Critical nutritional stress among adult tribal populations of West Bengal and Orissa, India.

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Abstract

This paper deals with cross-sectional studies carried out during the period 2004-2007. It is based on eight data sets of tribals of Paschim Medinipur and Bankura Districts of West Bengal and Keonjhar District of Orissa. The tribes include Bhumijs, Kora Mudis, Lodhas, Santals, Bathudis and Savars. Height and weight were measured following standard techniques. The body mass index (BMI) was computed following standard equation. Nutritional status (chronic energy deficiency, CED) was evaluated using internationally accepted cut-off values of BMI. We followed the World Health Organization's classification (1995) of the public health problem of low BMI, based on adult populations worldwide. Our results show that, in general, among the tribes studied:

i) Both sexes had very low levels of BMI
ii) There existed high rates of CED indicating a critical nutritional condition
iii) Women experienced greater nutritional stress
iv) The nutritional situation is similar in both West Bengal as well as Orissa.

Key Words: Tribes, West Bengal, Orissa, Body Mass Index, Undernutrition

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Introduction:

According to the latest census, India has more than 84 million tribals who constitute more than 8 % of the total population (Mittal and Srivastava, 2006). India probably has the largest number of tribal communities in the world (Topal and Samal, 2001). They are recognized as socially and economically vulnerable (Ghosh and Bharati, 2006). Most of the tribal populations reside in rural areas of the country. Traditionally, some of them were forest dwellers but now they have started cultivation either as owner or as agricultural labourers and are also engaged in hunting and fishing. The vast majority of the subjects are illiterate and very low-wage earning manual labourers. Thus, they belong to the low socio-economic class.

It has now been well established that anthropometry can be used to assess the nutritional and health status of adults (WHO, 1995). The body mass index (BMI) is an indicator of overall adiposity (Keys et al., 1972; Bose, 1996). Low BMI and high levels of undernutrition (based on BMI) is a major public health problem especially among rural underprivileged adults of developing countries (WHO, 1995). Although adult nutritional status can be evaluated in many ways, the BMI is most widely used because its use is inexpensive, non-invasive and suitable for large-scale surveys (Lohman et al., 1988; Ferro-Luzzi et al., 1992; James et al., 1994; Lee and Nieman, 2003). Thus, BMI is the most established anthropometric indicator used for assessment of adult nutrition status (Lee and Nieman, 2003). BMI is generally considered a good indicator of not only the nutritional status but also the socio-economic condition of a population, especially adult populations of developing countries (Ferro-Luzzi et al., 1992; Shetty and James, 1994; Nube et al., 1998; Khongsdier 2002; Mosha, 2003). A BMI < 18.5 kg/m^2 is widely used as a practical measure of chronic energy deficiency (CED), i.e., a 'steady' underweight in which an individual is in energy balance irrespective of a loss in body weight or body energy stores (Khongsdier, 2005). Such a 'steady' underweight is likely to be associated with morbidity or other physiological and functional impairments (James et al., 1988; Shetty and James, 1994; WHO, 1995). CED is caused by inadequate intake of energy accompanied by high level of physical activities and infections (Shetty and James, 1994; Shetty et al., 1994). CED has been associated with reduced work capacity (Pryer, 1993; Durnin, 1994), performance and productivity (Kennedy and Garcia, 1994), increased morbidity due to suppressed immune function (Garcia and Kennedy, 1994; Shetty and James, 1994; Strickland and Ulijaszek, 1994) and behavioural changes (Kusin et al., 1994).

Hitherto, data are scanty on the anthropometric and nutritional status of various tribal populations of India (Arlappa et al., 2005; Bose and Chakraborty, 2005; Bose et al., 2006a; b; c; d; Ghosh and Bala, 2006). It has been recently suggested (Bose and Chakraborty 2005) that there is urgent need to evaluate the nutritional status of various tribes of India. In view of this, the objective of the present study was to report the anthropometric characteristics and nutritional status of adult tribal populations of West Bengal and Orissa. Sex and inter-tribal differences are also reported.

