

Growth Progression in Physical, Physiological and Sickle Cell Traits Among Porja Tribal Girls of Visakhapatnam District, Andhra Pradesh

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ABSTRACT A cross-sectional study was, undertaken among Porja tribal girls in ITDA schools situated in the 4 mandals viz. Paderu, Araku valley, Ananthagiri, and Munchingput of Visakhapatnam district of Andhra Pradesh during February 1996 to January 1998. The sample consisted of 288 healthy girls aged 0+ to 18+ years. In this paper data on stature, body weight, upper arm, calf, chest abdominal and head circumferences and skinfolds at triceps, biceps, subscapular, suprailiac, abdominal, anterior thigh, medial calf, fore arm sites and blood pressure, pulse rate and sickle cell trait are presented including patterns of change in these physical and physiological traits with advancement of age. It has been observed that there is progressively increase in all the dimension with advancement of age except skinfolds. But homozygous (HbSS) and heterozygous (HbAS) sickle cell anemic Porja tribal girls have decelerating growth trend when compared to Normal Porja tribal girls. Analysis of the data reveal that all the dimensions exhibited maximum mean annual increments between 11+ and 14+ years. Blood pressure and pulse rate increased with increase in age with minor fluctuations. These girls are shorter and heavier than the ICMR, 1984 observations. The findings of the study can be used as a reference material for Porja tribal girls of Visakhapatnam district.

INTRODUCTION

Most published studies of physical growth in tribal populations have revealed that with the increase in age, there is a tendency for increase in all physical traits except skinfold measurements (Jhingon and Nath, 1985; Reddy, 1989; Dharma Rao and Busi, 1994., 1995, 1996, and 1997). Blood pressure is an important indicator of cardio-vascular functioning. Blood pressure varies with age, sex, race, body weight, body fitness and several other factors (Verma, 1991; Gray and Fujoka, 1991 and Putatunda and Dhara, 1994). Investigation 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, 1991), body composition (Sambasiva Rao, 1983), social status (Srivastava et al., 1997) and sex (Celine and Mathur, 1979). Another important dimension of the variation in arterial blood pressure is the interaction with other physiometric and anthropometric variables. In India very few researches have been conducted in this field (Padmavati and Gupta, 1959; Kate and Verma, 1989; Das and Mukherjee, 1963; Gangopadhyay et al., 1988; Nirmala and Chengal Reddy, 1991; Verma 1991; Dharma Rao and Busi, 1997). However, in Paderu ITDA of Visakhapatnam region there is dearth of published material related to growth and development, blood pressure and pulse rate and sickle cell trait of Porja tribal girls and the Indian Council of Medical Research (ICMR, 1984) in their nation wide growth survey did not include the Porja tribal girls of Visakhapatnam district. A cross-sectional growth study of Porja tribal girls was therefore undertaken in February 1996 to January 1999 covering 18 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 primitive tribal groups. *i.e.* Porja girls. In the present study an attempt has been made to study the effect of age from 0+ through 18+ years on 18 body measurements, throughout the growth period and also to study the adolescent growth spurt, and is aimed to, understand the association between blood pressure and pulse rate and sickle cell trait with height, body weight, circumferences and other skinfold

thickness and its implications for health of the population and to compare these girls with other tribal girls of India in order to find out the population differences of physical and physiological traits. In the present paper reports the 18 body measurements taken on the Porja tribal girls of Paderu, Araku valley, Ananthagiri and Munchingput mandals of Visakhapatnam district of Andhra Pradesh have been discussed.

MATERIAL AND METHODS

Porjas are predominantly found in scheduled areas of Visakhapatnam district and they are sparsely settled in Srikakulam and East Godavari Districts. According to 1981 census, the population of the Porja in Visakhapatnam district is 13,418 and in Andhra Pradesh is 16,374. This tribe is divided into the following endogamous subgroups. 1. Parangi Porja, 2. Didoi Porja, 3. Jhodia Porja, 4. Gadaba Porja, 5. Pangu Porja, 6. Kollai Porja, and 7. Bonda Porja. Few sections of Gadabas call themselves as Porjas. Most of the subdivisions speak their own dialects. Each of the subdivisions of Porja community are further divided into several exogamous clans such as *Killo* (tiger), *Korra* (sun), *Samardi* (bear), *Onthala* (snake), *Pangi* (kite), *Gollori* (monkey), and *Kimudu* (bear). The family and marriage patterns of Porjas are identical with other tribal groups living in Araku and Jolaput region.

