

A Study of Growth in Physical and Physiological Variables Among Koya Dora Tribal Boys of Andhra Pradesh

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ABSTRACT A cross-sectional study was undertaken among Koya Dora tribal boys in rural schools situated in the Rampachodavaram ITDA of East Godavari district of Andhra Pradesh (South India) during February to March, 1995. The sample consisted of 286 healthy boys aged 6+ to 18+ years. In this paper data on height, body weight, upper arm, calf, chest and head circumferences and skinfolds at biceps, triceps, subscapular, medial calf, forearm, supra-iliac, abdominal and anterior thigh sites are presented, including patterns of change in these physical traits with advancing age. It has been observed that there is an increase in all the dimensions with increase in age except skinfolds. Analysis of data reveal that all the dimensions exhibited the maximum mean annual increments between 13 and 14 years. These boys are shorter and heavier than the National Standards (ICMR, 1984). The findings of the study can be used as a reference materials for Koya Dora tribal boys.

INTRODUCTION

Several studies of physical growth in tribal population have observed that with the increase in age, there is a tendency for increase in all the physical traits except skinfolds (Singh, 1980; ICMR, 1984; Jhingon and Nath, 1985; Reddy, 1989; Nath et al., 1991; Kapoor and Kappor, 1991; Dharma Rao and Busi, 1994, 1995). Investigations carried out under different conditions by various research groups have shown positive correlation between blood pressure and age (Reddy et al., 1991), heredity (Nirmala and Chengal Reddy 1992), body composition (Sambasiva Rao, 1983), and Social status (Srivastava et al., 1977) and sex (Celine and Mathur, 1979). However, in the Rampachodavaram ITDA of East Godavari region there is dearth of published material related to growth and development of tribal boys and the Indian Council of Medical Research (ICMR 1984) in their nation

wide growth survey did not include the Koya Dora tribal boys of East Godavari district. A cross-sectional growth study of Koya Dora tribal boys was therefore undertaken in February to March 1995 covering 16 measurements. Many researchers have tried to enumerate the trends of growth under different situations all over the world, but little attention has been paid towards Koya Dora tribal boys. In the present study an attempt has been made to study the effect of age from 6+ through 18+ years on sixteen body measurements, throughout the growth period and also to study the adolescent growth spurt, and aimed to understand the association between blood pressure and pulse rate with other skinfold thickness and its implications for health of the population and to compare these boys with other tribal boys of India in order to find out the population differences of physical growth. The present paper reports the sixteen body measurements derived on the Koya Dora tribal boys of Rampachodavaram ITDA of East Godavari district of Andhra Pradesh.

MATERIAL AND METHODS

The Koyas are mainly inhabiting the hilly areas of East Godavari, West Godavari, Khammam and Warangal districts and are sparsely found in Adilabad and Karimnagar districts. The Koya population of the State as per 1981 census is 3,62,341 constituting 11.41% of the total Scheduled Tribe population. Koyas of Adilabad, Karimnagar, Warangal and some parts of East Godavari have forgotten their own dialect and adopted Telugu as their mother tongue. Koyas call themselves as Koitur in their dialect like Gonds. Marriage among Koyas

takes place after puberty and cross cousin marriages are encouraged. The following four types of acquiring spouses are in vogue among Koyas: 1. Marriage by negotiation. (Pillatini Talipipal Tungatam). 2. Marriage by Love and Elopement (Eruvuru Istamasi Kaliathoru). 3. Marriage by capture (Poyi thar). 4. Marriage by services. Marriage by negotiation is becoming more popular in modern times.

Monogamy is the general practice among Koyas though a few rich people and landlords may marry more than one woman. Levirate marriages are also in vogue. Descent is through male line only. Though Koya woman has got equal status with men in all social, religious activities and more important in economic sphere, she is not entitled to inherit property. The Koyas are mainly settled cultivators. They grow Jowar, Chodi, Bajra and other millets. As per 1971 census reports, 48.08% of the working population are cultivators and 47.02% are agricultural labourers. But as per 1961 census, cultivators constituted 63.91% and agricultural labourers 31.23% to the total working force among Koyas. This trend shows that many of the cultivators have lost their lands and become labourers. The material of the present study comprises of cross-sectional data collected on 286 Koya Dora tribal boys drawn from 6 ITDA schools of Rampachodavaram, East Godavari districts of Andhra Pradesh during the months of February to March 1995. The age of these subjects range from 6+ to 18+ years.

