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Brief Communication (Original)

Pubertal growth in normal Thai children: a longitudinal study

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Background: Pubertal growth data in Thai children has been reported as cross-sectional studies. There is no longitudinal study in Thai children.
Objective: Investigate the longitudinal growth data in normal Thai children including the relationship between age at pubertal onset and other growth parameters.
Material and method: Eighty-eight normal children (44 boys, 44 girls) were longitudinally assessed for the growth and puberty until they reached their final adult height. Pubertal staging was assessed by the Tanner method.
Results: Mean age of pubertal onset was 10.2 ± 1.2 years for girls and 12.2 ± 1.0 years for boys. Total pubertal height gain was 18.3 ± 4.0 cm for girls and 22.3 ± 4.4 cm for boys. Total pubertal height gain had a negative correlation with age at pubertal onset for girls, but not for boys.
Conclusion: The onset of puberty was not much changed from previous studies. Girls with early puberty had a higher pubertal height gain. This might be due to a compensatory mechanism. These longitudinal growth data can be used as a reference in clinical practices for Thai children.

Keywords: Pubertal onset, pubertal height gain, Thai children

The trend of puberty onset has been changing around the world during the last decade [1]. Many studies have shown the earlier onset of puberty especially in girls, but the age of menarche has not significantly changed. Racially different data has been shown in various studies [2-4]. Therefore, each country should have its own national reference data for use in clinical practices and for other researches in this area. All research on puberty in Thai children has been cross-sectional [5, 6], which may have less benefit than longitudinal study. Additionally, growth data during this period has rarely been mentioned. In this study, we investigated the longitudinal observational data of tempo of puberty and growth data in normal Thai children from puberty onset until they reached their final adult height.

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Material and method

Eighty-eight normal Thai children (44 girls and 44 boys) were recruited for the monitoring of their growth and pubertal assessment at the endocrine unit. None of them showed any clinical pathologic features. Their height was measured by trained nurses using stadiometer, and their weight was recorded on a digital scale. Puberty staging was evaluated using the Tanner standard [7, 8]. Testicular volume was estimated by using the Prader orchidometer. Bone age was determined by the atlas of Greulich and Pyle [9].

Final adult height was defined in girls and boys with a bone age of more than 15 years and 17 years, respectively, or where the height velocity was less than 1 cm/year in the previous year. Total puberty growth was defined as the height gain from the onset of puberty to the final adult height.

Statistical analysis

Data are expressed as mean ± standard deviation (SD). SPSS version 10.0 was used in statistical analysis.

Results

Table 1 shows Pubertal growth data in normal Thai boys (n= 44) and girls (n= 44).

Girls

The mean age of pubertal onset (breast Tanner II) was 10.2 ± 1.2 years and the mean bone age was 10.7 ± 0.7 years. At menarche, girls had a mean age of 11.8 ± 1.3 years and a mean bone age of 13.1 ± 0.5 years. The time lapse between the onset of puberty and menarche was 1.9 ± 0.5 years and the height gain was 13.6 ± 3.2 cm during this period. After menarche, girls' height gain was 6.0 ± 2.5 cm until they reach their final adult height. Peak height velocity (PHV), which occurred just after thelarche, was 8.0 ± 1.8 cm/years. The total puberty height gain from puberty onset to final adult height was 18.3 ± 4.0 cm. Total puberty height gain had a negative correlation with the onset of puberty (r=-0.6, p=0.007). Height gain after menarche also had a negative correlation with age at onset of puberty (r = -0.7, p= 0.006) and age at menarche (r=-0.8, p <0.001). In addition, age at puberty onset had a negative correlation with growth spurt (r=-0.4, p=0.04). Final adult height had a positive correlation with height (r = 0.6, p=0.01) and weight (r=0.6, p=0.02) at puberty onset. In girls, total pubertal height gain was 12% of adult height.

