International Journal of Research in Medical Sciences
Pardeshi AM. Int J Res Med Sci. 2017 Aug;5(8):3644-3648
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012
DOI: http://dx.doi.org/10.18203/2320-6012.ijrms20173578

Original Research Article

Analysis of perceived stress, cardiovascular and central nervous system changes before and after menstruation in the age group 18-22 years

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Received: 07 June 2017
Accepted: 08 July 2017

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ABSTRACT

Background: Premenstrual syndrome is a set of physical, behavioural or emotional symptoms that some women experience on regular basis in relation to menstruation. Premenstrual symptoms have been associated with perceived stress, and perceived stress is the strongest predictor of premenstrual syndrome. The purpose of this study was to investigate the premenstrual stress and its effect on cardiovascular system and sensorimotor association and processing capability of central nervous system.
Methods: The present study was done in 60 healthy female volunteers in age group of 18-22 years. We measured following parameters during premenstrual and postmenstrual phases- pulse rate, blood pressure, weight, auditory and visual reaction time and perceived stress with the help of Cohen's perceived stress scale.
Results: The study revealed that significant increase was observed in perceived stress, pulse rate, blood pressure, weight, auditory reaction time (ART), and visual reaction time (VRT) during premenstrual period as compared to postmenstrual period.
Conclusions: These changes could be attributed to fluid and salt retention due to ovarian steroids and to exaggerated response to hormonal changes leading to decrease in the processing capability of central nervous system. It is not clear how stress may contribute to increased pre-menstrual symptom severity, although stress-induced changes in ovarian hormone levels and neurotransmitters may be involved.

Keywords: Auditory reaction time, Blood pressure, Perceived stress, Pulse rate, Visual reaction time, Weight

INTRODUCTION

Premenstrual syndrome is a major clinical entity affecting a large segment of female population.[1] Premenstrual syndrome is a set of physical, behavioural or emotional symptoms that some women experience on regular basis in relation to menstruation. The symptoms occur monthly generally within 7 to 14 days prior to menstruation. Symptoms may seem to worsen as menstruation approaches and subside at the onset or after several days of menstruation.[2]

Certain behavioural and neurological symptoms occur in women especially during premenstrual phase. Headache, painful enlargement of breast, decreased ability to concentrate, nervous irritability, emotional instability, poor judgments, depression, tension, weight gain, and increased blood pressure have been reported during premenstrual phase, and are associated with salt and water retention.

Premenstrual symptoms are the cyclical changes that a woman perceives as troublesome or problematic which

escalate before menstruation, whereas PMS is a diagnostic term used for the cyclic recurrence of psychological and/or physical symptoms within the luteal phase of menstrual cycle.[3]

Generally, more stressful life events, or stressful life context, has been related to pre-menstrual symptoms.[4] Stress viewed as chronic phenomena has been found to contribute a significant amount of variance in pre-menstrual symptoms and higher variance in general health scores.[5]

Premenstrual symptoms have been associated with perceived stress, and perceived stress is the strongest predictor of Premenstrual Syndrome.[6] In this study, we assessed stress by using perceived stress score (PSS scale).[7]

Perceived stress is one of the primary factors associated with premenstrual syndrome; ahead of physical activity and dietary patterns.[8] Reaction time means time taken by an individual to react to an external stimulus. It provides an indirect index of the processing capability of the central nervous system and a simple means of determining sensory motor performances.[9]

Since menstrual cycle is associated with varying levels of sex steroids, it was hypothesized that blood pressure, pulse rate and reaction time could be altered across normal menstrual cycle.

The purpose of this study was to investigate the premenstrual stress and its effect on cardiovascular system and sensorimotor association and processing capability of central nervous system.

METHODS

The study was carried out after the approval from ethics committee in 60 healthy female volunteers in the age group of 18-22 years. Detailed history like age of menarche, duration of menstrual cycle and flow of each cycle was noted.

Inclusion criteria

- Girls with history of regular menstrual cycle 28-30 days duration for at least last six months were selected.
- The study included one baseline clinic visit and 4 cycle visits (2 per cycle) over two menstrual cycles, scheduled to visit any days between 1-7 days prior to the onset of next menstruation (premenstrual phase) and 5th to 10th day of menstrual cycle (postmenstrual phase).

Exclusion criteria

- Subjects with irregular cycle.
- Subjects on oral contraceptive
- Subjects on exogenous hormones.

Equipment's

- Reaction time apparatus made by Anand agency, Pune-2.[10]
- Automated blood pressure apparatus
- Weighing scale
- Cohen's perceived stress scale.

Parameters measured

In study following parameters measured during premenstrual and postmenstrual phases-

- Pulse rate (per minute)
- Blood pressure (mm Hg)
- Weight (kg),
- Auditory and visual reaction time (milliseconds)
- Perceived stress with the help of Cohen's perceived stress scale.

For auditory reaction time (ART) the stimulus used was a tone and click. For visual reaction time (VRT) red and green lights incorporated on the instrument were used.

