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The Association of Anthropometric Indices with Dysmenorrhea in High School Students: A Cross-Sectional Study

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Abstract

Background: Primary dysmenorrhea is one of the most common gynecological complaints that can affect the quality of life. The exact pathophysiology of dysmenorrhea is not yet fully understood. However, some studies have suggested an association between anthropometric indices and dysmenorrhea.
Objectives: We aimed to evaluated the association between anthropometric indices and dysmenorrhea.
Methods: In this cross-sectional study conducted in Qazvin, Iran, during 2016, 400 high school students aged between 14 and 18 years old were enrolled based on the inclusion criteria. The relevant information and anthropometric indices were collected using a checklist. The data were analyzed by SPSS version 17.
Results: Among 400 students, the prevalence of dysmenorrhea was 82.5%. There were significant differences in cycle length (29.15 $\pm$ 2.69 vs. 27.57 $\pm$ 2.38; P = 0.001), duration of menstruation (6.03 $\pm$ 1.11 vs. 5.65 $\pm$ 1.20; P = 0.011), hip circumference (93.13 $\pm$ 9.25 vs. 90.14 $\pm$ 12.15; P = 0.021), height (162.62 $\pm$ 5.47 vs. 160.72 $\pm$ 5.92; P = 0.01), and waist to hip ratio (WHR) (0.78 $\pm$ 0.06 vs. 0.81 $\pm$ 0.09; P = 0.001) between the groups with dysmenorrhea and without dysmenorrhea. Based on a logistic regression model, only WHR was a predictive protective factor for dysmenorrhea (OR = 0.896, CI95% = 0.821 - 0.971, P = 0.012) and height (OR = 1.057, CI95% = 1.006 - 1.111, P < 0.001), cycle length (OR = 1.238, CI95% = 1.117 - 1.372, P = 0.028), and menstruation length (OR = 1.269, CI95% = 1.002 - 1.608, P = 0.048) were risk factors.
Conclusions: WHR and height were noted to be associated with dysmenorrhea. In addition, WHR was found to be a protective factor and height to be a risk factor.

Keywords: Dysmenorrhea, Anthropometric Indices, Adolescence, High School Students

1. Background

Primary dysmenorrhea is one of the most common gynecological complaints (1). Although its prevalence is variable among different populations, the overall figure has been estimated to be 20 to 80% (2). In Iran, the approximate prevalence of dysmenorrhea is 71% (3). This condition is described as a cramping abdominal pain in lower quadrants, which may radiate to lumbosacral or groin area a few days before or during menstruation. In some cases, systemic symptoms like nausea and vomiting, diarrhea, fatigue, irritability, and vertigo have been reported (4, 5).

In spite of the fact that dysmenorrhea is not a life-threatening condition, it impacts the quality of life and occasionally, causes incapacitation (6) leading to absence from work or school for almost 1 - 3 days each month (7).

The risk factors for dysmenorrhea include menarche < 12 years of age, age < 20, nulliparity, longer and heavier menstruation cycles (menorrhagia), cigarette smoking, family history of dysmenorrhea, anxiety, and depression (8).

The etiology and pathophysiology of dysmenorrhea are not yet fully understood (9). Some studies suggested that obesity appears to be a risk factor for primary dysmenorrhea (10).

Weight gain, especially in the central parts of the body, could disrupt the balance of steroid hormones, namely androgen, estrogen, and sex hormone-binding globulin due to the increased level of estrogen produced by the adipose tissue (11, 12).

Estrogen and progesterone enhance prostaglandin synthesis, suggesting a relationship between obesity and

dysmenorrhea following prostaglandin formation (12). There are contradictory studies regarding the relationship between anthropometric indices and dysmenorrhea (11, 13). Some studies demonstrated a relationship between obesity and dysmenorrhea (14), while others indicated that dysmenorrhea is more likely in underweight women (15). There are even studies that found a U-shaped relationship between dysmenorrhea and obesity. On the contrary, another group of studies revealed that there is no statistically significant relationship between obesity and dysmenorrhea (15, 16).

Similar controversies can be observed regarding other anthropometric indices as well.

