

Physical growth among pre – adolescent Muria children (6-10 years) of Bastar district, Chhattisgarh: Bio – cultural perspectives

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ABSTRACT:

The Muria pre-adolescent children (6-10 years) were studied in terms of growth differentiation and impact of bio-cultural factors. Present study consists of 423 children, who were measured for weight, height, sitting height, bi-acromial diameter, bi-iliac diameter and mid-upper arm circumference. Means of different measurements increase in all ages with advancement of age. Present study reveals a sharp pre-adolescent growth spurt between 7 and 8 years as well as 8 and 9 years among boys and between 6 and 7 years, 8 and 9 years and 9 and 10 years among girls. All the mean values of weight and height are much lower than NCHS reference. Findings of the present study neither support the European data nor the findings from different parts of India. While, body weight increases with increase in parity, weight gain is more in nuclear families than joint families. Sitting height is more in small size and nuclear type family. Parental education, however, did not show any considerable impact on pre-adolescent growth characteristics among the Muria.

KEY WORDS: Growth, Preadolescent children, Family type, Parental education, Muria

INTRODUCTION

Human body is characterised with growth differentiation in body characters and also gradients of growth in attaining the maturity of growth characters (Krogman 1972). Growth is reflective of increase in size of the various parts and organs of the body. This increase is limited by pre-established constitution or has dietary factors and influenced by exogenous factors (climate, diet, environment etc.). Human growth is an active dynamic process which involves incessant change in an organism not yet mature and spends nearly first two decades of their life in growing, development and training their abilities to survive. The progression of growth follows a pattern that is consistent within individual but involves a wide range of differences with regard to age of onset and duration of specific stages as well as in the intensity of these changes. However, basic developmental norms are constant for all children belonging to different ethnic groups (Valadin and Ponter 1977 cited in Sharma 2004).

Studies on child growth and development have always occupied an important position in the scientific research curriculum and are of interest to the researchers of both medical Sciences and Physical Anthropology all over the world (Sharma 1970). The growth of children in population reflects their nutritional status and indirectly determines their standard of living. A well designed growth study may provide a powerful tool to identify the health and nutritional status of any population or community. India has several socially disadvantaged communities and Scheduled Tribes are the most deprived ones. The tribal population constitutes about 8.08 per cent of India's total population (Ali 2003), is characterized with widespread poverty, illiteracy, malnutrition, lack of safe drinking water and hygienic conditions, which are contributing factors for their dismal health conditions.

The pattern of physical growth and development is strongly influenced by socio-economic and nutritional status. Growth and development of children not only depend on physical growth but also mental and social development and personality of the child. Physical environment such as sun shine, good housing, lighting, ventilation, sanitation and economic factors indicating standard of living influence the growth and development. The malnutrition in children includes family income, family size, parental education, parenting style (affection, attention) and other measure such as presence of intellectual stimulations and factors of environment also strongly influence growth and development of child. In view of this present study is an attempt to examine the growth differentiation among the pre-adolescent Muria children in the light of bio-cultural perspectives.

MATERIALS AND METHODS

A cross-sectional sample of 423 Muria children (boys: 215; girls 208) of Kondagaon tehsil of Bastar district, Chhattisgarh state were measured on the basis of weight, height, sitting height, bi-acromial diameter, bi-iliac diameter and mid-upper arm circumference. All measurements were taken following the technique of Weiner and Lourie (1969). Different government Prathamikshalas and Private schools like Saraswati Vidya Mandir, situated in different villages of Kondagaon tehsil, were visited and data were collected from the 1st to 5th standard school children, age ranging from 6 to 10 years. As regards age, no stone was left unturned to expunge the incorrigibility. Special attention was paid by consulting the school records. Utmost care was taken to include only apparently physically and mentally normal children. In order to study the socio-economic status of the parents, particular information relating to occupation, income, parity of the child, parent's educational status and total family members have been collected from each parents.

The Muria: The Muria are one of the largest tribal groups in whole in Bastar district of Chhattisgarh. They are Dravidian speaking tribe and usually communicate among themselves in Gondi language (Singh 1998). Muria are cultivator. Rice is their staple food and with this they consume different local variety of pulses. Most of them are non-vegetarian. Nuclear type of family is the common type of family. Patrilineal form rule of inheritance is found among the Muria. In case of community decision there is no role of the women folk. Mother plays an important role in child rearing practices.

RESULTS

Mean, S.D., absolute growth per annum and values of total absolute growth for six measurements are furnished in Tables 1 and 2 for the Muria boys and girls respectively. Mean values of different measurements in both the genders increased with advancement of age. More fluctuation is noticed in S.D. values in weight, height and sitting height for both the genders (Table 1).

The boys are heavier than the girls in 6, 8 and 9 years, while in 7 and 10 years a reverse trend is perceptible (Table 1). Highest increment of 2.46 kg in girls and 1.87 kg in boys is evident in the age group of 9-10 years and 8-9 years respectively (Table 2). The total growth of 5.3 kg in boys and 6.44 kg in girls took place from 6-10 years in this population (Table 2). There is a continuous increase in height from the age of 6 years onwards in both the genders (Table 1). The girls of 7, 9 and 10 years are taller than the boys, while a reverse trend is perceptible in 6 and 8 years. The taller stature of girls than the boys at these ages can be due to the fact that perhaps the pre-adolescent growth spurt of the girls begins at those ages. The highest increment in height is observed among the boys as 5.58 cm in the age group 8-9 years and among the girls, it is 7.68 cm in 6-7 years (Table 2). It also revealed from the study that in height a total growth of 15.27 cm in boys and 20.27 cm in girls take place from 6-10 years of age (Table 2).

