

Upper Arm Circumference and Fat Fold at Triceps in Vadabaliya Boys of Visakhapatnam, Andhra Pradesh, India

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ABSTRACT A sample of 845 school-going boys of Vadabaliya parentage was studied in a cross-sectional anthropometric survey in 1986-87 at Visakhapatnam. Here the data on upper arm circumference and skinfold thickness at triceps have been reported. At all ages between 1 and 20 years their mean values of arm girth and fat fold at triceps are observed to be lower than those of the Indian school children and Bengali children. The "F" value show the statistical significance levels of regression function as a whole.

Selected body measurements like height, weight, upper arm circumference and skinfold thickness at triceps have universally been accepted as some sensitive indicators of growth progress and nutritional status of an individual. Height and weight are two most useful parameters to examine the mode of linear growth and development of total body mass, whereas arm circumference helps to evaluate the condition of muscle development. The skinfold thickness which act as a significant index of body fat also serves as an "interpretive tool" in clinical evaluation of individuals. It has again been pointed out that measurements of both arm girth and triceps skin fold thickness at a time do provide an objective basis to learn to what extent as individual had in his growing years suffered deficit in the muscle-protein reservoirs, calorie reserves, and growth process due to protein-calorie malnutrition (Jelliffe, 1966; Beaton and Bengoa, 1976). In this context an attempt has been made in the paper to present (1) the growth patterns of arm circumference and subcutaneous fat deposition at triceps region, (2) the magnitude of protein-calorie deficiency, and (3) a local standards for arm girth and triceps fat fold thickness respectively in the rural-bred boys of the

Vadabaliya parentage from Viskakhapatnam, North Coastal Andhra Pradesh, India.

MATERIAL AND METHODS

In a cross-sectional study 845 Vadabaliya boys were measured from the rural educational institutions from January 1986 to June 1987 in Visakhapatnam to obtain data on growth of normal, healthy children between the ages 1 and 20 years. They belonged, in general, to educated, lower socio-economic class families. Exact date of birth of each one of the boys was very carefully ascertained on the strength of documentary evidence 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 two physical traits are presented. (A) Upper arm circumference and (B) Triceps skinfold are also taken on 845 subjects. The age of each individual was calculated to three decimal places after Tanner et al. (1966).

The measurements of upper arm circumference (relaxed) and triceps skinfold thickness were taken after Weiner and Lourie (1969). Arm girth was measured to the nearest 0.1 cm

with a flexible steel tape, while triceps thickness was observed to the nearest 0.2 mm by Harpenden skinfold calipers.

RESULTS AND DISCUSSION

Mean with standard deviation and regression characteristics for both the measurements of the adequately nourished Vadabalija boys are presented in table 1.

A) Arm Circumference

Mean values of this physical trait are found to increase progressively with age. Between 1 and 20 years the boys marked a difference of 1.58 cm between the lowest and highest annual gain in arm girth. But maximum acceleration of growth takes place 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 girth happens to be only 1.65 cm. The " r^2 " indicates that the variation in the dependent variable is explained by that of the independent variable. The values of " t " show the statistical significant difference of " r^2 ", it was observed in 8, 10, 11, 12, 14, 16, 17 and 19 years of age group. The " F " values show the statistical significant difference of regression function in 10, 11, 12 and 19 years. In the remaining age group, values of " t " and " F " were non-significant. The whole " t " and " F " show statistical significance at more than 0.1% probability level (Table 1).

B) Fat Fold Thickness

Fat fold at triceps region increases at a slow rate from age 1 with the advancing ages till the 4 years after which skinfold thickness shows a gradual decline upto 9 years, and then increase from 10 to 17 years, after which the skinfold thickness shows a gradual decline. But the maximum rate of annual increment in the fat fold thickness occurs between the ages of 16 and 17 years. In the advanced ages

beyond 4 to 9 years the growth rate is of course negative. The " t " values show the statistical significant difference of " r^2 ", it was observed in 3, 6, 8, 9, 16, 19 and 20 years. The " F " values show the statistical significance in 3 years of age group only. The " t " and " F " values in the remaining age groups were non significant. The whole " t " and " F " show the statistical significant difference at more than 0.1% probability level (Table 1). The Adolescent growth spurt of upper arm circumference and triceps skinfold of Vadabalija boys was attained between 15-16, 16-17 years, respectively which is similar to that of Jat boys (Nath, 1972) and rural boys of Punjab (Sidhu and Phull, 1974), and it showed lesser mean values when compared with Indian school children (Vijayaraghavan et al., 1974), Indian young adults (Hanumantha Rao and Gowrinath Sastry, 1977) and Bengali children (Pakrasi et al., 1988).