The traditional sacred friendship is also prevalent among Porjas. These duminitive associations are formed irrespective of caste, creed and sex and these associations are continued from generation to generation. The main objective of this friendship is to promote the well being of each other. Sometimes the unmarried boys and girls enter into this sacred friendship and they can marry if they belongs to marriageable clans. Porjas especially Jhodia Porjas perform a folk dance called Jhodianat or Jellinat or Nandinat.

The Porjas largely subsist by shifting cultivation in view of their extreme backwardness and low literacy rate. Government of India recognized Bondo Porja, Khond Porja, Parangi Porja as primitive tribal groups. But these subdivisions are not exhaustive. There are some subgroup like Jhodia Porjas, Pengu Porjas who

are extremely backward and primitive. The literacy levels among Porjas are extremely low. As per 1981 census reports the literacy percentage is only 2.88. With regard to female literacy it is only 0.70 per cent and it is the lowest percentage among females of all the tribal groups.

The Porjas eat rice and *korra*. They prepare *gruel* (Ambali) with *sama*, *chodi* and consume it after their meal. They eat vegetables like tomatoes, pumpkins and beans. In summer season, they store the mango kernel powder and make use of it in rainy season. They eat beef and the flesh of almost all the domesticated wild animals including bears. They also eat all edible roots, tubers and some of the leaves available in the forest besides various minor forest produce.

The principal crops grown by Porjas are paddy, jowar, ragi, korra, sama etc. They also grow commercial crops like niger, ginger, chillies, sugarcane, and turmeric on small scale. They also grow vegetables like tomatoes, pumpkins, cucumbers and beans. They grow hill red gram in their Podu fields.

The material of the present study was based on a cross-sectional data collected on 288 Porja tribal girls drawn from 8 school from 4 selected mandals, viz., Paderu, Araku valley, Ananthagiri and Munchingput of Visakhapatnam district of Andhra Pradesh during the months of February 1996 to January 1999. The age of these subjects ranges from 0+ 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 0.00 to 0.99 years were in 0+ age group and 1.00 to 1.99 years were in 1+ age group and so on upto 18+ years is calculated after Eveleth and Tanner (1979). The measurements on each individual were taken during the working hours of the schools with minimum clothing. All bilaterally represented measurements were taken on the left. The anthropometric measurements were taken after Weiner and Lourie (1969). The weight of each individuals as recorded in kilograms using a portable weighing machine. The measurements were taken by the first author.

Blood pressure were determined on the subject by the method described by Rose et al.

(1982) using the sphygmomanometer with standard cuff and the stethoscope. The measurements were thoroughly practised for a week in the presence of a cardiologist of the local Government Hospital and the reading of the investigator was checked each time with that of the doctor till the readings were consistent. After standardizing the method the investigator started taking the blood pressure of subjects.

Heart rate was conveniently measured as pulse rate by palpation of the radial artery at the wrist, the number of beats occurring in half a minute being counted and doubled to give the rate per minute by using stop watch. Blood samples were collected by using intravenous method. Screening test for the presence of sickle cell trait was conducted after Daland and Castle (1948) and confirmation by cellulose acetate membrane electrophoresis.

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

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

RESULTS AND DISCUSSION

Mean values and standard deviations for

each anthropometric measurements for each individual year of age depicted in table 1 and 2. It can be inferred from the tables that the mean value for all the body measurements except skinfolds are progressively accelerating trend with age from 0+ to 12+ years showed steady pattern of growth, and from 13+ to 18+ years almost stationery pattern and decelerating trend of growth is investigated. From the table 2 it is clear that all the eight skinfold characters show non normal distributions at several ages. Standard deviations for these characters have not shown any consistent pattern as found earlier in the linear, transverse and circumferential and skinfold measurements (Dharma Rao and Busi, 1997).

Among the Porja tribal girls steady pattern in stature is noticed up to the age of 12+ years. The mean stature of infant at 0+ years age group is about 60.76 cm and doubled by 8+ years. The highest mean annual increments (+6.90 cm per year) has occurred between 11+ and 12+ years. The mean body weight of infant at 0+ years age group is about 4.45 kg it is doubled by 2+ years, and thrice by 4+ years and about 5 times by 9+ years and 6 times by 11+ years. The highest mean annual gain (+5.84 kg per year) has occurred between 13+ and 14+ years).

