

Risk factors for dysmenorrhea among young adult female university students

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Abstract

Objectives. The aim of this study was to investigate associated risk factors for dysmenorrhea in a sample of Serbian university students.

Methods. A case-control study was conducted among undergraduate students (n = 288) attending lectures during 2014/2015 academic year at the Faculty of Medical Sciences, University of Kragujevac.

Results. The only significant associations were between dysmenorrhea and age at menarche (OR adjusted = 0.74; 95% CI 0.58-0.95; p = 0.017), family history of dysmenorrhea (OR adjusted = 3.39; 95% CI 1.74-6.63; p = 0.000), duration of menstrual flow (OR adjusted = 1.52; 95% CI 1.16-1.99; p = 0.002) and smoking at least one cigarette a day (OR adjusted = 5.09; 95% CI 1.83-14.15; p = 0.002). The factors associated with dysmenorrhea were not interacting with each other.

Conclusion. Our results suggest that earlier age at menarche, longer duration of menstrual flow, prior family history of dysmenorrhea and smoking at least one cigarette a day are important risk factors associated with dysmenorrhea. Smoking cessation should be strongly encouraged.

Key words

- dysmenorrhea
- students
- risk factors

INTRODUCTION

Menstruation is a normal physiological process that occurs approximately once a month in women of reproductive age as a result of the breakdown of the endometrial tissue [1, 2]. This process is triggered by fall in progesterone and estrogen levels in the late secretory phase of menstrual cycle in the absence of pregnancy [2]. Women may experience certain discomfort and pain in the lower abdomen before or during their menstruation, but this normally should not affect their ability to perform everyday activities [3-5]. On the other hand, some women experience pain which is severe enough to limit normal daily activities and/or require medication, and this kind of pain is called dysmenorrhea [4-8]. Dysmenorrhea can be categorized as primary or secondary [7]. Primary dysmenorrhea refers to pain in the absence of obvious pelvic pathology [8, 9]. Secondary dysmenorrhea is attributed to some underlying pelvic disease or structural abnormality [4]. The reported prevalence of dysmenorrhea among university students considerably varies between 51% and 92.5% [10, 11]. Differences in definition of dysmenorrhea are the most important reasons for this variation. Some of the authors of the previously conducted studies did not consider severity of pain or effects of menstrual pain on daily activities, and used term "dysmenorrhea" to describe pain of any severity associated with menstruation [5, 9].

There is a range of factors which were associated with

dysmenorrhea in various studies [9]. Most of the studies conducted among university students showed that earlier age at menarche is a significant risk factor for dysmenorrhea, probably due to continuing hormonal imbalance [3, 4, 12, 13]. Some studies showed that increased severity of menstrual pain could be associated with older age [8], longer length of menstruation [4, 12, 14] and positive family history of dysmenorrhea [14, 15]. The studies which have examined association of factors such as alcohol consumption, coffee consumption and smoking with dysmenorrhea show mostly conflicting or inconclusive results [9]. For example, several studies indicated that smokers are more likely to experience dysmenorrhea [15-17], but other studies did not confirm this association [13, 14, 18]. One study from Turkey detected that coffee consumption is an important risk factor for dysmenorrhea [14] and another study from Iran reported that prevalence and risk of dysmenorrhea was higher among students who had higher intakes of caffeine [19]. But still it is unclear how exactly this is related to dysmenorrhea occurrence and it was suggested that it might be due to vasoconstricting effect of caffeine [19]. There are also studies which did not confirm this association [5, 10, 15]. The studies regarding effect of alcohol consumption contain some contradictions. One study showed that consumption of alcohol more than once per week decreased the odds of having dysmenorrhea, but in women with exist-

ing dysmenorrhea it increased the odds of having severe pain and pain lasting more than two days [17]. Recently conducted studies didn't find any association of alcohol consumption with occurrence of dysmenorrhea [13, 14, 20, 21]. Also, to our knowledge, there have been no studies conducted in Serbia that examined risk factors for dysmenorrhea.

With these aspects in mind, the aim of this study was to investigate associated risk factors for dysmenorrhea in a sample of Serbian university students, and therefore resolve controversies made by opposing results of previous studies.

METHODS

Study design and setting

This study was conducted at the Faculty of Medical Sciences, University of Kragujevac, public higher education institution located at the city of Kragujevac in Serbia. The design of our study was of the case-control type, with the primary aim to assess the association between various risk factors and the occurrence of dysmenorrhea defined by menstrual pain that interferes with daily activities and requires medication during each menstrual period.

