

Assessment of Nutritional Status Using Composite Index of Anthropometric Failure Among Children Aged < 5 Years and its Correlates



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Abstract

Background: Childhood malnutrition remains a significant public health issue in underdeveloped countries like Pakistan and globally. Effective policy formulation and action in under-resourced countries require a thorough and accurate evaluation of the malnutrition situation.

Methodology: A cross-sectional study was conducted at Fauji Foundation Hospital involving 419 children under 5 years of age, selected through nonprobability convenience sampling. Anthropometric measurements were entered into AnthroPlus software, and statistical analysis was performed using SPSS version 21. Frequencies and percentages were calculated for categorical variables, while means and standard deviations were determined for continuous variables. Malnutrition categories were determined according to conventional indices and the composite index of anthropometric failure (CIAF). Bivariate analysis was used to examine associations between various sociodemographic variables and the CIAF.

Results: A total of 419 children under 5 were included in the study, with 215 (51.3%) boys and 204 (48.7%) girls. The mean age of the children was 24.1 ± 18.5 months. The prevalence of stunting, wasting, and underweight among the children was 4.1%, 24.3%, and 24.3%, respectively. The CIAF revealed that malnutrition was present in 44.8% of the children.

Conclusion: The composite index of anthropometric failure provides a better estimate of malnutrition prevalence compared to conventional indices of stunting, wasting, and underweight, as a child can experience more than one form of malnutrition simultaneously.

Keywords: Under 5 children; wasting; stunting; underweight; CIAF; nutritional status; malnutrition

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Introduction

As the world is progressing and working towards achieving sustainable development by 2030 to eliminate all kinds of malnutrition, covid pandemic has set back the efforts globally. Children under 5 and women of reproductive age group are the most vulnerable groups to be affected by malnutrition. Malnutrition has many forms ranging from undernutrition to obesity. Among children under 5, 45 % deaths of children were related to undernutrition as of 2020 reports, and that too significantly in middle and low income countries (1).

UNICEF's data for 2019 revealed that our neighbouring country Bangladesh has approximately 28 % of children under 5 who are stunted and India has 34.7 % proportion of

stunting(2). 38%of children in Pakistan are stunted according to Pakistan demographic health survey and this number is feared to increase as the country is going through rapid inflation with the subsequent rise in food insecurity(3).

The most frequently used indices are unable to provide the general prevalence of under-nutrition(4) in the population because a child may experience more than one anthropometric failure at a time, so the Composite index of anthropometric failure (CIAF), created by Svedberg et al. in 2000 and modified by Nandy et al. in 2005, estimates the burden of under-nutrition more accurately(5). In accordance with WHO's criteria for malnutrition, stunting, wasting and underweight have different underlying processes. Stunting points towards chronic/ long-term undernutrition, Wasting denotes

acute undernutrition and underweight is a composite of acute and chronic undernutrition. Therefore, it has been argued that the three indices mentioned are not sufficient enough for measuring the overall prevalence of undernutrition among young children. To overcome this limitation, suggestions were made to construct a new aggregate of indicator

In a study done in Yemen CIAF identified undernutrition in 70.1% of children, while conventional anthropometric indices revealed 38.5% stunting, 39.9% wasting, and 55.1% underweight (6).

A case study done in Pakistan using data from the Demographic and Health survey revealed that out of total of 1870 children of age < 5 years included in the analysis, 50.1% fell in the composite index of anthropometric failure (CIAF) and the authors recommended that policy makers should use CIAF for better estimation of nutritional status (7).

Many studies have been done in other parts of the world using CIAF indicator as it provides a more accurate picture of malnutrition in population. Very little work has been done in Pakistan in estimating the prevalence of malnutrition using the alternative CIAF method.

Early assessment of malnutrition is important as it directly impacts growth, social and cognitive development later in life. Pakistan National Nutrition Survey 2018-2019 highlighted that the prevalence of stunting is 40.2 % which

is exceptionally high and after COVID-19 pandemic this percentage is feared to increase due to increase in household food insecurity and lack of access to healthcare services. Our rationale was to assess the current nutritional status .Very few studies have been conducted in Pakistan for assessment of nutritional status using the CIAF, we wanted to fill in that gap to get a more accurate picture.

