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Original Article

Stress and Menstrual Disorders Among Iranian Medical Students: A Cross-Sectional Study

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ABSTRACT

Menstrual disorders are common among women and can cause discomfort. Several environmental factors are considered to be associated with these disorders. Aim: To investigate the prevalence of psychological stress and menstrual disorders among Iranian medical students and to assess the environmental factors, including stress, that are associated with menstrual disorders. Methodology: This cross-sectional study was conducted on female medical students at Islamic Azad University Tehran Medical Sciences Branch, Tehran, Iran. Demographics, menstrual patterns and stress profile of the sample were assessed. Logistic regression models were used to evaluate factors associated with stress and menstrual disorders. Results: Out of 358 participants, 10.1% had a menstrual cycle < 21 days (polymenorrhea), 2.8% had a menstrual cycle of >35 days (oligomenorrhea), and 9.2% had irregular menstrual cycle (metrorrhagia). Moreover, 13.7% had period lengths of >7 days (hypermenorrhea). 51.1% of the sample experienced heavy menstrual bleeding (menorrhagia). The average stress score was 19.87±9.09. BMI, cigarette, and hookah smoking were significantly associated with higher stress (OR=1.158, 1.123 and 1.117, respectively). Polymenorrhea was significantly associated with age at menarche and stress score (OR=0.735 and 1.046, respectively). Metrorrhagia was also significantly associated with age at menarche and stress score (OR=0.757 and 1.043, respectively). New interns were less likely to have hypermenorrhea and metrorrhagia compared to pre-interns (OR=0.173 and 0.500, respectively). Conclusions: Stress was associated with short and irregular menstrual cycles. There was a higher prevalence of stress and menstrual disorders among medical students compared to general population, which warrants further investigation and action.

Keywords: Menstruation disorders, Menstrual cycle, Psychological stress, Medical students

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INTRODUCTION

Menstruation is a physiological process that begins during adolescence and continues until menopause. Menstrual disorders are a frequent occurrence among women of reproductive age and one of the main reasons for gynecological visits [1, 2]. The prevalence of menstrual disorders are reported to be as high as 75 percent [3, 4]. Some of these disorders include menorrhagia (heavy periods), metrorrhagia (irregular periods), polymenorrhea (frequent periods), oligomenorrhea (infrequent periods), dysmenorrhea (painful periods), amenorrhea (absence of periods) and premenstrual syndrome (PMS) [2, 5]. These disorders impose a heavy psychological and physical burden on the women experiencing them and might affect their academic and/or work performance, and lower their quality of life [1, 6-8]. Menstrual disorders are also associated with increased rate of infertility, type 2 diabetes, coronary heart disease and depression [9-11]. Previous studies have identified some of the factors associated with menstrual disorders such as diet, exercise, BMI, alcohol, tobacco, and age of menarche [1, 11-13]. Stress is considered to play an important role in inducing menstrual disorders, by acting through hypothalamus-pituitary-adrenal axis [11, 14]. Medical students are among the most vulnerable groups to stress and depression due to work overload, high expectations, etc. [15-17]. The studies also suggest that female medical students experience more stress than males [16, 17].

The main objective of this study was to assess the effect of stress on menstrual disorders in a group of Iranian medical students. The secondary objectives was to find other variables affecting menstrual disorders and variables affecting stress itself.

MATERIAL AND METHODOLOGY

Sample Selection :

This was a cross-sectional study conducted in October 2014 at Islamic Azad University Tehran Medical Sciences Branch. All female students studying medicine in pre-internship and internship stages at this university in the said time who agreed to participate were included in the study. We excluded students with polycystic ovary syndrome, mental health disorders and bleeding disorders as these could affect the results. Users of any drug that might affect menstrual patterns were also excluded. Moreover, there were no pregnant or lactating students in this university at the time of the study. All participants were required to read the exclusion criteria beforehand and abstain from the study if they had any of the criteria.

Data collection:

A self-administrated questionnaire was distributed among students. An English translation of the questionnaire is provided in the supplemental materials. The questionnaire was divided into three parts. The first part collected demographic information such as age, height, weight, education status (pre-intern, intern of 1st, 2nd, or 3rd six months), marital status, residence status, physical activity, and smoking habits. Physical activity was categorized into low, normal, and high groups. The normal group was defined as exercising for 3 days per week (at least 30 minutes each day). Those who exercised for less or more than 3 days per week were categorized into low or high groups, respectively. The second part of the questionnaire collected information about menstrual patterns such as age of menarche, menstrual cycle length, menstrual flow duration and menorrhagia. Menstrual cycle length was considered as the number of days between the first day of menses until the day before the onset of next menses. A menstrual cycle length between 21 and 35 days, and menstrual flow duration between 2-7 days was considered normal [5].

