Factors contributing to early menarche in school girls

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Abstract

Objective: To assess the average age of menarche in Pakistani girls from different socioeconomic backgrounds.

Methodology: This was a cross sectional study design carried out on female students studying in different schools of Karachi in 2014. Girls aged 10-14 years age were included. Schools from all three socio economic strata were selected through random sampling technique from a list of schools having health care services. Data was collected through a self-administered questionnaire translated in Urdu where required. Height and Weight was measured through calibrated instruments. Sample size was n=385 based on maximum proportion of 50%. Analysis was done on SPSS version 20. Chi-square and ANOVA was applied after checking data for normality.

Results: The total sample size was 275 after excluding poorly filled questionnaires. The mean age of menarche in our sample population was 11.73±1.2 years. Out of the total participants 127 (46%) students had reached the age of menarche. It was found that mean age of menarche was highest in participants of Kashmiri origin 14.5±0.1 years and lowest mean age was observed in those of Gujrati origin at 11.0±0.1 years (p 0.036). When mean age of menarche was compared with socioeconomic class highest mean age was observed in lower class 12.13 ±0.1 (p 0.268).

Conclusion: Our study reveals a decline in the mean age of menarche of at least 2 years in girls aged 10-14 years.

Keywords: Age of menarche, School going children, Factors affecting age of menarche. (JPMA 66: 629; 2016)

Introduction

Menarche, the first occurrence of menstruation, denotes the beginning of fertility[1] and is an essential marker of sexual maturity in young females. It occurs suddenly and distinctly, and is therefore the main indicator of female maturation.[2] Over the last several decades, the average age of menarche has shown a significant decline. For instance, a study conducted on evolutionary medicine[3] showed that the average menarcheal age decreased by 4 years in the modern West over the last 150 years. Another study[4] demonstrated similar trends in the menarcheal age in some developing nations as well.

In Europe, the average menarcheal age showed a four-year drastic decline from 17 to 13 years (over the mid-19th to mid-20th century).[5] Early menarche in European girls can be observed in Greece and Finland where the mean age at menarche was 12.3 years and 13.3 years respectively.[5] Comparable trends to the data mentioned above can be observed in the United States (U.S.) [5]. In the early 21st century (2001), the mean menarcheal age in the United States was 12.34 years.[6] According to a more recent article, approximately 16% of girls in the U.S. reach puberty at the mere age of 7,[7] showing continuation of the declining trend of menarcheal age.

A study conducted in Ireland in 2006 indicated that the mean menarcheal age of Irish girls decreased from 13.52 years to 12.53 years over a range of 20 years.[8] Several other countries had similar average ages of menarche. In Ethiopia it was 13.9 years[1] and a cross-sectional study in Kuwait found it to be 12.41 years.[9] Meanwhile, the mean age of menarche among Indo-Pakistani girls was found to be 13.06 years according to a study.[10]

Menarche is impacted by numerous genetic and environmental factors,[4] of which several are the focus of this study. These variables include BMI, dietary intake, socioeconomic status (SES), and physical activity of the adolescent female. Household environment and parents' level of education are also two crucial factors that determine menarcheal age. A study conducted in Seoul found that young women who had experienced menarche at an earlier than average age had a BMI and waist perimeter greater than women who had experienced it later or at the average menarcheal age.[11] A cross-sectional study conducted on the French E3N cohort observed that having a deceased dietary intake pre-puberty produced a delayed menarcheal age.[12] Low SES was linked to early menarche in a study conducted in the U.S.[13] Interestingly, decreased menarcheal age was

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independently correlated with decreased physical activity of adolescents, as well as with parents' having a limited educational status. The study further observed that youngsters with better-educated parents were more likely to see menarche in a healthier age range.[1] Household problems during prepubescent years (such as physical abuse, disrupted families, etc.) were strongly related with premature puberty (earlier age at menarche).[13]

In this study, we aimed to assess the average age of menarche in Pakistani girls from different socioeconomic backgrounds. We also assessed the association between average age of menarche and BMI levels, nutritional status, household environment, and parents' education whilst also taking the effects of physical activity into account. Additionally, we hypothesized that mass media influence has an effect on the age of menarche.

Methodology

This was a cross sectional study carried out on female students studying in different schools of Karachi in 2014. For the purpose of our study we included girls aged 10-14 years. The proportion of Pakistani females in the age group of 10-14 years is 4.9%.[14] This was taken for calculating the sample size. The calculated sample size at 95% confidence level and 3% bound of error was 199. The sample size was inflated and the entire female students in the selected schools were recruited in the study. Therefore a total of n=275 students were selected through consecutive sampling technique from three schools corresponding to high, low and middle socio economic status (SES). The SES was identified on the basis of Prasad classification of 2014.[15] These three schools were selected randomly from a list of schools that had school health services established on their grounds. This criterion was utilized for getting assistance from the school clinics regarding their height and weight measurement.

