Nutritional Status of Pre-School Children Attending Anganwadi Centres in Chittoor, Andhra Pradesh, India

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ABSTRACT

Context/Background: Malnutrition among children is a major public health problem in India. The objective of the study is to assess the nutritional status of pre-school children and to identify the socio-demographic determinants of malnutrition.

Methodology: In this community-based cross-sectional study, 194 under-five children were recruited from rural and urban areas of Chittoor district, Andhra Pradesh. Anthropometric measurements were measured and age standardized weight-for-age (WAZ), height-for-age (HAZ), and weight-for-height (WHZ) were calculated. The proportion of under nutrition (WAZ <-2 standard deviation (SD)), stunting (HAZ < -2SD), and wasting (WHZ < -2SD) were calculated along with the determinants.

Results: The mean age of the participants was 40.5 months (SD- 9.1 months), 101 (52.1%) were from rural areas, and 96 (495%) females. The HAZ values were significantly low in urban children (-0.81; 95%CI: -0.4, -1.21), among the non-Hindu children (-0.92; 95%CI: -0.35, -1.5). The overall prevalence of underweight, stunting, and wasting were 13.4% (95%CI: 8.5%, 18.3%), 23.7% (95%CI: 17.6%, 29.8%), and 19.6% (95%CI: 11.9%, 25.3%) respectively. Urban residence (OR 6.75; 95% CI: 3.03 – 15.04) was a strong predictor of stunting.

Conclusion: Malnutrition remains to be a public health problem in this area. Strengthening of existing programs should be the key strategy in combating malnutrition.

Keywords: India, Malnutrition, Preschool child, Severe acute malnutrition, Stunting

INTRODUCTION

Undernutrition among children in has remained a major public health problem globally, but more marked in the low- and middle-income countries. The condition directly affects child survival, morbidities, high infection rate, growth and development and future productivity in the life-cycle of the children. The worst damages of malnutrition occur during the most crucial periods of pregnancy and early childhood i.e., from conception to two years, i.e., the first 1000 days. Children who are undernourished will have weaker immune systems thereby becoming more susceptible to infections and illnesses. At the community level, this burden reduces productivity, including food production, and perpetuates the spiral of further malnutrition, infection, disease, poverty, and socioeconomic and political instability. The World Health Assembly has reiterated the importance of reduction of undernutrition and suggested the approaches to combat the condition, but failed to gain much. The estimated reduction of undernutrition from the national level surveys is unsatisfactory in many parts of the world. In the last two decades, the reduction of stunting was higher in Asia (38.2% to 22.7%) when compared with the other regions like...
the Latin Americas (16.7% to 9.0%) and Africa (38.0 to 30%). However, a high between country disparities is expected within a region because of socio-economic disparities. According to WHO report on malnutrition, 156 million were affected by stunting (low height-for-age) and 50 million children were found to be affected by wasting (low weight-for-height). Poor nutrition caused nearly half of deaths in children of under-five age group. In India, undernutrition continues to be a major public health challenge. Estimate in 2017 suggests that almost two-fifths of the children are suffering from stunting, one-sixth wasting, and one-third undernutrition. The National Family Health Survey (NFHS-5) (2019-21) shows that prevalence of stunting (38.4%), wasting (19.5%), severe wasting (7.7%) and underweight (32.1%) is still critically high in the country and changed only marginally compared to the finding from NFHS-4 in 2015-16. According to NFHS-4 data, 35.8% of under-five children were found to be underweight, 38.4% were stunted and 21.0% of the children had wasting.

Nutritional uplift in India can come with overall socio-economic development and hence the government of India initiated several supplementary feeding programs like Integrated Child Development Services (ICDS) Scheme aiming at overcoming specific nutritional deficiency diseases through various ministries of Government to combat malnutrition. Hence, pre-school children in India require special attention and care with respect to their health and nutritional status. In this regard, the Anganwadi centers plays a key role in implementing the programs in the community level. In India, Anganwadi centers provide a unique platform to screen the pre-school children for undernutrition. However, it is uncertain whether the screening results into appropriate management of the children or not. Also, this screening does not provide the further details like the determinants of undernutrition and thereby provision of targeted approach to combat the condition efficiently. In this background, the present study was conducted to assess the nutritional status of preschool children (24 to 60 months) by anthropometric measurements in urban and rural areas of Chittoor, and to identify the socio-demographic determinants of malnutrition.

