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**Research Article**

# Prevalence of malnutrition and proportion of anaemia among the malnourished children aged 1-5 years in a rural tertiary care centre, South India

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## ABSTRACT

**Background:** PEM is a disease of multiple deprivations and poverty, affecting nearly 150 million children under the age of five years in the world. Out of the 120 million children in India, over 75 million are estimated to suffer from visible PEM, which is indeed a matter of great concern. Numerous studies have been conducted time to time to know the prevalence of malnutrition, in order to target the at risk population so that effective intervention programmes can be implemented. To fight against malnutrition and PEM, we have to identify the malnourished so as to develop a target based intervention. For that, anthropometry provides the single most portable, universally applicable, inexpensive and non-invasive technique for assessing the size, proportions and composition of the human body.
**Methods:** A cross sectional study was done among 400 children aged 1-5 years who attended OPD, based on systematic random selection. Socio economic profile of the subjects and anthropometric values were taken by trained staff and the measured values were compared with WHO reference values and classified as underweight, stunted, thin or having wasting as per different classifications. The data was analyzed using the statistical software, SPSS version 20.
**Results:** Among the 400 children, 31% of the children were identified as underweight by IAP classification. Stunting was identified in 28.8% of the children. As per weight for height criteria, 27% of children were identified as having wasting. Thinness according to BMI classification was identified in 38% children. The sex wise difference in PEM and in stunting was not statistically significant. In this study 41.1% of the underweight children had anemia, 46.1% of the children who were stunted were having anemia and among the children who were having wasting, 37% of them were having anemia.
**Conclusions:** The study revealed that high percentage of children aged 1-5 years were malnourished, inspite of a very high rate of literacy, employment status, vaccination and health care facilities in Kerala and has shown the relevance of anthropometry in identifying the malnourished children from population. The conventional use of underweight (low weight for age) instead of z score as the sole criterion for identifying undernourished children may underestimate the true incidence of severe undernutrition in a community, so further research has to be done in to sort out the appropriate reference system for Indian population.

**Keywords:** Malnutrition, Under five children, IAP classification, z Scoring, WHO, Classification for wasting

## INTRODUCTION

Child malnutrition is a wide spread public health problem worldwide with consequences everywhere because good nutrition is an essential determinant for their well-being. Well-nourished children lead socially and economically active lives, while malnutrition adversely affects health, and leads to increased occurrence in the incidence of sickness among children. Malnutrition and the associated retarding influences can lead to increased morbidity, growth faltering, developmental delay and significant mortality. Malnutrition limits development and the capacity to learn. It also costs lives, about 50 per cent of all childhood deaths are attributed to malnutrition.

PEM is a disease of multiple deprivations and poverty, affecting nearly 150 million children under the age of five years in the world. In 1990, an estimated one out of three children (177 million) younger than five years in the developing world was or had been malnourished at some stage in their lives.

In the NFHS report, it is stated that prevalence of children who are underweight in India was higher than in any other 40 countries, even higher than Bangladesh and Nepal. According to NFHS 3, 43% percent of children under age five years are underweight for their age. WHO in 1995 has brought about cut off values for prevalence of each domains of malnutrition which has got public health significance. Going through the values we can find that malnutrition in India, according to any domains has got a very high public significance.

With almost half of under 5 children undernourished in India, the Millennium Development Goal (MDG) of halving the prevalence of underweight by 2015 seems a distant dream. Among the under five deaths due to malnutrition worldwide, as per WHO Classification, 75% can be described as mildly to moderately malnourished and thus might not betray any outward sign of the problem to a casual observer.

Nutritional status of children especially in the preschool age group is of paramount importance, since the foundation of lifetime health, strength and intellectual vitality is laid during that period. Various studies across the world have shown that there is a very high incidence of anaemia among the malnourished, and correction of anaemia has a very huge impact on treating malnutrition. Keeping this in mind, a study would be valid searching for the proportion of anaemia among the malnourished.

A study by Sheshadri et al[1] about effect of correcting anaemia in malnutrition, has shown that the iron supplemented anaemic children among the malnourished had a significantly greater mean weight gain ($p<0.05$).Similar studies by Auckett et al[2] and Chwang et al[3] also showed significant weight gain in those children whose anaemia was corrected compared to placebo treated children.