Table 1: Mean and standard deviation of seven body measurements among Porja tribal girls of Visakhapatnam district of Andhra Pradesh

Age (in years)	N	Body weight (kg)		Stature (cm)		Upper arm circumference (cm)		Calf circumference (cm)		Chest circumference (cm)		Abdominal circumference (cm)		Head circumference (cm)	
		$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
+0	10	4.45	0.98	60.76	2.98	12.86	0.53	15.08	0.81	39.70	1.99	38.60	2.37	41.69	1.39
1+	10	5.80	0.67	69.58	0.95	12.71	0.84	15.87	0.59	43.01	0.47	41.09	1.30	43.09	1.11
2+	10	8.55	0.72	83.83	2.75	13.07	0.99	15.16	0.97	46.15	0.60	45.77	0.78	49.17	0.95
3+	10	10.20	1.23	87.76	2.96	13.47	0.91	17.39	0.59	45.92	2.28	46.62	3.08	47.02	0.85
4+	10	13.45	1.01	106.99	5.45	14.51	1.85	19.23	1.45	52.44	1.34	47.63	0.75	48.86	0.75
5+	10	13.45	0.98	107.69	2.77	14.03	0.53	19.30	1.27	52.24	2.07	49.16	1.84	47.77	2.39
6+	18	15.47	1.40	110.37	5.16	14.66	0.83	20.33	1.03	52.09	2.05	50.73	3.06	49.21	1.60
7+	14	17.32	1.58	115.02	4.42	14.95	0.58	21.15	1.09	54.58	2.86	51.84	5.75	49.41	1.16
8+	29	20.41	2.48	123.24	5.30	15.69	1.37	22.32	1.27	56.62	2.47	51.12	3.00	50.14	1.53
9+	28	23.59	3.35	129.86	5.99	16.53	1.13	23.95	2.69	59.15	4.16	53.48	3.34	50.91	1.30
10+	22	24.90	1.56	134.02	2.75	16.63	0.85	24.18	0.99	60.43	5.14	54.15	2.59	51.39	1.14
11+	20	28.85	1.94	137.04	4.51	17.86	1.00	26.00	1.86	65.31	3.15	57.08	2.93	51.92	1.21
12+	25	34.04	3.26	143.94	4.96	19.44	1.30	27.03	1.29	69.59	4.30	59.35	2.51	52.35	1.30
13+	17	37.97	2.92	148.85	3.63	20.41	0.87	28.87	1.43	72.28	2.63	61.43	1.56	52.99	0.77
14+	13	43.80	4.16	150.33	4.29	22.82	1.63	30.65	1.85	78.49	4.72	67.25	4.02	53.73	0.88
15+	12	43.25	4.13	150.34	3.38	22.70	1.13	30.86	2.00	78.53	3.05	67.26	2.06	54.15	1.24
16+	10	44.40	2.59	152.19	2.24	22.18	0.41	30.57	1.49	79.38	3.45	66.79	0.68	53.45	0.46
17+	10	46.30	4.33	156.06	3.13	22.38	1.95	30.70	2.41	77.75	4.41	64.07	3.96	55.60	1.37
18+	10	48.05	2.48	158.57	4.93	21.19	0.32	32.20	0.64	77.44	2.49	67.95	0.38	55.49	1.40

Table 2: Mean and standard deviation of eight skinfold measurements among Porja tribal girls of Visakhapatnam district of Andhra Pradesh

