

## RELATION OF MENARCHEAL AGE TO PHYSICAL BUILD

by

H. D. SINGH,\* M.B.B.S., M.Sc.

K. MEENAKSHI, M.Sc.

and

K. S. BAGEERATHI,\*\* M.B.B.S.

Menarche is an event which occurs only in the primate female and is taken as the commencement of female reproductive life. Being a unique and easily recognizable landmark in a woman's life, the average age at which menarche occurs in girls has been extensively studied in various geographical areas of the world. Since sexual maturity is associated with physical growth, the relation between menarcheal age and physical characteristics have been widely investigated by cross-sectional as well as longitudinal studies in British, European and American girls. It has, however, been pointed out that accurate data of menarcheal age in tropical areas are lacking because of uncertainty of children's ages (Ellis 1950, Tanner 1962). This lacuna in knowledge was sought to be filled by a study in South Indian girls in whom accuracy of data could be ensured. The results seemed to us to be sufficiently interesting and worthwhile recording for comparison with the available Western data.

### *Material and Methods*

Our sample was restricted to an intelligent section of the community compris-

ing of school girls, medical students and hospital nurses. The subjects were from communities in whom menarche is an event of religious and even ritualistic significance and hence the date and time of menarche is noted down in family records, just as the date and time of birth is recorded for casting horoscopes. Only subjects who could verify and furnish accurate data were included. Hence the errors and bias liable in a cross-sectional study due to faulty recall are almost nil in this sample.

The sample consisted of 3 groups of subjects:

### *Group I*

School girls between 11 and 16 years of age with dates of birth between 1954 and 1960. Yes/No questions regarding menarche were asked of 200 girls. From 110 girls who gave positive answers, the dates of menarche were obtained.

### *Group II*

Data were obtained in 320 medical students in the pre-clinical years of study. These subjects were born between 1948 and 1952 and the range of age was 18-22 years.

### *Group III*

This group was made up of 40 older subjects born between 1939 and 1947 and included hospital nurses and older sisters

\*Dean, Kilpauk Medical College, Madras.

\*\*Tutors in Physiology, Kilpauk Medical College.

Received for publication on 29-8-72

of medical students who could furnish accurate data. This group was included in order to extend the range of birth days to about two decades with a view to determine whether there was any evidence of a secular trend.

Though the number of subjects studied is only 470, it was felt that an accurate cross-sectional study in a modest sample would be more reliable than a large-scale survey in which the accuracy of both date of birth and date of menarche is difficult to ensure. Height in centimetres, weight in kilograms and the transverse thoracic diameter in cm. at the level of the sixth rib were measured in all subjects of groups I and II.

are obtained with  $W/H^2$  and weight. At the age of 13 and 14 years girls who had attained menarche are taller, heavier, broader at the chest and have more weight for height than girls who had not started menstruating (Table II). The number of girls who had attained menarche by 12 years and number not attained menarche by 15 years were too few in this sample for making a similar comparison.

#### Discussion

A belief was widely held at one time that girls mature earlier in the tropics than in temperate regions, but data obtained in Nigerian, Ceylonese, Burmese

The ratios,  $\frac{\text{Weight}}{10 \times \text{square of height (meters)}} \left[ \frac{W}{H^2} \right]$ , and  $\frac{\text{Transverse thoracic diameter (cm)}}{10 \times \text{height (meters)}} \left( \frac{\text{TTD}}{H} \right)$  were calculated. The data were statistically analysed.

#### Results

The mean menarcheal ages were  $13.1 \pm 0.09$ ,  $13.8 \pm 1.47$  and  $14.0 \pm 1.63$  for Groups I, II and III respectively. Menarcheal age in young adults has a significant correlation with all parameters except height (Table 1). The best correlations

TABLE I

#### Correlation Co-efficient of Menarcheal Age with Other Parameters

Parameter	No. of subjects	Correlation coefficient
Height	320	- 0.09*
Weight	320	- 0.28
TTD	320	- 0.18
$W/H^2$	320	- 0.37
TTD/H	320	- 0.17
Year of birth	470	- 0.16

\* Not significant at 5% level.

(320 subjects belong to Group II only).

and Indian girls (Ellis 1950; Wilson and Sutherland 1950; Foll 1961; Madhavan 1965) have disproved this myth. Our results confirm that South Indian girls do not attain menarche any earlier than girls in temperate climates. A trend towards earlier menarche in recent years noted in Western populations is also evident in our study. The significant negative correlation between year of birth and menarcheal age, even in our small sample is indicative of the existence of a secular trend.

