

Stress as a risk factor for menstrual disorders

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Abstract. Introduction: Stress is defined as the body’s response to a stressor action. During ones’ lifespan, the female reproductive system undergoes a series of monthly cyclical morphofunctional changes, called menstrual cycle and aims at preparing the female body for a potential pregnancy. Despite the high prevalence of stress and its adverse health effects that have been scientifically proven, its action mechanisms are still unclear, remaining at the stage of hypotheses. The current study has the following objectives: research current prevalence of stress in Romanian female population; explore its association with age, workplace, academic environment; research the link between stress as a risk factor, and menstrual disorders in a female population in the country. Material and method: The study includes 678 women between 18 and 39 years old. Data collection was conducted using an online survey distributed via email and social networks. The questionnaire used is a “self-administered survey”, consisting of four parts, with a total of 25 questions. The first part collects demographics data of the participants, the second section assesses the psychological stress levels of the participants, the third part is allocated to symptoms and menstrual disorders, and the fourth to premenstrual symptoms. Results: The level of psychological stress among the study participants is high, in 91.9% of subjects, obtaining high or very high levels according to PSS-10 (Perceived Stress Scale – 10). Only 5.8% of them have a medium level of stress, 1.8% reported a low level of stress, and 0.6% have a very low stress. There have been observed the same high levels of psychological stress, regardless of age. It was noted that more than half of women surveyed (59.9%) have abnormal uterine bleeding of moderate severity, while in 39.4% the symptoms are mild. Only 0.7% have severe symptoms. 64.2% of women experience premenstrual syndrome, 3.5% have premenstrual dysphoric disorder, the remaining 32.3% having symptoms of low severity. After reviewing the results for each of premenstrual symptoms (PMS), it was observed a statistically significant correlation between them and increased stress levels for most classes of PMS symptoms (pain/breast congestion, musculoskeletal pains, pain/abdominal discomfort, edema, weight gain, bowel disorders). Conclusions: There is subjective correlation between stress levels and severity of abnormal uterine bleeding. With the exception of breast pain and congestion, edema, and weight gain, a statistically significant correlation has been observed between premenstrual symptoms classes and increased levels of stress.

Key Words: stress, menstrual cycle, premenstrual syndrome, premenstrual dysphoric disorder.

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Introduction

Stress is a multifaceted entity that includes both biopsychosocial and spiritual elements. It is defined as the body’s response to a stressor action. In psychology, stress refers to those situations perceived by individuals as threatening, outpacing their coping capabilities (Lazarus et al 1984). Selye suggested that stress is not always damaging, defining the terms of eustress and distress (Selye 1970). Selye describes several conditioning factors for the type of response to stressful situations. They can be internal (genetic factors, age, sex) or external (exposure to environmental agents, life experiences, diet, level of social support). The relative risk of developing a disorder associated with stress seems to be at least in part, dependent on these factors. A central part of the stress response is played by the corticotropin-releasing factor (CRF). It is an important endocrine regulator of both the pituitary and adrenal gland activity, as well as a neurotransmitter involved in autonomic nervous system

activity, metabolism, and behaviour (Chrousos 1998; Koob 1999; Lehnert et al 1998).

In the case of a severely acute stress, hyperexcitability of the Sympathetic Nervous System (SNS), and the entry into action of the hypothalamic-pituitary-adrenal axis with the discharge of large amounts of glucocorticoid hormone, lead to a disorder within the body, which causes short (hypoglycemia, palpitations, MI, stroke) or long term dysfunctionalities of any system (psychological shock, Post Traumatic Stress Disorder) (Miller et al 2007). The mechanisms through which chronic stress affects health are not fully understood. A potential mechanism appears to involve the hypothalamic-pituitary-adrenocortical axis (Flier et al 1998; McEwen 1993; Weiner 1992).

During ones’ lifespan, the female reproductive system undergoes a series of monthly cyclical morphofunctional changes that are called menstrual cycle. These changes are determined by sex hormones (estrogen and progesterone). Their secretion is under the direct control of hypothalamic-pituitary-gonadal axis (HPA), through the hypothalamic hormone GnRH (gonadotropin

releasing hormone) and follicle-stimulating hormones (FSH) and luteinotropic hormone (LH) (Porth et al 2011). Dysfunctional menstrual cycles are associated to the alterations of the hormones involved in the regulation of the cyclical endometrial changes, and they may be based on a primary or secondary ovarian condition. The latter can be caused by emotional stress, significant weight fluctuations, endocrine disorders (hypo/hyperthyroidism, disorders of the hypothalamic-pituitary axis) or nonspecific metabolics.