**METHODS**

**Study design:** This was a community-based cross-sectional study.

**Study settings:** The study was carried in Urban and Rural areas in Chittoor district. The urban area which was under Urban Health Centre of Apollo Institute of Medical Sciences (AIMSR), Chittoor. The rural area of study was the villages under Aragonda sub-centre in Chittoor district which is approximately 20 kilometres away from Chittoor.

**Study duration:** Data collection was done from May 2018 to August 2018

**Study Participants:** The Under-five children between 24 and 60 months of age attending the Anganwadi centres in Urban and rural field practice area of department of community medicine. The inclusion criteria were- age between 24 – 60 months, permanent resident of the area (at least 6 months) and attending anganwadi centres. The exclusion criteria were- any acute or chronic medical condition where it is difficult to perform anthropometric measurements, and unwilling to participate

**Sample size:** In a study done in same district, prevalence of underweight was 57%, stunting was 38% and wasting was 36%. In the present study, we assume a prevalence of 40%, with 8% of relative precision, our required sample size was found to be 150. After getting the list of all the pre-school children enrolled in Anganwadi centre, we found the number to be 206 and we enrolled all the children into our study.

**Tools and data collection process:** The list of the children attending Anganwadi centre was obtained, and their address taken. The principal investigator (PI) visited the house of the child and took the informed consent from the parent / guardian. After obtaining the informed consent, the PI carried out an interview of the mother or the primary care giver of the child through a pre-tested, semi-structured questionnaire. The questionnaire had two parts. In the first part, socio-demographic profile was asked; followed by the second part which had anthropometric measurements of the child- height, weight and mid-upper arm circumference (MUAC) through calibrated instruments.

**Definition of the outcome variables:** Three anthropometric measures were examined in this study—underweight, stunting, and wasting. Underweight was defined as z-scores of age standardized weight for age (WAZ) <-2 standard deviation (SD); stunting was defined as z-scores of age standardized height for age (HAZ) <-2SD while wasting was defined as z-scores of either age standardized weight for height (WHZ) <- 2SD.

**Data entry and analysis:** Data was entered in Microsoft excel. Anthropometric analysis was done by WHO Anthro software. Final data was analyzed by SPSS version 20.0. Categorical variables were expressed as proportion with appropriate 95% confidence interval (CI). For the continuous variables, mean with standard deviation (SD) or median with inter-quartile range (IQR) was estimated depending on the distribution of the variables. To check the association between two variables, we conducted univariate analysis with Chi-square test for the categorical variables. To check the mean difference of an outcome between two variables, we conducted unpaired t-test. For all
statistical analyses, a p-value <0.05 was considered significant.

**Human subject protection:** We obtained the institutional ethics committee clearance. In addition, we obtained written informed consent from all the parents of the children.

**RESULTS**

In this study, we recruited 194 participants out of 206 eligible participants. Twelve (6%) mothers did not give consent. Out of 194 participants, 93 (47.9%) were from urban areas and 102 (52.1%) from rural areas. (Table 1) The mean age of the participants was 40.5 months (SD- 9.1 months) and 96 (49.5%) females. Most of the participants belonged to Hindu (n=165, 85.1%) nuclear families (n=120, 61.9%) and poor socio- economic section (n=123, 64.1%). Most of the mothers have studied at least higher secondary level (n=150, 77.3%), and home maker (n=161, 83%).

