# Utility of mid arm circumfrence in identifying protein energy malnutrition in anganwadi children of 1 to 5 years of age in urban areas of Chamarajanagara district

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*Abstract*---Background: UNICEF reports that 53% of the Indian children are malnourished[125]. Early detection of malnourishment among preschool children helps to decrease the mortality and morbidity rate. Easy, economical and reliable anthropometric measures are required to detect the nutritional status among children in the community. Studies conducted in India found that prevalence of malnutrition in Anganwadi children ranges from 40 to 60%. Understanding the gravity of the problem, the present study was undertaken in and around Chamarajangara . Objective: Utility Of Mid Arm Circumference In Identifying Protein Energy Malnutrition In Anganwadi Children Of 1 To 5 Years Of Age. Materials and Methods: A cross sectional study was conducted in the urban areas of Chamarajanagara district in Karnataka from January 2020 to December 2021. All the children who were enrolled in the all the anganwadi centers in Chamarajanagara urban were included in the study. A total of 1000 children were included in the study . The data was collected by using a pre tested and semi structured questionnaire by Clinical examination and by anthropometry Measurement as per

standards. Results: Present study included 51% females and 49% males,, majority being in the age group of 48-60 (40.8%). 64.6% belong to joint family. 53.4% of the respondents were found to have dietary fallacies. The cut off mean value of Mid arm circumference was found to be 15.179 ± 1.030 where 53.8% were found to have malnutrition and this was found in the age group of 72-60 months. Conclusion: Mid arm circumference was found to be a sensitive indicator in identifying moderate to severe malnutrition. There were no obese or overweight children found in the present study.

*Keywords*---Anthropometry Measurement, Dietary Fallacies, Mid Arm Circumference, Mid Thigh Circumference.

## Introduction

Malnutrition is frequently part of a vicious cycle that includes poverty and disease. These factors are interlinked in such a way that each contributes to the presence and permanence of others. Socio-economic and political changes that improve health and nutrition can break the cycle, as can specific nutrition and health interventions. Malnutrition in children is the consequence of a range of factors like poverty, ignorance, illiteracy etc. and are often related to intake of poor quality food, insufficient food intake and severe and repeated infectious diseases or some combination of these three.[1]

The dietary intake of children also affects the physical growth of children. Balanced diet not only enhance the growth and development of child but also provide protection from various infections and diseases. To examine the gender disparity in nutrition intake in India, a child nutrition disparity index was computed including three components, viz. proportion of children underweight, stunting and wasting respectively.[2]

Children below five years of age are the most vulnerable section of the population who constitute 16.5% of the population. Due to the high prevalence of mortality and morbidity among children, which constitute to be 40% of the total deaths in India, child care has been the focused area of concern at any given time. India is a country where we find deep rooted tradition and cultural practices, taboos and false beliefs combined with poverty and lack of awareness, leading to malnutrition which poses to be the most acute problem and its impact being reflected on children. UNICEF reports that 53% of the Indian children are malnourished[3]. Early detection of malnourishment among preschool children helps to decrease the mortality and morbidity rate. Easy, economical and reliable anthropometric measures are required to detect the nutritional status among children in the community. Studies conducted in India found that prevalence of malnutrition in Anganwadi children ranges from 40 to 60%.[4,5] Nutritional status can be determined with the help of clinical examination of signs of nutritional deficiencies, dietary intake and anthropometry. When these methods are used in combination, provides better picture for assessment of nutritional status of children.[6]

Anthropometric measurements like weight, height, mid upper arm circumference, skin fold thickness, thigh circumference, head circumference and chest circumference are valuable indicators of nutritional status. Clinical examination is simplest, accurate and the most practical method of ascertaining nutritional status.[6]

Nutritional disorders in children of age less than 5 years in a developing country where deep root traditions, taboos and false beliefs have imprisoned the people, the problem of nutritional disorders is more acute and its impact is more in children. Therefore identifying PEM early in children of 1-5 years of age is required in the implementation of the preventive and the effective control measures of protein energy malnutrition.

**Objective:**

To compare the utility of mid arm circumference in detecting malnourished children.

**Materials and Methods:**

A cross sectional study was conducted in the urban areas of Chamarajanagar District in Karnataka from January 2020 to December 2021. All the children who were enrolled in the all the anganwadi centers in Chamarajanagara urban were included in the study. A total of 500 children were included in the study . The data was collected by using a pre tested and semi structured questionnaire by Clinical examination and by anthropometry Measurement as per standards.

