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Association Between Menstrual Disorders and Obesity-Related Anthropometric Indices in Female High School Students: A Cross-Sectional Study

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Abstract

Background: The menstrual cycle determines the health of women. Menstrual disorders are a major Geneologic problem among women, especially adolescents, which is a major source of anxiety for them and their families. Factors such as BMI, exercise, and stress can be related to menstrual disorders. As a result, this study was conducted to determine the association between menstrual disorders and anthropometric indices in Female High School Students.

Methods: This descriptive cross-sectional study was conducted in Sabzevar on 200 high school female students in 2017. The participants first completed the personal, midwifery, and family profile questionnaire. Finally, anthropometric indicators were measured. Data analysis was done using SPSS 16 software and Mann-Whitney test.

Results: The results of the study showed that oligomenorrhea with weight (p = 0.03), arm circumference (P = 0.03), BMI (P = 0.03), hypermenorrhea with waist circumference (P = 0.01), hypomenorrhea with height (P = 0.04), menorrhagia with waist circumference (P = 0.002), polymenorrhea with weight (P = 0.01), arm circumference (P = 0.04), Body mass index (p = 0.01) and metrorrhagia with weight (P = 0.01), hip circumference (P = 0.007), waist circumference (P = 0.004), and hip circumference (P = 0.01) have a significant association.

Conclusions: The results of this study showed that some anthropometric indices associated with menstrual disorders in female high school students. According to the results of this study, it seems that having a suitable lifestyle can prevent these disorders.

Keywords: Menstrual disorders, Anthropometric Indices, Menstruation

1. Background

Maturity in girls is determined by their 1st menstruation (1). Menstruation is a periodic uterine bleeding, which indicates a periodic erythrocyte endometrial laceration due to decreased production of estrogen and progesterone due to the collapse of the corpus luteum (2). The duration of the menstrual cycle and the duration as well as amount of bleeding is significantly different in normal women. Menstrual disorders are classified according to the age of the onset, period, duration and amount of bleeding, as well as the quality of bleeding. These disorders are more prevalent in adolescents than older ones, due to the fact that the physiological cycles of the hypothalamus, ovary, and uterus have not yet evolved and various factors also contribute to the development of this disorder (3). Adolescence is the stage of the transition phase of human physical and mental development, which usually occurs during puberty until legal maturity. This is when sudden changes occur in their bodies and changes are accompanied by problems. Most problems in girls are related to menstruation (1). Often the interval between these courses is 21 to 35 days and lasts for 3 to 7 days each time (4). An average of 35 - 40 milliliters of blood will be lost during menstrual bleeding. Anemia will occur if the monthly bleeding volume reaches more than 60 milliliters a month (5).

Menstrual disorders have a wide range of disorders, however, some of them can lead to significant problems and can even be considered as important causes of infertility (6). Factors such as BMI, exercise, and stress can be related to menstrual disorders. In subjects with weight gain, menstrual dysfunction is more commonly associated with irregular uterine bleeding with no ovulation. On the other hand, anorexia and intense exercise delay the menstruation and cause secondary amenorrhea. About 40% of

women have menstrual cycle problems and about 2% - 10% of these students have mental and occupational stresses in their daily lives (2). The menstrual cycle determines the health of women. Menstrual disorders are a major Genealogic problem among women, especially adolescents, which is a major source of anxiety for them and their families (7). The disorder of menstrual cycle indicates major disruptions such as functional impairment in the endocrine system, reproductive system, organic disorders, polycystic ovarian syndrome, and obesity (8, 9). Women often consider menstruation as a reason for the health of their fertility and the collapse of this order is considered a symptom of a disease that causes them to be susceptible. Menstrual irregularities include increasing or decreasing the interval between menstruation (polymenorrhoea and oligomenorrhoea), increasing or decreasing the duration of menstruation (hypomenorrhoea and hypermenorrhoea), intermittent spots, and increased menstrual bleeding (menorrhagia). Severe hemorrhage during menstruation and prolonged bleeding often affect the health of women and sometimes lead to hysterectomy (10). Increasing or decreasing the interval between menstruation (polymenorrhoea or oligomenorrhoea) is often one of the symptoms of polycystic ovary syndrome and requires medical attention. The reduction or increase in the interval between menstruation and severe bleeding is most common in the first 3 years after menarche and is 1 of the reasons for school absensability in young girls (11, 12). Menstrual disorders include a wide range of problems such as menstrual irregularities, hyper and hypomenorrhea, polymenorrhea and oligomenorrhea, amenorrhea, and menorrhagia (13). The occurrence of menstrual disorders causes discomfort and affects the social performance and quality of life of the individual (11).

