

Age at Menarche in Indonesian Girls: A National Survey

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ABSTRACT

Aim: to assess the age at menarche of Indonesian girls and to know the influence of BMI on menarche.

Methods: this is a large multicenter survey as part of the Indonesian growth study performed in 1992-1995. Menarcheal data were collected through interview with parents or children. Body weight and height were measured and BMI were calculated based on weight (kg)/height (m)².

Results: as many as 4145 of 17571 (24%) girls from 7 regions in Indonesia included in the growth study were eligible for the analysis of menarche. The youngest age of menarche was 9 years (n=12) and the oldest was 18 years (n=1). Most of Indonesian girls had their first period at age 12 (31.33%), age 13 (31.30%), and at age 14 (18.24%). The mean age of menarche was 12.96 years with mean BMI was 19.17 (50th to 75th percentile of BMI curve). The lowest mean age of menarche was found at Yogyakarta (12.45 years) and the highest was at Kupang (13.86 years). Kupang girls had their menarche at lower BMI (18.59) than other regions in Indonesia. All of the girls will enter menarche at BMI level greater than the 50th percentile.

Conclusion: this study showed that most of Indonesian girls will have their menarche at the age of 12-14 years (mean age of 12.96) if their BMI level are at 50th percentile or more according to age.

Key words: menarche, secular trend, body mass index.

INTRODUCTION

Concern regarding changing age toward earlier onset of menarche in United States girls has increased the need for current information on age at menarche in other country, including in Indonesia.¹⁻⁴ National data on the development of secondary sexual characteristics and menarche can serve as a baseline for assessing secular trends in pubertal development for the population and assist in the development of normative standards for puberty.¹⁻⁴ Age at menarche reflects numerous health aspects of a population including the timing of sexual maturation, growth and nutritional status, and environmental conditions.¹⁻⁴ In the Bogalusa Heart Study a significant decline in the mean age at menarche was found between 1978-1979 and 1992-1994 in both African-American girls and White American girls.⁵

Previous studies focusing on this topic were contributed to restricted area in Indonesia. Few data were derived from nationally representative samples, thus raising concern about the generalizability of findings to the Indonesian population. To address this need, we used data from Indonesian Growth Study provided in several areas in Indonesia to assess the age at menarche of Indonesian girls and to know the influence of BMI on menarche.

METHODS

Sample

The study was part of the Indonesian growth study performed in 1992-1995 to make a growth chart for Indonesia. Using calculation for stratified random sampling with regions and provinces as the strata and taking consideration of the subject's age, sex, socio-economic condition (urban-rural), and the sample size is 3,800 children per area. The study is cross sectional with data collection sites, representatives for Indonesian

Table 1. Percentage of age at menarche in different regions in Indonesia

Age at menarche (years)	Regions							
	Yogya-karta n (%)	Balik-papan n (%)	Jakarta n (%)	Bandung n (%)	Palem-bang n (%)	Makasar n (%)	Kupang n (%)	Indonesia n (%)
9	0 (0)	2 (0.3)	5 (0.9)	3 (0.4)	0 (0)	1 (0.2)	1 (0.3)	12 (0.29)
10	10 (1.5)	12 (1.9)	18 (3.3)	14 (1.9)	3 (0.5)	3 (0.5)	3 (0.8)	63 (1.52)
11	95 (13.8)	78 (12.1)	51 (9.5)	66 (9.0)	32 (5.6)	18 (3.1)	12 (3.1)	352 (8.49)
12	287 (41.7)	220 (34.1)	215 (39.9)	220 (30)	150 (26.3)	164 (27.9)	43 (11.3)	1299 (31.33)
13	197 (28.6)	199 (30.8)	135 (25.0)	271 (37)	178 (31.2)	207 (35.3)	110 (28.8)	1297 (31.30)
14	74 (10.7)	97 (15.0)	76 (14.1)	113 (15.4)	150 (26.3)	134 (22.8)	112 (29.3)	756 (18.24)
15	24 (3.5)	35 (5.4)	33 (6.1)	39 (5.3)	51 (8.9)	49 (8.3)	79 (20.7)	310 (7.48)
16	2 (0.3)	3 (0.5)	3 (0.6)	4 (0.5)	5 (0.9)	10 (1.7)	19 (5.0)	46 (1.11)
17	0 (0)	0 (0)	2 (0.4)	3 (0.4)	1 (0.2)	1 (0.2)	3 (0.8)	9 (0.21)
18	0 (0)	0 (0)	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.02)

population. The age grouping for infants from 0-1 year old is based on 3 months interval. While for children aged 12 months or older, the chronological age grouping is based on a 6 month's interval. The age is divided into 38 groups: 4 groups for children 0-1 year old and 34 groups from 1 – 18 years of age.

Proportionate random sampling to sample size were used in further sampling methods. Using sub-district as the sampling unit, the data collection was conducted in 7 sites in Indonesia as follows: Java, Sumatra, Kalimantan, Sulawesi and East Nusa Tenggara.

