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Short Communication

J Clin Med Res. 2023;15(4):239-242

The Relationship Between Body Mass Index and Dysmenorrhea in the General Female Population

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Abstract

Background: There may be an etiological association between obesity and dysmenorrheal traits. This study aimed to observe the relationship between body mass index (BMI) and dysmenorrhea in a general female population.

Methods: Premenopausal adult females (n = 2,805) undergoing health checkups were assessed for data such as the BMI and self-reported severity of dysmenorrhea. The BMI levels were compared according to the severity of dysmenorrhea with adjustment for age, smoking habit, exercise habit, serum lipids, and plasma glucose.

Results: The mean BMI level in females with severe dysmenorrhea (n = 278; 23.3 ± 4.5 (standard deviation) kg/m^2) was high relative to those with mild (n = 1,451; 22.3 ± 3.9 kg/m^2) and moderate (n = 1,076; 22.6 ± 4.4 kg/m^2) dysmenorrhea. Even after adjustment for covariables, the difference in BMI remained significant.

Conclusions: The high-normal BMI level may be seen in severe dysmenorrhea in the general female population. Further research is needed to confirm the findings.

Keywords: Obesity; Overweight; Pain; Menses; Women's health

Introduction

Dysmenorrhea, which involves pain with a cramping sensation in the lower abdomen occurring before and/or during the period of menses is a common gynecological complaint [1]. The prevalence of severe pain in females of reproductive age is 2-29%, and their quality of life is impaired by the severity of pain [1]. For this situation, further research on dysmenorrhea is required.

Although the influence of the pathophysiology of dysmenorrhea and its related lifestyles on physical conditions remains to be determined, we noticed inconsistent results in the relationship between obesity and dysmenorrhea in earlier reports. Those studies have reported that the body mass index (BMI) shows a positive [2] or inverse [3] correlation with severe dysmenorrhea. Another report has described a U-shaped correlation (the bottom of BMI in non-severe dysmenorrhea) [4]. Specifically, one study analyzed comparatively older females, who were all workers [2], while the other studies analyzed younger females [3, 4].

Considering the inconsistent results from specific populations [2-4], the current study aimed to establish the relationship between BMI and dysmenorrhea in a large-scale general population. This could provide consensus on this issue.

Materials and Methods

A total of 2,805 subjects who underwent health checkups for women in our healthcare screening center were consecutively enrolled in the study. Inclusion criteria were premenopausal subjects ≥ 20 years of age. Exclusion criteria were subjects without all variables for the analysis. The data of BMI, serum lipids (i.e., total cholesterol, high-density lipoprotein (HDL) cholesterol, triglycerides), and plasma glucose levels were determined after at least 12 h of fasting. The severity of dysmenorrhea (mild, moderate, or severe), smoking habit (current smoking or non-smoking), and exercise habit (expressed as ≤ 2 or > 2 times per week) were determined from a self-reported questionnaire. The study was conducted in accordance with the tenets of the Declaration of Helsinki and was approved by the Institutional Ethics Review Board (Jichi Medical University, No. 22-096).

Differences between groups were examined by Chi-squared test with residual tests for categorical variables or analysis of variance (ANOVA) with multiple comparisons for continuous variables. Because of its non-normally skewed distribution, the triglyceride value was log-transformed in the analysis. The relationship of dysmenorrhea (an explanatory variable) with the BMI level (a predictor) was tested using a multiple regression model adjusted for all examined variables. P values < 0.05 were considered statistically significant.