Study size

Based on the expected study power of 80%, the probability of the statistical error type 1 (α) of 0.05, and supposed difference in average age at menarche between the study groups (based on the results from a study conducted in Italy, which showed significant difference in mean age at menarche – in a group of students with pain 12.45 and in a group of students without pain 13.13 years [5]), we calculated a minimal number of 59 students per group. We used difference in average age at menarche between the study groups to calculate sample size because majority of previously conducted studies among university students consistently reported that earlier age at menarche is a significant risk factor for dysmenorrhea compared to other tested variables.

Participants: cases and controls

The participants were undergraduate students attending lectures during 2014/2015 academic year. A total of 288 students were enrolled during the study period. The students from the study sample who had menstrual pain that interfered with daily activities and required medication during each menstrual period in the last year were the cases in this study. The other students from the study sample who did not meet the above-mentioned criteria were the controls.

Data collection and variables

Data were collected using a self-reported questionnaire which was specially designed for this research. The questionnaire was anonymously completed by each participant who consented to participate in the study. The students were asked to provide information about age, height, weight, smoking, alcohol and coffee consumption, physical activity, chronic diseases, gynecological disorders, use of oral contraceptives, previous gynecological surgical procedures, family history of

dysmenorrhea, sex life history, abortion, pregnancy and menstrual history. Women who reported that they had experienced menstrual pain completed additional questions regarding the characteristics of pain and influence of pain on their ability to perform everyday activities.

Each participant's body mass index was calculated as the subject's weight in kilograms divided by height in squared meters (kg/m^2). The other variables that were followed were: smoking at least one cigarette a day, consuming alcohol more than one day per week, consuming at least one cup of coffee daily and being physically active more than 30 minutes in addition to routine daily activities more than one day per week. The period between the first day of menstruation and the day immediately prior to the next menstruation was defined as the menstrual cycle. Menstrual cycles were considered to be regular if ranged between 21 to 35 days. A family history of dysmenorrhea was defined as positive if a student's first degree relative (mother or sister) had a history of dysmenorrhea.

Statistical analysis

The frequency of each risk factor was determined for both cases and controls. The results of continuous data were expressed as mean \pm standard deviation (SD). The differences between cases and controls in the observed characteristics were assessed by the Student *t*-test or Mann-Whitney *U* test for continuous variables and the χ^2 -test for categorical variables. The differences were considered significant if probability of null hypothesis was less than 0.05. In order to estimate the association between potential risk factors and dysmenorrhea, crude and adjusted odds ratios (OR) with 95% confidence intervals (95% CI) were calculated using logistic regression.

Ethical approval

The study protocol was approved by the Ethics Committee of the Faculty of Medical Sciences, University of Kragujevac (No. 01-3098).

RESULTS

This study included 265 pharmacy students and 23 medicine students. Mean age of a total of 288 participants was 21.5 ± 1.81 years, ranging from 18 to 29 years. Menstrual pain was reported by 84.8% (244 out of 288) students, with 43.8% (126 out of 288) reporting that pain occurred during each period in the last year, and 41% (118 out of 288) reporting that pain occurred during some periods in the last year. Forty-four students (15.2%) reported that they did not have pain during menstruation in the last year.

We classified those having menstrual pain that interfered with daily activities and required medication during each menstrual period in the last year as having dysmenorrhea (cases) and this gives a rate of 29.9% (86 out of 288). Baseline characteristics of the cases and controls, and the differences between them, are shown in *Table 1*. Significant differences between the cases and controls were observed in following features: students with dysmenorrhea (cases) had an earlier menarche ($p = 0.015$), longer duration of menstrual flow ($p = 0.000$),