Perceived stress scale questionnaire

The Perceived Stress Scale is a 10-item self-report questionnaire that measures the persons' evaluation of the stressfulness of the situations in the past one month of their lives. The PSS is the only empirically established index of general stress appraisal.

In the present study, the students were explained about the PSS scale questionnaire in detail and were told to tick the appropriate numbers. Later, the total score was assessed.

For each question, they had to choose from the following alternatives: 0 - never, 1 - almost never, 2 - sometimes, 3 - often and 4 - very often.

Assessing the PSS score

The PSS score was determined by the following method:

First, by reversing the scores for questions 4, 5, 7 and 8. On these 4 questions, the scores could change from: 0 = 4, 1 = 3, 2 = 2, 3 = 1, and 4 = 0. Then, the scores were added up for each item to get the total.

The total score was represented as the stress score: the individual scores on the PSS could range from 0 to 40, which were grouped into 3 groups.

- Low stress: scores ranging from 0-13
- Moderate stress: scores ranging from 14-26
- High perceived stress: scores ranging from 27-40.

Statistical analysis

Results are entered in Microsoft Office Excel 2007 and analyzed using the statistical package for social sciences (SPSS) version 16. Data is expressed as Mean± Standard deviation. Test used is paired 't' test. P value of <0.05 is considered as significant.

RESULTS

During premenstrual phase, there was significant increase in pulse rate (P<0.000), in both systolic and diastolic blood pressure (P<0.000) and in weight (P<0.000). Also, there is significant prolongation of auditory and visual reaction time (P<0.000).

Table 1: Comparison of central nervous system during premenstrual and postmenstrual period (n=60).

Parameters	Pre-menstrual period, Mean ±SD	Post-menstrual period, Mean ±SD	T-value	P-value
Auditory reaction time (milliseconds)	252.37±25.61	214.88±12.07	14.07	0.000**
Visual reaction time (milliseconds)	291.52±21.58	267.13±22.70	13.35	0.000**

**P<0.001-statistically highly significant.

Table 1 shows that ART was highest in pre-menstrual phase and lowest in post-menstrual phase the values being 252.37±25.61msec and 214.88±12.07msec respectively (P-0.00). VRT was highest in pre-menstrual phase and lowest in post-menstrual phase the values being 291.52±21.58msec and 267.13±22.70msec respectively (P-0.00).

Table 2: Comparison of cardiovascular system during premenstrual and postmenstrual period (n=60).

Parameters	Premenstrual period, Mean ±SD	Postmenstrual period, Mean ±SD	T-value	P-value
Pulse (beats/minute)	86.48±6.61	80.13±5.15	11.71	0.000**
Systolic BP (mmHg)	118.87±8.44	112.40±8.14	12.58	0.000**
Diastolic BP (mmHg)	75.10±7.10	72.40±6.55	4.34	0.000**
Weight (kg)	53.65±7.935	53.490±7.92	8.43	0.000**

**P<0.001-statistically highly significant.

Table 2 shows that pulse, blood pressure and weight was highly significant in pre-menstrual phase as compared to post-menstrual phase.

Table 3: Comparison of perceived stress during pre-menstrual and post-menstrual phases (n=60).

Parameter	Mean rank	P-value
Stress 2-stress1		
Negative rank	30.50	0.000**
Positive rank	0.00	

**P<0.001-statistically highly significant.

Table 3 shows that perceived stress was highest in pre-menstrual phase.

DISCUSSION

In the present study, there was a highly significant increase in perceived stress in premenstrual period which is responsible for increased severity of symptoms. It is not clear how stress may contribute to increased pre-menstrual symptom severity, although stress induced changes in ovarian hormone levels and neurotransmitters may be involved. Stress has been shown to cause hormonal changes through the HPO axis, causing alterations in ovarian hormones that may render a woman more susceptible to menstrual disorders.

There was a highly significant increase in pulse rate and in both systolic and diastolic blood pressure during premenstrual phase as compared to those in postmenstrual phase. This could be explained based on increased fluid and salt retention induced by ovarian steroids and higher sympathetic activity due to premenstrual stress. Changes in the autonomic functions may also be responsible for some of the symptoms.

Increased blood pressure due to premenstrual stress is due to increase in peripheral resistance and is mediated by adrenocortical stimulation causing precapillary resistance.

This could be due to increase in sympathetic nervous activity or to elevation of circulating catecholamines while other active hormones like renin-angiotensin-aldosterone system also might contribute. Rise in blood pressure due to stress leads to increased epinephrine secretion and this rise in blood pressure is important sympathoadrenal response to physiological stressful experience caused by premenstrual stress.[11]

The increase in weight in premenstrual phase is due to generalized fluid accumulation associated with sodium retention caused by changes in ovarian steroid secretions during latter half of the menstrual cycle. Possible neuroendocrine causes of premenstrual edema are estrogen, progesterone, and renin-angiotensin-aldosterone axis.

