

Growth Pattern and Age at Menarche in Bania Girls of Mandi Gobindgarh

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ABSTRACT The present study is an attempt to investigate the growth pattern and age at menarche of Bania girls from Mandi Gobindgarh (Punjab). Cross-sectional data based on ten anthropometric measurements and two indices were collected from 284 Bania girls aged 9 to 16 years attending secondary school and belonging to middle socio-economic status. Additional information on age at menarche was obtained using status quo method. Bania girls are found to be shorter and lighter at all ages than well to do Indian and Punjabi girls. When compared to ICMR sample and Indian children belonging to low socio-economic group, Bania girls stand taller and heavier at all age levels. The probit analysis of the status quo data yielded median age at menarche of 12.88 ± 0.72 years.

INTRODUCTION

Body size and composition, growth velocity and maturational rate are all factors that, by reflecting conditions of early childhood, may offer important clues to the cumulative effects of genetic and environmental conditions and to the genesis of adult diseases. Thus, growth data as an indicator of public health and nutritional status of children, assume ever increasing importance because growth monitoring in children can serve as a powerful tool for appropriate action to promote improved health and nutritional status (Eveleth and Tanner, 1990).

In a multiethnic and geographically vast country like India, where there is great cultural and economic diversity such studies are more relevant. Numerous studies on Indian populations highlighting the differential growth patterns of rural and urban children and children belonging to different socio-economic classes have been reported (Vijayraghvan et al., 1971; ICRM, 1972; Sikri, 1972; Pereira et al., 1983;

ICMR, 1984; Sharma et al., 1987; Singh et al., 1991). Besides, information on age at menarche in Indian populations has also been obtained to investigate the range of variation in this practical indicator of sexual maturity. (Chitvale, 1957; Madhavan, 1965; Bai and Vijayalakshmi, 1973; Ghosh et al., 1973; Roberts et al., 1977; Singh and Ahuja, 1979; Talwar et al., 1987; Bhatnagar et al., 1987; Sharma et al., 1988; Talwar et al., 1994).

To augment data in this direction, the present study aims to provide information on growth pattern and menarcheal age of Bania girls aged 9 to 16 years from Mandi Gobindgarh.

MATERIAL AND METHODS

The present study is based on a cross-sectional sample of 284 Bania girls, ranging in age from 9 to 16 years, predominantly belonging to middle socio-economic status and residing in Mandi Gobindgarh. The data were collected from various secondary schools in Mandi Gobindgarh during Sept.-Nov., 1993. Dates of birth of subjects were obtained from the institutional records and cross-checked from their parents. Ages of the subjects were then calculated according to Decimal age calendar given by Tanner and Whitehouse (1966). The data thus collected were divided into eight age groups, each of the magnitude of one year.

The anthropometric data included weight, height, four skinfolds (triceps, sub-scapular, suprailiac and calf) two girths (biceps and calf) and two diameters (humerus and femur bicondylar). These measurements were taken employing standard anthropometric techniques (Weiner and Lourie, 1969). Harpenden caliper were utilized for taking fatfolds at various sites. Ponderal index, ($\text{Stature}^3 / \text{weight}$) closely associated with body build and body mass index (kg/m^2)

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were calculated for each of the subjects.

RESULTS

Table 1 presents the means and standard deviations for ten anthropometric measurements and two derived indices of Bania girls for the ages 9 through 16 years. The data presented clearly indicated a regular increase in the anthropometric measurements with advancing age. The growth spurt for weight and height is noticed between 12 to 13 years. Results on height / $3\sqrt{\text{weight}}$ ratio or ponderal index demonstrate that Bania girls have comparatively less weight for height uptill 13 years, whereafter, they start adding more weight for height, thereby showing a heavier body build. This is not unusual and occurs in most populations. The mean values of body mass index (wt/ht^2) increased with age but the magnitude of increase is much larger between the ages 11 to 16 years (Table 1). This is probably due to menarcheal age associated with better overall growth in females during this period (Visweswara Rao et al., 1991).

