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Prevalence of Under nutrition among Santal Preschool Children of Two Districts of West Bengal, India

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ABSTRACT:

Background: *Santals are one of the largest tribal groups living in India. The tribes of India constitute approximately 8.6% of the total population of the country. Under nutrition among tribal children is a significant public health problem in India as well as West Bengal. The present study was undertaken to evaluate the overall nutritional status (stunting, underweight and wasting) among Santal preschool children of West Bengal, India.*

Materials and Methods: *The present community based cross-sectional study was undertaken to determine the prevalence of under nutrition using stunting, underweight and wasting among Santal preschool children(1-5 years) in both sexes of two districts (Paschim Medinipur and Jhargram) of West Bengal, India. A total of 311 (Boys = 152; Girls = 159) participants were studied. The sample was selected through stratified random sampling method. Anthropometric measurements were recorded according to standard procedures and <-2 z-scores of height for age(HAZ), weight for age (WAZ) and weight for height (WHZ) were used to evaluate stunting, underweight and wasting, respectively, following the World Health Organization (WHO) Guidelines.*

Results: *The present study showed that boys were significantly taller, age combined, than girls and also at age 2, 3 and 5 years (except at age 1 and 4 years). Boys were significantly heavier than girls at age combined as well as at all age groups. The age combined prevalence of stunting, underweight and wasting were higher among boys (stunting = 52.0%, underweight = 26.3% and wasting = 15.8%) than girls (stunting = 44.0%, underweight = 20.8% and wasting = 10.7%). The overall age and sex combined prevalence of stunting, underweight and wasting were 47.9%, 23.5% and 13.2%, respectively.*

Conclusion: *Under nutrition is a major health problem among these tribal preschool children. The present study among Santal children of West Bengal revealed poor nutritional status with a higher incidence of stunting indicating long term or chronic undernutrition. The primary way of prevention is the raising of the level of awareness and improvement of supplementary nutrition.*

Key Words: *Undernutrition, Stunting, Underweight, Wasting, Z-score, Santal, Preschool children, Tribe.*

INTRODUCTION:

Under nutrition is a major health problem in India especially among preschool children. Globally in 2011, there were an estimated 165 million children under five years of age who were stunted, 101 million were underweight and 52 million were wasted (UNICEF WHO-The World Bank, 2012). The World Health Organization estimated that under nutrition is associated with about half of the child deaths among children under 5 years which occur each year in the developing world (WHO, 2003). Undernutrition is the most important cause of death in under five years age group in developing countries including India, where high rates of under-five morbidity and mortality are present. One out of every three children less than five years of age in developing countries is malnourished. Malnutrition affects growth and development thus impairing both physical and mental ability. Malnutrition plays an important role in more than half of all child deaths worldwide and has adverse effects on the health status of children aged 0-5 years (Ake-Tano et.al, 2011).

Undernutrition is more common among children of mothers who are undernourished themselves (i.e. body mass index below 18.5 kg/m^2) than those children whose mothers are not undernourished. Children from Scheduled Tribes have the poorest nutritional status on almost every measure and the high prevalence of wasting in this group (28%) is of particular concern. Around 70% children aged 6- 59 months are anaemic. Children of mothers who are severely anaemic are seven times as likely to be severely anaemic than children of mothers who are not anaemic. Only one third (33%) of Indian children receive any service from an *Anganwadi* Centre (AWC); less than 25% receive supplementary foods through ICDS; and only 18% have their weights measured in an AWC (NFHS 3, 2005-2006). Under nutrition denotes insufficient intake of energy and nutrients to meet an individual's needs to maintain good health. In most literature, under nutrition is used synonymously with malnutrition. In the strictest sense, malnutrition denotes both under nutrition and over nutrition. To overcome this, terms such as protein energy malnutrition, specific micronutrient deficiencies as well as other descriptive names such as kwashiorkor and marasmus have been used (Maleta, 2006).

The three most commonly used internationally recommended anthropometric indicators are stunting (low height-for-age), underweight (low weight-for-age) and wasting (low weight for-height) (WHO, 1995). Age, gender and body weight largely determine the nutrient requirement of an individual. Body weights and heights of children reflect their state of health, nutrition and growth rate (ICMR, 2009).

According to 2011 census of India, tribes constitute 8.6% of the total population. The tribes of West Bengal comprise more than 5 % (5.8%) of the total population of the state. Overall, 52,96,953 Schedule Tribal people are found in West Bengal. The Schedule Tribe compositions of the total population of the three studied blocks are Dantan I- 16.39%, Keshiary-34.25% and Nayagram- 40.01%. The Santals are the largest tribal group of West Bengal having a total population of 2,512,331. Their mother tongue is Santali, belonging to an Austro-Asiatic/Proto-Australoid linguistic group. They have their own script named *'Olchiki'*. Although they reside in several districts of West Bengal, the majority of Santals are found in Paschim Medinipur District. Among them, more than 90% reside in rural areas. Their traditional primary occupation has been settled cultivation. They also practise hunting,

gathering, and fishing. Lately, however, their primary occupation is daily agricultural and manual labourer.

The present study was undertaken to determine age and sex variations in height and weight, as well as to evaluate the overall nutritional status through stunting, underweight and wasting among Santal preschool children of two districts of West Bengal, India.

