# Menstrual Cycle Disorders and their Relationship with Body Mass Index (BMI) in Adolescent Girls

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## Article Info

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## ABSTRACT

**Background & Objective:** Menarche is an important stage in the development of girls which can predict the adolescent's puberty process and fertility onset. The changes in menstrual cycle have health consequences not only in adolescence but also over the life-course. Childhood obesity as a common health problem has been observed in both developed and developing countries, and its prevalence is continuing to increase. The aim of this study was to identify menstrual patterns and related disorders and also to investigate the relationship between menarche age, menstrual disorders, and (BMI) in high school girls in Urmia.

**Materials & Methods:** In this cross-sectional study, 716 adolescent girls aged 14-18 years were selected with multistage sampling from high schools of Urmia (Sept 2012 to Dec 2013). Participants completed the questionnaire of menstrual pattern characteristics including age at menarche, menstrual cycle length, dysmenorrhea, and the need for pain relief. BMI percentile was calculated and obesity was determined using the CDC's 2000 BMI-for-age growth charts.

**Results:** The results showed that the average of age, BMI, and menarche age were: $15.66 \pm 1.019$ year, $22.05 \pm 3.91$ kg/m2 and $12.87 \pm 0.98$ year, respectively. The prevalence of overweight and obesity were 13.7% and 8.4%, respectively. A large majority of the subjects (76.1%) had a normal, healthy weight. There was a significant association between BMI and the duration of flow, menarche age, menstruation flow, and pain severity ($P<0.05$).

**Conclusion:** Based on the results, planning and intervention for decreasing the BMI in high school girls can help reduce menstrual disorders. Future studies are required to confirm and complete our results.

**Keywords:** Menstrual cycles, Obesity, Menarche

## Introduction

Adolescence is an important period through which a person enters from childhood to adulthood and acquires abilities and competencies that she uses in adult life, and if she cannot, adulthood will not be easy. Adolescence is the time of fertility acquisition, the acquisition of emotional characteristics of adulthood, the time of acquiring individual and social identity, and so on. Physical, mental and emotional maturity in adolescence evolves and continues **(1, 2)**. Menstruation is usually the last sign of puberty. Menarche (age of first menstruation) in Iranian girls is on average at 12-13 years old and having the necessary knowledge at the right time, makes the process of puberty easier, more pleasant and healthier for the person **(3, 4)**. Menstrual cycle disorders are common in adolescent girls in the early post-menarche years, and adolescent girls are often being referred to outpatient endocrinology clinics for these disorders. The hypothalamic-pituitary-ovarian axis failure is the most common explanation for the cause of menstrual irregularities in adolescent girls **(4-9)**. During the first 2 years after menarche, most cycles are without ovulation. Menstrual disorders such as heavy bleeding and dysmenorrhea are the most common reasons for teenage girls to go to health centers and miss school. Menstrual irregularities in the early post menarche age can be considered as an indicator of impaired psychosocial adaptation in girls aged 19-13 years **(1, 10-12)**. How do these disorders affect a person's life? What are the challenges of the Iranian health system in this regard? And what

challenges do we solve with this study? The prevalence of menstrual disorders in 13-19 years old girls has been reported in various studies from 23.1% to 84.1% **(9, 11, 13, 14)**. Obesity is one of the factors affecting girls' menarche. Considering the prevalence of obesity in Iran and different countries and the complications of obesity and also due to the frequency of overweight in different parts of Iran, which in some cases has been reported as up to 30%, it is obvious that basic measures should be taken to prevent it from high school **(5, 15-19)**. To assess menstrual disorders in adolescence, one must have an understanding of the range of natural menstrual cycles in girls in any community. This study sought to find out the types of related disorders (such as amenorrhea, oligomenorrhea, polymenorrhea, hypermenorrhea, and etc.) after learning about the pattern of the menstrual cycle in high school girls in Urmia, who were all in the post-menarche age, we obtained and determined accurate information about the relationship between BMI and menarche in adolescent girls.

