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Articles

The Effect of Stress on Menstrual Dysfunction in Female Students of Higher Educational Institutions in Moscow

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Abstract

Background: Gynecological morbidity in women of young reproductive age remains an urgent issue in modern medicine. Along with many adverse factors affecting the health of girls and young women, who should be considered as expectant mothers, stress takes one of the leading positions.

Objective: To study the level of stress in female students with menstrual dysfunction.

Materials and methods: 136 female students from 18 to 23 years old (average age 19.3 ± 2.6 years). All of the participants completed a questionnaire compiled by the authors on the basis of standard questions in collecting general and gynecological anamnesis, criteria for diagnosing premenstrual syndrome, psychological stress scale PSM-25 (fully included, no changes), and Beck scale (fully included, no changes). The following features of the menstrual cycle were studied: cycle duration, menstruation duration, profusion, soreness, and regularity of menstruation as well as the presence of psycho-emotional changes during the phase changes of the cycle. A systematic review was carried out of 25 studies (review articles, qualitative studies, questionnaires, retrospective and prospective studies) published in Russian and English from 2000 to 2019 (with a predominant including (88%) data for the last 10 years) using the PubMed, ScienceDirect, ProQuest and GoogleScholar databases.

Results: 82.4% (n = 112) of the examined female students had various menstrual dysfunctions; the highest frequency was premenstrual syndrome (91.1%) and primary dysmenorrhea (85.7%). Students with high levels of stress and depression expressed significantly more often ($p < 0.05$) with irregular rhythms of menstruation in comparison to the healthy group.

Conclusions: It is recommended to physicians take into account the stress influence on gynecological pathology, while the awareness of young women about their health status should also be raised.

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1. Introduction

Gynecological morbidity in women of young reproductive age remains an urgent issue in modern medicine. Along with many adverse factors affecting the health of girls and young women, who should be considered as expectant mothers, stress takes one of the leading positions. Menstrual irregularities are diagnosed in 2-5% of women of reproductive age, which increases significantly among patients experiencing stress (Nagma et al., 2015; Savelyeva et al., 2017; Volel et al., 2016).

Although the general mechanisms for the development of a stress response are well understood, in each case the response to stress is purely individual, even when exposed to stress of the same intensity or duration (Delara & Woodgate, 2015; Maniam et al., 2014; Palm-Fischbacher & Ehlert, 2014). This depends on many factors, including the personality structure, level of social support, place of residence, presence of a permanent sexual partner, children, etc. (Odacı et al., 2017; Sorrenti et al., 2019). Some people with extremely low stress resistance may develop a pathological reaction (violation of adaptive mechanisms) in response to a stressful event that does not go beyond ordinary or everyday mental stress (Gómez et al., 2020; Ramlan et al., 2020).

Students whose parents are highly educated and those whose families have higher incomes have been found to be less likely to suffer from psychological distress (Islam et al., 2018). According to another study, 75.6% of medical students perceived their stress to be due to their studies (Jafri et al., 2017). Academic-related stressors include exams, failure to achieve, poor time management, the large amount of content to be learnt, poor marks and the desire to do well (high self-expectations) (Kulsoom et al., 2015). In addition, social issues, such as the death of loved one, relationship problem and home and family disharmony, can affect psychological health (Fuad et al., 2015).

Stress activates a hormonal pathway in the body called the hypothalamic-pituitary-adrenal (HPA) axis (Delara & Woodgate, 2015; Maniam et al., 2014; Palm-Fischbacher & Ehlert, 2014). Activation of the HPA axis is associated with an increase in the levels of cortisol and corticotropin-releasing hormone (CRH) (Delara & Woodgate, 2015; Maniam et al., 2014; Palm-Fischbacher & Ehlert, 2014). The hypothalamic-pituitary-adrenal axis, cortisol, and CRH help control the response to stress in the body (Maniam et al., 2014). The release of corticotropin-releasing hormone and cortisol can suppress normal levels of reproductive hormones, leading to anovulation or amenorrhea (Delara & Woodgate, 2015; Palm-Fischbacher & Ehlert, 2014). Singh et al. (2015) note that stress increases not only the cortisol level but also the levels of progesterone and its metabolite allopregnanolone. The results of experimental studies indicate

