Growth Pattern of the Kamars – A Primitive Tribe of Chhattisgarh, India

M. Mitra[1], P. V. Kumar[1], R. Ghosh[2] and P. Bharati[2]

[1] Department of Anthropology, Ravishankar University, Raipur, India
[2] Anthropology and Human Genetics Unit, Indian Statistical Institute, Calcutta, India

ABSTRACT

A cross sectional study of the physical growth status was made on 655 Kamar children (341 boys and 314 girls), aged 5 to 18 years, in the Raipur district of Chhattisgarh. The study aimed to find out the growth pattern of the Kamar children, which is considered to be a primitive tribe of Chhattisgarh, India and was compared with another Indian tribe and the official data for all India (ICMR). Anthropometric measurements included height, weight, sitting height, biacromial diameter, biilliocristal diameter, upper arm circumference, calf circumference and measurements of the triceps and subscapular skinfolds. All anthropometric measurements except skinfold thickenness exhibit uniform increase with age in both sexes. However, when height and weight of the Kamar boys and girls were compared with the data for other tribes and for all India, the Kamar children (both boys and girls) indicated lower weight and height and the difference showed to be significant, for almost all ages. Kamar boys showed higher anthropometric values than girls in almost all measurements except in biilliocristal diameter and in measured skinfolds. Poor socio-economic status of this primitive tribe may be one of the reasons for this poor growth pattern. However, in-depth study is necessary in order to arrive at any basic conclusions and to recommend any policy and interventions.

Introduction

The general standard of living and nutritional status of a population are measured by child growth[1–4]. Growth represents a complex interaction of nutritional intake, absorption and requirements, all of which vary within and among populations. For example, nutritional requirements alone are complex function of body size, age, health and activity levels[5]. As a result, even the best estimates of nutritional intakes are not an ideal indicator of a population's nutritional status because intake accounts for only one of the relevant variables[3,4]. Anthropometric di-

mensions, in contrast, are sensitive measures of nutritional status because growth is influenced by diet intake, expenditure and general health and because slowing or cessation of growth is one of the first observable responses to nutritional inadequacies[6,7].

India has several socially disadvantaged communities among which schedule tribes are the most deprived ones. The tribal population, which constitutes 7.7 % of the total population, is characterized by widespread poverty, illiteracy, malnutrition, lack of safe drinking water and hygienic conditions[8]. Although, health is one of the crucial parameters of development of a community, researchers have not paid much attention in studying the growth and nutritional status of the tribal communities in India. In fact, most of the works carried out in India on growth and nutritional status only deal with urban[9–12] and in rural populations[13–19]. Among the tribal population the studies are limited[20–22]. Moreover, there are absolutely no works, which deal with the growth pattern of the Kamars, a primitive tribe of the Chhattisgarh, the newly emerged state of India. The purpose of the study is to find out the growth pattern of the children (5–18 years) of the Kamar tribe and to compare with another tribe of the state and India data.

The Kamar is one of the five identified primitive tribes of Chhattisgarh in India. They live in the southeastern region of Raipur districts. They are isolated from the mainstream and modernization and depend almost entirely on natural resources for their subsistence. About 80% of the Kamar families are landless. They still practice-shifting cultivation in some places. They are mostly engaged in basketry. In the Sixth Five-Year Plan the Government of India has declared the Kamar as one of the most primitive tribe of India. The population growth rate is almost stagnant in Kamars since 1944.

Low literacy, inadequate nutrition intake, unsanitary environmental conditions such as very poor sanitation and personal hygiene and lack of safe drinking water has added in poor health status of the population[23].

Subjects and Methods

The sample for the present study was collected from forty-four villages of the Raipur district of Chhattisgarh State, India (Figure 1). The state consists of about 20,565 persons of Kamar population (1991 census). The sample consists of 655 children (341 boys and 314 girls), aged 5 to 18 years. Measurements were taken during the month of January 1992 to June 1992. The same investigator (P. V. Kumar) collected all the data.

Fig. 1. Location of Chhattisgarh and Raipur and distribution of places from which data were collected.

Age estimation

Assessment of exact age is most essential for conducting growth studies. It is general experience of fieldworkers that

exact age assessment of children in the rural area especially from the tribals particularly in primitive tribal communities is very difficult due to ignorance, illiteracy and lack of any written records. The age of the preadolescent children were ascertained from the school registers and then confirmed by teachers and members of »Kamar Development Agency« who reside in that area since 1982 for the development of the Kamar tribe. Ages of most of the adolescent children were estimated and cross checked from the reference to events remembered such as some important festivals, visiting of some eminent personalities, storm, floods etc. The aged members of the households and villages, along with the ward member and the clan chief also confirmed the ages of the children.

The age of the child was recorded in complete years. For analysis of the data the age grouping was done according to the age at the last birthday[24] (Rao et al, 1961). All the children who had completed 6 years but were less than 7 years were grouped as 6 and likewise age group was calculated.

