

Age at menarche and early menarche among healthy adolescents

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Abstract

Background Menarche is an important indicator of female adolescents' health and also population health. Age at menarche tends to decrease in many countries. Early menarche that defined from the lowest quartile of age at menarche, associated with some physical and psychological problems. Objective To determine the mean age at menarche, the prevalence of early menarche among healthy adolescents in Surakarta and its association to nutritional status.

Methods This cross-sectional study was conducted in 5 schools (3 junior and 2 senior high schools) in Surakarta, Central Java, Indonesia, from September 2016 to March 2018, by consecutive sampling technique. We included menarched healthy female students whose parent provided informed consent and without consuming any routine medication. Data were derived from self-reported questionnaire and measurements of body weight; body height; and body mass index (BMI) by calculated based on weight/height^2 (kg/m^2).

Results Of 835 eligible subjects, the mean age at menarche was 12.0 (SD 1.1) years (range 8.8-15.1 years) and the prevalence of early menarche was 11.1%. The peak of age at menarche were at 11,12, and 13 years (24.3%, 36.2%, and 23.9%, respectively) and almost 99.04% of subjects had menarche at 14 years old. The proportion of early menarche between subjects birth 1997-2001 and 2002-2007 were 8.4% and 16.1%. Early menarche associated with overweight-obese in adolescents (odd ratio 2.14; 95%CI 1.21 to 3.76).

Conclusion The mean age at menarche of healthy adolescents in Surakarta is younger than other previous studies in Indonesia. Early menarche was significantly a risk for overweight/obese in adolescents. [Paediatr Indones. 2019;59:33-7; doi: <http://dx.doi.org/10.14238/pi59.1.2019.33-7>].

Keywords: age at menarche; early menarche; adolescent; overweight; obese

Menstruation, especially menstrual cycle is an additional vital sign for female adolescent health.¹ Menarche, as the first menstruation, is the last pubertal sequence in adolescent girl, after telarche, adrenarche, and growth spurt.² Secular trends showed an earlier age at menarche in many countries, including in Indonesia females.³⁻⁵ On the other hand, early menarche associated with the risk of a sexual health (early sexual initiation), a reproductive health (functional ovarian reserve, eclampsia), and metabolic syndrome (obesity, cardiovascular disease). Some risk behaviour and psychological problems are also associated with early menarche.⁶⁻¹⁰

This study aimed to determine the mean age at menarche, the prevalence of early menarche among healthy adolescents in Surakarta and its association to nutritional status.

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Methods

This cross-sectional study was conducted in 5 schools (3 junior and 2 senior high schools) in Surakarta, Central Java, from September 2016 to March 2018, by consecutive sampling technique. We included healthy female students whose parent provided informed consent and experienced at least three menstrual cycles before the study. We excluded females taking hormonal drugs, any routine medication, or had chronic diseases.

Data of age at menarche were derived from self-reported questionnaire to the nearest of month. We defined early menarche at the lowest quartile of menarcheal age (<25th percentile). Gynecologic year is an interval time between chronological age and age at menarche, and categorised by less or more than 3 years. Measurements of body weight (BW) and height (BH) were performed 3 times and a mean value was calculated for each subject. We measured BH using stadiometer to the nearest 0.1 cm, and BW by Seca weighing scale and calculated to the nearest 0.1 kg. Body mass index was measured by pattern $BW(kg)/BH^2(m^2)$. Body mass index was plotted to CDC growth chart based on sex and age (in percentile). Nutritional status was categorised based on body mass index-for-age [CDC criteria: underweight (<5th percentile), normoweight (5th-85th percentile), overweight (85th-<95th percentile) and obese ($\geq 95^{\text{th}}$ percentile)].¹¹

The data was processed using SPSS 20.0. Numerical data (age at menarche, weight, height, body mass index) was defined as a median. Categorical data (nutritional status, early menarche, gynecologic year) was defined as proportion/percentage. Age at menarche was described in percentage and cumulative percentage. A Chi-square test was used for analyzing the association between early menarche and nutritional status (overweight-obese vs. under-normoweight). This study was approved by Ethics Committee of the Universitas Sebelas Maret Medical School.