We used PBAC to assess the presence of menorrhagia. Pictorial Blood Assessment Chart (PBAC) provides a simple and accurate method of measuring blood loss in menstrual bleeding [18]. The number of sanitary pads used each day is written down and multiplied by the respective coefficient (1 for lightly stained, 5 for moderately stained and 20 for completely blood saturated). The number of small (about 2 cm) and large clots (about 3.5 cm) and menstrual flooding are also recorded and multiplied by 1, 5 and 5, respectively.

A cut-off score of ≥100 corresponds to a blood loss of more than 80 mL with a sensitivity and specificity of more than 80%, when compared to alkaline haematin method, in the original study [18]. Most of subsequent studies used the same cut-off score, although other values have been used as well [29]. We used 100 as cut-off score in this study and considered blood loss of more than 80 mL (PBAC≥100) as menorrhagia [5]. To ensure accurate answers to PBAC, the participants were asked to take the questionnaire home with them and return it when they completed their period. Moreover, instructions for scoring were not revealed to the participants and the scores were calculated by the researchers. The third part consisted of the stress scale of the DASS-42 questionnaire to evaluate stress levels in the participants. The Depression Anxiety Stress Scale (DASS) is a questionnaire consisting of 42 items, divided to three subscales each consisting of 14 items to evaluate depression, anxiety and stress. Developed by Lovibond and Lovibond [19] in 1995, this scale provides a reliable measurement in all three subscales [20, 21]. Moreover, DASS is not influenced by gender, occupation, education and age [21]. While, there can be some overlap between anxiety and stress scales of DASS, Lovibond and Lovibond confirmed that the stress subscale can be used independently from the two other subscales [20]. While we used cut-off scores provided by Lovibond and Lovibond for classification of the stress profile (score≤14: no-stress, 15≤score≤18: mild stress, 19≤score≤25: moderate stress, 26≤score≤33: severe stress, score≥34: extremely severe stress), the raw score was used in the analysis as it provides better measurement [21].

Data Analysis :

Continuous variable was described using mean and standard deviation. Categorical variables were described using frequency and percentage. Univariate logistic regression analysis was used to test the association of each factor with stress score and menstrual disorders. Multivariate logistic regression analysis was used to adjust for confounders. For each predictor, two kinds of confounder variables were considered: statistical confounder and clinical confounder. A variable was considered as a statistical confounder if it had two criteria: 1. Statistically significant association with both the risk factor of interest and the outcome and 2. Unequal distribution among the groups being compared. Clinical confounders were chosen at the discretion of the researcher. For example, chronical age was considered as a clinical confounder for menarcheal age. A p-value less than 0.05 was considered statistically significant. All confidence intervals were calculated at 95%. SPSS version 25 was used for all statistical analysis.

Ethical considerations :

All the participants filled out the questionnaire voluntarily and gave written consent. Their names remain confidential. This study did not include any intervention on the participants and was approved by Islamic Azad University Tehran Medical Sciences Branch ethics committee.

RESULTS

Demographic characteristics:

There were a total of 472 female medical students studying at the university at the time of study. 358 students returned the filled questionnaires and were included in this study. 226 (63%) of the participants were pre-intern and 132 (37%) were interns with 59 (16.5%) being in the first, 41 (11.5%) being in the second and 32 (8.9%) being in third six months of internship. The mean age and BMI was 24.81±2.08 and 22.02±2.90, respectively. There were 32 occasional cigarette smokers, 1 permanent cigarette smoker, which were considered as the cigarette smoker group in the analysis. 69 occasional hookah smokers and 4 permanent hookah smokers among the population were considered as the hookah smoker group in the analysis. Physical activity profile of the sample was 226 (63.1%) low, 90 (25.1%) normal and 42 (11.7%) high, respectively. 34.1% of the students were living alone and 87.2% were single.

Menstrual patterns:

279 (77.9%) of the students had regular menstrual cycle, 36 (10.1%) had a menstrual cycle of less than 21 days (polymenorrhea), 10 (2.8%) had a menstrual

cycle of more than 35 days (oligomenorrhea), and 33 (9.2%) had irregular menstrual cycle (metrorrhagia). A normal menstrual bleeding length between 2 and 7 days was observed in 308 (86%) of the sample; 49 (13.7%) had period lengths of more than 7 days (hypermenorrhea). Only one student reported a bleeding length of less than 2 days (hypomenorrhea). Of the total population, 183 (51.1%) experienced heavy menstrual bleeding (menorrhagia).

