

## **ARM CIRCUMFERENCE AND FATFOLD AT TRICEPS IN BENGALI BOYS OF CALCUTTA, INDIA**

Kanti Pakrasi, P. Das Gupta and I. Das Gupta

**Abstract:** A sample of 856 school-going boys of Bengali parentage was studied in a cross-sectional anthropometric survey in 1982-1983 at Calcutta. Here the data on arm circumference and skinfold thickness at triceps have been reported. At all ages between 7 and 16 years their mean values of arm girth are observed to be lower than those of the well-to-do Indian boys, whereas in possessing fatfold at triceps they come very close to the latter group to mark almost a similar pattern of growth. Though the city-bred Bengali boys show larger fatfolds than their foreign coevals in London (like these well-to-do boys), yet they maintain definitely thinner arms.

### **INTRODUCTION**

Selected body measurements like height, weight, mid-upper arm circumference and skinfold thickness at triceps have universally been accepted as some sensitive indicators of growth progress and nutritional status of individuals. Height and weight are two most useful parameters to examine the mode of linear growth and development of total body mass, where as arm circumference helps to evaluate the condition of muscle development and skinfold thickness acts as a significant index of body fat and thereby of caloric reserves. Further, the measurement of body fat serves also as an 'interpretive tool' in clinical evaluation of individuals. It has again been pointed out that measurements of both arm girth and triceps fatfold at a time do provide an objective basis to learn to what extent an individual had in his growing years suffered deficit in the muscle-protein reservoirs, caloric reserves, and growth process due to protein-calorie malnutrition (Jelliffe 1966, Beaton and Bengoa 1976). In this very context an attempt has been made in the paper to present (i) the growth patterns of arm circumference and subcutaneous fat deposition at triceps region (ii) the magnitude of protein-calorie deficiency, and (iii) a local standard for arm girth and triceps fatfold respectively in the city-bred boys of the Bengali parentage from Calcutta (East India).

### **MATERIAL AND METHOD**

In a cross-sectional study 856 Bengali-speaking boys were measured in a missionary high school from April 1982 through September 1983 at north Calcutta to obtain data on

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growth of normal, healthy children between the ages 7 and 16 years. They belonged in general to educated, upper-middle to middle class families. Exact date of birth of each one of the boys was very carefully ascertained on the strength of documentary evidence or authentic birth records which were available from maternity ward of the hospital or nursing home, family horoscope, personal notebook and diary. Altogether 25 anthropometric measurements as recommended for the International Biological Programme (Weiner and Lourie 1981), were taken by one of the authors (PDG). Here the data on only two physical traits are presented: (A) Upper arm circumference taken on 775 subjects, and (B) Skinfold thickness at triceps observed on 804 subjects. The subjects were usually measured on their respective birthdays but in some cases they were examined within 3 days around the birth dates concerned. The ages referred here are exact ages and not age classes.

Following the techniques as described by Weiner and Lourie (1981) for the International Biological Programme, upper arm circumference (relaxed) and skinfold thickness at triceps were measured always on the left side of all the boys. Arm girth was measured to the nearest 0.1 cms. with a flexible steel tape, while triceps thickness was observed to the nearest 0.5 mm. by a Lange Calliper having a pressure of 10g/mm<sup>2</sup> of contact surface area.

The usual statistical parameters for normal distributions—mean, standard deviation, standard error of mean—have been calculated mainly to keep conformity with the use made by many investigators. It is obvious that the skewness of all distributions, especially those of arm fat, point out at once the need for stressing the median (50th percentile) as the best measure of central tendency and for percentiles as measures of variability (Johnston *et al.* 1972). Percentile values have also been estimated for the present data.

#### RESULTS AND DISCUSSION

Means with standard errors, standard deviations and per year increment for both the measurements of the adequately nourished Bengali boys are presented in Table 1 and 2.

##### (A) Arm Circumference :

Mean values of this physical trait are found to increase progressively with age. Between 7 and 16 years the boys marked a difference of 6 cms. between the lowest and highest annual gain in arm girth. But maximum acceleration of growth takes place 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 1.08 cms. (Table 1).

##### (B) Fatfold thickness :

Fatfold at triceps region increases at a slow rate from age 7 with the advancing ages till the peak growth is found at the age of 11 years after which the thickness shows a gradual decline (Table 2). But the maximum rate of annual increment in the fatfold occurs between

the ages 9 and 10 years. In the advanced ages beyond 10 years the growth rate is, of course, negative.