Numerous studies in Western subjects have established that girls who attain menarche early are taller and heavier than late maturers. It has also been found that though the weight difference persists into adulthood there is little difference in height between early and late maturers (Simmons and Greulich 1943;



TABLE II  
Physical Measurements of School Girls (Mean  $\pm$  SD)

Age	Status*	No.	Height	Weight	TTD	W/H <sup>2</sup>	TTD/H
13	N	30	144.3 $\pm$ 5.41	30.9 $\pm$ 4.26	17.8 $\pm$ 1.57	1.500 $\pm$ .184	1.235 $\pm$ .101
	M	11	147.4 $\pm$ 5.87	34.6 $\pm$ 3.76	18.9 $\pm$ 1.73	1.600 $\pm$ .143	1.283 $\pm$ .106
14	N	38	145.5 $\pm$ 5.71	31.8 $\pm$ 4.13	18.3 $\pm$ 1.25	1.501 $\pm$ .184	1.255 $\pm$ .084
	M	57	149.2 $\pm$ 4.53	35.6 $\pm$ 3.47	19.4 $\pm$ 1.54	1.600 $\pm$ .197	1.310 $\pm$ .117

\* N = Not attained Menarche. M = Attained Menarche.

Tanner 1962; Frisch and Revelle 1970). In a group of young adult South Indian women, Logambal and Bhaskar Rao (1969) found that mean weight as well as height were greater in those who had attained early menarche. Our study shows that at 13 and 14 years of age, girls who had attained menarche are taller and heavier than those who had not started menstruating. In young adults although the correlation co-efficient of menarcheal age with height shows a slight negative trend, it is not significant at 5% level; the difference in weight is, however, appreciable.

In most of the studies relating physique to menarche, either a simple weight-height ratio or the ponderal index have been used (Simmons and Greulich 1943; Roberts and Dann 1967). It has been pointed out by Khosla and Lowe (1967) that both these ratios are unreliable, and they recommended the ratio  $W/H^2$  as a satisfactory index of obesity. We have confirmed the applicability of this ratio in Indian subjects (Singh *et al* 1970),

TTD

and have also found that  $\frac{TTD}{H}$  is a satis-

factory index of linearity of build (Meenakshi and Singh 1970). Using these indices we find that late maturing girls are more linear and have less weight for height not only in the early adolescent ages, but also at 20 years.

It is interesting to note that in spite of wide geographical climatic, environmental and racial variations, as well as differences in growth patterns and physical build between Western and Asian populations, the relation of menarcheal age to physical characteristics are very similar.

#### Summary

The lack of accurate and reliable data on menarcheal age in Asian populations

prompted this investigation in South Indian girls. Data were obtained in 470 subjects in whom the correct dates of birth and menarche were known. The subjects comprised of school girls, medical students, and hospital nurses. Height, weight and transverse thoracic diameter were measured. The ratios,  $W/H^2$  and  $TTD/H$  were calculated and used as indices of obesity and linearity of build, respectively. At ages 13 and 14 years, girls who had attained menarche were found to be taller and heavier than girls who had not started menstruating. In young adults, though a weight difference is evident, the difference in height is negligible. Late maturing girls are more linear, and have less weight for height not only in the early adolescent ages but also at 20 years.

References

1. Ellis, R. W. B.: Brit. Med. J., 1: 85, 1950.
2. Foll, C. V.: Arch. Dis. Childh., 36: 302, 1961.
3. Frisch, R. E. and Revelle, R.: Science, 169: 397, 1970.
4. Logambal, A. and Bhasker Rao, K.: J. Obst. Gynec. India, 19: 490, 1969.
5. Khosla, T. and Lowe, C. R.: Brit. J. Prev. Soc. Med., 21: 122, 1967.
6. Shantha, Madhavan, S.: Ind. J. Med. Res., 53: 669, 1965.
7. Meenakshi, K. and Singh, H. D.: Ind. J. Pediat., 37: 448, 1970.
8. Roberts, D. F. and Dann, T. C.: Brit J. Prev. Soc. Med., 21: 170, 1967.
9. Simmons, K. and Greulich, W. W.: J. Paed., 22: 518, 1943.
10. Singh, H. D., Meenakshi, K. and Bageerathi, S.: Lancet, 2: 1358, 1970.
11. Tanner, J. M.: Growth at Adolescence, Blackwell Scientific Publications, Oxford, 1962.
12. Wilson, D. C. and Sutherland, I.: Brit. Med. J., 2: 862, 1950.

TABLE I

The relation of menarcheal age to physical build in South Indian girls

Menarcheal Age (Years)	Number of Subjects	Mean Height (cm)	Mean Weight (kg)	Mean $W/H^2$ (kg/m <sup>2</sup> )	Mean $TTD/H$ (cm/m)
11-12	100	145	35	1.65	0.18
13-14	200	155	45	1.85	0.19
15-16	150	165	55	2.05	0.20
17-18	100	175	65	2.25	0.21
19-20	50	185	75	2.45	0.22

The present study is one of the first in India. This is thought to be the first study of the relation of menarcheal age to physical build in South Indian girls. The present study is a preliminary study and the results are preliminary. The present study is a preliminary study and the results are preliminary.