Earlier Onset of Pubertal Maturation in Thai Girls

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Abstract

Background : Recent studies in the USA and Hong Kong demonstrated the onset of puberty in girls has shifted toward a younger age. Based upon previous studies on variations of pubertal maturation in Thai girls, the secular trend has also moved toward an earlier age. The latest study in 1995 revealed the mean age of menarche was 12.3 years.

Objectives : To identify the onset of puberty, menarche and pubarche in female children and adolescents in 2 Bangkok schools.

Method : Three hundred school girls aged 9-19 years were enrolled in the study. Data were collected from January 1997 through December 1999. Assessment of pubertal staging by Tanner's criteria was performed by a trained pediatrician. All were in good physical health and had normal height and weight. The median ages of thelarche, menarche and pubarche were estimated by probit analysis. All other parameters were expressed as mean $\pm$ SD.

Results : The median ages of thelarche and pubarche were 9.4 and 11.1 years, respectively. Two hundred and twenty one girls had experienced menstruation. The median age of menarche was 11.2 years, whereas, the mean age was 12.1 years. Most girls reached near final adult height after 14 years old.

Conclusion : The secular trend in decline of the ages of thelarche (or puberty) and menarche was observed in Bangkok girls. Further study in a larger population including a younger age group is required to define the current reference interval of onset of puberty.

Key word : Pubertal Maturation, Menarche, Pubarche, Adrenarche, Thelarche

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The onset of puberty in girls starts from 8 to 13 years of age[1]. The first sign of puberty is an enlargement of the breasts. Girls with breast development before 8 years of age were defined as having sexual precocity[1]. The definition of normal variations of pubertal changes is primarily based on studies in Europe and USA[1,2]. A recent study of pubertal maturation based on examination of over 17,000 healthy girls in USA revealed the onset of puberty had shifted toward a younger age i.e. the mean age at which Tanner stage 2 breast development was 9.96 years in white girls (~1 year earlier than the age cited in most previous studies) and 8.87 years in black girls (~2 years earlier)[3]. Hence, the criterion for premature breast development has changed from the onset of breast development (thelarche) of <8 to <7 years old in white girls and <6 years old in black girls [4]. In addition, a recent study from Hong Kong also demonstrated that at least 10 per cent of Chinese girls had Tanner stage 2 breast development before the age of 8 years (the 3rd and the 10th percentiles were 7.10 and 7.95 years, respectively)[5].

The studies on variations of pubertal maturation in a Thai population are limited. Formerly, the study in female medical students at Siriraj Hospital from 1963 to 1964 revealed the mean menarcheal age of 13.6 years[6]. A previous study in Bangkok carried out from 1975 to 1976 in upper income schoolgirls showed that the onset of menarche was 12.7 years of age[7]. Subsequently, the study from southern Thai schoolgirls revealed the median ages at thelarche (breast development) and menarche were 9.9 and 12.4 years, respectively[8]. A recent study in Thai girls from different parts of Thailand revealed the mean age of menarche was 12.3 years[9]. Therefore, similar to the studies in USA and Hong Kong, the onset of puberty in Thai girls has shifted toward a younger age.

Normative prevalence data on the pubertal characteristics of young girls at various ages are essential for the provision of appropriate anticipatory guidance and patient education. Because nationally representative pubertal data for Thai girls are lacking, clinicians have relied largely on Marshall and Tanner's classic study on variations of pubertal changes in girls[10]. Most previous studies in Thailand were conducted by using questionnaires. Therefore, secondary sexual maturation could not be assessed directly and validly. The present study was performed by direct physical examination and personal interviewing. The authors conducted the study in public school female children and adolescents in Bangkok to assess their secondary sexual characteristics and onset of puberty, menarche and pubarche (onset of pubic hair development).

METHOD

Data were collected from January 1997 through December 1999. Subjects were girls aged between 9 and 19 years old who were enrolled in a bone mineral density study in children[11]. The study was conducted in 2 schools in Bangkok, Samsaen and Phaya Thai Schools. Most children came from middle-income families. All were physically and mentally in good health. The study was approved by the ethics committee of the Faculty of Medicine, Ramathibodi Hospital. Informed consent for the assessment was obtained from the patients and their legal guardians. Careful physical examination was performed by a female pediatrician (US). The sexual maturity staging criteria and definitions used in the study were the 5 stages of breast and pubic hair development determined by direct physical examination as described by Marshall and Tanner (Tanner staging)[10]. The data on the girl's age, height, weight, medication history, and onset of menarche were recorded. All subjects' height and weight were within the normal ranges for US girls (NCHS)[12]. None had chronic systemic illnesses, nor taking any medications affecting growth and pubertal progression.