Age (in years)	N	Triceps (mm)		Biceps (mm)		Subsca- pular (mm)		Suprailiac (mm)		Abdominal (mm)		Anterior thigh (mm)		Medial calf (mm)		Forearm (mm)	
		$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
0+	10	8.50	2.07	6.72	2.04	6.82	1.87	7.88	2.62	9.92	4.75	13.84	2.32	12.28	4.44	9.10	2.23
1+	10	8.24	2.40	7.86	0.65	8.56	1.56	6.64	1.26	8.76	2.75	16.64	3.26	14.40	2.78	11.40	1.73
2+	10	10.90	1.12	7.24	1.45	6.36	1.65	4.86	1.01	4.66	0.86	9.68	1.58	10.06	1.09	8.16	1.78
3+	10	9.58	1.46	6.72	0.86	6.60	1.42	4.90	1.53	7.62	1.87	10.20	1.72	9.78	1.05	8.62	1.16
4+	10	9.82	3.02	6.70	2.13	8.42	0.92	6.22	1.18	8.32	3.24	10.94	1.86	7.80	2.67	8.74	2.15
5+	10	7.76	2.29	5.24	2.23	4.80	1.00	4.14	0.43	4.14	0.43	11.40	1.95	8.76	1.39	6.46	2.16
6+	18	9.29	3.05	5.35	1.73	5.90	1.73	4.99	1.46	6.69	2.45	11.03	3.57	9.12	1.43	7.00	1.86
7+	14	6.41	1.39	4.26	0.60	6.21	1.79	5.31	1.94	7.16	2.40	10.08	1.56	8.60	1.53	6.20	1.64
8+	29	7.93	2.27	4.46	1.41	6.21	1.87	5.73	2.50	6.71	2.78	11.80	3.04	8.41	1.85	5.81	1.71
9+	28	7.90	1.64	4.65	1.24	6.96	1.75	5.56	1.74	7.78	2.19	11.33	1.99	8.83	1.63	5.80	1.72
10+	22	7.74	1.45	4.47	1.40	7.38	1.91	6.09	1.97	8.04	2.63	12.13	3.47	9.21	1.15	5.49	1.28
11+	20	8.21	2.53	4.97	1.85	8.43	2.17	7.71	2.39	9.66	2.91	13.35	3.80	8.88	1.91	5.46	1.51
12+	25	10.40	3.18	6.01	2.15	10.33	1.51	8.70	2.68	11.84	4.16	14.70	3.36	10.26	1.79	5.89	1.50
13+	17	10.70	1.87	7.14	2.85	11.94	2.61	10.00	4.08	12.73	4.77	17.41	3.50	11.87	1.39	8.49	4.48
14+	13	16.20	3.13	8.26	1.53	13.49	2.98	13.52	3.39	17.01	3.75	19.81	6.46	15.60	3.13	9.23	1.36
15+	12	12.33	2.10	8.11	2.60	14.06	3.61	11.00	2.67	14.33	4.29	19.35	3.54	12.83	2.08	8.28	1.00
16+	10	15.04	1.81	7.46	2.05	14.16	2.28	13.50	2.38	17.10	1.72	18.28	2.60	11.42	0.69	8.16	0.68
17+	10	11.30	3.16	7.30	1.96	10.62	4.18	11.00	2.91	16.34	5.61	20.40	5.02	16.28	5.91	5.52	0.60
18+	10	8.24	3.51	4.86	1.20	9.22	2.80	7.22	2.90	5.56	0.71	14.06	5.12	11.44	0.68	5.36	2.27

The upper arm circumference of infant at 0+ years age group is about 12.86 cm it is one and half time by 12+ years. An increment of 3 cm is noticed from 12+ to 18+ years. The mean calf circumference of infant at 0+ years age group is about 15.08 cm. It is one and half times by 8+ years. An increment of 10 cms is noticed from 8+ to 12+ years and declined. The Maximum mean annual increase of upper arm and calf circumferences +2.41 cm and +1.84 cm per year has occurred between 13+ and 14+ years and 12+ and 13+ years, while the maximum, mean annual loss upper arm (-1.37 cm) and calf circumference (-1.68 cm per year) is found respectively between 14+ and 15+ years, and 15+ and 16+ years.

The mean chest circumference of infant at 0+ year age group is 39.70 cm. It is one and half times by 1+ years. The maximum mean annual increase +6.21 cm has occurred between 13+ and 14+ years. The mean abdominal circumference of infant at 0+ years age group is 38.60 cm. It is one and half times by 12+ years. The highest occurred between 13+ and 14+ years, while the maximum, mean annual loss of abdominal circumferences (-2.72 cm per year) is found between 16+ and 17+ years. The mean head circumference of infant at 0+ years age

group is about 41.69 cm. The highest mean annual gain (+2.15 cm) has occurred between 16+ and 17+ years, while the maximum mean annual loss (-2.15 cm per year) is found between 2+ and 3+ years.