Materials and Methods:

This paper deals with cross-sectional studies carried out during the period 2004-2007. It is based on eight data sets. Ethical permission was obtained from relevant authorities. Informed consent was also obtained from all subjects. Trained investigators made the anthropometric measurements following the standard techniques of Lohman et al. (1988). Height and weight were recorded to the nearest 0.1 cm and 0.5 kg, respectively. Technical errors of measurements (TEM) were computed and they were found to be within acceptable limits (Ulijaszek and Kerr, 1999). BMI was computed using the following standard equation:

BMI = Weight (kg) / height (m^2)

Nutritional status was evaluated using internationally accepted BMI guidelines (WHO, 1995). The following cut-off points were used:

CED Grade III:	BMI < 16.0
CED Grade II:	BMI = 16.0 – 16.9
CED Grade I:	BMI < 17.0 – 18.4
Normal:	BMI = 18.5 – 24.9
Overweight:	BMI ≥ 25.0

We followed the World Health Organization's classification (1995) of the public health problem of low BMI, based on adult populations worldwide. This classification categorises prevalence according to percentage of a population with BMI < 18.5.

1) Low (5–9%): warning sign, monitoring required.
2) Medium (10–19%): poor situation.
3) High (20–39%): serious situation.
4) Very high (≥ 40%): critical situation.

The distributions of the height, weight and body mass index were not significantly skewed in all groups. All statistical analyses were undertaken using the SPSS Statistical Package.

Results:

Table 1 presents the distribution of study sample by age, sex and study area. A total of 3163 (1710 males and 1453 females) adult tribal individuals were included in this study. In West Bengal, Bhumijs, Kora Mudis, Lodhas and Santals were studied from Paschim Medinipur District, while Kora Mudis from Bankura District were also investigated. All subjects from Orissa were resident of Keonjhar District. Three tribes from Orissa were included, namely, Bathudis, Santals and Savars.

The mean age, height, weight and BMI among adult tribal males of West Bengal and Orissa are presented in **Table 2**. The mean ages of all the tribal populations were similar. The mean (sd) varied from 32.7 years (11.3) among Kora Mudis of Bankura to 39.8 years (15.3) in Savars of Keonjhar. Mean (sd) height varied from 158.9 cm (6.2) among Kora Mudis of Bankura to 162.5 cm (5.8) in Savars of Keonjhar. Bathudis had the lowest mean weight 46.9 kg (6.3) while Santals of West Bengal (8.6) and Orissa (5.6) had the highest mean weight of 51.7 kg. The lowest mean BMI was found among Bathudis (mean = 18.4 kg/m^2, sd = 1.9) while Santals of West Bengal had the highest mean BMI of 20.0 kg/m^2 (2.6).

Table 3 presents the mean age, height, weight and BMI among adult tribal females of West Bengal and Orissa. The mean ages in all the ethnic groups were similar. Kora Mudis of Bankura had the lowest mean age of 31.7 years (10.6) while Savars of Orissa had the highest mean age of 38.0 years (13.9). The lowest mean height were recorded from Kora Mudis of Bankura (mean = 147.7 cm, sd = 5.6) while the highest mean height (mean = 149.8 cm, sd = 5.9) were found among Santals of West Bengal. On average, Bathudis were the lightest (mean = 39.8 kg, sd = 6.2) while Santals of West Bengal were the heaviest (mean = 43.4 kg, sd = 7.1). The lowest mean BMI of 17.9 kg/m^2 (2.5) were observed among the Bathudis while Lodhas and Santals of West Bengal had the highest mean BMI (mean = 19.3 kg/m^2, sd = 2.6). A noteworthy point is that the mean BMI of Bathudis was lower than the CED cut-off point of BMI < 18.5 kg/m^2.