Table 1. Mean and standard deviation of growth characteristics of boys and girls by age

Growth characteristics	Age in years									
	6		7		8		9		10	
	Boys	Girls								
N	36	35	34	35	44	52	60	52	40	35
Weight (kg)	15.88 (1.87)	15.26 (1.73)	16.56 (2.22)	16.77 (2.29)	18.25 (2.35)	17.40 (2.81)	20.12 (3.00)	19.24 (2.66)	21.18 (3.00)	21.70 (3.39)
Height (cm)	109.18 (6.05)	106.10 (6.07)	112.67 (6.27)	113.78 (5.59)	116.56 (6.68)	116.16 (7.88)	122.14 (7.55)	122.35 (6.28)	124.45 (7.90)	126.37 (7.26)
Sitting height (cm)	58.01 (3.04)	56.51 (2.74)	59.12 (2.97)	59.44 (2.78)	60.53 (3.00)	60.01 (3.88)	62.82 (3.64)	61.97 (3.81)	64.42 (3.41)	65.27 (3.51)
Bi-acromial diameter (cm)	23.31 (1.61)	23.01 (1.27)	24.15 (1.63)	24.02 (1.45)	25.01 (1.28)	24.64 (1.78)	25.67 (1.95)	26.73 (1.57)	26.63 (1.68)	26.86 (1.42)
Bi-iliac diameter (cm)	17.19 (0.96)	17.32 (1.02)	17.69 (0.21)	18.19 (1.30)	18.45 (1.43)	18.42 (1.47)	19.49 (1.15)	19.30 (1.29)	19.75 (1.34)	20.45 (1.46)
Mid upper arm circumference (cm)	13.48 (0.89)	13.55 (0.99)	14.05 (1.50)	13.94 (1.32)	14.24 (0.95)	13.98 (1.16)	14.96 (1.83)	14.80 (1.28)	15.26 (1.16)	15.78 (1.57)

Figures in parenthesis indicate standard deviation value

Table 2. Absolute growth per annum by age and sex

Growth characteristics	6-7 years		7-8 years		8-9 years		9-10 years		Total growth (6-10 years)	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Weight (kg)	0.68	1.51	1.69	0.63	1.87	1.84	1.06	2.46	5.3	6.44
Height (cm)	3.49	7.68	3.89	2.38	5.58	6.19	2.31	4.02	15.27	20.27
Sitting height (cm)	1.11	2.93	1.41	0.57	2.29	1.96	1.60	3.32	6.41	8.78
Bi-acromial diameter (cm)	0.84	1.01	0.86	0.62	0.66	2.09	0.96	0.13	3.32	3.85
Bi-iliac diameter (cm)	0.50	0.87	0.76	0.23	1.04	0.88	0.26	1.15	2.56	3.13
Mid upper arm circumference (cm)	0.57	0.39	0.19	0.04	0.72	0.82	0.30	0.98	1.78	2.23

In sitting height an increasing nature is noticed with advancement of age in both the boys and girls (Table 1). Highest increment in sitting height is 2.29 cm among boys in the age of 8-9 years, while for girls is 3.32 cm in 9-10 years (Table 2). The total growth in sitting height of 6.41 cm in boys and 8.78 cm in girls has been recorded from 6-10 years (Table 2). The boys are shorter than the girls in sitting height in 7 and 10 years of age (Table 1). Bi-acromial diameter shows a gradual trend of increment at all ages of boys and girls. It is also noticed from Table 1 that girls exceed the boys having higher mean value in 9 and 10 years. This may be another indication of pre-adolescent growth spurt of girls. Highest increment in bi-acromial diameter is 0.96 cm among boys in the age of 9 to 10 years, while for girls is 2.09 cm in 8 to 9 years (Table 2). A total increment of 3.32 cm in boys and 3.85 cm in girls took place from 6 to 10 years of age (Table 2).

Table 1 notify the increase of bi-iliac diameter throughout the ages in both boys and girls. The girls exceed the boys in 6, 7 and 10 years with higher mean values than their counterpart. Highest increment in bi-iliac diameter is noticed in 8-9 years for boys (1.04 cm) and 9-10 years for girls (1.15 cm) (Table 2). Total growth in this character is recorded to be 2.56 cm for boys and 3.13 cm for girls (Table 2). Mean of mid-upper arm circumference is higher among the boys in 6 and 10 years than that of the girls (Table 1). Highest increment of 0.72 cm is recorded among boys in 8-9 years and 0.98 cm is recorded among girls in 9-10 years (Table 2). The total growth in mid-upper arm circumference of 1.78 cm in boys and 2.23 cm in girls has been recorded from 6 to 10 years (Table 2).

Table 3. Bisexual difference in six anthropometric measurements- t values

Growth characteristics	6 years	7 years	8 years	9 years	10 years
Weight (kg)	1.48	0.39	1.60	1.66	0.63
Height (cm)	2.15*	0.78	0.26	0.14	1.14
Sitting height (cm)	2.21*	0.48	0.74	1.20	1.06
Bi-acromial diameter (cm)	0.86	0.35	1.16	3.21*	0.64
Bi-iliac diameter (cm)	0.54	0.41	0.10	0.86	2.19*
Mid upper arm circumference (cm)	0.32	0.31	1.18	0.53	1.62

*Significant at 5% level of probability

Regarding bisexual difference in growth characteristics, the boys differ significantly with the girls in height and sitting height in 6 years. In bi-acromial and bi-iliac diameter significant difference is noticed in 9 and 10 years respectively (Table 3).

Weight and height of the Muria boys and girls are compared with NCHS reference and the results are furnished in Tables 4 and 5 respectively. Mean weight of the Muria boys and girls are much lesser than NCHS reference. In case of height too a similar trend is visible. For a clear view of the situation the results are shown in Figures 1 (a and b) and 2 (a and b).

Table 4. Comparison of weight of boys and girls with Indian and NCHS standard

Sex	Age	Present study			NCHS		
		N	Mean	SD	N	Mean	SD
BOYS	6	36	15.88	1.87	298	22.6	5.4
	7	34	16.56	2.22	312	25.1	5.7
	8	44	18.25	2.35	296	27.7	6.3
	9	60	20.12	3.00	322	31.3	5.8
	10	40	21.18	3.00	334	35.4	6.9
GIRLS	6	35	15.26	1.73	296	21.8	5.6
	7	35	16.77	2.29	331	24.7	6.0
	8	52	17.40	2.81	276	28.1	6.0
	9	52	19.24	2.66	322	32.0	7.2
	10	35	21.70	3.39	330	35.7	7.4