Results

There were 835 eligible subjects born between 1997-2007. The mean of age and BMI were 15.1 (SD 1.8) years and 20.0 (SD 3.9) kg/m², respectively. Birth year

of subjects were from 1997-2007. The proportion of gynecologic age year less and more than 3 years were 48.5% and 51.5%. The prevalence of overweight and obese subjects were 9.3% and 1.8% (**Table 1**).

Table 1. Characteristics of subjects

Characteristics	(N=835)
Age, years	
Mean (SD)	15.1 (1.8)
Median (range)	15.1 (11.5-18.5)
Birth year, n (%)	
1997	7 (0.8)
1998	161 (19.3)
1999	136 (16.3)
2000	111 (13.3)
2001	122 (14.6)
2002	105 (12.6)
2003	94 (11.3)
2004	22 (2.6)
2005	32 (3.8)
2006	44 (5.3)
2007	1 (0.1)
Weight, kg	
Mean (SD)	49.9 (10.3)
Median (range)	48.0 (29.0-120.5)
Height, cm	
Mean (SD)	155.0 (6.4)
Median (range)	155.0 (132.0-184.4)
BMI, kg/m²	
Mean (SD)	20.7 (3.9)
Median (range)	20.0 (11.3-49.5)
BMI percentile	
Mean (SD)	57.0 (29.3)
Median (range)	57.0 (0.0-99.6)
Nutritional status, n (%)	
Underweight (<5 th)	40 (4.8)
Normoweight (5-<85 th)	702 (84.1)
Overweight (85-<95 th)	78 (9.3)
Obese ($\geq 95^{\text{th}}$)	15 (1.8)
Gynecologic age, years	
≤ 3 years, n (%)	405 (48.5)
>3 years, n (%)	430 (51.5)

The mean age at menarche was 12.0 (SD 1.1) years with the 25th, 50th, and 75th percentiles of age at menarche were 11.0, 12.0, 12.7 years, respectively. The prevalence of early menarche was 11.1%. (**Table 2**).

Most subjects had menarche at the ages of 11 (24.3%), 12 (36.2%), and 13 (23.9%) years (**Figure 1**). We cumulatively found 99.04% of female had their menarche by the age of 14 years (**Figure 2**). The prevalence of early menarche between subjects birth 1997-2001 and 2002-2007 were 8.4% and

16.1%, respectively (Table 3). Early menarche was significantly associated with higher rates of overweight-obesity ($P=0.008$) (Table 4).

Table 2. Age at menarche, number of early menarche and gynecologic year among subjects

Age at menarche, years	
Mean (SD)	12.0 (1.1)
Median (range)	12.0 (8.8-15.1)
25 th	11.0
50 th	12.0
75 th	12.7
Early menarche,* n (%)	93 (11.1)

*Early menarche: <25th percentile (<11 years of age)