MATERIALS AND METHODS:

Our community based cross-sectional study was undertaken to determine the prevalence of undernutrition using stunting, underweight and wasting among Santal preschool children (1-5 years) of both sexes. It was undertaken at 12 villages from 3 blocks of two districts (7 villages from Keshiary Block, 1 village from Dantan-l Block and 4 villages from Nayagram Block). A total of 311 (Boys = 152; Girls = 159) participants were studied. Age of the children were collected from birth certificate and immunization card and also confirmed by parents of the children. For analysis, age was grouped into 12 months interval. These tribal villages were selected by the block Community Development Project Officer (CDPO). Formal ethical approval was obtained from Vidyasagar University and Block Development Officer of the block.

The subjects were randomly selected from 12 villages using stratified random sampling. Initially, the villages were chosen based on those where tribes lived separately from non-tribal's.

Anthropometric measurements:

The data were collected through structure questionnaire by door to door visit. The anthropometric measurements (height and weight) were taken by standard procedure (Lohman et al., 1988).

Statistical Analyses:

After collecting information and taking measurements, analyses were undertaken using the SPSS (Version 16.0). There are several parameters to assess the nutritional status among preschool children. However, the most commonly used and reliable indicators are stunting (low HAZ), underweight (low WAZ) and wasting (low WHZ). These were used to evaluate the nutritional status of the subjects of the present study. Student's t-test was performed to test for sex differences in mean height and weight of all age groups. One way Anova (F test) was performed to test for statistically significant age group differences in mean height and weight. Stunting, underweight and wasting were used to evaluate the nutritional status of the subjects because these measures reflect both previous and current nutritional status of the children.

Internationally accepted the World Health Organization (WHO, 2006) age and sex specific – 2 Z-scores were followed to define stunting, underweight and wasting. Z-scores were calculated following the standard formula:

Z -Score = (X - Median of WHO, 2006)/ (Standard deviation of WHO, 2006)

Where, X = Particular score of height or weight of a subject.

Three commonly used undernutrition indicators: stunting, wasting and underweight were used to evaluate the nutritional status of the subjects. The World Health Organization (WHO, 2003) age and sex specific -2 z-scores were followed to define stunting, wasting and

underweight. These are:

Stunting: Height-for-age < –2 standard deviations (SD) of the WHO Child Growth Standards median;

Underweight: Weight for age < –2 SD of the WHO Child Growth Standards median; and

Wasting: Weight for height < –2 SD of the WHO Child Growth Standards median.

We followed the World Health Organization (WHO, 1995) classification for assessing severity of malnutrition by percentage prevalence ranges of these three indicators among children. The classification is shown in ***Table 1.***

RESULTS:

The age and sex specific mean height are presented in ***Table 2 and Figure 1.*** Significant sex differences in height were not found in any age groups. Significant ($p < 0.001$) age variations were found in mean height (Boys: $F = 218.92$; Girls: $F = 227.32$). Generally, it was found that boys and girls had similar mean height at all age groups. ***Table 3 and Figure 2*** presents the age and sex wise mean weight among the studied children. Significant sex difference in mean weight was not found in any age group, but significant ($p < 0.001$) age variations were found in mean weight (Boys: $F = 76.54$; Girls: $F = 86.07$). Generally, it was found that boys were heavier than girls at all age groups.

Table 4 shows the mean Z-score of height-for-age, weight-for-age and weight-for height. The age and sex combined z-values were -1.94, -1.49 and -0.96 for HAZ, WAZ and WHZ, respectively. ***Table 5*** and ***Figures 3 to 5*** present the prevalence of under nutrition among the participants. The overall (age and sex combined) rates of stunting, underweight and wasting were 47.9%, 23.5% and 13.2%, respectively. The age combined sex specific rates of stunting, underweight and wasting were higher among boys (stunting = 52.0%, underweight = 26.3% and wasting = 15.8%) than girls (stunting = 44.0%, underweight = 20.8%, and wasting = 10.7 %,). It was found that stunting frequencies decreased with increasing age in both sexes except 5 years. However, underweight and wasting frequencies fluctuated with age in both sexes.

According to WHO (WHO, 1995) classification of malnutrition, the overall age and sex combined rate of stunting was very high among the studied children. The severity of underweight and wasting was high. A critical situation was also observed when the age combined and sex-specific prevalence of under nutrition was considered. Highest rates of stunting and underweight were observed at age 1 year among boys (69.0% and 44.8%). High wasting was observed at age 2 years among boys (25.6%).

DISCUSSION:

The present study evaluated the nutritional status among preschool children of Santal tribe of two districts (Paschim Medinipur and Jhargram) of West Bengal. It has been observed that under nutrition among children is a serious public health problem internationally, especially in developing countries (Lancet, 1984). The present study clearly indicated that the overall prevalence of undernutrition ranged from very high (stunting: 47.9 %) to high

(underweight: 23.5% and wasting: 13.2 %;), according to WHO classification of severity of malnutrition (WHO, 1995).