## Methods

In this descriptive cross-sectional study, 716 first and second-year female high school students in Urmia were evaluated by multi-stage sampling method from September 2012 to December 2013, after obtaining informed consent. For the sample size considering 95% confidence level (95% α-1 =) and p = 0.34, (frequency of menstrual disorders) 734 people were considered **(20)** and 18 students were excluded due to medical disorders including hypothyroidism, hyperthyroidism and diabetes. Finally, 716 female students were enrolled in the study. Multi-stage sampling was performed in such a way that after coordination with the education officials of Urmia and receiving the approval of the ethics committee of Urmia University of Medical Sciences, 301 students from District 1 and 415 students from District 2 were examined. Then, according to the education districts, a list of 16 schools was prepared and the total number of female students in the first and second year of high school in each of the classes was determined. In the next stage, several schools (clusters) were selected from each district with the students of that region, then several classes from each grade were selected according to the population of each school. Sampling was done inside the classrooms by the census. At first, it was explained to the students how the study will be done, and the confidentiality of the information and the purpose of it was explained. Students willingly entered the study and completed the informed consent forms. Shoeless height was measured standing up using a height gauge Seca, Deutschland with an accuracy of 0.1 cm and, the weight of the girls with clothes and without shoes was measured using a digital scale with a sensitivity of 0.1 kg. Their body mass index was calculated by dividing weight (kg) by the square of height (m). After calculating BMI according to CDC 2000 body mass index **(21)** the values above the 95th percentile,

between the 95th and 85th percentages, between the 85th and 15th percentiles, and finally below the 15th percentile were determined. Then, for the relevant age and sex, based on reference percentiles, obese and overweight people, as well as normal and lightweight were identified, respectively. Information about the menstrual cycle including menarche age (first menstruation), amenorrhea (no menstruation until age 16), length of menstrual period (days), number of bleeding days (days), bleeding amount (number of pads used during a day) and Intensity of menstrual pain was collected through a questionnaire. The questionnaire was a checklist and did not need to be validated. The severity of menstrual pain was measured using the Dysmenorrhea assessment tool **(22)** with a score from one to three as follows: 1) no need to use medication 2) need to use medication and 3) inability to perform daily tasks (absence of school). The patterns of the menstrual cycle were defined as follows: normal menstrual cycle (length of menstrual period 23-25 days) and abnormal menstrual cycle (less than 23 days as polymenorrhea and more than 35 days as oligomenorrhea), number of days for normal bleeding (3-10 days), Hypermenorrhea (number of menstrual days more than 10 days), and Hypomenorrhea (number of menstrual days less than 3 days). Inclusion criteria were: 1) girls aged 14-18 years, 2) studying in a school in Urmia, 3) consent to participate in study, and 4) in the period of six months after the first menstruation. Exclusion criteria were: 1) Existence of any medical disorders, 2) Use of hormonal drugs, 3) Chronic physical and mental illness. Descriptive statistic indexes such as mean and percentage deviation were used to describe the data, and the Chi-square test and Fisher's exact test were used to examine the relationship between variables and qualitative scale. Statistically, $P < 0.05$ was considered significant and SPSS software (IBM SPSS, version 21, USA) was used to analyze the data.

## Results

Out of 716 students, 21.9% were in the first year, 29.5% in the second year, 42.9% in the third year, and 5.7% in the fourth year of high school. The mean age of participants was 15.65 ± 1.00, the mean age of menarche was 12.88 ± 0.99 years and the mean body mass index was 21.96 ± 3.86 kg / m2. A total of 76.7% of the samples had normal BMI (Tables 1 and 2). About 99.9% of participants reported to have normal menarche age (under 16 years) and 73.7% reported dysmenorrhea, of which 70% did not need medication to reduce their pain, 26.5% needed at least one medication to relieve pain, and 3.5% missed school due to severe pain (Table 3). Table 4 shows the relationship between body mass index percentile (BMI Percentile) and menstrual pattern. Among lean, normal, overweight, and obese students, 26.7%, 31.5%, 39.4%, and 31% experienced their first menstrual period before the age of 12, respectively. According to the results of the present study, there was a significant relationship between BMI percentile and number of

bleeding days, menarche age, bleeding amount and spotting during the menstrual cycle. This indicates a direct relationship between the occurrence of menarche and the amount of body mass index.