Studies have shown that various factors such as economic and social status, body mass index, age, education, and age of menarche affect menstruation (12, 14). Adams et al. found in their findings that women at lower ages are more likely to suffer from menstrual problems (15). Menstrual disorders can cause osteoporosis, infertility, iron deficiency, fatigue, and poor social functioning (1). A cross-sectional study was conducted on association of menstrual irregularities with BMI and nutritional status in adolescent girls. The results showed that 51.75% of girls that had a BMI of 14 - 24.9 had a regular menstrual pattern, 60 girls with inferior 25 - 29.9 BMIs were inefficient cycles. The results also showed a significant relationship between BMI and menstrual pattern (16). Low levels of hemoglobin and poor nutritional status are often associated with menstrual irregularities and women's problems in different groups (17). Menstruation is a monthly bleeding in women caused by a reduction in hormones, estrogen, and progesterone at the end of the monthly ovarian cycle (18, 19). In recent years, menstrual disorders have been intensified in developed and developing countries. However, the estimated prevalence or incidence of menstrual dysfunction is still very poor. Menstrual disorders include: amenorrhoea (menstrual irregularity), irregular cycles, or severe bleeding called menorrhagia. One of the most important factors associated with menstrual disorders is body weight, especially body fat. External factors such as caffeine and alcohol consumption, stress, smoking, occupation, socioeconomic status, and ethnicity are also effective in developing menstrual disorders (20, 21). While internal factors are caused by hormonal imbalance due to thyroid problems, polycystic ovarian syndrome, and body fat, they also contribute to menstrual disorders (22). Severe and prolonged menstrual irregularities require discovery and treatment, there may be a primary endocrinopathy, which also reduces fertility in the future, however, it may improve with preventive measures and adolescent treatment. Identifying abnormal menstrual patterns from adolescence may help identify early potential health problems for adolescents. Therefore, it is necessary to determine what factors are associated with menstrual irregularities to help improve their quality of life. On this basis, the researcher was given a study to determine the association between menstruation disorders and anthropometric indicators on high school female students.

2. Methods

2.1. Protocol

This descriptive cross-sectional study was conducted in 2017. The population of the study consisted of 200 high school female students. In this study, sampling was done by multistage random sampling method. Firstly, according to the list of all schools of education in different parts of the city, from the inner city of Sabzevar, 3 high schools and 1 high school of Toohid Shahr were selected by random cluster sampling, then in each high school from each educational level (3rd, 4th, and 5th) 1 class was selected randomly. Given that at each level there were 2 groups, (a) and (b), 8 classes were selected from 12 classes. Of each class, 25 Students entered the study. The sample size of this study was 150 students in the city of Sabzevar and 50 students in the district of Toohid Shahr. The sample size was calculated using the G * Power software. In addition, according to the studies with 95% confidence level and 80% test power, 187 Students were calculated) according to the Bakhshani and colleague study) (23). Considering 7% probability of sample loss, the number of final samples was estimated to be 200 students.

The criteria for entering the study included: high school students, fluency in the Farsi language, and having consent to participate in the research.The excluding criteria included: dieting for weight loss, hormonal medications, having depression and psychological stress, having specific illnesses, thyroid disease, renal failure, diabetes mellitus, lung mass Uterine, liver disease, absence of self-reported genital diseases, pain during the entire menstrual cycle or the entire time of bleeding, usage of oral contraceptives, and history of abdominal or pelvic surgery.

