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Pattern of growth in height and weight among Gadaba boys and girls of Bastar District, Chhattisgarh (India)

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The present study was conducted among the Gadaba boys and girls of Bastar District in order to evaluate the pattern of growth in height and weight among them. The data comprises 581 children (297 boys and 284 girls) ranging in age from 6 to 16 years, measured cross-sectionally. The present study reveals that the girls attain peak height velocity (PHV) and peak weight velocity (PWV) somewhat earlier than boys with greater magnitude of weight and lesser magnitude of height. The 50th percentile of the present sample indicates their status between 50th percentile of Indian Council of Medical Research (ICMR) and National Centre for Health Statistics (NCHS). The trend of physical growth as observed in height and weight may be expected to serve as the growth standards of Gadaba children of Bastar.

Key words: Physical growth, distance curve, velocity curve, Gadaba tribe, percentile.

INTRODUCTION

Anthropometric measurements such as height and weight are useful not only for growth and nutritional studies but are useful also for adaptation studies. Poor growth of children of low income groups in the technically under developed countries is to a large extent believed to be due to malnutrition. However, apart from malnutrition genetic, environmental factors may also be expected to play an important role, though their exact role in this respect is not very well understood (Singh, 2005). The differences in growth between Indian children and those living in developed countries were ascribed till recently to possible environmental, genetic and socio-cultural factors.

However, empirical studies indicate that the growth pattern can be explained in terms of genetic as well as of socio-economic environmental variables and that the latter are responsible for one share of the variance among different populations (Eveleth and Tanner, 1990; WHO, 1995). Jelliffe (1966) observed that the environment and especially nutrition affects growth more than any other factors. Whereas Dugdale et al. (1970) showed that genetic factors act on growth but become effective only when the nutritional and other factors reach an optimal level. Physical growth of Indian children is based mostly on cross-sectional studies and most of the earlier studies pertaining to growth velocity are confined

to the pre-school ages (Bharti and Basu, 1990; Bharti et al., 1992; Kaul, 1975; Singh, 2005). Several studies of physical growth in rural population suggest that with the increase in age, there is a tendency for acceleration in all metric traits (Singh, 2005). Singh (2005) showed that mean values of metric traits vary one ethnic group to another.

The Indian Council of Medical Research (ICMR, 1992) reported the anthropometric data of Indian Children and adolescents of different age groups on all India bases with respect to socio-economic classes, but empirical data on the growth pattern and nutritional measurement on tribal population have been most scant. No such studies have been carried out among the Gadaba tribe of Bastar.

In the present study, an attempt has been made to examine the trend of growth in height and weight among Gadaba boys and girls of Bastar and also to compare these data with other population in order to find out their physical status.

MATERIALS AND METHODS

The Gadaba, a scheduled tribe population is economically poor and distributed in some of the villages of Jagdalpur tehsil of Bastar district. Their population as per 2001 census is 6317 and

Table 1. Mean and Standard deviations of height and weight at different ages of Gadaba boys of Bastar, Chhattisgarh along with annual increment.

Age in year	No.	Mean	Height (cm)		Mean	Weight (kg)	
			S.D.	Increment		S.D.	Increment
6	25	108 .65	5.28	-	16.85	4.53	-
7	29	114.45	4.36	5.80	17.84	4.18	0.99
8	35	122.38	7.17	7.93	19.94	5.38	2.10
9	25	126.48	5.43	4.10	23.59	6.75	3.65
10	25	128.75	4.85	2.27	24.31	4.55	0.72
11	25	132.63.	5.28	3.88	26.69	5.35	2.38
12	30	136.15	7.30	3.52	28.73	6.85	1.74
13	28	148.57	8.59	12.42	36.14	5.12	7.41
14	25	151.28	4.90	271	38.67	4.95	2.53
15	30	153.13	8.52	1.85	45.48	6.45	6.81
16	20	154.26	3.78	1.16	46.80	6.39	1.32
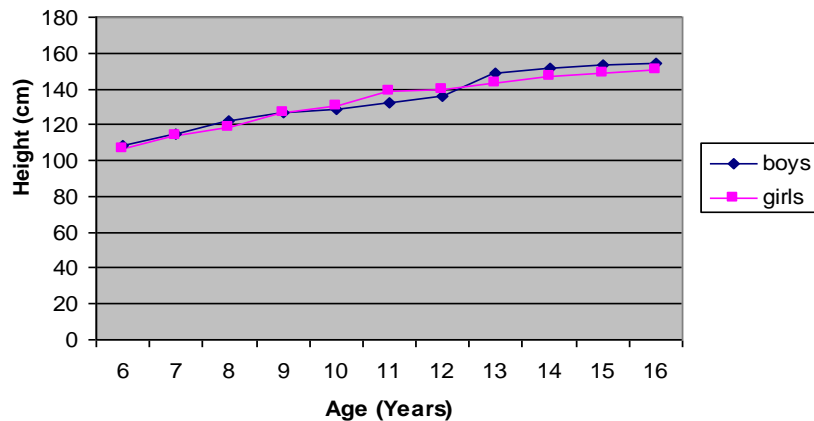
Figure 1. Mean height (cm) of Gadaba boys and girls of Bastar.