In the present study prevalence of stunting, underweight and wasting was found to be 47.9%, 23.5% and 11.1%, respectively **(*Table 5*)**. We found that the prevalence of stunting, underweight and wasting was higher among males in comparison to females. In general, stunting was decreased ***(Figure 3)*** upto 3 years of age in both sexes. Distinct sexual dimorphism ***(Figure 4)*** was observed in the age trend in the prevalence of underweight. In case of wasting ***(Figure 5)***, in both sexes, there was a decrease until 4 years of age. Thereafter, the prevalence increased in both sexes.

In West Bengal, the prevalence of stunting ranged between 35.1% and 58.6% (***Figure 6)***. The present study demonstrated higher prevalence rate of stunting than the Lodha children of Paschim Medinipur (Bisai et al. 2008), Munda and Oraon children in Paschim Medinipur (Bisai et al. 2012). Very high prevalence of stunting among tribal children has been reported in previous studies among Kora-Mudi children (Bisai et al. 2011), Santal tribal preschool children (Bisai S. 2014) and tribal children of West Bengal (NFHS-3, 2006), in comparison to the present study. In general, the prevalence of underweight in tribal preschool children of West Bengal ranged from 47.3% to 65.2%. The prevalence of underweight in the present study is lower than the prevalence rate in the all previous studies of West Bengal. Moreover, the prevalence of wasting in tribal preschool children of West Bengal ranged from 20.1% to 55.4%. Prevalence of wasting was lower in our study in comparison to other tribal children of West Bengal. Probably one of the reasons for the comparative low prevalence of underweight and wasting observed in the present study (compared to previous studies from West Bengal) could be due to the effective implementation of the Integrated Child Development Services (ICDS) program in the form of nutritional supplementation.

In India, the prevalence of stunting ranged between 27.4% and 67.8% ***(Figure 7)***. Higher rates of stunting were observed among tribal children in Bihar (Yadav et al. 1999), Gond preschool children of Madha Pradesh (Rao et al. 2005), Bharias of Madhya Pradesh (Dolla et al.2006), Saharia of Rajasthan (Rao et al. 2006), Tribal children in India (NFHS-3. 2006), Gond tribal children of Chhattisgarh (Mitra et al. 2007a), Kamar tribal children of Chhattisgarh (Mitra et al. 2007b) and tribal children of Thane district, Maharashtra (Khandare et al. 2008). The prevalence of stunting in the present study (47.3%) was similar to that of the Kawar tribal children in Chhattisgarh (Mitra et al. 2007a) than the present study. The prevalence of underweight in tribal preschool children of India ranged from 21.4% to 93.9% (Kamar tribal children of Chhattisgarh, Mitra et al. 2007b). Except for the hilly tribal districts of North India (Singh et al. 2016) other studies have reported higher prevalence of underweight and wasting than our study. The prevalence of wasting ranged between 11.1% and 85.6% (Kamar tribal children of Chhattisgarh, Mitra et al. 2007b). Preschool children of Saharia, a tribe of Rajasthan (Rao et al. 2006) show closer resemblance of the prevalence of wasting with the present study. Lower prevalence rate of stunting, underweight and wasting was observed in the hilly tribal district of North India (Singh et al. 2016) as compared national figures as well as our study. The prevalence of under nutrition (stunting, underweight and wasting) in almost all studies was in the category high to very high (***Figures 6 and 7***).

Improvement in infant and young child feeding and caring through co-ordinated efforts of ICDS and National Rural Health Mission (NRHM) can result in substantial improvement in nutrition and health status and survival during the critical period of life. However, our children had better nutritional status than other tribal children from other states of the country probably

suggesting the impact of better public health policies, at least among this population. However, the current situation calls for an urgent need to improve health care services provided to tribal children.

Conclusion:

The present study among Santal preschool children of West Bengal revealed poor nutritional status with a higher incidence of stunting. However, one of the major limitations of the present study is the small sample size from a limited area of study. Further studies are needed among a larger sample for effective planning. Urgent steps are needed to improve socio-economic conditions by income generating activities such as an employment guarantee scheme, food for work programme, etc. Important associated factors include food security along with increased dietary intake of calories and proteins and improved maternal education. Maternal health promotion during pregnancy, improved sanitation and provision of safe drinking water for prevention of diarrhoeal and other infections are also of paramount interest. Findings of the present study will be useful for programme managers in priority setting and resource allocation in the study area.

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Authors'Contribution: BM and JD collected the data and undertook data entry and analyses. BM also prepared the draft of the manuscript. SP undertook data analyses and prepared the manuscript. KB supervised the study and prepared the manuscript.

Statement of Conflict: The authors declare no conflict of interest.

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Table 1: Classification of assessment for severity of malnutrition by percentage prevalence ranges (WHO, 1995).

Classification	Low (%)	Medium (%)	High (%)	Very high (%)
Stunting	<20	20-29	30-39	≥40
Under weight	<10	10 – 19	20-29	≥30
Wasting	<5	5 – 9	10-14	≥15

Table 2: Age and sex variations in mean height.

Age (Years)	Boys (cm)		Girls(cm)		t value
	n	Mean (S.D)	n	Mean (S.D)	
1	29	74.95 (4.17)	33	75.73 (3.40)	-0.79
2	43	84.49 (4.08)	44	83.61 (3.68)	1.06
3	25	92.58 (3.65)	23	92.33 (4.94)	0.19
4	33	98.70 (4.64)	37	98.89 (4.60)	-0.17
5	22	104.59 (4.13)	22	102.49 (3.65)	1.78
Age combined	**152**	**89.99 (10.84)**	**159**	**89.41 (10.52)**	0.49
F=218.92*			**F=227.32***		

Significance at the level of p < 0.001.