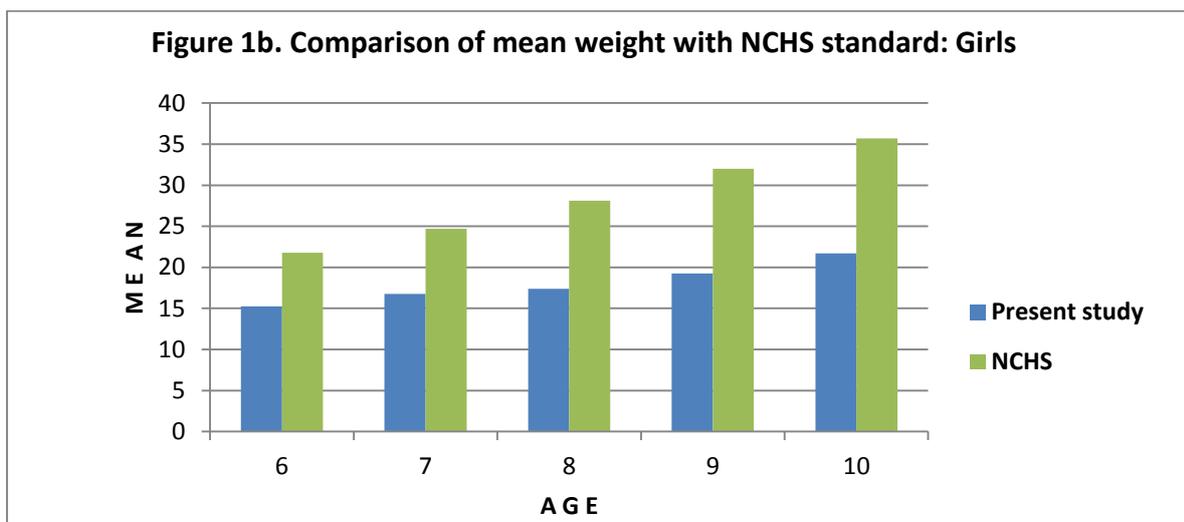
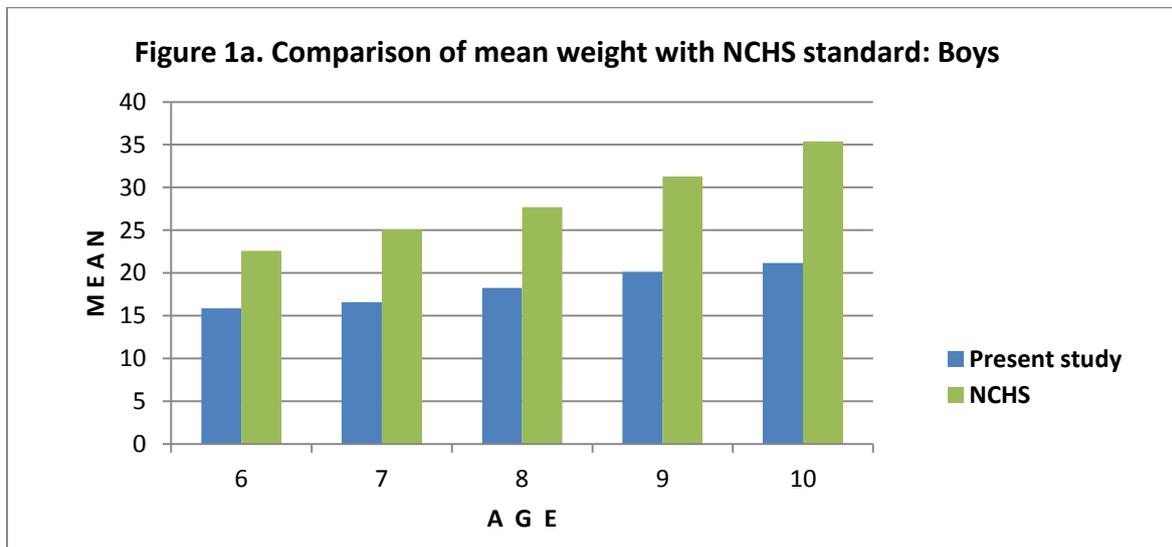
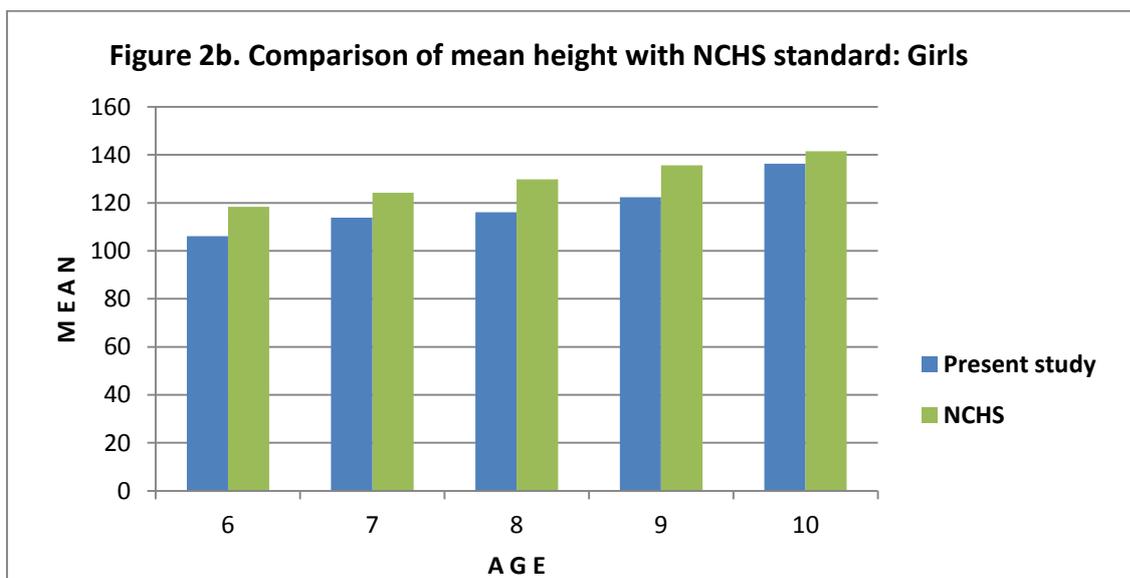
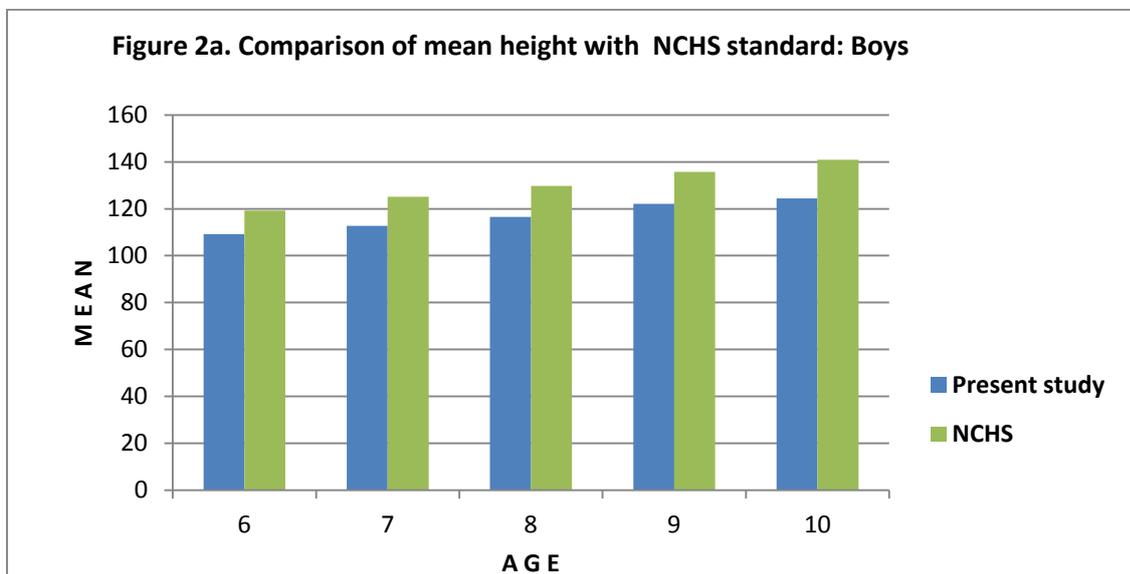