Fat fold at biceps region decreased gradually in the mean from 0+ to 10+ years, and increased to 18+ years; the highest mean annual gain (+1.13 mm) has occurred between 12+ and 13+ years while the maximum mean annual loss of thickness (-2.44 mm per year) is found between 17+ and 18+ years. The mean triceps increase and decrease gradually with minor irregularities in the mean from 0+ to 11+ years and it accelerates to 18+ years. The highest mean annual gain (5.50 mm per year) has occurred between 13+ and 14+ years, while the maximum mean annual loss of thickness (-3.74 mm per year) is found between 16+ and 17+ years.

The mean subscapular skinfold of infant at 0+ years age group is 6.82 mm and then gradually increased and decreased to 5+ years and increased with minute irregularities from 6+ to 18+ years. The highest mean annual gain (+1.90 mm per year) has occurred between 11+ and 12+ years, while the maximum, mean annual loss (-3.62 mm per year) is noticed between 4+ and 5+ years. The mean medial calf skinfold of

infant at 0+ age group is about 12.28 mm. It decreased 0+ to 8+ years and increases by 18+ years. The highest mean annual gain (+3.73 mm) has attained between 13+ and 14+ years, while the maximum mean annual loss of thickness (-4.34 mm per year) is noticed between 1+ and 2+ years.

The mean forearm skinfold is declined by 11+ years and it increases by 14+ years with minor fluctuations and declines. The highest mean annual gain (-2.60 mm) has attained between 12+ and 13+ years, while the maximum mean annual loss (-3.24 mm) is observed between 1+ and 2+ years.

The mean suprailiac skinfold of infant at 0+ age group is about 7.88 mm gradually decreases from 0+ to 6+ years and increased by 17+ years with few fluctuations (Table 2). The highest mean annual gain (+3.52 mm) has attained between 13+ and 14+ years, the maximum mean annual loss (-3.78 mm per year) is noticed between 17+ and 18+ years. From table 2, it is evident that all skinfold thickness increases gradually with minor irregularities in the means from 0+ to 11+ years reaching a highest peak value between 11+ and 17+ years from 17+ and 18+ years again gradually decelerating trend in skinfold thickness is clearly noticed.

The mean abdominal and anterior thigh skinfolds of infant from 0+ to 8+ years almost decelerating trend and 9+ to 17+ years accelerating trend with minor fluctuations, then it declines. The highest mean annual gain of abdominal and anterior thigh skinfolds is +4.28 mm and +2.71 mm, respectively occurred between 13+ and 14+ and 12+ and 13+ years, while the maximum mean annual loss of found between 17+ and 18+ years and the maximum mean annual loss of anterior thigh skinfold is 6.34 mm found between 17+ and 18+ years.

The maximum mean annual increments of highest peak velocity of stature (6.90 cm), and subscapular skinfold (1.90 mm), was attained between 11+ and 12+ years which is earlier by a year than calf circumference (1.84 cm), biceps (1.13 mm), anterior thigh (2.71 mm) and fore arm skinfold (2.60 mm) *i.e.* 12+ and 13+ years, and earlier by three years then body weight (5.84 kg), chest circumference (6.21 cm), abdominal circumference (5.81 cm), upper arm

circumference (2.41 cm), triceps (5.50 mm), suprailiac (3.52 mm), abdominal (4.28 mm), medial calf (2.73 mm) *i.e.* 13+ and 14+ years, and which is earlier by 5 years than head circumference (2.15 cm) *i.e.* 16+ and 17+ years is as similar to that of findings of Tanner (1962).

In the present study stature, body weight and all circumferences as well as systolic, diastolic blood pressure and pulse rate is progressively accelerated with advancement in age with few fluctuations. It supports that the systolic blood pressure (115.00 mm/Hg) and diastolic (76.36 mm/Hg) in 13+ years and pulse rate (92.44 per second) in 15+ years is below the normal range. The highest mean peak velocity blood pressure (125.55 mm/Hg) and diastolic blood pressure (81.11 mm/Hg) is attained in between 14+ and 15+ years and pulse rate (103.50 per second) *i.e.* 11+ and 12+ years. 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 differences in body composition, habitual physical activities, diet, income, smoking etc. (Table 3). Differential growth trends of homozygous and heterozygous sickle cell anemic Porja tribal girls were presented in table. 4. It can be inferred from the table the homozygous sickle cell anemic Porja tribal girls have decelerating growth trend when compared to heterozygous sickle cell anemic Porja tribal girls and normal Porja tribal girls.

