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The Relationship between Test Anxiety and the Incidence and Type of Menstrual Disorders in the Case of Students of University of Medical Sciences: A Longitudinal Study

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Abstract

Introduction: Anxiety is known as a potential contributing factor in the incidence of menstrual disorders. No studies have yet investigated the relationship between test anxiety and the incidence and type of menstrual disorders. The present study was therefore conducted to examine this relationship.

Method: The present descriptive, correlational and longitudinal study was conducted on all the female students of Arak University of Medical Sciences. Three weeks prior to the beginning of the university's exam period, the students' level of anxiety was measured using the Test Anxiety Scale. The students were simultaneously given a demographic and obstetric questionnaire to be filled out over three menstrual cycles, and the filled-out questionnaires were collected at the end of each cycle. The study exclusion criteria consisted of being unwilling to continue participation in the study and becoming pregnant over the course of the study.

Results: The majority of the students (50.5%) had moderate levels of test anxiety. Menorrhagia was the most frequent menstrual disorder developed in each of the three cycles. The logistic regression model showed that the incidence of menstrual disorders was affected by variables such as academic term, history of using Oral Contraceptive Pills (OCPs), history of taking medications affecting menstruation and history of mental illness and depression in the first cycle following the exam period, and by test anxiety, academic year, ethnicity, economic status, history of taking medications affecting menstruation and history of mental illness and depression in the second cycle following the exam period.

Conclusion: According to the results obtained, the incidence of menstrual disorders in the first and second cycles following the exam period is linked to the level of test anxiety, academic year, academic term, ethnicity, economic status, history of taking OCPs, history of taking medications affecting menstruation and history of mental illness and depression.

Keywords

Test anxiety, Menstrual disorders, Mental illness, Hormonal medications, Ethnicity, Level of education

Introduction

Menstrual disorders comprise a major health concern for women. These disorders have a significant impact on the overall health of women and the social costs incurred across the world [1-3]. Menstrual disorders are defined as any changes in the normal menstrual cycle [4]. The general prevalence of menstrual disorders has been reported as 5-10% [5,6]. In a multinational study conducted by the World Health Organization, the prevalence of menstrual disorders was reported as between 8% and 83% [7]. In Iran, only a few studies have examined the prevalence of these disorders. For instance, in Tehran, 35.8% of women experienced different forms of menstrual disorders and heavy menstrual bleeding was one of the most prevalent disorders (17.2%) [8]. The overall prevalence of menstrual disorders was reported as 43.25% [9] in Sanandaj and as 16.6% in Shiraz [10]. A study conducted by Atarod reported 60.8% of high school girls in Sari to experience at least one type of menstrual disorder, including irregular bleeding, oligomenorrhea and polymenorrhagia [11].

Menstrual disorders are consequential because they are linked to anovulatory cycles (cycles in which ovulation does not occur) and may therefore increase the risk of infertility, mental disorders and gynecologic cancers [12,13]. Although these disorders are rarely life-threatening, they can have adverse effects on the personal, family and social lives of women and lead to physical, psychological and social problems in them [14,15].

Factors affecting menstrual disorders include ethnicity, age, age at menarche, body mass index (BMI), history of surgical or medical issues, kidney problems, socioeconomic status and mental disorders [16-23]. Anxiety is also known as a potential contributing factor in the incidence of menstrual disorders. Some studies have shown that individuals with high levels of anxiety are more likely to experience menstrual disorders compared to individuals with lower levels of anxiety [24].

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Stress is a very important factor affects the level of test anxiety. The brain is the central organ of stress and adaptation to stress. Acute and chronic stress causes an imbalance of neural circuitry subserving cognition and anxiety [25]. Stress exerts its effects through permeating the endocrine gland system by suppressing of luteinizing hormone (LH) and follicle-stimulating hormone (Fsh) that can disrupt the menstrual cycle [26,27].

Exams are a potential cause of anxiety, fear and stress. Test anxiety involves unpleasant emotional experiences and perturbations in the individual when he/she feels his performance is being evaluated [28]. Iranian students have higher mean test anxiety scores compared to their American counterparts [29], and about 90% of Iranian students experience some degree of test anxiety [30].