The method of doing research was as follows: initially, the research was approved at the ethics committee of Sabzevar University of Medical Sciences. The referral letter was received from the Faculty of Nursing and Midwifery of Sabzevar University of Medical Sciences. The researcher referred to high schools in the city of Sabzevar. During a recall, the researcher asked students to participate in the research. The objectives and methodology of the research were explained to the participants. Written consent was completed by the participants. The questionnaires were submitted to the participants. Participants were asked to carefully answer the questionnaire. At the next stage, anthropometric indices of participants were measured. Meanwhile, the participants were assured that their information would remain confidential and they were allowed to discontinue the research at each stage of the research. In this study, according to the goals and questions of the study, 2 types of researcher-made questionnaires were used. First, the questionnaire of personal and health characteristics and then the questionnaire of menstruation with the necessary explanations of the researcher was completed by the participants. Individual profile and well-being questionnaire, including personal information of the individual, as well as factors such as history of various diseases (depression, psychological stress, thyroid, renal failure, diabetes mellitus, uterus mass, ovarian cyst, liver disease, usage of oral contraceptives, history of abdominal or pelvic surgery), use weight loss diet and hormone therapy. In this research, a researcher-made questionnaire was used to measure the characteristics of the menstrual cycle. The questionnaire measured the existence of any menstrual dysfunction with 2 options, yes and no. Validity of the menstrual questionnaire by content validity method was verified by 10 faculty members of Sabzevar University of Medical Sciences. Reliability was confirmed by Cronbach's alpha coefficient ($\alpha = 0.81$). Menstrual disorders in the study included: hypermenorrhea, oligomenorrhea, gypomenorrhea, polymenorrhea, menorrhagia, and metrorrhagia.

2.2. Definition of Words

Polymenorrhea: menstruation less than 21 days.

Oligomenorrhea: menstruation more than 35 days.

Hypermenorrhea: bleeding more than 9 days.

Metroragia: irregular hemorrhage at the spot level intervals between 2 cycles.

Menorrhagia: bleeding volume greater than 80 mL (Use more than one sanitary pad package)

Hypomenorrhea: very low bleeding and spotting (24).

Anthropometric indices: in the present study, weight (measured with light cover and no shoe and with accurately of 100 g), height (measured by using a tape meter that is fixed to the wall and the person standing in position without shoes in the tangential condition of the shoulder to the wal lwith Accuracy of 0.1 cm), body mass index (by dividing the weight in kilograms to squared height by meter), waist (measured in standing position, the mid-points of the hip adjacent upper anterior hip and subcutaneous vertebrae were determined, and measured at the end of normal exhalation), hip circumference (measured in the standing position while the meter is located on the upper anterolateral thoracic humorous), arm circumference (measured In the standing position, the midline of the arm), and thigh circumference (measured In the standing position, the midline of the hip).

Finally, the information was encoded and analyzed by the SPSS 16 software. Data were analyzed by descriptive statistical tests, Mann–Whitney test and logistic regression, and $P < 0.05$ was considered significant.

3. Results

A total of 200 students participated in this study. The demographic characteristics of the students showed that most students (75%) were in the range of 15 - 17 years old and had a mean age of 16 ± 2.3. The fathers of most students had a diploma education (57.5%), and were employees (38.5%) with an income of 15 million Rials and lower (62.3%). Mothers were mostly students with a secondary education (70%) as well as housewives (75%). The participants in the study reported, 14% (27 students) had oligomenorrhea, 22.5% (45 students) hypermenorrhea, 19% (36 studentss) hypomenorrhea, 14.5% (29 studentss) menorrhagia, 7% (14 students) polymenorrhea, and 13.5% (27 students) metrorrhagia. Other personal characteristics in students were listed in Table 1.

The results of the study showed that oligomenorrhea with weight (P = 0.03), arm circumference (P = 0.03), BMI (P = 0.03), hypermenorrhea with waist circumference (P = 0.01), hypomenorrhea with height (P = 0.04), menorrhagia with waist circumference (P = 0.002), polymenorrhea with weight (P = 0.01), arm circumference (P = 0.04) body mass index (P = 0.01), and metrorrhagia with weight (P = 0.01), hip circumference (P = 0.007), waist circumference

Table 1. Distribution of Absolute Frequency of Personal Characteristics in Students[a]

