

## Changes in Upper Arm Circumference and Fat Fold at Triceps Among Yadava Girls of North Coastal Andhra Pradesh

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**ABSTRACT** A sample of 632 school-going girls of Yadava parentage was studied in a cross-sectional anthropometric survey during January 1986 to June 1987 in Bheemunipatnam and Anandapuram mandals of Visakhapatnam district. In this paper the data on upper arm circumference and skinfold thickness at triceps have been reported. At all ages between 1 to 20 years their mean values of arm circumference and fat fold at triceps are observed to be lower than those of the Indian school girls and ICMR standards 1984.

In this paper an attempt has been made to present (1) the growth patterns of upper arm circumference and subcutaneous fat deposition at triceps region and (2) compared with local standards for upper arm circumference and triceps fat fold, respectively in the rural-bred girls of the Yadava parentage to find out the population difference.

### MATERIAL AND METHODS

In a cross-sectional study 632 Yadava girls were measured from the rural educational institutions from January 1986 to June 1987 in Bheemunipatnam and Anandapuram mandals of Visakhapatnam district to obtain data on growth between the ages 1 to 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. In this paper the data on only two physical traits are presented. (A) upper arm circumference and (B) triceps skinfold are taken on 632 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 of upper arm circumference (relaxed) and triceps skinfold were taken after Weiner and Lourie (1969). Arm girth was measured to the nearest 0.1 cm. with a flexible steel tape. While triceps skinfold thickness was observed to the nearest 0.2 mm by a Harpenden skinfold caliper.

### RESULTS AND DISCUSSION

Mean with standard deviation and standard error for the upper arm circumference and triceps skinfold measurements among Yadava girls are presented in table 1.

#### (A) Upper Arm Circumference

Mean values of this physical trait are found to increase progressively with age. Between 1 to 20 years the girls marked a difference of 1.35 cm between the lowest and highest annual gain in arm girth. But maximum acceleration of growth attained between the ages 13 and 14, 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 1.40 cm.

Table 1: Mean, standard deviation and standard error of mean of upper arm circumference and triceps skinfold among Yadava girls of Visakhapatnam

| Upper arm circumference (cm) |           |      |      | Age<br>(in years) | Triceps skinfold (mm) |           |      |      |
|------------------------------|-----------|------|------|-------------------|-----------------------|-----------|------|------|
| N                            | $\bar{X}$ | SE   | SD   |                   | N                     | $\bar{X}$ | SE   | SD   |
| 50                           | 11.92     | 0.24 | 1.73 | 1                 | 50                    | 8.37      | 0.39 | 2.18 |
| 40                           | 13.16     | 0.16 | 1.03 | 2                 | 40                    | 9.12      | 0.36 | 1.78 |
| 36                           | 13.82     | 0.11 | 0.69 | 3                 | 36                    | 9.66      | 0.30 | 1.83 |
| 40                           | 14.07     | 0.12 | 0.77 | 4                 | 40                    | 9.07      | 0.33 | 2.08 |
| 60                           | 14.30     | 0.11 | 0.88 | 5                 | 60                    | 8.09      | 0.23 | 1.82 |
| 47                           | 14.42     | 0.10 | 0.70 | 6                 | 47                    | 7.22      | 0.21 | 1.50 |
| 47                           | 14.63     | 0.11 | 0.78 | 7                 | 47                    | 6.55      | 0.24 | 1.62 |
| 44                           | 15.26     | 0.12 | 0.83 | 8                 | 44                    | 6.76      | 0.19 | 1.24 |
| 34                           | 15.81     | 0.14 | 0.81 | 9                 | 34                    | 7.23      | 0.28 | 1.61 |
| 27                           | 16.04     | 0.19 | 0.97 | 10                | 27                    | 7.25      | 0.38 | 1.97 |
| 27                           | 16.74     | 0.18 | 0.96 | 11                | 27                    | 7.30      | 0.37 | 1.90 |
| 21                           | 17.58     | 0.18 | 0.84 | 12                | 21                    | 7.38      | 0.50 | 2.30 |
| 35                           | 18.30     | 0.14 | 0.84 | 13                | 35                    | 7.69      | 0.35 | 2.09 |
| 18                           | 19.70     | 0.19 | 0.82 | 14                | 18                    | 8.99      | 0.85 | 3.59 |
| 28                           | 20.12     | 0.20 | 1.08 | 15                | 28                    | 8.28      | 0.30 | 1.60 |
| 20                           | 21.35     | 0.40 | 1.78 | 16                | 20                    | 9.28      | 0.51 | 2.29 |
| 21                           | 21.45     | 0.27 | 1.23 | 17                | 21                    | 10.21     | 0.82 | 3.78 |
| 11                           | 21.52     | 0.36 | 1.20 | 18                | 11                    | 10.24     | 0.71 | 2.38 |
| 13                           | 21.58     | 0.25 | 0.92 | 19                | 13                    | 9.55      | 0.85 | 3.06 |
| 13                           | 21.63     | 0.30 | 1.08 | 20                | 13                    | 9.94      | 0.72 | 2.82 |