2. Objectives

The aim of the present study was to investigate the relationship between the intensity of pain in dysmenorrhea and anthropometric indices in adolescent girls in Qazvin, Iran. Most of these indices are modifiable by changing lifestyle. Hence, determining their association with dysmenorrhea may result in a better quality of life during menstruation periods among patients with dysmenorrhea.

3. Methods

3.1. Study Design and Participants

This cross-sectional study was undertaken in Qazvin, Iran, in March 2016. We completed checklists for 400 out of 421 high school students aged between 14 and 18 years old selected from one private and one state school. Prior to the initiation of the study, a permission was granted by the educational administration of Qazvin.

3.2. Sample Size

A total of 33,155 high school students entered the academic year 2015 - 2016, out of which 19,554 were female. The prevalence of dysmenorrhea was assumed 70%, and considering a confidence interval of 95%, 5% type I error, and 80% power, the minimum sample size was calculated at 372. Considering sample attrition, 400 students were enrolled in this study.

3.3. Data Gathering

Data were garnered by using a checklist consisting of information about menstruation such as age at menarche, menstruation duration, cycle length, presence and duration of dysmenorrhea, and anthropometric information including height, weight, waist circumference, and hip circumference.

The students were grouped in tens and examined one by one. All the data were collected by one researcher.

Height was measured with the accuracy of 0.5 cm and without shoes. Weight was measured with the accuracy of 0.1 kg by a digital scale, which was calibrated each day before use.

Waist circumference was considered as the slimmest part between the ribs and the iliac spine and hip circumference as the most eminent part of the pelvis.

Waist to hip ratio (WHR), waist to height ratio (WHtR), and body mass index (BMI) were later calculated.

BMI was calculated as weight in kilograms divided by the square of height in meters. Body fat of the triceps skinfold site was measured by using calipers and calculated by the Duerenberg equation (17).

Pain severity was measured using visual analogue scale (VAS), in which the participants pointed at their level of pain severity described as follows. VAS is a 100-millimeters (mm) scale, which is made up of either a horizontal or a vertical line for pain intensity and its two extremities differ based on its implication. In the present study, the two extremities were noted as "no pain at all" at the lowest end and "severe pain" at the other. Severe pain was described as a pain that disrupts daily activities.

Any point between 0 and 4 mm was considered as no pain, between 5 and 44 mm as mild, between 45 and 74 mm as moderate, and between 75 and 100 mm as severe (18).

3.4. Ethical Considerations

This study was approved by the Ethics Committee of the Qazvin University of Medical Sciences (code No.: QUMS.REC.1394.9).

Participation in the study was voluntary, and the data were collected after obtaining verbal consent from students' parents in a session where the study objectives and procedure were explained.

3.5. Inclusion Criteria

Nulligravida high school students aged between 14 and 18 years old were included in the study. We excluded students who had irregular menstruation cycles (less than 21 days or more than 35 days), menstruation lasting more than 8 days, and chronic diseases and those who consumed any medications other than non-steroids anti-inflammatory drugs and over-the-counter analgesics.

3.6. Statistical Analysis

To describe qualitative variables, frequencies were used, and to describe quantitative variable, mean $\pm$ standard deviation was applied. For bivariate analysis, *t*-test was used to analyze quantitative variables and Chi-square test was run to analyze qualitative variables.

Table 1. Univariate Qualitative Analysis of Variables Including Menstruation Information and Body Mass Index Groups in High School Students

Variable	N	Frequency, %
Menstruation information		
Dysmenorrhea		
Had	330	82.5
Didn't have	70	17.5
Severity of dysmenorrhea		
Didn't have	70	17.5
Mild	107	26.8
Moderate	97	24.3
Severe	126	31.5
Anthropometric indices		
Body mass index (kg/m^2)		
< 18.5	84	21
18.5 - 25	245	61.2
> 25	71	17.8

Table 2. Univariate Analysis Including Menstruation Information, Anthropometric Indices and Age in High School students