The cutoff for the different stages of menarche (early, normal and late) was taken from literature. Mean age 13.6±1.5[16] was taken from similar studies conducted in the region and within ± two standard deviation was taken as normal range. Data was collected through self-administered structured questionnaire that was developed in English. It comprised of questions pertaining to their demographic profile, nutritional assessment that was carried out through BMI, for which height and weight were measured through calibrated instruments, nutritional habits and influence of media. Information regarding the birth history and feeding status in infancy was taken from the medical records maintained by the school health programme. Prior to administration, the questionnaire was pilot tested on ten students and changes were made accordingly to the feedback received.

Questionnaire was simultaneously given to all students and they were not allowed to discuss the questions among themselves. The purpose of the study was explained to the students and they were informed that data would not be used for any other purpose. Students who did not consent were excluded from the study.

Data entry was done on Microsoft Excel and then transferred to SPSS version 20 for analysis. P value < .05 was taken as significant. Stratification was done on the basis of socio-economic class and BMI. Chi Square was applied to find association between categorical variables. After fulfilling the assumptions and checking the data for normality through Shapiro Wilk test and Levene's test for homogeneity, ANOVA was applied for finding mean difference in age of menarche in different ethnicities, BMI groups and socioeconomic groups.

All authors declare that written informed consent was obtained from the subjects (or other approved parties) for publication of this study.

The authors also state that all necessary ethical approval was obtained from the Ethics Review Committee (ERC) of Ziauddin University.

Results

The mean age of menarche in our sample population was 11.73±1.2. A total of n= 275 students were selected from grades 5 to 7 and sample was taken from schools catering to every socio-income strata of the society. The mean age of sample was 11.54±1.6 and out of the total participants 127 (46%) students had reached the age of menarche. Major chunk of the participants 232 (84.4%) belonged to middle class whereas minorities were from upper 24 (8.7%) and lower class 6.9% (n=19). Approximately half 49.1% (n=135) of the participants were from families who had migrated from the Indian sub-continent.

After fulfilling all the assumptions for ANOVA, difference in mean age of menarche among different ethnic groups was assessed. It was found that mean age of menarche was found to be greatest in participants of Kashmiri origin 14.5 (±0.1) and minimum mean age was observed in Gujrati at 11.0 (±0.1) years (p value 0.036). When mean age of menarche was compared with socioeconomic class highest mean age was observed in lower class 12.13±0.1 (p value 0.268).

Literature review identified two main determinants affecting the age of menarche, nutrition and media influence. These two factors are presented in Tables-1 and 2. For nutritional assessment BMI was taken after

Table-1: Association of time of menarche with media influence.

Factors	Age of menarche						P value
	Early Menarche		Normal		Late Menarche		
	n	%	n	%	n	%	
Watching Television	89	39.4	21	9.5	113	51.1	0.118
Watching Movies	54	37.8	21	14.7	68	47.6	0.002
Using Internet	66	37.7	15	8.6	94	53.7	0.865
Watching comedy shows	58	38.9	20	13.4	71	47.7	0.008
Watching cartoons	34	24.5	14	10.1	91	65.5	0.001
Watching reality TV	39	50.6	3	3.9	35	45.5	0.006
Watching romantic movies	23	48.9	5	10.6	19	40.4	0.109
Watching Dramas	42	37.8	13	11.7	56	50.5	0.378
Watching action movies	26	41.3	10	15.9	27	42.9	0.038
Watching fantasy movies	26	37.1	11	15.7	33	47.1	0.067
Watching thrillers	27	57.4	8	17	12	25.5	0.001
Watching horror movies	73	38	20	10.4	99	51.6	0.313

Table-2: Association of time of menarche with nutrition.

Factors		Age of Menarche						P value
		Early Menarche		Normal		Late Menarche		
		n	%	n	%	n	%	
Eating Breakfast	Yes	79	35.4	18	8.07	126	56.5	0.223
	No	22	42.3	7	13.4	23	44.23	
Eating Eggs	Yes	30	32.6	9	9.8	53	57.6	0.603
	No	71	38.8	16	8.7	96	52.5	
Drinking Milk	Yes	39	39	7	7	54	54	0.613
	No	62	35.4	18	10.3	95	54.3	
Drinking Carbonated beverages	Yes	61	31.6	23	11.9	109	56.5	0.004
	No	40	48.8	2	2.4	40	48.8	
Fast Food Intake	Yes	8	33.3	3	12.5	13	54.2	0.811
	No	93	37.1	22	8.8	136	54.2	
Fried food Intake	Yes	71	33.2	21	9.8	122	57	0.071
	No	30	49.2	4	6.6	27	44.3	
Fried Potatoes	Yes	84	35.3	23	9.7	131	55	0.393
	No	17	45.9	2	5.4	18	48.6	
Eating Chocolates	Yes	82	35	23	9.8	129	55.7	0.299
	No	19	46.3	2	4.9	20	48.8	
Eating Fruits and Vegetables	Daily	28	24.1	7	6.0	81	69.9	0.001
	2-3 times a week	64	44.8	16	11.2	63	44	
	Never	9	56.3	2	12.5	5	31.2	