The present data on the Vadabalija boys have further been used to develop the local standards of reference for upper arm circumference and arm fat thickness during the growing years. Table 2 presents the distribution of centile values of these two characters by age. Estimates are given for seven percentiles from the 3rd through the 97th centile of the same time 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 Vadabalija children the extreme percentiles are shown in the tables advisedly.

With respect to both arm girth and arm fat one may not see 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 97th centiles

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

Upper arm circumference (cm)										Triceps skinfold thickness (mm)				
N	X	S.E.	S.D.	r ²	T	F	Age Group (in years)	N	X	S.E.	S.D.	r ²	T	F
47	12.67	0.16	1.13	0.03	1.12	1.25	1	47	8.34	0.27	1.84	0.02	0.84	0.71
37	13.37	0.17	1.04	0.005	0.41	0.17	2	37	8.39	0.29	1.74	0.0001	0.06	0.004
34	13.98	0.16	0.94	0.12	0.62	0.38	3	34	9.40	0.36	2.10	0.16	2.43 ¹	5.91 ²
37	14.42	0.12	0.75	0.01	0.68	0.46	4	37	9.84	0.46	2.77	0.02	0.93	0.87
44	14.64	0.12	0.81	0.02	0.89	0.79	5	44	8.45	0.27	1.80	0.01	0.72	0.52
65	14.71	0.10	0.80	0.005	0.58	0.33	6	65	7.11	0.22	1.79	0.03	1.34 ²	1.79
47	14.89	0.14	0.97	0.03	1.15	1.32	7	47	6.57	0.22	1.52	0.03	1.24	1.54
58	14.96	0.12	0.95	0.06	1.90 ¹	3.62	8	58	6.02	0.19	1.48	0.04	1.53 ²	2.33
45	15.61	0.12	0.78	0.006	0.51	0.26	9	45	5.75	0.18	1.19	0.07	1.76 ¹	3.10
59	15.86	0.11	0.88	0.16	3.32 ³	11.01 ³	10	59	5.90	0.16	1.24	0.003	0.40	0.16
44	16.07	0.16	1.03	0.11	2.26 ¹	5.11 ²	11	44	5.99	0.18	1.20	0.01	0.66	0.43
26	16.75	0.17	0.86	0.30	3.24 ³	10.52 ³	12	26	6.08	0.31	1.59	0.06	1.55	1.55
48	17.89	0.15	1.01	0.02	0.88	0.77	13	48	6.28	0.24	1.66	0.02	1.02	1.04
35	18.99	0.27	1.62	0.07	1.62 ²	2.62	14	35	6.50	0.27	1.59	0.005	0.39	0.15
38	20.06	0.22	1.36	0.005	0.41	0.17	15	38	6.59	0.36	2.22	0.01	0.65	0.43
54	21.71	0.19	1.41	0.06	1.85 ¹	3.44	16	54	6.46	0.25	1.82	0.04	1.52 ¹	2.31
33	22.47	0.26	1.49	0.06	1.42 ²	2.02	17	33	6.69	0.27	1.54	0.007	0.45	0.21
34	23.39	0.22	1.28	0.03	0.92	0.84	18	34	6.62	0.34	2.00	0.04	1.08	1.17
21	23.56	0.18	0.81	0.2	2.39 ¹	5.71 ²	19	21	6.59	0.33	1.50	0.18	2.03 ¹	4.11
39	23.72	0.17	1.06	0.03	1.17	1.37	20	39	6.35	0.18	1.10	0.07	1.69 ¹	2.86
845	—	—	—	0.84	66.66 ³	4435.44 ³	Whole	845	—	—	—	0.12	10.97 ³	120.39 ³