constituted about 0.73% of total tribal population of Bastar. The Gadabas of Bastar district are predominantly cultivators; though some of them are engaged as labourers. Rice and Pez are their staple food. Marriages among Gadabas take place after puberty. They follow the rules of patriarchal and patrilocal.

The material for the present study was based on a cross-sectional data collected on 581 individuals (297 boys and 284 girls) of Gadaba tribe drawn from different village of Jagdalpur tehsil of Bastar district, Chhattisgarh (India). The present study considers those individuals whereas birth records were available and all the individuals of both sexes aged 6 to 16 years were measured cross-sectionally for weight and height following the methods as suggested by Weiner and Lourie (1969). Accurate data of birth were recorded for all individuals, who were ascertained first from subject and latter verified either from school records or birth records of panchyat. Height was measured to the nearest 0.10 cm, with an anthropometric and body weight was measured to the nearest 0.05kg, with weighing machine. The data on height and weight were analyzed separately for both sexes and considered each age group to assess annual growth in respective measurements.

Growth patterns for height and weight were graphically represented by distance curve however velocity curve is also used to examine the height peaks of annual increments in both sexes.

The 50th percentile value of the present sample has been considered for comparison with other data as presented by ICMR and National Centre for Health Statistics (NCHS).

RESULTS

The mean and standard deviation for height and weight along with annual increment among Gadaba boys are presented in Table 1. The mean height increases with age with the maximum increase occurring during 12 to 13 years. The velocity of growth of height is relatively high during 7 to 8 years and decreases until 12 years and then increases until an adolescent peak is reached (12.42 cm/year) at an average of 13 years. The rate of gain in height after the peak decreases and is <1.50 cm/year at 16 years.