measuring the weight and height of the participants. Mean weight of the sample population was found to be 36.41±9.4 Kg, mean height was 145.5cm (±10.1) and mean BMI was 17.1±4. No significant difference was observed when age of menarche was compared with BMI groups (p 0.378). When inquired about their feeding practices in infancy 221 (80%) of the students affirmed that they were breastfed. When the mean age of menarche was compared with breastfed history no significant difference was observed (p 0.958).

Discussion

The study revealed that the mean age of menarche in the participating girls from Karachi was 11.68±1.147 years (n=275). About 0.8% of the girls attainted early (8 years) and late menarche (16 years) while the majority 36.2% of girls matured around the age of 12 years. Factors associated with the beginning of menstruation were nutrition, media influence, socioeconomic status and ethnicity. A major finding was that there was no significant association between BMI and a breastfed

history with the age of menarche.

The study's mean age of menarche is lower than that which was found in Canadian girls according to a study conducted in 2010 (12.72±1.05 years)[17] and that in American girls (12.34 years)[6] or even in Turkish (12.74 years)[18] or Indian (13.7 years) girls.[19] The average menarcheal age in Indo-Pakistani girls by another study done in 1991 was demonstrated to be 13.06±0.20 years.[10] When compared, the current study reports a mean age of menarche significantly lower than the one done in 1991.

Amongst the nutritional factors, only the regular consumption of carbonated drinks showed to have a significant association with the age of menarche. An increased consumption was associated with higher number of late menarcheal ages (56.5%) and a low number of early menarcheal ages. According to a recent prospective cohort study conducted in the United States, the regular consumption of sugar-sweetened drinks was associated with early onset of menarche.[20] Another study conducted in Belgium also significantly related the age of menarche with drinking high-carbonated drinks, among other factors.[21] The other factors in the nutritional assessment such as consumption of eggs, milk, fast food, fried food, fried potatoes and chocolates were shown to be not significant. These findings were supported by the studies conducted in India[19] and in Turkey,[18] which showed no association of the menarcheal age with the consumption of dairy products and eggs. A daily consumption of fruits and vegetables was majorly associated with late menarche whereas those who had a bare minimal intake showed a higher peak in early menarche.

The mean age of menarche was shown to be positively associated with mass media influence, including regular viewing of movies, comedy shows, cartoons, reality TV, action movies and thrillers. Surprisingly, there was no positive association found between the age of menarche and regular usage of the Internet, even though majority (53.7%) of girls attainted late menarche. Similar observation was reported in another study conducted on adolescents in pubertal age which showed significant association with media viewing.[22]

Based on socioeconomic status, those belonging to the lower class had the highest mean age of menarche while those belonging to the upper class had the lowest. These findings were inconsistent with those in a study conducted in Turkey,[23] which found the menarcheal age to be lowest in the low socioeconomic group and highest in the middle socioeconomic group. The mean age of menarche according to ethnicity was very variable with 2 peaks seen in the Pathan and the Kashmiri girls. The Kashmiri girls showed a significantly late mean age of menarche and the Gujrati girls showed a significantly early mean age of menarche. The variability in menarcheal onset by socioeconomic status and ethnicity has been demonstrated by other studies done in the United States.[24,25]

Although the study showed no association between BMI and menarcheal age, other studies[13,24,25] have demonstrated a significant association between the two. A study conducted in Spain,[26] indicated high weight in girls being associated with an early onset of menarche, whereas a study conducted in Iran,[27] showed a high mean age of menarche in obese girls. Other studies also established an inverse association between BMI[28] and obesity[9] with the onset of menarche.

According to the study, a breastfed history in the girls showed no association with the age of menarche. A cohort study,[29] conducted in the Philippines, also showed the duration of breastfeeding was not associated with the menarcheal age.

A shortcoming in this study was that data was only collected in schools and girls within the age bracket of the study who had dropped out of school or those who had never attended school could not be reached. Therefore, the results cannot be attributed to all young females nationwide. It was also difficult to draw a casual inference since this was a cross sectional study; however associations have been stated. Despite these drawbacks, the study had various advantages. It is one of the first cross sectional studies done in Pakistan to estimate the average age of menarche in young adolescent females and to determine the association of the menarcheal age to factors such as BMI, nutrition, media influence and socioeconomic status. The data was collected close to the time of menarche for most girls, thus reducing recall bias.

Conclusion

Age at which girls are attaining menarche has shown a decline when compared with the local data almost 2 decades back. Region wise comparison also showed the girls to be maturing at a younger age than in other countries.

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