Table 3: Age and sex variations in mean weight.

Age (Years)	Boys (kg)		Girls(kg)		t value
	n	Mean (S.D)	n	Mean (S.D)	
1	29	8.52 (1.22)	33	8.18 (0.97)	1.18
2	43	10.43 (1.58)	44	10.04 (1.33)	1.22
3	25	12.26 (1.27)	23	11.93 (2.16)	0.62
4	33	14.08 (1.87)	37	13.86 (1.88)	0.48
5	22	14.95 (1.96)	22	14.70 (1.74)	0.45
Age combined	**152**	**11.81 (2.78)**	**159**	**11.46 (2.86)**	**1.09**
F=76.54*			**F=86.07***		

**** Significance at the level of p < 0.001.***

Table 4: Age and sex variations in mean (sd) of HAZ, WAZ and WHZ.

Age in years	Sex	Stunting (HAZ<-2.0)	Underweight (WAZ<-2.0)	Wasting (WHZ<-2.0)
1	**Boys**	-2.72 (1.55)	-1.83 (0.94)	-1.29 (0.96)
	Girls	-1.71 (1.17)	-1.44 (0.69)	-1.23 (1.11)
2	**Boys**	-2.18 (1.20)	-1.69 (0.93)	-1.13 (1.24)
	Girls	-2.03 (1.05)	-1.56 (0.78)	-0.82 (1.04)
3	**Boys**	-1.88 (0.93)	-1.45 (0.60)	-1.03 (0.85)
	Girls	-1.63 (1.21)	-1.39 (0.98)	-0.98 (1.23)
4	**Boys**	-1.82 (1.06)	-1.29 (0.75)	-0.67 (0.92)
	Girls	-1.62 (1.02)	-1.24 (0.70)	-0.69 (0.85)
5	**Boys**	-1.73 (0.86)	-1.59 (0.70)	-1.14 (0.89)
	Girls	-1.98 (0.74)	-1.42 (0.56)	-0.72 (0.98)
Age combined	**Boys**	**-2.09 (1.20)**	**-1.57 (0.82)**	**-1.05 (1.02)**
	Girls	**-1.80 (1.06)**	**-1.42 (0.75)**	**-0.88 (1.04)**
Age & Sex combined		**-1.94 (1.14)**	**-1.49 (0.79)**	**-0.96 (1.03)**

(HAZ = height-for-age z-score; WAZ = weight-for-age z-score; WHZ = weight-for-height z-score).

Table 5: Prevalence (%) of stunting, wasting and underweight.

Age in years	Sex	Stunting (HAZ<-2.0)	Underweight (WAZ<-2.0)	Wasting (WHZ<-2.0)
1	**Boys**	69.0	44.8	24.1
	Girls	48.5	18.2	24.2
2	**Boys**	65.1	30.2	25.6
	Girls	45.5	31.8	11.4
3	**Boys**	40.0	24.0	12.0
	Girls	34.8	34.8	13.0
4	**Boys**	42.4	9.1	0.0
	Girls	35.1	8.1	0.0
5	**Boys**	31.8	22.7	13.6
	Girls	59.1	9.1	4.5
Age combined	**Boys**	**52.0**	**26.3**	**15.8**
	Girls	**44.0**	**20.8**	**10.7**
Age & Sex combined		**47.9**	**23.5**	**13.2**

(HAZ = height-for-age z-score; WAZ = weight-for-age z-score; WHZ = weight-for-height z-score).

Figure 1: Age trends in mean height (cm).