To date, only one study has investigated the effect of test anxiety on the incidence of menstrual disorders; this study found that test anxiety is involved in the incidence of this disorder [31].

Due to the limited number of foreign studies and the complete lack of studies conducted in Iran on the relationship between test anxiety and the incidence and type of menstrual disorders, and also given the absence of a study on the effect of test anxiety on the menstrual cycles following exam periods, the present study was conducted to investigate the relationship between test anxiety and the incidence and type of menstrual disorders in the cycle during and the first and second cycles following a specific exam period in female students of Arak University of Medical Sciences.

Materials and Methods

The present descriptive, correlational and longitudinal study was conducted on all the female students at Arak University of Medical Sciences to investigate the correlation between test anxiety and the incidence of menstrual disorders in the cycle during and the first and second cycles following a specific exam period.

The study subjects included 700 female students at Arak University of Medical Sciences, 114 of whom were unwilling to participate in the study, 115 submitted an incomplete Test Anxiety Scale and 99 withdrew from the study (making for a total of 328 exclusions). The data obtained from the remaining 372 participants were analyzed (Figure 1).

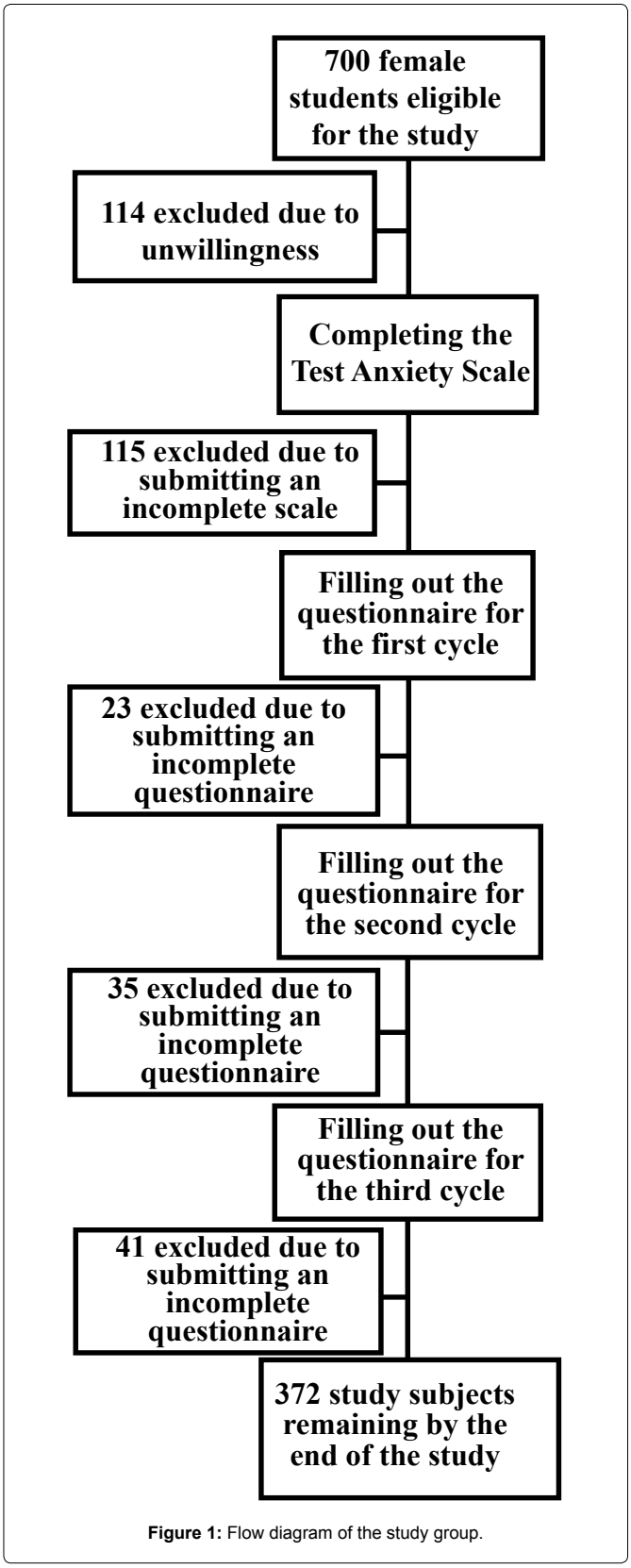

Figure 1: Flow diagram of the study group.

