. The exhausting

training and capacity building of ICDS staff using newer methods of detection like CIAF along with an improved reporting system will help to curb preschool undernutrition more effectively.

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