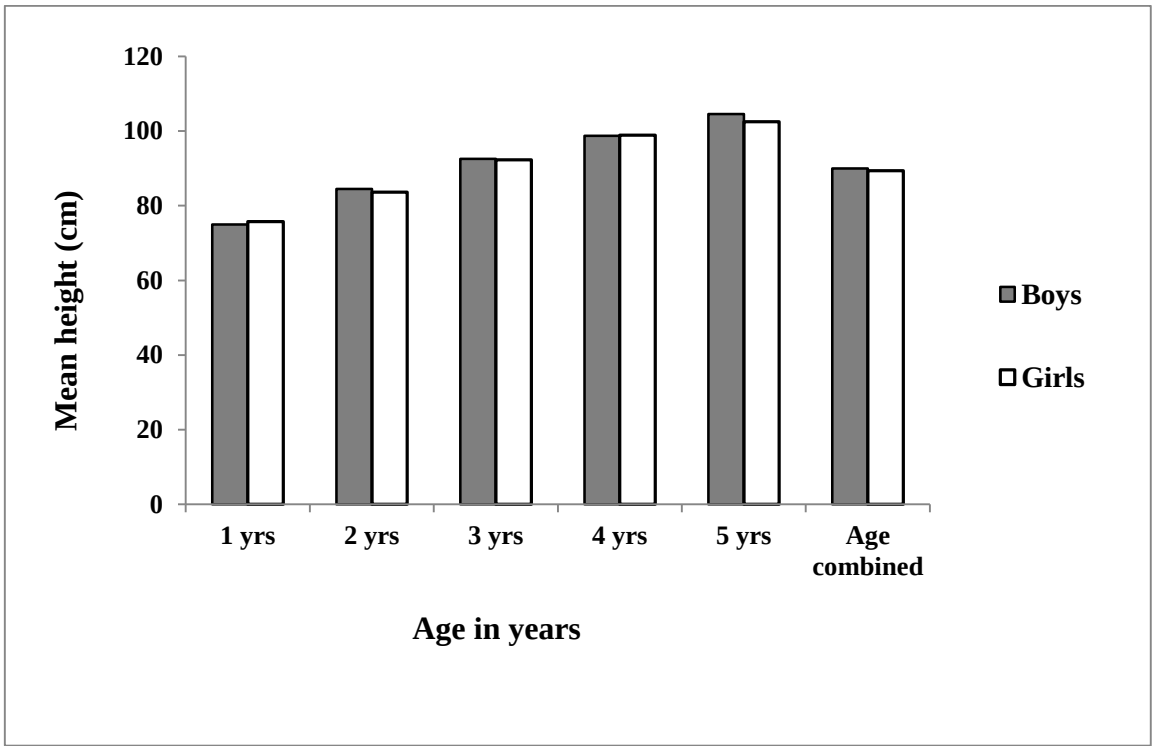


Figure 2: Age trends in mean weight (kg).

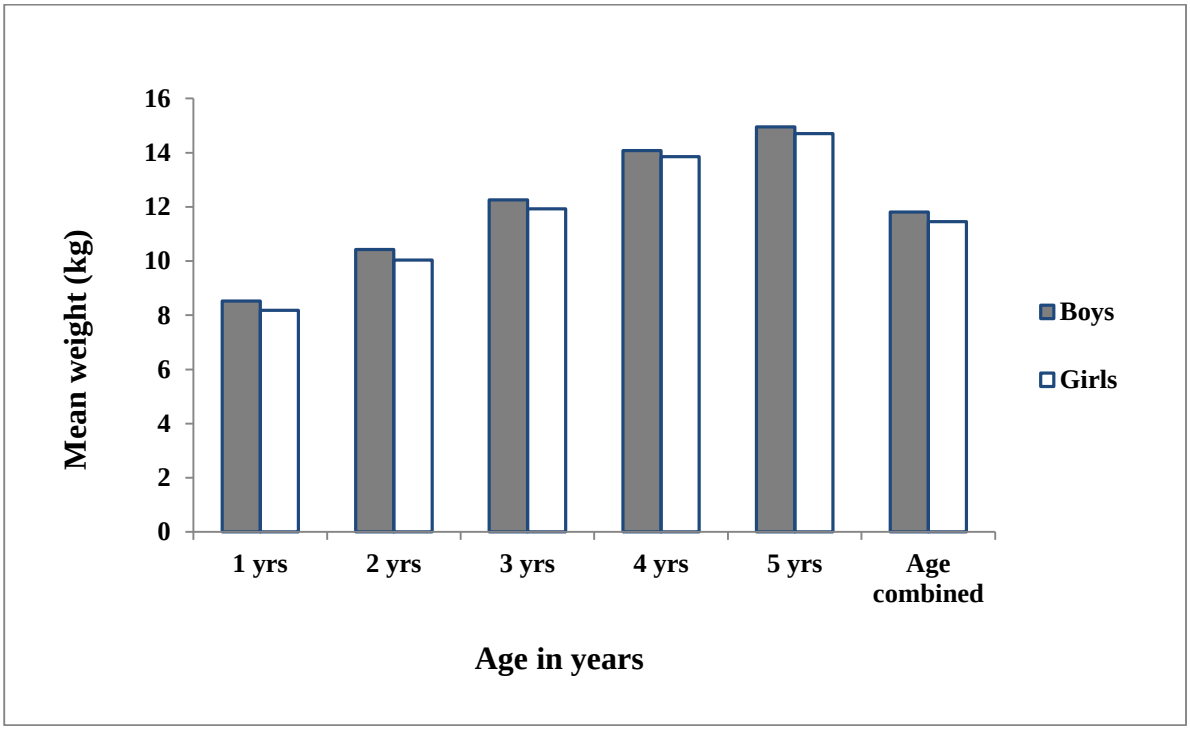


Figure 3: Age trends in the prevalence (%) of stunting.