The study exclusion criteria consisted of being unwilling to continue participation and becoming pregnant over the course of the study. Data were collected using the Test Anxiety Scale, a demographic and obstetric questionnaire and Higham's pictorial chart.

The study defined menstrual disorder as all the changes that can occur in the normal menstrual cycle, including spotting, metrorrhagia, menorrhagia, menometrorrhagia, hypermenorrhea, oligomenorrhea and amenorrhea. Each of these disorders was defined according to a set of criteria as described. Spotting: abnormal bleeding requiring no sanitary napkins and occurring between two consecutive periods either before or after the menstrual bleeding [32,33]. Metrorrhagia: Irregular uterine bleeding occurring in menstrual cycles in which ovulation occurs [32,33]. Menorrhagia: Heavy bleeding of more than 80 ml in each menstrual cycle [32,33]. Menometrorrhagia: Irregular and unpredictable menstrual cycles with heavy bleeding of more than 80 ml in each cycle [32,33]. Hypermenorrhea: Prolonged bleeding for more than 7 days in each cycle [32,33]. Oligomenorrhea: Bleeding for less than 3 days in each cycle [32,33]. Amenorrhea: The absence of menstrual bleeding for three normal menstrual cycles or for a period of six months in women who had normal menstruations in the past [32-33].

After obtaining the approval of the Ethics Committee of the university and written consent from the students, the students' anxiety levels were measured three weeks before the final exams using the Test Anxiety Scale containing 25 multiple-choice items with a minimum score of zero and a maximum of 75. Higher scores indicated a greater level of anxiety. Participants were divided into a "no anxiety", a "low anxiety", a "moderate anxiety" and a "high anxiety" group according to their scores. The validity and reliability of this questionnaire had already been confirmed in previous studies [34].

Following their completion of the Test Anxiety Scale, participants were given the demographic and obstetric questionnaire, the menstrual bleeding chart and Higham's pictorial chart to assess their menstrual bleeding and they were instructed on how to complete the chart. Higham's pictorial chart is a tool for determining the amount of menstrual bleeding in milliliter, in which the number of sanitary pads or tampons used per day, is ticked against its corresponding picture on the chart as a tally stick. The slightly wet pads receive one

point (1 ml), moderately wet pads receive 5 points (5 ml) and fully wet pads receive 20 points (20 ml). Once the menstrual bleeding stops, the total volume of bleeding is calculated by adding up the scores. If the amount of bleeding is more than 80 ml, the subject is taken to have menorrhagia. This chart has been used several times in different studies and has a confirmed validity and reliability and can serve as a standard and reliable tool [35]. The questionnaires were arranged to be filled out over three menstrual cycles after the subjects' anxiety was assessed, including the cycle during and the first and second cycles following the exam period. Participants filled out one questionnaire in each of their cycles. The researcher sampler remained in touch with participants throughout all the three cycles and collected the questionnaires at the end of each.

Descriptive statistics were used to describe the demographic and obstetric details of the subjects and the logistic regression analysis was then used to assess factors that could predict the incidence of menstrual disorders in the cycle during and the first and second cycles following the exam period. Cochran's test, McNemar's test, the Chi-squared test and the independent *t*-test were used to compare different factors between the group with and the group without menstrual disorders over the three cycles. The statistical analyses were performed in SPSS-20 at the significance level of $P < 0.05$.

Results

The mean test anxiety score obtained by the students was 41.41 ± 14.93. The majority of the students (50.5%) suffered from a moderate level of test anxiety. Menorrhagia was the most frequent type of menstrual disorder observed in the cycle during (29%) and the first and second cycles following (23.5% and 26.6%) the exam period. Significant differences were observed between the menstrual disorders occurring in the cycle during and the first cycle following the exam period and also between the disorders occurring in the cycle during and the second cycle following the exam period; however, no significant differences were observed between the menstrual disorders occurring in the first and second cycles following the exam period (Table 1).

After dividing participants according to their test anxiety level, significant differences were observed between the group with and the group without menstrual disorders in all the three cycles (Table 2).

