

## **Dimensions and Causes of Child Malnutrition: A Study of Preschool Children of Raipur, Chhattisgarh, India**

**Mitashree Mitra, Alka Tiwari, Rohini Ghosh and Premananda Bharati**

### **INTRODUCTION**

The relationships between malnutrition and infection and their influence on human growth and development are complex. Inadequate growth in poor countries is generally the consequences of infectious disease and low nutrient intake, especially inadequate energy and protein intake, relative to nutritional requirements (Martorell and Habicht, 1986; Lutter et al., 1990; Bouis and Hunt, 1998). More than half of the malnourished children in the developing world is found in South Asia (UNICEF, 1993, 1996). In a vast and multiethnic country like India, the extent and type of malnutrition among children varies from region to region and from state to state, depending upon the geography, socioeconomic factors, food habits, levels of literacy, climate, religious and cultural beliefs (ICMR, 1972; Gopalan, 1988; Rao and Rao, 1994; Ghosh et al., 2001).

Malnutrition is considered to be a leading cause of child mortality in India. In Chhattisgarh the mortality rate among preschool children was 122.7 per 1000 live births (NFHS, 2002). In Chhattisgarh the data on nutritional and health status of preschool children are very scanty and it is essential to have this basic information for the planning of nutritional programs aimed for improving the nutritional status of preschool children.

The aim of the present paper is to assess the types and frequencies of malnutrition and delineate the factors contributing to the observed pattern of malnutrition among preschool sample of children from three specific populations i.e. Saryupari Brahmin, Teli and Rawat of Raipur through nutritional anthropometric survey. Brahmin is a well-known priestly caste of India. Saryupari Brahmin of Chhattisgarh, or better known as Chhattisgarhi Brahmin, is considered to be branch of Kanya Kubja division. They have migrated from the area across the Saryu River in Uttar Pradesh to this region long back (400 – 500 yrs.) but at present they live as the natives of Chhattisgarh. The Rawat was not been

separated as caste (Russell and Hiralal, 1916) and were recognized under the Ahir caste. Rawats show some cultural and occupational identity with the cattle herder groups of India, such as Ahri, Yadav, Gwala etc. due to belonging to the same ancestor King Nanda. Now Government of India included, them in OBC category. Teli is an occupational caste of oil pressures and vendors. A great bulk of Telis has now abandoned their traditional occupation and most of them are primarily agriculturists. They are also included in OBC category by Govt. of India

### **MATERIAL AND METHODS**

The data for the present study was collected in 1996-97 from 4 Anganbadi, 1 Balbadi and 3 Nursery and pre nursery school located in Gandhi Nagar, Sunder Nagar, Sarsawati Vihar, Kota and Rohinipuram area of Raipur district. Some boys and girls especially aged at 2-3 years were also examined at home. The anthropometric survey on 121 Saryupari Brahmin (57 Boys and 64 girls), 93 Rawat (49 boys and 46 girls) and 97 Teli (46 boys and 51 girls) children ranging in age from 2+ to 5+ years was conducted for the assessment of nutritional and health status. The anthropometric techniques used in this study follow closely those recommended by Jelliffe (1966) and Weiner and Lourie (1981). The date of birth of the children was recorded from Anganbadi, Balbadi and school registers. Accuracy of the age of the subject was verified from parents, teachers as well as birth certificates. Detailed information about socioeconomic factors was collected from the subject, teachers and parents.

Sample drawn on Teli and Rawat children can be considered to be fairly representative of the rural population of Raipur City. Rawat and Teli preschool children were mostly attending Anganbadi and Balbadi, which cater to the lower socioeconomic class. The Brahmin children were attending the private schools, which (because of the high fees they charge) cater to affluent and

belong to upper socio economic class. In the present study the indices suggested by Jelliffe (1966), Roa and Singh (1970), Kanawati and Mc Laren (1970), Dugdale (1971), Waterlow (1972), Ghosh and Tejaswini (1976), Waterlow et al., (1977), were followed for assessing the nutritional status. The NCHS growth standards were used as reference.

## RESULTS

Tables 1, 2 and 3 show the analysis of nutritional anthropometry of Suryupari Brahmin, Rawat and Teli children ranging in age from 2 to 5 years. Nutritional anthropometric data indicate high prevalence of malnutrition among the children of Brahmin, Rawat and Teli. It was found that there are multiple forms of malnutrition, with the most common being mild to moderate type of PEM in Brahmins and moderate to severe type of PEM in Rawats and Teli as indicated by various nutritional anthropometric indices.