Table 1
Baseline characteristics of cases and controls

Variable	Cases (n = 86)	Controls (n = 202)	Test value and significance of null hypothesis	Crude odds ratios with 95% confidence intervals
Age (years)	21.84 ± 1.74	21.83 ± 2.13	U = 7603.5; p = 0.089	1.11 (0.97-1.28)
BMI (kg/m ²)	20.48 ± 2.27	20.65 ± 2.13	T = 1.305; p = 0.193	0.92 (0.82-1.04)
Age at menarche	12.55 ± 1.33	13.0 ± 1.29	U = 7080.0; p = 0.015*	0.76 (0.63-0.93)
Duration of menstrual flow (days)	5.87 ± 1.17	5.24 ± 0.9	U = 6401.5; p = 0.000*	1.53 (1.22-1.91)
Family history of dysmenorrhea	60/79 (75.9%)	86/181 (47.5%)	χ ² = 16.92; p = 0.000*	3.49 (1.93-6.31)
Use of oral contraceptives	2 (2.3%)	12 (5.9%)	χ ² = 1.01; p = 0.314	0.38 (0.08-1.72)
Have regular menstrual cycles	77 (89.5%)	189 (93.6%)	χ ² = 0.846; p = 0.349	0.59 (0.24-1.43)
Residence (rural vs. urban)	Rural: 16 (18.6%) Urban: 70 (81.4%)	Rural: 35 (17.3%) Urban: 167 (82.7%)	χ ² = 0.008; p = 0.927	1.09 (0.57-2.10)
Chronic disease	4 (4.7%)	17 (8.4%)	χ ² = 0.769; p = 0.381	0.53 (0.17-1.63)
Had sexual intercourse	59/84 (70.2%)	118/195 (60.5%)	χ ² = 1.993; p = 0.158	1.54 (0.89-2.67)
Age at first sexual intercourse	18.38 ± 1.82	18.81 ± 1.71	U = 2830.0; p = 0.141	0.86 (0.71-1.04)
Number of sexual partners	1.75 ± 0.75	1.74 ± 1.12	U = 2955.0; p = 0.292	0.99 (0.72-1.36)
Gynecological condition (endometriosis, polycystic ovaries, etc.)	10 (11.6%)	17 (8.4%)	χ ² = 1.993; p = 0.158	1.43 (0.63-3.27)
Had surgical gynecological procedure	4 (4.7%)	5 (2.5%)	χ ² = 0.362; p = 0.548	0.52 (0.14-1.99)
Previous pregnancy	0 (0%)	2 (1%)	χ ² = 0.025; p = 0.875	0.99 (0.98-1.01)
Smoking at least one cigarette a day	18 (20.9%)	15 (7.4%)	χ ² = 9.553; p = 0.002*	3.30 (1.58-6.91)
Consuming at least one cup of coffee daily	63 (73.3%)	119 (58.9%)	χ ² = 4.738; p = 0.030*	1.91 (1.09-3.32)
Consuming alcohol more than one day per week	20 (23.3%)	39 (19.3%)	χ ² = 0.360; p = 0.548	1.27 (0.69-2.33)
Being physically active more than 30 minutes in addition to routine daily activities more than one day per week	41 (47.7%)	124 (61.4%)	χ ² = 4.091; p = 0.043*	0.57 (0.34-0.95)

Results are presented as mean ± SD, or n (%); *Significant difference

family history of dysmenorrhea ($p = 0.000$), were more likely to smoke at least one cigarette a day ($p = 0.002$), have regular daily coffee intake ($p = 0.030$) and were less likely to be physically active more than 30 minutes in addition to routine daily activities more than one day per week ($p = 0.043$). None of the participants had history of previous abortions. Also, there were no participants who were pregnant at the time of completing the questionnaire.

The results of the logistic regression analysis (Cox & Snell R square 0.208, Nagelkerke R square 0.294, Hosmer-Lemeshow Chi square 7.372, $df = 8$, $p = 0.497$) with adjustment for potential confounders are shown in Table 2. The adjusted model of logistic regression included 258 participants (79 cases and 179 controls). This was due to missing data when multiple variables were included in the adjusted model (2 participants did not know how old they were when they experienced first menstruation, 28 participants did not know if any of their family members had dysmenorrhea and 9 participants did not provide answers on the question if they have ever had sexual intercourse). The only significant associations were between dysmenorrhea and age at menarche, family history of dysmenorrhea, duration of menstrual flow, and smoking at least one cigarette a day. Although the crude odds ratios for “consuming

at least one cup of coffee daily” and “being physically active more than 30 minutes in addition to routine daily activities more than one day per week” (Table 1) were significantly different from one, after adjustment confidence limits of these odds ratios included the value of one. The interactions between risk factors which are likely to have an additive risk for dysmenorrhea were investigated (Table 3). The analysis did not show a clear synergistic effect for any of the factors that were individually associated with dysmenorrhea. After adjustment, the odds ratios dropped down and their confidence intervals included 1, so they were not statistically significant ($p > 0.05$).