**Nutritional status of the participants**

The median z-scores (IQR) for WAZ (Median: -1.22, IQR: -1.74 to -0.73), HAZ (Median: -0.98, IQR: -2.82 to -0.21) and WHZ (Median: -0.78, IQR: -1.53 to -0.15) were skewed substantially from the WHO reference median of zero. (Figure 1) The skewness is even more prominent for the height-for-age in the urban children. The HAZ values were significantly low in urban children compared to the rural children (-0.81; 95% CI: -0.4, -1.21), among the non-Hindu children compared to the Hindu children (-0.92; 95% CI: -0.35, -1.5) and among the children whose mothers are homemaker than the children of working (outside) mothers (0.8; 95% CI: 0.25, 1.35). (Table 2) However, we noticed a reverse relationship in the distribution of the WHZ. The WHZ values were significantly low in rural children compared to the urban children (-0.58; 95% CI: -0.23, -0.91), among the Hindu children compared to the non-Hindu children (-0.50; 95% CI: -0.02, -0.98) and among the children whose mothers are working (outside) mothers than the children of homemakers (-0.72; 95% CI: -0.27, -0.17). (Table 2)

The overall prevalence of underweight, stunting, and wasting were- 13.4% (95% CI: 8.5%, 18.3%), 23.7% (95% CI: 17.6%, 29.8%), and 19.6% (95% CI: 11.9%, 25.3%) respectively. There were a total 16 (8.3%, 95% CI: 5.6%, 11.0%) severely malnourished children. While the proportion of underweight and wasting was significantly high in the rural areas, the proportion of stunting was substantially high (OR 6.75; 95% CI: 3.03 – 15.04) among the urban children. (Supplementary table 1-3) The distribution of underweight was similar in both urban and rural area (Figure 1). Severe wasting (WHZ <-3SD) was strongly associated with children whose mothers are working outside (OR 6.0; 95% CI: 2.1, 17.8)

| Table 1: Socio demographic variables of the study subjects (N=194) |
|-----------------------------|--------------------------|
| Variable                    | Children (%)             |
| Age (in months)             |                          |
| 24 – 36                     | 68 (35.1)                |
| >36 – 48                    | 74 (38.1)                |
| >48 – 60                    | 52 (26.8)                |
| Gender                      |                          |
| Female                      | 96 (49.5)                |
| Male                        | 98 (50.5)                |
| Birth order                 |                          |
| One                         | 102 (52.6)               |
| Two                         | 80 (41.2)                |
| Three                       | 12 (6.2)                 |
| Religion                    |                          |
| Hindu                       | 165 (85.1)               |
| Muslim                      | 24 (12.4)                |
| Christian                   | 5 (2.6)                  |
| Type of family              |                          |
| Nuclear                     | 120 (61.9)               |
| Joint family                | 5 (2.6)                  |
| Three generation            | 69 (35.6)                |
| BG Prasad SocioEconomic status for August 2018 (INR) |          |
| Class I (>= 6871)            | 2 (1)                    |
| Class II (3435- 6870)       | 7 (3.6)                  |
| Class III (2061-3434)       | 9 (4.7)                  |
| Class IV (1031- 2060)       | 51 (26.6)                |
| Class V (< = 1030)          | 123 (64.1)               |
| Education of Mother         |                          |
| Illiterate                  | 6 (3.1)                  |
| Primary                     | 5 (2.6)                  |
| Middle                      | 33 (17.0)                |
| Higher secondary            | 100 (51.5)               |
| Intermediate                | 32 (16.5)                |
| Graduation & above          | 18 (9.3)                 |
| Occupation of Mother        |                          |
| Home Maker                  | 161(83.0)                |
| Working Gainfully           | 33 (17.0)                |

**DISCUSSION**

In this study, we have estimated the prevalence of different types of undernutrition among the under-five pre-school children and examined the association of these outcomes with the socio- demographic determinants. We found that prevalence of stunting is high compared to the other two malnutrition types. Prevalence of stunting is remarkably high in urban areas compared to rural area. All the three forms of malnutrition are equally distributed in respect to the socio-demographic variables. Women working outside home is a strong predictor severe acute malnutrition.

While prevalence of underweight and stunting in our study falls on ‘medium prevalence’ in cut-off values for public health significance, according to World Health Organization (Nutrition Landscape Information System- Country Profile indicators); the prevalence of wasting falls on serious level prevalence’ in cut-off values for public health significance.