Most satisfactory method of nutritional grading is based on expressing observed weight of a child as percentage of normal weight for his/her chronological age. This gives current nutritional status of the children and is most sensitive tool for evaluating the nutritional status of growing children. Using weight deficit method (Jelliffe, 1966) as tool for nutritional grading, it was observed that prevalence of PEM among the Brahmin preschool children is mostly of mild (Grade I) type (46.28%). Only 5.78 percent children fall in the severe grade of PEM category. 28.10 percent children were observed to have normal nutritional status. The prevalence of PEM among the Rawat preschool children is mostly of moderate (Grade II) type (48.38%). Only 1.09 percent children were observed to have normal nutritional state. 40.86 percent and 9.67 percent children were observed to have Grade I and Grade III degree of malnutrition respectively. The prevalence of PEM among Teli preschool children is mostly of moderate (50.51%) type according to weight for age. Only 4.12 percent children belong to normal nutritional state. 40.22 percent and 5.15 percent children were observed to have Grade I and Grade III degree of malnutrition respectively.

Seone and Latham (1971) pointed out the weight for height as an index of current nutritional status. Height for age gives the picture

of the past nutritional history of individual population. In the present study 38.01 percent Brahmin preschool children were found to be normal in weight for their height. 42.97 percent and 19.02 percent of children were found to have

**Table 1: Distribution of Brahmin preschool children by various nutritional indices of evaluation of health status**

| Grade                                                            | Boys |        | Girls |        | Total |        |
|------------------------------------------------------------------|------|--------|-------|--------|-------|--------|
|                                                                  | No.  | %      | No.   | %      | No.   | %      |
| <i>Weight for Age</i>                                            |      |        |       |        |       |        |
| Normal                                                           | 16   | 28.07  | 18    | 28.13  | 34    | 28.10  |
| Grade I                                                          | 28   | 49.13  | 28    | 43.75  | 56    | 46.28  |
| Grade II                                                         | 10   | 17.54  | 14    | 21.87  | 24    | 19.85  |
| Grade III                                                        | 03   | 5.26   | 04    | 6.25   | 07    | 5.78   |
| Total                                                            | 57   | 100.00 | 64    | 100.00 | 121   | 100.01 |
| <i>Weight for Height</i>                                         |      |        |       |        |       |        |
| Normal                                                           | 19   | 33.33  | 27    | 42.18  | 46    | 38.01  |
| Grade I                                                          | 26   | 45.62  | 26    | 40.64  | 52    | 42.97  |
| Grade II                                                         | 12   | 21.05  | 11    | 17.18  | 23    | 19.02  |
| Grade III                                                        | -    | -      | -     | -      | -     | -      |
| Total                                                            | 57   | 100.00 | 64    | 100.00 | 121   | 100.00 |
| <i>Weight/Height<sup>2</sup></i>                                 |      |        |       |        |       |        |
| Normal                                                           | 15   | 26.31  | 16    | 25.00  | 31    | 25.61  |
| Grade I                                                          | 28   | 49.12  | 30    | 46.88  | 58    | 47.93  |
| Grade II                                                         | 10   | 17.54  | 14    | 21.88  | 24    | 19.83  |
| Grade III                                                        | 04   | 7.03   | 04    | 6.26   | 08    | 6.63   |
| Total                                                            | 57   | 100.00 | 64    | 100.00 | 121   | 100.00 |
| <i>MUAC/HC Ratio</i>                                             |      |        |       |        |       |        |
| Normal                                                           | 21   | 36.84  | 18    | 28.12  | 39    | 32.25  |
| Grade I                                                          | 26   | 45.62  | 35    | 54.68  | 61    | 50.41  |
| Grade II                                                         | 10   | 17.54  | 10    | 15.62  | 20    | 16.52  |
| Grade III                                                        | -    | -      | 01    | 1.56   | 01    | 0.82   |
| Total                                                            | 57   | 100.00 | 64    | 100.00 | 121   | 100.00 |
| <i>MUAC</i>                                                      |      |        |       |        |       |        |
| Normal                                                           | 50   | 87.72  | 56    | 87.50  | 106   | 87.61  |
| Malnourished                                                     | 07   | 12.28  | 08    | 12.50  | 15    | 12.39  |
| Total                                                            | 57   | 100.00 | 64    | 100.00 | 121   | 100.00 |
| <i>Weight/Height<sup>1.6</sup></i>                               |      |        |       |        |       |        |
| Less than 88                                                     | 28   | 49.13  | 27    | 42.18  | 55    | 45.45  |
| More than 88                                                     | 29   | 50.87  | 37    | 57.82  | 66    | 54.55  |
| Total                                                            | 57   | 100.00 | 64    | 100.00 | 121   | 100.00 |
| <i>Weight/ Height<sup>3x100</sup></i>                            |      |        |       |        |       |        |
| Upto 1.20                                                        | 06   | 10.54  | 09    | 14.07  | 15    | 12.39  |
| 1.21-1.50                                                        | 29   | 50.87  | 33    | 51.56  | 62    | 51.25  |
| 1.51-1.60                                                        | 22   | 38.59  | 22    | 34.37  | 44    | 36.36  |
| Total                                                            | 57   | 100.00 | 64    | 100.00 | 121   | 100.00 |
| <i>100x3 <math>\sqrt{10x}</math> Weight (gm)/ Sitting Height</i> |      |        |       |        |       |        |
| Upto 92.0                                                        | -    | -      | -     | -      | -     | -      |
| 92.1-95.0                                                        | 15   | 26.33  | 14    | 21.87  | 29    | 23.97  |
| 95.1-100                                                         | 10   | 17.54  | 18    | 28.12  | 28    | 23.14  |
| 100.1-105.0                                                      | 19   | 33.33  | 21    | 32.83  | 40    | 33.06  |
| 105.0 and above                                                  | 13   | 22.80  | 11    | 17.18  | 24    | 19.83  |
| Total                                                            | 57   | 100.00 | 64    | 100.00 | 121   | 100.00 |
| <i>Height for Age</i>                                            |      |        |       |        |       |        |
| Normal                                                           | 49   | 90.74  | 54    | 84.37  | 103   | 85.13  |
| Grade I                                                          | 08   | 9.26   | 10    | 15.63  | 18    | 14.87  |
| Grade II                                                         | -    | -      | -     | -      | -     | -      |
| Grade III                                                        | -    | -      | -     | -      | -     | -      |
| Total                                                            | 57   | 100.00 | 64    | 100.00 | 121   | 100.00 |