Anthropometric measurements

The anthropometric measurements of height, weight, sitting height, biacromial diameter, biilliocristal diameter, upper arm circumference and calf circumference, head length, head breadth, bizygomatic diameter, bigonial diameter, morphological height and skinfold thickness of subscapular and triceps of Kamar boys and girls were taken as per the IBP recommendations[25].

The measurements were taken by Dr. P. V. Kumar alone, to maintain uniformity and accuracy in techniques after undergoing extensive training. 655 Kamar children were measured. Portable weighing machine and anthropometer, tape, spreading caliper, Sliding caliper and Harpenden skinfold caliper were used to measure the various anthropometric measurements. Biilliocristal diameter of the girls aged 14–18 years could not be taken, as the tribes came for the first time with contact with outside people and were very shy to give the measurement.

The percentiles were calculated as referred by WHO, 1995[26]. Absolute growth of a character (difference of mean is calculated by subtracting the mean value of the lower age group from that of the next higher age group. Descriptive statistics like mean and standard deviation were used and t-test was used to find the differences between the mean sample.

Results

The mean anthropometric traits of height, weight, sitting height, biacromial diameter, biilliocristal diameter, upper arm circumference and calf circumference of the Kamar boys and girls are shown in Table 1.

The distance curve of height shows slight elevation on the curve in age group of 10–12 years among the boys, while rapid elevation was seen after 15 years. The girls seem to be slightly taller than boys in the 15 age groups. The maximum age group difference between two successive age groups is 7.12 cm in case of boys between 15 and 16 and 6.61 cm among the girls between 13 and 14 years, which corresponds with the adolescent growth spurt. The mean weight of the girls is higher in the 6 age groups and crosses the distance curve of weight of the boys up to 11 years. From 13 years onwards, the weight of the boys increases rapidly. The maximum increase in weight is 4.06 kg. In the 14 and 15 age group in case of boys and 2.59 kg in case of girls.

The distance curve of the sitting height for boys remains higher than the girls throughout the age period, except at 14 and 15 years, where the girls gain more sitting height than the boys. The in-

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TABLE 1

MEAN AND STANDARD DEVIATION FOR ANTHROPOMETRIC MEASUREMENTS OF KAMAR BOYS AND GIRLS BY AGE

Age group (yrs.)	N	Height (cm)		Weight (kg)		Sitting height (cm)		Biacromial diameter (cm)		Billiocristal diameter (cm)		Upper arm circum. (cm)		Calf circum. (cm)	
		X	SD	X	SD	X	SD	X	SD	X	SD	X	SD	X	SD
Boys															
5	40	98.80	4.82	10.50	1.69	55.13	1.74	20.98	1.71	15.20	1.09	10.80	0.79	16.66	1.26
6	23	105.00	5.20	13.10	2.26	57.40	1.62	23.00	1.69	16.32	0.99	12.03	1.63	18.29	1.60
7	23	108.50	6.50	15.92	2.10	58.71	1.36	24.96	1.01	17.27	1.31	13.76	1.49	20.09	1.31
8	22	114.71	6.60	17.15	2.41	61.25	1.46	26.19	1.21	18.64	0.79	14.83	1.10	21.87	1.12
9	25	120.63	6.06	19.30	3.12	63.94	1.51	27.00	0.78	19.72	1.36	15.26	1.13	22.31	1.71
10	24	127.16	4.49	20.04	2.80	66.03	1.21	27.89	1.11	20.33	1.00	16.14	1.36	24.30	1.74
11	20	129.41	4.32	22.80	3.46	67.41	1.32	28.60	0.94	21.19	1.09	17.06	1.40	25.69	2.01
12	26	132.55	3.16	24.85	2.96	68.38	1.69	28.98	2.01	21.79	1.02	17.93	0.98	26.26	1.94
13	23	137.16	4.66	25.70	3.02	70.36	2.01	29.51	1.64	22.06	0.92	18.64	1.39	26.96	1.71
14	29	140.52	4.41	26.94	2.64	71.61	1.91	30.32	0.91	22.46	1.22	19.20	1.26	27.26	1.90
15	24	144.70	5.62	31.00	2.84	73.27	3.09	32.32	2.00	24.31	1.33	20.60	0.87	28.41	1.44
16	22	151.82	4.16	34.10	1.96	78.03	2.11	33.07	1.31	24.79	0.88	21.84	1.21	30.74	2.03
17	19	155.93	3.17	37.23	1.40	80.83	1.66	33.88	1.61	25.42	1.20	22.10	1.43	31.31	1.62
18	21	157.51	3.25	40.87	2.33	81.46	1.70	34.61	2.04	25.97	1.13	22.29	1.60	31.79	2.01
Girls															
5	31	97.61	4.01	11.17	0.96	53.88	1.68	21.00	1.23	15.94	1.09	10.71	1.26	16.23	2.00
6	20	103.74	5.76	13.50	1.44	56.37	1.72	22.41	1.60	17.06	1.02	11.26	1.29	18.21	1.72
7	23	108.00	5.01	16.05	1.23	58.09	1.60	23.16	0.94	17.94	1.31	12.70	1.41	19.70	1.92
8	19	112.69	4.14	16.85	1.14	59.92	1.31	25.00	1.82	19.36	1.46	13.64	1.20	20.53	1.73
9	22	115.90	4.28	19.15	1.92	61.08	2.06	25.87	1.61	20.59	0.96	14.31	1.06	21.96	2.00
10	21	121.46	5.01	20.52	2.12	63.41	1.91	26.71	1.46	21.44	0.88	15.14	1.34	22.34	1.62
11	20	126.97	5.70	22.17	2.06	66.02	1.62	27.60	0.89	22.17	1.00	16.16	1.41	22.82	2.16
12	29	130.60	4.21	23.60	3.52	67.70	1.96	28.42	1.24	22.98	1.32	16.64	1.39	23.34	1.92
13	26	133.76	5.29	25.43	3.67	69.84	2.00	29.19	1.91	24.49	1.41	17.10	1.62	24.21	1.33
14	21	140.37	4.20	27.25	3.56	73.03	1.72	31.15	1.77	–	–	18.00	1.51	26.42	1.94
15	21	145.04	4.16	29.84	3.22	75.44	2.26	32.63	1.86	–	–	19.20	1.11	26.87	2.11
16	19	147.90	3.06	31.82	3.12	77.08	1.71	33.16	1.43	–	–	19.60	1.20	27.43	1.67
17	20	150.11	2.84	34.00	3.66	78.31	1.36	33.94	1.78	–	–	19.97	1.60	27.90	1.60
18	22	151.96	2.87	36.05	2.93	79.28	1.49	34.17	1.99	–	–	20.32	1.40	28.82	1.72

