PRINT: ISSN 0970-9274 ONLINE: 2456-6608 DOI: 10.31901/24566608.1993/04.04.08

JOURNAL OF HUMAN ECOLOGY J. Hum. Ecol., 4(4): 285-290 (1993)

Changes in Circumferences and Fat Folds in Yadava Boys of North-Coastal Andhra Pradesh, India

B. Dharma Rao and B.R. Busi
Department of Anthropology, Andhra University, Visakhapatnam 530 003, Andhra Pradesh, India

KEY WORDS Yadava. Upper Arm Circumference. Triceps. Subscapular. Andhra Pradesh.

ABSTRACT A sample of 757 school going boys of Yadava parentage was studied in a cross-sectional anthropometric survey in 1986-87 at Visakhapatnam. Here the data on upper arm and calf circumferences; and triceps and subscapular skinfold thickness have been reported. At all ages between 1 and 20 years their mean values of circumferences and fat folds are observed to be lower than those of the ICMR standards 1984 and Bengali boys. The "F" show the statistical significant levels of regression function as a whole.

In this paper an attempt has been made to present (1) the growth patterns of arm and calf circumferences and subcutaneous fat deposition at triceps and subscapular regions, and (2) compared with local standards for arm and calf circumferences and triceps and subscapular fat folds, respectively in the rural-bred boys of the Yadava parentage to find out the population difference.

MATERIAL AND METHODS

In a cross-sectional study 757 Yadava boys were measured from the rural educational institutions from January 1986 to June 1987 in Visakhapatnam to obtain data on growth of children between the ages 1 through 20 years. Exact date of birth was collected for every subject either from the concerned school register or birth records of village panchayats. Altogether 21 anthropometric measurements as recommended for the International Biological Programme (Weiner and Lourie, 1969), were taken by the first author. Here the data on only four physical traits are presented. (A) Upper arm circumference, (B) Calf circumference (C) Triceps skinfold and (D) Subscapular skinfold are also taken on 757 subjects. The age of each individual was calculated to three decimal places after Tanner et al. (1966). The measurements on individuals were taken during the working hours of the schools with minimum clothing. All bilaterally represented measurements were taken on the left hand side of the subject. The measurements upper arm circumference (relaxed), calf circumference; triceps and subscapular skinfolds were taken after Weiner and Lourie (1969). Arm and calf circumference was measured to the nearest 0.1 cm with a flexible steel tape. While triceps and subscapular thickness was observed to the nearest 0.5 mm by a Harpenden skinfold caliper.

RESULTS AND DISCUSSION

Mean with standard deviation and regression characteristics for four measurements for the Yadava boys are presented in tables 1 and 2.

A) Arm Circumference

Mean values of this physical trait are found to increase progressively with age. Between 1 to 20 years the boys marked a difference of 1.21 cm between the lowest and highest annual gain in arm girth. But maximum acceleration of growth attained between the ages 14 and 15 years, when the peak velocity of growth of total body mass is also manifested. The maximum increment per year in the growth of arm girth happens to be only 1.34 cms. The "r^2"

Table 1 : Mean, standard deviation and regression characteristics of upper arm circumference and triceps skinfold among Yadava boys of Visakhapatnam