Objectives:

1. To assess the nutritional status of children < 5 years using CIAF.
2. To compare the CIAF status with conventional means of assessing nutritional status in children <5 years of age.
3. To determine factors affecting nutritional status in children <5 years of age.

Operational Definitions:

Stunting is defined as height-for-age z score (HAZ) < -2 (8)

Wasting is defined as weight-for-height z score (WHZ) < -2 (8)

Underweight is defined as weight-for-age z score (WAZ) < -2 (8)

CIAF index- Composite Index of Anthropometric Failure is the sum of the children in groups B to Y (B+C+D+E+F+Y) as given below in table 1.

Table 1. Classification of children with anthropometric failure assessed by Composite Index of Anthropometric Failure (CIAF)

Group name	Description	Wasting	Stunting	Underweight
A	No failure: Children whose height and weight are above the age-specific norm (i.e. above - 2 Z-scores) and do not suffer from any anthropometric failure	No	No	No
B	Wasting only: Children with acceptable weight and height for their age but who have subnormal weight for height	Yes	No	No
C	Wasting and underweight: Children with above-norm heights but whose weight for age and weight for height are too low	Yes	No	Yes
D	Wasting, stunting and underweight: Children who suffer from anthropometric failure on all three measures	Yes	Yes	Yes
E	Stunting and underweight: Children with low weight for age and low height for age but who have acceptable weight for their height	No	Yes	Yes
F	Stunting only: Children with low height for age but who have acceptable weight, both to their age and for their short height	No	Yes	No
Y	Underweight only: Children who are only underweight	No	No	Yes

Methodology

Cross sectional Study was conducted at Paediatric OPD of Fauji Foundation Hospital from 15th February to 15th July, 2023.Children of 6 – 59 months of age were included in the study using non-probability convenience sampling. Sample size of 365 was estimated using the Raosoft calculator by

keeping the CI at 95 % and 5% margin of error considering the previous prevalence of stunting to be 40.2%. Children of both genders and those attending the OPD at the time of data collection were included and those having chronic illnesses that could have an effect on the nutritional status such as celiac, thalassemia and childhood genetic disorders were

excluded. Data was collected through a semi-structured interviewer-based questionnaire. Anthropometric measurements were recorded and interpreted as length/height-for-age, weight-for-length/ height, and weight-for-age z scores as well as according to WHO growth standards for girls and boys as well as CIAF classification as given in table 1.

Anthropometric data was entered into WHO Anthroplus software for analysis. Data was analysed using SPSS version 21. Prevalence of CIAF was calculated if a child has any one of the six different types of anthropometric failures. Frequency and percentages were calculated for categorical variables while mean and standard deviation will be calculated for continuous variables. The significance of each of the conventional indices, in proportion to CIAF, was also evaluated by calculating SI (stunting/CIAF), WI (wasting/CIAF), and UI (underweight/CIAF). These indices do not have any units.

Results

Overall, 419 children under the age of 5 were included and examined in study. Of our study participants 215(51.3 %) were boys and 204(48.7 %) were girls. The mean age of the children was 24.1 ±18.5 months and mean age of the mothers was 29.7 years ±5.1. the women who completed their education till secondary were 172(41.1%), whereas only 113(27 %) were graduate or above.

Majority of the mothers (65.4%) were housewives. 85.7% of the children were delivered at a healthcare facility. 26.5% of the children’s vaccination status was not complete according to the EPI schedule. Table 4 shows the overall prevalence of malnutrition according to the conventional indices and according to CIAF.10.5%,4.1 % and 24.3% of children under five were Stunted, Wasted and Underweight respectively in comparison to CIAF which revealed that malnutrition was present in 44.8 % of the individuals. Amongst these 44.8 % of children 38.4% had single failure and 5.9% had multiple anthropometric failures.