The distance curve for height in the present sample shows (Figure 1) a gradual increase from 6 to 16 years, while the velocity curve (Figure 3) indicates the highest
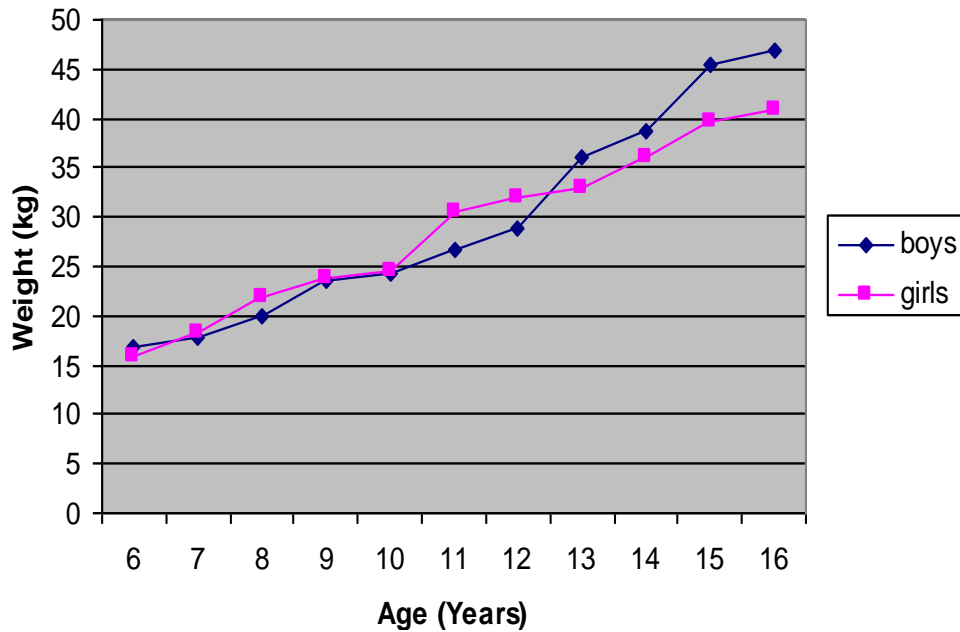
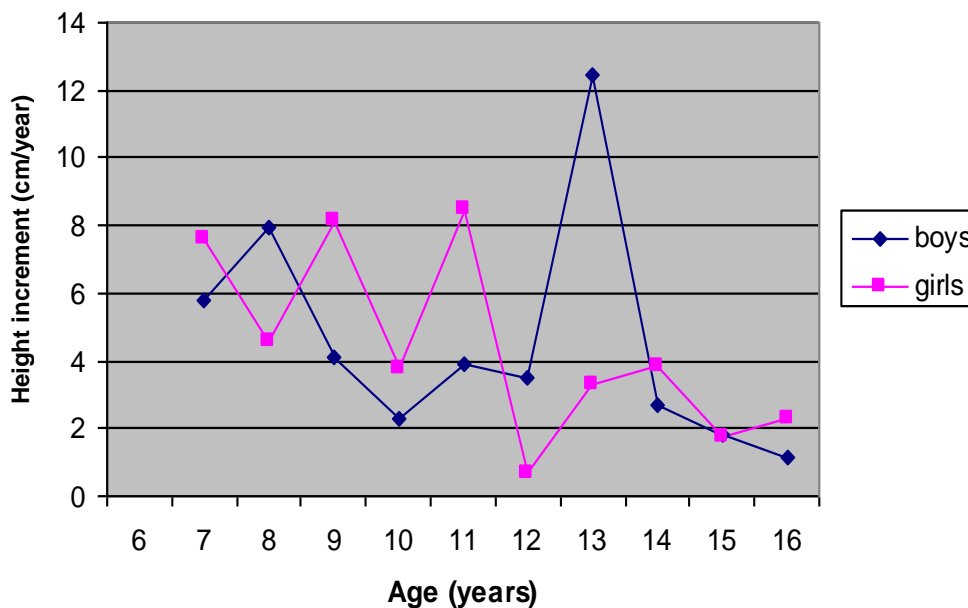**Figure 2.** Mean body weight (kg) of Gadaba boys and girls of Bastar.

Figure 3. Mean height velocity (cm/year) among Gadaba boys and girls of Bastar.

rate of increment at the age of 13 years (12.42 cm/year) among the Gadaba boys of Bastar.

The mean weight varies from 16.85 to 46.80 kg among Gadaba boys aged 6 to 16 years. The velocity of growth of weight increases until 9 years and then increases until a adolescent peak is reached (7.41 kg/year) at an average of 13 years. The rate of gain in weight after the peak decreases and is <1.5 kg at 16 years.

The distance curve for weight in the present sample indicated (Figure 2) a gradual increase from 6 to 16 years. While the velocity curve (Figure 4) shows the height rate of increment at the age of 13 years (7.41 kg/year) and next peak of growth at 15 years (6.81 kg/year) among the Gadaba boys of Bastar.

