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RESEARCH ARTICLE

ASSESSMENT OF ANTHROPOMETRIC FAILURE AMONGST UNDER FIVE CHILDREN IN AN URBANIZED VILLAGE OF DELHI: A CROSS SECTIONAL STUDY

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Abstract

Background: Childhood malnutrition is a major public health problem be it a developing or developed country. It is a major contributor to the deaths among the under-five group. This highlights the need for an accurate index to measure the burden of malnutrition correctly as traditionally used indices underestimate the burden.A new index, the Composite Index of Anthropometric Failure- CIAF can give a better approximation of the burden of malnutrition amongst under five children.

Objective: To assess the nutritional status in terms of Composite Index of Anthropometric Failure (CIAF) amongst under five children in the study population.

Methods:A cross-sectional study was conducted to include 260 children under five yearsusing stratified random sampling, in an urbanized village of Delhi from November 2018 to April 2020. Data was collected using pre-designed, semi structured questionnaire. Anthropometric measurements were taken according to World Health Organization (WHO) guidelines. Using WHO 2006 growth charts, Weight-for-Age, Height-for-Age and Weight-for-Height were determined for each child and were used to calculate Composite Index of Anthropometric Failure (CIAF) Prevalence (%).Descriptive statistics and chi square test were applied.

Results and Conclusion: Out of the total 260 study participants, only 80 (30.8%) participants had no anthropometric failure i.e., 69.2% had one or more type of anthropometric failure. According to standard anthropometric indices, 39.2% were underweight, 40.8% stunted and 47.3% were wasted. CIAF can act as a single aggregated figure to determine the status of undernourished children in the community.

Introduction:-

Few challenges faced by the world match the scale of malnutrition, which affects one out of every three children under five years of age. Malnutrition is a major public health problem in every country. Diet is one of the most important risk factor that contribute to the global burden of the disease.[1] Childhood undernutrition is mainly contributed by children in low income and lower middle income countries.Acute malnutrition, both moderate and severe, has major implications, including increased morbidity and mortality, as well as an elevated risk of diseases

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in adulthood. In India, severe acute malnutrition is a potentially fatal illness and a major underlying cause of mortality in children under the age of five. Undernutrition is well documented to increase child mortality owing to common morbidities such as diarrhea, acute respiratory infections, malaria, and measles, among others.[2]

According to the United Nations International Children's EmergencyFund (UNICEF), WHO and World Bank Group Joint Child Malnutrition Estimates, stunting has impacted an estimated 151 million children worldwide, while wasting continues to endanger the lives of an estimated 51 million children under the age of five.[3] The economic repercussions amount to an annual loss of 11 percent of GDP in Africa and Asia, but mitigating malnutrition generates a return on investment of $16 for every $1 spent.[1]India is the leading contributor, accounting for around one-fifth of all under-five mortality worldwide, with approximately 1.8 million children dying each year.[4]

Adequate nutrition during childhood is fundamental requirement for a child's full development potential. Poor quality of feeding practices followed to feed the infants and young children of the society plays an important role in the causation of malnutrition among the under five children of the society. Children of a younger age group are more vulnerable to the effects of malnutrition.The Sustainable Development Goals (SDG 3.2) proposed for all countries aims to reduce under-five mortality to at least as 25 per 1000 live births in every country by 2030.Currently, around 79 countries have under-five mortality rate above 25. Around 30% of the world's malnourished children live in India. The target is to end malnutrition by 2030.[1]

The growthestimation in children is vital for screening health status, to identify divergences from normality, and to evaluate the efficiency of interventions.[5]Child Growth Standards (2006) given by World Health Organization (WHO) are a vital instrument to diagnose and screen both undernutrition and overweight, thereby tackling the dual burden of malnourishment disturbing populations worldwide.[6]WHOhas recommended use of three indicators for assessment of undernutrition: i.e., underweight (low weight-for-age), stunting (low height-for-age), and wasting (low weight-for-height).

