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The Association Between Menarche Age and Birth Weight, Mother and Older Sister's Age of Menarche

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Abstract

Background: Age of menarche is a sign of the beginning of the ability to reproduce and is usually a turning point for the development and maturity and puberty. Regulatory factors in the onset of menarche age are not well understood, but in developed countries, it is thought that about half of the variations in the onset age of menarche is associated with genetic factors.
Objectives: To determine the association between menarche age, birth weight and the mother and older sister's age of menarche; the subjects of this study were Shirazifemaleprimary, middle and high schools students in 2014 - 2015.
Methods: This is a cross-sectional study, which was done on 2000 girls aged 9 - 18 years. In the first stage, sampling of schools in 4 regions was randomly assigned to clusters. Then, the students in each school were selected purposively. The questionnaires filled in by the participants contained demographic items, menarche age, and birth weight. Data were analyzed through SPSS (version16), using Chi-square test and ANOVA.
Results: The majority of the subjects (n: 1294, 64.7%) had normal menarche age (11 - 14 years old).There was no relationship between menarche age and birth weight (P: 0.67).However, it was significantly associated with the students' mother and older sister's age of menarche (P: 0.001).
Conclusions: According to the findings, menarche age was within the normal range (11 - 14 years) in the majority of the subjects. There was a significant positive association between menarche age in both mothers and girls. In other words; girls reach menarche age earlier than their mothers. Thus, and mother and older sister's menarche age can be a proper criterion to predictit in girls.

Keywords: Menarche, Birth, Weight, Mother, Sister

1. Background

Puberty is a critical period and transient stage foundation for the next stages of a person's life (1). In the 21st century, the mean age of puberty has steadily declined (2). Menarche age is a sign of one's reproductive abilities and is usually a turning point for maturity development. Although the factors affecting the onset of menarche are not well understood, genetics is considered as the most probable factor in developed countries (3). Menarche age was significantly correlated among identical twins and ethnic groups (4). Genetics has been considered as the most contributing factor on the menarche age onset. Some studies have investigated the relationship between puberty age in mother and daughters to confirm the role of genetics (5). Geneticfactorsare estimated to be about 57% - 82% (3, 6). The correlation between the menarcheal age of mother and daughter, daughters and younger siblings, and identical ethnic groups imply the importance of genetics in this regard (7). Recent studies (8-11) have presented an evidence of the significant relationship between certain physical and clinical characteristics in mothers and menarche age in their daughters. However, some differences still exist (8, 12). The probable correlation between the girls' early menarche age and their mothers' menarche age was three times more than in obese girls. Therefore, mothers' age at menarche may be an indirect cause of early menstruation in girls (8). Birth weight is one of the significant factors affecting the menarche onset. However, its biological mechanisms are still unclear (13, 14). Higher birth weight and lower gestational weight may be the factors contributing to the early onset of puberty (15).

However, there are contradictory results about the association between birth weight and menarche age (8, 16-18). Premature birth is a common pregnancy result, which may influence the metabolic status during childhood and puberty (19). However, recent studies have not suggested a significant association between prematurity and menarche age (14, 19, 20). Szwed and Kosinka (14) have revealed the record of different menarche ages among Polish girls

born before 37 weeks. Moreover, the sign of early menarche was observed in girls who weighed below 2500 gram at birth. The same trend was found in Asian female adolescents, as well. The girls who were born prematurely had a delay (4 months) in sexual maturity onset compared to those born after 41 weeks (20), due to various factors affecting the onset of menarche and the limited information in this regard.

2. Objectives

This study aimed to determine the association among birth weight, age at menarche, the mother and older sister's age of menarche in female students at primary, middle, and high schools.

3. Methods

This cross-sectional study was done in 2014 - 2015. The study population included all female students at elementary, middle and high school across all four regions. According to previous studies (21), and statistics experts' opinion, the following Formula 1 and parameters were used to determine the sample size:

$P_1 = 0.35$; $P_2 = 0.60$; $P_3 = 01.05$; $-\alpha = 0.95$; d = 0.01; q = 1-p.

$$n = \frac{Z^2 \times pq}{d^2} \quad (1)$$

The sample size was calculated to be 2000 girls aged 9 to 18 years old; they were classified to four categories based on their age: 9 - 10 years, 11 - 12 years, 13 - 14 years, and 15 - 16 years.

Inclusion criteria were girls aged 9 - 18 years old who were studying in different levels, willingness to participate in the study, no history of medication except anti-allergic drugs and sedatives (3 months prior to the study), and no history of chronic physical and mental illness. Exclusion criteria included evidence of any crisis or stressful event and the students or parents' request to withdraw from the study. Firstly, a sample of 6 - 8 schools was obtained as a cluster; then, according to statisticians' opinion, sampling was conducted on the basis of 500 subjects at the age up to 10 years (125 from each region), 1000 at the age of 11 - 14 years (from any area, 250), and another 500 at the age of 15 - 18 years (125 from each region).The samples were selected from each of the three study stages from each region. After assessing the study inclusion and exclusion criteria and explaining the study aims to the subjects, they were asked to complete the demographic questionnaire (including menarche age, personal information such as birth weight, the age of their mother and older sister's menarche).