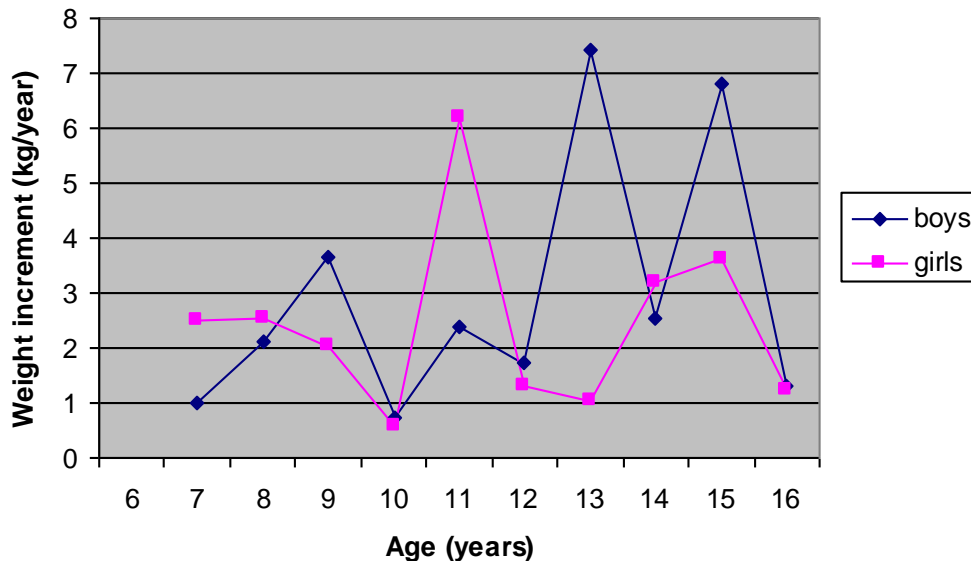The mean and standard deviation for height and Weight along with annual increment among the Gadabas

Figure 4. Mean Body weight velocity (Kg/year) among Gadaba boys and girls of Bastar.

Table 2. Mean and Standard deviations of height and weight at different ages of Gadaba girls of Bastar, Chhattisgarh along with annual increment.

Age in year	No.	Mean	Height (cm)		Mean	Weight (kg)	
			S.D.	Increment		S.D.	Increment
6	30	106.25	5.78	-	15.80	4.37	-
7	30	113.84	8.65	7.59	18.30	3.87	2.50
8	25	118.45	7.45	4.61	21.83	4.65	2.53
9	30	126.58	8.47	8.13	23.85	6.48	2.02
10	34	130.35	6.28	3.77	24.44	5.29	0.59
11	26	138.86	8.35	8.51	30.63	6.35	6.19
12	25	139.55	7.67	0.69	31.92	4.75	1.29
13	29	142.85	6.48	3.30	32.96	5.65	1.04
14	20	146.67	5.85	3.82	36.14	5.22	3.18
15	15	148.39	6.15	1.72	39.75	4.79	3.61
16	20	150.65	5.65	2.26	40.98	5.98	1.23

girls age 6 to 16 years are presented in Table 2. The mean height varies from 106.25 to 150.65 cm. The velocity of growth of height is relatively high during 6 to 7 years (7.59 cm/year) and 8 to 9 years (8.13 cm/year) and decreases until 9 years. Then increase until and adolescent peak is reached (8.51 cm/year) at an average of 11 years. The rate of gain in height after the peak decreases and is <1.5 cm at 12 years.

The distance curve for height in the present sample of Gadaba girls shows (Figure 1) a gradual increase from 6 to 16 years. While the velocity curve indicates (Figure 3) the highest peak of growth at 11 years (8.51 cm/year) with next peaks at 9 years.

The mean weight varies from 15.80 to 40.98 kg and its maximum increase occurring during 10 to 11 years. The velocity of growth of weight is observed steady up to 9 years becoming faster after 10 years until and adolescent peak is reached (6.19 kg/year) at an average of 11 years. The rate of gain in weight after the peak decreases and is <1.30 kg at 12.13 and 16 years.

The distance curve for weight in the present sample of Gadaba girls indicates (Figure 2) a gradual increase from 6 to 16 years, where as the velocity curve shows (Figure 4) the height peak of annual growth at 11 years with next peaks at 15 years (3.61 kg/year).

Table 3 exhibits the 50th percentile values for height and weight among the Gadaba boys and girls of Bastar. A steady increase is observed from one age group to the next in both sexes of present sample. The 50th percentile values of height indicates its higher value in boys than

Table 3. Median value (50th Percentile) of height and weight at different ages of Gadaba boys and girls of Bastar, Chhattisgarh.