that progesterone and allopregnanolone can both increase stress and reduce stress and anxiety (Singh et al., 2015). From another side, it was found female students to be significantly more anxious and distressed compared with male students (Abdallah & Gabr, 2014; Adhikari et al., 2017). Progesterone is responsible for ovulation, and since premenstrual syndrome occurs in ovulatory cycles, progesterone is probably the main cause of premenstrual symptoms in stress-sensitive women (Pavlova et al., 2013; Singh et al., 2015).

During examination sessions, up to 25% of students have dysmenorrhea of varying severity, including rhythm disturbance and variations in menstruation duration, i.e., polymenorrhea, hyper- or hypomenorrhea (Pavlova et al., 2013; Said & Mettwaly, 2017; Singh et al., 2015). In contrast to "classical" stress according to G. Selye, the basis of emotional (in this case, examination) stress are the primary changes in mental activity that occur during intensive preparation for exams (Pavlova et al., 2013). At the same time, the leading factor in the development of stress among students is mental overstrain due to the formation of a focus of persistent nervous excitement, which can lead to insomnia, decreased appetite, shifts in the functioning of the gastrointestinal tract, etc. (Pavlova et al., 2013). It should be noted that adaptation disorders and the psychobiological characteristics of the body in young girls under the influence of stress can lead to impaired fertility at an older age, which emphasizes the relevance of the problem under discussion. Moreover, when consulting such patients, it is difficult, and sometimes impossible, to determine the threshold at which stress will not adversely affect reproductive function and quality of life (Nagma et al., 2015). This study was conducted to determine the level of stress and its severity in female students of higher educational institutions with various menstrual irregularities.

2. Materials and Methods

From October 2018 to March 2019, 136 girls from 18 to 23 years old (average age 19.3 ± 2.6 years) who were students of higher educational institutions were examined. Group 1 consisted of 112 students with menstrual irregularities, and Group 2 comprised 24 conditionally practically gynecologically healthy girls without impaired reproductive function.

Exclusion criteria were the presence of a number of gynecological diseases, namely uterine fibroids, endometriosis, PCOS, and acute inflammatory gynecological diseases, as well as hormonal contraception, intrauterine contraceptive, pregnancy, lactation, and mental illness, and a combination of education at university and work.

All of the participants completed a questionnaire compiled by the authors on the basis of standard questions in collecting general and gynecological anamnesis, criteria for diagnosing premenstrual syndrome, psychological stress scale PSM-25 (fully included, no changes), and Beck scale (fully included, no changes) (Kupriyanov & Kuzmin, 2012; Savelyeva et al., 2017; Vodopyanova & Starchenkova, 2005).

The following features of the menstrual cycle were studied: cycle duration, menstruation duration, profusion, soreness, and regularity of menstruation as well as the presence of psychoemotional changes during the phase changes of the cycle.

The PSM-25 scale was chosen because it enables the measurement of stress sensations in somatic, behavioral and emotional indicators and is intended to measure stress as a natural state of mental tension. There is a correlation between the integral indicator PSM and the Spielberger anxiety scale ($r = 0.73$), with the Beck Depression Inventory index ($g = 0.75$) (Kupriyanov & Kuzmin, 2012).

The study was approved by the Ethics Committee Of Medical Institute at the RUDN University (№22). The study protocol complied with Russian rules regulations and guidelines for Good Clinical Practice. Due to the retrospective nature of the study, oral informed consent was obtained from the patients before study inclusion according to the World Medical Association's Declaration of Helsinki and Federal law No. 323-FZ of 21.11.2011 (as amended on 28.12.2013) "On the basics of public health protection in the Russian Federation".

The statistical processing of the obtained results of the study was carried out in Microsoft Excel 2017 using average values (M), frequency (%), and reliability (p), which was determined using the student's criterion; the critical level in this study was taken as equal to 0.05.