Mild-to-moderate malnutrition cases are likely to go unnoticed since traditional indicators of malnutrition used for prevalence of 'wasting', 'stunting' or 'underweight' may be missing out a considerable proportion of undernourished children having different combinations of these conditions.[7] Peter Svedberg suggested that, for a more accurate picture of nutritional status among under-five children, all three must be considered and termed these as states of "Anthropometric Failure" (AF).[8] He constructed an aggregate indicator that incorporates all the three states of AF. This is called as the Composite Index of Anthropometric Failure- CIAF. His original model suggested six sub-groups of anthropometric failure (designated A-F), to which Nandy et al. added a seventh (named Y).[9]Although numerous studies have assessed the nutritional status of under-5, very few have used the more accurate anthropometric index CIAF for this. The magnitude of undernutrition in terms of CIAF has not been studied adequately in North India.

Material And Methods:-

Present study was a cross-sectional study, conducted in an urbanized village of Delhi with atotal population of 6139,from November 2018 to April 2020. All children under 5 years of age, residing in the study area for not less than last 6 months were included in the study.The sample size was calculated by using formula at 95% confidence level, N= (Z1-α/2)2 PQ /L2, consideringthe minimum prevalence of wasting i.e. 18% as reported by Savanur MS, Ghugre PS in the year 2014and taking the absolute error as 5%.[12]Resultant sample size came out to be 236, considering 10 percent non response rate, final sample size calculated was 259, which was rounded off to 260. So, a total of 260 children who were under 5 years of age were included in the study.

Systematic random sampling technique was used for the selection of households having children under 5 years of age. A List of households having one or more under five members was made from the data of the survey conducted by the Department of Community Medicine, Vardhman Mahavir Medical College (VMMC)& Safdarjung hospital. This list was used as the sampling frame. The no. of households having under 5 children in the population were 780 according to the survey and the sample size was 260, giving a sampling interval of 3.The first house to be included in the study was determined by simple random sampling technique and then every 3rd house was included the study. In case where more than 1 under 5 children were present in any household, then Kish method was used to select one under 5 child amongst all present in the household.[10]

On the day of visit, questionnaire was filled to gather relevant information, anthropometric measurements were taken and clinical examination of the child was done.A pre-designed, pre-tested, interviewer administered, semi-structured questionnaire in both Hindi and English language was used to assessthe socio-demographic data of the study subject.Anthropometric measurements such as height and weight were taken for the calculation of the Composite Index of Anthropometric Failure (CIAF) of the study population. To record weight, if the child was less than 2 years old or was unable to stand, tared weighing was done, if the child was 2 years or older, child was weighed alone using standardized recently calibrated analog weighing machine as per guidelines by WHO. To measure height, if a child was less than 2 years of age, recumbent length (lying down) was measured using infantometer and if the child aged 2 years or older and was able to stand, standing height was measured using stadiometer as per guidelines by WHO.[6]UsingWHO growth charts, Weight-for-Age, Height-for-Age and Weight-for-Height were determined for each child and were used to calculate Composite Index of Anthropometric Failure (CIAF) Prevalence(%). The anthropometric sub-groups used were: A-no failure; B-wasting only; C-wasting andunderweight; D- wasting,stunting and underweight; E-stuntingandunderweight; F-stunting only; Y-underweight.The sum of children in the sub-groups B to Y provides CIAF prevalence. Operational definitions used for underweight, wasting and stunting were as follows: Underweight is defined as Weight for Age Z-score (WAZ) of <-2. Severe underweight is considered if WAZ is < -3 of the WHO (2006) reference standards.Wasting (acute malnutrition) is defined as a Weight for Height Z-score (WHZ) of <-2. Severe wasting is considered if WHZ is <-3 of the WHO (2006) reference standards.Stunting (chronic malnutrition) is defined as a Height for Age Z-score (HAZ) of < -2. Severe stunting is considered if HAZ is < -3 of the WHO (2006) reference standards. The cut-off points for mid upper arm circumference(MUAC) of 13.5 cm was used for identifying children with under-nutrition.An MUAC of between 13.5 and 12.5 cm denoted moderate under- nutrition, and less than 12.5 cm denoted severe under- nutrition.[6]Study subjects which required immediate health care/attention were referred to the paediatric department of the parent institution.