Stress profile:

The mean stress score of the total sample was 19.87±9.09. Of the total population, 107 (29.9%) did not report significant stress. In the remaining 251 participants, mild, moderate, severe and extremely severe stress was reported by 49 (13.7%), 109 (30.4%), 70 (19.6%) and 23 (6.4%), respectively. Stress levels were higher in single students (20.11±8.880 vs 18.22±10.388) and those living alone (20.11±8.956 vs 19.74±9.181), although the difference was not statistically significant (P=0.238 and P=0.669, respectively). In general, stress levels and education status showed an inverse trend (20.21±9.194, 20.66±8.310, 17.93±10.130 and 18.47±8.262 for pre-interns and interns in 1st, 2nd and 3rd six months, respectively), but this was not statistically significant (P<0.05 for all comparisons). Stress levels in different exercise groups were inconsistent (17.89±8.375, 20.85±9.146, 18.83±9.690 for low, medium, and high groups) with no statistical significance (P<0.05 for all comparisons). Chronical age and menarcheal age did not show any particular association with stress scores (P=0.866 and P=0.982, respectively). A statistically significant effect was found for BMI (P=0.005, OR=1.158, CI= 1.045-1.284). Compared to non-smokers, cigarette and hookah smokers tended to have higher stress levels (23.18±7.943 vs 19.53±9.147 and 21.83±8.955 vs 19.35±9.075, respectively), both of which were statistically significant (P=0.028, OR= 1.123, CI= 1.013-1.246 and P=0.036, OR= 1.117, CI= 1.008-1.239, respectively).

Table 1. Characteristics of the sample, categorized by menstrual cycle length

PARAMETERS		Normal	Polymenorrhea	Oligomenorrhea	Metrorrhagia
Age		24.86±2.21	24.69±1.45	24.56±1.51	24.52±1.72
Age at menarche		12.91±1.41*	12.25±1.42	13.25±1.58†	12.31±1.80‡
BMI		21.87±2.76	22.21±2.46	23.19±2.42	22.86±4.31
Stress Score		19.14±8.81	23.03±8.66	19.67±10.05	22.88±10.66
Education status					
Pre-intern		173 (62.0%)	26 (72.2%)	4 (44.4%)	23 (69.7%)
Intern, 1st six months		49 (17.6%)	4 (11.1%)	-	6 (18.2%)
Intern, 2nd six months		28 (10.0%)	5 (13.9%)	4 (44.4%)	3 (9.1%)
Intern, 3rd six months		29 (10.4%)	1 (2.8%)	1 (11.1%)	1 (3.0%)
Residence status	With family	186 (66.7%)	23 (63.9%)	7 (77.8%)	19 (57.6%)
Marital status	Single	245 (87.8%)	30 (83.3%)	6 (66.7%)	30 (90.9%)
Cigarette smoking		21 (7.5%)	5 (13.9%)	1 (11.1%)	6 (18.2%)
Hookah smoking		49 (17.6%)	11 (30.6%)	3 (33.3%)	12 (36.4%)
Physical activity					
Low		74 (26.5%)	7 (19.4%)	4 (44.4%)	5 (15.2%)
Medium		175 (62.7%)	24 (66.7%)	5 (55.6%)	21 (63.6%)
High		30 (10.8%)	5 (13.9%)	-	7 (21.2%)

Continuous variables are presented as mean±standard deviation and categorical variables are presented as frequency (percentage). * Excluding 4 missing entry, †,‡ Excluding 1 missing entry

Factors affecting menstrual patterns:

In the univariate analysis, age at menarche was associated with polymenorrhea (P=0.011, OR=0.734, CI= 0.578-0.932) and metrorrhagia (P=0.028, OR= 0.755, CI=0.587-0.970). Adjusting for chronological age in the multivariate analysis did not significantly improve the results and the association was still statistically significant (P=0.012, OR=0.735, CI=0.578-0.933 and P=0.031, OR=0.757, CI=0.588-0.976, respectively). Cigarette and hookah smoking were associated with metrorrhagia (P=0.047, OR=2.730, CI=1.014-7.348 and P=0.012, OR=2.682, CI=1.238-5.813, respectively). Stress score was associated with polymenorrhea (P=0.016, OR=1.049, CI= 1.009-1.090) and metrorrhagia (P=0.025, OR= 1.046, CI=1.006-1.090). Adjusting for smoking status in the multivariate analysis did not result in a meaningful change and the stress level remained significantly associated with polymenorrhea (P=0.023, OR=1.046, CI= 1.006-1.088) and metrorrhagia (P=0.043, OR= 1.043, CI=1.001-1.086). Characteristics of the sample categorized by menstrual cycle length are shown in table 1.