Grade I and II degree of malnutrition respectively. Using weight for height index of malnutrition, it was observed that prevalence of PEM in Rawat preschool children is mostly of mild type (46.23%). 21.52 percent and 23.65 percent children were observed to have Grade II

and III degree of malnutrition. Only 8.60 percent children were observed to have normal nutritional state. Among Telis most of children were observed to have mild type (51.54%) of PEM according to weight for height index.

Rao and Singh (1970) recorded weight and

**Table 2: Distribution of Rawat preschool children by various nutritional indices of evaluation of health status**

| Grade                                                            | Boys |        | Girls |        | Total |        |
|------------------------------------------------------------------|------|--------|-------|--------|-------|--------|
|                                                                  | No.  | %      | No.   | %      | No.   | %      |
| <i>Weight for Age</i>                                            |      |        |       |        |       |        |
| Normal                                                           | -    | -      | 01    | 2.27   | 01    | 1.09   |
| Grade I                                                          | 21   | 42.85  | 17    | 38.63  | 38    | 40.86  |
| Grade II                                                         | 23   | 46.93  | 22    | 50.01  | 45    | 48.38  |
| Grade III                                                        | 5    | 10.22  | 04    | 9.09   | 09    | 9.67   |
| Total                                                            | 49   | 100.00 | 44    | 100.00 | 93    | 100.00 |
| <i>Weight for Height</i>                                         |      |        |       |        |       |        |
| Normal                                                           | 05   | 10.22  | 03    | 6.83   | 08    | 8.60   |
| Grade I                                                          | 19   | 38.77  | 24    | 54.54  | 43    | 46.23  |
| Grade II                                                         | 15   | 30.61  | 05    | 11.36  | 20    | 21.52  |
| Grade III                                                        | 10   | 20.40  | 12    | 27.27  | 22    | 23.65  |
| Total                                                            | 49   | 100.00 | 44    | 100.00 | 93    | 100.00 |
| <i>Weight/Height<sup>2</sup></i>                                 |      |        |       |        |       |        |
| Normal                                                           | 03   | 6.14   | 02    | 4.54   | 05    | 5.37   |
| Grade I                                                          | 17   | 34.69  | 17    | 38.63  | 34    | 36.55  |
| Grade II                                                         | 12   | 24.48  | 12    | 27.27  | 24    | 25.83  |
| Grade III                                                        | 17   | 34.69  | 13    | 29.56  | 30    | 32.25  |
| Total                                                            | 49   | 100.00 | 44    | 100.00 | 93    | 100.00 |
| <i>MUAC/HC Ratio</i>                                             |      |        |       |        |       |        |
| Normal                                                           | 01   | 2.04   | -     | -      | 01    | 1.08   |
| Grade I                                                          | 27   | 55.10  | 20    | 45.45  | 47    | 50.54  |
| Grade II                                                         | 16   | 32.65  | 20    | 45.46  | 36    | 38.71  |
| Grade III                                                        | 05   | 10.21  | 04    | 9.09   | 09    | 9.68   |
| Total                                                            | 49   | 100.00 | 44    | 100.00 | 93    | 100.00 |
| <i>MUAC</i>                                                      |      |        |       |        |       |        |
| Normal                                                           | 31   | 63.26  | 30    | 68.18  | 61    | 65.59  |
| Malnourished                                                     | 18   | 36.74  | 14    | 31.82  | 32    | 34.41  |
| Total                                                            | 49   | 100.00 | 44    | 100.00 | 93    | 100.00 |
| <i>Weight/Height<sup>1.6</sup></i>                               |      |        |       |        |       |        |
| Less than 88                                                     | 30   | 61.23  | 28    | 63.64  | 58    | 62.37  |
| More than 88                                                     | 19   | 38.77  | 16    | 36.36  | 35    | 37.63  |
| Total                                                            | 49   | 100.00 | 44    | 100.00 | 93    | 100.00 |
| <i>Weight/ Height<sup>3x100</sup></i>                            |      |        |       |        |       |        |
| Upto 1.20                                                        | 22   | 44.89  | 21    | 47.73  | 43    | 46.23  |
| 1.21-1.50                                                        | 23   | 46.95  | 19    | 43.18  | 42    | 45.16  |
| 1.51-1.60                                                        | 04   | 8.16   | 04    | 9.09   | 08    | 8.61   |
| Total                                                            | 49   | 100.00 | 44    | 100.00 | 93    | 100.00 |
| <i>100x3 <math>\sqrt{10x}</math> Weight (gm)/ Sitting Height</i> |      |        |       |        |       |        |
| Upto 92.0                                                        | -    | -      | 01    | 2.27   | 01    | 1.07   |
| 92.1-95.0                                                        | 13   | 26.53  | 09    | 20.45  | 22    | 23.65  |
| 95.1-100                                                         | 13   | 26.54  | 16    | 36.36  | 29    | 31.18  |
| 100.1-105.0                                                      | 18   | 36.73  | 15    | 34.09  | 33    | 35.48  |
| 105.0 and above                                                  | 05   | 10.20  | 03    | 6.83   | 08    | 8.62   |
| Total                                                            | 49   | 100.00 | 44    | 100.00 | 93    | 100.00 |
| <i>Height for Age</i>                                            |      |        |       |        |       |        |
| Normal                                                           | 18   | 36.74  | 19    | 43.18  | 37    | 39.78  |
| Grade I                                                          | 27   | 55.10  | 22    | 50.00  | 49    | 52.68  |
| Grade II                                                         | 04   | 8.16   | 03    | 6.82   | 07    | 7.54   |
| Grade III                                                        | -    | -      | -     | -      | -     | -      |
| Total                                                            | 49   | 100.00 | 44    | 100.00 | 93    | 100.00 |