*(B) Fat Fold Thickness at Triceps*

Fat fold at triceps region increases at a slow rate from age 1 with the advancing ages till 3 years after which thickness shows a gradual decline upto 7 years, and then increase from 8 to 18 years, after which thickness shows a gradual decline. But the maximum rate of annual increment in the fat fold attained between the ages of 13 and 14 years. In the advanced ages beyond 4 to 7 years the growth rate is of course negative. The adolescent growth spurt of both upper arm circumference and triceps skinfold of Yadava girls was attained between 13-14 years as similar to that of Vadabaliya girls (Dharma Rao and Busi, 1992).

The present data on the Yadava girls 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 present the distribution of centile values of these two 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 both arm girth and arm fat 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 97th centiles remains always proportionately greater than that from the 3rd to 50th centiles.

Table 2: Percentiles for upper arm circumference and triceps skinfold at different ages of Yadava girls of Visakhapatnam

| Upper arm circumference (cm) |       |       |       |       |       |       | Age<br>(in years) | Triceps skinfold centiles (mm) |      |      |       |       |       |       |
|------------------------------|-------|-------|-------|-------|-------|-------|-------------------|--------------------------------|------|------|-------|-------|-------|-------|
| 3rd                          | 10th  | 25th  | 50th  | 75th  | 90th  | 97th  |                   | 3rd                            | 10th | 25th | 50th  | 75th  | 90th  | 97th  |
| 8.66                         | 9.70  | 10.75 | 11.92 | 13.09 | 14.14 | 15.17 | 1                 | 4.27                           | 5.57 | 6.90 | 8.37  | 9.84  | 11.16 | 12.47 |
| 11.22                        | 11.84 | 12.46 | 13.16 | 13.85 | 14.48 | 15.10 | 2                 | 5.06                           | 6.35 | 7.66 | 9.12  | 10.58 | 11.89 | 13.18 |
| 12.52                        | 12.93 | 13.35 | 13.82 | 14.28 | 14.70 | 15.11 | 3                 | 5.91                           | 7.10 | 8.31 | 9.66  | 11.00 | 12.21 | 13.40 |
| 12.62                        | 13.08 | 13.55 | 14.07 | 14.59 | 15.06 | 15.51 | 4                 | 5.40                           | 6.57 | 7.75 | 9.07  | 10.39 | 11.57 | 12.74 |
| 12.64                        | 13.17 | 13.70 | 14.30 | 14.89 | 15.43 | 15.95 | 5                 | 4.84                           | 5.87 | 6.92 | 8.09  | 9.26  | 10.30 | 11.34 |
| 13.01                        | 13.52 | 13.95 | 14.42 | 14.89 | 15.31 | 15.74 | 6                 | 4.40                           | 5.30 | 6.20 | 7.22  | 8.23  | 9.14  | 10.04 |
| 13.16                        | 13.63 | 14.10 | 14.63 | 15.16 | 15.63 | 16.10 | 7                 | 3.50                           | 4.47 | 5.45 | 6.55  | 7.64  | 8.63  | 9.60  |
| 13.70                        | 14.19 | 14.70 | 15.26 | 15.82 | 16.32 | 16.82 | 8                 | 4.43                           | 5.17 | 5.92 | 6.76  | 7.60  | 8.35  | 9.09  |
| 14.29                        | 14.77 | 15.26 | 15.81 | 16.36 | 16.85 | 17.33 | 9                 | 4.20                           | 5.16 | 6.14 | 7.23  | 8.31  | 9.29  | 10.26 |
| 14.21                        | 14.80 | 15.38 | 16.04 | 16.69 | 17.28 | 17.86 | 10                | 3.54                           | 4.72 | 5.91 | 7.25  | 8.58  | 9.77  | 10.95 |
| 14.93                        | 15.50 | 16.09 | 16.74 | 17.39 | 17.97 | 18.54 | 11                | 3.73                           | 4.86 | 6.01 | 7.30  | 8.58  | 9.73  | 10.87 |
| 15.99                        | 16.50 | 17.01 | 17.58 | 18.15 | 18.65 | 19.16 | 12                | 3.05                           | 4.43 | 5.82 | 7.38  | 8.93  | 10.33 | 11.70 |
| 16.72                        | 17.22 | 17.73 | 18.30 | 18.87 | 19.37 | 19.88 | 13                | 3.76                           | 5.01 | 6.28 | 7.69  | 9.10  | 10.37 | 11.62 |
| 18.16                        | 18.65 | 19.14 | 19.70 | 20.25 | 20.75 | 21.24 | 14                | 2.24                           | 4.39 | 6.56 | 8.99  | 11.41 | 13.59 | 15.74 |
| 18.09                        | 18.73 | 19.39 | 20.12 | 20.85 | 21.50 | 22.15 | 15                | 5.27                           | 6.23 | 7.20 | 8.28  | 9.36  | 10.33 | 11.29 |
| 18.00                        | 19.07 | 20.15 | 21.35 | 22.55 | 23.63 | 24.70 | 16                | 4.97                           | 6.34 | 7.73 | 9.28  | 10.83 | 12.21 | 13.59 |
| 19.14                        | 19.87 | 20.62 | 21.45 | 22.28 | 23.03 | 23.76 | 17                | 3.10                           | 5.36 | 7.65 | 10.21 | 12.76 | 15.05 | 17.32 |
| 19.26                        | 19.98 | 20.71 | 21.52 | 22.33 | 23.06 | 23.78 | 18                | 5.76                           | 7.19 | 8.63 | 10.24 | 11.85 | 13.29 | 14.71 |
| 19.85                        | 20.40 | 20.96 | 21.58 | 22.20 | 22.76 | 23.31 | 19                | 3.79                           | 5.63 | 7.48 | 9.55  | 11.61 | 13.47 | 15.30 |
| 19.60                        | 20.24 | 20.90 | 21.63 | 22.36 | 23.01 | 23.66 | 20                | 4.63                           | 6.32 | 8.03 | 9.94  | 11.84 | 13.55 | 15.24 |