Table 5. Comparison of height of boys and girls with Indian and NCHS standard

Sex	Age	Present study			NCHS		
		N	Mean	SD	N	Mean	SD
B O Y S	6	36	109.18	6.05	298	119.2	3.7
	7	34	112.67	6.27	312	125.1	4.2
	8	44	116.56	6.68	296	129.8	5.2
	9	60	122.14	7.55	322	135.8	6.3
	10	40	124.45	7.90	334	140.9	7.8
G I R L S	6	35	106.10	6.07	296	118.3	3.6
	7	35	113.78	5.59	331	124.2	4.5
	8	52	116.16	7.78	276	129.8	6.3
	9	52	122.35	6.28	322	135.7	7.5
	10	35	126.37	7.26	330	141.5	8.4



Impact of bio-cultural factors on growth:

Selected five measurements of both boys and girls of the Muria from 6- 10 years have been discussed in terms of bio-cultural factors and particular measurements. Altogether 423 children were examined regarding their parity, family size, family type and literacy level of the children's parents with the body weight, stature, sitting height, bi-acromial diameter and bi-iliac diameter.

In Tables 6a and 6b mean weight of pre-adolescent boys and girls of Muria has been presented according to bio-cultural factors. It reveals that body weight increases with increase in parity with some exceptions. This is true for both the genders. Weight gain is more in small family children than medium and large families. Side by side, children from nuclear family have higher body weight than joint family. Majority of the children's parents were non-literate and there was no difference of mean weight between boys and girls in each age in terms of literacy of the parents.

Like weight, stature also increases with increase in parity in both the genders. Stature is recorded to be more among the boys and girls in the medium size family as well as nuclear type family than others. Higher mean of stature is recorded among the boys belong to father literate and mother non-literate category, whereas among the girls mean stature is recorded to be more in the category of non-literate parents (Tables 7a and 7b). Like weight and stature, mean of sitting height too increases with increase in parity with some exceptions. This is true for both the genders. Mean sitting height is more in small size family as well as nuclear type family among the boys and girls both. Children of non-literate parents are characterized with higher mean of sitting height than other categories (Tables 8a and 8b).

Boys belong to second parity show higher mean of bi-acromial diameter than other parity, whereas among the girls no such trend is perceptible. Though boys and girls of nuclear type family show higher mean, in case of family size higher mean is recorded among the boys of large size family and the girls of medium size family. Higher mean value is recorded among the boys belong to father literate and mother non-literate category and among the girls belong to illiterate parents (Tables 9a and 9b). In case of bi-iliac diameter no such trend of higher or lower mean is recorded in both the genders in respect of bio-cultural factors (Tables 10a and 10b).

Table 6a. Mean and SD of growth characteristics for weight by bio-cultural factors: Boys

Bio-cultural factors	6 years			7 years			8 years			9 years			10 years		
	N	Mean	SD	N	Mean	SD									
Parity															
1	14	15.3	1.46	10	16.4	2.71	18	19	2.56	8	20.2	2.4	11	20.8	2.56
2	9	16.4	1.98	8	17.6	2.65	9	18.4	2.61	13	20	2.69	11	20.8	3.71
3	9	15.6	1.33	6	15.6	1.59	10	17.5	2.36	20	19.9	3.56	9	22.7	3.02
4	3	18	3.61	6	16.8	1.47	7	17.3	0.76	15	20	2.74	7	21.1	2.67
5+	1	16	-	4	15.6	1.03	-	-	-	4	21.6	3.88	2	20	1.41
Family Size															
Small	2	13.5	0.71	3	17.5	3.04	2	19	2.83	2	20.5	2.12	-	-	-
Medium	29	16.1	1.93	25	16.5	2.15	32	18.4	2.25	40	20.1	2.53	29	21.1	3.17
Large	5	15.5	0.94	6	16.5	2.49	10	17.7	2.83	18	20.1	4.03	11	21.3	2.63
Family type															
Nuclear	34	16	1.86	33	16.6	2.24	43	18.3	2.35	50	19.9	2.41	36	21.1	2.99
Joint	2	14.5	1.41	1	15	-	1	15	-	10	21	5.13	4	21.6	3.52
Parents' education															

Father & Mother literate	1	18	-	-	-	-	-	-	-	-	-	-	-	-	-
Father literate & Mother non-literate	8	15.7	1.16	9	16.6	2.66	9	17.8	1.58	15	20	2.46	9	20.8	1.39
Father non-literate & Mother literate	-	-	-	-	-	-	1	19.5	-	-	-	-	-	-	-
Father & Mother non-literate	27	15.9	2.04	25	16.6	2.1	34	18.4	2.58	45	20.2	3.17	31	21.3	3.33

Table 6b. Mean and SD of growth characteristics for weight by bio-cultural factors: Girls

