THE PUBERTY PROFILE OF FEMALE ADOLESCENTS IN CHERAS, MALAYSIA

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Abstract

Objectives: The objectives of our study were to determine the mean age of onset of thelarche and menarche, to determine the ages of each stage of puberty and to investigate if there are any ethnic differences in these ages amongst female adolescents in Kuala Lumpur, Malaysia.

Methods: This was a cross-sectional study involving three secondary schools in Cheras, Kuala Lumpur. A total of 730 students were recruited via stratified random sampling. Self-administered survey forms on menstruation and puberty were used.

Results: Out of 730 recruited respondents, 385 (52.74%) completed the survey and informed consents were obtained from their parents/legal guardians. Our respondents' ages ranged between 13 to 17 years old with the median (IQR) age of 14.00(2.00) years. With regards to ethnicity, 329 (85.50%) were Malay, 46 (11.90%) were Chinese, 9 (2.30%) were Indian and 1(0.30%) was a Bajau. The mean age for breast development (thelarche) and menarche were 11.72 ±1.10 and 11.97±1.11 years respectively. The majority, 363 (94.30%), out of 385 respondents had attained menarche. There appeared to be a later onset of puberty amongst Malays comparatively.

Conclusion: The mean ages of pubertal onset and menarche amongst female adolescents in the Cheras area are similar to those reported worldwide.

Keywords: *Puberty, Thelarche, Menarche, Pubertal Onset, Adolescents*

Introduction

Puberty is a process leading to physical, sexual, and psychosocial maturation (1). Belinda Pinyerd (2005) defined puberty as the stage of development during which an individual first attains fertility and is capable of reproduction (2). Physical changes that occur during puberty include somatic growth, primary sexual organ development (gonads and genitals), and the appearance of secondary sexual characteristics (breasts and pubic hair). Female adolescents undergo three stages of pubertal development; thelarche, pubarche and menarche.

Thelarche is defined by the appearance of breast bud that typically occurs between age eight and thirteen years, with an average of eleven years. Development before the age of eight is considered as precocious puberty and later than age thirteen is considered delayed (3). Pubarche is the first appearance of pubic hair, which is result of adrenarche pathway and occurs independently of the pituitary gonadal maturation or gonadarche (3). Thus, pubarche in girls do not provide any information on pituitary-ovarian maturation (4-6). Marcia E. Herman-Giddens et al (7), 1999 reported earlier onset of pubic hair; 8.9 years in African-

American compared to 10.5 years in white girls. Menarche is the onset of menstruation which usually occurs at an average age of 12.8 years (range 11 to 13 years) (2). Initial menstrual cycles are usually anovulatory, which is associated with irregular and often painful periods, the menstrual cycles become ovulatory and more regular after one to two years (8).

For European countries, data on onset of thelarche do not indicate any obvious geographical gradient; the average thelarche age was 10.9 years in United States (9), 9.7 among White Americans (10), 10.6 year in Greece and 11.2 year in Denmark and UK (11). In Asia, average thelarche age of 9.8 year was reported in Hong Kong. As for menarche age, Mac Mahon in the United States reported the mean menarche age to be 12.8 years (12), and similarly, Tanner and Davies (1985) reported it to be 12.7 (9). In Asia, mean menarche age was reported to be 12.4 years in Hong Kong, 12.6 years in Japan (11) and 12.5 years in Thailand (11). Unfortunately, in Malaysia, there are currently no published data on age of pubertal onset except for menarche age which is 12.3 years (13). According to American Academic of Paediatrics (2006), primary amenorrhea has been defined as no menarche by 16 years of age; however, many diagnosable and treatable disorders can and should be detected earlier, using the statistically derived guideline of 14 to 15 years of age (14). Hence, it is crucial to determine the mean age of puberty onset in our population as a tool to access normal hormonal development and exclusion of serious abnormalities.

The onset of puberty is influenced by both genetic and environmental factors. Genetic factors encompasses familial, ethnicity and gender while environmental factors are namely nutritional status, socioeconomic background, physical and psychological stresses as well as exposure to environmental-disrupting chemicals (11). It is virtually impossible to isolate each factor because many of them are interrelated. Thus, timing of puberty is important as it may be an early indicator of the effects of genetic and environment influencing normal physiological processes.