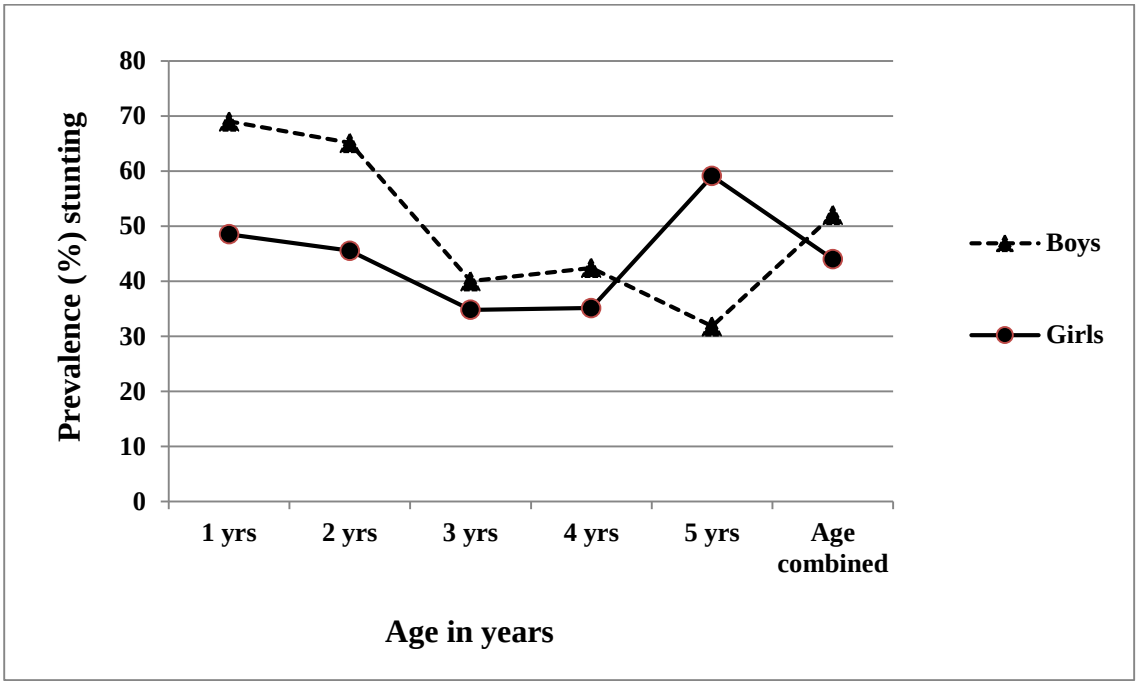


Figure 4: Age trend in the prevalence (%) of underweight.

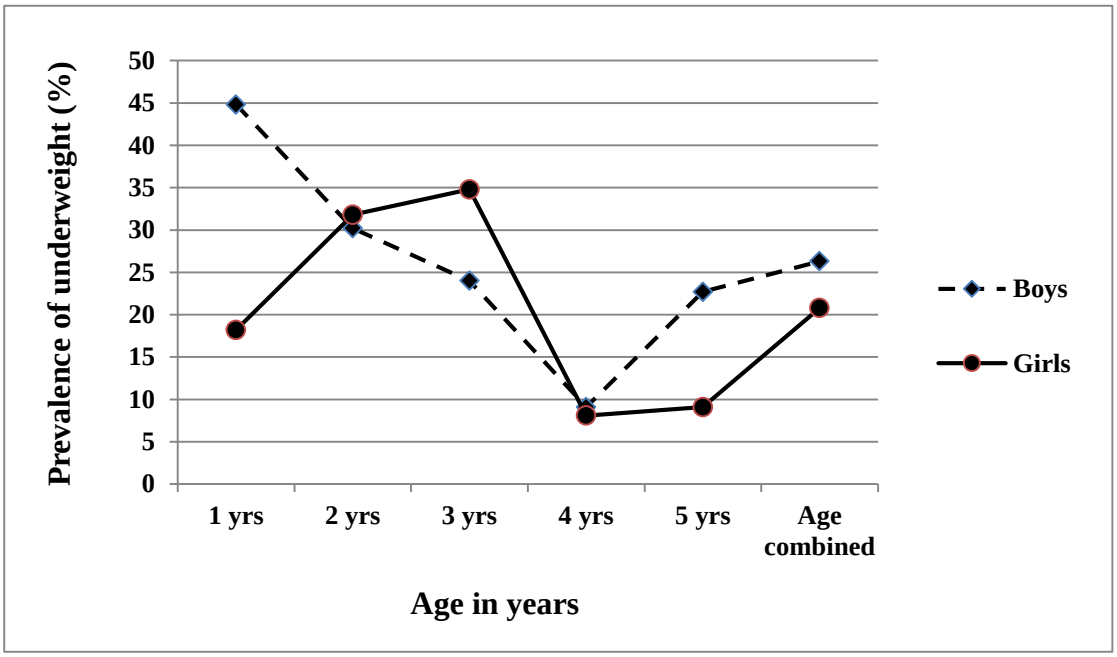


Figure 5: Age trend in the prevalence (%) of wasting.