Fig. 2. Percentile stature of Kamar boys.

Fig. 3. Percentile stature of Kamar girls.

crement for girls is rather gradual and nearly uniform than the boys. The maximum age group difference between two successive age groups is 4.76 cm between 15 and 16 years in boys and 3.19 cm between 13 and 14 years in girls, indicating the adolescent spurt. Biacromial diameter for the two sexes show that the curve for boys crosses that for girls after 15 years and then continues to rise comparatively at more rapid rate than the girls up to 13 years, indicating comparatively broader shoulders of boys at this age period. After 13 years, the curve for girls rises at a rapid rate and exceeds the boys and remains at a higher level till 18

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Fig. 4. Percentile weight of Kamar boys.

Fig. 5. Percentile weight of Kamar girls.

years. The maximum increase of 2.10 cm between 14 and 15 years in boys and 1.96 cm between 13 and 14 years was observed. A comparison of distance curves of the biiliocristal diameter for the two sexes reveals that the curve for girls remains at a higher level than boys throughout the ages. Up to 9 years the curves for both the sexes run parallel. The growth in girls accelerates up to 13 years than the boys at a more rapid rate. The maximum age group difference between two successive age groups is 1.85 cm between 14 and 15 in boys which corresponds to the adolescent spurt. Upper arm circumference for both the sexes

TABLE 2
TEST OF SIGNIFICANCE OF VARIOUS ANTHROPOMETRIC MEASUREMENTS BETWEEN THE
KAMAR BOYS AND GIRLS

Age group (yrs.)	Height	Weight	Sitting height	Biacromial diameter	Biilliocristal diameter	Upper arm circum.	Calf circum.
5	1.11	–2.10*	2.99**	–0.06	–2.82**	0.34	1.04
6	0.73	–0.69	1.99	1.14	–2.37*	0.90	0.15
7	0.29	–0.25	1.39	6.21**	–1.69	2.41*	0.78
8	1.16	0.50	2.98**	2.37*	–1.89	3.23**	2.82**
9	3.07**	0.19	5.23**	2.89**	–2.48*	2.92**	0.62
10	3.90**	–0.64	5.27**	2.93**	–3.83**	2.44*	3.85**
11	1.61	0.68	2.92**	3.45**	–2.88**	1.99	4.27**
12	1.93	1.41	1.35	1.21	–3.72**	3.93**	5.50**
13	2.37*	0.28	0.89	0.63	–7.06**	3.11**	6.19**
14	0.12	–0.33	–2.71**	–2.18*	–	2.88**	1.50
15	–0.23*	1.24	–2.67**	–0.53	–	2.79**	2.76**
16	3.38**	2.69*	1.55	–0.20	–	5.86**	5.63**
17	5.86**	3.58**	5.06**	0.11	–	4.23**	6.43**
18	5.76**	5.84**	4.39**	0.70	–	4.20**	5.10**

* p <0.05, ** p<0.01

show that the curve for boys remains at higher level than girls through out the age period. The growth in girls is more gradual and smoother than in boys up to 10 years, while this trend is observed in boys from 9 to 15 years. After 15 years the growth in boys accelerates rapidly at a more rapid rate till 18 years. The maximum age group difference between two successive age groups is 1.78 cm between 15 and 16 years in boys and 1.20 cm between 14 and 15 years in girls, indicating adolescent spurt. The calf circumference runs parallel up to 7 years. After 9 years the acceleration of growth in boys is more rapid than in girls, except at 14 and 15 years. The maximum age group difference of calf circumference between two successive age groups is 2.33 cm between 15 and 16 in boys and 2.21 cm between 13 and 14 in girls.