To accurately stage the pubertal development of a girl, we must assess breast development and pubic hair stages which were the two aspects classified by W.A.Marshall and J.M.Tanner in 1969 (15).

As there are no published data on the age and prevalence of the pubertal changes of Malaysian adolescents, hence, the objectives of this study were to determine the prevalence of pubertal changes, to determine the age ranges of onset of thelarche, pubarche and menarche in female adolescents in Malaysia and also to scrutinize whether there is a difference in the age of pubertal onset (defined as onset of thelarche) between different ethnic groups in Malaysia. Therefore, the data collected from this study can be used for clinical purposes and for future research work.

Materials and Methods

This was a cross sectional study involving three secondary schools in Kuala Lumpur. The data were collected from September 2015 until October 2015. The researchers had obtained approval from the Ministry of Education to collect data from these schools. Each school has five forms (Form 1 for ages 13 years to Form 5 for ages 17 years) with several classes in each form. A total of 730 students were recruited from the three schools via stratified sampling method; 10-20 female students were randomly selected from each class of each form, from forms 1 to 5, that the researchers could access in the three schools. Envelopes containing information sheets, parental consent forms and survey forms were distributed to the 730 students and a week later, the researchers returned to the schools to collect the consent forms, the completed survey forms and measure the students' heights and weights. Each of the documents were in bilingual languages (English and Bahasa Malaysia) to ensure that the all the students could participate.

These survey forms were pretested on fifteen female adolescents within the same age range prior to the study. This pretest was for face validity; to assess the clarity of the of the wording of the questions, to determine if they were easily understood and to assess time taken for the respondents to complete each survey form. From the pretest; the researchers had to change a few of the wordings of the questions to enable better comprehension. The time taken for each survey form to be completed was only 10 minutes.

The survey form consisted of questions asking demographic data such as age, date of birth, gender, ethnicity, and household income in the first part and in the second part; the pubertal section consisted of questions on ages of pubarche, thelarche and menarche. These were to be filled in by the students themselves. Information pamphlets with Tanner stages for pubarche and thelarche were distributed to assist the students in assessing their own stages of puberty. Prior to data collection, the researchers gave lectures on pubertal changes to the students with permission and support by the school authorities.

On the day of data collection, the students who could participate assembled in the school halls. The researchers took two measurements of height (in cm using measuring tapes) and weight (in kg using weighing scales) and the average measurement were calculated and recorded. Subsequently their body mass indexes (BMI) were calculated.

Informed consents were pre-obtained from parents and the parents were invited to ask questions regarding the study by giving them the contact numbers of the researchers. They were assured their daughter's participation would be confidential and would not affect their academic progress. Only students with parental informed consents were included in the study. Approval had been obtained prior to data collection from the Ministry of Education Malaysia (MOE) and Human Ethical Committee of Universiti Kebangsaan Malaysia Medical Centre (UKMMC). The project code for this study was FF-2015-270.

All collected data were recorded and analysed using Statistical Package for Social Sciences (SPSS) 20.0. Descriptive analyses were used where mean ± standard deviation (SD), median (md), interquartile ranges (IQR), were used to describe continuous variables. Frequencies and percentages were used for categorical variables. Bivariate analyses such as Mann-Whitney test was used to compare the median ages of onset of puberty (onset of first time of puberty) while Chi-square test was used to compare the presence of comorbidities between ethnic categories (Malay and non-Malay) and to compare association between BMI and presence of menses. Kruskal-Wallis test was used to compare the median age of onset of each pubertal stages (thelarche and menarche) and prevalence of BMI among different ethnic groups.

Results

Socio-Demographic Characteristics of Respondents

The three schools selected in this study were located in the area of Cheras, Kuala Lumpur, Malaysia. Out of 730 respondents recruited, 481 (65.89%) respondents had parental consents. There were 436 (59.73%) completely filled questionnaires, however only 385 (52.74%) respondents had their heights and weights recorded. Thus data from these 385 respondents who participated fully in this study were analysed. The data normality was tested using a histogram. The mean and standard deviation (SD) were used for the data that was normally distributed. While median and inter-quartile range (IQR) were used for data that was not normally distributed. Majority of our respondents (70.7%) were from Form 1 and 2 and less participation of those from Form 3, Form 4 and Form 5 as they had other commitments such as major exams and extra-curricular activities.