**Table 3: Distribution of Teli preschool children by various nutritional indices of evaluation of health status**

| Grade                                                            | Boys |        | Girls |        | Total |        |
|------------------------------------------------------------------|------|--------|-------|--------|-------|--------|
|                                                                  | No.  | %      | No.   | %      | No.   | %      |
| <i>Weight for Age</i>                                            |      |        |       |        |       |        |
| Normal                                                           | -    | -      | 04    | 7.85   | 04    | 4.12   |
| Grade I                                                          | 21   | 45.65  | 18    | 35.29  | 39    | 40.22  |
| Grade II                                                         | 23   | 50.01  | 26    | 50.98  | 49    | 50.51  |
| Grade III                                                        | 02   | 4.34   | 03    | 5.88   | 05    | 5.15   |
| Total                                                            | 46   | 100.00 | 51    | 100.00 | 97    | 100.00 |
| <i>Weight for Height</i>                                         |      |        |       |        |       |        |
| Normal                                                           | 04   | 8.69   | 08    | 15.68  | 12    | 12.37  |
| Grade I                                                          | 27   | 58.69  | 23    | 45.09  | 50    | 51.54  |
| Grade II                                                         | 15   | 32.62  | 15    | 29.41  | 30    | 30.94  |
| Grade III                                                        | -    | -      | 05    | 9.82   | 05    | 5.15   |
| Total                                                            | 46   | 100.00 | 51    | 100.00 | 97    | 100.00 |
| <i>Weight/Height<sup>2</sup></i>                                 |      |        |       |        |       |        |
| Normal                                                           | 05   | 10.86  | 03    | 5.88   | 08    | 8.27   |
| Grade I                                                          | 21   | 45.65  | 29    | 56.86  | 50    | 51.54  |
| Grade II                                                         | 10   | 21.73  | 08    | 15.68  | 18    | 18.55  |
| Grade III                                                        | 10   | 21.76  | 11    | 21.58  | 21    | 21.64  |
| Total                                                            | 46   | 100.00 | 51    | 100.00 | 97    | 100.00 |
| <i>MUAC/HC Ratio</i>                                             |      |        |       |        |       |        |
| Normal                                                           | -    | -      | 01    | 1.96   | 01    | 1.05   |
| Grade I                                                          | 19   | 41.30  | 22    | 43.14  | 41    | 42.26  |
| Grade II                                                         | 24   | 52.17  | 26    | 50.98  | 50    | 51.54  |
| Grade III                                                        | 03   | 6.53   | 02    | 3.92   | 05    | 5.15   |
| Total                                                            | 46   | 100.00 | 51    | 100.00 | 97    | 100.00 |
| <i>MUAC</i>                                                      |      |        |       |        |       |        |
| Normal                                                           | 32   | 69.56  | 33    | 64.71  | 65    | 67.02  |
| Malnourished                                                     | 14   | 30.44  | 18    | 35.29  | 32    | 32.98  |
| Total                                                            | 46   | 100.00 | 51    | 100.00 | 97    | 100.00 |
| <i>Weight/Height<sup>1.6</sup></i>                               |      |        |       |        |       |        |