The difference in mean height, weight, sitting height, biacromial diameter, biilliocristal diameter, upper arm circumference and calf circumference between the Kamar boys and girls is shown in Table 2. Boys are significantly taller than the girls at 13 years (p<0.05) and 9, 10 and 16 onwards (p<0.01). In case of weight, girls are significantly heavier than boys at 5 years, while boys are significantly heavier than girls at 16 and 18 years of age. The boys have significantly higher sitting height in most of the ages at 5, 8, 9, 10, 11, 17 and 18 (p<0.01) than the girls. The girls on the other hand, has significantly higher sitting height in the 14 and 15 (p<0.01) years ages than the boys.

The Kamar boys have significantly higher biacromial diameter in the 7 to 11 years than the girls. The girls, on the other hand, have significantly higher biacromial diameter (p<0.05) than the boys in the 14 years. The Kamar girls were found to have higher biilliocristal diameter at age 5 (p<0.01), 6 and 9 (p <0.05) and 10, 11, 12 and 13 (p <0.01) years than the boys.

In case of the upper arm circumference, the boys have significantly higher value at 7, 8, 9, 10, 12 and 13 to 18 years ages than the girls. The calf circumference also reveals similar results,

TABLE 3

MEAN AND STANDARD DEVIATION FOR ANTHROPOMETRIC MEASUREMENTS OF KAMAR BOYS AND GIRLS BY AGE

Age group (yrs.)	N	Head length (cm)		Head breadth (cm)		Bizyg. diameter (cm)		Bigonial diameter (cm)		Morph. face height (cm)		Subscapular skinfold (cm)		Triceps skinfold (cm)	
		X	SD	X	SD	X	SD	X	SD	X	SD	X	SD	X	SD
Boys															
5	40	14.47	0.86	12.24	0.57	10.16	0.71	8.00	0.60	8.40	0.74	4.13	0.81	3.68	1.07
6	23	14.96	0.71	12.54	0.61	10.21	0.66	8.29	0.36	8.54	0.63	3.87	0.68	4.96	1.18
7	23	15.62	0.67	12.80	0.70	10.31	0.59	8.61	0.41	8.69	0.49	4.43	0.72	4.61	0.85
8	22	16.02	0.61	12.89	0.52	10.62	0.46	8.79	0.36	8.77	0.50	4.94	0.90	4.83	1.20
9	25	16.35	0.52	12.92	0.62	11.21	0.59	8.96	0.47	8.96	0.42	4.80	1.20	5.00	1.28
10	24	16.86	0.54	12.99	0.56	11.53	0.63	9.10	0.50	9.07	0.41	6.00	0.65	3.79	1.00
11	20	17.20	0.70	13.11	0.50	11.69	0.46	9.19	0.61	9.17	0.57	5.31	0.46	4.69	1.60
12	26	17.42	0.32	13.26	0.47	11.76	0.79	9.27	0.42	9.26	0.60	5.42	0.62	4.11	1.43
13	23	17.63	0.39	13.42	0.71	11.96	0.56	9.36	0.37	9.42	0.52	5.60	0.62	5.00	0.96
14	29	17.96	0.46	13.63	0.61	12.16	0.60	9.77	0.55	9.57	0.40	5.16	1.00	6.12	2.14
15	24	18.67	1.01	13.96	1.01	12.83	0.74	9.86	0.41	10.05	0.71	4.64	1.10	5.18	1.39
16	22	18.78	0.72	14.06	0.62	12.96	0.49	9.93	0.62	10.26	0.43	3.81	0.59	5.61	1.64
17	19	18.92	0.69	14.12	0.73	13.04	0.51	9.98	0.52	10.51	0.64	5.19	0.46	4.72	1.28
18	21	19.12	0.71	14.21	0.63	13.16	0.59	10.12	0.62	10.94	0.63	5.62	0.82	5.23	0.86
Girls															
5	31	14.31	0.87	12.20	0.64	9.48	0.67	7.91	0.57	7.64	0.59	5.15	1.41	4.32	1.64
6	20	14.76	0.61	12.38	0.56	9.96	0.54	8.23	0.50	7.92	0.61	5.42	0.81	6.40	1.26
7	23	15.21	0.58	12.49	0.62	10.16	0.61	8.41	0.61	8.10	0.50	5.69	1.60	5.71	2.09
8	19	15.79	0.91	12.60	0.71	10.51	0.69	8.66	0.42	8.21	0.61	5.88	0.62	5.84	1.09
9	22	16.21	0.79	12.73	0.57	10.96	0.61	8.89	0.58	8.49	0.52	6.09	0.92	4.65	1.63
10	21	16.72	0.75	12.82	0.61	11.36	0.59	9.01	0.31	8.59	0.61	4.88	1.08	6.49	1.62
11	20	16.88	0.69	12.90	0.57	11.57	0.34	9.17	0.42	8.65	0.31	4.96	1.01	7.20	1.90
12	29	17.19	0.70	13.37	0.46	11.89	0.51	9.28	0.53	9.06	0.36	3.90	0.59	6.34	2.11
13	26	17.44	0.59	13.53	0.56	11.99	0.49	9.64	0.61	9.28	0.61	6.32	0.81	6.00	1.74
14	21	18.10	0.96	13.77	0.53	12.54	0.63	9.73	0.59	9.44	0.71	5.61	1.75	5.31	1.52
15	21	18.42	0.76	13.83	0.42	12.71	0.32	9.84	0.40	9.57	0.61	5.00	2.02	4.92	0.89
16	19	18.50	0.69	13.89	0.62	12.80	0.31	9.92	0.93	9.71	0.56	5.43	0.94	5.43	1.70
17	20	18.61	0.76	13.93	0.59	12.91	0.43	10.00	0.32	9.94	0.47	6.89	0.88	6.08	1.00
18	22	18.66	0.50	14.04	0.60	12.99	0.48	10.10	0.60	10.12	1.02	5.71	1.21	5.94	1.41