As the histogram of the results did not show a normal distribution, hence we included the median and IQR results (Table 1). The median age of the height, weight and BMI of respondents were recorded (Table 2).

Table 1: Socio-demographic characteristics of respondents (n=385)

Variables	Median (IQR)	Range		N	%
		Min.	Max.		
Age (years)	14.00 (2.00)**	13	17		
13				132	34.30
14				140	36.40
15				50	13.00
16				45	11.70
17				18	4.70
Ethnicity					
Malay				329	85.50
Chinese				46	11.90
Indian				9	2.30
Others				1	0.30

Variables	Median (IQR)	Range		N	%
		Min.	Max.		
Household income per month				47	12.20
				114	29.60
≤ RM999				61	15.80
RM1000-RM 2999				46	11.90
Rm3000-Rm4999				3	0.80
≥RM5000				2	0.50
Parent not working				112	29.10
Not staying with parent					
Not sure					
Presence of comorbidity				46	11.90
Yes				339	88.10
No					

**skewed to the right

Table 2: Median age of height, weight and bmi of respondents (n=385)

Variables	Mean (± SD)	Median (IQR)	Range	
			Min.	Max.
Height (cm)	153.90 (± 6.77)		129.25	184.00
Weight (kg)		87.15(15.43)**	28.30	106.70
BMI (kg/m^2)		19.91(6.03)**	11.43	41.26

**skewed to the right

Pubertal characteristics of the respondents

Prevalence of thelarche and menarche

In this study, all of the respondents (n=385; 100%) had attained thelarche. The prevalence of the respondents whom thelarche was their first pubertal change was 370 (96.10%), whilst for 14(3.64%) respondents; pubarche occurred prior to thelarche. The majority (n=363; 93.51%) of respondents had attained menarche, however 22(5.70%) respondents had not. Among those who had attained menarche, 3(0.78%) of them were unable to accurately recall their age of attaining menarche (Figure 1, Figure 2).

The mean (±SD) for age of menarche was 11.97 (±1.11) years old with the age range from 9 to 16 years old. Twenty-two (5.70%) respondents stated that they have not attained menarche. We took the age of thelarche as pubertal onset age. The mean (±SD) age for pubertal onset in our cohort of respondents was 11.72 (±1.10) years old and the lowest age recorded was 8 years old and the highest age was 15 years old (Table 3).
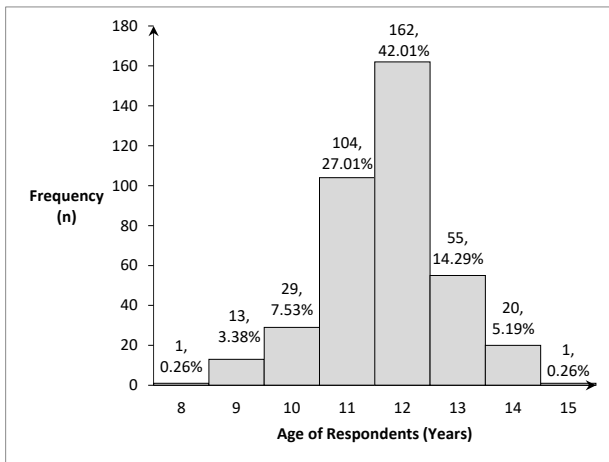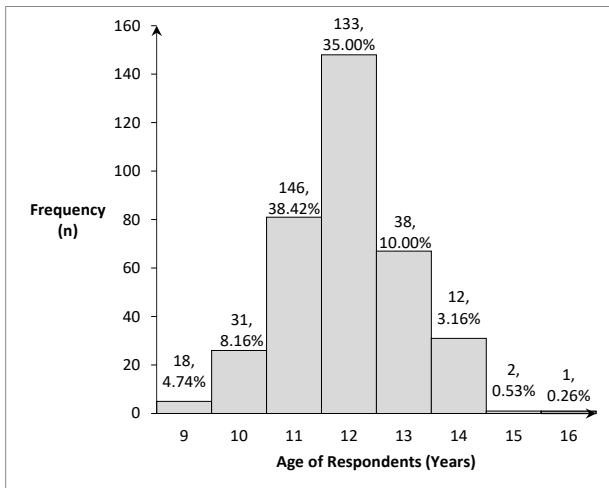
Figure 1: Ages of onset of thelarche (n=385)