Variable	Mean ± SD
Menstruation information	
Age (years)	16.16 ± 0.95
Age at menarche	13.06 ± 1.14
Cycle length (days)	28.88 ± 2.70
Menstruation length (days)	5.97 ± 1.13
Dysmenorrhea length (days) (n = 323)	2.46 ± 1.55
Anthropometric indices	
Height (centimeters)	162.29 ± 5.59
Weight (kilograms)	60.19 ± 10.22
Waist circumference (centimeters)	72.31 ± 7.29
Hip circumference (centimeters)	92.71 ± 9.59
Body mass index (Kg/m^2)	22.85 ± 3.76
Waist to hip ratio	0.79 ± 0.07
Waist to height ratio	0.45 ± 0.04
Fat mass	16.22 ± 4.78
Fat mass percentage	28.00 ± 3.16

To analyze pain severity, which was categorized in four groups, analysis of variance (ANOVA) test or Kruskal-Wallis test (based on Levene's equality of variances test) with post hoc analysis (Bonferroni for equal variances and Dunnett's T3 for unequal variances) was used. P-value less than 0.05 was considered significant.

For multivariate analysis, a logistic regression model was designed. The variables included in the model consisted of those which showed a significant difference in bivariate analysis. P-values less than 0.05 were considered significant for each variable in the model.

4. Results

From 421 female students aged between 14 and 18 years old in both schools, 400 checklists were completed and analyzed. The mean age of the participants was 16.16 ± 0.95 years. The prevalence of dysmenorrhea was 82.5%.

Among these 400 students, 26.8% had mild, 24.3% had moderate, and 31.5% reported severe pain (Tables 1 and 2). We found significant differences in cycle length, duration of menstruation, hip circumference, WHtR, and WHR between the groups with dysmenorrhea and without dysmenorrhea (P = 0.001, P = 0.011, P = 0.021, P = 0.010, and P = 0.001, respectively). The results are demonstrated in Table 3.

ANOVA and Bonferroni post hoc test reflected noticeable differences in terms of cycle length (P = 0.001), age (P = 0.01), fat mass (P = 0.009), and fat mass percentage (P = 0.031) among the students based on their pain intensity (i.e., without pain and with mild, moderate, or severe pain). These results are exhibited in Table 4.

As the homogeneity of variance test was significant for hip circumference and WHR, we used Kruskal-Wallis test to analyze the difference of these variables, which appeared to be significant (P = 0.028) in terms of hip circumference among the groups categorized as without dysmenorrhea and with mild, moderate, and severe pain. There was also a significant difference between the groups without dysmenorrhea and with moderate pain in post hoc analysis (Dunnett T3; P = 0.049). However, there was no significant difference regarding WHR between the groups (P = 0.091).

A logistic regression model was designed for dysmenorrhea based on the bivariate analysis. All significant variables in bivariate analysis were entered in the model (Table 3). Accordingly, for an addition of 1 in WHR, the odds of having dysmenorrhea is lowered by 10.4%. Also, for an addition of 1 cm in height, 1 day of cycle length, and 1 day of menstruation length, the odds of having dysmenorrhea is increased by 5.7%, 23.8%, and 26.9%, respectively (Table 5).

5. Discussion

In this study, a prevalence of 82.5% for dysmenorrhea was found. Most of the students (31.5%) reported severe pain using VAS. Also, a good majority of the participants had normal BMI (61.2%).

Table 3. Bivariate Analysis of the Quantitative Variables Comparing Dysmenorrhea in Students

Variables	Dysmenorrhea		P-Value
	Had (N = 330)	Didn't Have (N = 70)	
Age at menarche	13.05 ± 1.13	13.11 ± 1.21	0.679
Age	16.19 ± 0.96	16.04 ± 0.93	0.241
Cycle length	29.15 ± 2.69	27.57 ± 2.38	0.001
Length of menstruation	6.03 ± 1.11	5.65 ± 1.20	0.011
Weight	60.46 ± 10.06	58.89 ± 10.89	0.245
Waist circumference	73.13 ± 7.18	73.05 ± 7.11	0.938
Hip circumference	93.13 ± 9.25	90.14 ± 12.15	0.021
Height	162.62 ± 5.47	160.72 ± 5.92	0.010
BMI	22.88 ± 3.79	22.73 ± 3.60	0.765
WHR	0.78 ± 0.06	0.81 ± 0.09	0.001
WHtR	0.45 ± 0.04	0.45 ± 0.04	0.425
FM	16.43 ± 4.78	15.26 ± 4.70	0.064
FMP	28.12 ± 3.13	27.44 ± 3.28	0.106

Abbreviations: BMI, body mass index; WHR, waist to hip ratio; WHtR, waist to height ratio; FM, fat mass; FMP, fat mass percentage.