TABLE 4

TEST OF SIGNIFICANCE OF VARIOUS ANTHROPOMETRIC MEASUREMENTS BETWEEN THE
KAMAR BOYS AND GIRLS

Age (yrs.)	Head length	Head breadth	Bizyg. diameter	Bigonial diameter	Morph. face ht.	Subscap. skinfold	Triceps skinfold
5	0.75	0.27	4.18**	0.64	4.67**	–3.47**	–1.86
6	0.97	0.87	1.35	0.44	3.24**	–6.80**	–3.76**
7	2.22**	1.56	0.85	1.26	3.97**	–3.39**	–2.31*
8	0.93	1.43	0.58	1.01	3.14**	–3.76**	–2.74*
9	0.69	1.07	1.41	0.57	3.45**	–4.13**	0.80
10	0.69	0.92	0.92	0.74	2.98**	4.10**	–6.48**
11	1.41	1.23	0.94	0.12	3.52**	1.39	–4.42**
12	1.61	–0.86	–0.69	0.08	1.44	9.34**	–4.51**
13	1.40	–0.59	0.20	–1.94	0.86	–3.49**	–2.53*
14	–1.22	–0.86	–2.13*	0.24	0.74	–1.04	1.54
15	0.61	0.13	0.72	0.17	2.33*	–0.71	0.74
16	1.24	0.86	1.23	0.04	3.48**	–6.34**	0.33
17	1.33	0.89	0.83	–0.14	3.06**	–7.45**	–3.60**
18	2.37*	0.89	1.04	0.10	3.14**	–0.38	–1.95

* $p < 0.05$, ** $p < 0.01$

TABLE 5

PERIOD OF OCCURRENCE OF ADOLESCENT SPURT AS INDICATED BY »HPV« IN DIFFERENT
BODY MEASUREMENTS AMONG THE KAMARS OF CHHATTISGARH

Measurements	Boys adolescent spurt		Girls adolescent spurt	
	Age group	HPV	Age group	HPV
Body weight	14–15	4.06 kg	14–15	2.59 kg
Height	15–16	7.12 cm	13–14	6.61 cm
Sitting height	15–16	4.76 cm	13–14	3.19 cm
Biacromial diameter	14–15	2.10 cm	13–14	1.96 cm
Biiliocristal diameter	14–15	1.85 cm	–	–
Upper arm circumference	15–16	1.78 cm	14–15	1.20 cm
Calf circumference	15–16	2.33 cm	13–14	2.21 cm
Head length	14–15	0.71 cm	13–14	0.66 cm
Head breadth	14–15	0.33 cm	11–12	0.47 cm
Bizygomatic diameter	14–15	0.67 cm	13–14	0.55 cm
Bigonial diameter	13–14	0.41 cm	12–13	1.94 cm
Morphological face height	14–15	0.48 cm	11–12	0.41 cm
Nose height	14–15	0.22 cm	11–12	0.20 cm
Nose breadth	14–15	0.14 cm	13–14	0.11 cm
Triceps skinfold	13–14	1.12 cm	9–10	1.84 cm
Subscapular skinfold	16–17	1.38 cm	16–17	1.46 cm

HPV = Highest peak velocity

i.e. the boys have greater value at 8 , 10 , 11 , 12 , 13 and 15 onwards than the girls.

The head length, head breadth, bizygomatic diameter, bigonial diameter, morphological facial height and skinfold thickness of subscapular and triceps of Kamar boys and girls is shown in Table 3. The distance curve for head length for the two sexes reveal that the curve for the boys remain at a higher level than the girls from the 15 years to 13 years.