The prevalence of CED (based on BMI) among adult tribal males of West Bengal and Orissa is presented in **Table 4**. All ethnic groups (pooled) prevalence of CED were 44.2% and 37.3% in West Bengal and Orissa, respectively. The corresponding values of CED Grades I, II and III were 29.5%, 8.7%, 6.0% (West Bengal) and 24.8%, 7.5%, 5.0% (Orissa). The highest rate of CED was found among the Bathudis (52.7%) while the lowest was found among the Santals (26.2%) of Orissa. In all ethnic groups, there was an increasing trend in the rates from CED Grade III to CED Grade I. The rates of CED Grade II were intermediate between these two grades in all tribal populations. The overall (all tribes pooled and both States combined) rate of CED among men was 40.7%. The corresponding values for CED Grades I, II and III (all tribes pooled and both States combined) were 27.1%, 8.1% and 5.5%, respectively.

Table 5 shows the prevalence of CED (based on BMI) among adult tribal females of West Bengal and Orissa. All ethnic groups (pooled) prevalence of CED were 50.3% and 54.8% in West Bengal and Orissa, respectively. The corresponding values of CED Grades I, II and III were 26.1%, 12.7%, 11.5% (West Bengal) and 25.4%, 13.6%, 12.8% (Orissa). The highest rate of CED was found among the Bathudis (64.5%) while the lowest was found among the Lodhas (40.7%) of West Bengal. In all ethnic groups, there was an increasing trend in the rates from CED Grade III to CED Grade I. The rates of CED Grade II were intermediate between these two grades in all tribal populations. The overall (all tribes pooled and both States combined) rate of CED among women was 51.8%. The corresponding values for CED Grades I, II and III (all tribes pooled and both States combined) were 25.4%, 13.6% and 12.8%, respectively.

The nutritional condition of the various tribal studied populations is summarized in **Table 6**. In all ethnic groups, the nutritional condition varied from serious (20 – 39%) to critical (≥ 40%). **Figure 1** shows the overall (tribe and sex combined) prevalence of CED in West Bengal and Orissa. An important observation was that the nutritional stress among tribals (overall tribe and sex-combined) in both West Bengal (CED = 47.4%) as well as Orissa (CED = 43.6%) was similar.

Discussion:

Tribal undernutrition is a major public health problem in India. Since a sizeable proportion of India's population comprises of numerous tribes, it is imperative that the rates of undernutrition among them is reduced considerably. Without significant reduction in these rates, human developmental activities in India will be severely handicapped. Moreover, since undernutriton is linked with morbidity and mortiality, (WHO, 1995), these high rates of undernutrtiion may have developmental consequences.

Recent data from the National Family Health Survey (NFHS, 2001; 2007) have also demonstrated that tribal populations of India have very low BMI and high rates of undernutrition. As can be seen from **Table 7**, the results of the present study are in concordance with the findings of NFHS Surveys. However, it must be pointed out here that the NFHS did not take into consideration inter-tribal differences in mean BMI and rates of CED. This is a serious lacunae of the NFHS data. As our study clearly indicates, there are distinct inter-tribal differences in mean BMI and CED rates. Thus, it is erroneous not to consider inter-tribal differences in mean BMI and CED rates. For effective health policy formulation, it is imperative to prioritize tribes for appropriate nutritional intervention programmes based on mean BMI values and CED rates.

Of primary importance, from anthropological and public health perspectives, is the need for immediate nutritional intervention programs to be implemented among all these ethnic groups. Although priority must be given to tribal groups having the highest rates of undernutrition, all groups must be incorporated in these food supplementation programs. It is imperative that the recommendations should include not only adequate dietary intake but also various ways in which they can enhance their socio-economic status through improved education and employment opportunities. It is expected that better educational attainment will lead to more scope for employment and healthier dietary practices. It is imperative that relevant government authorities should play a proactive role in reducing the rates of undernutrition among tribals. It has already been emphasized (Topal and Samal, 2001) that there exists variation in social and economic conditions among tribes of India. This variation must be taken into account before tribal-specific intervention programmes are formulated and initiated.