Anganwadis were listed initially. Personal information of each child, including information regarding family size, type of family, birth order of the children, were collected from Anganwadi records. The socio-economic status of family is determined by using the modified B.G. Prasad's classification. Clinical examination was done for clinical signs of nutritional deficiency. The clinical signs looked for in this age-group were: sparse hair, hyper or hypo pigmented hair, flag sign, increased lanugo hair, perifollicular hemorrhages, alopecia, dyssebacia, bitot's spots, pallor, cheilosis, angular stomatitis, glossitis, atrophied papillae, bleeding gums, loosening of teeth, hyper or hypopigmented skin, xerosis, scaly diffuse erythema, loss of subcutaneous fat, intertriginous erosions, rash over upper central chest and neck (casal's necklace), rash over the malar area, fissuring of nails, koilonychias, white nails, and perianal crusting. Systemic examination was also done.

Height, weight, mid arm circumference, mid-thigh circumference and other nutritional anthropometric measurements were taken. Data was entered in the standardized proforma. The anthropometric measurements were taken following the standard techniques recommended by Jelliffe.

Mid upper arm circumference (MUAC)[7] was performed on the left arm using shakir tape , midway between the acromion and the olecranon process. The clothing was uncovered over the arm. The measuring tape encircling the arm was held gently without pressing the soft tissues.

Any child whose MAC is

< 12.5 cm - Red zone - Indicates severe malnutrition

12.5-13.5 - Yellow zone Border line malnutrition

and > 13.5 - Green zone adequately nourished.[7]

Data entry and statistical analysis was performed with the help of SPSS Version 17. Percentages and Chi-square tests were used for the analysis of the data. The P value <0.05 was considered significant and P value <0.01 was considered highly significant.

**Results :**

A total of 500 children were interviewed data collected and analysed.

**Table 1: Socio Demographic Profile of the subjects**

| Socio Demographic Profile | | Frequency | Percentage |
|---|---|---|---|
| **Age** | 12 -24 months | 61 | 12.2 |
| | 25- 36 months | 82 | 16. |
| | 37 - 48 months | 153 | 31 |
| | 49 - 60 months | 204 | 41. |
| **Gender** | Male | 247 | 49% |
| | Female | 253 | 51% |
| **Religion** | Hindus | 407 | 81.4 |
| | Muslims | 89 | 17.8 |
| | Christians | 4 | .8 |
| **Type of Family** | Joint | 323 | 64.6 |
| | Nuclear | 177 | 35.4 |
| **SES** | Class II | 4 | 8% |
| | Class III | 128 | 25.6% |
| | Class IV | 368 | 73.6% |

It is found that majority of the children (40.8%) are in the age group of 49-60 months, 30.6% are in the age group of 37-48 months and 16.4% are found in the age group of 25-36 months and only 12.2% in the age group of 12-24 months. Majority of the respondents are females (51%) and the remaining 49% are male respondents. The data shows that majority 80.66% (121) of children were Hindus, followed by Muslims 11.33% (17) and only 8.00% (12) children belonged to Christian religion. Majority (64.6%) belong to joint family, and the remaining 35.4% belong to nuclear family. The socio economic status of the respondents is measured by modified B.G. Prasad classification. Here since the respondents are children their socio-economic status cannot be measured. Hence the parent's socio economic status is measured. This is a very important factor to be considered as one of the aetiology for the malnutrition of the children as the life

style of any individual depends on the socio-economic condition. Majority of the respondents (73.6%) belong to class IV, 25.6% of them belong to Class III and only 8% of them belong to Class II socio economic status.

In our study majority (53.4%) of the respondents had faced Dietary fallacies. Remaining 46.6% of the respondents had not reported to have faced dietary fallacies.

With health education provided for the mothers regarding the nutrition of the children there is still much of misconceptions regarding the weaning pattern, weaning food and period, faulty cooking methods. This is influenced by the family culture and practices and lack of awareness of the mother and care takers of the child. This has an effect on the nutritional level of the children.