Data Collection

Anthropometric measurements were taken by trained enumerators. Infants and children under five years of age have been measured at Posyandu (Community-based Child Health Center) and maternity hospitals or clinics. Pre-school and school children were measured at the school (pre-school, elementary, junior high and senior high). In each district, the sites were randomly selected and consisted of private and government-related institutions. Data were collected, including menarcheal status, through interview with parents or children. Girls aged 8 to 18 years were asked about whether they had attained period/menstrual cycle and their age (years) at first period/menstrual cycle. A pre-data collection questionnaire had been developed to assess inclusion to the study. Body weight and height were measured; and BMI were calculated based on weight (kg)/height (m)².

RESULTS

There were 34800 children included in the growth study ranging from birth up to 18 years, 17229 boys and 17571 girls. As many as 4145 (24%) girls were eligible for the analysis of menarche. The youngest age of menarche was 9 years, found in 12 (0.29%) girls, 5 of

the girls lived in Jakarta. Only one (0.02%) girl got her menarche at 18 years of age, but the cause of delayed menarche was not elaborate.

Most girls in Indonesia had their first period at age 12 (31.33%), age 13 (31.30%), and at age 14 (18.24%) (**Table 1, Figure 1**). Almost all areas in Indonesia had the same pattern, except for Palembang, Makasar, and Kupang. In Palembang, more children had their menarche at age 13 (31.2%), followed by the age of 12 (26.3%) and 14 (26.3%), while in Makasar we found 35.3% of girls had their menarche at age 13, followed by age 12 (27.9%) and 14 (22.8%). There were 29.3% of girls in Kupang had their first menarche at the age of 14, 28.8% at 13, and 11.3% at the age of 12 (**Table 1**).

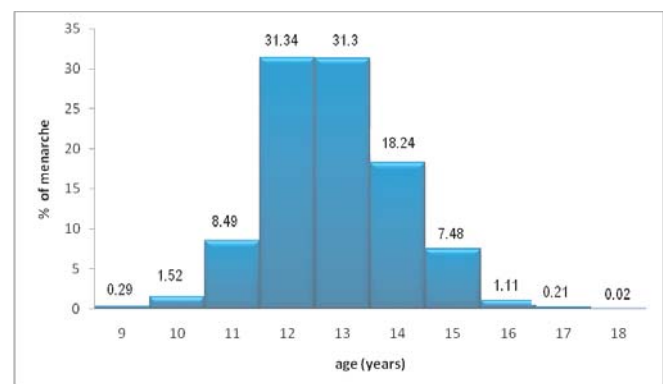
**Figure 1.** Proportion of menarcheal age of Indonesian girls

Figure 2 showed the cumulative percentage of age at menarche of Indonesian girls. At the age of 12, 41.63% girls had their menarche and increased to 72.93% at the age of 13. Around 91.17% of Indonesian girls already had their menarche at age of 14 and 98.65% at the age of 15.

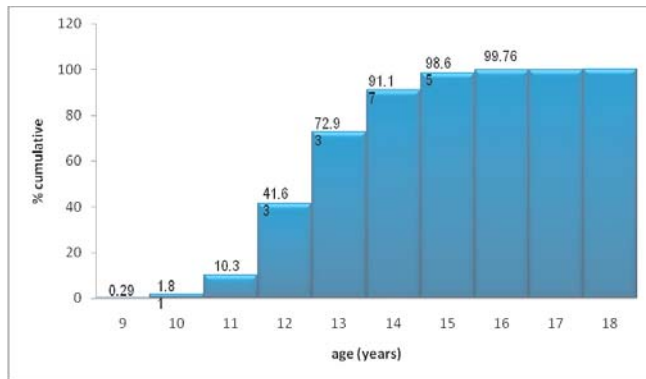


Figure 2. Cumulative percentage of menarcheal age of Indonesian girls

The mean age of menarche among Indonesian girls was 12.96 years with mean BMI was 19.17 lying on the 50th to 75th percentile of Indonesian BMI curve (**Table 2**). The lowest mean age of menarche was found at Yogyakarta (12.45 years) and the highest at Kupang (13.86 years). Kupang girls had their menarche at lower BMI (18.59) compared with those of Yogyakarta (19.37) and Indonesia as a whole (19.17). The highest mean of BMI at menarche was found at Jakarta (19.54). But all of the girls would enter menarche at BMI level greater than the 50th percentile according to age.