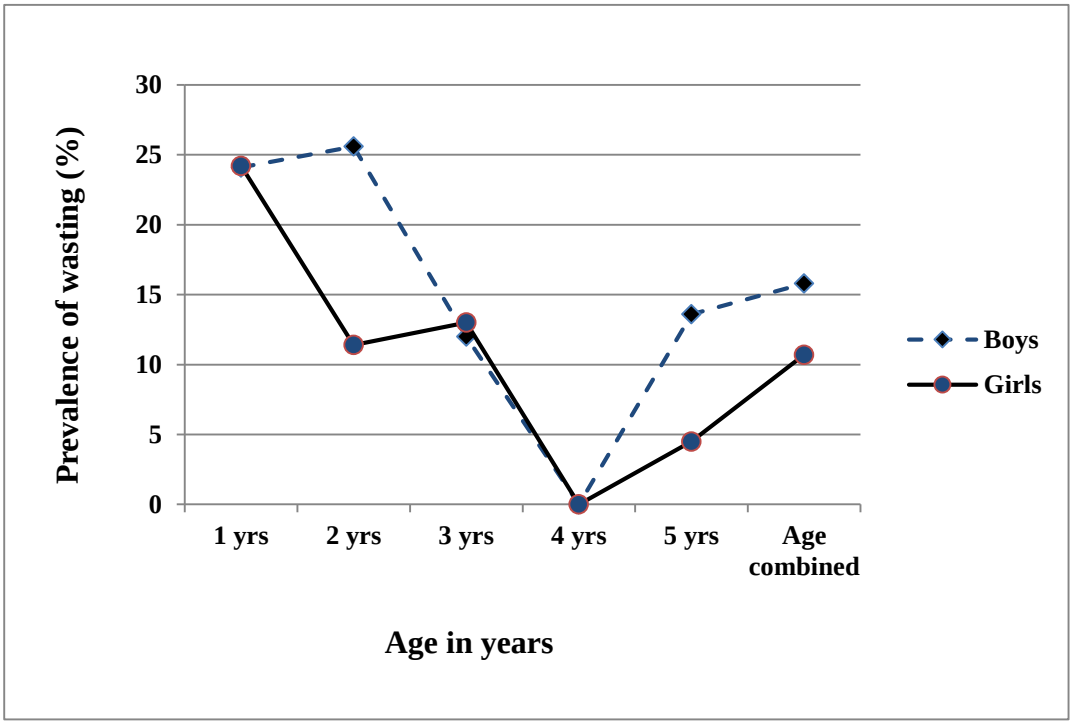
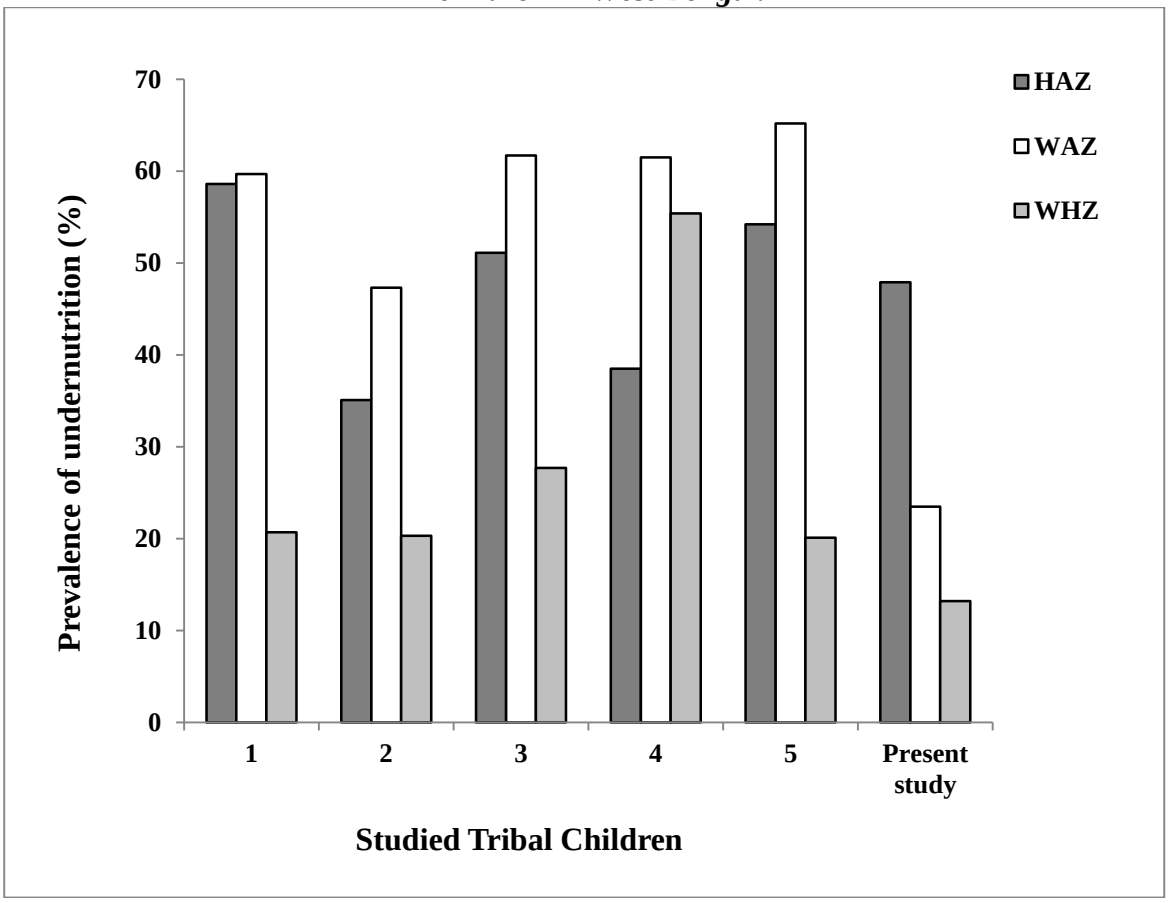


Figure 6: Comparison of the prevalence (%) of under nutrition with other tribal preschool children in West Bengal.