In comparison with the well-to-do Indian boys (Raghavan *et al.* 1974) the Bengali boys of Calcutta, East India, present lower values of arm circumference in the given ages. But they mark higher values than their Indian counterparts belonging to low socio-economic groups in Hyderabad, South India. Nevertheless, the time of peak annual growth in arm girth is observed to be the same, namely, between the ages 14 and 15 years, in all the three samples. Another study on the well- and under-privileged boys of Delhi, North India, tallies also with above findings (Datta-Banik *et al.* 1973). On the otherhand, the values recorded for the boys belonging to the families of middle income group in Coimbatore, South India, vary very little from those of the Bengali boys between 7 and 12 years (Easwari and Devadas 1984). Similarly, the Punjabi boys of Delhi, aged 11 to 16 years, strike a close similarity with the Bengali boys in presenting the pattern of growth in arm girth (Singh 1970). The data available for the Gaddi Rajput boys living in Himalayan range, North India, (Singh 1980) show that their arm girth values are appreciably lower than the present study group. Now with respect to the values of arm girth for the British and American boys (Eveleth and Tanner 1976, and Malina, 1972) though the well-to-do Indian boys come somewhat closer to them, the Bengali and other boys in India vary at once markedly in showing thinner arm development. (Fig. 1).

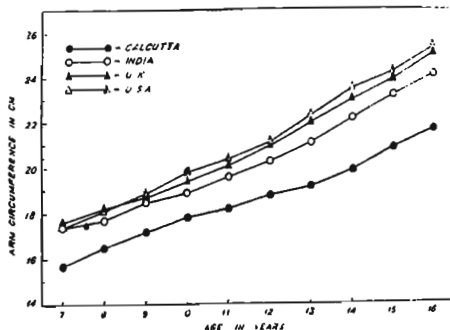


FIG 1. MEAN ARM CIRCUMFERENCE CURVE OF BENGALI BOYS OF CALCUTTA IN COMPARISON WITH WELL-TO-DO INDIAN, BRITISH AND AMERICAN BOYS

The Calcutta boys show in lower ages (7-9 years) lesser arm fat than the well-to-do Indian boys, but they maintain higher values at the ages 10 and 11 years, the peak growth increment being found at 11 years. After the peak they show the same pattern of growth as evinced by these well-off boys. In comparison with other data on fat deposition at triceps as obtained for the Gaddi Rajputs, the Bengali boys of Sodpur town, West Bengal (Das and Mukherjee 1981) the Bengali boys of Calcutta do mark better subcutaneous fat reserve, and thereby higher caloric reserves, in the given ages. It is interesting that like the well-off Indian boys the Calcutta boys also differ from their London counterparts (Tanner and Whitehouse 1975) in presenting higher skinfold values at triceps (Fig. 2). They possess, of course, much less arm fat than the American boys (Johnston *et al.* 1972 and 1974).

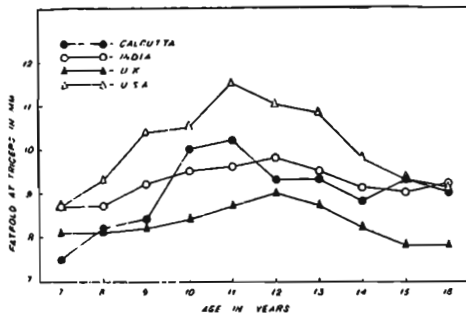


FIG. 2. MEAN TRICEPS SKINFOLD THICKNESS CURVE OF BENGALI BOYS OF CALCUTTA IN COMPARISON WITH WELL-OFF INDIAN, BRITISH AND AMERICAN BOYS

The present data on the Bengali boys have further been used to develop the local standards of reference for arm circumference and arm fat thickness during the growing years. Tables 3 and 4 present the distribution of centile values of these two characters by age. Estimates are given for seven percentiles from the 3rd through the 97th (Fig. 3 and Fig. 4), 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 Bengali children the extreme percentiles are shown in the tables advisedly.

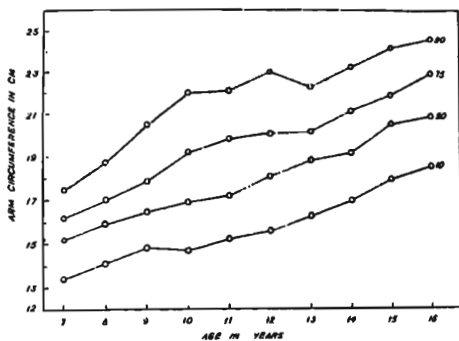


FIG 3 PERCENTILES FOR ATTAINED ARM CIRCUMFERENCE BY AGE IN BENGALI BOYS OF CALCUTTA

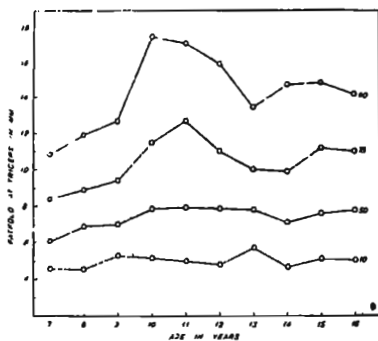


FIG 4 PERCENTILES FOR ATTAINED SKINFOLD THICKNESS AT TRICEPS IN BENGALI BOYS OF CALCUTTA

With respect to both arm girth and arm fat one may note 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 remains always proportionately greater than that from the 3rd to 50th centiles.