The prevalence of malnutrition in our study is low when compared with the finding from the other parts of the country.
A study done in Goa, the overall prevalence of underweight, wasting and stunting was found to be 33.4%, 24% and 31.5%. A study conducted in Assam, the North-East part of the country, found that the overall prevalence of underweight, stunting and wasting was found to be 29%, 30.4% and 21.6% respectively. Whereas study conducted in the northern part of the country in Bareilly, UP showed the prevalence of underweight, stunting and wasting as 53.86, 43.22% and 60.67% respectively.

Lower prevalence of malnutrition in the present study may be due to improved effectiveness in the implementation in the program or local factors. A remarkable higher burden of stunting in urban area in the present study could be contributed by other factors like availability of food, exposure to poor environmental factors.

Importantly, we found that the proportion of malnutrition is equally distributed in respect to the socio-demographic factors. Other studies conducted in the similar region, found that age group, urban residence, gender, and lower socioeconomic status to be the common socio-demographic predictors of undernutrition.

Figure 1A-F: Distribution of anthropometric indices in relation to rural/urban residence, Chittoor, India, 2018
Table 2: Distribution of anthropometric z-scores in different socio-economic groups

| Variables           | WAZ          | HAZ          | WHZ          |
|---------------------|--------------|--------------|--------------|
|                     | Mean value   | Difference (95% CI) | P value | Mean value | Difference (95% CI) | P value | Mean value | Difference (95% CI) | P value |
| Gender              |              |              |              |              |              |              |              |              |
| Male                | -1.2         | -0.04        | 0.69         | -0.96       | 0.11         | 0.6          | -0.99       | 0.2           | 0.12    |
| Female              | -1.16        | (-0.19, 0.28) |              | -1.07       | (-0.31, 0.54) |              | -0.78       | (-0.13, 0.55) |              |
| Area of residence   |              |              |              |              |              |              |              |              |
| Rural               | -1.13        | 0.1          | 0.4          | -0.63       | -0.81        | <0.001*      |              |              |
| Urban               | -1.23        | (-0.13, 0.34) |              | -1.44       | (-0.4, -1.21) |              | -0.58       | (-0.23, -0.91) |              |
| Family type         |              |              |              |              |              |              |              |              |
| Nuclear             | -1.16        | 0.04         | 0.62         | -1.08       | -0.16        | 0.47         | -0.81       | 0.19          | 0.28    |
| Third generation    | -1.2         | (-0.21, 0.28) |              | -0.92       | (-0.59, 0.28) |              | -1          | (-0.17, 0.54) |              |
| Religion            |              |              |              |              |              |              |              |              |
| Hindu               | -1.14        | 0.24         | 0.14         | -0.88       | 0.92         | 0.001*       | -0.95       | -0.5          | 0.04*   |
| Non-Hindu           | -1.38        | (-0.08, 0.57) |              | -1.8        | (0.35, 1.5)  |              | -0.45       | (-0.02, -0.98) |              |
| Birth order         |              |              |              |              |              |              |              |              |
| One                 | -1.16        | 0.03         | 0.82         | -1.01       | 0           | 0.98         | -0.88       | 0.02          | 0.45    |
| >One                | -1.2         | (-0.21, 0.26) |              | -1.01       | (-0.41, 0.43) |              | -0.9        | (-0.33, 0.38) |              |
| Mother’s education  |              |              |              |              |              |              |              |              |
| <=8th standard      | -1.27        | -0.12        | 0.4          | -1.14       | -0.16        | 0.54         | -0.87       | 0.02          | 0.46    |
| >8th standard       | -1.15        | (-0.40, 0.16) |              | -0.98       | (-0.66, 0.34) |              | -0.89       | (-0.39, 0.43) |              |
| Mothers’ occupation |              |              |              |              |              |              |              |              |
| Homemaker           | -1.22        | -0.05        | 0.9          | -0.36       | 0.8          | 0.004*       | -1.48       | -0.72         | <0.001 |
| Working gainfully   | -1.17        | (-0.37, 0.27) |              | -1.15       | (0.25, 1.35) |              | -0.76       | (-0.27, -0.17) |              |
| Fathers’ education  |              |              |              |              |              |              |              |              |
| <=8th standard      | -1.31        | -0.16        | 0.28         | -1.23       | -0.25        | 0.26         | -0.87       | 0            | 0.98    |
| >8th standard       | -1.15        | (-0.45, 0.12) |              | -0.98       | (-0.75, 0.26) |              | -0.87       | (-0.42, 0.41) |              |
| SES                 |              |              |              |              |              |              |              |              |
| Low SES#            | -0.93        | 0.28         | 0.17         | -0.9        | 0.15         | 0.33         | -0.9        | 0.26          | 0.39    |
| High SES$           | -1.21        | (-0.12, 0.69) |              | -1.05       | (-0.57, 0.87) |              | -0.63       | (-0.33, 0.05) |              |