During the exam period, the group with and the group without menstrual disorders were matching in terms of occupation ($P = 1$), marital status ($P = 0.24$), age ($P = 0.1$), body mass index (BMI) ($P = 0.63$), history of smoking ($P = 1$), household size ($P = 0.35$), number of trips taken during the last month ($P = 0.53$) and economic status ($P = 0.36$), but showed significant differences in terms of academic level ($P = 0.001$), academic term ($P = 0.001$), field of study ($P = 0.001$), ethnicity ($P < 0.001$), history of mental illness and depression ($P = 0.03$), history of acute stress over the past three months ($P = 0.016$) and history of stress requiring medication over the past three months ($P < 0.001$).

In the first cycle following the exam period, the two groups matched in terms of academic level ($P = 0.184$), field of study ($P = 0.072$), ethnicity ($P = 0.701$), marital status ($P = 0.53$), age ($P = 0.53$), BMI ($P = 0.82$), history of smoking ($P = 1$), household size ($P = 0.6$), number of trips taken during the last month ($P = 0.13$) and economic status ($P = 0.35$), but showed significant differences in terms of academic term ($P = 0.001$), history of mental illness and depression ($P = 0.001$), history of acute stress over the past three months ($P = 0.018$) and history of stress requiring medication over the past three months ($P = 0.002$).

In the second cycle following the exam period, the two groups matched in terms of marital status ($P = 0.08$), age ($P = 0.01$), BMI ($P = 0.051$), history of smoking ($P = 1$), household size ($P = 0.83$) and the number of trips taken during the last month ($P = 0.64$), but showed significant differences in terms of academic level ($P < 0.001$), academic term ($P = 0.028$), field of study ($P < 0.001$), ethnicity ($P = 0.001$), occupation ($P = 0.01$), economic status ($P = 0.01$), history of mental illness and depression ($P = 0.001$), history of acute stress over the past three months ($P < 0.001$) and history of stress requiring medication over the past three months ($P = 0.002$).

The independent *t*-test and the Chi-squared test showed significant differences between the groups in their obstetric details; during the exam period, these differences were observed in terms of history of taking OCPs, parity, number of menstrual cycles per year, contraception method used, history of surgery on the uterus and ovaries, type of surgery and history of taking medications affecting menstruation; in the first cycle following the exam period, the differences were observed in terms of parity, contraception method used, history of taking OCPs, type of surgery and history of taking medications affecting menstruation; in the second cycle following the exam period, the difference was observed in terms of age at menarche, parity, contraception method used, history of taking OCPs, type of surgery and history of taking medications affecting menstruation (Table 3).

The logistic regression model was used to assess the interventional effect of the variables that were significantly different between the two groups in the cycle during the exam period. The only remaining variables included the number of menstrual cycles per year ($P = 0.999$), the contraception method used ($P = 0.995$), the duration of taking OCPs ($P = 0.994$), mental illness and depression ($P = 0.997$)

Table 1: Comparing menstrual disorders in the three cycles (the cycle during and the first and second cycles following the exam period) using Cochran's and McNemar's tests.

Menstrual disorder	P-value
Difference between the three cycles	0.005
Difference between the cycle during and the first cycle following the exam period	0.009
Difference between the cycle during and the second cycle following the exam period	0.007
Difference between the first and second cycles following the exam period	1
Significant differences were observed between the menstrual disorders occurring in the cycle during and the first cycle following the exam period and also between the disorders occurring in the cycle during and the second cycle following the exam period; however, no significant differences were observed between the menstrual disorders occurring in the first and second cycles following the exam period.	

Table 2: Comparing the level of anxiety in the group with and the group without menstrual disorders during the three cycles using the Chi-squared test.

Menstrual disorder anxiety	Cycle during the exam period		P-value	First cycle following the exam period		P-value	Second cycle following the exam period		P-value
	With number (%)	Without number (%)		With number (%)	Without number (%)		With number (%)	Without number (%)	
None	4 (2.13)	8 (4.35)	< 0.001	4 (2.5)	8 (3.77)	< 0.001	4 (2.5)	8 (3.77)	0.027
Low	76 (40.43)	68 (36.96)		72 (45)	72 (33.96)		72 (45)	72 (33.96)	
Moderate	84 (44.68)	104 (56.52)		60 (37.5)	128 (60.38)		68 (42.5)	120 (56.61)	
High	24 (12.76)	4 (2.17)		24 (15)	4 (1.89)		16 (10)	12 (5.66)	
Total	188 (100)	184 (100)		160 (100)	212 (100)		160 (100)	212 (100)	
Significant differences were observed between the group with and the group without menstrual disorders in all the three cycles in total.									