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

Table 2 : Percentiles for upper arm circumference and triceps skinfold thickness at different ages of Vadaballija boys of Visakhapatnam

3rd	Upper arm circumference centiles (cm)						Triceps skinfold thickness centiles (mm)						
	10th	25th	50th	75th	90th	97th	3rd	10th	25th	50th	75th	90th	97th
10.54	11.22	11.91	12.67	13.43	14.12	14.80	4.88	5.98	7.10	8.34	9.58	10.70	11.80
11.41	12.04	12.67	13.37	14.07	14.70	15.33	5.12	6.16	7.21	8.34	9.57	10.62	11.66
12.21	12.77	13.34	13.98	14.62	15.19	15.75	5.45	6.71	7.98	9.40	10.82	12.09	13.35
13.01	13.46	13.91	14.42	14.93	15.38	15.83	4.63	6.29	7.97	9.84	11.71	13.39	15.05
13.12	13.60	14.09	14.64	15.19	15.68	16.16	5.06	6.14	7.23	8.45	9.67	10.76	11.84
13.21	13.68	14.17	14.71	15.25	15.74	16.21	3.74	4.82	5.90	7.11	8.32	9.40	10.48
13.07	13.65	14.23	14.89	15.55	16.13	16.71	3.71	4.62	5.54	6.57	7.60	8.52	9.43
13.17	13.74	14.32	14.96	15.60	16.18	16.75	3.24	4.12	5.02	6.02	7.02	7.92	8.80
14.14	14.61	15.08	15.61	16.14	16.61	17.08	3.51	4.22	4.95	5.75	6.55	7.28	7.99
14.20	14.73	15.27	15.86	16.45	16.99	17.52	3.57	4.31	5.06	5.90	6.74	7.49	8.23
14.13	14.75	15.37	16.07	16.77	17.39	18.01	3.73	4.45	5.18	5.99	6.80	7.53	8.25
15.13	15.65	16.17	16.75	17.33	17.85	18.37	3.09	4.04	5.01	6.08	7.15	8.12	9.07
15.99	16.60	17.21	17.89	18.57	19.18	19.79	3.16	4.15	5.16	6.28	7.40	8.41	9.40
15.94	16.91	17.89	18.99	20.09	21.07	22.04	3.51	4.46	5.43	6.50	7.57	8.54	9.49
17.50	18.32	19.14	20.06	20.98	21.80	22.62	2.41	3.74	5.09	6.59	8.09	9.44	10.77
19.06	19.90	20.76	21.71	22.66	23.52	24.36	3.04	4.13	5.23	6.46	7.69	8.79	9.88
19.67	20.56	21.46	22.47	23.48	24.38	25.27	3.79	4.72	5.65	6.69	7.73	8.66	9.59
20.98	21.75	22.52	23.39	24.26	25.03	25.80	2.86	4.06	5.27	6.62	7.97	9.18	10.38
22.04	22.52	23.01	23.56	24.11	24.60	25.08	3.77	4.67	5.58	6.59	7.60	8.51	9.41
21.73	22.36	23.00	23.72	24.44	25.08	25.71	4.28	4.94	5.61	6.35	7.09	7.76	8.42

remains always proportionately greater than that from the 3rd to 50th centiles.

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

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

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REFERENCES

- Beaton, G.H. and Bengoa J.M. (Eds.): *Nutrition in Preventive Medicine. Monograph Series No. 62*. World Health Organization, Geneva (1976).
- Datta Banik, N.D., Nayar, Sushila, Krishna, R., Bakshi, S. and Taskar A.D. : Growth patterns of Indian school children in relation to nutrition and adolescence. *Ind. 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).
- Jelliffe 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.)*. Ph.D. Thesis, 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. and Phull, A.K. : Patterns of physical growth in rural boys. *Arch. of Child Health*, 15 : 220-232 (1974).
- Tanner, J.M., Whitehouse, R.H. and Thakanihi, M. : Standards from birth to maturity for height, weight, height velocity and weight velocity, British children 1965 (Part I). *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).