Bio-cultural factors	6 years			7 years			8 years			9 years			10 years		
	N	Mean	SD	N	Mean	SD									
Parity															
1	14	14.9	1.75	8	15.8	1.69	17	17.5	2.8	9	17.5	2.7	6	22.3	2.91
2	9	14.7	0.56	11	16.9	2.18	11	17.2	1.97	10	18.5	2.01	7	22.1	3.75
3	7	16.6	2.13	6	17.6	2.89	12	18.8	3.68	16	19.2	2.36	14	21.2	3.42
4	6	15.4	1.98	8	16.8	2.79	10	16.5	1.92	11	20.7	2.11	6	21.6	4.17
5+	-	-	-	2	17.5	1.41	2	14.3	2.47	6	20.7	3.74	2	22.8	3.89
Family Size															
Small	1	15.5	-	1	13.5	-	2	18	2.12	-	-	-	1	25	-
Medium	31	15.4	1.8	25	17	2.31	33	17.7	2.63	34	19	2.74	26	22.1	3.25
Large	3	14.2	0.76	9	16.6	2.18	17	16.7	3.23	18	19.7	2.51	8	20	3.56
Family type															
Nuclear	33	15.2	1.75	31	16.7	2.34	45	17.3	2.72	46	19.3	2.72	33	21.9	3.32
Joint	2	15.5	2.12	4	17	2.12	7	17.9	3.55	6	18.9	2.31	2	18	2.83
Parents' education															
Father & Mother literate	-	-	-	3	19	0.5	2	15.5	2.12	-	-	-	-	-	-
Father literate & Mother non-literate	5	15.3	2.36	10	16.8	1.9	14	16.6	2.94	13	19.2	2.6	17	20.9	3.54
Father non-literate & Mother literate	-	-	-	-	-	-	-	-	-	-	-	-	1	24	-
Father & Mother non-literate	30	15.3	1.66	22	16.5	2.47	36	17.8	2.74	39	19.2	2.71	17	22.4	3.23

Table 7a. Mean and SD of growth characteristics for height by bio-cultural factors: Boys

Bio-cultural factors	6 years			7 years			8 years			9 years			10 years		
	N	Mean	SD	N	Mean	SD									
Parity															
1	14	106.2	3.54	10	111.2	6.52	18	120.2	6.6	8	121.3	3.9	11	124.5	8.51
2	9	111.4	6.23	8	117.3	5.86	9	114.5	8.41	13	122.4	7.61	11	123.4	9.56
3	9	110.5	7.12	6	110.5	6.69	10	114.4	6.74	20	122.5	7.79	9	126.3	7.77
4	3	114.3	9.1	6	111.4	4.27	7	115.4	3.74	15	122.5	7.76	7	124.4	6.58
5+	1	114.4	-	4	115.1	6.68	-	-	-	4	127.1	11.8	2	126.3	1.13
Family Size															
Small	2	104.3	1.27	3	116.2	4.69	2	118.5	5.37	2	122.4	5.66	-	-	-
Medium	29	109.3	6.32	25	113.5	6.37	32	117.4	6.98	40	122.5	8.18	29	124.5	8.57
Large	5	111.2	4.91	6	112.4	7	10	114.3	7.58	18	122.4	10.4	11	126.3	5.82

Family type															
Nuclear	34	110.3	5.81	33	113.4	6.35	43	117.2	6.93	50	122.5	6.01	36	124.2	7.93
Joint	2	102.5	7.07	1	116.5	-	1	106.3	-	10	124.1	13	4	125.4	8.72
Parents' education															
Father & Mother literate	1	114.3	-	-	-	-	-	-	-	-	-	-	-	-	-
Father literate & Mother non-literate	8	110.3	6.31	9	113.4	6.06	9	118.1	10	15	123.3	4.52	9	122.3	3.89
Father non-literate & Mother literate	-	-	-	-	-	-	1	106.2	-	-	-	-	-	-	-
Father & Mother non-literate	27	109.4	6.37	25	112.3	6.46	34	116.3	6.03	45	122.4	8.3	31	125.2	8.65

Table 7b. Mean and SD of growth characteristics for height by bio-cultural factors: Girls

Bio-cultural factors	6 years			7 years			8 years			9 years			10 years		
	N	Mean	SD	N	Mean	SD									
Parity															
1	14	105.5	4.36	8	112.3	3.65	17	115.4	7.02	9	119.4	10.8	6	131.1	3.89
2	9	105.4	3.44	11	112.4	6.5	11	114.3	7.49	10	122.3	10.9	7	127.2	9.43
3	7	111.4	5.96	6	116.2	4.98	12	117.2	9.67	16	121.3	6.41	14	125.4	7.06
4	5	104.3	10.8	8	114.5	6.18	10	114.4	7.03	11	126.1	6.4	6	127.5	7.91
5+	-	-	-	2	115.1	2.4	2	107.5	12.6	6	126.2	6.73	2	128.4	8.84
Family Size															
Small	1	102.2	-	1	110.4	-	2	115.2	3.96	-	-	-	1	133.1	-
Medium	31	107.5	5.23	25	114.3	5.84	33	116.3	7.68	34	122.3	9.72	26	128.2	6.68
Large	3	96.1	9.88	9	113.1	5.33	17	113.3	8.37	18	123.4	4.59	8	123.4	8.14
Family type															
Nuclear	33	106.4	6.22	31	114.2	5.74	45	115.3	8.07	46	122.2	8.67	33	127.4	7.15
Joint	2	104.3	2.76	4	115.1	4.56	7	113.2	6.73	6	123.1	4.67	2	119.5	4.74
Parents' education															
Father & Mother literate	-	-	-	3	118.2	2.91	2	112.2	1.34	-	-	-	-	-	-
Father literate & Mother non-literate	5	104.2	10.5	10	113.4	5.34	14	114.3	8.07	13	122.4	6.49	17	125.4	8.06
Father non-literate & Mother literate	-	-	-	-	-	-	-	-	-	-	-	-	1	132.1	-
Father & Mother non-literate	30	106.4	5.16	22	114.1	5.93	36	116.1	8.01	39	123.1	8.86	17	128.3	7.04

Table 8a. Mean and SD of growth characteristics for sitting height by bio-cultural factors: Boys