Table 2.-Socio-demographic characteristics of mothers/caregivers and their children

Variables	categories	Freq(419) /Mean	%/SD
Age of Child (Months)		24.1	±18.5
Sex of the child	Male	215	51.3
	Female	204	48.7
Age of mother/ caregiver		29.7	±5.1
Educational status of mothers/caregiver	Primary	134	32
	Secondary	172	41.1
	Graduate/Post Graduate	113	27
Occupational status of mothers/caregiver	Working	145	34.6
	Housewife	274	65.4
Family size		5.4	2.1
Average Household income (PKR)		71857	
No of Antenatal Visits	>4	275	65.6
	<4	144	34.4

Variables	categories	Freq(419) /Mean	%/SD
Place of Delivery	Home	60	14.3
	Healthcare Facility	359	85.7
Vaccination Status	Complete	308	73.5
	Incomplete	111	26.5
Had diarrhoea in the last 2 weeks	Yes	108	25.8
	No	311	74.2
Had Cough/ARI in the last 2 weeks	Yes	179	42.7
	No	240	57.3
Breastfeeding for 6 months	Yes	290	69.2
	No	129	30.8
History of Formula Feeding	Yes	234	55.8
	No	185	44.2
Weaning at 6 months of age	Yes	270	64.4
	No	149	35.6
Place of residence	Urban	260	62.1
	Rural	159	37.9
Mothers pregnancy status	Yes	74	17.7
	No	345	82.3

Table 3. Subgroups of anthropometric failure according to CIAF

Group	Description	Boys	Girls	Total (n=419)	%
A	No failure	116	115	231	55.1
B	Wasting only	9	8	17	4.1
C	Wasting/under weight	5	1	6	1.4
D	Wasting/stunting/underweight	5	1	6	1.4
E	Stunting/under weight	6	7	13	3.1
F	Stunting only	19	23	44	10.5
Y	Underweight only	54	48	102	24.3
Total CIAF	B+C+D+E+F+Y	98	90	188	44.8
Single failure	(B+F+Y)	82	79	161	38.4
Multiple failures	(C+E+D)	16	9	25	5.9

Table 4. Overall prevalence of undernutrition according to conventional indices and CIAF

Group	Male (%)	Female	Total	Percentage
Stunting	19	23	44	10.5
Wasting	9	8	17	4.1
Underweight	54	48	102	24.3
CIAF	98	90	188	44.8

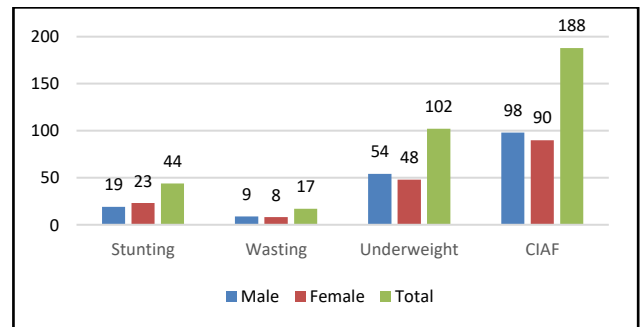


Figure1. Prevalence of undernutrition according to conventional indices and CIAF

Table 5. Bivariate Logistic Regression Analysis on Composite Index of Anthropometric Failure of children under Five Years of Age

variable	categories	CIAF		P value
		Yes (188)	No (231)	
Sex	male	97	116	0.326
	female	91	115	
Educational status	Primary	75	59	0.008
	secondary	71	101	
	Graduate & above	42	71	
Vaccination status	Complete	137	169	0.917
	incomplete	50 + 1	61 + 1	
Exclusive breastfeeding	yes	136	154	0.328
	no	52	77	
History of formula feed	yes	100	134	0.810
	no	88	97	
Weaning at 6 months	Yes	120	150	0.932
	no	68	81	
Occupation of mother	Working	63	82	0.941
	housewife	125	149	
History of cough	yes	76	102	0.967
	no	112	128 + 1	
History of diarrhea	yes	60 + 1	45 + 3	0.947
	no	127	184	

Table 5 shows the results of bivariate binary logistic regression. A significant association was found between educational status of mothers and presence of malnutrition according to the composite index.

Table 6. Values of SI, UI and WI

Index	Boys CIAF=98	Girls CIAF=90	Overall CIAF=188
SI = Stunting/CIAF	19/98=0.19	23/90=0.25	0.22
WI = Wasting/CIAF	9/98=0.09	8/90=0.08	0.09
UI = Underweight/CIAF	54/98=0.55	48/90=0.53	0.54

Discussion

This research offers recent estimates of the prevalence of undernutrition in children less than 5 years using aggregate measures of anthropometric failure since standard indices understate the prevalence of undernutrition and do not reflect the total prevalence of undernutrition in children. By employing the composite index of anthropometric failure as an overall indicator, this can be prevented.