Table 2. Mean age, weight, and BMI at onset of menarche for different regions of Indonesian girls

Region	Age at menarche	BMI (percentile)	Weight (kg)
Yogyakarta	12.45	19.37 (75 th -90 th)	43.95
Balikpapan	12.62	19.34 (75 th -90 th)	43.55
Jakarta	12.89	19.54 (75 th -90 th)	44.54
Bandung	12.74	19.01(50 th -75 th)	44.20
Palembang	13.08	19.20 (75 th)	42.93
Makasar	13.09	19.16 (50 th -75 th)	43.66
Kupang	13.86	18.59 (50 th -75 th)	41.35
Indonesia	12.96	19.17 (50th-75th)	43.45

DISCUSSION

There are several factors influencing timing of puberty in girls, including genetic and environmental factors.¹⁻⁹ Among many of those environmental factors, nutritional status and weight are the most influencing factors.¹⁻⁹ It has been proposed that there is secular trend on reduced timing of puberty.^{1-5,7,9}

Timing of puberty is varying in different countries; the first signs of puberty are budding shape of areola and papilla (M2) in girls and increase testicular volume (G2) in boys.¹⁰ Menarche occurred on the last stage of puberty in girls, usually at approximately 2 years after initiation of puberty.^{10,11} The age of puberty has been used as a measure of health status of specific population. Most of the studies on puberty timing have focused on age at menarche because it is relatively easy

to collect either retrospectively or prospectively.¹⁻⁵ By knowing the age of menarche in a population, we could estimate the timing of the first signs of puberty to occur. This is the first multicentre survey on age at menarche of the Indonesian girls. Our study also used the age at menarche as a variable in determining the timing of puberty in Indonesian girls.

Our study showed that most of Indonesian girls have their first period at the age of 12, followed by age of 13 and 14. Mean age at menarche was 12.96 years, varying from 12.45 to 13.86 years through the region. This value is not different from the US girls^{1,3,5} or British girls.¹² Wu et al,¹³ found that among the US girls, the black girls enter puberty earlier (12.1 years) than the Mexican American (12.2 years) and the white girls (12.7 years). The British girls had their menarche at the age of 12 years and 11 months.¹² This fact showed that there is no significant difference of menarcheal age between the developed and developing countries. In parallel with Wu et al,¹³ who stated that they did not observe a significant association between measures of pubertal development and socioeconomic factors. Indonesian girls had earlier age at menarche if compared to other developing countries, such as Guatemalan girls (13.71±1.36 years)¹⁴ or Ethiopian girls (median: 14.8 years; range: 13.9-15.3 years).¹⁵ These differences showed us the possible role of nutrition and socioeconomic status in age at menarche.

There was a little variation regarding the age at menarche in Palembang, Makasar, and Kupang compared to Indonesian girls in general. More girls on those regions had their menarche at age 13, followed by age of 14, and 12. There is no explanation for this variation. Race, socioeconomic status, nutrition or EDCs exposure may be contributed to this phenomenon.

Improvement in energy intake and nutrition has been linked to an earlier age at menarche.²⁻⁶ Frisch¹⁶ suggested that there is a critical fat mass required for menarche and a higher fat mass needed to maintain reproductive capacity. Otherwise, Garn et al,¹⁷ stated that there was no clear evidence about the threshold level of weight or fat for the onset of menarche. Sherar et al.¹⁸ studied 61 girls and found the range of body mass at menarche was 50.10 kg. Reductions in variability of body fat and weight were not apparent at menarche, which does not support the hypothesis that a critical body weight/fat is required for menarche. This finding was supported by Himes et al.¹⁹ who found out that the average effects of menarcheal status on BMI assessments of overweight and obesity are small and usually should not be clinically important.

Most of evidences agreed that there is a major influence of body fat at the onset of puberty and menarche in girls.^{2,3,5,6,17,20} A longitudinal study stated that increased BMI at age of 3 with increase in BMI between the ages of 3 and 6, were significant risk factors for whether a girl would be earlier than average in entering puberty.²⁰

The discovery of the protein leptin, which is produced by fat cells provided a molecular basis for the suspected link between body fat and reproductive function.^{2,6,21} Leptin levels were found to be much higher in obese children than in children with normal BMI.^{2,6,21,22}

A cross sectional study stated that the rise in serum leptin was well established 2 years before increasing of serum LH and estradiol.²³ A longitudinal study in Ohio has shown that leptin was highly correlated with body fat mass; and higher leptin were associated with a decline in the age of menarche.²⁴ This study in concordance with the hypothesis that leptin mediates the relationship between body fat and earlier menarche.^{2,21,24}

The Indonesian girls have their first period at mean BMI of 19.17, lying between the 50th to 75th percentiles of Indonesian BMI curve. Even though there was variation in the age of menarche and BMI level, but it is likely that most of Indonesian girls will have their first period if their BMI level has reached 50th percentile according to age. This study supported the previous hypothesis that critical fat mass is needed for menarche.^{2,3,5,6,16,19}

CONCLUSION

This study showed that most of Indonesian girls will have their first period at the age of 12-14 years (mean age of 12.96) if their BMI level is at 50th percentile or more according to age. There was no large variation among areas in Indonesia. Further longitudinal study is needed to determine the timing of puberty in Indonesian girls and its relationship with body mass index, fat mass, leptin level, race influence, and other environmental factors.

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