Upper arm circumference							*Age group in years*	*Triceps skinfold*						
N	*X*	*SE*	*SD*	r^2	*t*	*F*		*N*	*X*	*SE*	*SD*	r^2	*t*	*F*
48	12.69	0.20	1.40	0.02	1.01	1.01	1	48	8.75	0.27	1.90	0.03	1.23	1.52
46	13.41	0.14	0.93	0.07	1.81	3.28	2	46	8.83	0.29	1.95	0.19	3.19^3	10.26^3
44	13.82	0.12	0.82	0.01	0.63	0.40	3	44	9.39	0.31	2.06	0.002	0.30	0.09
46	14.14	0.11	0.73	0.05	1.48	2.19	4	46	9.13	0.25	1.68	0.001	0.23	0.05
82	14.42	0.09	0.78	0.02	1.34	1.80	5	82	7.47	0.21	1.88	0.00	0.003	0.00
55	14.57	0.08	0.60	0.004	0.46	0.21	6	55	6.50	0.19	1.40	0.07	1.95^1	3.79
52	14.70	0.09	0.67	0.11	2.55^3	6.50^2	7	52	6.29	0.20	1.44	0.03	1.34^2	1.81
48	15.01	0.08	0.55	0.09	2.19^1	4.80^2	8	48	6.13	0.37	2.53	0.002	0.27	0.08
47	15.55	0.12	0.84	0.10	2.27^1	5.15^2	9	47	5.82	0.18	1.22	0.08	1.93^1	3.73
36	16.22	0.15	0.91	0.02	0.83	0.69	10	36	6.14	0.20	1.20	0.05	1.36^2	1.86
27	16.57	0.18	0.96	0.01	0.48	0.23	11	27	6.14	0.33	1.69	0.06	1.23	1.52,
28	17.18	0.18	0.97	0.16	2.26^1	5.11^2	12	28	6.16	0.24	1.29	0.07	1.42^2	2.03
24	17.85	0.17	0.84	0.001	0.13	0.02	13	24	6.18	0.48	2.34	0.00	0.003	0.00
31	18.72	0.21	1.19	0.03	0.65	0.42	14	31	6.47	0.29	1.60	0.004	0.36	0.13
24	20.06	0.31	1.53	0.07	1.33	1.76	15	24	7.12	0.49	2.39	0.08	1.39^2	1.93
27	21.32	0.25	1.32	0.01	0.44	0.19	16	27	6.03	0.21	1.10	0.12	1.84^1	3.38
22	22.50	0.32	1.48	0.30	2.96^3	8.783	17	22	6.61	0.44	2.08	0.05	1.03	1.07
23	23.20	0.28	1.32	0.07	1.28	1.63	18	23	6.91	0.48	2.29	0.06	1.17	1.36
20	23.58	0.21	0.95	0.08	1.25	1.57	19	20	7.20	0.41	1.84	0.08	1.23	1.51
27	23.85	0.26	1.33	0.04	1.00	1.00	20	27	7.46	0.51	2.67	0.003	0.27	0.07
757	16.39	0.12	3.39	0.85	67.42^3	4545.01^3	Whole	757	7.15	0.08	2.16	0.09	8.79	77.32^3

1. Significant at 5% level 2. Significant at 1% level 3. Significant at 0.1% level

indicates that the variation in the dependent variable is explained by the independent variable. The "t" show the statistical significant difference of "r^2", it was observed in 7,8,9,12 and 17 years of age group. The "F" show the statistical significant difference of regression function in 7,8,9,12 and 17 years. The remaining age group of "t" and "F" were not significance. The whole "t" and "F" show statistical significance at more than 0.1% probability level (Table1).

B) Calf Circumference

Mean values of this physical trait are found to increase progressively with age. Between 1 to 20 years the boys marked a difference of 1.30 cm between the lowest and highest annual gain in arm circumference. But maximum acceleration of growth attained between the ages 15 and 16 years when the peak velocity of growth of total body mass is also manifested. The maximum increment per year in the growth of arm circumference happens to be only 1.48 cm. The "r^2" indicates that the variation in the dependent variable is explained by the independent variable. The 't' show the statistical significant difference of "r^2", it was observed in 1 to 8, 11,12,17 and 18 years of age group. The 'F' show the statistical significant difference of regression function in 1,3 to 8, 11,12 and 17 years. The remaining age group of "t" and "F" were not significant. The whole "t" and "F" show statistical significance at more than 0.1% probability level (Table 2).