TABLE 6
COMPARISON OF WEIGHT OF KAMAR BOYS AND GIRLS WITH OTHER INDIAN STUDIES

Age (yrs.)	A Present study		B Bison-Horn Maria (Mitra & Verma, 1987)		t-test (A and B)	C Indian (rural) (ICMR, 1972)		t-test (A and C)
	N	X	N	X		N	X	
Boys								
5	40	10.50	21	15.40	6.07**	1364	14.40	14.10**
6	23	13.10	17	16.20	3.99**	1513	15.90	5.77**
7	23	15.92	21	17.70	2.62**	1510	17.60	3.67**
8	22	17.15	31	18.60	2.28*	1610	19.30	4.00**
9	25	19.30	20	21.85	3.16**	1497	21.10	2.78**
10	24	20.04	22	22.86	2.85**	1668	23.10	5.20**
11	20	22.80	25	26.16	2.49*	1572	25.10	2.88**
12	26	24.85	27	28.82	3.14**	1605	27.80	4.82**
13	23	25.70	35	29.94	3.87**	1393	31.00	8.03**
14	29	26.94	22	32.00	2.91**	1216	33.70	12.46**
15	24	31.00	25	35.58	3.27**	1086	37.10	9.63**
16	22	34.10	25	39.73	4.05**	971	41.20	14.56**
17	19	37.23	17	45.00	4.87**	812	43.90	16.58**
18	21	40.87	–	–	–	885	45.80	8.67**
Girls								
5	31	11.17	24	15.37	4.40**	1190	13.90	14.85**
6	20	13.15	20	16.17	6.67**	1142	15.40	6.71**
7	23	16.05	21	16.74	1.52	1367	17.20	4.23**
8	19	16.85	21	19.17	4.65**	1327	18.80	6.85**
9	22	19.15	24	21.53	2.91**	1284	20.80	3.82**
10	21	20.52	21	22.73	2.43*	1254	22.50	4.08**
11	20	22.17	21	24.81	2.28*	984	24.50	4.72**
12	29	23.60	26	31.11	5.74**	967	27.30	5.41**
13	26	25.43	22	32.52	5.53**	808	30.60	6.84**
14	21	27.25	24	33.31	5.56**	656	33.50	7.53**
15	21	29.84	17	36.44	3.76**	598	35.40	7.20**
16	19	31.82	15	37.20	4.61**	509	37.90	7.85**
17	20	34.00	16	41.31	5.76**	440	39.30	6.01**
18	22	36.05	–	–	–	365	39.60ž	4.70**

*p <0.05, ** p<0.01

During this period both curves run parallel to each other, but the increment in boys is uniform than the girls. After 10 years the head length in girls grows at a more rapid rate, while the acceleration in boys slows down. The curve for girls crosses the boys and remains at a higher level at 14 years of age. After 14 years the head length of boys grows rapidly and cross the curve for girls and remains at a higher level till 18 years. The age group difference between two successive age

groups is 0.71 cm between 14 and 15 in boys and 0.66 cm between 13 and 14 in girls. The distance curves of head breadth for the two sexes show that the curve for the boys remains at a higher level than for girls from 5 years to 11 years. During this period the increment in girls is steady and uniform. After 11 years the curve for girls shows increase in head circumference.

The bizygomatic diameter for the Kamar boys and girls indicates that the curve for boys remains at a higher level than that for girls from 5 to 11 years. After 11 years the curve for girls increases and crosses that for boys. At 13 years it touches the curve for boys and then increases. After 14 years the curve for boys increases rapidly and crosses that for girls and remains at a higher level till 18 years. The maximum age group difference between two successive ages in boys is 0.67 cm between 14 and 15 years and 0.55 cm between 13 and 14 years in girls, corresponding to the adolescent growth spurt. The bigonial diameter curves of the two sexes reveals that the curve for boys remains at a higher level than the girls from 5 to 11 years. After 12 years both the curves increase rapidly and after 14 years both curves run in an intertwined manner up to 18 years. The maximum age group difference is 0.41 cm in boys in the 13 and 14 years and 0.36 cm in girls between 12 and 13 years in girls.

The curve for the morphological face height remains at a higher level among the boys than that for girls throughout the growth period. After 14 years the acceleration of growth is more rapid in boys than for girls. The maximum age group difference in the morphological facial height in case of boys is 0.48 cm between 14 to 15 years and 0.41 cm in girls between 11 and 12 years.

The subscapular skinfold thickness shows fluctuating growth pattern, partic-ularly in the latter phase of growth in both the sexes. The subscapular skinfold for girls increases regularly from 5 to 9 years and shows variations of 2.19 mm in boys and 2.99 mm in girls. The maximum age group difference between two successive age groups is 1.38 mm and 2.02mm between 16 and 17 years in boys and girls respectively. The triceps skinfold thickness doesn't show any regular trend of growth in both the sexes. The maximum age group difference between two successive age groups is 1.12 mm between 9 and 10 years in girls.