Figure 2: Ages of onset of menarche (n=360)

Table 3: Pubertal characteristic of respondents (n=385)

Variable	Mean (±SD) (years)	Range (years)		N	%
		Min.	Max.		
Breast Development	11.72 (±1.10)	8	15		
				6	1.60
Tanner Stage 1				89	23.10
Tanner Stage 2				154	40.00
Tanner Stage 3				110	28.60
Tanner Stage 4				26	6.80
Tanner Stage 5					
Age of Menarche	11.97 (±1.11)	9	16		
Attained menarche					
Yes				363	94.30
No				22	5.70

Association between ethnicity and median age of thelarche and menarche

As only one student was of Bajau ethnicity was involved in this survey thus we decided to exclude her from the analysis. The median (IQR) age of 3 ethnic groups were significantly different. The Malay group had a significantly later age of thelarche compared to Chinese (Table 4). However, there was no significant difference for menarche age between the ethnic groups, (p= 0.38) (Table 5).

Table 4: Median age of thelarche among different ethnic groups (n=384)

Variables	Median (IQR)	Range		n	%	x² statistics (df)	p value
		Min.	Max.				
Ethnicity							
Malay	12.00 (1.00)	9	15	329	85.46	11.47 (2)	0.003
		8	14	46	11.95		
Chinese	11.00 (2.00)	11	12	9	2.34		
Indian	11.00 (2.00)						

***Kruskal- Walis test
*Post hoc test: Malay vs. Chinese, p=0.009; Malay vs. Indian; p=0.225, Chinese vs. Indian, p=2.37

Table 5: Median age of menarche among different ethnics (n=359)

Variables	Median (IQR)	Range		n	%	x² statistics (df)	p value
		Min.	Max.				
Ethnicity							
Malay	12.00 (2.00)	9	16	306	92.40	1.92 (2)	0.38
		9	14	44	95.70		
Chinese	12.00 (2.00)	9	14	9	100.00		
Indian	12.00 (3.00)						

*Kruskal –Walis test
*There was no significant difference for menarche age between the ethnic groups.

Association between median ages of pubertal onset and ethnicity

Pubertal onset in this study is taken as the age of thelarche. A total of 329 (85.45%) respondents were Malay with the median (IQR) of 12.00 (1.00) years old and for non-Malay, the total was 56 (14.54%) respondents with the median (IQR) of 11.00 (2.00) years old. We discovered that the median age of puberty of non-Malay respondents was earlier than Malay. Futhermore, there was a significant difference between ethnicity of respondents (grouped as Malay and non-Malay respondents) and the median age of onset of puberty, (p=0.002) (Table 6).

Table 6: Median age of pubertal onset of malay and non-malay

Variables	N	Median(IQR) (years old)	Z statistics	p value
Malay	329	12.00(1.00)		
Non- Malay	56	11.00(2.00)	-3.13	0.002

*Mann-Whitney Test

Discussion

Biro et al (16), 2003, proposed two pathways as the initial manifestations of puberty which are thelarche pathway and ardenarche pathway. In thelarche pathway, the initial manifestation of puberty is the development of areolar maturation while in the adrenarche pathway, the development of pubic hair is the initial manifestation of puberty . In this study, majority of our respondent developed thelarche as their first stage of puberty. Thus we took the onset of puberty to be the mean age of thelarche. The mean (±SD) age of onset of thelarche in our study was 11.72 (±1.10) years which is about one year later than the mean (±SD) age of onset of thelarche of 10.10 (±1.20) years reported in Thailand and 10.7 (±0.9) years in US (16,17). The mean (±SD) for menarcheal age in our study was 11.97(±1.11) years which was comparable to other studies which were 12.3 (±1.10) years among female Malaysian adolescents, 12.18 (±1.07) years among Asian Girls and 12.80 years in United States respectively, (11,13,19).