C) Fat Fold Thickness at Triceps

Fat fold at triceps region increases at a slow rate from age 1 with the advancing ages till

Table 2 : Mean, standard deviation and regression characteristics of calf circumference and subscapular skinfold among Yadava boys of Visakhapatnam

Calf circumference							*Age group in years*	*Subscapular skinfold*						
N	X	SE	SD	r^2	t	F		N	X	SE	SD	r^2	t	F
48	14.70	0.24	1.64	0.09	2.16^1	4.66^2	1	48	6.13	0.18	1.27	0.10	2.21^1	4.87^2
46	16.08	0.16	1.09	0.08	1.91^1	3.66	2	46	5.91	0.22	1.51	0.11	2.38^1	5.65^2
44	17.34	0.13	0.89	0.12	2.36^1	5.56^2	3	44	5.87	0.18	1.21	0.03	1.22	1.50
46	18.21	0.13	0.87	0.10	2.26^1	5.13^2	4	46	5.68	0.16	1.09	0.00	0.009	0.0001
82	19.12	0.10	0.87	0.07	2.50^3	6.27^2	5	82	5.16	0-.12	1.05	0.004	0.56	0.31
55	19.65	0.11	0.78	0.19	3.52^3	12.41^3	6	55	5.04	0.13	0.99	0.02	1.01	1.02
52	20.55	0.13	0.92	0.09	2.26^2	5.11^2	7	52	5.03	0.14	1.01	0.003	0.37	0.14
48	21.34	0.13	0.89	0.13	2.60^3	6.77^2	8	48	4.99	0.16	1.08	0.02	0.93	0.86
47	22.24	0.17	1.16	0.004	0.13	0.02	9	47	5.14	0.16	1.10	0.09	2.10^1	4.41^2
36	23.14	0.22	1.31	0.06	1.42	2.02	10	36	5.28	0.15	0.87	0.02	0.79	0.62
27	25.67	0.21	1.11	0.25	2.87^3	8.24^3	11	27	5.32	0.19	1.01	0.02	0.79	0.62
28	24.28	0.25	1.32	0.23	2.82^3	7.95^3	12	28	5.36	0.19	1.03	0.02	0.75	0.56
24	24.96	0 21	1.03	1.74	1.32	0.07	13	24	5.41	0.26	1.29	0.01	0.46	0.21
31	26.22	0.27	1.48	0.005	0.38	0.14	14	31	5.64	0.23	1.28	0.001	0.19	0.04
24	27.17	0.39	1.90	0.11	1.69	2.86	15	24	5.97	0.27	1.34	0.007	0.38	0.15
27	28.65	0.30	1.56	0.008	0.44	0.19	16	27	6.26	0.20	1.04	0.004	0.33	0.11
22	29.39	0.34	1.61	0.38	3.49^3	12.16^3	17	22	6.72	0.23	1.09	0.09	1.38^2	1.91
23	29.57	0.25	1.22	0.16	2.01^2	4.05	18	23	7.20	0.33	1.60	0.20	2.32^1	5.38^2
20	29.86	0.39	1.74	0.02	0.66	0.44	19	20	7.64	0.33	1.49	0.07	1.19	1.41
27	30.62	0.28	1.44	0.05	1.14	1.29	20	27	8.07	0.48	2.51	0.02	0.62	0.38
757	21.89	0.17	4.68	0.93	102.80^3	10567.46^3	Whole	757	5.70	0.05	1.44	0.08	8.25^3	68.08^3

1. Significant at 5% level 2. Significant at 1% level 3. Significant at 0.1% level

the 3 years after which thickness shows a gradual decline upto 9 years, and then increase from 10 to 15 years, after which thickness shows a gradual decline and gradually increases through 18, 19 and 20 years of age. But the maximum rate of annual increment in the fat fold attained between the ages of 14 and 15 years. In the advanced ages beyond 4 to 9 years the growth rate is of course negative. The "t" show the statistical significant difference of "r^2", it was observed in 2,6,7,9,10,12,15 and 16 years. The "F" show the statistical significance in 2 years of age group only. The "t" and "F" show the statistical significant difference at more than 0.1% probability level (Table 1).

D) Fat Fold Thickness at Subscapular Region

The subscapular fat fold region declined at a slow rate from age 1 to 8 years, and then increase from 9 to 20 years. But the maximum rate of annual increment in this fat fold attained between the ages of 17 and 18 years. In the advanced ages beyond 1 to 8 years the growth rate is of course negative. The "t" show the statistical significant difference of 'r^2', it was observed in 1,2,9,17 and 18 years. The "F" show the statistical significance in 1,2,9 and 18 years of age group. The "t" and "F" values in the remaining age groups were not significant. The whole "t" and "F" show the statistical significant difference at more than 0.1% probability level (Table 2).