Being aware of the fact that the ages of Bengali boys are exact, while the data for well-off boys relate to age-classes it is observed here that the Bengali boys possess generally lower mean values for either one of the two physical traits in question than the well-to-do Indian boys over the growing years. They differ also in median values. The 50th percentile values of arm circumference for the Bengali boys fall in between the 5th and the 25th percentile values of the well-off Indian boys (Raghvan *et al.* 1974), the median values for the latter group being fairly higher. Truly speaking, the medians of the Bengalis come very close to those shown for the boys of low socio-economic groups in Hyderabad. On the otherhand, the 50th percentile values for fatfold at triceps of the Calcutta boys are a little higher than the 25th percentile but slightly lower than the 50th percentile values of the well-to-do Indian boys. The medians of the Bengalis are, again, appreciably greater than those noted for the boys of the said low socio-economic groups.

It may be noted here that when the standards of fatfold at triceps for the well-off Indian boys are stated to be similar to those of British boys, but lower than the American boys (Raghavan *et al.* 1974) the developmental position of the Bengali boys in this respect needs, of course, no elaboration.

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Table 1. Mean Arm Circumference with standard errors (SE), standard deviations (SD) and yearly increments at different ages of Bengali children of Calcutta.

Age in years	N	Range variation (cms.)	Mean (cms.)	SE	SD	Per year increment (cms.)
7	58	13.0-28.2	15.72	0.33	2.53	
8	82	11.5-29.0	16.47	0.31	2.80	0.75
9	94	13.4-27.2	7.19	0.27	2.61	0.72
10	67	13.8-28.8	17.85	0.40	3.27	0.66
11	96	12.8-30.3	18.18	0.32	3.13	0.33
12	94	14.1-27.9	18.84	0.31	2.99	0.66
13	92	15.0-27.3	19.20	0.24	2.30	0.36
14	89	15.8-27.5	19.88	0.26	2.50	0.68
15	70	16.0-29.3	20.96	0.32	2.72	1.08
16	33	18.5-32.2	21.67	0.48	2.78	0.71

Table 2. Mean values of Triceps skinfold with standard errors (SE), standard deviations (SD) and yearly increments at different ages of Bengali children of Calcutta.

Age in years	N	Range variation (mm.)	Mean (mm.)	SE	SD	Per year increment (mm.)
7	62	3.5-20.0	7.50	0.38	3.00	—
8	83	4.0-25.0	8.18	0.44	4.00	0.68
9	91	4.0-23.5	8.36	0.37	3.50	0.18
10	76	4.0-32.0	10.05	0.61	5.35	1.69
11	97	4.0-33.0	10.19	0.54	5.35	0.14
12	95	3.0-25.0	9.34	0.43	4.23	-0.85
13	95	5.0-21.5	9.27	0.39	3.80	-0.07
14	93	4.0-23.0	8.76	0.43	4.11	-0.51
15	76	3.0-21.5	9.26	0.51	4.44	0.50
16	36	5.0-22.0	9.04	0.65	3.93	-0.22

Table 3. Percentiles for Arm circumference at different ages of Bengali boys of Calcutta.

Age in years	Centiles (cms.)						
	3	10	25	50	75	90	97
7	13.08	13.44	14.15	15.20	16.23	17.52	21.50
8	12.76	14.10	14.72	15.92	16.99	18.75	24.66
9	13.76	14.84	15.49	16.45	17.85	20.47	24.03
10	13.88	14.67	15.41	16.95	19.18	22.08	26.50
11	13.95	15.22	15.94	17.20	19.85	22.12	25.37
12	14.88	15.57	16.75	18.10	20.12	23.06	26.27
13	15.67	16.32	17.62	18.90	20.20	22.27	24.03
14	15.96	16.99	18.18	19.18	21.17	23.31	25.20
15	16.21	18.00	19.15	20.60	23.95	24.75	27.14
16	18.50	18.66	19.61	20.45	23.02	24.72	25.80

Table 4. Percentiles for Fatfold at Triceps at different ages of Bengali boys of Calcutta.

Age in years	Centiles (mms.)						
	3	10	25	50	75	90	97
7	3.64	4.58	5.44	6.09	8.37	10.81	14.12
8	4.00	4.55	4.99	6.87	8.92	11.92	18.50
9	4.12	5.27	5.85	6.97	9.38	12.65	15.82
10	4.01	5.15	6.25	7.86	11.50	17.48	23.35
11	4.00	4.97	6.02	7.92	12.69	17.14	23.05
12	3.45	4.75	5.87	7.86	11.05	15.88	17.59
13	5.00	5.68	6.61	7.81	10.04	13.38	20.57
14	4.00	4.65	5.65	7.12	9.96	14.71	18.30
15	3.42	5.10	5.82	7.58	11.20	14.80	20.34
16	5.00	5.00	5.67	7.75	11.00	14.13	14.97



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