The instrument of the research was a questionnaire which consisted of 48 questions developed by the researchers in two parts.

Part I: Demographic questionnaire contained self-reporting items such as age of the students, the number of siblings, parents' level of education, etc.

Part II: Content validity was applied to determine the appropriateness of the questionnaires' items. After reading different scientific books and articles, the confounding variables were defined, and then the questionnaires were prepared and confirmed by a number of faculty members.

The research settings included primary, middle, and high schools located in different areas of Shiraz city.

After approval of the ethics committee and obtaining the letter of introduction from protective education centre for schools, the questionnaires were distributed among the students. The students filled in all the questionnaires under supervision of a health educator and school counselor. Besides, information of mothers and sisters was completed by students at home.

The questionnaires were completed from October 2014 to May 2015. Some of them were incomplete and in some of them there were a number of unanswered questions. It was not possible to return them because they were anonymous. As a result, the questions that the girls answered were entered into SPSS and the questions without answer were not removed.

In this study, normal menarche age was between 11 - 14 years; early menarche was below seven, and delayed menarche was over 15 years (22).

3.1. Ethical Considerations

After the approval of Shiraz University of Medical Sciences ethics committee (93 - 7173) and the authorities' permission by education department, a referral form was obtained from the security office, which was delivered into the designated school administrators. The subjects were assured that they can withdraw from the study at any stage and that their identity would remain confidential. The informed consent in the 9-10-year-old girls was completed by the parents and the rest were completed by female students.

3.2. Statistical Analysis

After collecting the data, SPSS statistical software (version 16) was used to analyze the data through descriptive statistics, Chi-square test, and ANOVA.

4. Results

About 1386 (69.3%) subjects had experienced menarche while 30.7 did not. The majority of subjects (n: 1294, 64.7%)

had normal menarche age (11 - 14 years old) (Table 1). The subjects' birth weight was between 1000 to 5000 grams with a mean of 3103 grams. The menarche age of the study subjects ranged between 11 - 14 years with 1294 cases (7.64% (Table 1). The subjects with at least 1000 g birth weight up to 5000 gram had a mean birth weight of 3103 g. There was no significant relationship between the menarche age and birth weight (P: 0.67) (Table 2). There was a significant correlation between the onset of menarche and the mother's menarche age (P: 0.001) while the menarche age between 13-14-year olds was more common (n: 606, 51.9%).However, the minority was below 9 years of age (n: 11, 0.09%). In addition, there was a significant correlation between the onset of menarche and the older sister's menarche age (P: 0.001),while the menarche age was between 13 - 14 years in 143 subjects(30.7%).However, the minority was between 9 - 10 years of age (n: 15, 3.2%) (Table 3). Studying the link between the menarche type and mother and older sister's age implies its significant correlation with the mother's menarche age (P: 0.001). The mean age in the majority (n: 1147) was 13.36 ± 1.43 while it was 12.83 ± 1.94 in the minority (n: 12) (Table 4).

5. Discussion

Menarche age is a measurable and sensible criterion for the onset of puberty in girls (23). According to our findings, which were consistent with other studies in Iran and the world (24-28), menarche age was normally between 11 - 14 years. There are some factors affecting the menarche age in different communities such as genetics and racial differences, and also geographical and nutritional factors.

Despite the contrary findings, no significant association was found between the birth weight and menarche age in this study. Some studies reported a significant relationship while the mechanism was unknown (29, 30). On the other hand, the studies done by Danesh and colleagues in Shahrkord (2009), and Kabir (2006) (31, 32) indicate no significant relationship. According to a study done in Netherlands in 2006, no difference was found between the onset of puberty and its increasing trend among different girls in terms of birth weight (19). On the other hand, the study done on 156 subjects in Australia showed that the menarche age was lower in taller and thinner girls at birth (18). Also, a study conducted in Spain indicated that early menarche occurs in girls with lower birth weight, so it leads to shorter height in adolescence (33). This difference roots in the racial, environmental and geographical variances.

The strong correlation among identical ethnic, local, and family groups at menarche age implies the importance of genetic effect on puberty onset. According to data analysis, about 50% - 80% of changes in puberty are determined by genetic factors (34). In this study, the increase in mother's menarche age was along with the girls' menarche onset. This finding was consistent with the one done on girls living in Tehran (region 13) (35). The study done by Einy and Puta showed a positive relationship between mother and girl's menarche age (36, 37).

According to the study conducted by Ghoreishi and colleagues in Yasuj and the one conducted by Mohamtiad, the girls' menarche age was earlier than their mothers (38, 39). The same genetic, familial, climatic and dietary conditions in families provide the possibility to compare the onset of menarche age in sisters. However, different sources claim that it reduces over time (40, 41). In this study, there was a significant correlation between the menarche age and older sister's menarche time.