DISCUSSION

The obtained results show that significant risk factors associated with dysmenorrhea were: earlier age at menarche, family history of dysmenorrhea, longer duration of menstrual flow and smoking at least one cigarette a day. These factors were not interacting with each other.

In the present study it was observed that students who earlier reached menarche were more likely to experience dysmenorrhea. This finding is consistent with results of the majority of studies, such as those conducted among Nigerian, Hong Kong, Bangladesh and Japanese university students [3, 4, 12, 13]. This may

Table 2
Crude and adjusted odds ratios (OR) of the risk factors for dysmenorrhea

Risk factors	Crude OR (95% CI)	p	Number of women included in the model: total (cases/controls)	Adjusted* OR (95% CI)	p	Number of women included in the model: total (cases/controls)
Age at menarche	0.76 (0.63-0.93)	0.008*	286 (86/200)	0.74 (0.58-0.95)	0.017*	258 (79/179)
Family history of dysmenorrhea	3.49 (1.93-6.31)	0.000*	260 (79/181)	3.39 (1.74-6.63)	0.000*	
Duration of menstrual flow	1.53 (1.22-1.91)	0.000*	288 (86/202)	1.52 (1.16-1.99)	0.002*	
Smoking at least one cigarette a day	3.30 (1.58-6.91)	0.002*	288 (86/202)	5.09 (1.83-14.15)	0.002*	
Gynecological condition (endometriosis, polycystic ovaries, etc.)	1.43 (0.63-3.27)	0.394	288 (86/202)	1.47 (0.51-4.29)	0.479	

p – Statistical significance

Adjusted for age, age at menarche, duration of menstrual flow, smoking at least one cigarette a day, consuming alcohol more than one day per week, consuming at least one cup of coffee daily, being physically active more than 30 minutes in addition to routine daily activities more than one day per week, body mass index, use of oral contraceptives, family history of dysmenorrhea, regular menstrual periods, place of residence (rural vs. urban), chronic disease, gynecological condition, previous gynecological surgical procedures

* Statistically significant

be attributed to the similarity of hormonal pattern and ovulatory efficiency of early maturing girls and adult females that could lead to a longer exposure to uterine prostaglandins which are responsible for pain [15, 22]. On the other hand, the study conducted among Turkish nursing students did not find statistically significant increased odds for occurrence of dysmenorrhea in students who had earlier menarche [18]. In this study only 56 students didn't have dysmenorrhea opposed to 315 who reported dysmenorrhea, and this small number of controls might be the reason for not reaching statistical significance in logistic regression analysis [18]. Another significant risk factor for dysmenorrhea was presence of longer duration of menstrual flow. The majority of previous studies such as those conducted in Hong Kong, Iran, Bangladesh, Nigeria and Turkey reported similar results [3, 4, 12, 14, 19].

Family history of dysmenorrhea was also an important predictor for the dysmenorrhea occurrence. This result is in line with studies performed among university students in Ethiopia, Turkey and Iran [6, 14, 15, 18, 19, 23]. Some researchers suggested that this may be due to behavior learned from their mothers and sisters [6, 15, 19, 23, 24]. However, some studies suggested that there is a genetic susceptibility to dysmenorrhea [24, 25]. Cytochrome P450 2D6, glutathione S-transferase Mu and Estrogen receptor 1 gene polymorphisms were associated with increased risk of dysmenorrhea but exact biological mechanism by which these gene polymorphisms could contribute to dysmenorrhea occurrence has yet to be determined [25, 26]. Also, the results of the recently conducted meta-analysis observed trend towards an increased risk of the variant progesterone receptor gene polymorphism allele and predisposition

Table 3
The interactions between significant risk factors for dysmenorrhea

Risk factors	Crude OR (95% CI)	Statistical significance (p)	Adjusted* OR (95% CI)	Statistical significance (p)
Family history of dysmenorrhea and smoking at least one cigarette a day	5.70 (1.91-16.99)	0.002*	0.42 (0.06-2.78)	0.371
Family history of dysmenorrhea and age at menarche	1.08 (1.04-1.13)	0.000*	0.72 (0.42-1.23)	0.228
Family history of dysmenorrhea and duration of menstrual flow	1.30 (1.18-1.44)	0.000*	1.45 (0.82-2.54)	0.195
Smoking at least one cigarette a day and age at menarche	1.10 (1.04-1.17)	0.001*	0.67 (0.30-1.46)	0.314
Smoking at least one cigarette a day and duration of menstrual flow	1.26 (1.11-1.44)	0.001*	0.02 (0.42-2.46)	0.966
Age at menarche and duration of menstrual flow	1.02 (1.01-1.03)	0.028*	0.96 (0.80-1.16)	0.686