Stress response involves SNS activation with consequent augmentation of the release of epinephrine (adrenaline) from the adrenal medulla, in an adaptive attempt to combat the stressor. Putative mechanisms through which hormonal fluctuations determined by stress affect the menstrual cycle are not completely understood. Sufficiently intense stressors, or the chronic ones may disrupt the menstrual cycle altogether. Chronic psychological stress interferes with the normal reproductive function and it is considered a common factor of amenorrhea, within the functional hypothalamic chronic anovulation syndrome (FHCA). In addition, it was observed that intensity of the stressors that is too low to produce amenorrhea may, however, cause temporary menstrual disorders (Fink 2010). At the moment, there are few studies that use current diagnostic criteria for PMS (Premenstrual syndrome) and PMDD (Premenstrual Dysphoric Disorder). In one such study, Girdler et al. (1998) demonstrated that patients with PMDD have significantly elevated peripheral resistance and norepinephrine reactivity. In 2007, Epperson et al. demonstrated a significantly higher response to aggressive acoustic stimuli during the luteal phase compared with the follicular phase among women with PMDD, diagnosed according to DSM. Despite the high prevalence of stress and its adverse health effects that have been scientifically proven, its action mechanisms are still unclear. Moreover, the studies to examine the association between stress and disorders of the menstrual cycle in Romanian patients are very few. This should be of great concern, because, the presence of premenstrual dysphoric syndrome may influence the severity of the depression in menopause (Armean et al 2014).

The current study has the objective of researching the current prevalence of stress in a Romanian female population, explore its association with age, workplace and academic environment. We also aim at researching the link between stress as a risk factor and menstrual disorders in a female population in the country. The study aims at creating a Romanian validated questionnaire for assessing the relation between stress and menstrual disorders.

Material and method

This is an observational cross-sectional study, conducted between March and June 2016. The sample includes 678 women between 18 and 39 years old. Data collection was conducted using an online survey distributed via email and social networks. The introductory section of the questionnaire included the eligibility criteria, the purpose and the main objective of the study, as well as information regarding the use of the data provided, and the anonymity aspects. The consent of the participants was obtained with the approval of the Ethics Committee of the University of Medicine and Pharmacy "Iuliu Hatieganu" Cluj-Napoca. The questionnaire used is a "self-administered survey", consisting of four parts, with a total of 25 questions.

Table 1. PSS-10 Score Interpretation

| Level of psychological stress | PSS-10 Score |
|-------------------------------|--------------|
| Very Low | 0-7 |
| Low | 8-11 |
| Medium | 12-15 |
| High | 16-20 |
| Very High | 21-40 |

The first part collects demographics data of the participants (age, residence, education level, occupation). The second section assesses the psychological stress levels of the participants through PSS-10 scale (Perceived Stress Scale - 10). The third part is allocated to symptoms and menstrual disorders, and the fourth to premenstrual symptoms. The last two sections are an abridged version of a questionnaire previously used in other studies to evaluate the menstrual symptoms in patients with postural tachycardia syndrome (Paggs et al 2012) and those with vasovagal syncope (Muppa 2013). To assess stress levels, we used the Perceived Stress Scale - 10 question version (PSS-10) developed by Sheldon Cohen and his collaborators in 1983, downloaded from the website www.mindgarden.com. Interpretation of the questionnaire is in the form of a score. Minimum possible score is 0 and the maximum 40 (Table 1). Usually scores in groups with high levels of stress lies around 20.

As mentioned previously, the last two sections of the questionnaire used in this study are intended to gather data on menstrual and premenstrual manifestations among respondents. These two sections have been developed based on a broader and more detailed questionnaire previously used in other studies (Peggs 2012; Muppa 2013). Inclusion in premenstrual disorders was done as follows: PMS - the intensity of symptoms in the affective area and the ones among the classes "pain/breast congestion," "edema/weight gain" or "bowel disorders" is at least 3; PMDD - if the intensity of symptoms in class "Mood disorders" is 5 and that of symptoms from a minimum of 4 classes among "pain/breasts congestion", "Musculoskeletal pain", "edema/weight increase," "Bowel disorders" "Vegetative disorders" is at least 4. For menstrual disorders, but also for other factors that might influence these disorders, we have allocated a score to assess the intensity of the symptoms. The resulting value from the addition of these scores was divided into three intervals (0-3 mild; 4-7 moderate, 8-11 severe), each corresponding to a certain degree of severity of abnormal uterine bleeding. The score has indicative value; we used this method to simplify and briefly assess these types of disorders.