Age in year	Height (cm)		Weight (kg)	
	Boys	**Girls**	**Boys**	**Girls**
6	107.78	105.76	16.45	15.60
7	114.13	113.39	17.15	18.95
8	121.95	118.19	19.54	21.05
9	126.27	125.94	22.93	23.36
10	128.38	129.96	23.97	24.87
11	132.37	135.99	26.28	29.46
12	135.87	139.43	27.98	30.58
13	147.94	142.87	35.79	32.94
14	151.09	146.17	38.35	35.68
15	152.78	148.48	45.17	38.95
16	153.83	150.29	46.33	40.27
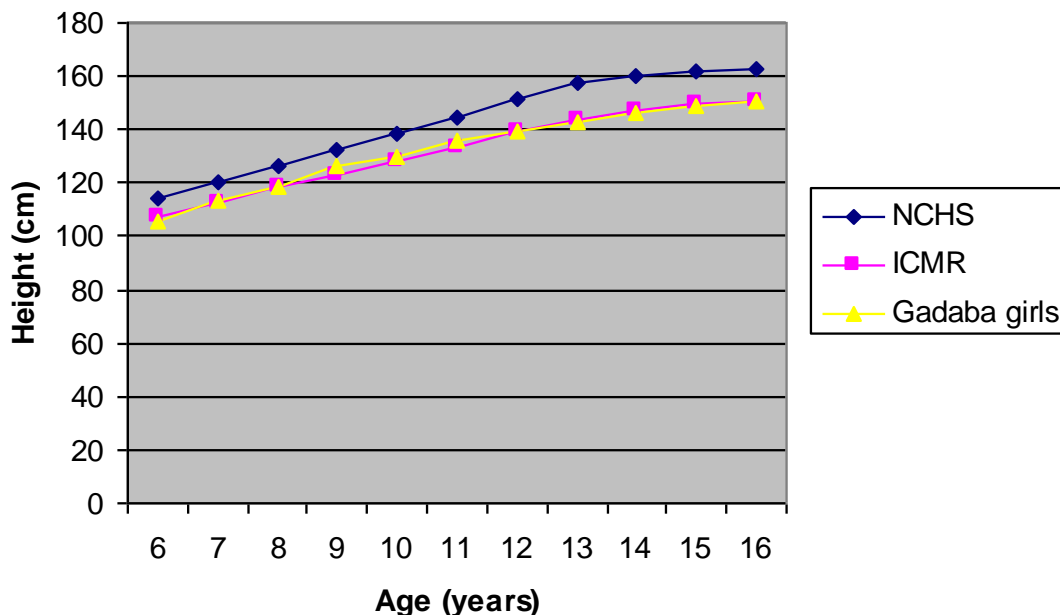
Figure 5. 50th percentile of height of the Gadaba boys compared with data from literature.

girls from 6 to 9 years and then from 13 to 16 years while in case of weight the 50th percentile value is observed higher in boys than girls from 13 to 16 years.

The 50th percentile values of height of the Gadaba boys of present sample are observed greater than those reported by ICMR (1972) at ages 7, 8 and 9 years, whereas the 50th percentile values of weight are observed higher at 6, 9, 10, 11, 12, 13 and 14 years. However, in all ages the 50th percentile values of height and weight are observed lower as compared to the 50th percentile of National Centre for Health Statistics (NCHS, 1987) (Figures 5 and 6).

The 50th percentile values of height of the Gadaba girls

are observed greater at 7 to 12 years and weight also at 7 to 15 years as compared to values reported by ICMR (1972)[7]. However, Gadaba girls indicate smaller magnitude of height and weight as compare to the 50th percentile of NCHS (Figures 7 and 8).