*Statistically significant; # BG Prasad class Socio-economic IV/V, $ BG Prasad Socio-economic class I/II/III

LIMITATIONS

The study participants were recruited through the anganwadi centers and we expect to miss a few children to recruit in the study. However, we have earlier intimated the local village health workers to recruit the maximum number of participants. We also expect a few misclassifications in the outcome variables. However, we have used calibrated instruments and uniform anthropometry examination process to reduce the measurement bias and thereby misclassification.

CONCLUSION

Malnutrition remains to be a public health problem in this area. All forms of malnutrition are prevailed among the children under five years of age irrespective of any among all socio-demographic groups, more likely among the urban children and the working mothers. The existing system to identify the children with malnutrition through anganwadi system should be strengthened. We strongly recommend for continuous monitoring of the children through simple nutritional assessment by village...
level health workers through the existing national level programs like ICDS. Besides, supportive supervision of the village-level healthcare workers, and linking referral services from the anganwadi center to the nutritional rehabilitation center for the SAM children can identify the conditions and initiate treatment at an early stage. High prevalence of chronic malnutrition suggests long-term effect of various factors which are unnoticed and may need further exploration.

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Supplementary Table 1: Association of Socio-demographic variables with underweight based on the WHO child growth std

| Variables                      | Frequency in nutritional status group | OR (95% CI)         | p value |
|--------------------------------|--------------------------------------|---------------------|---------|
|                                | Underweight (%) | Normal (%)          |         |
| **Age (months)**               |                       |                     |         |
| 24-35                          | 10 (14.7)             | 58 (85.3)           | Ref. category |
| 36-47                          | 7 (9.5)               | 67 (90.5)           | 1.7 (0.6, 4.6) 0.33 |
| 48-60                          | 9 (13.3)             | 43 (82.7)           | 0.8 (0.3, 2.2) 0.7 |
| **Gender**                     |                       |                     |         |
| Male                           | 12 (12.2)            | 86 (87.8)           | 0.8 (0.4, 1.9) 0.64 |
| Female                         | 14 (14.6)            | 82 (85.4)           |         |
| **Birth order**                |                       |                     |         |
| One                            | 13 (12.8)            | 89 (87.2)           | Ref. category |
| Two                            | 12 (15.0)            | 68 (85.0)           | 0.8 (0.4, 1.9) 0.54 |
| Three                          | 1 (8.3)              | 11 (91.7)           | 1.6 (0.2, 13.5) 0.55 |
| **Socio-economic status (BG Prasad – August 2018)** | | | |
| Poor (class IV, V)             | 25 (14.4)            | 149 (85.6)          | 2.9 (0.4 – 25.0) 0.31 |
| High (class I, II, III)        | 1 (5.6)              | 17 (94.4)           |         |
| **Education of mother**        |                       |                     |         |
| Up to middle level             | 6 (13.6)             | 38 (86.4)           | 1.02 (0.4 – 2.7) 0.95 |
| Above middle level             | 20 (13.3)            | 130 (86.7)          |         |
| **Residence**                  |                       |                     |         |
| Urban                          | 16 (17.2)            | 77 (82.8)           | 1.89 (0.8 – 4.4) 0.14 |
| Rural                          | 10 (9.9)             | 91 (90.1)           |         |