Finally, as nutritional status is intricately linked with dietary habits as well as the ecology of the population, further research should be undertaken to investigate, in details, these factors. Each tribal population has its unique food habits (Mandal et al., 2002). Moreover, there are distinct inter-tribal differences in the environment in which they reside, i.e. ecology of the population (Mandal et al., 2002). The present report did not deal with these factors as they

were beyond the scope of study. These are limitations of the present study. However, it is imperative that future studies on tribal populations include these parameters when investigating their nutritional status.

In conclusion, our study provided strong evidence that, in general, among the tribes studied here:

v) Both sexes had very low levels of BMI
vi) There existed high rates of CED indicating a critical nutritional condition
vii) Women experienced greater nutritional stress
viii) The nutritional situation is similar in both West Bengal as well as Orissa.

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Table 1. Distribution of study sample by age, sex and study area.

Community	Male	Female	Both	Study area	Year of data collection
WEST BENGAL					
Bhumij	161	185	346	Paschim Medinipur	2007
Kora Mudi	250	250	500	Bankura	2005
Kora Mudi	87	123	210	Paschim Medinipur	2006
Lodha	157	199	356	Paschim Medinipur	2007
Santal	197	213	410	Paschim Medinipur	2006
ORISSA					
Bathudi	226	183	409	Keonjhar	2004
Santal	332	----	----	Keonjhar	2006
Savar	300	300	600	Keonjhar	2005
Total	**1710**	**1453**	**3163**	**W.B. and Orissa**	**2004-2007**

Table 2: Mean age, height, weight and BMI among adult tribal males of West Bengal and Orissa.

Tribe	n	Age (yrs)	Height (cm)	Weight (kg)	BMI (kg/m^2)
WEST BENGAL					
Bhumij	161	36.3 (16.0)	159.4 (6.7)	47.4 (7.0)	18.7 (2.4)
Kora Mudi	250	32.7 (11.3)	158.9 (6.2)	47.3 (6.4)	18.7 (1.8)
Kora Mudi	87	35.3 (15.3)	162.1 (5.9)	48.9 (6.7)	18.6 (1.9)
Lodha	157	39.0 (17.7)	161.4 (6.1)	50.8 (7.9)	19.5 (2.7)
Santal	197	35.0 (13.4)	160.5 (6.4)	51.7 (8.6)	20.0 (2.6)
ORISSA					
Bathudi	226	38.0 (14.4)	159.4 (6.4)	46.9 (6.3)	18.4 (1.9)
Santal	332	34.7 (13.1)	162.5 (5.8)	51.7 (5.6)	19.6 (1.8)
Savar	300	39.8 (15.3)	159.6 (6.5)	49.1 (6.5)	19.3 (2.1)

Table 3: Mean age, height, weight and BMI among adult tribal females of West Bengal and Orissa.

Tribe	n	Age (yrs)	Height (cm)	Weight (kg)	BMI (kg/m^2)
WEST BENGAL					
Bhumij	185	33.8 (13.3)	148.4 (5.4)	40.5 (7.3)	18.4 (2.3)
Kora Mudi	250	31.7 (10.6)	147.7 (5.6)	40.0 (5.4)	18.3 (2.1)
Kora Mudi	123	34.8 (15.2)	149.3 (5.9)	40.9 (6.3)	18.3 (2.1)
Lodha	199	34.4 (14.9)	149.2 (5.2)	42.9 (6.5)	19.3 (2.6)
Santal	213	35.6 (14.5)	149.8 (5.9)	43.4 (7.1)	19.3 (2.6)
ORISSA					
Bathudi	183	35.6 (13.2)	149.2 (6.7)	39.8 (6.2)	17.9 (2.5)
Savar	300	38.0 (13.9)	148.5 (5.6)	41.6 (6.5)	18.9 (2.7)

Table 4: Prevalence of CED (based on BMI)
among adult tribal males of West Bengal and Orissa.