Statistical analysis

Mean ± SD and frequency (percentage) were used to describe the patients' characteristics for continuous and categorical data, respectively. Probit analysis was used to estimate the probability of thelarche, pubarche, and menarche at each age[13]. Cumulative probability curve *versus* age was constructed. Median probability and its 95 per cent confidence interval (CI) were estimated. Ages at these corresponding probabilities were calculated using this estimated probit model. All analyses were performed using STATA version 7.0[14].

RESULTS

There were 300 girls enrolled in the study. Mean weight, height and body mass index (BMI) were categorized by age group. The mean height in

Table 1. Weight, height and body mass index (BMI) of 300 girls by age group.

Age (yr)	Number	Mean ± SD		
		Weight, kg	Height, cm	BMI, kg/m^2
9-9.99	28	31.6 ± 5.1	138.6 ± 6.0	16.4 ± 1.9
10-10.99	37	35.4 ± 5.7	142.5 ± 6.3	17.4 ± 2.3
11-11.99	38	39.4 ± 6.5	149.2 ± 4.8	17.6 ± 2.5
12-12.99	36	44.1 ± 6.9	154.6 ± 4.4	18.4 ± 2.3
13-13.99	28	46.7 ± 6.4	157.3 ± 3.7	18.9 ± 2.4
14-14.99	31	50.2 ± 6.3	158.0 ± 3.7	20.1 ± 2.6
15-15.99	32	52.5 ± 6.2	159.8 ± 4.2	20.6 ± 2.1
16-16.99	30	52.0 ± 8.3	160.2 ± 4.7	20.2 ± 2.5
17-17.99	21	51.4 ± 5.1	158.1 ± 3.5	20.5 ± 1.9
18-18.99	19	54.3 ± 4.5	158.2 ± 4.5	21.7 ± 1.3

Table 2. Mean ages according to Tanner's stages of breast (B) and pubic hair (PH) and menarche.

Stage	Number	Mean age ± SD (yr)	Range (yr)
B 1	27	10.0 ± 0.70	9.0-11.9
B 2	23	10.2 ± 0.64	9.4-11.9
B 3	70	11.6 ± 1.06	9.3-13.6
B 4	103	14.3 ± 1.92	9.4-18.9
B 5	77	16.2 ± 1.58	12.0-18.9
PH 1	73	10.4 ± 0.75	9.0-12.0
PH 2	66	12.8 ± 1.89	9.4-17.9
PH 3	81	14.6 ± 2.49	10.8-18.9
PH 4	72	15.4 ± 1.76	12.2-18.9
PH 5	8	16.7 ± 1.06	15.2-18.2
Menarche	221	12.1 ± 1.15	8.6-16.2

Table 3. Probability of thelarche, pubarche and menarche to age of the onset in 300 girls.

Thelarche		Pubarche		Menarche	
Age (yr)	Probability (%)	Age (yr)	Probability (%)	Age (yr)	Probability (%)
9.1	39	9.5	3	9.8	3
9.4	50	10.1	10	10.2	10
10.3	75	10.6	25	10.7	25
11.1	90	11.1	50	11.2	50
11.5	95	11.7	75	11.7	75
11.8	97	12.2	90	12.2	90
		12.6	95	12.5	95
		12.7	97	12.7	97

each age group older than 14 years was approximately 158-160 cm (Table 1). This suggests that most girls reached near final adult height after 14 years of age. The BMI gradually increased with increasing age from 16 kg/m^2 at age 9 years to 22 kg/m^2 at age 18 years (Table 1). The mean ages ± SD on reaching each stage of pubertal maturation i.e. Tanner stages of breast and pubic hair and menarche are demonstrated in Table 2 and Fig. 1-2.