Supplementary Table 2: Association of Socio-demographic variables with Stunting based on the WHO child growth standards

| Variables                      | Frequency in nutritional status group | OR (95% CI)         | p value |
|--------------------------------|--------------------------------------|---------------------|---------|
|                                | Stunting (%) | Normal (%)          |         |
| **Age (months)**               |                       |                     |         |
| 48-60                          | 15 (28.8)             | 37 (71.2)           | Ref. category |
| 36-48                          | 13 (17.6)            | 61 (82.4)           | 0.53 (0.34 – 1.99) 0.14 |
| 24-36                          | 18 (26.5)            | 50 (73.5)           | 0.89 (0.22 – 1.23) 0.77 |
| **Gender**                     |                       |                     |         |
| Female                         | 22 (22.9)            | 74 (77.1)           | 0.91 (0.47 – 1.77) 0.79 |
| Male                           | 24 (24.5)            | 74 (75.5)           |         |
| **Birth order**                |                       |                     |         |
| 3                              | 3 (25)                | 9 (75)              | Ref. category |
| 2                              | 21 (26.3)            | 59 (73.8)           | 1.07 (0.20 – 3.31) 0.93 |
| 1                              | 22 (21.6)            | 80 (78.4)           | 0.82 (0.26 – 3.42) 0.78 |
| **Socio-economic status (BG Prasad – August 2018)** | | | |
| Poor (class IV, V)             | 43 (41.7)            | 131 (75.3)          | 1.64 (0.45 – 5.92) 0.45 |
| High (class I, II, III)        | 3 (16.7)             | 15 (13.7)           |         |
| **Education of mother**        |                       |                     |         |
| Up to middle level             | 12 (27.3)            | 32 (72.7)           | 1.28 (0.59 – 2.71) 0.53 |
| Above middle level             | 34 (22.7)            | 116 (77.3)          |         |
| **Residence**                  |                       |                     |         |
| Urban                          | 37 (39.8)            | 56 (60.2)           | 6.75 (3.03 – 15.04) <0.001* |
| Rural                          | 9 (8.9)              | 92 (91.1)           |         |

*Statistically significant

Supplementary Table 3: Association of Socio-demographic variables with Wasting based on the WHO child growth standards

| Variables                      | Frequency in nutritional status group | OR (95% CI)         | p value |
|--------------------------------|--------------------------------------|---------------------|---------|
|                                | Wasting (%) | Normal (%)          |         |
| **Age (months)**               |                       |                     |         |
| 48-60                          | 9 (17.3)              | 43 (82.7)           | Ref. category |
| 36-48                          | 10 (13.5)             | 64 (86.5)           | 0.75 (0.28, 1.99) 0.56 |
| 24-36                          | 8 (11.8)              | 60 (88.2)           | 0.64 (0.23, 1.78) 0.34 |
| **Gender**                     |                       |                     |         |
| Female                         | 14 (14.6)             | 82 (85.4)           | 1.11 (0.49, 2.52) 0.79 |
| Male                           | 13 (13.6)             | 85 (86.7)           |         |
| **Birth order**                |                       |                     |         |
| Three                          | 1 (8.3)               | 11 (91.7)           | Ref. category |
| Two                            | 9 (11.3)              | 71 (88.8)           | 1.39 (0.16, 12.10) 0.76 |
| One                            | 17 (19.7)             | 85 (83.3)           | 2.20 (0.27, 18.19) 0.46 |
| **Socio-economic status (BG Prasad – August 2018)** | | | |
| Poor (class IV, V)             | 24 (13.8)             | 150 (86.2)          | 1.28 (0.28, 5.92) 0.75 |
| High (class I, II, III)        | 2 (1.1)               | 16 (88.9)           |         |
| **Education of mother**        |                       |                     |         |
| Up to middle level             | 6 (13.6)              | 38 (86.4)           | 0.97 (0.36, 2.57) 0.95 |
| Above middle level             | 21 (14)               | 129 (86)            |         |
| **Residence**                  |                       |                     |         |
| Urban                          | 9 (9.7)               | 84 (90.3)           | 0.49 (0.21, 1.16) 0.10 |
| Rural                          | 18 (17.8)             | 83 (82.2)           |         |