The adolescent growth spurt of upper arm circumference and triceps skinfold of Yadava boys was attained between 14-15 years and calf circumference and subscapular skinfold 15-16 and 17-18 years, respectively as similar to that of Gaddi Rajputs, (Singh, 1980), Jat boys (Nath, 1972), Tibetan boys (Singh, 1980), Punjabi boys (Sidhu, 1969) and it has lesser mean values when compared with Indian school

Table 3 : Percentiles for upper arm circumference and triceps skinfold at different ages of Yadava boys of Visakhapatnam

Upper arm circumference centiles (cm)							*Age Group in years*	*Triceps skinfold centiles (mm)*						
3rd	*10th*	*25th*	*50th*	*75th*	*90th*	*97th*		*3rd*	*10th*	*25th*	*50th*	*75th*	*90th*	*97th*
10.06	10.90	11.74	12.69	13.64	14.48	15.32	1	5.18	6.31	7.47	8.75	10.03	11.19	12.32
11.66	12.22	12.78	13.41	14.04	14.60	15.16	2	5.16	6.33	7.51	8.83	10.15	11.33	12.50
12.28	12.77	13.27	13.82	14.37	14.87	15.36	3	5.52	6.75	8.00	9.39	10.78	12.03	13.26
12.77	13.20	13.65	14.14	14.63	15.08	15.51	4	5.97	6.98	7.99	9.13	10.27	11.28	12.29
12.95	13.42	13.89	14.42	14.95	15.42	15.89	5	3.93	5.06	6.20	7.47	8.74	9.88	11.01
13.44	13.80	14.16	14.57	14.98	15.34	15.70	6	3.87	4.71	5.55	6.50	7.45	8.29	9.13
13.44	13.84	14.25	14.70	15.15	15.56	15.96	7	3.58	4.44	5.32	6.29	7.26	8.14	9.00
13.98	14.30	14.64	15.01	15.38	15.72	15.04	8	1.37	2.89	4.42	6.13	7.84	9.37	10.89
13.97	14.47	14.98	15.55	16.12	16.63	17.13	9	3.53	4.26	5.00	5.82	6.64	7.38	8.11
14.51	15.05	15.60	16.22	16.84	17.39	17.93	10	3.88	4.60	5.33	6.14	6.95	7.68	8.40
14.76	15.34	15.92	16.57	17.22	17.80	18.38	11	2.96	3.97	5.00	6.14	7.28	8.31	9.32
15.36	15.94	16.52	17.18	17.84	18.42	19.00	12	3.73	4.51	5.29	6.16	7.03	7.81	8.59
16.30	16.80	17.31	17.88	18.45	18.96	19.46	13	1.78	3.18	4.60	6.18	7.76	9.18	10.58
16.48	17.19	17.92	18.72	19.52	20.25	20.96	14	3.46	4.42	5.39	6.47	7.55	8.52	9.48
17.18	18.10	19.03	20.06	21.09	22.02	22.94	15	2.62	4.06	5.50	7.12	8.74	10.18	11.62
18.84	19.63	20.43	21.32	22.21	23.01	23.80	16	3.96	4.62	5.29	6.03	6.77	7.44	8.10
19.72	20.60	21.50	22.50	23.50	24.40	25.28	17	2.70	3.94	5.20	6.61	8.02	9.28	10.52
20.72	21.51	22.31	23.20	24.09	24.89	25.69	18	2.60	3.97	5.36	6.91	8.46	9.85	11.22
21.79	22.36	22.94	23.58	24.22	24.80	25.37	19	3.74	4.84	5.96	7.20	8.44	9.56	10.66
21.35	22.14	22.95	23.85	24.75	25.56	26.35	20	2.44	4.04	5.66	7.46	9.26	10.88	12.48

children (Vijayaraghavan et al., 1974), Indian youth adults (Hanumantha Rao and Gowrinath Sastry, 1977) and Bengali children (Pakrasi et al., 1988).