The difference in mean head length, head breadth, bizygomatic diameter, bigonial diameter, morphological height and skinfold thickness of subscapular and triceps between the Kamar boys and girls are shown in Table 4. Boys were found to have significantly higher head length than the girls at 7 and 18 years. In case of bizygomatic diameter, the boys have significantly higher value in the 5 years and the girls have higher value in the 14 years. The Kamar boys have significantly higher morphological facial height in ages from 5 to 11 and from 15 to 18 than girls. In case of the subscapular skinfold thickness, the girls have significantly higher value in the 5 to 10 , 12 , 13 , 16 and 17 years than the boys. Triceps skinfold also shows similar results i.e. the girls have significantly higher value in the 6 to 8 , 10 to 13 and 17 years than the boys.

Height

Figures 2 and 3 shows a steady increase of height percentile values from one age to the next. The comparison of 3rd through 97th indicates that about 95% of the 5-year-old boys and girls have attained a height between 89.73 / 90.07 cm and 107.87 / 104.15 cm. At 18 years of age the height of about 95% of the boys and girls ranges between 151.45 / 146.65 cm and 163.57 / 157.26 cm.

TABLE 7
COMPARISON OF THE HEIGHT OF KAMAR BOYS AND GIRLS WITH OTHER INDIAN STUDIES

Age (yrs.)	A Present study		B Bison-Horn Maria (Mitra & Verma, 1987)		t-test (A and B)	C Indian (rural) (ICMR, 1972)		t-test (A and C)
	N	X	N	X		N	X	
Boys								
5	40	98.80	21	108.60	7.62**	1364	101.10	2.92**
6	23	105.00	17	113.20	4.63**	1513	107.40	2.14**
7	23	108.50	21	116.70	4.17**	1510	113.20	3.37**
8	22	114.71	31	122.80	4.52**	1610	118.60	2.68**
9	25	120.63	20	128.67	4.30**	1497	123.00	1.90
10	24	127.16	22	131.60	2.47**	1668	128.10	0.98
11	20	129.41	25	136.02	3.30**	1572	132.40	2.96**
12	26	132.55	27	141.64	5.23**	1605	137.40	7.34**
13	23	137.16	35	146.44	5.82**	1393	143.50	6.22**
14	29	140.52	22	148.97	3.93**	1216	148.30	8.94**
15	24	144.70	25	154.97	4.96**	1086	153.10	6.99**
16	22	151.82	25	158.58	3.81**	971	157.50	5.96**
17	19	155.93	17	159.96	1.61	812	160.40	5.61**
18	21	157.51	–	–	–	885	162.00	5.89**
Girls								
5	31	97.61	24	108.81	9.49**	1190	99.50	2.46*
6	20	103.74	20	113.15	4.93**	1142	106.30	1.91
7	23	108.00	21	117.55	4.62**	1367	111.90	3.58**
8	19	112.69	21	124.27	6.68**	1327	117.20	4.51**
9	22	115.90	24	129.23	8.01**	1284	122.20	6.65**
10	21	121.46	21	131.20	5.05**	1254	126.70	4.60**
11	20	126.97	21	136.00	3.83**	984	131.20	3.18**
12	29	130.60	26	144.22	7.79**	967	136.70	7.33**
13	26	133.76	22	145.57	7.40**	808	141.50	7.24**
14	21	140.37	24	147.34	4.05**	656	145.30	5.13**
15	21	145.04	17	149.21	2.38*	598	147.70	2.74**
16	19	147.90	15	152.15	2.22*	509	149.60	2.22*
17	20	150.11	16	153.22	1.56	440	150.10	0.01
18	22	151.96	–	–	–	365	150.00	2.79**

*p <0.05, ** p<0.01

Weight

The comparison between the 3rd and 97th percentile of 5.0 years boys and girls (Figures 4 and 5) show that about 95% of the boys and girls weigh between 7.32 / 8.36 – 13.68 / 11.97. The same percentage of 16 years old boys and girls ranges between 36.98 / 31.18–44.76 / 42.12 kg. It is evident from the percentile extremes that the increase in the third percentile between 5.0–18.0 years is 29.66 / 22.82 kg while during the same age period the in-crease in the 97th percentile is 31.08 / 30.15 kg. This indicates a gradual widening of the range of variation with the increase of age from 5.0–18.0 years.

The detection of Highest Peak Velocity (HPV) (Table 5) corresponding to the occurrence of adolescent spurt among the Kamars has been observed between 11–14 years in girls and 13–15 years in boys. Among the boys out of 16 measurements 9 body measures obtained the HPV between 14–15 years indicating an adoles-

cent spurt in these measurements. 4 body measurements indicated HPV in the 15–16 years and 2 measurements 13–14 and one in the 16 –17 years. In case of the girls, maximum HPV was observed in 7 measurements out of 16, in the 13 –14 years. 3 measurements indicated HPV in the 11–12 years. Thus the adolescent period is extended between 11–14 years in girls and 14–16 years in boys, which indicates that the adolescent growth spurt period lasts for about two to three years. It occurs two years earlier in girls than in boys.

Comparisons

The height and weight of the present study on Kamar girls and boys were compared with Bison-Horn- Maria, the most populous tribe of Chattisgarh and with the official data for all India (ICMR, 1972)[27].