Secondly, various studies and guidelines have shown anthropometry is the single most universally applicable, useful, inexpensive technique to assess the nutritional status and is important for public health decisions that affect the health and social welfare of individuals and populations. But there has been no proper guidelines suggesting which is the appropriate classification to be used to classify malnutrition in various population and different age group.

So, along with the aim of finding prevalence of malnutrition and proportion of anaemia, this study tries to compare various forms of classification of malnutrition based on various available anthropometric profile like stunting, wasting, BMI.

Prevalence of anaemia various study has done for the prevalence of anaemia and malnourished children having anaemia in various state of India. Garn and Smith in their study have said children with high haemoglobin values are about 3 cm taller and 3 kg heavier than the low haemoglobin children.[4]

Similarly a study by D. Bhatia and S. Sheshadhri[1] also showed that anaemic children are 4.6 cms shorter and about 2 kg weighing less than non anaemic children. Another study was conducted at the nutritional research centre, Trivandrum, Kerala on patterns of anaemia and its relation to nutritional status among 3633 preschool children attending *Anganwadi* centres in rural areas of Kerala state during the period of 1996-1998. The overall prevalence of anaemia was 11.4%.

Among the anaemic patients, normal nutrition was seen in 46.7%, mild under nutrition in 11.78% and moderate under nutrition in 16.87%.[5]

## METHODS

### *Study design*

This is descriptive study and cross-sectional survey, which was carried out for one year duration in department of paediatrics, Dr. SMCSI Medical College, Karakonam, Kerala.

### *Study population*

Children between the ages of 1 to 5 visiting our OPD selected on a random basis.

### *Exclusion criteria*

- Parent refusal
- Those having chronic illness

- Those already diagnosed with under nutrition

***Sample size***

Sample size estimated with reference to a previous study.

***Sampling technique***

Systematic random sampling technique was used. First number selected from random number table as 10, from the computer generated OPD token number, and then every 10th child who fulfils the eligibility criteria was selected daily till sample size was achieved.

***Methodology***

Information on the socio economic profile of the subjects was collected using a Performa. The anthropometric measurements were recorded by personnel specifically trained for the study. One trained person was dedicated for reading weight and another for height, to avoid inter-observer error. Height was measured by wall mounted fibre glass tape with the least count of 0.5. The tape was mounted accurately on the wall perpendicular to the floor and weight measurement was taken by standardized digital weighing scale with the least count of 0.1. The equipments were standardized at regular intervals.

***Analysis of anthropometry***

After obtaining weight and height of the children, they were compared with the WHO reference charts. Underweight was defined as percentage of weight for age less than 80%. Malnutrition classified according to PEM will be termed as Underweight in this study.

Children were classified as wasted when weight-for-height z-score was <-2 SD.

***Reference values***

For assessing weight for age to classify malnutrition according to IAP, the reference values were taken from growth chart compiled by Agarwal et al[6] as recommended by IAP.[7] Weight-for-height and height for age Z scores were computed for boys and girls separately by age groups.

## RESULTS

The data was analyzed using the statistical software, SPSS version 20. The qualitative variables were summarized using proportions with 95% confidence interval. For Quantitative variables mean with standard deviation were used.

Overall prevalence of protein energy malnutrition among study subjects according to IAP classification.

In the present study among the 400 children, PEM was present in 124 (31%). Out of the 124, children, 66 (53.2%) were boys, and 46.8% of girls had PEM. The sex wise difference in PEM is not statistically significant (p value=0.62).

***Grading of protein energy malnutrition across age group***

The table 1 shows age wise, sex wise and grade wise distribution of PEM. Considering boys, in all age group maximum boys have Grade 1 PEM. In 12-24 months age group it is 25.7%, in 24-36 group there are 18.8%, in 37-48 months 18.5% are grade 1 PEM, and in 49-60 months 22.7% are having Grade 1 PEM. Similarly in Girls, In 12-24 months age group it is 28.6%, in 24-36 group there are 27.7%, in 37-48 months 14.8% are grade 1 PEM, and in 49-60 months 26.7% are having grade 1 PEM.