Hypomenorrhea was not considered in the analysis due to insufficient data (only 1 participant). In univariate analysis, new interns (first six months of internship) were less likely to have hypermenorrhea compared to pre-interns (P=0.023, OR=0.185, CI=0.043-0.793). After adjusting for age and stress in the multivariate analysis, the observed effect was still significant (P=0.019, OR=0.173, CI=0.040-0.750). Characteristics of the sample categorized by presence of hypermenorrhea are shown in table 2.

Education status was the only predictor of menorrhagia in the univariate analysis. Menorrhagia was significantly lower in new interns (first six months of internship) compared to pre-intern students (P=0.20, OR=0.498, CI= 0.276-0.897). After adjusting for age and stress in the multivariate analysis, this effect was still significant (P=0.026, OR=0.500, CI=0.272-0.921). Characteristics of the sample categorized by presence of menorrhagia are shown in table 3.

Table 2. Categorized by presence of hypermenorrhea

	Normal	Hyper-menorrhea
Age	24.79±1.89	24.94±3.06
Age at menarche	12.81±1.49*	12.71±1.30†
BMI	22.06±2.86	21.86±3.21
Stress Score	19.89±9.05	19.92±9.47
Education status		
Pre-intern	190 (61.7%)	36 (73.5%)
Intern		
1st six months	57 (18.5%)	2 (4.1%)
2nd six months	36 (11.7%)	4 (8.2%)
3rd six months	25 (8.1%)	7 (14.3%)
Residence status		
With family	201 (65.3%)	34 (69.4%)
Single	267 (86.7%)	44 (89.8%)
Cigarette smoking	31 (10.1%)	2 (4.1%)
Hookah smoking	70(22.7%)	5 (10.2%)
Physical activity		
Low	80 (26.0%)	10 (20.4%)
Medium	189 (61.4%)	36 (73.5%)
High	39 (12.7%)	3 (6.1%)

Table 3: Categorized by presence of menorrhagia

	Normal	Hyper-menorrhea
Age	24.86±1.93	24.76±2.22
Age at menarche	12.71±1.47*	12.88±1.47†
BMI	22.02±2.99	2.04±2.84
Stress Score	19.34±9.24	20.41±8.95
Education status		
Pre-intern	190 (61.7%)	36 (73.5%)
Intern		
1st six months	103 (59.2%)	123 (67.2%)
2nd six months	37 (21.3%)	22 (12.0%)
3rd six months	20 (11.5%)	20 (10.9%)
Residence status		
With family	112 (64.4%)	123 (67.2%)
Single	149 (85.6%)	162 (88.5%)
Cigarette smoking	14 (8.0%)	19 (10.4%)
Hookah smoking	34 (19.5%)	41 (22.4%)
Physical activity		
Low	41 (23.6%)	49 (26.8%)
Medium	115 (66.1%)	110 (60.1%)
High	18 (10.3%)	24 (13.1%)

DISCUSSION

We measured three menstrual characteristics (cycle length, duration of menses, and the amount of blood loss characterized by the presence of menorrhagia) in a sample of Iranian medical students. The prevalence of all measured menstrual disorders (with the exception of oligomenorrhea) were higher compared to overall Iranian population [8]. The prevalence of menorrhagia in our sample was exceptionally higher than the average population (51.1% vs 19.24%). Metrorrhagia was also more prevalent in our sample (9.2% vs 6.04). Polymenorrhea was roughly the same as overall population (10.1% vs 9.94%). Interestingly, the presence of oligomenorrhea was much lower in our sample compared to national prevalence (2.8% vs 19.24%) and hypomenorrhea was virtually absent (vs 5.25% in the overall population). Hypermenorrhea was approximately the same as national average (13.7% vs 12.94%).

We were unable to find any English papers reporting stress levels in a general Iranian population using DASS-42 scale for comparative purposes, since all available papers used the short 21-question version of DASS scale (DASS-21). However, we found one article in Persian by Asghari Moghaddam et al. [22], that reported on a sample of 420 participants recruited from general adult population. In this sample, the mean stress score was reported at 10.67±8.98, which is roughly half the score measured in our sample of medical students (19.87±9.09). This result is consistent with previous studies which report a higher level of stress among medical students compared to the general population [17].