The weight of the Kamar boys (Table 6), when compared with the Bison-Horn -Maria tribe[28] and Indian rural boys, were found to be lower in all the ages and the difference is significant. In case of the girls the same trend was observed except in 7 years, where the difference in weight with the Bison-Horn-Maria is non-significant.

The height of the Kamar boys (Table 7) is lower than the Bison-Horn-Maria tribe and rural Indian boys. The difference in height with Bison-Horn-Maria tribe is non-significant in the 18 years. Non-significant difference was also observed in 9 and 10 years with the Indian rural boys. All other age groups show significant difference in height with the Bison-Horn-Maria and Indian rural boys.

Among the girls, non-significant difference in height was observed in the 17 when compared with Bison-Horn-Maria. Non-significant difference was also observed in the 6 and 7 years when the height of the Kamar girls was compared with the Indian rural girls. In all other age groups, the difference is significant.

Discussion

Analysis of various body dimensions and nature of the distance curves reveal that the mean values of the different body measurements were representing more or less increasing trend with advancement in age. The rate of increase was however, not uniform in all the age groups and in all the characters. Further it was noted from the distance curves that up to the 11 years of age, Kamar boys in majority of the measure remain at a higher level than girls, but after 11 years of age such uniformity was not maintained.

It was also observed that most of the body measure show age group difference which extended between 11–14 years in girls and 14–16 years in boys which suggests that adolescent period last for about two to three years and it occurred generally two years earlier in girls than boys. The age group difference at many age levels was close to »HPV« for various body measurements indicating a high degree of multimodality spurt. It can be attributed to poor socio-economic condition leading to poor nutrition among the Kamars.

It was also observed from the growth gradient values of various measures that more than 90 percent of total growth took place by 14 years, except in body weight, total arm length and upper arm circumference. In general, girls were ahead in maturation over boys. Sex-differences among Kamar children were highly pronounced for stature, sitting height, total arm length, total lower extremity length, biliocristal diameter, upper arm circumference, antero-posterior chest, morphological face height, triceps skinfold and subscapular skinfold. Considering all the body measurements it was observed that the sex difference was pronounced at 5 years of age, a slight decline was observed up to 8 years, where the sex-difference were least. The sex-difference was

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also remarkable at 10 years. From 12 years onwards the sex-difference starts increasing and reaches their maximum at 17 years. The girls were found to have significantly higher values for biilliocristal diameter and skinfold thickness of subscapular and triceps than boys. In most of the other anthropometric measurements, the boys have greater value.

From the percentile values it can be concluded that majority of Kamar children fall below 3rd percentile range, representing severely undernourished group and 3rd and 25th percentile range indicating undernourished group. The growth pattern of the Kamar boys and girls is slower than the Bison-Horn-Maria tribe and all Indian children. There may be several socio-cultural and environmental factors associated with this phenomenon. The factors responsible for the same are to be identified and proper intervention strategies are to be implemented.

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P. Bharati

Anthropology and Human Genetics Unit, Indian Statistical Institute, 203 B.T. Road, Calcutta – 700 108, India

OBRAZAC RASTA KOD KAMARA – PRIMITIVNOG PLEMENA IZ CHHATTISGARHA, INDIJA

SAŽETAK

Transverzalna studija rasta i razvoja obuhvatila je 655 djece (341 dječak i 314 djevojčica, dobi od 5 do 18 godina) plemena Kamar u oblasti Raipur u Chhattisgarhu, Indija. Cilj studije bio je istražiti uzorak rasta djece primitivnog plemena Kamar iz Chhattisgarha, Indija, te usporediti nalaze s drugim indijskim plemenima, te sa službenim (ICMR) podacima o rastu djece u Indiji. Antropometrija je uključivala mjerenje visine tijela, tjelesne mase, sjedeće visine, biakromijalnog raspona, biiliokristalnog raspona, opsega nadlaktice, potkoljenice, te mjerenje kožnog nabora tricepsa i subskapularnog kožnog nabora. Sva su antropometrijska mjerenja, s izuzetkom kožnih nabora, pokazala porast s dobi u oba spola. Međutim, usporedba visine i tjelesne mase dječaka i djevojčica Kamara s djecom iz drugih plemena te s podacima o prosječnoj veličini djece u Indiji pokazala je kako su djeca Kamara, oba spola, značajno manje tjelesne mase i visine u gotovo svim dobnim skupinama. Dječaci Kamara pokazali su veće antropometrijske vrijednosti od djevojčica u gotovo svim mjerama osim u biiliokristalnom rasponu i mjerenim kožnim naborima. Nizak socio-ekonomski status ovog primitivnog plemena sigurno je jedan od razloga primijećenog zaostajanja u rastu. Međutim, bilo koji temeljni zaključak nije moguće donijeti, kao što nije moguće niti odrediti politiku i planirati intervenciju, bez da se provede longitudinalno istraživanje kojim bi gornje pretpostavke dobile svoju potvrdu.