**Table 1: Prevalence of protein energy malnutrition grading according to the age group and sex.**

| Age | PEM grades | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Boys | | | | | Girls | | | | |
| | No PEM | I | II | III | IV | No PEM | I | II | III | IV |
| 12 -24 Months | 97<br>71.3% | 35<br>25.7% | 4<br>2.9% | 0<br>0.0% | 0<br>0.0% | 61<br>67% | 26<br>28.6% | 4<br>4.4% | 0<br>0.0% | 0<br>0.0% |
| 25 -36 Months | 26<br>60.5% | 8<br>18.8% | 9<br>20.% | 0<br>0.0% | 0<br>0.0% | 31<br>66% | 13<br>27.7% | 3<br>6.4% | 0<br>0.0% | 0<br>0.0% |
| 37 -48 Months | 19<br>70.4% | 5<br>18.5% | 3<br>11.1% | 0<br>0.0% | 0<br>0.0% | 20<br>74% | 4<br>14.8% | 3<br>11.1% | 0<br>0.0% | 0<br>0.0% |
| 49 -60 Months | 12<br>85.7% | 2<br>14.3% | 0 | 0<br>0.0% | 0<br>0.0% | 11<br>73.3% | 4<br>26.7% | 0 | 0<br>0.0% | 0<br>0.0% |
| Total | 154<br>70% | 50<br>22.7% | 16<br>7.3% | 0<br>0.0% | 0<br>0.0% | 123<br>68.3% | 47<br>26.1% | 10<br>5.6% | 0<br>0.0% | 0<br>0.0% |

***Prevalence of wasting in children (z score classification of malnutrition by WHO)***

In this study, 108 (27%) children were having wasting, out of which 57 (25.9%), were boys and 108 (27%) were girls.

In this study, 265 (66.3%) children were normal, moderate and severe wasting constituted 48 (12%) and 60 (15%) respectively. Overweight children were 17 (4.3%) and 10 (2.5%) children were obese.

**Table 2: Distribution of wasting.**

| Wasting | Boys | | Girls | | Total | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| Present | 57 | 25.9% | 51 | 28.3% | 108 | 27.0% |
| Absent | 163 | 74.1% | 129 | 71.7% | 292 | 73.0% |
| Total | 220 | 100.0% | 180 | 100.0% | 400 | 100.0% |

**Table 3: Grading of malnutrition based on wasting.**

| WHO weight for age | Frequency | Percent |
|---|---|---|
| Severe malnutrition | 60 | 15% |
| Moderate malnutrition | 48 | 12% |
| Normal | 265 | 66.3% |
| Overweight | 17 | 4.3% |
| Obesity | 10 | 2.5% |
| Total | 400 | 100.0% |

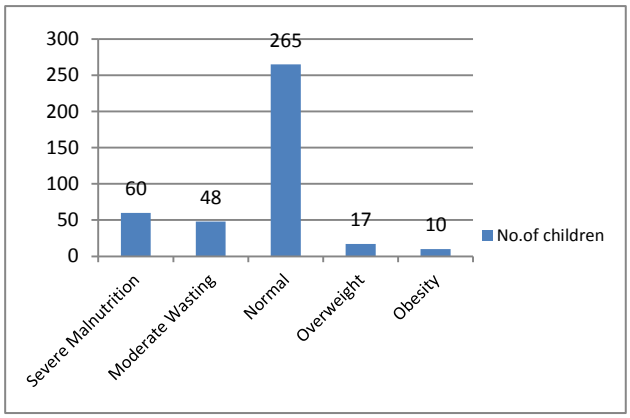


**Figure 1: Bar chart showing distribution of wasting in children.**

***Comparison of malnutrition according to IAP and z scoring by WHO***

In this present study malnutrition was assessed using both IAP and z score system it was found that malnutrition according to IAP classification was identified in 124 (31%), while 108 (27%) of children were identified as malnourished by z score classification.