Being aware of the fact that the ages of Yadava girls are exact, while the data for well-off girls related to age classes it is observed here that the Yadava girls possess generally lower mean values for either one of the two physical traits in question than the Vadabalija girls and well-to-do Indian girls over the growing years. The 50th percentile values of upper arm circumference for the Yadava girls fall in between the 5th and the 25th percentile values of the Vadabalija girls (Dharma Rao and Busi, 1992) and well-off Indian girls (Raghavan et al., 1974). It will be apparent from the foregoing results that the findings among Yadava girls were more or less similar to the findings of Singh (1980), Dharma Rao and Busi (1992) and Singal et al. (1990).

It may be noted here that when the standards of fat fold at triceps for the Indian girls are stated to be less than those of British girls, American girls (Raghavan et al., 1974 Cronk

et al., 1983; Muller, 1982 and ICMR Standards' 1984) to developmental position of the Yadava girls in this respect needs, of course no elaboration.

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#### REFERENCES

- Cronk, C.E., Mukherjee, D. and Roche, A.F.: Changes in triceps and subscapular skinfold thickness during adolescence. *Hum. Biol.*, 55: 707-721 (1983).
- 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. *Indian J. Pediatr.*, 40, 173-179 (1978).
- Dharma Rao, B. and Busi, B.R.: Physical growth and maturity gradients of certain physical traits in rural



- Vadabaliya girls of North coastal Andhra Pradesh, India. *J. Hum. Ecol.*, 3: 53-54 (1992).
- 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).
- Muller, W.H.: The changes with age of the anatomical distribution of Fat. *Social Science and Medicine* (1982).
- Nath, S.: *A Study of Age Changes of Different Biological variables in the Jat Boys of Meerut (U.P.)*, Ph.D. Thesis (Unpublished), University of Delhi, Delhi (1972).
- Pakrasi, K., Dasgupta, P. Dasgupta, I. and Majumder, 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).
- Singh, S.P.: Physical growth of Gaddi Rajputs of Dhaura Dhar range of Himalayas. *Z. Morph. Anthropol.*, 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. Anthropol. Hum. Genet.*, 16: 49-62 (1990).
- Tanner, J.M., Whitehouse, 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. Childh.*, 41: 454-471, 613-635 (1966).
- Weiner, J.S. and Lourie, J.A.: *IBP. Hand book No. 9. Human Biology*. Blackwell, Oxford and Edinburgh (1969).