Boys

The mean age of puberty onset (testicular volume of 4 mL) was 12.2 ± 1.0 years and the mean bone age was 12.4 ± 0.8 years. The puberty growth spurt occurred at a testicular volume of 8.2 ± 1.7 mL with a peak height velocity of 9.7 ± 1.7 cm/years. The puberty growth spurt occurred within the first year after puberty onset. The time lapse between the onset of puberty and final adult height was 3.7 ± 0.4 years with a puberty height gain of 22.3 ± 4.4 cm. Puberty height gain had a negative correlation with bone age at the onset of puberty (r= -0.77, p=0.009) but not with chronological age. Final adult height had a positive correlation with height at puberty onset (r=0.8, p <0.001). During puberty, boys gained 13% of total adult height.

Discussion

This is the first longitudinal growth data for normal Thai children during the pubertal period. Most normal data of growth and puberty in Thai children have come from cross-sectional studies. These reference values are flawed because of considerable variations at pubertal onset.

Previous cross-sectional studies regarding self assessment puberty data has shown that the mean onset of puberty was 10.4 ± 1.3 years in girls and 11.3 ± 1.7 years in boys [5, 6]. The present longitudinal results showed that girls had a similar age of pubertal onset as those in previous cross-sectional studies. In a cross-sectional study by Li et al. [10], urban Chinese girls showed earlier breast development at a median age of 9.2 years and 20% of girls showed evidence of breast development by the age of eight years. Our

Table 1. Pubertal growth data in normal Thai children. Data are expressed as mean±SD

	Girl (n= 44)	Boy (n=44)
Onset of puberty (year)	10.2 ± 1.3	12.2 ± 1.0
BMI at onset (kg/m^2)	17.8 ± 2.8	19.3 ± 3.5
1st yr height velocity after onset (cm/year)	8.0 ± 1.8	9.5 ± 1.8
2nd yr height velocity after onset (cm/year)	6.9 ± 1.6	7.4 ± 1.6
3rd yr height velocity after onset (cm/year)	-	4.7 ± 1.9
4th yr height velocity after onset (cm/year)	-	2.1 ± 0.7
Time from onset to menarche (year)	1.9 ± 0.5	-
Age of menarche (year)	11.8 ± 1.3	-
Height gain from onset to menarche (cm)	13.6 ± 3.2	-
Height gain from menarche to final height (cm)	6.0 ± 2.5	-
Total puberty height gain	18.3 ± 4.0	22.1 ± 3.6
Final adult height	156.5 ± 5.0	168.7 ± 6.2

result is comparable to the longitudinal study for the Cantonese schoolgirls. Girls with earlier puberty onset have a higher puberty growth spurt and higher puberty height gain. This may be due to a compensatory mechanism to allow them to reach their genetic height potential. Similar studies have shown that girls with an earlier onset of puberty were associated with greater pubertal height gain and later onset puberty boys were associated with smaller pubertal height gain and a shorter period of pubertal growth [11]. The earlier the onset of puberty a girl has, the greater the puberty height she will gain. However, such a correlation is not found in boys in our study.

According to a longitudinal study of pubertal growth assessment based on growth records of 145 Swedish children [12], using height and age at puberty onset alone could predict final adult height more accurately than using bone age determination. Mid-parental height data added little value to prediction of final height. Pubertal onset in their study was evaluated based on the infancy-childhood-puberty (ICP) growth model, not physical examination. Therefore, the age at onset of puberty may be questioned. Height and weight at pubertal onset had a positive correlation with final adult height. Therefore, optimization of height and weight at pubertal onset to maximize final height is advised.

The present study shows the total puberty height gain in boys was 3.8 cm higher than that in girls. In a longitudinal study by Pantsiotou et al. [13], Greek schoolgirls showed that the peak height velocity and time from breast onset and menarche was 9.6 cm/year and 2.1 year in average maturers, which is higher than those in our study [13]. This suggests less pubertal height gain in Thai children compared with Western children. In a previous study [14], we showed that Thai schoolboys had shorter trunks and legs after the age of 15 compared to that of British children. This suggests that Thai children, or perhaps Asian children, have a shorter adolescent growth spurt [14].

In conclusion, the onset and tempo of normal Thai adolescents including growth data during that period was examined. This longitudinal result may be useful for advice to children and their parents in clinical practice or be used as reference for clinical research of Thai children.

The authors have no conflict of interest to report.

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