Bio-cultural factors	6 years			7 years			8 years			9 years			10 years		
	N	Mean	SD	N	Mean	SD									
Parity															
1	14	56.5	2.28	10	56.5	3.12	16	61.6	3	8	62.6	2.02	11	64.5	2.88
2	9	59.3	2.91	8	60.5	2.89	9	60.5	3.91	13	62.5	3.33	11	63.9	3.97
3	9	58.1	3.16	6	56.8	3.21	10	59.6	3.36	20	62.9	4.2	9	65.6	3.44
4	3	60.1	4.56	6	58.1	2.45	7	59	0.56	15	52.7	3.86	7	63.8	3.89
5+	1	60.8	-	4	59.8	3.49	-	-	-	4	64.3	4.58	2	63.4	2.76
Family Size															
Small	2	55.7	2.83	3	60.1	2.4	2	62.8	1.41	2	63.5	2.97	-	-	-
Medium	29	58.3	3.09	25	59.1	3.03	32	60.8	2.85	40	62.6	3.23	29	64.4	3.62
Large	5	57.4	2.99	6	56.6	3.36	10	59.1	3.93	18	63.2	4.58	11	54.4	2.96
Family type															
Nuclear	34	58.2	3	33	59.1	3.02	43	60.6	3.1	50	62.6	3.14	36	64.5	3.52
Joint	2	54.5	0.42	1	59.8	-	1	56	-	10	64	5.57	4	63.5	2.32
Parents' education															
Father & Mother literate	1	60.8	-	-	-	-	-	-	-	-	-	-	-	-	-
Father literate & Mother non-literate	8	57.6	2.84	9	59	3.22	9	60.4	3.25	15	63	2.55	9	63.6	2.76
Father non-literate & Mother literate	-	-	-	-	-	-	1	61.7	-	-	-	-	-	-	-
Father & Mother non-literate	27	58	3.2	25	59.2	2.95	34	60.5	3.2	45	62.6	3.95	31	64.7	3.59

Table 8b. Mean and SD of growth characteristics for sitting height by bio-cultural factors: Girls

Bio-cultural factors	6 years			7 years			8 years			9 years			10 years		
	N	Mean	SD	N	Mean	SD									
Parity															
1	14	55.8	2.16	8	56.2	2.34	17	60.4	3.75	9	61.2	6.1	6	66.6	1.98
2	9	55.5	1.89	11	58.9	3.39	11	59.7	3.19	10	60.4	3.55	7	64.6	4.5

3	7	58.6	3.41	6	60.1	2.69	12	60.2	5.04	16	62.1	3.53	14	64.5	3.67
4	5	57.7	3.43	8	60.4	2.34	10	60.1	3.39	11	63	2.53	6	65.7	3.41
5+	-	-	-	2	61.6	1.06	2	57	6.01	6	63.5	1.98	2	68	4.81
Family Size															
Small	1	57.2	-	1	60.8	-	2	61	1.91	-	-	-	1	67.3	-
Medium	31	56.6	2.81	25	59.1	2.96	33	60.2	3.83	34	62.2	4.15	28	65.9	3.06
Large	3	55.7	2.82	9	60.1	2.36	17	59.5	4.56	18	61.6	3.12	8	62.7	4.11
Family type															
Nuclear	33	65.5	2.82	31	59.2	2.76	45	59.9	3.72	46	62	3.94	33	65.4	3.46
Joint	2	57	0.28	1	51.1	2.73	7	60.8	5.09	5	61.6	2.87	2	61.3	1.91
Parents' education															
Father & Mother literate	-	-	-	3	61.5	0.91	2	58.4	0.84	-	-	-	-	-	-
Father literate & Mother non-literate	5	56.4	3.54	10	58.9	2.2	14	59.2	4.02	13	63	3.59	17	64.8	4.2
Father non-literate & Mother literate	-	-	-	-	-	-	-	-	-	-	-	-	1	63.8	-
Father & Mother non-literate	30	56.5	2.66	22	59.4	3.11	36	60.4	3.91	39	61.6	3.86	17	65.7	2.75

Table 9a. Mean and SD of growth characteristics for bi-acromial diameter by bio-cultural factors:
Boys

Bio-cultural factors	6 years			7 years			8 years			9 years			10 years		
	N	Mean	SD	N	Mean	SD									
Parity															
1	14	22.6	1.19	10	24.1	1.92	16	25.3	1.09	8	25.5	1.69	11	26	1.71
2	9	23.7	1.81	8	25.1	1.59	9	25.2	1.55	13	26.1	1.47	11	26.2	1.86
3	9	23.7	1.66	6	23.3	1.6	10	24.6	1.58	20	26	1.61	9	27.5	1.6
4	3	24.1	2.78	6	23.9	1.25	7	24.5	0.7	15	25.2	2.58	7	26.7	1.42
5+	1	23.8		4	24.2	1.05	-	-	-	4	27.8	2.17	2	27	0.21
Family Size															
Small	2	21.6	0.28	3	25	2.19	2	25.4	1.7	2	24.2	2.69	-	-	-
Medium	29	23.3	1.65	25	24.1	1.62	32	25	1.15	40	25.9	1.52	29	26.4	1.72
Large	5	24.1	1.19	6	24	1.54	10	24.8	1.71	18	26	2.67	11	26.8	1.58
Family type															
Nuclear	34	23.4	1.57	33	24.2	1.65	43	25.1	1.24	50	25.8	1.55	36	26.5	1.65
Joint	2	22.4	2.69	1	24	-	1	22.6	-	10	26.2	3.44	4	26.9	2.2
Parents' education															
Father & Mother literate	1	24.9	-	-	-	-	-	-	-	-	-	-	-	-	-

Father literate & Mother non-literate	8	23.8	1.8	9	24.1	1.63	9	25	1.05	15	26.4	1.12	9	26.3	1.04
Father non-literate & Mother literate	-	-	-	-	-	-	1	25.6	-	-	-	-	-	-	-
Father & Mother non-literate	27	23.1	1.55	25	24.2	1.66	34	25	1.37	45	25.7	2.15	31	26.6	1.83

Table 9b. Mean and SD of growth characteristics for bi-acromial diameter by bio-cultural factors:
Girls

Bio-cultural factors	6 years			7 years			8 years			9 years			10 years		
	N	Mean	SD	N	Mean	SD									
Parity															
1	14	22.8	1.01	8	23.8	0.89	17	24.7	1.82	9	25	2.3	6	27.6	0.86
2	9	22.6	1.03	11	23.9	1.63	11	24.7	1.04	10	25.3	1.04	7	26.8	1.52
3	7	24.3	1.27	6	24.9	1.66	12	25	2.32	16	25.7	1.29	14	26.5	1.36
4	5	22.6	1.64	8	23.7	1.62	10	24	1.56	11	26.2	1.54	6	26.7	1.69
5+	-	-	-	2	24.2	0.99	2	22.9	2.26	6	26.8	1.26	2	27.9	2.19
Family Size															
Small	1	21.2	-	1	22.3	-	2	25	1.27	-	-	-	1	28.3	-
Medium	31	23.2	1.25	25	24.2	1.46	33	24.9	1.75	34	25.4	1.65	28	27.1	1.16
Large	3	21.7	0.55	9	23.8	1.44	17	23.9	1.79	18	26.3	1.25	8	26.1	1.94
Family type															
Nuclear	33	23	1.32	31	24	1.53	45	24.6	1.81	46	25.7	1.6	33	27	1.38
Joint	2	22.4	0.14	1	24	0.65	7	24.4	1.72	5	26.1	1.37	2	25.3	1.41
Parents' education															
Father & Mother literate	-	-	-	3	25.2	0.85	2	24.1	1.56	-	-	-	-	-	-
Father literate & Mother non-literate	5	23	1.42	10	23.7	0.99	14	24.1	1.99	13	25.6	1.67	17	26.7	1.34
Father non-literate & Mother literate	-	-	-	-	-	-	-	-	-	-	-	-	1	28.8	-
Father & Mother non-literate	30	23	1.29	22	24	1.63	36	24.7	1.72	39	25.8	1.56	17	26.9	1.49