Table 4. Bivariate Analysis of Quantitative Variables Comparing Severity of Dysmenorrhea in Students[a]

Variables	Severity of Dysmenorrhea				P-Value[a]
	Didn't Have (N = 70)	Mild (N = 107)	Moderate (N = 97)	Severe (N = 126)	
Age at menarche	13.11 ± 1.21	12.97 ± 1.10	12.91 ± 1.16	13.22 ± 1.13	0.189
Cycle length	27.57 ± 2.38[b]	29.48 ± 2.45[b]	29.2 ± 2.58[b]	28.84 ± 2.94[b]	0.001
Length of menstruation	5.65 ± 1.2	6.09 ± 1.11	5.94 ± 1.03	6.05 ± 1.18	0.063
Weight	58.89 ± 10.89	60.75 ± 10.52	60.85 ± 10.58	59.91 ± 9.29	0.584
Waist circumference	73.05 ± 7.11	72.71 ± 7.76	74.43 ± 7.24	72.47 ± 6.52	0.202
Height	160.72 ± 5.92	162.24 ± 6.30	162.82 ± 4.78	162.80 ± 5.24	0.060
BMI	22.73 ± 3.60	23.13 ± 4.11	22.92 ± 3.66	22.64 ± 3.63	0.784
Age	16.04 ± 0.93	16.01 ± 0.99[b]	16.11 ± 0.88	16.39 ± 0.69[b]	0.010
WHtR	0.45 ± 0.043	0.44 ± 0.048	0.45 ± 0.045	0.44 ± 0.041	0.197
FM	15.26 ± 4.70[b]	16.21 ± 4.92	17.54 ± 4.98[b]	15.76 ± 4.38	0.009
FMP	27.44 ± 3.28[b]	27.95 ± 3.05	28.78 ± 3.17[b]	27.75 ± 3.11	0.031

Abbreviations: BMI, body mass index; FM, fat mass; FMP, fat mass percentage; WHtR, waist to height ratio.
[a] The overall P-value reported by the analysis of variances (ANOVA) test.
[b] Significant pair wise based on Bonferroni test (P-value < 0.05 was considered significant).

According to the present study, cycle length, length of menstruation, WHR, and height were significantly different between the groups with and without dysmenorrhea. Moreover, WHR seemed to be a protective variable for dysmenorrhea, whereas all the other evaluated anthropometric indices in our study could not significantly predict dysmenorrhea.

In a study conducted in Saudi Arabia, the prevalence of dysmenorrhea was 74% (19). That study was performed on a relatively similar population to ours. From a pain severity point of view, the mentioned study reported a prevalence of 27.90% for severe pain. It seems that the results of this study revealed a higher prevalence rate than other studies.

Zannoni et al., Sharma et al., and Ibrahim et al. reported prevalence rates of 68%, 67.2%, and 60.9%, respectively (20-22). It is worth mentioning that the last study was conducted on university students.

In another study carried out by Habibi et al. in Isfa-

Table 5. Dysmenorrhea Logistic Regression Model

Variable	OR	Confidence Interval 95%	P-Value
WHR	0.896	0.821 - 0.971	0.012
Height	1.057	1.006 - 1.111	< 0.001
Cycle length	1.238	1.117 - 1.372	0.028
Menstruation length	1.269	1.002 - 1.608	0.048
Hip circumference	1.011	0.957 - 1.068	0.694
Fat mass	1.030	0.839 - 1.265	0.776
Fat mass percentage	1.058	0.843 - 1.328	0.0628

Abbreviations: OR, odds Ratio; WHR, Waist to hip ratio.

han, Iran, the prevalence of dysmenorrhea in university students was calculated at 89.1%. In general, 30.3%, 36.5%, and 33.2% of students reported mild, moderate, and severe pain, respectively (23). As a whole, a great variation of 25 to 90% has been reported in different studies (24, 25).