Kabir and colleagues did the same study in 2006 to compare the mean age of menarche in grandmothers (as the previous generation) with mothers and aunts. The results proved the fact that the menarche age is increasing over the time. This increase is more absolute in the fourth daughter compared to the other siblings. The standard error in these figures indicates a significant increase (32), which is consistent with the results of this study. It seems that a longitudinal cohort study is the best method to identify the connection between the mothers' features and menarche age in girls. However, this type of study is hardly possible due to time and financial limitations. Another possible error is related to the mothers' recall (42). In addition, the long interval in the mother-daughter menarche time leads to more errors. Pre-adult body mass index (BMI) can be another possible confounding factor affecting the mother-daughter menarche time (10). Multi-stage random sampling scheme, subjects' categorization based on the target population and the same chance of being selected are of this study's strengths. It increases the chance of generalizing the results while it minimizes the possibility of bias. Cross-sectional potential of this study, the error possibility of recalling the birth weight and mothers' menarche age are the limitations of this study. Another limitation was the fact that some of the information was based on subjective evidence, but some information was extracted from the school health records and growth charts in the school files for girls. Due to high expenses and commuting difficulties, rural areas were not included in this research. Further studies, including both rural and urban areas, are recommended.

5.1. Conclusion

According to the results, the majority of subjects (n: 1294, 64.7%) had normal menarche age (11 - 14 years old). There was no relationship between the menarche age and

Table 1. Distribution of Age at Menarche

Age of Menarche	No. (%)
7 - 10	71 (3.6)
11 - 14	1294 (64.7)
15 - 18	21 (1.1)
Menarche	1386 (69.3)
Non-menarche	614 (30.7)
Total	2000 (100)

Table 2. The Relationship Between Age at Menarche and Birth Weight[a]

Variable	9 - 10	11 - 12	13 - 14	15 - 16	Total	Chi-Square	Significance Level
Birth weight, gram							
≥ 1500	-	7 (1.1)	7 (1.4)	1 (4.8)	15 (1.2)		
1501 - 2500	9 (14.3)	120 (19.1)	97 (19.1)	6 (28.6)	232 (19)	6/68	0.67
2501 - 3500	41 (65.1)	386 (61.4)	301 (59.1)	10 (47.6)	738 (60.5)		
≥ 3500	13 (20.6)	114 (18.2)	104 (20.4)	4 (19)	235 (19.3)		

[a]Values are expressed as No. (%).

Table 3. The Relationship Between Age at Menarche and Age of Menarche Mother and Older Sister[a]

Variable	9 - 10	11 - 12	13 - 14	15 - 16	Total	Chi-Square	Significance Level
Age							
> 9	6 (9.5)	2 (0.3)	3 (0.6)	-	11 (0.9)		
9 - 10	3 (4.8)	6 (1)	3 (0.6)	-	12 (1)		
Maternal age at menarche							
11-12	17 (27)	192 (31.7)	65 (13.5)	-	274 (23.5)		
13 - 14	24 (38.1)	298 (49.2)	282 (58.8)	2 (11.1)	606 (51.9)		
15 - 16	13 (20.6)	108 (17.8)	127 (26.5)	16 (88.9)	264 (22.6)		
Total	63 (100)	606 (100)	480 (100)	18 (100)	1167 (100)	161.55	0.001
> 9	10 (37)	74 (30.7)	43 (22.1)	-	127 (27.3)		
9 - 10	4 (14.8)	7 (2.9)	4 (2.1)	-	15 (3.2)		
Older sister age at menarche							
11 - 12	9 (33.3)	95 (39.4)	36 (18.5)	-	140 (30)		
13 - 14	3 (11.1)	53 (22)	86 (44.1)	1 (33.3)	143 (30.7)		
15 - 16	1 (3.7)	12 (5)	26 (13.3)	2 (66.7)	41 (8.8)	75.31	0.001
Total	27 (100)	241 (100)	195 (100)	3 (100)	466 (100)		

[a]Values are expressed as No. (%).

Table 4. The Relationship Between Types of Menarche and Age of Menarche Mother and Older Sister

Variable	Number	Mean ± SD	Standard Error	ANOVA	Significance Level
Maternal age at menarche[a]					0.001
> 9	12	1.94± 12.83	0.56		
9 - 14.9	1147	1.43± 13.36	0.04	11.69	
≤15	18	0.63± 14.94	0.15		
Total	1177	1.44 ± 13.38	0.04		
Older sister age at menarche					0.31
> 9	6	7.06 ± 8.5	2.88		
9 - 14.9	463	5.79± 9.38	0.26	1.15	
≤ 15	3	1.15 ±14.33	0.66		
Total	472	5.79 ± 9.4	0.26		

[a]Means: Type of menarche, natural menarche (14 - 11 years) and early menarche (less than 7 years) and late menarche (more than 15 years).

birth weight. However, its link with the menarche age in mother and older sister was significant, so it can be a proper criterion to estimate the menarche age in girls. Genetics is an influential factor on the menarche age. Researchers believe that other factors including race, nutrition status, public health and geographical location affect both its onset and progressive trend. This research provides an insight for researchers in the field of women's health.

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