Obesity-Related Anthropometric Indices	Mean ± SD	Min-Max
Height	163.35 ± 5.67	145 - 175
Weight	61.99 ± 10.69	42 - 87
Arm circumference	28.90 ± 3.60	19 - 38
Hip circumference	98.93 ± 13.24	90 - 150
Waistcircumference	82.47 ± 13.30	61 - 119
Thigh circumference	51.86 ± 6.45	37 - 70
BMI	23.25 ± 4.01	15.94 - 34.17
Age Students	16 ± 2.3	15 - 18
Age of the menarche	13.19 ± 1.72	9 - 15
Menstrual cycle length	29.80 ± 7.20	15 - 90
duration of menstrual bleeding	6.43 ± 1.49	1 - 15

Abbreviation: SD, standard deviation.
[a]Values are expressed as mean ± SD or No. (%).

(P = 0.004), and hip circumference (P = 0.01) have a significant association (Table 2).

Also, the results from the sub-targets showed that there is a significant relationship between oligomenorrhea with waist-to-hip ratios (P = 0.037), height-to-arm ratio (P = 0.022), hypermenorrhea with hip-to-thigh ratio (P = 0.046), waist-to-hip ratio (P = 0.039), waist-to-height ratio (P = 0.023), height-to-waist ratio (P = 0.03), Hypomenorrhea with height-to-arm ratio (P = 0.039), arm-to-height ratio (P = 0.034), height-to-waist ratio (P = 0.032), menorrhagia with hip-to-thigh ratio (P = 0.005), waist-to-hip ratio (P = 0.048), waist-to-height ratio (P = 0.002), height-to-waist ratio (P = 0.002), polymenorrhea with height–to-thigh ratio (P = 0.007), hip-to-thigh ratio (P = 0.002), merorrhagia with hip-to-thigh ratio (P = 0.007), waist-to-hip ratio(P = 0.001), height-to-hip ratio (p = 0.001), hip-to-height ratio (P = 0.002), waist-to-height ratio (P = 0.008), and height-to-waist ratio (P = 0.01).

Based on the results of the logistic regression test, there was no significant relationship between age, menarche age, and menstrual disorders including metrorrhagia, oligomenorrhea, hypermenorrhea, hypomenorrhea, menorrhagia, polymenorrhea (Table 3).

4. Discussion

Menstruation is a unique phenomenon and represents the beginning and end of reproductive age (13). Additionally, menstruation is considered as an indicator of women's health. Therefore, adolescent girls should understand the patterns of menstruation and factors affecting it such as age, weather, activity, and BMI. As a result, this understanding improves their understanding of menstrual characteristics, proper management, and menstrual issues (25).

Accordingly, the present study was conducted to determine the association of obesity-related anthropometric indices with menstrual disorders on 200 high school female students. The results showed that there were a significant r elationship b etween o ligomenorrhoea with weight, arm circumference, body mass index, hypermenorrhea with waist circumference, hypomenorrhea with height, menorrhagia with waist circumference, polymenorrhea with weight, arm circumference, hip circumference, body mass index and metrorrhagia with weight, hip circumference, waist circumference. It seems that there is a certain amount of body fat to maintain the normal ovulation cycle, however, much more or less fat is associated with reproductive health disorders (26).

There are several known mechanisms on the effect of adipose tissue on ovulation and menstrual cycle: 1) the adipose tissue converts androgens into estrogens, 2) body weight affects estrogen metabolism, lighter women have less effect on estrogen metabolism and obese women are more likely to affect estrogen metabolism, 3) obese women have less ability to attach estrogen to sexually transmitted globulin that causes estrogen to be inactivated, thus, increasing the serum free estradiol level (27). In addition, fat tissue produces adipokines (signaling molecules that differ in their production from fat mass), which may directly reduce ovarian function by altering the signal of the hypothalamus-pituitary-ovarian axis, thus, leading to menstrual disorders (28).

The study of Kafaei Atrian et al. (2012) was conducted with the aim of association between menstrual cycle regularity and obesity-related anthropometric indices in dormitory students of Kashan University of Medical Sciences. It was shown that there is a significant s tatistic between menstrual cycles regularity with height, body mass index (BMI), and pelvic-to-height ratio. In addition, due to association between menstrual cycle regularity and obesity-related anthropometric indices, control of weight and BMI may lead to a reduction of menstrual irregularity (29).