Table 3: Comparing obstetric details in the group with and the group without menstrual disorders using the independent t-test and the Chi-squared test.

Menstrual disorder	Cycle during the exam period (N = 372)		P-Value	First cycle following the exam period (N = 372)		P-Value	Second cycle following the exam period (N = 372)		P-value
	With mean (S.D)/ number(%)	Without mean (S.D)/ number(%)		With mean (S.D)/ number(%)	Without mean (S.D)/ number(%)		With mean (S.D)/ number(%)	Without mean (S.D)/ number(%)	
Age at menarche (in year)	13.35 (1.29)	13.48 (1.35)	0.35	13.31 (1.21)	13.49 (1.4)	0.19	13.21 (1.39)	13.57 (1.25)	0.01*
Duration of taking OCPs (in month)	2.57 (1.62)	4 (2.31)	0.004*	3 (1.93)	3.54 (2.23)	0.39	2.8 (1.76)	3.67 (2.27)	0.13
Parity	0.02 (0.145)	0 (0)	0.045*	0.03 (0.157)	0 (0)	0.045*	0 (0)	0.2 (0.136)	0.045*
Frequency of menstrual cycles per year Less than 6 times 6 times or more	12 (6.82) 164 (93.18)	4 (2.27) 172 (97.73)	0.04*	8 (5.41) 140 (94.59)	8 (3.92) 196 (96.08)	0.51	8 (5.41) 140 (94.59)	8 (3.92) 196 (96.08)	0.51
Contraception method used Hormones Condoms IUD Natural contraception No methods	4 (2.13) 8 (4.25) 4 (2.13) 4 (2.13) 168 (89.36)	8 (4.35) 20 (10.87) 0 0 156 (84.78)	0.005*	8 (5) 8 (5) 0 0 144 (90)	4 (1.89) 20 (9.43) 4 (1.89) 4 (1.89) 180 (84.9)	0.02*	8 (5) 8 (5) 4 (2.5) 0 140 (87.5)	4 (1.89) 20 (9.43) 0 4 (1.89) 184 (86.79)	0.009*
History of taking OCPs Yes No	36 (19.15) 152 (80.85)	44 (23.91) 140 (76.09)	0.26	20 (12.5) 140 (87.5)	60 (28.3) 152 (71.7)	< 0.001*	24 (15) 136 (85)	56 (26.42) 156 (73.58)	0.008*
Surgery on the uterus or ovaries Yes No	0 188 (100)	8 (4.35) 176 (95.65)	0.004*	4 (2.5) 156 (97.5)	4 (1.89) 208 (98.11)	0.69	4 (2.5) 156 (97.5)	4 (1.89) 208 (98.11)	0.69
Type of surgery None Cystectomy Laparoscopy	188 0 0	176 (95.65) 4 (2.175) 4 (2.175)	0.015*	156 (97.5) 4 (2.5) 0	208 (98.11) 0 4 (1.89)	0.016*	156 (97.5) 4 (2.5) 0	208 (98.11) 0 4 (1.89)	0.016*
Pregnancy during the past 6 months Yes No	0 1 (100)	0 1 (100)	1	0 1 (100)	0 1 (100)	1	0 1 (100)	0 1 (100)	1
Abortion during the past 6 months Yes No	0 1 (100)	0 1 (100)	1	0 1 (100)	0 1 (100)	1	0 1 (100)	0 1 (100)	1
Childbirth during the past 6 months Yes No	0 1 (100)	0 1 (100)	1	0 1 (100)	0 1 (100)	1	0 1 (100)	0 1 (100)	1
Breastfeeding during the past 6 months Yes No	0 1 (100)	0 1 (100)	1	0 1 (100)	0 1 (100)	1	0 1 (100)	0 1 (100)	1
Use of medications affecting menstruation Yes No	32 (17.02) 156 (82.98)	64 (34.78) 120 (65.22)	< 0.001*	20 (12.5) 140 (87.5)	76 (35.85) 136 (64.15)	< 0.001*	20 (12.5) 140 (87.5)	76 (35.85) 136 (64.15)	< 0.001*
History of diseases affecting menstruation Yes No	20 (10.64) 168 (89.36)	20 (1087) 164 (89.13)	0.94	12 (7.5) 148 (92.5)	28 (13.21) 184 (86.79)	0.079	12 (7.5) 148 (92.5)	28 (13.21) 184 (86.79)	0.079
Changes in menstrual bleeding over the past 3 months Yes No	24 (12.27) 164 (87.23)	28 (15.22) 156 (84.78)	0.49	16 (10) 144 (90)	36 (16.98) 176 (83.02)	0.055	20 (12.5) 140 (87.5)	32 (15.09) 180 (84.91)	0.48