The statistical analysis and the graphs for this study were performed using SPSS version 20 (Statistical Package for the Social Sciences). In this research, apart from the descriptive analysis of variables (mean, median, modal value, standard deviation, minimum, and maximum) given the type and objectives formulated, we used cross tabulation, chi-square test, Cramer's V test and One-Way ANOVA.

Results

The sample includes women aged 18 to 39 years, distributed as observed in Table 2.

The level of psychological stress among the study participants is high, with no less than 91.9% of them obtaining a score that

Table 2. The distribution by age of the study participants

| | | Frequency | Percent |
|----------------|-------------|-----------|---------|
| Validated data | 18-25 years | 494 | 72.9 |
| | 26-30 years | 121 | 17.8 |
| | 31-35 years | 34 | 5.0 |
| | 36-39 years | 29 | 4.3 |
| | Total | 678 | 100.0 |

Table 3. Severity of abnormal bleeding per age group

| Age (years) | | Menstrual syndrome | | | Total |
|-------------|--------------|--------------------|----------|--------|--------|
| | | mild | moderate | severe | |
| 18-25 | Frequency | 189 | 302 | 3 | 494 |
| | % out of age | 38.3% | 61.1% | 0.6% | 100.0% |
| 26-30 | Frequency | 47 | 73 | 1 | 121 |
| | % out of age | 38.8% | 60.3% | 0.8% | 100.0% |
| 31-35 | Frequency | 15 | 18 | 1 | 34 |
| | % out of age | 44.1% | 52.9% | 2.9% | 100.0% |
| 36-39 | Frequency | 16 | 13 | 0 | 29 |
| | % out of age | 55.2% | 44.8% | 0.0% | 100.0% |
| Total | Frequency | 267 | 406 | 5 | 678 |
| | % out of age | 39.4% | 59.9% | 0.7% | 100.0% |

corresponds to high or very high levels according to PSS-10. Only 5.8% of them have a medium level of stress, 1.8% reported a low level of stress, and 0.6% have a very low stress. There have been observed the same high levels of psychological stress, regardless of the age of the women. Things are not different based on the level of stress by occupation, either. Regardless of occupation, high and very high levels of stress manifest in over 90% of women participating in the study.

Of the total sample, menstrual cycles are present in 98.7% (668) of women. The sample includes women whose age at first menstruation is between 8 and 18 years. The average age of menarche is 12.76 years, while the most frequent age at which first period is experienced is 12 years (modal value=12). It was noted that more than half of women surveyed (59.9%) have abnormal uterine bleeding of moderate severity, while in 39.4% the symptoms are mild. Only 0.7% have severe symptoms (Table 3). When asked if the changes during menstruation are more severe during stressful periods, it is observed that regardless of the intensity of abnormal uterine bleeding, the percentage of women who answered that these changes are more intense during periods of stress is approximately 60% (Table 4).

It also resulted that 64.2% of women experience premenstrual syndrome, 3.5% have premenstrual dysphoric disorder, the remaining 32.3% having symptoms of low severity.

Bivariate chi-square test (χ^2) indicated the presence of significant difference between women of different ages with respect to the premenstrual diagnosis ($\chi^2 = 15.663$, $df = 6$, $p = 0.016$) (Table 5).

After reviewing the results for chi-square tests and Cramer V for each of premenstrual symptoms, it was observed a statistically significant correlation between them and increased stress levels for most classes of PMS symptoms. For all studied classes of premenstrual symptoms, chi-square test showed p-values

Table 4. Correlations between the severity of menstrual bleeding and reported stress

| Degree of severity of abnormal menstrual bleeding | | Subjective correlation of the severity of uterine bleeding with stress | | Total |
|---|-----------|--|----------|--------|
| | | Negative | Positive | |
| mild | Frequency | 99 | 168 | 267 |
| | % | 37.1% | 62.9% | 100.0% |
| moderate | Frequency | 156 | 250 | 406 |
| | % | 38.4% | 61.6% | 100.0% |
| severe | Frequency | 2 | 3 | 5 |
| | % | 40.0% | 60.0% | 100.0% |
| Total | Frequency | 257 | 421 | 678 |
| | % | 37.9% | 62.1% | 100.0% |

Table 5. Frequency of different types of premenstrual disorder by age

| Age (years) | | Diagnostic | | | Total |
|-------------|--------------|---------------------------------|-------|----------|--------|
| | | Premenstrual dysphoric disorder | PMS | Molimina | |
| 18-25 | Frequency | 20 | 329 | 145 | 494 |
| | % out of age | 4.0% | 66.6% | 29.4% | 100.0% |
| 26-30 | Frequency | 3 | 75 | 43 | 121 |
| | % out of age | 2.5% | 62.0% | 35.5% | 100.0% |
| 31-35 | Frequency | 1 | 20 | 13 | 34 |
| | % out of age | 2.9% | 58.8% | 38.2% | 100.0% |
| 36-39 | Frequency | 0 | 11 | 18 | 29 |
| | % out of age | 0.0% | 37.9% | 62.1% | 100.0% |
| Total | Frequency | 24 | 435 | 219 | 678 |
| | % out of age | 3.5% | 64.2% | 32.3% | 100.0% |

ranging from 0.001 to 0.023, and the Cramer's V test showed p values between 0.104 and 0.153. Such statistical relationship between the two parameters (stress and different types of premenstrual symptoms) is significant with a reduced association (Table 6 and 7).