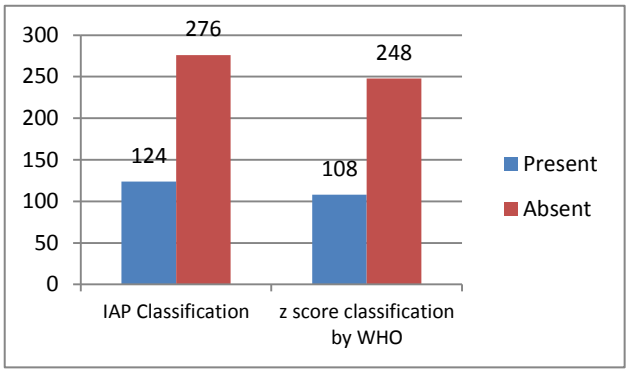


**Figure 2: Bar chart comparing IAP classification and z score classification.**

**Table 4: Anemia in underweight children.**

| PEM(n=124) | | Frequency | Percent |
|---|---|---|---|
| **Anemia** | No anemia | 73 | 58.9 |
| | Anemia present | 51 | 41.1 |
| | Total | 124 | 100.0 |

In this study 51 (41.1%) underweight children has anemia and 73 (58.9%) were not anemic.

**Table 5: Anemia in children who have wasting.**

| Wasting(n=108) | | Frequency | Percent |
|---|---|---|---|
| **Anemia** | No anemia | 68 | 63.0 |
| | Anemia present | 40 | 37.0 |
| | Total | 108 | 100.0 |

In this study among the children who were having wasting, 40 (37%) of them were having anemia and 68 (63%) were not anemic.

**Table 6: Anemia in children who are malnourished according to BMI.**

| BMI underweight (n=152) | | Frequency | Percent |
|---|---|---|---|
| **Anemia** | No anemia | 95 | 62.5 |
| | Anemia present | 57 | 37.5 |
| | Total | 152 | 100.0 |

In this study, among children who were thin, 57(37.5%) were having anemia.

**Table 7: Distribution of anemia in stunted children.**

| Stunting | | Frequency | Percent |
|---|---|---|---|
| **Anemia** | No anemia | 62 | 53.9 |
| | Anemia present | 53 | 46.1 |
| | Total | 115 | 100.0 |

In this study, 53(46.1%) children who were stunted have anemia.

## DISCUSSION

In this study, among the 400 children, 31% of them had PEM. A study by Varghese et al in SAT hospital, Trivandrum in 2008 showed prevalence of Protein Energy Malnutrition (PEM) was 27.5 % as classified by the Indian Academy of Pediatricians.

A study from northern part of Kerala by A. Shibulal, also showed similar results, with the rate of under-nutrition with weight for age analysis was found to be 37%.[8]

According to NFHS-3, Forty-three percent of children under age five years are underweight for their age, which is the national average for prevalence of PEM. According to NFHS-3 prevalence of malnutrition in Kerala state was found out to be 22%.

***Proportion of anemia in underweight children (weight for Age)***

In this study 41.1% of the underweight children had anemia and 58.9% were not anemic.

Similar results were obtained in studies done at Kottyam, Kerala by George A.N. et al says the proportion of anemia in moderately undernourished was 17%.Similar results were also reported in study by Aswathy S. et al, in 2003, conducted in Lucknow, which states that the risk difference (RD) of moderate to severe anemia in the underweight children when compared to normal was 10.9, with a significant p value=0.001.[9]

Third round of NFHS also has similar results which states that half of young children who are stunted or underweight are moderately or severely anaemic, compared with 36-37 percent of those who are not stunted or underweight.

***Proportion of anemia in stunted children***

In this study, 53 (46.1%) children who were stunted have anemia.

Stunting denotes chronic malnutrition and as expected the prevalence of anemia will be higher in stunted children than in normal children.

The NFHS 3 also reports a 50% chance of anemia in stunted children when compared to children who are not stunted.

Contradicting reports are there as in a study in 2014 by Cynthia Anticona et al which states that no statistically significant association was found in the occurrence of stunting with anemia. However, undoubtedly various studies have shown that correction of anemia has improved linear growth of children significantly.

## CONCLUSION

This study shows that conventional IAP classification label more children as malnourished when compared with the classification based on wasting. Growth monitoring of children by weight for age criteria alone is bound to miss other forms of under nutrition. Hence the feasibility regarding inculcating other criteria like height for age and weight for height is essential for designing a better tool.

The conventional use of underweight (low weight for age) instead of z score as the sole criterion for identifying undernourished children may underestimate the true incidence of severe under nutrition in a community, so further research has to be done to sort out the appropriate reference system for Indian population.

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