Probit analysis was used to estimate the probability of onset of thelarche, pubarche, and menarche (Table 3 and Fig. 3). For thelarche, age at

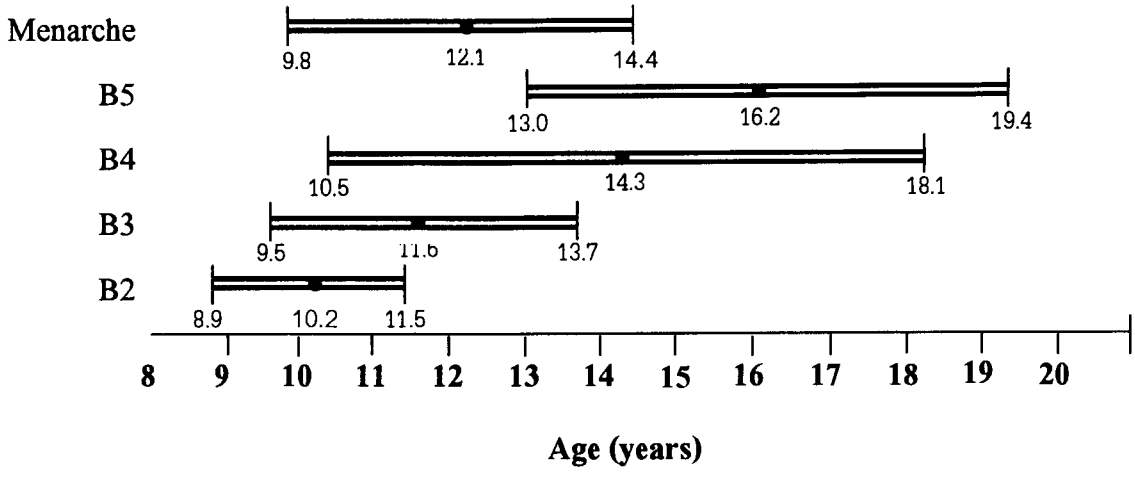

Fig. 1. Mean ± 2 SD on reaching each Tanner's stage of breast (B) and menarche.

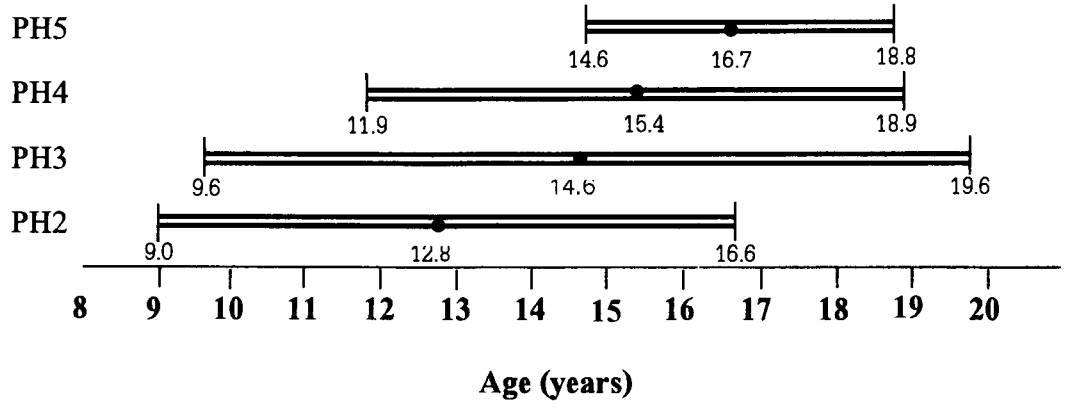

Fig. 2. Mean ± 2 SD on reaching each Tanner's stage of pubic hair (PH).

the median probability of onset was 9.4 years. The estimated 95 per cent CI of the median probability were 0.059 and 0.943, respectively; and resulted in the corresponding age at the range of 7.4 and 11.5 years (Table 3 and Fig. 1-2). The age at median probability of pubarche was 11.1 years. The estimated 95 per cent CI of the median probability were 0.231 and 0.769, respectively. The corresponding ages of this range were 10.5 and 11.87 years (Table 3 and Fig. 3). Only 221 girls had experienced menstruation. The median probability of menarcheal age was estimated at 11.2 years with 95 per cent CI of 10.6 to 11.8 years (Table 3 and Fig. 3).

DISCUSSION

The present study demonstrated that the onset of thelarche and menarche were 9.4 (95% CI: 7.4, 11.6) and 11.2 (95% CI : 10.6, 11.8) years, respectively. In addition, the onset of pubarche (adrenarche) was 11.1 (95% CI: 10.5, 11.8) years. These

