Chapter 13

GENERAL DISCUSSION
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The present study suggests that a large percent of Santal children aged 5-12 years of surveyed region of Purulia district suffer from undernutrition. Measurement of physical growth pattern of children from growth curve generally indicates the nutritional status of those children. In the present study, the age related growth curves of different anthropometric parameters indicate that the mean values of height (around 5th percentile), weight (3rd to 5th percentile), MUAC (5th to 10th percentile), skinfold thicknesses (5th to 10th percentile for TRSF and SBSF), UAMA (around 10th percentile), UAFA (around 5th percentile), UAMAH (around 5th percentile) and BF% (below 2nd percentile) of Santal children at different ages are placed at the lower level of the reference. The growth pattern of Santal children as assessed from age related growth curves of different anthropometric parameters shows that undernutrition prevailed in these children. Many authors considered the location of age related growth curves of anthropometric parameters below 5th percentile of the reference as indicator of undernutrition in children (Frisancho 1990). The lower growth pattern of different anthropometric parameters also indicates that all anthropometric parameters are seriously affected due to undernutrition. But, weight and BF% are found to be affected maximum among all anthropometric parameters. From this observation, it can be suggested that growth curve analysis can be used primarily for assessing the undernutrition in children. In a different study, Rao & Reddy (2000) assessed the nutritional status in Sugali children from the growth curve analyses of height and weight, and reported that Sugali children were suffering from undernutrition as the growth curves of height and weight of Sugali children were located below the 5th percentile values of NCHS reference.

In addition to the growth curve analysis, z-score analyses of different anthropometric parameters revealed the magnitude of undernutrition in Santal children. The percentage of undernourished children calculated from below -1 z-score of height-for-age (53% for boys and
62% for girls), weight-for-age (77% for boys and 79% for girls), weight-for-height (57% for boys and 62% for girls), TRSF-for-age (71% for boys and 90% for girls), SBSF-for-age (61% for boys and 44% for girls), upper arm muscle area by height (UAMAH) (80% for boys and 77% for girls), and STSSF-for-age (66% for boys and girls) are very high. A wide range of the percentage of undernutrition has been observed from the results of z-score analyses and it has been found that magnitude of undernutrition is not similar in all anthropometric indices. The results also indicate that all anthropometric indices are not equally sensitive for measuring the nutritional status of Santal children. From the z-score analyses, it can be suggested that weight, TRSF and UAMAH are found to be mostly affected parameters in surveyed children compared to the other anthropometric measurements. Frisancho (1981) opined that the nutritional status of a subject measured by different anthropometric methods may be different and the nutritional status of a subject can not be assessed by any single parameter. A subject identified as undernourished by one parameter may not be identified as undernourished by other parameters. In an attempt to get comprehensive idea of nutritional status, Frisancho (1981) suggested that when a subject was identified as undernourished by all the three parameters (height-for-age, weight-for-height and UAMAH), there was high probability that the subject would be undernourished definitely or truly undernourished. In the present study (chapter 7), the suggested method of Frisancho (1981) has been used and this analysis provides the important information regarding identification of the truly undernourished children. Results of the present study indicate that about 32% boys and 36% girls appear to be definitely or truly undernourished. However, the previous reports of others assessed the nutritional status by stunting and wasting cannot be compared with the data of the truly undernourished children. When the results of undernutrition of the present study are compared with that of Bagchi (1981) which was conducted in 3 decades ago (66% for boys and 65% for girls were stunted and 91% for boys and 90% for girls wasted), it is found that
percentage of wasted children in the surveyed region has decreased. Recently, a high percentage of undernutrition, as measured from age and sex specific cut-off values of BMI, has also been reported (59.5% of boys and 53.3% girls) in Santal pre-school children (2-6 years) in Purulia district (Das & Bose, 2011). So, undernutrition prevails not only in the school-age group, even pre-school aged children are also suffering from undernutrition. The z-score analyses of different anthropometric parameters reveal that the magnitude of undernutrition is much higher in surveyed Santal children compared to Gond and Kawar tribal children (Mitra et al. 2007) but it lower than other tribal children like Kamar (Mitra et al. 2007), Saharia (Rao et al. 2006) and Sugali (Laxmaiah et al. 2007).

Prevalence of undernutrition in surveyed population is affected by their dietary intake. Lower consumption of foods and nutrients in respect to the RDA is evident in the present study. The deficiency is prominent in protein (18-20% of RDA) and calorie (33-37% of RDA), as well as in some micronutrients such as calcium (about 60% of RDA), iron (70-73% of RDA), vitamin A (70-72% of RDA), riboflavin (about 68% of RDA), and free folic acid (about 60% of RDA). But, the food and nutrient consumptions of surveyed Santal population are found to be higher than that of Santal population of Narayangarh of Paschim Midnapore (Bagchi, 1981) and Santal population of Rajmahal hills of Bihar (Moitra & Chowdhury, 1991) indicating that surveyed population consume comparatively higher amount of food and nutrients in respect to RDA of ICMR (2011). The deficiency of calorie and nutrients in Santal population reported by Bagchi (1981) are as follows: calorie (40% of RDA), protein (46% of RDA), calcium (about 72% of RDA), iron (70% of RDA), vitamin A (76% of RDA), riboflavin (about 71% of RDA), and free folic acid (about 72% of RDA). From this observation it may be said that, though the dietary consumption by Santal population of the present study seems to be improved compared to that of
past studies (Bagchi 1981, Moitra & Chowdhury 1991), the undernutrition still prevails in Santal children of the study area.