HAZ = Stunting
WAZ = Underweight
WHZ = Wasting

1. Tribal children in West Bengal (NFHS-3, 2006)
2. Lodha children of Paschim Medinipur, West Bengal (Bisai et al. 2008)
3. Kora-Mudi children of PaschimMedinipur, West Bengal (Bisai and Mallick 2011)
4. Munda and Oraon children of PaschimMedinipur, West Bengal (Bisai et al. 2012)
5. Santal tribal preschool children of PaschimMedinipur, West Bengal (Bisai, 2014)
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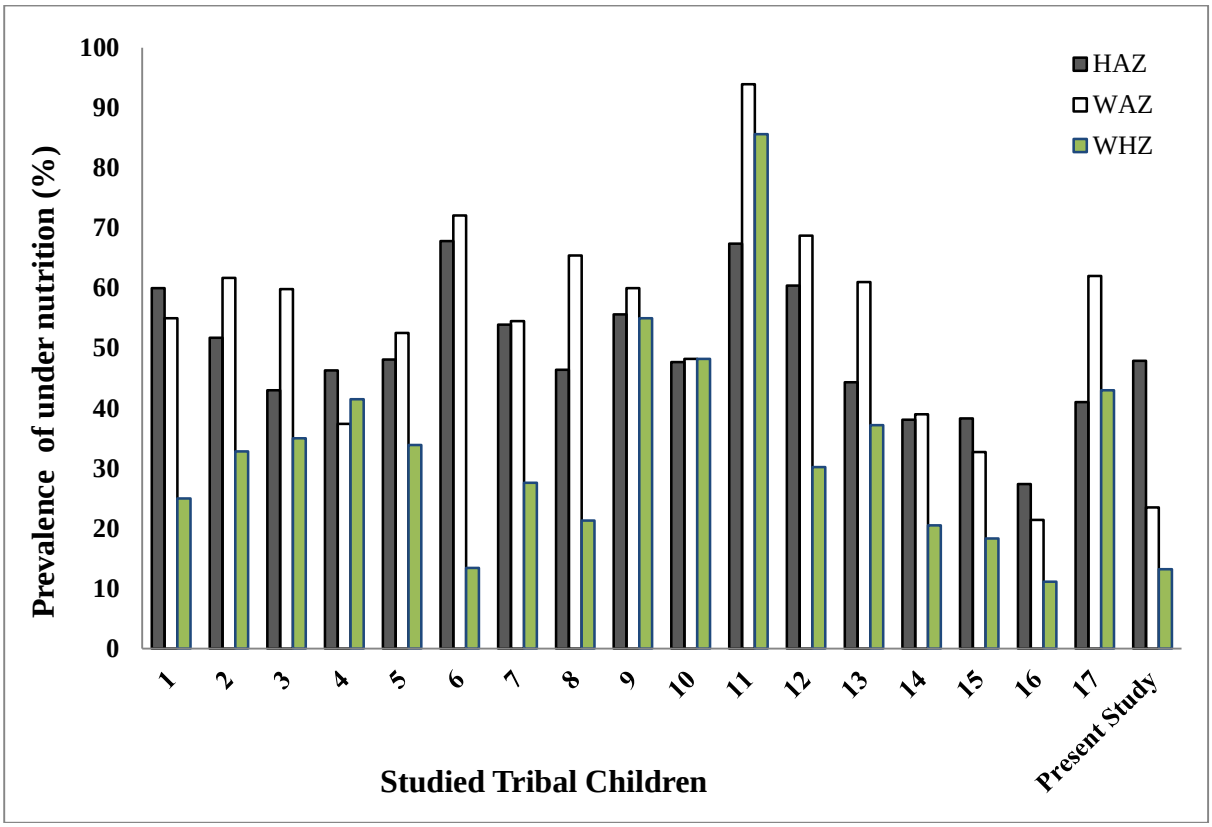
Figure 7: Comparison of the prevalence (%) of under nutrition with other tribal preschool children in India.



(HAZ = Stunting, WAZ = Underweight and WHZ = Wasting).

1. Tribal children in Bihar (Yadav et al. 1999)
2. Gond preschool children, Madhya Pradesh (Rao et al. 2005)
3. Kodaku preschool children in central India, Madhya Pradesh (Dolla et al. 2005)
4. Raj Gond in Madhya Pradesh (Sharma et al. 2006)
5. Bharias: A tribe of Madhya Pradesh (Dolla et al. 2006)
6. Saharia: A tribe of Rajasthan (Rao et al. 2006)
7. Tribal children in India (NFHS-3, 2006)
8. Tribal population of Khammam district, Andhra Pradesh (Laxmaiah et al. 2007)
9. Gond tribal children, Chhattisgarh (Mitra et al. 2007(a))
10. Kawar tribal children, Chhattishgarh (Mitra et al. 2007(a))
11. Kamar tribal children, Chhattishgarh, (Mitra et al. 2007(b))
12. Four tribal blocks of Thane district, Maharastra (Khandare et al. 2008)
13. Baiga: A tribe of Madhya Pradesh (Chakma et al. 2009)
14. Tribal children in Kerala (Philip et al. 2015)
15. Sugali tribe of Chittoor, Andhra Pradesh (Reddy et al. 2016)
16. Hilly tribal district of North India (Singh et al. 2016)
17. Tribal children in Kerala (Arjun et al. 2017)
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