Statistical Analysis:
The data was entered in Microsoft Excel. Qualitative data was summarized as proportions while quantitative data as mean, median and appropriate measures of dispersion including confidence intervals. Data analysis was done using licensed SPSS software version 21.0.Quantitative data was analyzed using appropriate statistical tests. Association between two categorical variables was analyzed by using odds ratio along with 95% confidence interval (CI). P value < 0.05 was considered to be statistically significant.

Results:-

There were 142 (54.6%) males and 118 (45.4%) females in the study population. The age of the study participants ranged from 1 to 60 months. Around half i.e.127 (48.8%) of the children were toddler (1-3 years) and rest were almost equally distributed in the age groups of infancy (till 1 year) i.e. 69 (26.5%) and pre-school (3-5 years) i.e. 64 (24.7%). Male: female ratio observed in the age groups of infancy, toddler and pre-school were 1.46, 1.04 and 1.28 respectively (Table 1).

Growth Assessment:
Out of the total 260 participants, 102 (39.2%) participants were found to be underweight by weight-for-age criteria whereas 106 (40.8%) were stunted by height-for-age criteria and 123 (47.3%) were found to be wasted by weight-for-height criteria (Table 02). According to weight-for-age criteria of WHO, 43 (16.5%) participants were moderately underweight and 59 (22.7%) participants were severely underweight. A total of 51 (19.6%) study subjects were moderately stunted and 55 (21.2%) study subjects were severely stunted. Nearly 1/3rd of the children (90; 34.6%) were moderately wasted. Severe acute malnutrition was observed in 33 (12.7%) children and that by Mid-Upper Arm Circumference criteria, it was seen in 46 (18.7%) (Table 03).

Composite Index of Anthropometric Failure:
Out of the total 260 study participants, only 80 (30.8%)participants had no anthropometric failure, 69.2% had one or more type of anthropometric failure.In other words, more than two thirds of the study participants were undernourished. Although there was no child being underweight alone but the underweight was seen along with stunting in 17 (6.5%) children and along with wasting and stunting in 49 (18.8%) children. Wasting alone was found in 38 (14.6%) and stunting in 40 (15.4%) (Table 04).

Discussion:-

In the present study, the Composite Index of Anthropometric Failure (CIAF) was used to assess the nutritional status of children under 5 years of age. It was found that the prevalence of undernutrition in terms of CIAF was 69.2%. More than 2/3rd of the study population had some kind of anthropometric failure in one or the other form. Different types of undernutrition were seen in the study subjects either alone or in combination with the other types. Only 30.8% participants had no anthropometric failure (Table 04). The result of this study is comparable with the various studies conducted across India such as study conducted by Boregowda GS et al in 2014 in urban slums of Raipur city, Chhattisgarh found CIAF to be 62.1, 60.5% in study conducted by Solanki R et al in 2014 in Ahmedabad city, Gujarat, 58.59% according to Dhok RS et al (Nagpur) and 62.5% according to study conducted by Anwar et al in 2013, in rural area of Varanasi, according to Sen J et al it was 63.6% in Darjeeling and various others. [11–15]On the other hand, it was much lower in the study conducted by Dasgupta A et al in 2013 in a Rural Area of West Bengal, where it was almost half of the CIAF of the current study i.e. 32.7%.[16]As this study was conducted in the rural area, different risk factors may be playing role and contributing to the difference from the present study. Raman D et al also found prevalence of malnutrition to be 54% only, among children aged between 1 and 5 years.[17] However, the difference in the prevalence was noted due to the different classification used to classify malnourished i.e. Gomez Classification, which took into account only weight for age criteria. This highlights the problem of underreporting of anthropometric failure even more when it is calculated through a single criteria rather than CIAF.[11,13–17]