**Table 2 : Distribution of RDA of Cal among the respondents.**

| SL.NO | RDA | Calorie Intake | Protein Intake |
|-------|-------|----------------|----------------|
| 1. | 50-70 | 51 | 6 |
| 2. | 70-90 | 217 | 100 |
| 3 | >90 | 232 | 394 |
| | Total | 500 | 500 |

Data of Recommended Dietary Allowance of the Calories clearly shows that majority of the respondents (46.4%) have an RDA of above 90, 43.4 % had an RDA of 70-90, and only 10.2% of the respondents had RDA of 50-70.

Calories in the diet is very essential for the growth of the child. In the present study only 46.4% of the children are having sufficient calories in their diet. The other 53.6% are reported to have below the range of 90 RDA of cal. The present study also shows the effect of this insufficiency of RDA of Cal on the health of the respondents. It is observed by the above data that 78% of the respondents have RDA of protein above 90 and 20% have RDA of 70-90. 1.2% of the respondents have RDA of 50-70. The RDA of protein is seen insufficient among 21.2% of the respondents with the range below 90. This fact reveals that malnutrition is prevalent among the preschoolers and it has a major implication on the health of the children.

**Table 3**
**Comparison of The Nutritional Status Of The Respondents Vs Dietary Fallacies**

| SL.NO | NUTRITIONAL STATUS | Dietary fallacies | | TOTAL |
|-------|--------------------|-------------------|-----|-------|
| | | NO | YES | |
| 1. | Grade III PEM | 0 (0%) | 6 (2.2%) | 6 (1.2%) |
| 2. | Grade II PEM | 0 (0%) | 45(16.9%) | 45(9.0%) |
| 3 | Grade I PEM | 2 (0.9%) | 216(80.9%) | 218(43.6%) |
| 4 | Normal | 231 (99.1%) | 0 (.0%) | 231(46.2%) |
| | Total | 233 (100.0%) | 267 (100%) | 500 (100%) |

$X^2$=492.037  p<0.001  vhs

Data in the above table clearly depicts that 46.2% of the respondents are having normal nutritional status, where as 43.6% are having Grade I PEM , 9.0% are having Grade II PEM, and only 1.2% of the respondents are having Grade III PEM. When the weight for age and the dietary fallacies was compared and  it was found that 99.1% of the respondents whose nutritional status is normal have no dietary fallacies, whereas 80.9% of the respondents having Grade I PEM have dietary fallacies.  It is also seen that 16.9% of those respondents having Grade II PEM also had dietary fallacies.  This is also noticed among the respondents having Grade III PEM (2.2%) who had dietary fallacies.  However, very highly significant association (p<0.001) was observed with the weight for age and the dietary fallacies.   Hence the present study showed that the dietary fallacies caused nutritional deficiency among the children.

In our study among the respondents as per their mid arm circumference.  79.2 % of them are having normal mid arm measurement, 15.2% are having moderate malnutrition as measured by the midarm circumference whereas 5.6% are found to be severely malnourished.  Mid arm circumference is an easy indicator to measure the nutritional level of the children.

**Table 4**
**Showing The Distribution Of Respondents' Mid Arm Circumference**

| AGEGROUP | SEX | N | Mean | Std. Deviation | t |
|---|---|---|---|---|---|
| 12 -24 months | Male | 29 | 14.717 | 1.403 | 2.826 |
| | Female | 32 | 13.813 | 1.091 | p=0.006  hs |
| 25- 36 months | Male | 43 | 14.605 | 1.311 | 1.344 |
| | Female | 39 | 14.226 | 1.235 | p=0.183 ns |
| 37 - 48 months | Male | 79 | 14.577 | 1.281 | .451 |
| | Female | 74 | 14.669 | 1.229 | p=0.652  ns |
| 49 - 60 months | Male | 96 | 14.967 | 1.241 | 2.782 |
| | Female | 108 | 14.482 | 1.232 | p=0.006  hs |

Mean distribution in the above table shows the measurement of Mid arm circumference of the respondents according to their age group.  The result indicates that the comparison among the gender in the age group of 12-24 months is highly significant.  As the age increases the difference among the gender is negligible in the age group of 25-36 (p=0.183) and 37-48 months (p=0.652). However, in the age group of 49-60 months the comparison among the male and female respondents shows highly significant results (0.006).   This result clearly shows that there will be more chances of occurrence of malnutrition among the girls as the age increases.   The measurement of mid arm circumference is the easiest method to check the malnutrition among the children