The exact date of birth was collected for every subject either from the concerned school registers or from birth records of the Panchayats. The doubtful cases were excluded from the present sample. All the subjects between age 6.00 to 6.99 years were in 6+ age group and so on upto 18+ years is calculated after Eveleth and Tanner (1976). All bilaterally represented measurements were taken on the left. The measurements were taken after Weiner and Lourie (1969).

The blood pressure was measured on the subject using Diamond B.P. apparatus, Deluxe,

Pune, by one of the authors (B.D. Rao). The procedure of the measurement of blood pressure was thoroughly practised as per the manual of the instrument for a week in the presence of a medical doctor of the University Health Centre and the readings were checked each time with that of the doctor till the readings were consistent. Thus after standardisation of the technique, the blood pressure readings were taken thrice on each subject giving 2 minutes gap in between the measurements. The readings of the electronic instrument were checked periodically. *i.e.* once in a week with that of the readings obtained through a mercury sphygmomanometer, to ascertain the former. Blood pressure measurement of the subject were taken in the morning. *i.e.*, before 10 A.M. in seated position at their home environment. The subjects were asked to relax on a stool or flat raised platform for about 10 minutes, resting his left arm on a table or on a flat place at heart level.

The values for a growth velocity of a measurement are easily obtained by subtracting for that variable, say at age 'A' from its mean value at age (A+1 year) is as below.

$$\text{Velocity (V)} = \bar{X}(A+1) - \bar{X}.A.$$

RESULTS AND DISCUSSIONS

Mean values and standard deviations for each anthropometric measurement for each individual year of age are depicted in table 1 and 2. It can be inferred from the tables that the mean values for all of these measurements increase with advancement of age with a few fluctuating discrepancies of a minor nature because the data are cross-sectional. From the table 2 it is clear that all the eight skinfold characters show non normal distributions at several ages.

In Koya Dora tribal boys a steady increase in stature is noticed upto the age of 13 years. The mean stature of 6 years age group is about 113.05 cm and one and half times by 18 years. The highest annual gain (+8.78 cm per year) has occurred between 13 and 14 years while the

Table 1: Mean and standard deviation of six body measurements among Koya Dora tribal boys of Andhra Pradesh

Age (in years)	N	Body weight		Stature		Upper arm Circum- ference		Calf Circum- ference		Chest Circum- ference		Head Circum- ference	
		\bar{X}	SD	\bar{X}	SD	\bar{X}	SD	\bar{X}	SD	\bar{X}	SD	\bar{X}	SD
6+	11	18.63	3.66	113.05	4.81	14.68	0.64	20.95	1.05	54.22	3.31	47.85	0.54
7+	17	21.35	1.80	121.97	3.79	15.21	0.76	22.29	0.84	55.15	3.00	49.09	1.31
8+	13	24.46	3.43	126.81	6.87	15.81	0.80	23.63	1.65	57.34	3.26	49.44	1.28
9+	10	25.70	4.66	130.95	8.01	16.05	0.96	24.19	1.68	58.90	2.66	49.60	1.14
10+	21	25.57	3.90	129.73	7.46	16.27	0.76	23.55	1.39	60.24	2.45	49.46	1.29
11+	28	28.25	1.69	136.72	4.62	16.57	0.83	24.67	1.02	62.95	3.20	49.99	1.28
12+	33	32.33	4.17	142.73	6.20	17.79	1.13	26.18	1.42	64.51	4.56	50.55	1.46
13+	41	35.09	4.06	146.40	4.89	18.21	1.60	26.86	1.75	68.51	4.46	51.06	1.87
14+	36	40.83	4.86	155.18	4.86	19.51	1.53	28.44	1.81	71.35	4.19	51.22	1.17
15+	29	44.27	5.66	157.58	6.70	20.60	1.86	29.27	2.28	72.84	3.30	51.67	1.21
16+	19	46.31	6.49	160.90	5.51	21.16	1.67	29.98	1.99	74.24	4.34	51.78	1.43
17+	14	48.50	5.89	160.17	7.24	21.21	0.89	30.54	1.45	77.06	3.52	52.32	1.34
18+	14	51.92	3.38	161.45	5.43	21.67	1.39	31.08	1.15	78.90	2.58	52.86	1.30

Table 2: Mean and standard deviation of eight skinfold measurements among Koya Dora tribal boys of Andhra Pradesh