It was found also that our respondents were not able to recall their onset of pubarche very well. This may be because developing breasts require wearing bras and menarche requires using pads thus it was easier for the respondents to remember fairly accurately their onset of thelarche and menarche but found it difficult to recall the onset of pubarche. The researchers therefore decided to not include the results of the onset of pubarche in this study.

There were differences in the median ages among three ethnic groups represented in this study. The median age of the thelarche for Chinese and Indian adolescents were earlier compared to Malay adolescents (p=0.003). However, for menarche age, our study found no significant differences between ethnic groups. This was consistent with a local study by Golam Hossain et al (20), 2013 which stated that the variations in age at menarche among Malaysian ethnic groups were statically non-significant. Non-Malay adolescents had earlier onset of puberty compared to Malay adolescents. There was an unequal distribution of the different ethnic groups in this study as the Cheras area where the schools were located consisted of mostly Malay residents. The aim of this study was to determine the ages of pubertal onset and not the factors contributing towards it. Even though our findings stated a significant difference between the menarchal ages between the Malay and non-Malay groups, we will not be able to extrapolate it to Malaysian adolescents as a whole as the non-Malay numbers are too small and not representative of the national distribution of Malaysia. Thus a bigger study involving more schools with a greater distribution of the non-Malay ethnic groups is required to confirm if there really is a difference in the ages of pubertal stages amongst the different ethnic groups.

In our study, majority of female adolescents had attained menarche, with only 22 students who had not. Out of these 22 respondents, 22.7% were underweight, importantly there was significant association between body mass index and attainment of menarche, which was consistent with a study in Iran, whereby it was reported that menarcheal age was delayed for underweight subjects (21). Majority of these respondents were aged 13 and 14 years old, and had Tanner staging 2 for thelarche so they will probably attain menarche in one or two years' time. Furthermore, we presumed that those with Tanner Stages 4 and 5 for breast development will attain menarche soon. An underweight respondent aged 15, with Tanner stage 2 for breast development, whom have not attained pubarche was referred to the paediatric and adolescent gynaecology (PAG) clinic, HCTM, PPUKM, for further investigations.

Strength of Study

There were strengths pertaining to our study. Firstly, to date, this is the only study in Malaysia about pubertal profile of female adolescents which explored the different stages of puberty; thelarche and menarche. There were a few prior studies locally conducted, however they either focused only on menarche or thelarche. Secondly, albeit utilising a self-assessment survey form, these survey forms were counterchecked during data collection. The researchers went through all questions in the questionnaire together with all respondents in order to ensure that they really understood the questions and were able to provide relevant answers to the questions.

Study limitations

However, there were few limitations to our study. First and foremost the time restriction in both parties; the researchers were mostly undergraduate medical students with tight work and study schedules limiting their availability to be out of the hospital for the field work needed in this study. The respondents also had only a week to complete the survey forms. If they were given more time, most likely a greater number of respondents could have participated. Many of the older (Form 5) students were not able to participate due to exam commitments. Lastly, the results were based on self-assessment whereby recall method was used and the respondents' bodies were not examined directly by the researchers. We were not able to do this as most likely the majority of the parents would not have given consent. However, based on Mary A. Carskadon and Chritine Acebo (1993) reported that self-rating scale were applicable and self-rating assessments were consistent with normal pubertal development (22). Next, a more homogenous distribution of ethnicity in

a larger cohort would be able to better consolidate our findings of a significant difference in pubertal ages between the different ethnic groups.

This study also further emphasizes the need for a more comprehensive sexual and reproductive health education programme to be implemented in Malaysian schools and also to educate on maintaining normal adolescent body mass indexes.

Conclusion

In conclusion, all of our respondents had developed thelarche whilst 94.29% had attained menarche. The mean (±SD) age for pubertal onset in our cohort of respondents was 11.72 (±1.10) years old. The mean (±SD) for age of menarche was 11.97 (±1.11) years old with the age range from 9 to 16 years old. Thus, we concluded that majority of our respondents had attained puberty as most had attained menarche. The non-Malay adolescents attained puberty at an earlier age as compared to the Malay group. This study also showed that the mean age of pubertal onset was later as compared to other studies from Asia and US population. The prevalence of overweight and obesity in this study was high. This was an alarming trend and preventive actions should be prioritized and implemented.

Conflict of Interest

Financial Disclosure

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