Inadequate dietary nutrient intake, especially of protein and iron, by surveyed children is evident from biochemical and hematological measurements. The results of the present study (chapter 10) indicate that a mild iron deficiency is observed in surveyed children. The mild iron deficiency might be due to lower dietary intake of iron among surveyed children (Chapter 9). The indicators of iron status like serum iron, serum ferritin, serum transferrin, TIBC and transferrin saturation, as well as the marker of protein status like serum albumin are affected in graded manner with the higher degrees of stunting. This finding clearly suggests that the stunting may be associated with the deficiency of specific nutrients like iron and protein in Santal children. So, the prevalence of undernutrition among study population measured by anthropometry and dietary intake can be supported strongly by the results of biochemical estimations.

The literacy rate in Santal population is low (12.5%) (Census 2001). Research findings of several studies showed that nutritional status was associated with the development of cognitive functions (Chang et al. 2002, Liu et al. 2003). The present study suggests that there is a prominent impairment of cognitive development in Santal children. The cognitive development is assessed from the age related growth curve of cognitive scores. The location of the growth curve for cognitive functions is around 5th percentile values of the reference indicating the impairment of cognitive development in Santal children. The study points out that this impairment of cognitive development in terms of IQ level is strongly associated with vulnerable nutritional status. Earlier studies reveal that the deficiency of the nutrients like protein and iron in the diet leads to substantial impairment of cognitive functions such as low intellectual competence and capacity to learn in children (Chang et al. 2002, Pollitt et al. 1994).
According to the Census report (Census 2001), more than 84% of Santals are unskilled workers. Several studies reported that nutritional status was an important determinant for the development of motor functions (Groos 1991, Benefice et al. 1996). In the present study, the motor development has appeared to be affected in surveyed children. This impairment is evident from the location of the growth curve for motor development which is placed below the 3rd percentile values of the reference and from the distribution of more than 82% Santal children in “well-below average” (below -2 z-score) category. Results indicate that nutritional status as major determinant, and age, sex and height as partial determinants have been identified for the motor development of Santal children. As the undernutrition is associated with permanent impairment of brain size, neuron numbers, synapse, and myelination together with neurological and behavioral deficits (Stanfield 1993), the poor nutritional status alter the learning processes and consequently the movement proficiency of the growing child (Zernicke & Schneider 1993) as well as the physical growth which produces a long-term negative impact in motor development.

According to the Kuppuswami’s scale (Kumar et al. 2007), all children of the present study are found to be in lower socioeconomic group. Undernutrition has been identified as a consequence of poverty. Children of low SES have poor access to the material and non-material resources and they lack the experiences of proper parental care, economic support, education, and social connections. Thus these children become prone to the risk for developmental problems. The present study describes that the poor socioeconomic status of Santal children is closely associated with their lower growth of different anthropometric parameters such as height, weight, skinfold thickness. The occurrence of undernutrition of Santal children, as assessed by biochemical and hematological parameters, is also strongly associated with the socioeconomic factors like monthly family income and parental education (Chapter 10). From these
observations, it can be inferred that poor nutritional status of surveyed children is also associated with their lower socioeconomic status. The discussion sections of the earlier chapters (Chapters 11 & 12) have focused on the role of socioeconomic factors on the brain development. The present investigation emphasized that socioeconomic factors are significantly associated with the cognitive and motor functions. The effects of poor SES may affect the brain development directly due to inadequate nurturing and/or indirectly by affecting the nutrients intake.

A number of limitations of the present study should be mentioned. The conclusion cannot be generalized for the Santal children of the country as the study has been carried out on small number of subjects in a particular region of Purulia district. Besides the anthropometric parameters, the undernutrition of surveyed children has been measured by dietary intake and biochemical estimations. The parasitic infection, which is another causative factor for the occurrence of undernutrition, has not been investigated in the present study. The Colored Progressive Matrices has been used as a non-verbal test for measuring the cognitive development to avoid the language problem. Any verbal test has not been used for measuring the cognitive functions of these surveyed children. The impact of the nutritional and socioeconomic status on the cognitive development would have been understood better, had such tests were conducted in the present study.

Thus, anthropometric assessments, measurement of dietary intake and biochemical and hematological estimations in the present study suggest that the undernutrition prevails in Santal children of surveyed region. The magnitude of undernutrition of surveyed children in the present study is found to be lower and food intake by surveyed children in the present study is found to be improved than previous study conducted three decades ago (Bagchi 1981). The progression of different developmental programs may be responsible for this improvement. Poor nutritional and socioeconomic status in Santal children affects their motor and cognitive development.