| Less than 88                                                     | 26   | 56.53  | 31    | 60.78  | 57    | 58.76  |
| More than 88                                                     | 20   | 43.47  | 20    | 39.22  | 40    | 41.24  |
| Total                                                            | 46   | 100.00 | 51    | 100.00 | 97    | 100.00 |
| <i>Weight/ Height<sup>3x100</sup></i>                            |      |        |       |        |       |        |
| Upto 1.20                                                        | 21   | 45.66  | 31    | 60.78  | 52    | 53.60  |
| 1.21-1.50                                                        | 17   | 36.95  | 15    | 29.41  | 32    | 32.98  |
| 1.51-1.60                                                        | 08   | 17.39  | 05    | 9.81   | 13    | 13.42  |
| Total                                                            | 46   | 100.00 | 51    | 100.00 | 97    | 100.00 |
| <i>100x3 <math>\sqrt{10x}</math> Weight (gm)/ Sitting Height</i> |      |        |       |        |       |        |
| Upto 92.0                                                        | -    | -      | 01    | 1.96   | 01    | 1.03   |
| 92.1-95.0                                                        | 09   | 19.56  | 09    | 17.64  | 18    | 18.55  |
| 95.1-100                                                         | 24   | 52.17  | 26    | 50.98  | 50    | 51.54  |
| 100.1-105.0                                                      | 10   | 21.73  | 11    | 21.56  | 21    | 21.64  |
| 105.0 and above                                                  | 03   | 6.54   | 04    | 7.86   | 07    | 7.24   |
| Total                                                            | 46   | 100.00 | 51    | 100.00 | 97    | 100.00 |
| <i>Height for Age</i>                                            |      |        |       |        |       |        |
| Normal                                                           | 20   | 43.47  | 23    | 45.09  | 43    | 44.33  |
| Grade I                                                          | 21   | 45.67  | 25    | 49.03  | 46    | 47.42  |
| Grade II                                                         | 05   | 10.86  | 03    | 5.88   | 08    | 8.25   |
| Grade III                                                        | -    | -      | -     | -      | -     | -      |
| Total                                                            | 46   | 100.00 | 51    | 100.00 | 97    | 100.00 |

height square ratio to be remarkable constant in preschool children and to be unaffected by sex. Jelliffe and Jelliffe (1971) have considered this ratio as most useful age independent index of PEM. In the present study 25.61 percent Brahmin, 5.37 percent Rawat and 8.27 percent Teli preschool children were found to have normal nutritional status by weight/height ratio. Majority of Brahmin, Rawat and Teli preschool children had mild grade of malnutrition. The severity of Grade II & III type of malnutrition is more in Rawat and Teli children.

The ratio of mid upper arm circumference and head circumference ratio is useful to detect marginal cases of PEM. (Hiernaux, 1963). This ratio detected 32.25 percent Brahmin, 1.07 percent Rawat and 1.05 percent Teli preschool children as normal. Brahmin and Rawat children had mostly mild grade of malnutrition while Teli

had mostly severe grade of malnutrition. The sex distribution of normal children is marginally in favor of boys in Brahmin and Rawat whereas it is marginally in favor of girls in Teli.

Jelliffe (1966), Jelliffe and Jelliffe (1971) and Roa et al. (1978) suggested mid upper arm circumference as an useful public health index of PEM. Following Ghosh and Tejaswini (1976) mid upper arm circumference detected 87.61 percent Brahmin, 65.59 percent Rawat and 67.02 percent Teli children to be in normal nutritional state.