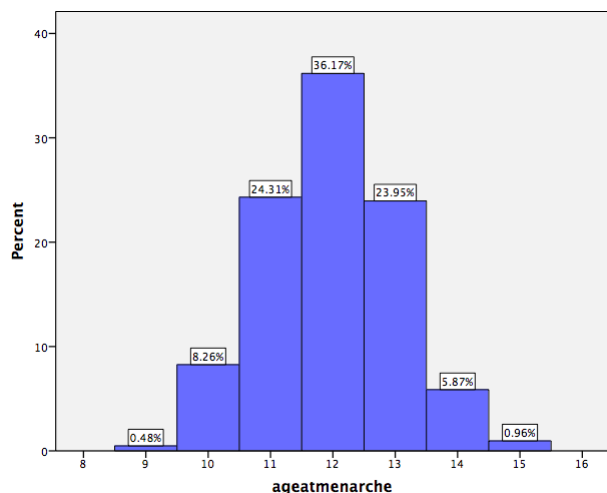


Figure 1. Ages at menarche of Surakarta girls

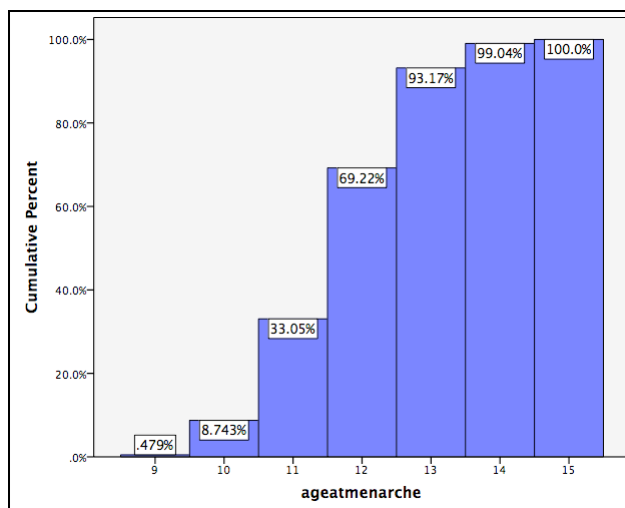


Figure 2. Cumulative percentage of ages at menarche of Surakarta adolescents

Table 3. Association between birth year and early menarche

Birth year	Early menarche	Normal menarche	Odds ratio (95% CI)	P value
2002-2007, n(%)	48 (16.1)	250 (83.9)	2.10 (1.36 to 3.24)	
1997-2001, n(%)	45 (8.4)	492 (91.6)		0.0008

Table 4. Associations between early menarche and nutritional status

	Overweight-obese (n=93)	Normo-underweight (n=742)	Odds ratio (95% CI)	P value
Age at menarche, n(%)				
Early	18 (19.4)	75 (10.1)	2.14 (1.21 to 3.76)	0.0088
Normal	75 (80.6)	667 (89.9)		

Discussion

Timing of puberty has been used as an indicator of population health status. The interval time between breast budding (as the first sign of puberty in female) and menarche is approximately 2-2.5 years. Although menarche is the last stage of puberty, it is the easiest parameter to evaluate the timing of puberty.² Present study showed the mean age at menarche in adolescents living in Surakarta was 12.0 (SD 1.1) years. It was younger than results of Batubara study (which held in 1992-1995, 12.96 years), Sohn study (in Indonesian female born before 1990, 13.18 years) and Wahab's meta-analysis study (before 2010, 13.63 years).³⁻⁵ Our study showed that most of Surakarta's female had their menarche at 11-13 years old. At 14 years of age,

almost 99% of female have had their menarche. It is one year younger than the previous study.⁴ There may be some considerations with the results: first, Surakarta is a city near to Yogyakarta where the lowest mean age at menarche according to Batubara's study;⁴ second, our subjects were from urban. Some studies revealed the difference of menarcheal age between urban and rural area.¹²⁻¹⁷ Further study is needed to compare urban and rural in Surakarta area.

In our study, the proportion of early menarche from 1997-2001 to 2002-2007 was increasing (from 0.08 to 0.16). The overall proportion of early menarche in Indonesia from Wahab's study was 0.07 (95%CI, 0.05 to 0.10). The lowest one was from the Purworejo District, Central Java, (0.02; 95%CI, 0.017 to 0.022) and the highest ones were from Yogyakarta (0.12, 95%CI, 0.09 to 0.16) and Jatinangor West Java (0.14, 95%CI, 0.10 to 0.19). The proportion of early menarche in other studies (Korea, French, Saudi) were varied. The early menarche cut off was different among studies, depended on the lowest quartile of age at menarche.^{5,10,16}

Several problems had been known associated with early menarche.⁶⁻¹⁰ This study proved that early menarche twicely increased the risk of overweight and obese adolescent. Meta-analysis by Prentice concluded that early menarche increased risk of adult's obesity twice.¹⁷ Previous studies revealed that body mass index was a risk for early menarche and vice versa early menarche associated with adult's body mass index.¹⁷⁻¹⁹ Our study could not differentiate whether the obesity occurred before or after menarche because we did not have nutritional status data before menarche. The history of small gestational age data not provided in this study could be a confounding factor related to the obesity in adolescents.

There are other limitations of our study. First, a recall bias might occurred from self-reported questionnaire. Almost all subjects cannot exactly determine the time of menarcheal age. Second, the study design was cross sectional study. A cohort prospective study is needed to determine the risk of obesity in early menarche subjects with controlling the confounding factors, such as nutrition, physical activity, genetic or nutritional status before puberty. We proposed to give some attentions to early menarche in the context of obesity and other physical, and also psychological problems.

We conclude that the mean age at menarche in our study is earlier with peak at 11-13 years of age. The proportion of early menarche increases and associates with obesity in female adolescents.

Conflict of Interest

None declared.

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