The present data on the Yadava boys have further been used to develop the local standards of reference for upper arm and calf circumferences and fat fold thicknesses during the growing years. Tables 3 and 4 present the distribution of centile values of these four characters by age. Estimates are given for seven percentiles from the 3rd through the 97th while we are immediately conscious of the strong limitations inherent in estimating the 3rd (or the 10th) and the 90th (or the 97th) percentiles in given age groups averaging about a little more than 75 in number. Nevertheless, when there is no data representing a large and comprehensive growth study in the Yadava children the extreme percentiles are shown in the tables advisedly.

With respect to arm and calf circumference and fatfolds one may not changes in the values as it is expected, from one age to next. Steadily increasing values of almost all of the centiles with age are evident. Over the growing years the difference from the 50th to the 97the centiles remains always proportionately greater than that from the 3rd to 50th centiles.

Being aware of the fact that the ages of Yadava boys are exact, while the data for well off boys related to age classes it is observed here that the Yadava boys possess generally lower mean values for either two of the four physical traits in question than the well to do Indian boys over the growing years. The 50th percentile values of upper arm and calf circumferences for the Yadava boys fall in between the 5th and the 25th percentile values of the well-off Indian boys (Raghavan et al., 1974).

It will be apparent from the foregoing results that the findings among Yadava boys were more or less similar to the findings of Sidhu (1969), Sharma and Kaul (1970), Nath (1972), Sidhu

Table 4 : Percentiles for calf circumference and subscapular skinfold at different ages of Yadava boys of Visakhapatnam

Calf circumference centile (cm)							*Age*	*Subscapular skinfold centiles (mm)*						
3rd	*10th*	*25th*	*50th*	*75th*	*90th*	*97th*	*group in years*	*3rd*	*10th*	*25th*	*50th*	*75th*	*90th*	*97th*
11.62	12.60	13 59	14.70	15.81	16.80	17.78	1	3.74	4.50	5.27	6.13	6.99	7.76	8.52
14.03	14.68	15.34	16.08	16.82	17.48	18.13	2	3.07	3.97	4.89	5.91	6.93	7.85	8 75
15.67	16.20	16.74	17.34	17.94	18.48	19.01	3	3.59	4.32	5.05	5.87	6.69	7.42	8.15
16.57	17.09	17.62	18.21	18.80	19.33	19.85	4	3.63	4.28	4.94	5.68	6.42	7.08	7.73
17.48	18.00	18.53	19.12	19.71	20.24	20.76	5	3.18	3.81	4.45	5.16	5.87	6.51	7.14
18.18	18.65	19.12	19.65	20.18	20.65	21.12	6	3.18	3.77	4.37	5.04	5.71	6.31	6.90
18.82	19.37	19.93	20.55	21.17	21.73	22.28	7	3.13	3.74	4.35	5.03	5.71	6.32	6.93
19.67	20.20	20.74	21.34	21.94	22.48	23.01	8	2.96	3.81	4.26	4.99	5.72	6.37	7.02
20.06	20.75	21.46	22.24	23.02	23.73	24.42	9	3.07	3.73	4.40	5.14	5.88	6.55	7.21
20.68	21.46	22.25	23.14	24.03	24.62	25.60	10	3.64	4.16	4.69	5.28	5.87	6.40	6.92
21.58	22.25	22.92	23.67	24.42	25.09	25.76	11	3.42	4.03	4.64	5.32	6.00	6.61	7.22
21.80	22.59	23.59	24.28	25.17	25.97	26.76	12	3.42	4.04	4.66	5.36	6.06	6.68	7.30
23.02	23.04	24.26	24.96	25.66	26.28	26.90	13	2 98	3.76	4.54	5.41	6.28	7.06	7.84
23.44	24.32	25.22	26.22	27.22	28.12	29.00	14	3.23	4.00	4.77	5.64	6.51	7.28	8.05
23.60	24.73	25.89	27.17	28.45	29.61	30.74	15	3.45	4.25	5.06	5.97	6.88	7.69	8.49
25.72	26.65	27.60	26.65	29.70	30.65	31.58	16	4.30	4.93	5.56	6.26	6.96	7.59	8.23
26.36	27.33	28.30	29.39	30.48	31.45	32.42	17	4.67	5.32	5.98	6.72	7.46	8.12	8.77
27.28	28.01	28.75	29.67	30.39	31.13	31.86	18	4 19	5.15	6.12	7.20	8.23	9.25	10.21
26.59	27.63	28.68	29.86	31.04	32.09	33.13	19	4.84	5.73	6.63	7.64	8.85	9.55	10.44
27.91	28.17	29.65	30.62	31.59	32.47	33.33	20	3.35	4.85	6.37	8.07	9.77	11.29	12.79