Discussions

The share of menstrual symptoms with different intensities is similar for almost all age groups except those aged between 36 and 39, where the share of menstrual syndrome is slightly higher compared to other age groups. However, the results show that this difference is not statistically significant. These results are supported by data from the literature that describe greater variability, at least for the menstrual rhythm among these age groups (Chiazze 1968).

More than 60% of women reported that changes during menstruation are more severe during stressful periods, expressing a subjective positive association between the two parameters. The share of the three degrees of severity of abnormal uterine bleeding (mild, moderate and severe) is about the same for all levels of stress, without statistically significant differences to be noticed. The prevalence of premenstrual dysphoric disorder is within the range described in literature (McEwen 1993). On

Table 6. Frequency of stress reported for patients with PMS symptoms

| | | Pain/breast congestion | | | | | Musculoskeletal pains | | | | | Pain/abdominal discomfort | | | | | Edema/weight gain | | | | | |
|---------------------------------|-----------|------------------------|----|-----|-----|-----|-----------------------|-----|-----|-----|-----|---------------------------|----|-----|-----|-----|-------------------|-----|-----|-----|----|----|
| Intensity of PMS symptom | | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | |
| Stress level | very low | Frequency | 1 | 1 | 0 | 2 | 0 | 3 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 2 | 1 | 2 | 0 | 1 | 0 |
| | | % | 25 | 25 | 0 | 50 | 0 | 75 | 0 | 0 | 25 | 0 | 25 | 0 | 0 | 25 | 50 | 25 | 50 | 0 | 25 | 0 |
| | low | Frequency | 4 | 3 | 2 | 3 | 0 | 4 | 6 | 2 | 0 | 0 | 3 | 4 | 4 | 1 | 0 | 10 | 1 | 0 | 1 | 0 |
| | | % | 33 | 25 | 17 | 25 | 0 | 33 | 50 | 17 | 0 | 0 | 26 | 33 | 33 | 8 | 0 | 8 | 8 | 0 | 8 | 0 |
| | medium | Frequency | 2 | 12 | 12 | 7 | 6 | 10 | 10 | 11 | 4 | 4 | 2 | 9 | 15 | 8 | 5 | 18 | 13 | 5 | 2 | 1 |
| | | % | 5 | 31 | 31 | 18 | 15 | 26 | 26 | 28 | 10 | 10 | 5 | 23 | 39 | 20 | 13 | 46 | 33 | 13 | 5 | 3 |
| | high | Frequency | 38 | 60 | 92 | 76 | 9 | 65 | 66 | 84 | 52 | 8 | 20 | 54 | 98 | 81 | 22 | 126 | 73 | 51 | 21 | 4 |
| | | % | 14 | 22 | 33 | 28 | 3 | 24 | 24 | 30 | 19 | 3 | 7 | 20 | 35 | 30 | 8 | 46 | 27 | 18 | 7 | 2 |
| | very high | Frequency | 43 | 68 | 121 | 95 | 21 | 58 | 81 | 114 | 73 | 22 | 17 | 59 | 111 | 119 | 42 | 146 | 88 | 70 | 35 | 9 |
| | | % | 12 | 20 | 35 | 27 | 6 | 17 | 23 | 33 | 21 | 6 | 5 | 17 | 32 | 34 | 12 | 42 | 25 | 20 | 10 | 3 |
| Total | | Frequency | 88 | 144 | 227 | 183 | 36 | 140 | 163 | 211 | 130 | 34 | 43 | 126 | 228 | 210 | 71 | 301 | 177 | 126 | 60 | 14 |
| | | % | 13 | 21 | 34 | 27 | 5 | 21 | 24 | 31 | 19 | 5 | 6 | 18 | 34 | 32 | 10 | 44 | 26 | 19 | 9 | 2 |