**Table 1. General characteristics of the participants**

| Frequency | |
|---|---|
| | Age (years) |
| 104(14.5) | 14 |
| 194(27.1) | 15 |
| 288(40.2) | 16 |
| 108(15.1) | 17 |
| 22(3.1) | 18 |
| | percentile BMI (kg/m2) |
| 15(2.1) | <5 |
| 549(76.7) | 5-85 |
| 94(13.1) | 85-95 |
| 58(8.1) | >95 |
| | WHR) Waist to Hip Ratio( |
| 140(19.6) | <0.8 |
| 576(80.4) | >=0.8 |

**Table No. 2. Quantitative demographic characteristics of participants**

| Standard deviation | Mean | Max | Min | |
|---|---|---|---|---|
| 1.0 | 15.65 | 18 | 14 | Age at the time of sampling |
| 3.86 | 21.96 | 37.07 | 14.23 | BMI (kg/m$^2$) |
| 10.85 | 56.96 | 103 | 38 | Weight (kg) |
| 5.21 | 60.96 | 180.2 | 144.4 | Height (cm) |
| 9.45 | 77.2 | 114 | 56 | Waist (cm) |
| 9.41 | 92.3 | 166 | 72 | Around the pelvis (cm) |
| 2.06 | 6.09 | 30 | 2 | Number of bleeding days (days) |
| 12.08 | 29.75 | 150 | 12 | Menstrual cycle length (days) |
| 1.88 | 2.86 | 11 | 1 | Bleeding amount (number of pads per day) |
| 0.99 | 12.88 | 16 | 10 | Menarche age (years) |
| 0.05 | 84.0 | 99.0 | 0.51 | WHR |

**Table 3. Menstrual pattern in participants**

| Frequency(٪) | |
|---|---|
| | Menarche age (years |
| 715(99.9) | <16 |
| 1(0.1) | Amenorrhea (>16) |
| | Number of bleeding days (days |

| Frequency(٪) | |
|---|---|
| 34(4.7) | < 3 |
| 673(94) | 3-10 |
| 9(1.3) | >10 |
| | Menstrual cycle length (days) |
| 85(11.9) | <23 |
| 589(82.3) | 23-35 |
| 42(5.9) | >35 |
| | Dysmenorrhea |
| 511(73.7) | yes |
| 182(26.3) | no |
| | Intensity of pain |
| 428(67.2) | No medication |
| 186(26.2) | taking medication |
| 23(3.6) | Inability to perform activities (absence from school) |
| | Spotting |
| 207(28.9) | yes |
| 509(71.1) | no |

**Table 4.** Relationship between BMI and Oligomenorrhea, Hypomenorrhea, Polymenorrhea, Hypermenorrhea

| P-value | BMI Frequency (%) | | | | | Menstrual pattern (Fisher exact test*) |
|---|---|---|---|---|---|---|
| | Total | >95 | 85-95 | 5-85 | <5 | Number of bleeding days (days) |
| | 34(4.7) | 2(3.4) | 9(9.6) | 21(3.8) | 2(13.3) | Hypomenorrhea (< 3) |
| 0.003* | 673(94) | 56(96.6) | 85(90.4) | 520(94.7) | 12(80) | 3-10 |
| | 9(1.3) | 0 | 0 | 8(1.5) | 1(6.7) | Hypermenorrhea (>10) |
| | 716(100) | 58(100) | 94(100) | 549(100) | 15(100) | Total |
| | | | | | | Menarche age |
| | 232(32.4) | 18(31.1) | 37(39.4) | 173(31.5) | 4(26.7) | 11-12 |
| 0.03* | 453(63.3) | 38(65.5) | 56(59.6) | 350(63.8) | 9(60) | 13-14 |
| | 31(4.3) | 2(3.4) | 1(1.1) | 26(4.7) | 2(13.3) | 15-16 |
| | 716(100) | 58(100) | 94(100) | 549(100) | 15(100) | Total |
| | | | | | | Menstrual cycle length (days) |
| | 85(11.9) | 12(20.7) | 6(6.4) | 64(11.7) | 3(20) | Polymenorrhea (<23) |
| 0.1 | 589(82.3) | 42(72.4) | 77(81.9) | 459(83.6) | 11(73.3) | 23-35 |
| | 42(5.9) | 4(6.9) | 11(11.7) | 26(4.7) | 1(6.7) | Oligomenorrhea (>35) |
| | 716(100) | 58(100) | 94(100) | 549(100) | 15(100) | Total |