and Phull (1974), and lower mean values when compared to the findings of (Vijayaraghavan et al. (1974), Hanumantha Rao and Gowrinath Sastry (1977) and ICMR (1984).

It may be noted here that when the standards of fat fold at triceps and subscapular for the well-off Indian boys are stated to be less than those of British boys, American boys (Raghavan et al., 1974) and Bengali boys (Pakrasi et al., 1988) to developmental position of the Yadava boys in this respect needs, of course no elaboration.

ACKNOWLEDGEMENT

Financial support from the Division for Scientific and Technical personnel of Council for Scientific and Industrial Research (C.S.I.R.) under Scientist's pool scheme (Grant No. B 84 85) is gratefully acknowledged.

REFERENCES

Datta Banik, N.D., Nayar, Sushila R., Krishna, Bakshi S. and Taskar A.D.: Growth patterns of Indian school children in relation to nutrition and adolescence. *Indian J.Pediatr., 40:* 173-179 (1978).

Hanumantha Rao, D. and Gowrinath Sastry, J.: Growth patterns of well-to-do, Indian adolescents and young adults. *Ind. J.Med. Res., 66:* 950-956 (1977).

ICMR.: Growth and physical development of Indian infants and children. *ICMR Technical Report Series No. 18* (1984).

Jellife, D.B.: The assessment of the Nutritional status of the community. *Monograph Series No. 53 World Health organization,* Geneva (1966).

Nath. S.: *A Study of Age Changes of Different Biological Variables in the Jat Boys of Meerut (U.P.).* Doctoral thesis (Unpublished), University of Delhi, Delhi (1972).

Pakrasi, K., Dasgupta, P., Dasgupta. I., and Majumdar, P.P.: Growth in height, weight and skinfold thickness of Bengali boys of Calcutta, India. *Anthrop. Anz., 46 :* 1–16 (1988).

Raghavan, V.K., Singh, Darshan and Swaminathan, M.C.: Arm circumference and fat fold at triceps in well-nourished Indian school children. *Ind. J. Med. Res., 62:* 994–1001 (1974).

Sidhu, L.S.: *Biological Survey of the Punjabi Males with Special Reference to Age Changes*. Ph. D. thesis (Unpublished), Punjab University, Chandigarh (1969).

Sidhu, L.S. and Phull, A.K.: Patterns of physical growth in rural boys. *Arch. of Child Health, 15:* 220–232 (1974).

Sharma, J.C. and Kaul, S.: Socio-economic differences in the growth of Punjabi Boys. *Anthropologist, 17:* 43–55 (1970).

Singh, S.P.: Physical growth of Gaddi Rajputs of Dhaula Dhar range of Himalayas. *Z. Morph. Anthrop., 71 :* 65–81 (1980).

Singal, P., Bhatnagar D.P. and Kaur, Hardeep: Changes in somatotypes between 1 to 16 years in Rajput and Brahmin girls of Chamba district (H.P.). *Ind. J.Phys. Anthrop. Hum. Genet., 16:* 49–62 (1990).

Tanner, J.M., Whitchouse, R.H. and Takaishi, M.: Standards from birth to maturity for height, weight, height velocity and weight velocity, British children 1965 (Part 1). *Arch. Dis. Child, 41:* 454–471, 613–635 (1966).

Weiner, J.S. and Lourie, J.A.: *Human Biology. IBP. Hand book No. 9*. Blackwell Scientific Publications, Oxford and Edinburgh (1969).