In fact, when the individual criteria were considered in thecurrent study also, the prevalence of underweight (weight for age < -2SD), stunting (height for age < -2SD) and wasting (weight for height < -2SD) revealed was 39.2%, 40.8% and 47.3% respectively (Table 02), which was much lower when compared to the prevalence in terms of CIAF i.e., 69.2%. Other studies too have reported the same findings. Anwar et al in 2013, in rural area of Varanasi, found CIAF to be 62.5% and the prevalence of stunting, underweight and wasting found was 43.1%, 35.2% and 31.5%, respectively and Sen J et al (West Bengal, 2010) CIAF was 63.6% and individually it was 52% (underweight), 43.3 % (Stunting), 21.5% (Wasting).[14,15] Nandy S et al also showed prevalence of Underweight to be 47.1%, while CIAF was 59.9% for under three children. CIAF was found to be 65.25% for toddlers in a study by N Seetharaman et al, and underweight was found to be 46.6%. [18,19]

In the present study, the rate of underweight (39.2%) and stunting (40.8%) are similar to the national prevalence i.e., 35.8% and 38.4% respectively. However, the prevalence of wasting in the current study was much higher at 47.3% than the national figure of 21%. A study by Sethy G et al in Berhampur city, Odisha in 2016 reported even higher prevalence of underweight, stunting and wasting was 55.3%, 42% and 75%. This prevalence was higher when compared to the present study findings especially that of wasting (47.3%).[20] The variation in prevalence was may be due to the different types of study area in both the studies (Urbanized village vs. Urban slum). The high prevalence of wasting indicates acute nutritional deficiency whereas stunting is an indicator of chronic malnutrition and the study population in both these studies was underprivileged.[20]

According to weight for age criteria of WHO, 43 (16.5%) participants were moderately underweight and 59 (22.7%) participants were severely underweight. This is similar to the study findings of Sethy G et al (Odisha, 2016) where they found 18% moderate and 20% were severely underweight study participants. Study conducted by Savanur MS et al in 2014 in Mumbai found prevalence of moderate and severely underweight as 27.8% and 7.9%.[19,20]

Study conducted by Sethy G et al (Odisha, 2016) found prevalence of mild, moderate and severe stunting as 20.6%, 10.7% and 10.7% respectively. In the current study, 19.6% study subjects were moderately stunted and 21.2% study subjects were severely stunted. Study conducted by Savanur MS et al in 2014 in Mumbai found prevalence of moderate and severe stunting as 22.6% and 11.2%.[19,20] The higher prevalence of severe stunting in our study may imply that there might be food insecurity prevalent in the study area for quite some time.

Nearly 1/3rd of the children (90; 34.6%) were moderately wasted and 12.7% had severe wasting. Study conducted by Sethy G et al had much lower prevalence of moderate whereas severe wasting was much higher i.e. 10.7% and 21.3% respectively.[20]As there was adequate feeding practices in 69.3% of the participants, this could have resulted in higher recovery, supporting the aforementioned finding among the study participants.[22]Study conducted by Savanur MS et al in 2014 in Mumbai found lesser prevalence of both moderate and severe wasting i.e. 16.4% and 2.1% respectively.[19,20] Possible reason can be inclusion of different age group i.e. 2-4 years that too from Anganwadi Centres. The daily feeding programs at Anganwadis might be the reason.[23] In addition, they excluded preterm children from their study which may have resulted in selection bias.

In the present study, there was no failure (CIAF Category A) in only 30.8% of study participants, wasting (B) was seen in 14.6%, underweight along with wasting (C) was seen in 13.8%. A combination of underweight along with stunting and wasting (D) was seen in 18.8%. Underweight and stunting (E) was found in 6.5% of the study participants. CIAF category F i.e. stunting only was seen in 15.4% of the study participants. No study participant was found to fall in the category Y i.e. underweight only (Y) (Table 11). Findings of study conducted by Boregowda GS et al in 2014 in urban slums of Raipur city, Chhattisgarh suggests much lower prevalence when each group was compared separately to the findings of the present study sine no failure (A) was seen in 37.9% of the prticipantsi.e. malnutrition was seen in 62.1% had one or the kind of malnutrition which is much lower compared to the current study i.e. 69.2%. In the same study wasting only (B) was seen in 1%, underweight with wasting (C) in 7.6%, underweight with stuntingand wasting (D) in 9.1%, underweight with stunting (E)- 21.8%, stunting only (F) in 16%, isolated underweight (Y) in 6.7% study participants.Study conducted by Solanki R et al in Ahmedabad city reported prevalence of undernutrition in the category of Group E to be 27.1, Group F it was 15.6% and Group D it was 7.3% i.e. when CIAF was calculated in both the studies, the results are similar in both studies.[10,11] Study results seen by Sen J et al in 2010 in West Bengal indicated that the overall prevalence of undernutrition was highest in Group E (26.2%) followed by multiple failures (9.4%). The incidences were found to be approximately similar in Group C (8.3%), Group F (7.9%) and Group Y (8.0%). The incidences of wasting only (Group B) was observed to be the lowest (3.8%).[15]Composite Index of Anthropometric Failure (CIAF) can act as a single aggregated figure for the number of undernourished children in the community. This information can help heath care workers, clinicians, planners or policy makers to have a better estimate of the prevalent problem in the community so that need-specific reforms can be planned.Prevalence of malnutrition in under five was very high at a CIAF of 69.2%.