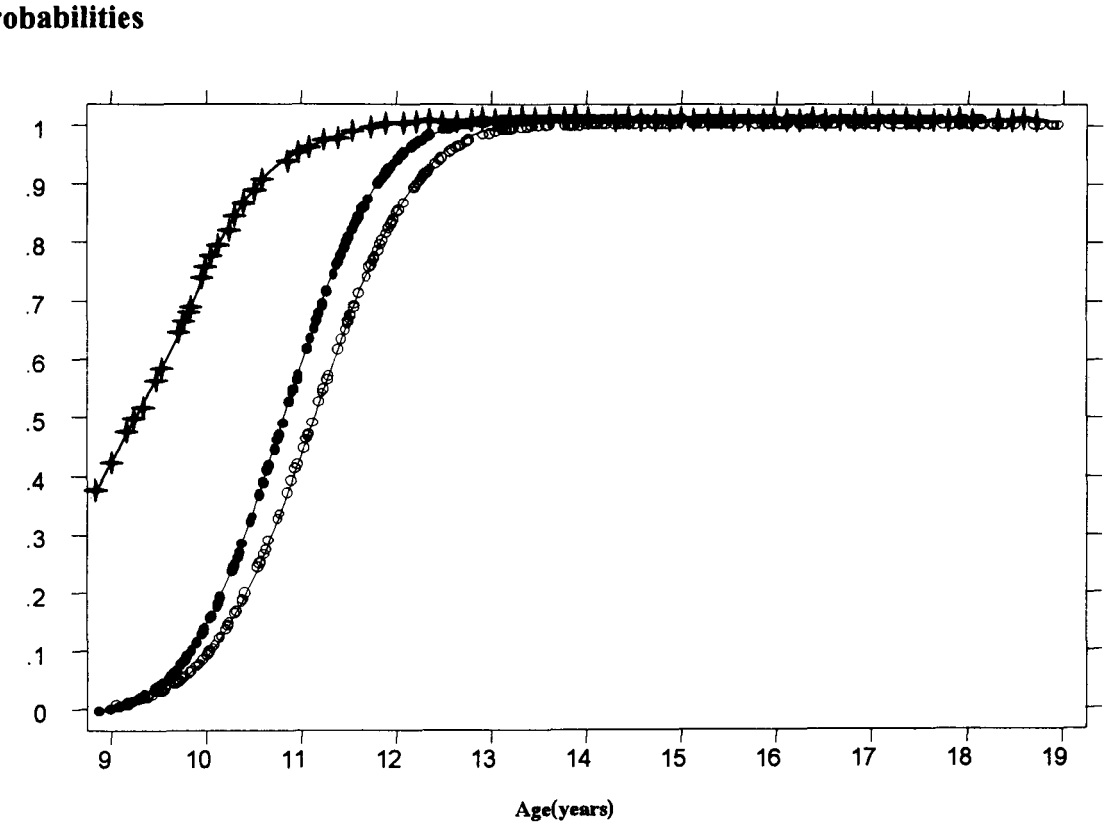

Fig. 3. Probability of breast development (✦-----✦), pubic hair development (○-----○) and menarche (●-----●) of Thai girls.

data demonstrated that the onset of secondary sexual development had shifted toward a younger age.

Based upon the present data, almost 40 per cent of children had thelarche at less than 9 years of age (Table 3). Thus, this estimation might be overestimated since the youngest girl included in the study was 9 years of age. Therefore, the mean age for girls with Tanner stage 2 breast was 10.2 years, whereas the corresponding median age was 9.4 years. (95% CI: 7.4, 11.5). The present result also suggested that pubertal maturation in girls had progressed earlier than in the previous reports[6-8].

Although precocious puberty may compromise final adult height[1], earlier onset of puberty as seen in the present study, did not affect the final height. The mean final height in the studied group was about 158-160 cm (Table 1) which is about 1-3 cm taller than that of the national growth data[15]. Therefore, children with early normal puberty do not have reduced final height. Hence, treatment with gonadotropin-releasing hormone analogue to stop pubertal progression in these children is not indicated and has not been demonstrated to improve final height[16,17].

The secular trend of earlier sexual maturation in Thai girls is similar to that in developed countries[3,5]. This trend is probably the adaptation of humans to the improvement of nutrition, health and socioeconomic status. In addition, contaminated estrogens or estrogen-like substances in foods may have contributed to the earlier sexual maturation. Nevertheless, this speculation has not been verified.

Comparing the rate of pubertal progression in US girls, the onset of menarche was about 3 years behind the thelarche[3], whereas it was about 2 years

in the present study. The mean age of menarche in white girls in the USA was 12.9 years and has remained stable over the last 45 years[3]. In contrast, it was 11.2 years in the present study and has declined 2.5 years over the last 35 years. These findings demonstrated the earlier onset of puberty in US girls as well as Thai girls. In contrary, the rate of pubertal progression through menarche in the present study was 1 year sooner than US girls. The discrepancy of the rate of pubertal progression between US girls and Thai girls in the present study was difficult to explain. Further studies in a larger population are essential to confirm this unexpected finding.