Femur width records an increase of larger

magnitude (1.05 cm) as compared to humerus width (0.75 cm). Biceps and calf girths show a rapid increase from 11 to 15 years thereby showing muscular development during this period. A clear tendency to deposit fat by Bania girls during adolescence is depicted by all skinfolds. However, the rate of deposition increases fairly rapidly after 11 years and it continuous throughout the adolescence. Hence, once peak height velocity is reached, there is dramatic increase in the velocity of fat accumulation in females (Barnes, 1975). In fact, fat pattern also appears to change in adolescence from a more peripheral to a centralized one (Baumgartner and Roche, 1988). Similar findings have been reported for sample girls of the present study. Regarding, the menarcheal age of Bania girls, the probit analysis of the status quo data yielded median age at menarche of 12.88 ± 0.72 years (Table 2).

DISCUSSION

Much of human variability is rooted in the years of growth and development beginning prenatally and continuously post-natally as the

Table 1: Mean $\pm$ S.D. of ten anthropometric measurements and two indices by age of Bania girls of Mandi Gobindgarh

Measurements	9 N=36 $\bar{X} \pm S.D.$	10 N=33 $\bar{X} \pm S.D.$	11 N=35 $\bar{X} \pm S.D.$	12 N=37 $\bar{X} \pm S.D.$	13 N=35 $\bar{X} \pm S.D.$	14 N=35 $\bar{X} \pm S.D.$	15 N=36 $\bar{X} \pm S.D.$	16 N=35 $\bar{X} \pm S.D.$
Weight (Kg)	26.02 (3.96)	29.90 (6.48)	31.31 (4.88)	36.57 (5.99)	41.34 (8.78)	44.34 (5.55)	44.33 (6.25)	48.57 (5.96)
Height (Cm)	129.12 (5.44)	134.96 (7.24)	139.74 (6.25)	145.11 (5.78)	151.45 (6.09)	152.85 (4.90)	153.18 (4.20)	154.35 (3.56)
Ht/ $3\sqrt{\text{wt}}$	43.79 (1.73)	43.77 (2.01)	44.50 (2.16)	43.91 (1.84)	44.12 (2.27)	43.29 (1.81)	43.22 (1.71)	42.43 (1.47)
BMI (Kg/m^2)	15.57 (1.75)	16.20 (2.42)	16.03 (2.31)	17.30 (2.26)	17.91 (3.01)	18.97 (2.15)	18.87 (2.34)	20.36 (2.18)
Humerus width (cm)	4.81 (0.42)	5.06 (0.37)	5.18 (0.35)	5.41 (0.32)	5.50 (0.46)	5.52 (0.35)	5.55 (0.22)	5.56 (0.31)
Femur width (cm)	6.77 (0.81)	7.20 (0.53)	7.44 (0.48)	7.51 (0.40)	7.85 (0.47)	7.85 (0.46)	7.80 (0.43)	7.82 (0.40)
Upper arm circumference (cm)	17.09 (1.94)	17.85 (2.68)	17.98 (2.19)	18.75 (2.45)	19.28 (2.83)	20.21 (2.76)	22.56 (2.66)	22.61 (3.30)
Triceps skinfold (cm)	6.90 (1.64)	7.47 (2.41)	7.38 (1.58)	7.82 (2.06)	8.24 (2.60)	9.18 (1.90)	9.43 (2.68)	9.12 (2.41)
Subscapular skinfold (mm)	6.41 (2.05)	6.77 (2.46)	6.92 (2.25)	7.87 (2.62)	9.37 (3.22)	9.40 (2.09)	9.48 (2.88)	9.98 (2.33)
Suprailiac skinfold (mm)	5.95 (1.85)	6.72 (2.36)	6.77 (2.25)	7.39 (2.42)	7.99 (2.19)	8.12 (1.80)	8.20 (2.69)	8.36 (1.92)
Calf skinfold (mm)	6.76 (1.67)	7.85 (1.95)	7.93 (2.12)	8.95 (2.32)	9.45 (2.36)	9.70 (2.21)	9.85 (2.45)	11.39 (5.69)