DISCUSSION

In present study, the 50th percentile values of height and weight observe among Gadaba boys are lower than the values obtained for Indian boys ICMR (1972) at ages 6, 11, 12, 15 and 16 years and Gadaba boys are about 1 to
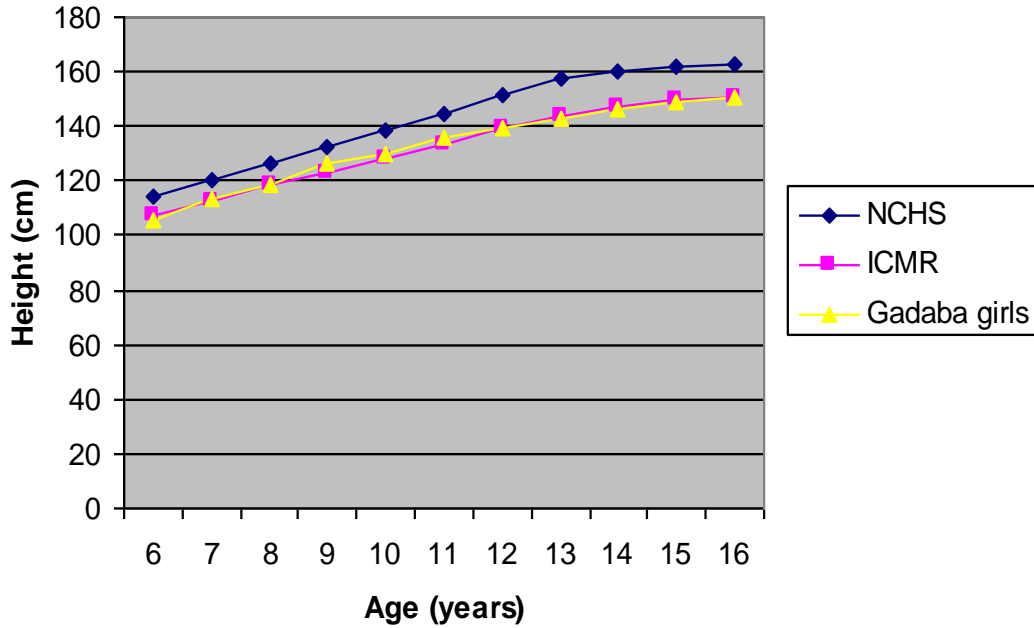
Figure 6. 50th percentile of height of the Gadaba girls compared with data from literature.
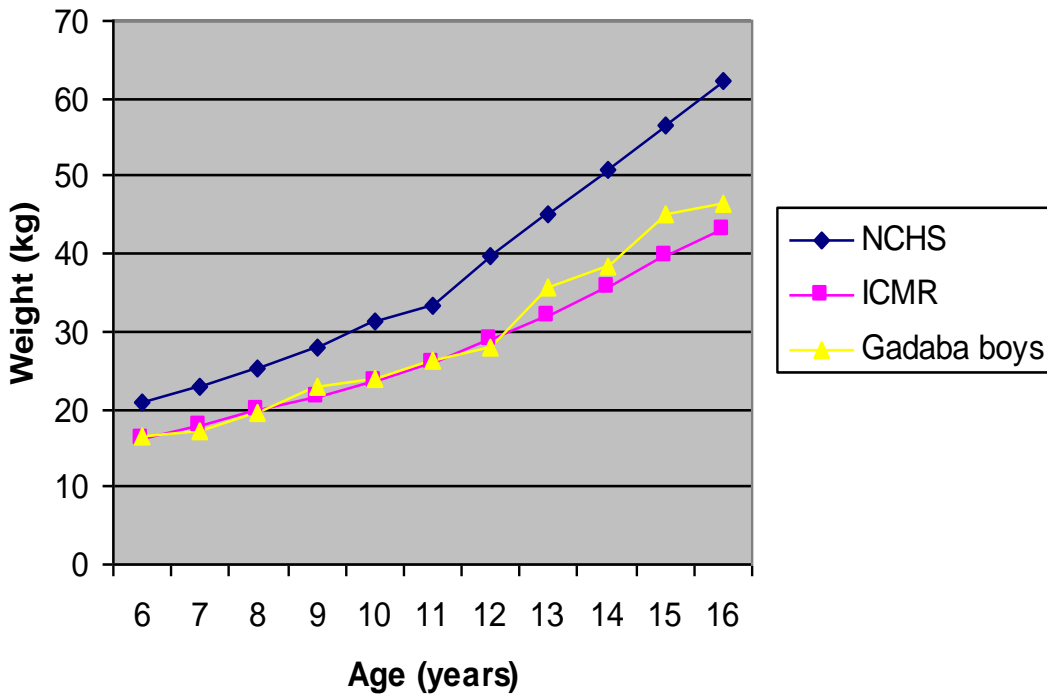

Figure 7. 50th percentile of weight of the Gadaba boys compared with data from literature.