The present study also shows the prolongation of both ART and VRT during premenstrual phase as compared to those during postmenstrual phase. Retention of water and sodium due to variation in sex steroid levels during menstrual cycle might influence the process of axonal conduction time and availability of neurotransmitter at synapses in auditory pathways. Changes in either of these two processes cause conduction time to vary during menstrual cycle.

Progesterone acts at the level of plasma membrane of selected cells by a nongenomic mechanism to inhibit the activation of adenyl cyclase. Progesterone is metabolized by extra adrenal 21-hydroxylation to deoxy corticosterone, which acts by way of mineral corticosteroid receptor.[12]

Another metabolite formed by reduction of progesterone acts in the brain as an anesthetic/anxiolytic agent by binding to gamma amino butyric acid GABA (A) receptor. GABA is an inhibitory neurotransmitter, an endogenously produced anxiolytic like compound. These metabolites are formed in women during premenstrual phase when progesterone excretion is high. The conformational changes of GABA (A) receptor after anxiolytic steroid binding increase the affinity of GABA for this receptor. GABA favors influx of chloride ions into the cells. Increased chloride entry into brain cells serves to hyperpolarize the membrane and thereby inhibits neural transmission. This neural transmission inhibition affects sensorimotor association and processing capability of central nervous system.

Study finding that reaction time is significantly prolonged during the premenstrual phase could be attributed to modulation in neurotransmitter involved due to hormonal fluctuations affecting sensorimotor association and processing capability of central nervous system.[9]

Bruce and Russel have done the study on weight changes and balances of sodium, water and potassium across normal menstrual cycle, have shown occurrence of sodium and water retention in premenstrual phase.[13] This retention of water and sodium might influence the process of axonal conduction and availability of neurotransmitter at synapses in auditory pathway resulting in delayed conduction and hence increased ART in premenstrual phase.

CONCLUSION

In this study, there was significant increase in pulse rate, blood pressure auditory reaction time and visual reaction time. Premenstrual stress changes the level of ovarian steroid hormone, causes the retention of salt and fluid, reduced velocity of nerve impulse, impair sensory motor coordination and processing speed of central nervous system. Premenstrual stress also affects the sympathetic system.

Future implementation

The analyses show that higher perceived stress precedes an increased severity of premenstrual symptoms. Stress reduction programs for reducing psychosocial stress may be a potentially noninvasive and cost-effective method for PMS relief compared with pharmaceutical treatments

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Reid RL, Yen SSC. Premenstrual syndrome. Am J Obstetr Gynecol. 1981;139:85-104.
2. Thomas B, Mathew B, Sharon B. Premenstrual syndrome. University of Pennsylvania health system 1997;1:1-3.
3. Davis AJ, Johnson SR (2000, reaffirmed 2010). Premenstrual syndrome. ACOG Practice Bulletin No. 15, pp. 1-9. Washington, DC: American College of Obstetricians and Gynaecologists.
4. Woods NF, Most A, Longenecker GD. Major life events, daily stressors, and pre-menstrual symptoms. Nurs Res. 1985;34(5):263-7.
5. Gannon L, Luchetta T, Pardie L, Rhodes K. Perimenstrual symptoms: Relationships with chronic stress and selected lifestyle variables. Behav Med. 1989;15(4):149-59.
6. Gollenberg AL, Hediger ML, Mumford SL, Whitcomb BW, Hovey KM, Wactawski-Wende J, et al. Perceived stress and severity of pre-menstrual symptoms: the bio cycle study. J Women's Health (Larchmt). 2010;19(5):959-67.
7. Cohen S., Kamarck T, Mermelstein R. A global measure of perceived stress. J Health Social Behav. 1983;24:386-96.
8. Deuster PA, Adera T, South-Paul J. Biological, social and behavioral factors associated with premenstrual syndrome. Arch Family Med. 1999;8(2):122-8.

9. Das S, Gandhi A, Mondal S. Effect of premenstrual stress on audio-visual reaction time and audiogram. Indian J Physiol Pharmacol. 1997;41:67-70.
10. Malathi A, Parulkar V. Apparatus for measurement of reaction time. Indian J Physiol Pharmacol. 1987;31(2):104-6.
11. Freyschuss UL, Hjemdahl PA, Juhlin-Dannfelt AN, Linde BI. Cardiovascular and sympathoadrenal responses to mental stress influences of blockade. Am J Physiol. 1988;255:1443-53.
12. Garry F, Gant C, MacDonald PC. (eds). Williams's obstetrics 20th (edn). Connecticut. Appleton and Lange. 1997:84-6.
13. Bruce J, Russell GF. Premenstrual tension: a study of weight changes and balances of sodium, water and potassium. Lancet. 1962;11:267-71.

Cite this article as: Pardeshi AM. Analysis of perceived stress, cardiovascular and central nervous system changes before and after menstruation in the age group 18-22 years. Int J Res Med Sci 2017;5:3644-8.