3. Results

In the studied cohort of students ($n = 136$), 82.4% ($n = 112$) were diagnosed with various disorders of the menstrual cycle, with the greatest frequency being symptoms of premenstrual syndrome (91.1%) and primary dysmenorrhea (85.7%), as depicted in Figure 1. Opsenorrhea was detected in 23.2% of the respondents (cycle duration > 35 days), and promenomenorrhea in 5.4% (cycle duration < 21 days). Oligomenorrhea (shortening of the duration of menstrual bleeding) affected 5.4% of the examined students, polymenorrhea (more than 7 days of menstrual bleeding) affected 17.9% of patients. About a third of the girls surveyed (30.4%) complained of menorrhagia (heavy menstrual bleeding), and 14.2% of the respondents noted the presence of scanty discharge.

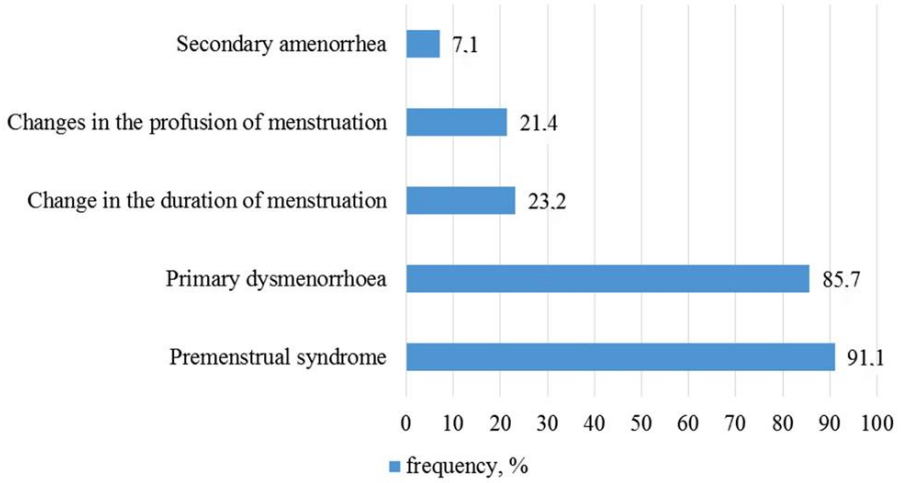

Figure 1. The frequency of menstrual irregularities in the examined students (n = 112)

We conducted a comparative analysis of demographic data among the students of both groups. It was found that the fact of living with parents was recorded significantly more often (66.1%) in students with menstrual irregularities compared to girls without reproductive system pathologies (33.3%, $p < 0.05$). The presence of a permanent partner was found significantly more often in healthy female students (75.0%) compared to patients with menstrual irregularities (39.2%, $p < 0.05$).

When analyzing the results of determining the level of stress using the PSM-25 scale (Figure 2), in students with menstrual irregularities and without pathology of the reproductive system, it was found that the examined Group 2 had low levels of stress significantly ($p < 0.05$) more often (75.0%) compared to Group 1 (51.7%). It is noteworthy that only patients with menstrual dysfunction had a high level of stress.