6.00 cm shorter and about 0.50 to 5 kg heavier than their Indian counterparts at 12 to 16 years. The 50th percentile values of height are observed greater at 7, 10, 11 and 13 years among Gadaba girls as compared to the values obtained for Indian girls and they are about 0.25 to 2.50 cm taller than Indian girls as reports by ICMR (1972). However, Gadaba girls are observed about 0.20 to 3 kg heavier at 7 to 15 years than their Indian counterparts.

Comparison of the present sample with 50th percentile of NCHS, the Gadaba boys and girls are observed shorter
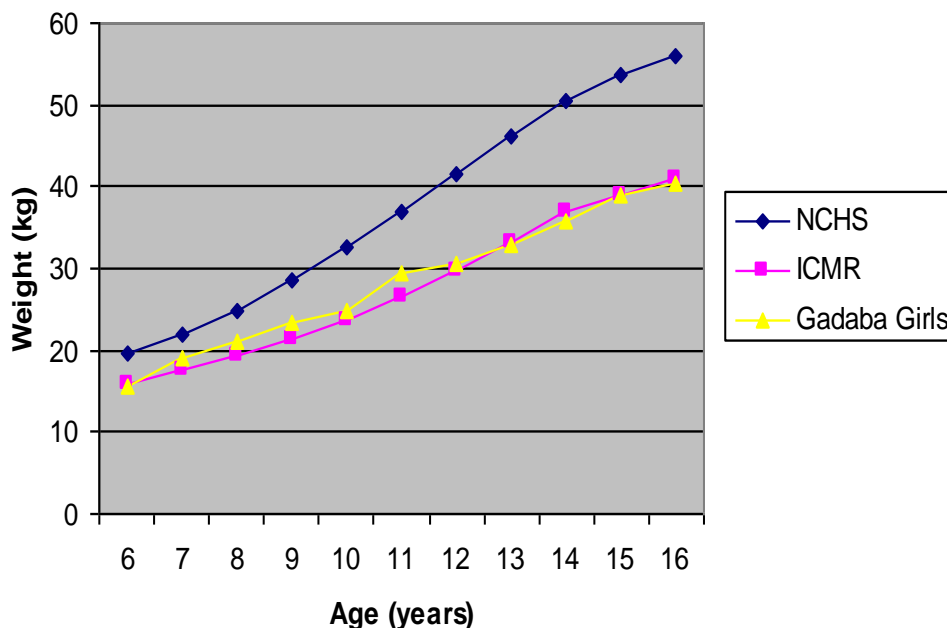
Figure 8. 50th percentile of weight of the Gadaba girls compared with data from literature.

and lighter than their U.S. Counterparts. Gadaba boys are about 2 to 14 cm. shorter and about 4 to 13 kg lighter, while girls of the present sample are observed about 3 to 10 cm shorter and about 3 to 15 kg lighter than NCHS. It is important to note that the children of present sample came from lower income group families and the differences in both parameters may be due to differences in gene pool and environment. However, the genetic potential for growth in population can be realized only in the most favorable living condition.

Conclusions

The mean value of height and weight among both the sexes of Gadaba children indicate positive correlation with age. The boys of present sample are about 1 to 5 cm taller than that of girls. While Gadaba girls belonging to age groups 7 to 12 years are about 0.11 to 3.00 kg heavier than boys of the present sample.

The age of peak height velocity (PHV) is an important indicator of tempo growth of a population and the Gadaba girls in the present study attain PHV, somewhat earlier than of boys and the same trend can be seen for peak weight velocity, although the magnitude of peak height velocity is greater in boys than the girls. While the magnitude of peak weight velocity is observed greater in girls as compared to boys among the Gadabas of Bastar.

The Gadaba boys attain an overall increase of 45.64 cm in height (Stature) from 6 to 16 years in contrast to 44.40 cm among Gadaba girls. However, in body weight the Gadaba boys indicate an overall increase of 29.95 kg

from 6 to 16 years in contrast to 25.18 kg among Gadaba girls.

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