Regarding pubic hair development, its onset is about 2 years behind the thelarche. Some girls had menarche prior to pubarche. Some had progression of breasts through stage 4 without the appearance of pubic hair. None had pubarche prior to thelarche nor the stages of pubic hair which progressed more than those of breast. Hence, pubarche in Thai girls usually appears at the late phase of puberty. These findings are in contrast to those in US girls where the mean age of pubarche was similar to that of thelarche in black girls and half a year behind thelarche in white girls[3].

This study suggests that earlier pubertal maturation is a real phenomenon. Therefore, more appropriate standards for defining precocious and delayed puberty may need to be developed. However, due to the small sample size and late age at entry in the study, these findings may not represent the normative data for the Thai population. Further study in a larger population including younger age groups is required to determine the normative data for Thai girls.

SUMMARY

The median ages of thelarche, pubarche and menarche were 9.4, 11.1 and 11.2 years, respectively. The secular trend toward earlier pubertal development was observed in Bangkok girls.

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เด็กหญิงไทยเข้าสู่ความเป็นสาวเร็วขึ้น

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การศึกษาในสหรัฐอเมริกาและฮ่องกงเมื่อเร็ว ๆ นี้ แสดงให้เห็นว่า เด็กหญิงเข้าสู่ความเป็นหนุ่มสาว (puberty) เร็วขึ้นกว่าเดิม การศึกษาในประเทศไทยก็พบว่ามีลักษณะคล้ายกันคือเด็กหญิงเข้าสู่ puberty เมื่ออายุน้อยลง การศึกษาในปี พ.ศ. 2538 พบว่าเด็กหญิงไทยใน 4 ภาคทั่วประเทศมีระดูครั้งแรกเมื่ออายุ 12.3 ปี

วัตถุประสงค์ : เพื่อศึกษาการเริ่มเข้าสู่ puberty การมีระดูครั้งแรก (menarche) และการเริ่มมีขนที่หัวหน่าว (pubarche) ในเด็กหญิงไทยในเขตกรุงเทพมหานคร

ประชากรและวิธีการศึกษา : เด็กนักเรียนหญิงอายุระหว่าง 9–19 ปี จำนวน 300 คน ซึ่งมีสุขภาพดี ได้รับการตรวจ pubertal staging โดยใช้เกณฑ์ของ Tanner การศึกษานี้เริ่มตั้งแต่เดือนมกราคม พ.ศ. 2540 ถึงเดือนธันวาคม พ.ศ. 2542 เด็กทุกคนมีน้ำหนักและส่วนสูงอยู่ในเกณฑ์ปกติ อายุที่เริ่มเข้าสู่ puberty โดยประเมินจากเริ่มมีการพัฒนาของเต้านม (thelarche), menarche และ pubarche คำนวณโดยใช้ probit analysis

ผลการศึกษา : มัธยฐานของอายุที่มี thelarche และ pubarche เท่ากับ 9.4 และ 11.1 ปี ตามลำดับ มีเด็กหญิง 221 คนที่มีระดูแล้ว พบว่ามัธยฐานของอายุที่มี menarche เท่ากับ 11.2 ปี (อายุระหว่าง 9.4–16.2 ปี) แต่อายุเฉลี่ยที่มี menarche เท่ากับ 12.1 ปี เด็กนักเรียนหญิงส่วนใหญ่จะมีความสูงเต็มที่เท่าผู้ใหญ่ เมื่ออายุมากกว่า 14 ปี

สรุป : การศึกษานี้แสดงให้เห็นว่า มีแนวโน้มของการเข้าสู่ puberty และการมีระดูเร็วขึ้นในเด็กหญิงรุ่นปัจจุบันในเขตกรุงเทพมหานคร การศึกษาในประชากรกลุ่มใหญ่ขึ้นทั่วประเทศเพื่อกำหนดเกณฑ์ปกติของช่วงอายุที่เข้าสู่ puberty ในเด็กหญิงรุ่นปัจจุบัน จึงมีความจำเป็นมาก

คำสำคัญ : ความเป็นสาว, การเริ่มมีระดู, การเริ่มมีขนที่หัวหน่าว, การพัฒนาของเต้านม

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