Age (in years)	N	Triceps		Biceps		Subscapular		Medial calf		Supra iliac		Forearm		Abdominal		Anterior thigh	
		\bar{X}	SD	\bar{X}	SD	\bar{X}	SD	\bar{X}	SD	\bar{X}	SD	\bar{X}	SD	\bar{X}	SD	\bar{X}	SD
6+	11	6.18	1.66	3.40	0.83	4.12	0.44	7.96	1.61	3.34	0.57	3.94	0.62	3.90	0.65	7.43	2.41
7+	17	5.71	1.28	3.32	0.50	4.31	0.77	8.16	1.67	3.71	0.54	3.88	0.57	3.88	1.10	7.81	1.55
8+	13	5.83	1.54	3.30	0.55	4.27	0.83	8.36	1.96	3.96	0.74	3.87	0.55	3.98	0.88	7.85	2.04
9+	10	6.00	1.96	3.44	0.77	5.06	1.71	7.52	2.40	4.26	1.52	4.00	1.40	5.18	2.22	8.48	3.17
10+	21	6.77	1.67	3.64	0.68	5.33	0.83	8.75	1.97	4.72	1.04	4.34	0.71	4.95	1.31	9.00	1.47
11+	28	6.72	1.70	3.70	1.03	5.21	1.12	8.80	1.76	5.05	1.48	4.25	0.96	5.01	1.31	8.89	1.71
12+	33	6.74	1.63	3.63	0.64	5.74	1.15	8.80	1.96	5.59	1.38	4.29	0.78	6.01	1.25	9.19	1.73
13+	41	6.60	1.72	5.31	0.15	5.80	1.38	8.63	1.97	5.40	1.31	4.10	0.74	5.82	1.58	8.65	2.31
14+	36	6.74	1.73	3.78	0.61	6.96	1.70	9.41	1.66	6.22	1.59	4.35	1.02	6.77	1.54	9.28	1.90
15+	29	6.46	1.76	3.73	0.62	7.60	1.57	8.96	1.76	6.19	1.52	4.20	0.66	7.33	2.13	9.33	1.91
16+	19	6.78	1.76	3.84	0.73	7.98	1.54	10.28	1.57	6.23	1.40	4.40	0.50	7.62	1.28	9.76	1.80
17+	14	6.52	1.13	4.20	0.75	8.60	0.92	9.88	1.59	6.22	1.35	4.34	0.77	7.37	1.56	9.55	1.12
18+	14	6.30	1.54	4.01	1.04	8.17	1.35	8.51	1.44	6.18	1.51	3.97	0.65	7.24	1.32	9.14	1.85

maximum mean annual loss (-0.72 cm per year) is noticed between 16 and 17 years. The mean body weight of 6 years age group is about 18 kg; it is doubled by 13 years, and thrice by 18 years. The highest annual gain (+5.74 kg per year) has occurred between 13 and 14 years while the maximum mean annual loss (-0.12 kg per year) is found between 9 and 10 years. The mean upper arm circumference of 6 years age group is about 14 cm. It is one and half times by 15 years. An increment of 1 cm is noticed from 15

to 18 years. The mean calf circumference for 6 year age group is 21 cm. It was one and half times by 18 years. The maximum mean annual increase of upper arm and calf circumference (+1.30 cm and +1.58 cm per year) has occurred, respectively between 13 and 14 years. While the maximum mean annual loss of calf circumference (-0.63 cm per year) is found between 9 and 10 years.

The mean chest circumference for 6 year age group is 54 cm. It was one and half times by 18

years. The maximum mean annual increase (+2.84 cm) has occurred between 13 and 14 years. The mean head circumference for 6 years age group is 48 cm. The highest annual gain (+0.56 cm) has occurred between 11 and 12 years while the maximum mean annual loss (-0.13 cm) per year is found between 9 and 10 years, and it declines by 17 years. The mean head circumference for 6 year age group is 47.85 cm. The highest annual gain (+0.56 cm) has occurred between 11 and 12 years while the maximum mean annual loss (-0.13 cm) per year is found between 9 and 10 years, and it declines by 17 years.

Fat fold at Biceps region increase gradually with minor irregularities in the mean from 6 to 17 years; the highest annual gain (+1.68 cm) has occurred between 12 and 13 years while the maximum mean annual loss of thickness (-0.01 mm per year) is found between 7 and 8 years, and increase to 17 years and then decline. The mean triceps decreases continuously throughout 6 to 8 years; and from 9 to 18 years consistent. The highest annual gain (-0.32 mm per year) has occurred between 15 and 16 years while the maximum mean annual loss of thickness (-0.04 mm per year) is found between 10 and 11 years and declines by 16 years.

The mean subscapular skinfold at 6 years is 4.12 mm and then gradually increases with minute irregularities from 6 to 18 years. The highest annual gain (+1.16 mm per year) has occurred between 13 and 14 years while the maximum mean annual loss (-0.03 mm per year) is noticed between 7 and 8 years. The mean medial calf skinfold increases 6 to 16 years and decreases by 18 years. The highest annual gain (+0.78 mm) has attained between 13 and 14 years while the maximum mean annual loss of thickness (-0.00 mm per year) is noticed between 11 and 12 years and it declines by 18 years.