A study by Tomas-Rodriguez et al. (26) showed a significant difference in cycle length between patients with and without dysmenorrhea, which is in line with our findings (P = 0.001). In addition, with a multivariate analysis, they demonstrated that quality of life, menstrual flow, and medication use had a significant relationship with dysmenorrhea. The association of WHR and dysmenorrhea was not addressed in their study as in the current study. However, we did not include the above variables because the students suffering from chronic diseases or taking any medications, except for the over-the-counter analgesics, were excluded from the study.

To the best of our knowledge, the relationship between anthropometric variables (except for BMI) and dysmenorrhea has not been studied using a logistic regression model.

Sundell et al. (27) also noticed a significant difference in menstrual duration between groups with and without dysmenorrhea, which was in line with our finding. However, they did not find a significant relationship between dysmenorrhea and cycle length, duration of menstruation, hip circumference, and height, which is contradictory to our results. Moreover, Sundell et al. pointed out that the severity of dysmenorrhea was linked to menstrual duration. The present study, however, did not show such an association. Based on the present study, cycle length was significantly longer in the groups with mild and moderate dysmenorrhea. This discrepancy could be attributed to different study populations, as in our study, students aged between 14 and 18 years old were enrolled.

Same results were observed in a study by Strinic et al. (28), where no relationship was observed between the severity of dysmenorrhea and height, weight, and age at menarche.

Another study by Jalili et al. (29) revealed a significant association between BMI and dysmenorrhea, but height, weight, age at menarche, duration of menstrual period, regularity of menstrual period, and the amount of bleeding were not associated with dysmenorrhea. In contrast, we did not find any association between BMI and dysmenorrhea, but we noted a difference in cycle length, menstruation length, hip circumference, and height between the groups with and without dysmenorrhea. Mind you that our study only assessed primary dysmenorrhea excluding any irregular cycles and abnormal amounts of menstrual bleeding.

In a study performed in Ahvaz, Iran (12), the overall prevalence of dysmenorrhea was calculated at 100%, and 71.65% of the students claimed to have moderate or severe dysmenorrhea. They presented a significant relationship (analyzed by Pearson correlation coefficient) between the severity of dysmenorrhea and WHR, waist circumference, fat mass percentage, and fat mass, although the correlation coefficient was low. In the current study as shown in Table 3, a significant difference was found in cycle length, age, fat mass, and fat mass percentage among different groups based on pain severity. Also, the prevalence of dysmenorrhea among our participants was 85%.

Nulliparity and age less than 20 years old were shown to be the risk factors for dysmenorrhea (8, 30, 31). Since the study was conducted on adolescents and none of the participants had a history of parity, the overall higher rate of dysmenorrhea in this study can be explained.

This study demonstrated that WHR, height, cycle length, and menstruation length could predict the incidence of dysmenorrhea in a logistic regression model. Previously, in a study by Ju et al. (15), a U-shaped relationship was recorded between BMI and dysmenorrhea.

Due to the rules and regulations of the ministry of education, the researchers could not use a better sampling method. We suggest future studies to address the association of socioeconomic status and environmental factors such as cigarette smoking with dysmenorrhea.

5.1. Conclusion

Based on the present study, cycle length, length of menstruation, WHR, and height were significantly different in groups with and without dysmenorrhea. Furthermore, cycle length, age, fat mass, and fat mass percentage were significantly different among the groups based on pain severity as measured by VAS. Regardless of WHR, which was found to be a protective variable for dysmenorrhea and height as a risk factor, none of the other anthropometric indices could significantly predict dysmenorrhea. However, length of menstruation and cycle length can be assumed as risk factors for dysmenorrhea.

Footnote

Ethical Considerations: This study was approved by the Ethics Committee of Qazvin University of Medical Sciences (code No.: QUMS.REC.1394.9).

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