Table 10a. Mean and SD of growth characteristics for bi-iliac diameter by bio-cultural factors: Boys

Bio-cultural factors	6 years			7 years			8 years			9 years			10 years		
	N	Mean	SD	N	Mean	SD									
Parity															
1	14	16.9	0.68	10	17.5	1.31	16	18.8	1.8	8	19	0.85	11	20	1.73
2	9	17.1	0.61	8	18.2	1.29	9	18.3	1.28	13	19.4	0.96	11	19.4	1.11
3	9	17.4	1.14	6	17.8	1.39	10	18.2	1.09	20	19.2	1.2	9	19.8	1.38
4	3	18	2.19	6	17.3	1.02	7	18	0.72	15	19.2	1.24	7	19.7	1.19
5+	1	17.6	-	4	17.8	0.96	-	-	-	4	19.4	1.73	2	20.2	1.34
Family Size															
Small	2	16.2	0.64	3	18.3	0.7	2	18	0.71	2	19.6	7.07	-	-	-
Medium	29	17.3	0.94	25	17.6	1.2	32	18.5	1.49	40	19.2	1.01	29	19.6	1.39
Large	5	17.1	1.1	6	17.7	1.52	10	18.2	1.3	18	19.2	1.48	11	20.1	1.21
Family type															
Nuclear	34	17.2	0.97	33	17.7	1.23	43	18.5	1.41	50	19.2	0.98	36	19.7	1.31
Joint	2	16.5	0.57	1	18.3	-	1	16.9	-	10	19.4	1.82	4	20.2	1.81
Parents' education															
Father & Mother literate	1	18.8	-	-	-	-	-	-	-	-	-	-	-	-	-
Father literate & Mother non-literate	8	17.1	0.9	9	17.3	1.36	9	18.5	0.83	15	19.2	0.99	9	19.5	0.18
Father non-literate & Mother literate	-	-	-	-	-	-	1	19	-	-	-	-	-	-	-
Father & Mother non-literate	27	17.2	0.96	25	17.8	1.16	34	16.4	1.55	45	19.2	1.21	31	19.8	1.5

Table 10b. Mean and SD of growth characteristics for bi-iliac diameter by bio-cultural factors: Girls

Bio-cultural factors	6 years			7 years			8 years			9 years			10 years		
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
Parity															
1	14	17.4	1	8	17.8	1.52	17	18.6	1.43	9	18.4	1.65	6	20.9	1.23
2	9	17	0.8	11	17.9	1.35	11	18.7	0.78	10	19.1	1.01	7	20.6	1.16

3	7	17.7	1.12	6	18.9	1.37	12	18.7	2.06	16	19.3	1	14	20.2	1.59
4	5	17	1.34	8	18.4	1.11	10	17.9	1.23	11	19.7	1.18	6	20.4	1.92
5+	-	-	-	2	18.6	0.14	2	16.8	1.06	6	20.2	1.45	2	20.5	1.56
Family Size															
Small	1	17	-	1	16.3	-	2	18.9	0.71	-	-	-	1	21.6	-
Medium	31	17.4	1.06	25	18.2	1.39	33	18.6	1.44	34	19.2	1.32	28	20.7	1.34
Large	3	16.8	0.55	9	18.4	0.96	17	17.9	1.54	18	19.4	1.26	8	19.4	1.42
Family type															
Nuclear	33	17.3	1.01	31	18.2	1.36	45	18.5	1.48	46	19.3	1.33	33	20.6	1.37
Joint	2	18.2	1.06	1	18.2	1	7	18.2	1.54	5	19.4	1.07	2	18.4	1.48
Parents' education															
Father & Mother literate	-	-	-	3	19.6	0.85	2	18.5	0.42	-	-	-	-	-	-
Father literate & Mother non-literate	5	17.3	1.33	10	17.6	1.26	14	18.2	1.56	13	19.2	1.3	17	20.3	1.56
Father non-literate & Mother literate	-	-	-	-	-	-	-	-	-	-	-	-	1	21.8	-
Father & Mother non-literate	30	17.3	0.99	22	16.2	1.26	36	18.5	1.5	39	19.3	1.3	17	20.5	1.37

DISCUSSION

Like other parts of India growth studies in Central India are mainly centred on individual and collective efforts of specialized scholars. Findings of these studies are mainly in the form of university dissertation works or research articles. However, growth studies among pre-adolescent Indian are scanty. Sharma (2004) reported a cross sectional growth study among the pre-adolescent Yadav children of Uttar Pradesh. Pattern of growth and nutritional status were examined by Kharyal (2013) among Garhwali and Jaunsari pre-adolescent and adolescent Rajput females of Dehradun district, Uttarakhand. While Baruah et al. (2015) studied growth differentiation during pre-adolescence among the Garo and Rabha of Assam. Though there are good number of growth studies in Central India, study among the pre-adolescent Muria tribe has so far not been done to the best of authors knowledge.

According to Roche and Sun (2003):

“During the preschool years, the rate of growth slows from being rapid during infancy to a near constant rate that begins at 4 to 5 years of age when the average annual increments are about 2 kg for weight and 6 cm for stature. Sex difference in stature and weight during the preschool years are slight. Middle childhood (7 to 10 years) is a period of continued steady, but slightly increasing growth in body size for most children. On average, children increase in weight by about 3 kg per year at 7 years and by about 4 kg per year at 10 years and they increase in stature by about 5 cm per year from 7 to 10 years. At 7 years, males are, on average, about 2 cm taller than females, but there is only a small sex

difference in weight. By 10 years, the average female is about 1 cm taller than the average male and about 1 kg heavier.”