| P-value | BMI Frequency (%) | | | | | Menstrual pattern  (Fisher exact test*) |
|---|---|---|---|---|---|---|
| | | | | | | Bleeding amount (number of pads per day) |
| **0.01*** | 532(76.7) | 36(63.2) | 70(77.8) | 412(77.4) | 14(93.3) | 1-3 |
| | 149(21.6) | 21(36.8) | 19(21.1) | 109(20.5) | 0 | 4-6 |
| | 13(1.9) | 0 | 1(1.1) | 11(2.1) | 1(6.7) | > 6 |
| | 694(100) | 57(100) | 90(100) | 532(100) | 15(100) | Total |
| | | | | | | Intensity of pain |
| **0.4*** | 428(67.2) | 33(67.3) | 52(61.2) | 338(69) | 5(38.5) | No medication |
| | 186(21.9) | 14(28.6) | 33(38.8) | 132(26.9) | 7(53.8) | taking medication |
| | 23(3.6) | 2(4.1) | 0 | 20(4.1) | 1 | Inability to perform activities (absence from school) |
| | 637(100) | 49(100) | 85(100) | 490(100) | 13(100) | Total |
| | | | | | | Spotting |
| **0.04** | 207(28.9) | 18(31) | 28(29.8) | 155(28.2) | 6(40) | yes |
| | 509(71.1) | 40(69) | 66(70.2) | 394(71.8) | 9(60) | no |
| | 716(100) | 58(100) | 94(100) | 549(100) | 11(100) | Total |

## Discussion

According to the results of this study, the mean of age, BMI, and age of menarche were 15.65 ± 1.0 years, 21.96 ± 3.86 Kg / m2, and 12.88 ± 0.99 years, respectively. The prevalence of overweight and obesity was 13.7% and 8.4%, respectively. There was a significant relationship between BMI and number of menstrual days, age of menarche, bleeding amount, and pain intensity (P <0.05). The mean BMI in the present study was similar to other studies **(23, 24)**. Menarche is an important stage in the development of girls **(3)**. Different studies in Iran have reported the age of menarche from 12.3 years to 15 years. Even the age of menarche has been reported differently in different studies in one city **(23, 25-30)**. The average age of menarche in Iran has been different compared to other countries **(1, 6, 8, 9, 11, 12, 31-34)**. The difference in the menarche age is related to changes in lifestyle and diet. According to various studies conducted in Urmia in different years, the age of menarche has been decreasing and BMI has been increasing since 2004 **(24, 35)**. According to the evidence of similar studies, there is a relationship between obesity and menarche age **(8, 25, 30)**, while in some studies such a relationship has not been reported **(27)**. In studies conducted in Kermanshah and Tehran, the rate of obesity and overweight was reported less than the present study. It seems that the age pattern of the samples in those studies and methods of determining obesity and overweight might be the reason for this difference. In the present study, unlike previous ones, the BMI percentile according to age and sex was used

as a method to determine obesity and overweight. It also seems that socio-cultural and geographical differences play a role in this difference **(25, 30)**. Similar to the present study in other studies in Iran and other countries, dysmenorrhea has been reported as the most common menstrual disorder (36-38) and this rate in studies has varied from 56% to 82% **(1, 6, 9, 11-13, 23, 32)**. Due to the effects of dysmenorrhea on students' poor performance in school, it is important to pay attention to its risk factors **(9)**. In one study, one-eighth of the students did not attend school due to this problem and 6.4% referred to medical centers **(12)**. Absence from school in Singapore was reported 24% **(11)**, in USA 21% **(13)**, Nigeria 9.7% **(9)** and Egypt 61% **(32)**. In addition, it should be noted that since dysmenorrhea is a common problem, further investigation is recommended for people who do not respond to simple painkillers **(9)**. In the present study, no relationship between dysmenorrhea and BMI was observed. Since obese people have higher levels of estrogen and prostaglandins, it seems that these people are more prone to dysmenorrhea **(26)**, but this relationship has been reported differently in various studies **(23, 26)**. Irregular menstrual cycles in the first 5 years since menarche are physiological, and referral to medical centers is recommended only in serious conditions, so education in the field of menstrual disorders is important **(3, 9)**. Polymenorrhea is more common in non-ovulatory cycles. In the present study, no relationship was observed between polymenorrhea and BMI, while according to previous studies, there is a

relationship between low BMI and polymenorrhea **(9, 11)**.

## Conclusion

Menarche age is influenced by various factors and in the present study, it was related to BMI. Planning and intervening to reduce BMI in high school girls can help reduce menstrual disorders. Due to the high prevalence of menstrual disorders, improving the awareness of adolescents and their families as well as teachers about normal menstrual cycles in health care programs is important and necessary.

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## Conflict of Interest

The authors declared no conflict of interest.

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