Female reproductive system is mainly controlled by hypothalamic-pituitary-ovarian axis via Gonadotropin releasing hormones (GnRH) [23]. Therefore, any environmental factor that might alter this pathway can have the ability to affect menstrual patterns [24]. Several environmental and psychosocial factors have been reported to affect menstrual patterns in earlier studies [1, 11-13]. In this study, we showed that stress level was independently associated with polymenorrhea and metrorrhagia. An increase of one point in stress score measured by DASS-42 scale increased the odds of polymenorrhea and metrorrhagia by 4.6% and 4.3%, respectively. This is consistent with earlier studies, which showed that higher stress levels is associated with menstrual disorders [11, 15, 24, 25]. Psychological stress acts via hypothalamic-pituitary-adrenal axis, which can have an inhibitory effect on the hypothalamic-pituitary-ovarian axis [23]. This effect is mediated by the release of corticotrophin-releasing hormone (CRH) from the hypothalamus that causes the release of adrenocorticotropic hormone (ACTH) from the pituitary gland, which in turn causes the release of cortisol from the adrenal glands [14]. Both CRH and Cortisol play a role in altering female reproductive function. CRH acts by inhibiting GnRH and Cortisol acts by inhibiting the release of luteinizing hormone (LH) by the pituitary gland and the release of estrogen by the ovaries, and also induces estrogen resistance [14].

The association between age at menarche and menstrual disorders is less clear. While some studies report increased prevalence of menstrual anomalies in women with early or late onset of menarche [6, 7, 11, 24-26], some studies report no such effect [27]. In this study, we found that early menarche is independently associated with polymenorrhea and metrorrhagia. Each year of decrease in age of menarche increased the odds of polymenorrhea and metrorrhagia by 26.5% and 24.3%, respectively. Early onset of menarche might contribute to menstrual disorders by increasing psychological distress as several studies have linked early onset of menarche to stress and mental problems. However, these effects are considered temporary and present only in adolescents and are less likely to continue into adulthood [28, 29]. Indeed, in the present study there was no association between age of menarche and stress score.

Medical education in Iran lasts about seven years and is divided into four stages. The first two are theoretical basic sciences and pathophysiology. The third part, pre-internship, lasts two years and the students learn by observing interns, residents or attending physicians in a hospital setting. Internship, which lasts for 18 months, is when the students have a relative degree of autonomy and are allowed to perform simple medical procedures under supervision, rather than simply observing. The pressure of habituating to a new environment

can put a psychological burden on pre-intern medical students who entered hospital setting recently, as seen in their increased stress levels. Interestingly, hypermenorrhea and menorrhagia were significantly higher in pre-intern medical students compared to interns, and this effect was independent of stress levels. It is possible that these menstrual disorders are explained by other psychological and/or workplace factors, which were unaccounted for in this study.

This study is the first study to discuss the association between psychological stress and menstrual disorders in Iran. The only similar study we were able to identify was conducted by Tavallaee et al. in 2011 [26], which mainly discussed dysmenorrhea. Moreover, the study provided no details about how the stress levels were measured whereas we used a reliable and validated scale (DASS-42) to evaluate stress profile of our sample. Diagnosis of dysmenorrhea and premenstrual syndrome without an accurate history and clinical investigation is confounded by personal judgment of the participant, as each individual perceives symptoms such as pain in a different way [30-32]. Therefore, measuring these two disorders using only a self-administered questionnaire yields inaccurate result and was not included in our study.

This study is not without limitations. This was a cross-sectional study. Therefore, no causality can be determined from this study. The study was limited to students in one university as opposed to a sample from several different universities across the country. The result of this study should be considered with caution when applied to other populations. The menstrual patterns were evaluated based on students' self-reports, rather than clinical examinations, biomedical markers, or hormone measurements, which can lead to bias. We tried to limit this bias by using standard scoring scales to measure the stress levels and the amount of blood loss, but still, the results largely rely on the participant's perception of their menstrual pattern.

CONCLUSION

In summary, we showed that there is a higher prevalence of stress and menstrual disorders among Iranian female medical students. Higher stress level and earlier onset of menarche were independently associated with polymenorrhea and metrorrhagia. Interestingly, pre-intern students were more likely to have hypermenorrhea and menorrhagia compared to interns, independent of their stress level. These results warrant further research and implementation of policies to alleviate the psychosocial distress and menstrual disturbances among this at-risk population.

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