The mean forearm skinfold increases 6 to 17 years. The highest annual gain (+0.25 mm) has attained between 13 and 14 years, the maximum annual loss (-0.01 mm) is observed be-

tween 7 and 8 years, and it decreases by 18 years. The mean suprailiac skinfold at 6 years is 3.34 mm, gradually increases from 6 to 18 years (Table 2). The highest annual gain (+0.82 mm) has attained between 13 and 14 years, the maximum mean annual loss (-0.01 mm per annum) is noticed between 16 and 17 years. From table 2 it is evident that skinfold thickness increase gradually with minor irregularities in the means from 6 to 11 years reaching a peak value between 12 to 15 years. From 16 to 18 years again gradual downward trend in thickness is clearly noticed.

The mean abdominal and anterior thigh skinfolds from 6 to 18 years almost accelerating in trend. The highest annual gain of abdominal and anterior thigh skinfold is +0.95 mm and 0.63 mm respectively occurred between 13 and 14 years while the maximum mean annual loss of abdominal skinfold (-0.01 mm per year) is found between 6 and 7 years and the maximum mean annual loss of anterior thigh skinfold is (-0.10 mm) is found between 10 and 11 years.

The maximum mean annual increments or highest peak velocity of head circumference (0.56 cm) were attained between 11 and 12 years which is earlier by a year than Biceps skinfold (1.68 mm) and two years than upper arm circumference (1.30 cm). Body weight (5.74 kg), calf circumference (1.58 cm), chest circumference (2.84 cm), subscapular (1.16 mm), medial calf (0.78 mm), suprailiac (0.82 mm), forearm (0.25 mm), abdominal (0.95 mm) and anterior thigh skinfold (0.63 mm) *i.e.* (13 and 14 years). Apart from the highest peak velocity some measurements showed second highest peak velocity for the lower intensity. The highest peak velocity of stature (3.32 cm), medial calf (1.32 mm), forearm (0.20 mm), abdominal (0.29 mm) and anterior thigh (0.43 mm) between 15 and 16 years which is earlier by a year than chest circumference (2.82 cm), head circumference (0.54 cm), *i.e.* 16 and 17 years; and earlier by two years than body weight (3.42 kg), *i.e.* 17 and 18 years.

In the present study the systolic and diastol-

ic blood pressure and pulse rate is increased with increase in age with minor fluctuations. It is well known that the blood pressure is influenced by a large number of external factors. The deviations from the expected trend observed in the present study must have been due to the differences in body composition, habitual physical activity, diet, income, smoking, aging etc. (Table 3).

Table 3: Values of mean, standard deviation of blood pressure and pulse rate of Koya Dora tribal boys by age

Age (in years)	N	SBP		DBP		Pulse rate	
		\bar{X}	SD	\bar{X}	SD	\bar{X}	SD
12	31	105.87	10.70	70.64	11.23	87.22	17.75
13	41	103.14	9.96	69.17	9.52	87.95	19.06
14	36	101.61	13.15	63.33	10.69	87.44	20.30
15	29	110.48	15.96	70.48	9.69	80.48	14.24
16	19	113.15	14.45	73.68	11.64	90.73	23.49
17	14	110.14	14.64	74.28	12.83	87.57	21.65
18	14	112.14	11.88	76.28	9.24	81.71	17.50

SBP = Systolic Blood Pressure

DBP = Diastolic Blood Pressure

It will be apparent from the foregoing results that the findings among Koya Dora tribal boys reveals that they were taller and heavier, and larger upper arm and calf muscles and higher triceps and subscapular skinfolds than the findings of Singh (1980), and also shorter and heavier than findings of Jhingon and Nath (1985). These boys are shorter and heavier than the standards of ICMR (1984) and these boys were more or less similar to the findings of Wolanski (1961), Tanner et al. (1966), Sidhu (1969), Malcolm (1970), Low (1971), Johnson et al. (1975), Malhotra (1975) and Injeti (1980). Reddy (1989), Nath et al. (1991), Dharma Rao and Busi (1994, 1995). The results generated in this paper can therefore be utilised as reference material for the Koya Dora tribal boys in Rampachodavaram ITDA of East Godavari district of Andhra Pradesh. Goldstein and Tanner (1980) have recently pointed out that the findings obtained from such studies would be useful as an alternative to the growth standards.

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