| | | Bowel disorders | | | | | Mood disorders | | | | | Vegetative disorders | | | | | |
|---------------------------------|-----------|-----------------|-----|-----|-----|-----|----------------|----|-----|-----|-----|----------------------|-----|-----|-----|----|----|
| Intensity of PMS symptom | | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | |
| Stress level | very low | Frequency | 1 | 0 | 2 | 1 | 0 | 2 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 2 |
| | | % | 25 | 0 | 50 | 25 | 0 | 50 | 25 | 25 | 0 | 0 | 25 | 0 | 25 | 0 | 50 |
| | low | Frequency | 6 | 3 | 3 | 0 | 0 | 5 | 4 | 1 | 2 | 0 | 8 | 2 | 0 | 2 | 0 |
| | | % | 50 | 25 | 25 | 0 | 0 | 42 | 33 | 8 | 17 | 0 | 66 | 17 | 0 | 17 | 0 |
| | medium | Frequency | 6 | 18 | 7 | 6 | 2 | 4 | 9 | 14 | 9 | 3 | 20 | 10 | 6 | 1 | 2 |
| | | % | 15 | 46 | 18 | 15 | 5 | 10 | 23 | 36 | 23 | 8 | 51 | 26 | 15 | 3 | 5 |
| | high | Frequency | 47 | 64 | 94 | 54 | 16 | 26 | 53 | 92 | 81 | 23 | 103 | 73 | 58 | 34 | 7 |
| | | % | 17 | 23 | 34 | 20 | 6 | 10 | 19 | 34 | 30 | 8 | 37 | 27 | 21 | 12 | 3 |
| | very high | Frequency | 48 | 66 | 101 | 107 | 26 | 16 | 57 | 89 | 116 | 70 | 94 | 94 | 95 | 44 | 21 |
| | | % | 14 | 19 | 29 | 30 | 8 | 5 | 16 | 26 | 33 | 20 | 27 | 27 | 27 | 13 | 6 |
| Total | | Frequency | 108 | 151 | 207 | 168 | 44 | 53 | 124 | 197 | 208 | 96 | 226 | 179 | 160 | 81 | 32 |
| | | % | 16 | 22 | 30 | 25 | 7 | 8 | 18 | 29 | 31 | 14 | 33 | 26 | 24 | 12 | 5 |

Table 7. Results for statistical tests of correlation between premenstrual symptom intensity and stress

| Premenstrual symptoms class | P Value for Chi-Square test | Correlation Parameter Value for Cramer V |
|----------------------------------|-----------------------------|--|
| Pain/Breast congestion | 0.086 | 0.094 |
| Musculoskeletal pains | 0.023 | 0.104 |
| Pain/abdominal discomfort | 0.015 | 0.106 |
| Edema. weight gain | 0.416 | 0.078 |
| Bowel disorders | 0.001 | 0.123 |
| Mood disorders | 0.000 | 0.153 |
| Vegetative disorders | 0.000 | 0.132 |

the other hand, PMS has a much higher prevalence compared to the values described.

Thus, in women up to 35 years old, there is a higher prevalence of premenstrual syndrome and premenstrual dysphoric disorder compared to women over 35 years of age. When it comes to age, the results are consistent with current literature, which tells us that PMS has a frequency among women of ages starting at the end of the third decade of life until the age of 40 years (Chiazze 1968). Cramer's V coefficient (Cramer's V = 0.107) indicates a low intensity relation between the two variables.

It should be noted that since accurate inclusion in the two diagnostics of syndrome and premenstrual dysphoric disorder are to be decided following a documented prospective investigation for at least 3 months, the current study has only presumptive value. Therefore, the link between premenstrual disorders and stress will be made, separately, for each of the symptom class to be encountered.

When asked whether changes in the premenstrual period are more frequent in stressful periods, it is observed that regardless of age, the percentage of people who observed a correlation

(with subjective value) is approximately 55-60%, which is also in accordance with the data described in the literature, with values between 50-68% (Lazarus 1984).

Conclusions

Stress levels among women in the selected sample is high. More than half of women surveyed have moderate severity of abnormal uterine bleeding. There is a subjective correlation between stress levels and severity of abnormal uterine bleeding. There is a statistically significant association of low intensity with the severity of abnormal uterine bleeding. As the stress level increases, there is a higher intensity of back pain, joint and muscle pain during PMS. Increased stress level is accompanied by higher intensities of pain and abdominal discomfort during PMS.

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Citation Covaliu BF, Predescu N, Armean SM, Minoiu C. Stress as a risk factor for menstrual disorders. *HVM Bioflux* 2017;9(1):6-10.

Editor Ștefan C. Vesa

Received 2 January 2017

Accepted 9 January 2017

Published Online 9 January 2017

Funding None reported

**Conflicts/
Competing
Interests** None reported