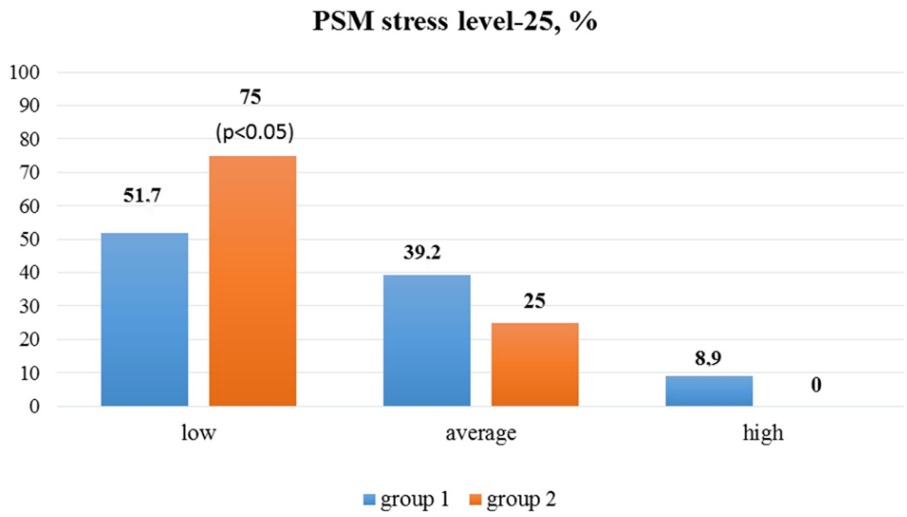

Figure 2. The frequency of the stress level on the PSM-25 scale in students of Group 1 (with menstrual irregularities) and Group 2 (without irregularities)

When assessing the frequency of symptoms of depressive states on the Beck scale in the participants of both studied groups (Figure 3), it was documented that students with menstrual dysfunction (Group 1) had mild depression, as well as asthenic-sub-depressive symptoms, significantly ($p < 0.05$) more often (57.1%) than the examined girls of Group 2 (33.3%). The frequency of a moderate degree of depression was established to be twice as high in girls with a pathology of the reproductive system.

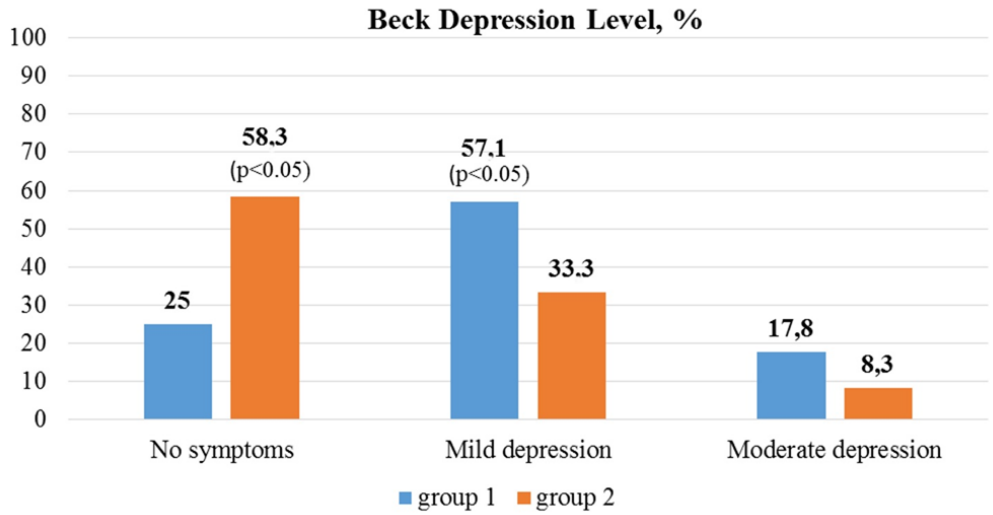

Figure 3. The frequency (%) of depressive states on the Beck scale in students of Group 1 (with menstrual irregularities) and Group 2 (without irregularities)

We found that students with high stress levels were 5.3 times more likely to suffer from irregular menstruation, 1.2 times more likely to have dysmenorrhea, and 1.1 times more likely to have symptoms of premenstrual syndrome (PMS). Similar data were obtained for cases of depression: Menstrual irregularities, dysmenorrhea and PMS were found to occur almost two times more frequently (Table 1).

Table 1. The frequency of stress and depression depending on the identified menstrual irregularities

Type of violation	PSM-25		Beck Scale	
	Low to medium stress	High stress	Lack of depression	Mild to moderate depression
Menstrual irregularities, excluding cases of secondary amenorrhea	15.6%	80%	33.3%	66%

Type of violation	PSM-25		Beck Scale	
	Low to medium stress	High stress	Lack of depression	Mild to moderate depression
Irregularities associated with a change in the profusion of menstruation	23.5%	20%	58.3%	50%
Secondary amenorrhea	5,9%	20%	0	100%
Symptoms of premenstrual syndrome	90.2%	100%	15.7%	84.3%
Primary dysmenorrhea	84.3	100%	39.6%	60.4%

After stress and depression diagnosis surveyed women were administrated to psychologist or psychiatrist consultation.