Tables And Figures

Table 01:- Distribution of the study participants according to their age and gender. (N= 260).

Serial No.	Age Groups	Male n(%)	Female n(%)	Total n(%)
1.	Infant (0-12 months)	41 (28.9)	28 (23.7)	69(26.5)
2.	Toddler (13-36 months)	65(45.8)	62(52.6)	127(48.8)
3.	Pre- School (37-60 months)	36(25.3)	28(23.7)	64(24.7)
Total n (%)		142 (54.6)	118 (45.4)	260 (100)

Table 02:- Distribution of study participants according to Undernutrition category (N=260).

Serial No.	Undernutrition Category	Frequency	%
1.	Underweight	102	39.2
2.	Stunted	106	40.8
3.	Wasted	123	47.3

*Multiple responses

Table 03:- Distribution of study participants according to severity of undernutrition (N=260).

Serial No.	Undernutrition	Male	Female	Total
I.	**Weight for age (N=260)**			
1.	Normal	93 (65.5)	65 (55.1)	158 (60.8)
2.	Moderately underweight	24 (16.9)	19 (16.1)	43 (16.5)
3.	Severely underweight	25 (17.6)	34 (28.8)	59 (22.7)
II.	**Height for age (N=260)**			
1.	Normal	87 (61.3)	67 (56.8)	154 (59.2)
2.	Moderately Stunted	26 (18.3)	25 (21.2)	51 (19.6)
3.	Severely Stunted	29 (20.4)	26 (22.0)	55 (21.2)
III.	**Weight for height (N=260)**			
1.	Normal	76 (53.5)	61 (51.7)	137 (52.7)
2.	Moderately wasted	49 (34.5)	41 (34.7)	90 (34.6)
3.	Severely wasted	17 (12.0)	16 (13.6)	33 (12.7)
IV.	**Mid-Upper Arm Circumference (n=248)**			
1.	Normal	97 (71.9)	79 (69.9)	176 (70.9)
2.	Moderate Acute Malnutrition	14 (10.4)	12 (10.6)	26 (10.4)

3.	Severe Acute Malnutrition	24 (17.8)	22 (19.5)	46 (18.7)

Table 04:- Distribution of study participants according to CIAF Category (N= 260).

CIAF SUBGROUPS	DESCRIPTION	Frequency	%
A	No failure	80	30.8
B	Wasting only	38	14.6
C	Wasting + Underweight	36	13.8
D	Wasting+ Stunting +Underweight	49	18.8
E	Stunting+ Underweight	17	6.5
F	Stunting only	40	15.4
Y	Underweight	0	0

Conclusion:-

Overall, only 30.8% of the study subjects were anthropometrically normal. This is a very serious problem, by any scale. Current measures of undernutrition areunable to give a reliable estimate of the overall prevalence of undernourishment in a population. This issue has been addressed with the construct of the indicator, CIAF. Underestimation of this proportion i.e. under-five children with undernourishment, might end up in reduced to efforts to alleviate this problem from the society. Hence, use of this indicator to estimate the true prevalence of undernourishment in under five children is recommended.

Conflict of Interest:-
Nil.

Ethical clearance:-
Taken from institute ethics committee (IEC/VMMC/SJH/Thesis/October/2018-70).

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