Table 2: Total number of percentage of Bania girls who attained menarche

Age in years	Menarche			
	Number	Occurred	% age	Probit Value
9 Year	36	—	—	—
10 Year	33	—	—	—
11 Year	35	—	—	—
12 Year	37	4	10.81	3.76
13 Year	35	17	48.57	4.96
14 Year	35	33	94.28	6.58
15 Year	36	35	97.22	6.91
16 Year	35	35	100.00	—

Median age at menarche 12.88 ± 0.72

genotype expresses itself in its interaction with a variety of environmental conditions. To study the population difference in growth patterns mean heights and weights of Bania girls have been compared with various Indian populations. Bania girls when compared with well to do Indian girls (Vijayaraghvan et al., 1971) are found to be considerably shorter and lighter at all ages. Their growth curves for weight and height run well above the similar curves for all India pooled sample (ICMR, 1984); Punjabi girls from low socio-economic group (Talwar et al., 1994) and Indian children from low socio-economic group (Vijayaraghvan et al., 1971). However, their growth curves run very close to the growth curves for weight and height of Punjabi girls from high socio-economic group (Talwar et al., 1994).

The weight curve of Bania girls when compared to similar curve for NCHS coincides the 30th percentile till 10 years, whereafter it fluctuates between 20th and 30th percentile to merge with 20th percentile at 16 years. Whereas, for height similar trend as for weight is witnessed till 13 years, whereafter, the values come to lie between 10th and 20th percentile of NCHS curve for height to finally meet the 10th percentile at 16 years.

Comparison of mean upper arm circumference value of Bania girls with standards reported for American White (Frisancho, 1974) and well to do Indians (Vijayaraghvan et al., 1974) reveals a poor performance of the sample girls as compared to these two population groups, especially up to 14 years when their growth curve lies below the 5th percentile of American Whites. After 14 years, sample girls pick up to

catch up with the 10th percentile of American whites and exhibit almost equal value as that of well to do Indians at 15 years. This would suggest that peak of muscle growth velocity is some what later than the peak height velocity but girls do have an adolescent spurt in muscle. The increase in size of muscle reflect increased amount of contractile protein and muscle and underlies great increase of strength occurring simultaneously (Tanner, 1978). Sample girls also exhibit similar findings.

The mean values for fat fold at triceps were found to fluctuate between 5th and 10th percentile of U.S. Whites except at 16 years, where the curve dips below 5th percentile. The triceps fat fold of Bania girls were distinctively less than well nourished Indian girls (Vijayaraghvan et al., 1974) of corresponding ages who in turn were placed between the 25th and 50th percentiles of Americans. It indicates that Indian children have smaller triceps skinfold than those of Americans. The difference in subcutaneous fatness between Bania girls and well fed Indian suggest that different environmental agents are operating in females belonging to different socio-economic groups. The low fat reserves in the present sample seems to have close relationship with their dietary habits. In fact the amount of body fat situated subcutaneously in any group of people is uncertain (Durnin and Womersley, 1974).

It is well documented that age at menarche is well correlated with age at peak (Tanner et al., 1976). The spurt may occur at any time from six months before to six months after menarche (Zacharias and Rand, 1983). In our sample age at menarche and peak height were almost simultaneous.

Bania girls of present sample have been compared with other population samples for age at menarche. Bania girls of present study show earlier maturation when compared with their Indian counterparts. Bania girls are ahead of South Indians, (13.27); Punjabi twins, (13.03); Agra girls, (13.40), and Punjabi Girls, (13.87) belonging to low socio-economic group. Their age at menarche is more than that of Punjabi girls (12.65), belonging to high socio-economic group. The average menarcheal age in various sample world wide compiled by Eveleth and

Tanner, (1990, pp. 162-165) fall at or below 12.6 years. It is well known fact that individual's menarcheal age depend on genetic endowment and health status which in turn is governed by various environmental factors. There is still a need for clarification of the magnitude of the influences of particular factors on menarcheal age (Henneberg and Louw, 1995).

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