4. Discussion

The assessment of the menstrual cycle in this study was carried out on the basis of the National Gynecology Guide, 2017 (Savelyeva et al., 2017): The menstrual cycle was considered normal for a duration of 21-35 days, the normal duration of menstrual bleeding was considered to be 2-7 days, and the normal volume of menstrual blood loss was considered to be 50-80 ml. For convenience of perception and visualization, the revealed irregularities of the menstrual cycle were divided into two groups: 1) disturbances in the rhythm of menstruation, i.e. irregularities associated with a change in the frequency of menstruation, and 2) menstrual disorders, i.e. symptoms that occur against the background of a regular rhythm of menstruation in clear connection with certain days of the cycle (Kuznetsova, 2018). All cases of three or more episodes of deviations from the indicated duration of the normal cycle during the year preceding the survey were attributed to menstrual rhythm disturbances. It should be noted that the researchers did not aim to study various options for the irregularities of the duration of the menstrual cycle. Therefore, in the context of this study, only one type of irregularity was identified in a separate group, namely secondary amenorrhea, that is, the absence of menstruation for 6 months with a previously regular cycle (Savelyeva et al., 2017), since up to 30% of cases of secondary amenorrhea are functional hypothalamic amenorrhea, one of the reasons for which may be acute or chronic stress. In addition, the presence of primary dysmenorrhea, i.e. painful menstruation arising from the menarche or 1.5-2 years after the

establishment of ovulatory cycles, as well as premenstrual syndrome (at least 5 diagnostic criteria in the presence of at least one of the main criteria listed above) (Savelyeva et al., 2017).

Volel et al. (2016) note that in modern classification systems, all disturbances of the menstrual rhythm provoked by stress belong to the group of hypothalamic amenorrhea (N.91). In many studies, the concepts of "stress-provoked", "stress-dependent", and "hypothalamic" amenorrhea are synonymous, and the concept of "hypothalamic" is sometimes replaced by the term "psychogenic" amenorrhea, whereby the leading role in its occurrence is given to disorders of the central nervous system (Volel et al., 2016).

Pavlova et al. (2013) draw attention to the fact that under the conditions of study at universities, exam stress is repeated every 5 months for 5-6 years, which significantly affects the dysfunction of the menstrual cycle in students.

Currently, there are no population studies among female students of the Russian Federation exploring the prevalence of menstrual irregularities, as well as their relationship with stress levels, which underlines the relevance of this study. In this study, we seek to determine the prevalence of dysmenorrhea in young women studying in higher education as well as the relationship with the presence of a stress factor. The results of our study show that the prevalence of dysmenorrhea was relatively high (82.4%), but the figure obtained is consistent with previous studies from developing and developed countries. Published data show that the incidence of dysmenorrhea varies from 34% in Egypt to 80% in Australia, while it has been shown to affect 85% of Spanish-speaking teenage girls and 94% in Oman (Abu Helwa et al., 2018; Banikarim et al., 2000; De Sanctis et al., 2016; Hillen et al., 1999). It is difficult to explain and interpret the differences in the prevalence of dysmenorrhea. Nevertheless, the use of different criteria for determining dysmenorrhea in different studies, cultures, lifestyles, and genetics, as well as the degree of social and personal stress, are potential causes for the variations in the prevalence rate of dysmenorrhea.

We document the existence of a relationship between menstrual irregularities and the fact that the examined girls lived with their parents as well as the absence of a permanent sexual partner. Karout et al. (2012) also established a significant relationship between the place of residence of female students and dysmenorrhea: With logistic regression, the likelihood of dysmenorrhea was 8.93 times higher among single students than those who were married, and 2.04 times higher among students who lived in a dormitory than those who lived with their family. Karout et al. (2012) also proved the relationship between marital status and regular menstruation (OR 2.18) and dysmenorrhea (OR 8.93). We documented the existence of a relationship between menstrual irregularities and the fact that the examined girls lived with their parents and did not

have a permanent sexual partner. Karout et al. (2012) also established a significant relationship between the place of residence of female students and dysmenorrhea: With logistic regression, the likelihood of dysmenorrhea was 8.93 times higher among single students than those who were married, and 2.04 times higher among students who lived in a dormitory than those who lived with their family. Karout et al. (2012) proved the relationship between marital status and regular menstruation (OR 2.18) and dysmenorrhea (OR 8.93).