**Table 5**
**Comparison Of The Weight For Age Of The Respondents And Their Mid Arm Circumference.**

| MID ARM CIRCUMFERENCE | Weight for age | | | | Total |
|---|---|---|---|---|---|
| | Grade III PEM | Grade II PEM | Grade I PEM | Normal | |
| Severe | 4(66.7%) | 12(26.7%) | 9(4.1%) | 3(1.3%) | 28(5.6%) |
| Moderate | 2(33.3%) | 33(73.3%) | 39(17.9%) | 2(.9%) | 76(15.2%) |
| Normal | 0(.0%) | 0(.0%) | 170(78.0%) | 226(97.8%) | 396(79.2%) |
| Total | 6(100.0%) | 45(100.0%) | 218(100.0%) | 231(100.0%) | 500(100.0%) |

Mid arm circumference gives an indication of the nutritional status of the child. The present study indicates that 5.6% of the respondents have severe malnutrition as indicated by the measurement of mid arm circumference. 15.2% of them have moderate malnutrition and the remaining 79.2% are normal. The study further shows the distribution of these respondents according to the weight for age. It can be highlighted that among those respondents who have normal nutritional status 1.3% of them are shown to have severe malnutrition according to their mid arm circumference, 0.9% to have moderate malnutrition. Those respondents with Grade I PEM, 4.1% have severe and 17.9% moderate malnutrition. 66.7% of the respondents with Grade III PEM are found to have severe and 33.3% have moderate malnutrition. When these two factors were compared the result was indicated to be very highly significant (p<0.001).

**Discussion**

Malnutrition presently is the most important focussed area because of its relevance as medical and social issue especially in the developing nation like that of India.

The proportion of females was found higher in the present study. Similar proportion was showed in the study conducted by Karthikeyan *et al.*[7] and Mathur et al [8] had males higher than females.

The result of the study indicates that majority (53.4%) of the respondents had Dietary fallacies and the other 46.6% did not report dietary fallacies. Dietary fallacies included faulty weaning practices and the period of weaning.

In the study done in the tribal area of Tamilnadu showed that 28.32% of children in the age group of 12 – 24 months had delayed weaning or faulty weaning method which was a contributory factor to under nutrition[4].

This fact was seen also in the study made by Rao et.al.[9] He reported that malnutrition is found due to inadequate knowledge about complementary feeds in caregivers and lack of the effective breast feeding.

Ray SK et al[3] in their study revealed that diet of children aged 12 -36 months was adequate for proteins in 20.14% and for calories in 16.56% and in 37 – 60 months, calories were adequate in 38.94% & proteins in 32.40%.

An reference was in a study made by Gupta MJ et al [10] where they observed in the age group of 1-6 years children has only 70% intake of energy while the protein intake was found to be adequate. Another study by Kapur D[11] revealed that the nutrient intake was grossly inadequate among the children whose findings were similar to our study findings .

All these factors clearly indicate that inadequacy dietary intake combined with faulty weaning procedures contribute to the malnutrition of the children.

The present study found that the mid arm circumference was sensitive indicator to detect malnutrition as against the study conducted by Joseph B et al[12] who conducted the study in the rural area of Karnataka. The present study showed 53.8% prevalence of malnutrition among children of age 12 to 60 months. This result was similar to the prevalence indicated in the study done by Krishna Agarwal K *et al*[13] in Jabalpur and showed that prevalence of malnutrition to be 52.09% in the rural areas in children 1 to 5 years based on mid arm circumference. Where as another study done by Kishori B *et al*[14] revealed only 33.31% of children having malnutrition. Sood AK et al[15] in their study conducted in rural area in Faridabad district detected malourishment among 27.2% of the children by using mid arm circumference. Hence the result indicated by the present study based on the measurement of the mid arm circumference proved to be a sensitive indicator to detect malnutrition.

## Conclusion

Lower socio-economic condition, dietary fallacies and short birth interval were the most important causative factors which had an adverse effect on nutritional status of child. Nutrition deficiency had an impact of early transitional growth failure. . MUAC could detect only one third of the children with malnutrition detected as per the weight for age, but was found to be a sensitive indicator in identifying moderate to severe malnutrition. Henceforth Welfare programs should be concentrated more on health education to the mothers at an early gestational period regarding nutrition, sanitation, and other health care needs of the foetus and child after birth. Scope for further research in the urban areas also should be identified to detect malnutrition among underfive children.

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