*A significant difference was observed between the groups with and without menstrual disorder in their obstetric details before using thelogistic regression model.

Table 4: The odds ratio of test anxiety level and some of the intervening variables affecting the incidence of menstrual disorders in the first and second cycles following the exam period using stepwise logistic regression.

Variable	First cycle following the exam period				Second cycle following the exam period			
	OR	*P*-value	95% CI of the OR		OR	P-value	95% CI of the OR	
			Lower bound	Upper bound			Lower bound	Upper bound
Test anxiety level	-	-	-	-	0.407	< 0.001	0.254	0.651
Academic term	0.593	0.01	0.399	0.881	-	-	-	-
Academic level	-	-	-	-	0.131	< 0.001	0.048	0.354
Ethnicity	-	-	-	-	0.756	0.009	0.612	0.933
Economic status	-	-	-	-	0.638	0.001	0.486	0.838
History of taking OCPs	1.936	0.032	1.06	3.535	-	-	-	-
Use of medications affecting menstruation	2.462	0.003	1.363	4.449	3.44	< 0.001	1.782	6.643
Mental illness and depression	5.747	0.002	1.925	17.151	9.748	0.001	2.496	38.074

Variables that could predict the incidence of menstrual disorders in the first and the second cycle following the exam period according to logistic regression model.

and history of acute stress over the past three months (P = 0.999), none of which had an effect on the incidence of menstrual disorders in the cycle during the exam period.

The logistic regression model was also used to assess the interventional effect of the variables that were significantly different between the two groups in the first and second cycles following the exam period. According to this model, academic term, history of taking OCPs, history of taking medications affecting menstruation and history of mental illness and depression were variables that could predict the incidence of menstrual disorders in the first menstrual

cycle following the exam period, while test anxiety level, academic level, ethnicity, economic status, history of taking medications affecting menstruation and mental illness and depression could predict the incidence of menstrual disorders in the second cycle following the exam period (Table 4).

Discussion

According to the results obtained, the students' mean test anxiety score was 41.41 ± 14.93. The majority of the students (50.5%) suffered from moderate levels of test anxiety. The incidence of menstrual disorders was greater in the cycle during than in the first and second cycles following the exam period. Menorrhagia was the most frequent type of menstrual disorder that occurred during the three cycles. A significant relationship was found between test anxiety and the incidence of menstrual disorders in the second cycle following the exam period; however, this relationship was not significant in the cycle during and the first cycle following the exam period. The incidence of menstrual disorders was affected by academic term, history of taking OCPs, history of taking medications affecting menstruation and history of mental illness and depression in the first cycle following the exam period, and by test anxiety level, academic level, ethnicity, economic status, history of taking medications affecting menstruation and history of mental illness and depression in the second cycle following the exam period.

Previous studies conducted on Iranian female nursing and midwifery students have shown moderate levels of test anxiety in the majority of students [36-38], which is consistent with the results of the present study. In contrast, studies conducted by Yousefi in Kurdistan University of Medical Sciences and by Sahebulzamani in Isfahan University of Medical Sciences showed high levels of test anxiety in the students [39,40]. The difference in the levels of test anxiety reported in these studies may be attributed to the different factors that can affect test anxiety and also the individual interpretations of these factors. Women are more likely to experience test anxiety than men [40]. Factors affecting test anxiety include prolonged exam periods, the lack of physical activity, the extensive scope of the field of study, the lack of knowledge about anxiety reducing techniques or their non-application in case the knowledge does exist, difficulty of the course material, the professors' design of the test questions, the students' academic abilities, the exam's competence to evaluate the students, the lack of concentration and the existence of distractions, poor test environments and the status of the educational system [36,37]. These factors are obviously not similar in different universities and faculties. A large part of the disparity of results between different studies can thus be attributed to these factors.