It will be apparent from the foregoing discussions that the findings on the Porja tribal girls who were heavier in body weight and taller in

Table 3: Values of mean, standard deviation of blood pressure and pulse rate of Porja tribal girls by age

Age (in years)	N	Systolic blood pressure		Diastolic blood pressure		N	Pulse rate	
		$\bar{X}$	S.D.	$\bar{X}$	S.D.		$\bar{X}$	S.D.
12+	21	118.28	13.99	80.00	12.65	20	103.50	14.96
13+	11	115.00	11.18	76.36	8.09	9	102.89	17.86
14+	13	116.92	11.82	79.23	11.15	13	98.30	13.03
15+	9	125.55	15.09	81.11	13.64	9	92.44	11.90
16+	10	113.00	10.59	73.00	6.75	10	93.00	17.47
17+	10	113.00	13.37	75.00	9.71	10	101.00	15.58
18+	10	112.00	10.32	76.00	6.99	10	96.00	16.94

Table 4: Differential growth trends ($\bar{X} \pm SD$) of homozygous and heterozygous sickle cell anemic Porja tribal girls

Age	Body weight		Stature		Upper arm circumference		Calf circumference		Chest circumference		Abdominal circumference		Head circumference	
	HbSS	HbAS	HbSS	HbAS	HbSS	HbAS	HbSS	HbAS	HbSS	HbAS	HbSS	HbAS	HbSS	HbAS
15+	37.50	39.00	147.35	152.15	20.50	18.25	28.50	28.00	71.50	72.00	65.50	64.00	53.50	54.00
SD	0.70	1.41	2.19	0.21	0.70	0.35	3.50	0.00	0.70	2.82	3.53	5.65	2.12	0.00
16+	41.50	43.50	149.25	150.10	21.85	22.20	28.15	29.05	76.15	80.10	65.85	67.15	52.10	54.05
SD	0.70	0.70	0.35	0.14	0.07	0.28	0.07	0.21	0.21	0.14	0.07	0.21	0.14	0.07

Skinfolds													
Triceps		Biceps		Subscapular		Suprailiac		Abdominal		Anterior thigh		Medial calf	
HbSS	HbAS	HbSS	HbAS	HbSS	HbAS	HbSS	HbAS	HbSS	HbAS	HbSS	HbAS	HbSS	HbAS
10.00	7.30	6.10	4.10	10.20	8.50	6.70	6.40	10.33	9.20	19.40	13.30	10.90	9.70
0.85	3.53	0.14	0.14	0.69	3.53	0.34	1.97	0.57	2.26	5.37	4.38	1.27	2.40
12.50	14.60	5.30	6.30	12.50	13.10	11.50	12.10	15.70	16.10	16.10	17.20	10.00	11.30
0.14	0.00	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.28	0.28	0.14

Forearm			
HbSS	HbAS	HbSS	HbAS
7.00	7.00	7.00	5.10
1.69	0.99	7.00	7.80
0.28	0.14	0.28	0.14

HbAS, N = 2 (both 15 & 16 years)
HbSS, N = 2 (both 15 & 16 years)

stature than the results obtained by Singh (1980) and Nath (1991), taller and lighter than findings of Indu Talwar and Bharjit Singh (1995) and also taller than the findings of Hauspie et al. (1980), taller and lighter than Savara tribal girls (Dharma Rao and Busi, 1997), heavier and taller than Chenchu girls and Jatapu tribal girls (Dharma Rao and Busi, 1996 and 1997) and also these girls are taller and heavier than the ICMR, 1984 observations. These results are general, universal in character and are observed in many population (Johnston et al., 1975; Dharma Rao and Busi, 1997). Both juvenile and adolescent growth spurt are similar to the findings of Tanner (1962). These girls were more or less similar to the findings of Tanner et al. (1996), Dharma Rao and Busi (1992, 1993, 1994, 1995, 1996, and 1997). The findings generated in this paper can therefore be utilised as reference material for the Porja tribal girls in Visakhapatnam district of Andhra Pradesh. Goldstein and Tanner (1980) and Dharma Rao and Busi (1998) have pointed out that the findings obtained from such studies would be useful as an alternative to the growth standards and also to recommend the proper care and medical treatment to the sickle cell anemic subjects.

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