The study of Hassan Ali Abdella et al. (2014) was conducted with the aim of determining mass index and menstrual problems, it was shown that there is a significant positive correlation between BMI and duration of short and long menstrual cycles, as well as the duration of bleeding with BMI (P = 0.001). In addition, they showed a significant correlation between the amount of bleeding and body mass index, and heavier hemorrhages cause iron deficiency, which should be compensated for by iron supplementation (30).

The study of Mari et al. (2005) was conducted with the

Table 3. Relationship Between Menstrual Disorders and Demographic Characteristics in Female High School Students

Variable	Metrorrhagia	Oligomenorrhea	Hypermenorrhea	Hypomenorrhea	Menorrhagia	Polymenorrhea
Age						
P Value	0.13	0.90	0.10	0.49	0.10	0.80
OR	0.66	0.53	0.25	0.48	0.82	0.574
Confidence interval 95%						
Lower	-0.327	-0.224	-0.441	-0.230	-0.451	-0.341
Upper	1.42	1.38	1.22	1.52	1.33	1.21
Age of menarche						
P Value	0.45	0.56	0.20	1.56	0.13	0.12
OR	0.596	0.429	0.341	0.22	0.521	0.275
Confidence interval 95%						
Lower	-0.253	-0.325	-0.441	-0.725	-0.361	-.202
Upper	1.03	1.45	1.56	1.06	1.22	1.33

aim of examining the effect of age, body mass index, and social environmental factors on the menstrual cycle of adolescent girls, showed that one of the important factors on the menstrual cycle is body weight (31). However, a study by Bassi et al. (2015), which was conducted with the aim of determining the relationship between menstrual cycle pattern and body mass index on 196 students aged 17 - 20 years, showed that only 6.6% and 5.6% of participants in the study had short and long cycles and there is no correlation between cyclic duration and BMI (32). A study by Agarwal et al. (2009), which was conducted with the aim of a questionnaire study on menstrual disorders in adolescent girls in Singapore, showed that menstrual disorders in girls are correlated with body mass index. As the body mass index increases, the prevalence of oligomenorrhea increases, while polymenorrhea occur in girls with low body mass index (33). The Deshpande et al. (2013) study was conducted with the aim of assessing body mass index and body fat with menstrual cycle pattern in adult girls, which showed the relationship between irregular menstrual cycles and high BMI (34). In a study by Ganesh et al. (2013), which was conducted with the aim of linking body mass index and menstrual cycle pattern in high school girls, it was shown that there was no significant correlation between BMI and bleeding patterns (35). In addition, a study by Lee et al. (2006), which was conducted with the aim of the menstrual cycle of teenage girls in Malaysia, showed that there was no significant relationship between BMI and menstrual cycle disorders such as duration of bleeding, bleeding volume, and irregular menstruation cycle (36). A study by Thapa et al. (2015) was conducted with the aim of examining the correlation between BMI and irregular menstrual cycle on 253 students. The results showed that the prevalence of irregular menstrual cycle, polymenorrhoea, oligomenorrhoea, secondary amenorrhea, menorrhagia and hypomenorrhoea were 38.7, 1.7, 3.4, 0.8, 17.4, and 5.1% showed of irregular menstrual cycle, polymenorrhea, oligomenorrhea, and hypomenorrhea had a significant correlation with body mass index. However, there is no significant correlation between BMI with menorrhagia, secondary amenorrhea, and metrorrhagia (37). In addition, the study by Karout et al. (2012) was conducted with the aim of prevalence and pattern of menstrual disorders among Lebanese nursing students and showed that there is a significant correlation between the nutritional status of girls with BMI and hypomenorrhea and no significant association with metrorrhagia, menorrhagia, and secondary amenorrhea (38).