An inconsistent small growth spurt in stature, known as the mid-growth spurt, occurs at about 7 years in males and 6 years in females (Tanner and Cameron, 1980; Butler et al., 1990; Guo et al., 1992). There may be inconsistent spurts in stature at about 9 years in each sex with mean increases in growth rates of about 1.0 to 1.5 cm per year for males and 1.0 cm per year for females (Wales and Milner, 1987; Wit et al., 1987; Butler et al., 1990; Tillmann et al. 1998). Sharma's (2004) study reveals a sharp pre-adolescent growth spurt among the Yadav girls between 9 and 10 years, whereas among the Yadav boys it is yet to start and growth rate slows down between 9 and 10 years. The study of Baruah et al. (2015) reveals a sharp pre-adolescent growth spurt between 4 and 5 years as well as 7 and 8 years in both boys and girls among the Garo. Among the Rabha pre-adolescent growth spurt is noticed between 4 and 5 years as well as 5 and 6 years among the boys, while among the girls it occurred between 4 and 5 years. In contrast the present study reveals a sharp pre-adolescent growth spurt between 7 and 8 years as well as 8 and 9 years among Muria boys and between 6 and 7 years, 8 and 9 years and 9 and 10 years among girls. Thus, findings of the present study neither support the European data nor the findings from other parts of India.

Present study reveals considerably lower mean of weight and height in the Muria pre-adolescent than NCHS reference. Living conditions of the Muria in Kondagaon Tehsil of Bastar are deplorable and characterized with poverty, illiteracy, malnutrition, lack of safe drinking water, sewage and proper housing. Low level of physical growth among the Muria thus, corroborated by these findings.

Kirchengast (2015) is of the opinion:

“Human growth, taking place during childhood and adolescence, is influenced by various intrinsic and extrinsic factors. Among extrinsic factors life circumstances and socioeconomic situation have a profound impact on the growth process.”

The average body weight of adults not only varies markedly between populations but also from generation to generation, mostly due to genetic disposition and environmental factors. Among environmental conditions socioeconomic determinants are of special importance for human growth during childhood and adolescence (Bielicki and Waliszko, 1992; Li et al., 2004; c.f. Kirchengast, 2015). It has been observed that the Muria children under study are from very poor socioeconomic status and most of their parents are non literate. They live in nuclear families and their parents are practicing agricultural labour work or very less of them are doing agriculture in their small piece of land. Side by side, these Muria individuals are little conscious about their children health.

It is noticed from the findings of impact of bio-cultural factors on growth that while body weight of the pre-adolescent Muria increases with increase in parity, weight gain is more in nuclear families than joint families. On the other hand height gain is more in medium size and nuclear type family among the boys and girls. Sitting height is more in small size and nuclear type family in both the genders. Though parental education did not show any considerable impact on growth characteristics, it can be well assumed that parental care towards children will be more in nuclear type and small size families than the joint type and medium and large size families. The same is true for the first and second parity children.

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Author's contributions:

AD and PA (M) collected field data. The idea and vision behind the paper was given by AD, who has analysed the data and drafted the manuscript. DKA edited and prepared the final manuscript.

Conflict of interest

The authors declare that there is no conflict of interest.

REFERENCES

- Ali A. 2003. Health status of tribals in India. In: DK Adak, B Bhattacharya, R Ghosh, M Pal, P Bharati, TS Vasulu, editors. *Demography and Health Profile of the Tribals: A study of MP*. New Delhi, Anmol Publications.
- Baruah T, Adak DK and Bharati P. 2015. Growth differentiation during pre-adolescence among the Garo and Rabha. In: M Sikdar, editor. *Human Growth: The Mirror of the Society*. Delhi, B. R. Publishing Corporation.
- Bielicki T and Waliszko. H. 1992. Stature, upward social mobility and the nature of statural differences between social classes. *Ann Hum Biol*, 6:589-93.
- Butler GE, McKie M and Ratcliffe SG. 1990. The cyclical nature of prepubertal growth. *Am J Hum Biol*, 17:177-98.
- Guo S, Siervogel RM, Roche AF and Chumelia WC. 1992. Mathematical modelling of human growth: A comparative study. *Am J Hum Biol*, 4:93-104.
- Kharyal A. 2013. *Growth patterns and nutrition in preadolescent and adolescent Rajputs females of Jaunsar Bawar and Garhwali of Dehradun district, Uttarakhand*. Ph. D. Thesis (unpublished). Patiala, Punjab. Department of Human Biology, Punjabi University.
- Kirchengast S. 2015. The impact of socioeconomic change on human growth. In: M Sikdar, editor. *Human Growth: The Mirror of the Society*. Delhi, B. R. Publishing Corporation.
- Krogman WM. 1972. *Growth and physical development of Indian infants and children*. Tech Rep Ser No. 18, New Delhi, ICMR.
- Li L, Manor O and Powe C. 2004. Are inequalities in height narrowing? Comparing effects of social class on height in two generations. *Arch Dis Child*, 89:1018-33.
- Roche A and Sun S. 2003. *Human Growth: Assessment and Interpretation*. Cambridge, Cambridge University Press.
- Sharma JC. 1970. *Physical growth and development of the Maharashtrians*. Lucknow, Ethnographic and Folk culture Society.

- Sharma MB. 2004. Multivariate Distance Analysis for Growth Characters during Preadolescence among Yadav Children of Eastern Uttar Pradesh. *J Indian Anthropol Soc*, 39:67-76.
- Singh KS. 1998. *India's Communities: H-M. People of India*, National Series, Vol V. Anthropological Survey of India. Delhi, Calcutta, Chennai, Mumbai, Oxford University Press.
- Tanner JM and Cameron M. 1980. Investigation of the mid-growth spurt in height, weight and limb circumferences in single-year velocity data from the London 1966-67 growth survey. *Ann Hum Biol*, 7:565-77.
- Tillmann V, Thalange NKS, Foster PJ, Gill MS, Price DH and Clayton PE. 1998. The relationship between stature, growth and short-term changes in height and weight in normal prepubertal children. *Pediatric Research*, 44:882-6.
- Valadin I and Ponter D. 1977. *Physical Growth and Development: From Conception to Maturity: A Programmed Text*, 1st Edition. Boston, Little Brown and Company.
- Wales JKH and Milner RDG. 1987. Knemometry in assessment of linear growth. *Arch Disease Child*, 62:166-71.
- Weiner, JS and Lourie JA. 1969. *Human Biology: A Guide to Field Methods*. IBP No. 9. Oxford, Blackwell.
- Wit JM, Kalsbeek EJ, Wijk-Hoek JM and Leppink GJ. 1987. Assessment of the usefulness of weekly knemometric measurements in growth studies. *Act Paediatrica Scandinavica*, 76:974-80.