Manuscript submitted February 21, 2023, accepted March 31, 2023
Published online April 28, 2023

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doi: https://doi.org/10.14740/jocmr4893

Table 1. Clinical Data of the Study Subjects According to the Severity of Dysmenorrhea

Variables	All (n = 2,805)	Mild (n = 1,451)	Moderate (n = 1,076)	Severe (n = 278)	P value
Age group					< 0.01
≤ 40 years, %	11.9	9.6	14.0	15.1[a, b]	-
41 - 49 years, %	66.0	64.0	63.4	67.6[a, b]	-
≥ 50 years, %	22.1	26.4	17.6	17.3[a]	-
Age (mean), years	46 ± 5	46 ± 5	45 ± 5[a]	45 ± 5[a]	< 0.01
BMI, kg/m^2	22.5 ± 4.1	22.3 ± 3.9	22.6 ± 4.4	23.3 ± 4.5[a]	< 0.01
Current smoking, %	8.9	8.0	9.0	13.3[a]	< 0.01
Exercise habit, %	14.5	16.4	12.0[a]	14.0	< 0.01
Total cholesterol, mg/dL	205 ± 45	205 ± 48	204 ± 43	205 ± 42	0.72
HDL-cholesterol, mg/dL	68 ± 15	69 ± 15	67 ± 15[a]	65 ± 15[a]	< 0.01
Triglycerides, mg/dL	68 (51 - 94)	68 (51 - 92)	68 (50 - 94)	71 (52 - 101)	0.28
Glucose, mg/dL	96 ± 10	96 ± 10	96 ± 10	97 ± 12	0.08

Data are shown as the mean ± standard deviation, median (interquartile range), and percentage. P values present the difference in each variable among females with mild to severe dysmenorrhea (by Chi-squared test or ANOVA). [a]P < 0.05 in comparison to the mild dysmenorrhea group (by the residual tests following Chi-squared test or the multiple comparison tests following ANOVA). [b]P < 0.05 in comparison to the moderate dysmenorrhea group (by the residual tests following Chi-squared test or the multiple comparison tests following ANOVA). BMI: body mass index; HDL: high-density lipoprotein.

Results

The clinical data of the study subjects are shown in Table 1. The subjects were divided into the mild (n = 1,451, 51.7%), moderate (n = 1,076, 38.4%), and severe (n = 278, 9.9%) groups according to the severity of dysmenorrhea. Among the three groups, significant differences were found in age, age group, BMI, smoking habit, exercise habit, and HDL-cholesterol level (P < 0.01 in all variables). The percentage of age group of ≤ 40 years and 41 - 49 years in the severe group was higher than that in the mild and moderate group, and that of age group of ≥ 50 years in the severe group was lower than that in the mild group. The percentage of subjects with a smoking habit in the severe group was higher than that in the mild group. The percentage of subjects with an exercise habit in the moderate group was lower than that in the mild group. The moderate and severe groups included significantly younger subjects with lower HDL-cholesterol levels in comparison to the mild group. In particular, the severe group showed significantly higher BMI levels in comparison to the mild group (P < 0.01). The severe group tended to have high BMI levels relative to the moderate group (P = 0.058).

As shown in Table 2, after a multiple regression analysis with adjustment for age, smoking habit, exercise habit, total cholesterol, HDL-cholesterol, triglycerides, and glucose (model 1), the difference in BMI among the three groups of dysmenorrhea remained significant (P = 0.02), along with significant variables as follows: total cholesterol (P < 0.01), HDL-cholesterol (P < 0.01), triglycerides (P < 0.01), and glucose (P < 0.01). In the similar analysis with adjustment for age group (instead of age) and the other variables (model 2), we observed almost the same result of difference in BMI among the three groups (P = 0.02), along with significant variables as follows: total cholesterol (P < 0.01), HDL-cholesterol (P < 0.01), triglycerides (P < 0.01), and glucose (P < 0.01).

Discussion

In the current study, the high-normal BMI levels were seen in severe dysmenorrhea in the general female population. Although the between-severity difference in BMI appears to be slight, such a difference may affect cardiometabolic factors, even in healthy people [5]. Since earlier studies have reported inconsistent results regarding the relationship between BMI and dysmenorrhea in age-specific and occupationally-specific populations [2-4], the findings from the current study, which analyzed a large cohort in the general population, are valuable for confirming this association. Furthermore, the results suggest that the management of obesity might be considered in severe dysmenorrhea, while the idea that has received little attention to date.