4.1. Conclusions

The results of the study showed that oligomenorrhea with weight, arm circumference, BMI, hypermenorrhea with waist circumference, hypomenorrhea with height, menorrhagia with waist circumference, polymenorrhea with weight, arm circumference, body mass index and metrorrhagia with weight, hip circumference, waist circumference, and hip circumference have a significant association. According to the results of this study and confirmation of association between anthropometric indices and menstrual disorders, as well as considering that menstrual disorders are more common in young girls and at the end of adolescenceand changing lifestyle, eating habits and hard competition are responsible for the psychological or physical pressure of this age group, which

causes hormonal imbalance. Having this imbalance is one of the causes of menstrual disorders. Menstrual problems affect day-to-day life, which causes disruption in work, performance, and daily living. Health education, routine medical examinations, family and school support, stress management, diet, and lifestyle modifications help resolve menstrual problems.

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Footnote

Conflict of Interests: Authors have no conflict of interests.

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Table 2. Distribution of Absolute Frequency of Personal Characteristics in Students and Relationship Between Menstrual Disorders and Obesity-Related Anthropometric Indices in Female High School Students[a]

Anthropometric Indicators	Metrorrhagia			Oligomenorrhea			Hypermenorrhea			Hypomenorrhea			Menorrhagia			Polymenorrhea		
	Yes[b]	No[b]	P Value	Yes	No	P Value	Yes	No	PValue	Yes	No	P Value	Yes	No	P Value	Yes	No	P Value
Height	165.00 ± 4.69	163.09 ± 5.78	0.28	162.85 ± 6.59	163.43 ± 5.53	0.62	163.51 ± 5.21	163.30 ± 5.81	0.3	162.94 ± 7.07	163.43 ± 5.34	0.04	161.96 ± 4.12	163.58 ± 5.87	0.07	161.42 ± 5.45	163.49 ± 5.67	0.19
Weight	59.51 ± 7.61	62.37 ± 11.06	0.01	65.28 ± 8.01	61.45 ± 10.99	0.03	60.22 ± 8.77	62.50 ± 11.16	0.1	63.38 ± 12.14	61.68 ± 10.36	0.09	59.48 ± 10.11	62.41 ± 10.76	0.86	55.42 ± 7.10	62.48 ± 10.77	0.01
Arm circumference	27.88 ± 3.52	29.05 ± 3.60	0.46	29.92 ± 3.00	28.73 ± 3.67	0.03	28.71 ± 2.71	28.95 ± 3.83	0.1	29.33 ± 3.20	28.80 ± 3.69	0.29	28.55 ± 3.12	28.95 ± 3.68	0.38	27.07 ± 3.36	29.03 ± 3.59	0.04
Hip circumference	96.14 ± 24.17	99.36 ± 10.63	0.007	97.53 ± 15.99	99.16 ± 12.77	0.54	99.88 ± 13.19	98.65 ± 13.28	0.77	97.88 ± 13.19	99.16 ± 13.28	0.30	102.17 ± 14.61	98.38 ± 12.96	0.36	92.28 ± 18.80	99.43 ± 12.65	0.05
Waistcircumference	81.55 ± 8.50	82.61 ± 12.81	0.004	84.64 ± 10.47	82.11 ± 12.57	0.31	79.02 ± 9.98	83.47 ± 12.75	0.01	82.63 ± 11.52	82.43 ± 12.50	0.75	79.93 ± 8.08	82.90 ± 12.85	0.002	78.64 ± 11.65	82.75 ± 12.33	0.22
Thigh circumference	52.29 ± 7.07	51.79 ± 6.37	0.27	51.78 ± 6.60	51.87 ± 6.44	0.94	50.80 ± 5.03	52.16 ± 6.79	0.08	52.58 ± 6.67	51.70 ± 6.41	0.52	50.79 ± 4.82	52.04 ± 6.68	0.15	47.64 ± 4.44	52.17 ± 6.47	0.01
BMI	21.88 ± 2.80	23.47 ± 4.13	0.10	24.70 ± 3.42	23.02 ± 4.06	0.03	22.61 ± 3.83	23.44 ± 4.05	0.16	23.76 ± 3.60	23.14 ± 4.10	0.31	22.70 ± 3.95	53.35 ± 4.02	0.32	21.33 ± 3.00	23.40 ± 4.04	0.02

Abbreviation: BMI, body mass index.

[a] Mann-Whitney testn = 200. The values of $P < 0.05$ were considered significant.

[b] Yes: with menstrual disorders, No: without menstrual disorders.