The overall prevalence of malnutrition in our study using the CIAF was 44.8% which is more as compared to stunting (10.5%), wasting (4.1%) and underweight (44.8%) individually. Results similar to our study were reported in a research done in Indonesia which showed that prevalence of anthropometric failure according to CIAF was 42.1. However children having stunting only were less in this study (2.4%) as compared to ours (9). In Ethiopia, 53.78 % of the children had anthropometric failure according to CIAF (10). 57.3% of children in Tanzania were found to be undernourished in a recent study which shows higher prevalence of malnutrition

as compared to our study but that can be owed to much smaller sample size (11).

Regional data reveals that CIAF in India was (45%) with 27.3 % children being stunted while our study showed that the prevalence of stunting was 10.5 % being more in females as compared to males. The prevalence of wasting was 17.8 % and underweight children were 24.5 % of which is similar to the percentage of underweight children in our study (24.3 %) (12). Similar results were found out in a research done in India in which the prevalence of anthropometric failure was found to be 45% (13).

According to Pakistan Demographic and health survey stunting was prevalent in 38% of children and wasting was prevalent in 7 % of children under 5 years of age. According to conventional indices, our study also showed that wasting was least prevalent but other indicators are far more than found in our study but this can be owed due to inclusion of whole country including the marginalised and poverty stricken areas while 62.1% of our population belonged to urban areas (14).

A study done in Rahim Yar Khan showed CIAF in 62.23 % of children while according to the Conventional indices 41.89% of children were underweight, 58.86% were stunted, and 8.11% were wasted (15). The CIAF prevalence being higher than our study could be attributed to larger sample size and data was collected from the whole district. But the highest percentage was of children who were underweight which is similar to our study as our study also revealed highest percentage of children being underweight.

Our study revealed that 69.2 % of women practiced exclusive breastfeeding whereas in another study from Pakistan showed that exclusive breastfeeding rates were 81% (16).

In Bangladeshi survey, 66.8% of mothers exclusively nursed their children for 6 months (17). In Romania 46.7% of the women practiced exclusive breastfeeding which is less as compared to our study (18).

In a study done in Indonesia, 48.4%, reported growth failure of which 21.3 % belonged to the stunting and underweight category where as 1.3% experienced wasting (19). In our study wasting was present in 4.1% of the children whereas the percentage of children who were stunted and underweight were 3.1%.

The strengths of our study included vigorously trained staff who collected detailed data after proper consent. Our study also collected data on multiple socio demographic variables like EPI and other factors that could impact the nutritional status.

The limitation of our study was that it was done in a single location. Inclusion of children from other locations in the country can provide various outcomes. Therefore, these findings cannot be applied to the whole state or country and can't be generalised.

Conclusion

In comparison to the traditional indices of stunting, wasting, and underweight, the composite index of anthropometric measurement provides a better estimated prevalence of malnutrition because a child can have many failures simultaneously. Based on our study findings 44.8% of the children had malnutrition according to CIAF while 10.5%, 4.1 % and 24.3% of children under five were Stunted, Wasted and Underweight respectively according to the conventional indices.

Classifying undernourished children into various groups, the CIAF makes it possible to identify children who have numerous anthropometric failures at an early age. As a result, it makes it possible for medical professionals to give priority to and prompt care to those who need it the most. Additionally, this knowledge can help healthcare professionals, physicians, planners, and policymakers more accurately assess the widespread issue in the community, enabling the implementation of reforms, treatments, and policies tailored to individual needs.

Ethical Approval:

This study was approved by the Ethical Review Committee of the Foundation University Medical College, Islamabad. Ref. No. FF/FUMC/215-171/Phy/22 Date: 31-01-2022

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Authors' Contribution:

MR: Major contributions in concept and design.

SM: Analysis and interpretation of data.

SB: Drafting the article and major revision.

FAR & NA: Major revision of the intellectual content

RA: Drafting of the article

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