Adjusted for age, age at menarche, duration of menstrual flow, smoking at least one cigarette a day, consuming alcohol more than one day per week, consuming at least one cup of coffee daily, being physically active more than 30 minutes in addition to routine daily activities more than one day per week, body mass index, use of oral contraceptives, family history of dysmenorrhea, regular menstrual periods, place of residence (rural vs. urban), chronic disease, gynecological condition, previous gynecological surgical procedures.

* Statistically significant

for the endometriosis which is one of the common causes of secondary dysmenorrhea [27].

Among the examined lifestyle factors only smoking at least one cigarette a day was significantly associated with dysmenorrhea. Inconsistent results for the association between smoking and dysmenorrhea can be found in literature. Study conducted among Turkish university students showed that cigarette smokers had 1.6-fold higher risk compared with nonsmokers [15]. The one-year prospective study conducted among college women in the USA showed that current smokers had a 1.5-fold increased risk of experiencing pain lasting longer than two days [17]. Although it is not entirely clear how smoking might contribute to dysmenorrhea, one of the possible explanations is the fact that nicotine acts as a vasoconstrictor which leads to reduced blood flow in endometrium and decreased amount of oxygen available to the uterus which result in pain [16]. On the contrary, two other studies conducted in Turkey and one study conducted in Japan did not detect significant association of dysmenorrhea with smoking status and authors tried to explain this discrepancy by the fact that they did not ask what is the dose of cigarettes used and the duration of smoking [13, 14, 18]. Nevertheless, smoking cessation should be strongly encouraged as it may have other harmful effects on health. The results of our study did not identify association of alcohol and coffee consumption with dysmenorrhea occurrence, which is in accordance with most of the previously conducted studies [5, 10, 13-15, 20, 21]. Our results did not detect older age as significant risk factor for dysmenorrhea which is in accordance with results of the studies conducted among Hong Kong and Turkish university students [12, 18]. On the other hand, studies conducted in Nigeria and Egypt reported that participants older than 15 and 17 years, respectively, were more likely to have dysmenorrhea [8, 28]. Participants in these studies were younger (10-19 years) than participants in our study so this might explain discrepancy [8, 28]. The possible reason for more frequent occurrence of dysmenorrhea in older age is that the probability of ovulation increases with age, and the fact that menstrual pain is more likely to occur during ovulatory cycles [17]. Studies which have included participants of wider age range (18-51 years), showed that the prevalence and

risk for dysmenorrhea was highest in women between 20 and 24 years of age and that both prevalence and risk for dysmenorrhea decrease after the age of 25 [23, 29, 30]. This observation could be attributed to the fact that women are more likely to get pregnant and give birth as they become older and this protective effect of pregnancy and delivery may be a result of lower release of prostaglandin by endometrium and disappearance of uterine adrenergic nerves [9, 22]. Previously conducted studies did not examine interactions of risk factors, but our study showed that factors that were associated with dysmenorrhea acted independently.

Limitation of our study is the fact that data were obtained through self-report method, therefore its accuracy depends on the truthfulness of the respondents and their willingness to share experiences on a sensitive topic like menstruation. Still, it is important to emphasize that self-report method is difficult to avoid since there is no biomedical marker for dysmenorrhea and the fact that pain is subjective phenomenon. Additional limitation of the study is the fact that we did not collect any data (demographic, clinical, motivation) on students who refused to participate. Another important limitation is that we could not differentiate between primary and secondary dysmenorrhea, since gynecological examination was not performed. Nevertheless, this study still brings important insights regarding dysmenorrhea and associated risk factors for its occurrence in female university students.

CONCLUSION

Our results suggest that earlier age at menarche, longer duration of menstrual flow, prior family history of dysmenorrhea and smoking at least one cigarette a day are important risk factors associated with dysmenorrhea. Smoking cessation should be strongly encouraged.

Conflict of interest statement

There are no potential conflicts of interest or any financial or personal relationships with other people or organizations that could inappropriately bias conduct and findings of this study.

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