The mechanisms of higher BMI levels in severe dysmenorrhea are unclear; however, possible explanations are raised. First, it could be due to the activation of the prostaglandin (PG)-related pathway, which causes dysmenorrhea [6, 7]. Females with severe dysmenorrhea typically have a high PG level in the endometrium and a high menstrual blood volume, which is accompanied by a high peripheral blood PGE2 level [6]. PGE2 is known to induce fat accumulation through PGE2 receptor 4 [7]. Second, it could be due to a lowering of the pain threshold by obesity [8, 9]. Overweight subjects are known to be sensitive to neuropathic pain [8] and migraine attack [9]. Recently, the concept of obesity-induced pain, which occurs due to the complex interplay of factors, for example via weight-related systemic inflammation, mechanical stress, or neuro-immunity, has been proposed [10]. Thus, higher BMI levels can cause more severe dysmenorrhea. The underlying

Table 2. Results of a Multiple Regression Model on the BMI Level

Variables	β	Standard error	*t*	P value
Model 1				
Age, years	0.02	0.01	1.50	0.13
Current smoking, presence	-0.43	0.23	-1.85	0.06
Exercise habit, presence	0.06	0.19	0.33	0.74
Total cholesterol, mg/dL	0.01	0.00	3.72	< 0.01
HDL-cholesterol, mg/dL	-0.08	0.01	-15.46	< 0.01
Triglycerides, mg/dL	3.69	0.39	9.53	< 0.01
Glucose, mg/dL	0.11	0.01	15.97	< 0.01
Dysmenorrhea, severity level	0.24	0.10	2.41	0.02
Model 2				
Age group	0.19	0.12	1.56	0.12
Current smoking, presence	-0.43	0.23	-1.83	0.07
Exercise habit, presence	0.06	0.19	0.30	0.76
Total cholesterol, mg/dL	0.01	0.00	3.78	< 0.01
HDL-cholesterol, mg/dL	-0.08	0.01	-15.47	< 0.01
Triglycerides, mg/dL	3.68	0.39	9.50	< 0.01
Glucose, mg/dL	0.11	0.01	15.97	< 0.01
Dysmenorrhea, severity level	0.24	0.10	2.37	0.02

Model 2: instead of age in model 1, the age group (≤ 40, 41 - 49 years, ≥ 50 years) was entered as an explanatory variable into the model. Triglycerides values were log-transformed in the analysis. BMI: body mass index; HDL: high-density lipoprotein.

mechanisms should be further investigated.

The current study is associated with several limitations. First, the severity of dysmenorrhea was self-reported, and we did not use any pain scales, while the prevalence was in line with the commonly reported prevalence of severe dysmenorrhea [1]. Second, the study subjects were comparatively healthy because they were recruited in health checkups. Third, the cross-sectional design of the study means that the cause-and-effect of the relationship cannot be fully determined. Fourth, the diseases that cause dysmenorrhea (e.g., uterine pathologies such as endometriosis and polycystic ovary syndrome) and the dysmenorrhea-related symptoms (e.g., edema) were not directly detected. Finally, the drugs that subjects used (e.g., hormones, pain relief medicines) were not recorded in the database. These issues will be addressed in future work.

In summary, the general female population with severe dysmenorrhea may show the high-normal BMI levels. Further research is needed to confirm the findings.

Acknowledgments

None to declare.

Financial Disclosure

None to declare.

Conflict of Interest

None to declare.

Informed Consent

The study was approved by the Institutional Ethics Committee. The retrospective database study was conducted by informed consent in an opt out manner as indicated by the committee.

Author Contributions

KT contributed to the study design, literature research, clinical studies, manuscript preparation, and manuscript editing. KK contributed to the study design, literature research, data analysis, statistical analysis, and manuscript review. HU contributed to the study design, data acquisition, and manuscript review; All authors read and approved the final manuscript.

Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Abbreviations

BMI: body mass index; HDL: high-density lipoprotein; PG: prostaglandin

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