Using height deficit method, 85.13 percent Brahmin, 39.78 percent Rawat and 44.34 percent Teli children were found to be normal in height for their age. The analysis reveals that Rawat and Teli children were suffering from PEM for a longer duration. Evaluation of indices used for classifying the children into various grades of

**Table 4: Evaluation of various anthropometric indices used to assess health status among Brahmin, Rawat and Teli preschool children**

| Indices                | Normal |       |       |       |       |       | Malnourished |       |       |       |       |       |
|------------------------|--------|-------|-------|-------|-------|-------|--------------|-------|-------|-------|-------|-------|
|                        | Boys   |       | Girls |       | Total |       | Boys         |       | Girls |       | Total |       |
|                        | No.    | %     | No.   | %     | No.   | %     | No.          | %     | No.   | %     | No.   | %     |
| <b>Brahmin</b>         |        |       |       |       |       |       |              |       |       |       |       |       |
| Wt.def.                | 16     | 28.07 | 18    | 28.13 | 34    | 28.10 | 41           | 71.93 | 46    | 71.87 | 87    | 71.90 |
| Wt/ht                  | 19     | 33.33 | 27    | 42.18 | 46    | 38.01 | 38           | 66.66 | 37    | 57.81 | 75    | 61.98 |
| Wt/ht <sup>2</sup>     | 15     | 26.31 | 16    | 25.00 | 31    | 25.61 | 42           | 73.68 | 48    | 75.00 | 90    | 74.38 |
| MUAC                   | 50     | 87.72 | 56    | 87.50 | 106   | 87.61 | 7            | 12.28 | 8     | 12.50 | 15    | 12.39 |
| MUAC/HC                | 21     | 36.84 | 18    | 28.12 | 39    | 32.25 | 36           | 63.16 | 46    | 71.87 | 82    | 67.77 |
| Wt/ht <sup>1.6</sup>   | 28     | 49.13 | 27    | 42.18 | 55    | 45.46 | 29           | 50.87 | 37    | 57.82 | 66    | 54.54 |
| Wt/ht <sup>3x100</sup> | 51     | 89.97 | 55    | 85.93 | 106   | 87.60 | 6            | 10.54 | 9     | 14.07 | 15    | 12.39 |
| 100x3√10xwt/sit.ht.    | 42     | 73.68 | 50    | 78.13 | 92    | 76.03 | 15           | 26.33 | 14    | 21.87 | 29    | 23.96 |
| Ht/age                 | 49     | 90.74 | 54    | 84.37 | 103   | 85.13 | 8            | 14.04 | 10    | 15.62 | 18    | 14.88 |
| <b>Rawat</b>           |        |       |       |       |       |       |              |       |       |       |       |       |
| Wt.def.                | 0      | 0     | 1     | 2.27  | 1     | 1.09  | 49           | 100.0 | 43    | 97.73 | 92    | 98.92 |
| Wt/ht                  | 5      | 10.22 | 3     | 6.83  | 8     | 8.60  | 44           | 89.79 | 41    | 93.18 | 85    | 91.39 |
| Wt/ht <sup>2</sup>     | 3      | 6.14  | 2     | 4.54  | 5     | 5.37  | 46           | 93.87 | 42    | 95.45 | 88    | 94.62 |
| MUAC                   | 31     | 63.26 | 30    | 68.18 | 61    | 65.59 | 18           | 36.74 | 14    | 31.82 | 32    | 34.41 |
| MUAC/HC                | 1      | 2.04  | 0     | 0     | 1     | 1.07  | 48           | 97.96 | 44    | 100.0 | 92    | 98.92 |
| Wt/ht <sup>1.6</sup>   | 30     | 61.23 | 28    | 63.64 | 58    | 62.56 | 19           | 38.77 | 16    | 36.36 | 35    | 37.64 |
| Wt/ht <sup>3x100</sup> | 27     | 55.10 | 23    | 52.27 | 50    | 53.76 | 22           | 44.89 | 21    | 47.73 | 43    | 46.23 |
| 100x3√10xwt/sit.ht.    | 36     | 73.47 | 34    | 77.27 | 70    | 75.27 | 13           | 26.53 | 10    | 22.73 | 23    | 24.73 |
| Ht/age                 | 18     | 36.74 | 19    | 43.18 | 37    | 39.78 | 31           | 63.27 | 25    | 56.82 | 56    | 60.22 |
| <b>Teli</b>            |        |       |       |       |       |       |              |       |       |       |       |       |
| Wt.def.                | 0      | 0     | 4     | 7.85  | 4     | 4.12  | 46           | 100.0 | 47    | 92.16 | 93    | 95.88 |
| Wt/ht                  | 4      | 8.69  | 8     | 15.68 | 12    | 12.37 | 42           | 91.30 | 43    | 84.31 | 85    | 87.63 |
| Wt/ht <sup>2</sup>     | 5      | 10.86 | 3     | 5.88  | 8     | 8.27  | 41           | 89.13 | 48    | 94.12 | 89    | 91.75 |
| MUAC                   | 32     | 69.56 | 33    | 64.71 | 65    | 67.02 | 14           | 30.44 | 18    | 35.29 | 32    | 32.98 |
| MUAC/HC                | 0      | 0     | 1     | 1.96  | 1     | 1.05  | 46           | 100.0 | 50    | 98.04 | 96    | 98.97 |
| Wt/ht <sup>1.6</sup>   | 26     | 56.53 | 31    | 60.78 | 57    | 58.76 | 20           | 43.47 | 20    | 39.22 | 40    | 41.24 |
| Wt/ht <sup>3x100</sup> | 25     | 54.35 | 20    | 39.22 | 45    | 46.39 | 21           | 45.66 | 31    | 60.78 | 52    | 53.60 |
| 100x3√10xwt/sit.ht.    | 37     | 80.43 | 41    | 80.39 | 78    | 80.41 | 09           | 19.56 | 10    | 19.61 | 19    | 19.59 |
| Ht/age                 | 20     | 43.47 | 23    | 45.09 | 43    | 44.34 | 26           | 56.52 | 28    | 54.90 | 54    | 55.67 |