Tribe	Sample Size	CED (%)			
		Total	**Grade I**	**Grade II**	**Grade III**
WEST BENGAL					
Bhumij	161	48.4	29.8	6.2	12.4
Kora Mudi	250	48.0	31.6	12.0	4.4
Kora Mudi	87	51.7	31.0	12.6	8.0
Lodha	157	45.2	31.2	8.3	5.7
Santal	197	31.5	24.4	5.1	2.0
Pooled	**852**	**44.2**	**29.5**	**8.7**	**6.0**
ORISSA					
Bathudi	226	52.7	30.5	14.6	7.5
Santal	332	26.2	19.0	3.9	3.3
Savar	300	38.0	27.0	6.0	5.0
Pooled	**858**	**37.3**	**24.8**	**7.5**	**5.0**
Total male	**1710**	**40.7**	**27.1**	**8.1**	**5.5**

Table 5: Prevalence of CED (based on BMI)
among adult tribal females of West Bengal and Orissa.

Tribe	Sample Size	CED (%)			
		Total	**Grade I**	**Grade II**	**Grade III**
WEST BENGAL					
Bhumij	185	58.9	27.0	14.1	17.8
Kora Mudi	250	56.4	30.0	12.4	14.0
Kora Mudi	123	55.3	25.2	17.9	12.2
Lodha	199	40.7	21.6	12.1	7.0
Santal	213	41.8	25.4	9.4	7.0
Pooled	**970**	**50.3**	**26.1**	**12.7**	**11.5**
ORISSA					
Bathudi	183	64.5	24.6	19.1	20.8
Savar	300	49.0	24.0	13.0	12.0
Pooled	**483**	**54.8**	**24.2**	**15.3**	**15.3**
Total female	**1453**	**51.8**	**25.4**	**13.6**	**12.8**

Table 6. Nutritional condition of the studied populations.

Tribe	Male	Condition	Female	Condition	Both Sexes	Condition
WEST BENGAL						
Bhumij	48.4	Critical	58.9	Critical	54.0	Critical
Kora Mudi	48.0	Critical	56.4	Critical	52.2	Critical
Kora Mudi	51.7	Critical	55.3	Critical	53.8	Critical
Lodha	45.2	Critical	40.7	Critical	42.7	Critical
Santal	31.5	Serious	41.8	Critical	36.8	Serious
Pooled	**44.2**	**Critical**	**50.3**	**Critical**	**47.4**	**Critical**
ORISSA						
Bathudi	52.7	Critical	64.5	Critical	57.9	Critical
Santal	26.2	Serious	-----	-----	-----	-----
Savar	38.0	Serious	49.0	Critical	43.5	Critical
Pooled	**37.3**	**Serious**	**54.8**	**Critical**	**43.6**	**Critical**

Table 7: Mean BMI and prevalence of CED among tribals of the present study: A comparison with National Family Health Survey (NFHS) 2 and 3 data.

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Study	Sex	Sample Size	Mean BMI	CED (%)	Nutritional Condition
NFHS-2					
India	Female	6590	19.1	46.3	Critical
Orissa	Female	796	18.5	55.5	Critical
West Bengal	Female	287	18.2	64.2	Critical
NFHS- 3					
India	Female	9810	19.1	46.6	Critical
	Male	5500	19.3	41.3	Critical
PRESENT STUDY					
West Bengal	Female	970	18.7	50.3	Critical
	Male	852	19.1	44.2	Critical
Orissa	Female	483	18.5	54.8	Critical
	Male	858	19.2	37.3	Serious
Total	Female	1453	18.7	51.8	Critical
	Male	1710	19.2	40.7	Critical

Source: National Family Health Survey – 2 (2001).
National Family Health Survey – 3 (2007).

Figure 1: Overall (tribe and sex-combined) prevalence of CED in West Bengal and Orissa.