According to the data obtained, the incidence of PMS was 91.1%, which slightly exceeds the data available in the literature for Russia, according to which the incidence of PMS in the structure of gynecological morbidity is 20-85% (Unanyan et al., 2018). In the cohort of patients of Arslantaş (Arslantaş et al., 2018), this indicator is 57.1%, and in the work of Malik (Malik & Bhat, 2018), it reaches 80%.

In our sample of patients, menstrual rhythm disturbances were documented with a frequency of 28.5%, opsomenorrhea was detected in 23.2% of the examined students, and 5.9% of the students surveyed had amenorrhea. In a study by Azis et al. (2018), the frequency of opsomenorrhea was approximately 2 times lower than the index of our sample (12.34%), and in a study by Bindoo Yadav (Yadav & Taneja, 2019), the discussed indicator was 77.7%.

This study aims to identify the relationship between the stress factor and menstrual irregularities among university students in Moscow. Early on, Yusoff et al. (2010) and Saini et al. (2010) revealed a high level of stress among students, reaching 32.8% and 36.4%, respectively, and the results of a study by Quince et al. (2012) document that from 8.2% to 10.6% of students in Cambridge suffer from depression of varying severity. Nagma et al. (2015), using the chi-square criterion, established a relationship between high levels of stress and irregular menstrual cycles in students. Delara and Woodgate (2015) established the presence of psychological disorders (depressive states) significantly more often in students with an irregular menstrual cycle compared to examined girls without a pathology of the reproductive system. The results in terms of the level of stress and depression on the PSM-25 and Beck scales in our study indicate that students with high levels of stress and depressive states of varying severity are significantly more likely ($p < 0.05$) to have irregular menstruation compared to healthy peers.

Among the menstrual irregularities that were more common among students with high levels of stress, dysmenorrhea and symptoms of premenstrual syndrome, as well as menstrual rhythm disturbances, which were found in 100% of respondents in the group number 2, can be distinguished first. No dependence on the presence of menorrhagia on the level of stress was found; however, half of the girls surveyed (50.0%) claimed that the reason for their profuse menstruation was precisely the effect of the stress factor. It is noteworthy that more than half

of the respondents (57%) had combined menstrual irregularities. Most often, among the causes of stress and depression, the participants highlighted problems with the educational process and personal relationships. It should be noted that 83% of the examined students with a pathology of the reproductive system perceived their symptoms (especially dysmenorrhea and PMS symptoms) as acceptable and did not require the help of a doctor, regardless of the severity of their condition. Moreover, only 1 out of 4 respondents suffering from amenorrhea said the planned to seek the advice of a specialist.

5. Conclusion

Stress activates the complex hormonal mechanisms of the body, which have a pathological effect, including on the reproductive system of young women. The data in the literature, as well as the results of our own studies, indicate a higher frequency of various menstrual irregularities among girls with high levels of stress and depression. Therefore, when advising female students, both those who are healthy and those suffering from any reproductive system disorders, it is recommended that specialists take into account the effects of stress and its adverse effects on the formation of gynecological pathology, while the awareness of young women about their health status should also be increased. Student support counselling services on campus or as part of external contact organizations were suggested. The limitation of our study is the small sample size (especially of healthy young women); therefore, taking into account the results obtained, which are also comparable with global data, and considering the status of the studied patient population as an important "reproductive fund of the country", we recommend conducting larger multicenter studies to study the adverse effects of the stress factor on the health status of students.

Conflict of Interest Statement

The authors declare that the research was conducted in the absence of any potential conflict of interest.

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