def = deficiency

malnutrition is in Table 4. On the basis of indices, majority of the Rawat and Teli preschool children were found to suffer from moderate to severe grades of malnutrition.

## DISCUSSION

Thus it appears that PEM is a major public health problem especially in Rawat and Teli preschool children, which may be due to non-availability of food. The findings clearly indicates towards such socioeconomic and micro-environmental factors as extreme poverty, poor nutrition, illiteracy, poor sanitation and personal hygiene, lack of safe drinking water, environmental sanitation etc. as probable contributors towards poor nutritional status. All these observation suggest that preschool children need better nutrition and health care to combat the problem of PEM.

The result of nutritional anthropometric data indicates that there are multiple forms of malnutrition. The pattern of PEM observed in the children is primarily of mild to moderate intensity in Brahmin and moderate to severe intensity in Rawat and Teli preschool children respectively. The rate of malnutrition is significantly lower in Brahmin than Rawat and Teli. It occurs with greatest prevalence in Teli than Rawat. The impact of illness on nutritional status is well known. Children of different populations under study experience almost similar types of morbidity pattern. The principal cause of inter-population differences in illness impact is that Brahmin children are having more of their illness treated effectively through the Government and private doctors and by western medical system. The inter-population differences in illness treatment represent potentially persuasive indications of differences in disease impact among the children in different population under study. Bearing in mind the complex nature of malnutrition disease relationship, the evidence suggests that illness treatment behavior be of considerable importance. Brahmin children receive treatment more often with western medicine and this may account for small but significance differences in illness impact beside socioeconomic status and personal health care. The result of socioeconomic factor suggest that food intake via purchasing power are contributing factors to the problem of child malnutrition. But they are not the only

factor of importance. No doubt, income is important, but parent's education and behavior related to child health care is also equally important. Some differences in dietary quality and quantity are a logical expectation in a situation characterized by differences in rates of malnutrition among these populations.

In fact, there is no simple univariate explanation as to what account for quite high prevalence of mild to moderate PEM in the study population. It is not socioeconomic factor or illness or parental behavior alone, rather it is a complex mixed of factors that probably varies in exact composition from child to child. What is important to realize is that the "Health for All by 2000AD" to which our country is committed, can be achieved only if we take strong measures on war footing to prevent PEM.

**KEYWORDS** Nutritional Status. Malnutrition. Protein Energy Malnutrition (PEM). Preschool. Teli. Rawat. Brahmin

**ABSTRACT** The aim of the paper is to assess child malnutrition and delineate the factors contributing to the observed pattern of malnutrition among preschool children from three specific population namely-Saryupari Brahmin, Teli and Rawat of Raipur district of Chattisgarh, India through nutritional anthropometric survey. The nutritional anthropometric data collected on 121 Saryupari Brahmin (57 boys and 64 girls), 93 Rawat (49 boys and 46 girls) and 97 Teli (46 boys and 51 girls) children ranging in age from 2+ to 5+ years. The pattern of protein- energy malnutrition observed is primarily of mild to moderate intensity in Brahmin and moderate to severe intensity in Rawat and Teli children. The findings clearly indicate towards various socio economic and micro-environmental factors as probable contributors towards poor nutritional status. All these observation suggest that preschool children need better nutrition and health care combat the problem of PEM.