Exams are a potential cause of stress. Stress is a very important factor affects the level of test anxiety. The brain is the central organ of stress and adaptation to stress. Acute and chronic stress cause an imbalance of neural circuitry subserving cognition and anxiety [25]. Stress exerts its effects through permeating the endocrine gland system. Stress causes ACTH secretion from the anterior pituitary, resulting in the stimulation of adrenal secretion of cortisol and other glucocorticoids, which then leads to the inhibition of LH secretion [26]. Stress is also known to increase gonadotropin inhibiting hormone (GnIH) levels in the brain [41], which in turn inhibits the secretion of GnRH as well as Fsh and LH [27]. In periods of crisis, the suppression of LH and Fsh caused by the secretion of glucocorticoids and GnIH can disrupt the menstrual cycle. The present study used the lambda coefficient and found a high correlation between test anxiety and menstrual disorders in the three cycles (the cycle during and the first and second cycles following the exam period) while ignoring the other intervening variables ($P < 0.001$ in all the three cycles). The mean test anxiety score was higher in all the three cycles in the group with menstrual disorders compared to in the group without; however, the difference was not significant. Also, after dividing the anxiety into subgroups, it was observed that the menstrual disorders in groups with low and high anxiety was higher, but in the group with average anxiety was lower than the other groups, in all three cycles; the difference was not significant too. The frequency of the incidence of menstrual disorders was higher in the cycle during than in the first and second cycles following the exam period, and menorrhagia was found to be the most frequent type of menstrual disorder in all the three cycles. Entering the other intervening variables into the logistic regression model led to the observation that, despite the greater incidence of menstrual disorders in the cycle during the exam period, test anxiety only affected the incidence of menstrual disorders in the second cycle following the exam period. Lee, et al. were the first to address the relationship between test anxiety and menstrual disorders and thus found that changes in the menstrual pattern are greater in high school students with higher levels of test anxiety [31]. Sigmon, et al. showed that students with higher levels of anxiety present more menstrual symptoms compared to students with lower levels of anxiety [42]. Other studies have also reported a higher incidence of menstrual disorders due to high levels of depression and anxiety [23,24,43]. Menstrual disorders appear to be affected by several intervening factors. In the present study, the role of test anxiety was reported to be small in the cycle during and the first cycle following the exam period, which must be due to the study's assessment of a larger number of factors compared to the other studies on the subject. However, the effect of anxiety on the second cycle following the exam period suggests the long-lasting effect of anxiety on hormonal regulation and the menstrual cycle.

The present study found significant inverse relationships between academic term and the incidence of menstrual disorders in the first cycle following the exam period and between academic level and the incidence of menstrual disorders in the second cycle following the exam period. The highest rate of menstrual disorders occurred at lower academic terms and levels. No studies had previously investigated the direct effect of academic term on the incidence of menstrual disorders. In a study conducted by Bromberger, menstrual disorders were found to be more prevalent in women with lower levels of education; however, the relationship was not significant [44]. In a study conducted by Agarwal, no relationships were observed between the level of education and the incidence of menstrual disorders [45]. Academic term and level are independent factors that do not directly affect the incidence of menstrual disorders and may simply impose their potential effect through factors such as the difficulty of the course material, learning about the instructors' teaching methods, learning study skills, learning about the new environment and getting used to a new lifestyle and their consequent potential effects on the level of anxiety, and also through increasing the level of knowledge and the consequent changes in lifestyle and nutritional habits.