## REFERENCES

- Bouis, H.E. and Hunt, J.: Linking food and nutrition security: Past lessons and future opportunities. *Asian Dev. Rev.*, **17**: 168-213 (1998).
- Comas, J.: *Manual of Physical Anthropology*. Charles C. Thomas, Springfield (1960).
- Dugdale, A.E.: An age independent anthropometric index of nutritional status. *Am. J. Clin. Nutr.*, **24**: 174 (1971).
- Frisancho, A. R.: Anthropometric standards for the assessment of growth and nutritional status. *Ann. Arbor, The Univ. of Michigan Press* (1990).
- Ghose, S. M. and Tejaswini, T.: Quick nutritional screening by mid arm circumference or a bangle. *Ind. Pediatr.*, **12**:15 (1976).
- Ghosh, R., Das, P.K. and Bharati, P.: Health and nutritional status of Ho preschool children of Orissa. *J. Hum. Ecol.*, **12**:109-113 (2001).
- Gopalan, C.: Stunting: Significance and implications for pub-

- lic health policy. In: *Linear Growth Retardation in less Developed Countries*. J.C. Waterlow (Ed.). Nestle Nutrition Workshop Series 14, Raven Press, New York, Pp. 265-284 (1988).
- Hiernaux J.: *Am. J. Phys. Anthropol.*, **21**: 575 (1963).
- Indian Council of Medical Research: *Growth and Physical Development of Indian Infants and Children*. Technical Report No. 18, ICMR, New Delhi (1972).
- Jelliffe, D.B.: *The Assessment of the Nutritional Status of the Community*. W.H.O. Monograph series no. 53, WHO, Geneva (1966).
- Jelliffe, D.B. and Jelliffe, E.F.P.: Age independent anthropometry. *Am. J. Clin. Nutr.*, **24**: 1377 (1971).
- Kanawati, A.A. and McLaren, D.S.: Assessment of marginal nutrition. *Nature*, **28**: 573 (1970).
- Lutter, C.K. et al.: Age- specific responsiveness of the weight and height to nutritional supplementation. *Am. J. Clin. Nutr.*, **51**: 359-364 (1990).
- Martorell, R. and Habicht, J.P.: Growth in early childhood in developing countries. In: *Human Growth: A Comprehensive Treatise*, Vol. 3, F. Falkner and J.M. Tanner (Eds.). Plenum Press, New York, Pp. 241-263, (1986).
- National Family Health Survey. *Chhattisgarh*. International Institute for Population Sciences, Bombay (2002).
- Rao, D.H. and Rao, M.K.: Levels of malnutrition and socio-economic conditions among Maria Gonds. *J. Hum. Ecol.*, **5**: 185-190 (1994).
- Rao, K.V. and Singh, D.: An evaluation of the relationship between nutritional status and anthropometric measurements. *Am. J. Clin. Nutr.*, **16**: 83 (1970).
- Rao, K.V. et al.: A comparison of arm and calf circumferences as indicators of PCM in early childhood. *Ind. J. Nutr. Diet.*, **15**: 112 (1978).
- Russell, R.V. and Hiralal: *The Tribes and Castes of the Central Provinces of India*. Vol. II and III. Cosmo Publishers, New Delhi (1916, Reprint 1975).
- Seoan, N. and Latham, M.C.: Nutritional anthropometry in the Identification of malnutrition in childhood. *J. Trop. Paed. Env. Child Hlth*. **17**: 90 (1971).
- United Nation's Children's Fund: *Child Malnutrition: Progress Towards the World Summit for Children Goal*. UNICEF, New York (1993).
- United Nation's Children's Fund: *The Progress of Nation*. UNICEF, New York (1996).
- Waterlow, J.C.: Classification and definition of protein-calorie malnutrition. *Brit. Med. Gaz.*, **3**: 566 (1972).
- Waterlow, J.C. et al.: The presentation and use of height and weight data for comparing the nutritional status of group of children under ten years. *Bull. W.H.O.*, 55-48 (1977).
- Weiner, J.S. and Lourie, J.A.: *Practical Human Biology*. Blackwell Scientific Publications, Oxford (1981).

**Authors' Addresses:** **Mitashree Mitra and Alka Tiwari**, School of Studies in Anthropology, Pt. Ravishankar Shukla University, Raipur, Chattisgarh, India  
**Rohini Ghosh and Premananda Bharati**, Anthropology and Human Genetics Unit, Indian Statistical Institute, 203 B.T.Road, Kolkata 700 108, West Bengal, India