The present study found significant inverse relationships between the history of taking medications affecting menstruation and OCPs and the incidence of menstrual disorders in the first cycle following the exam period and also between the history of taking medications affecting menstruation and the incidence of menstrual disorders in the second cycle following the exam period. In other words, menstrual disorders occurred less in students who had a history of taking medications affecting menstruation and OCPs. The medications used by the participants included Metformin, non-steroidal anti-inflammatory drugs (NSAIDs, including Naproxen and Mefenamic acid) and hormone pills and OCPs (low dose contraceptive pills (LD), high dose contraceptive pills (HD), Cyproterone Compound and Medroxyprogesterone). Many studies have shown that a history of using NSAIDs and OCPs contributes to controlling the amount of bleeding and reduces its duration more effectively [46,47]. Moreover, a history of taking Metformin and hormonal medications contributes to controlling and reducing a variety of menstrual disorders [48,49]. These studies were consistent with the present study. However, some studies found no relationships between the history of taking OCPs and hormonal medications and the incidence of menstrual disorders [50,51]. The disparity of findings may be due to the differences in sample size, genetics, nutrition, age range, level of daily physical activity and the type, method and duration of medication intake.

The chaotic physiological systems in patients with mental disorders may contribute to menstrual disorders through affecting

the hypothalamic-pituitary-adrenal axis or hypothalamic-pituitary-ovarian axis. Fluctuations in estrogen levels may be responsible for abnormal menstrual bleeding and dysfunctional neurotransmitter systems (especially serotonergic and noradrenergic systems) in the brain circuits, which mediate symptoms of depression [44]. Bromberger et al. found a significant relationship between the history of depression and the incidence of menstrual disorders [44]. A number of other studies have also reported significant relationships between mental disorders and menstrual problems, but without specifying the nature of the mental illness or the time of its development (i.e. recent or past) or the type of the menstrual disorder developed [43,52,53]. One of these studies shows that heavy bleeding, painful contractions and premenstrual syndrome (PMS) are twice more likely to occur in women aged 18-55 with at least one serious mental illness compared to women without these symptoms [43]. Two other studies have reported that women aged 40-55 and 35-59 who have mental disorders experience more severe bleeding compared to those without these disorders [52,53]. Similarly, in the present study, a direct relationship was observed between the history of mental disorders and depression and the incidence of menstrual disorders in the first and second cycles following the exam period.

The present study found a significant relationship between ethnicity and the incidence of menstrual disorders in the second cycle following the exam period. In this cycle, the number of individuals with menstrual disorders was greater than the number of those without them among the Kurd population, fewer among the Lur and Turk populations and almost identical among the Fars population of Iran. The relationship between ethnicity and menstrual disorders has also been demonstrated in other studies [16,54]. The differences observed between the ethnicities may be due to the differences in genetic factors, lifestyles and nutritional habits.

A better economic status leads to an improved lifestyle and nutrition, which in turn reduces the incidence of menstrual disorders [50,55]. The present study found a significant inverse relationship between economic status (determined by floor area occupied by the family, type of family residence and monthly family income) and the incidence of menstrual disorders. In other words, individuals with a higher economic status are less likely to develop menstrual disorders. Studies conducted by Fikree and Harlow were consistent with the present study [7,56]. In contrast, studies conducted by Shahbazian and Tak-Falah found no relationships between socioeconomic status and the incidence of menstrual disorders [57,58]. The disparity of results may be due to the differences in the subjects' age range and the small number of subjects that were economically well-off in the discussed studies.

The main points of strength for the present study include the novelty of its subject, its use of census sampling, its assessment of a large number of factors interfering in the incidence of menstrual disorders and its use of the longitudinal method of research. The limitations of the study include its collection of data through questionnaires, which may have restricted the students' full disclosure of their mental problems, smoking, history of pregnancy and abortion and history of taking various medications such as OCPs. We suggest a long term follow up study to determine whether the impact of the anxiety would have long term effect in these women in their general health or is this only a transit, short term effect, in future studies.

Conclusion

The results obtained indicate that test anxiety, academic level, academic term, ethnicity, economic status, history of taking OCPs, history of taking medications affecting menstruation and history of mental illness and depression are related the incidence of menstrual disorders in the first and second cycles following the exam period. Among these factors, test anxiety appears to be the one that can be effectively manipulated before and during the exam period through encouraging physical activities, teaching anxiety reducing techniques and coping mechanisms, increasing the students' concentration and implementing different strategies, which then leads to a reduced incidence of menstrual disorders among students.

Conflicts of interest

The authors report no declaration of Interests.

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