Sir Salimullah Medical College Journal

Sir Salimullah Med Coll J 2023; 31: 21-25

Original Article

DOI: https://doi.org/10.3329/ssmcj.v31i1.69356

Correlation of Serum Electrolytes and Ovarian Hormones Levels in Premenstrual Syndrome

Jumana Rajia[1], Mahmuda Begum[2], Israt Jahan Chowdhury[3], Habiba Akter[4], Tahmina Akter[5], Tania Sultana[6], Fouzia Farid[7], Mohammad Nurunnabi[8]

Article information
Received: 05-11-2022
Accepted: 03-02-2023

Cite this article:
Rajia J, Begum M, Chowdhury IJ, Akter H, Akter T, Sultana T et al. Correlation of Serum Electrolytes and Ovarian Hormones Levels in Premenstrual Syndrome. Sir Salimullah Med Coll J 2023; 31: 21-25

Key words:
PMS, Serum electrolytes, Ovarian hormones, PMS symptoms.

Abstract

Background: *Premenstrual syndrome (PMS) is a recurrent psychological and physical symptom that may occur during the late luteal phase of menstrual cycle and resolve with menstruation in the women. Alteration of serum electrolyte levels in accordance with ovarian hormonal fluctuations has some association with PMS which affect their regular activities and reproductive life.*

Methods: *A cross-sectional study was conducted to assess the correlation of serum electrolytes and ovarian hormones levels in premenstrual syndrome among the 30 young unmarried women with PMS from July 2016 to June 2017 in the Department of Physiology, Sir Salimullah Medical College, Bangladesh.*

Results: *In the non-PMS and PMS group, the mean of serum sodium level was 139.97±1.30 and 140.93±1.68 mmol/L, and serum potassium level was 4.20±0.32 and 4.17±0.31 mmol/L. The mean of serum estrogen level was 177.10±6.90 and 283.53±5.73 pg/ml and serum progesterone was 19.35±2.55 and 14.67±2.20 ng/ml in the group A and B. Premenstrual scores of irritability, abdominal bloating, backache, depression, fatigue, breast tenderness, headache, anxiety were significantly higher in comparison to those of postmenstrual scores in PMS group ($p<0.05$). Serum estrogen level ($r= +0.558$) and serum progesterone level ($r= -0.408$) were correlated with PMS symptoms scores in PMS group ($p<0.05$).*

Conclusion *The results of the current study showed that the PMS group has some physical and psychological symptoms as a result of fluctuations in ovarian hormone levels and biochemical markers during the late luteal phase of the menstrual cycle.*

Introduction

Premenstrual disorders are mental or physical symptoms that appear during the luteal phase of the menstrual cycle, interfere with the patient's regular day-to-day activities, and disappear immediately after menstruation. After ovulation, the luteal phase starts and concludes with the onset of menstruation.[1] Under the influence of estrogen produced by the growing follicle, a new endometrium regenerates during the follicular phase. Based on the influence of progesterone and estrogen from the corpus luteum, which coincides with the luteal phase of the ovarian cycle, the endometrium becomes extremely vascular and mildly edematous after ovulation.[2] The secretory nature of endometrial, which is progestational in character and ends at roughly 28 days with the onset of menstruation, is produced by progesterone acting on an endometrium primed by estrogen.[3]

1. Assistant Professor, Department of Physiology, Sir Salimullah Medical College, Dhaka 1000, Bangladesh.
2. Professor and Head, Department of Physiology, Sir Salimullah Medical College, Dhaka 1000, Bangladesh.
3. Assistant Professor, Department of Physiology, Northern International Medical College, Dhaka 1209, Bangladesh.
4. Assistant Professor, Department of Physiology, Khwaja Yunus Ali Medical College, Sirajganj 6751, Bangladesh.
5. Assistant Professor, Department of Physiology, Sir Salimullah Medical College, Dhaka 1000, Bangladesh.
6. Assistant Professor, Department of Physiology, Cumilla Medical College, Cumilla 3500, Bangladesh.
7. Associate Professor, Department of Physiology, Dhaka Community Medical College, Dhaka 1217, Bangladesh.
8. Assistant Professor, Department of Community Medicine, Sylhet Women's Medical College, Sylhet 3100, Bangladesh.

Address of Correspondence: Dr. Jumana Rajia, Lecturer, Department of Physiology, Sir Salimullah Medical College, Dhaka 1000, Bangladesh. Email: dr.jumana07@gmail.com ORCID : 0000-0002-8731-8374

PMS is a common, moderate psychological and physical symptom that might appear in the late luteal phase of a woman's menstrual cycle and go away four days after menstruation starts.[4] According to American College of Obstetricians and Gynecologists criteria, PMS can be diagnosed if the patients report at least 1 affective symptom (depression, angry outbursts, irritability, anxiety, confusion, or social withdrawal) and somatic symptom (breast tenderness, abdominal bloating, headache, or swelling of the extremities) during the 5 days before menstruation in each of the 3 prior menstrual cycles. These symptoms are relieved within 4 days of onset of menstruation. More severe symptoms include irritability, dysphoria and mood liability.[5,6]

The level of serum sodium was significantly decreased but no significant difference of potassium was found in luteal phase as compared to those of follicular and menstrual phases.[7-9] Again, the level of serum sodium was significantly decreased, whereas serum potassium was significantly increased in secretory phase.[10,11] A low level of progesterone causes some premenstrual mood symptoms such as aggressive behavior and fatigue.[12] The rhythmical fluctuation in hormonal level in accordance with this alteration of biochemical parameters during luteal phase may develop some psychological and physical symptoms and ultimately turns into PMS or in severe cases premenstrual dysphoric disorder (PMDD).[13]

Methods

Study design and settings

This is a cross-sectional study was commenced to observe the serum electrolytes and ovarian hormones levels in young unmarried women with premenstrual syndrome from July 2016 to June 2017 in the Department of Physiology, Sir Salimullah Medical College, Dhaka 1000, Bangladesh.

Sample selection criteria

Participants were purposely selected 60 with apparently healthy young unmarried women between the ages of 18 and 25, who had body mass index (BMI) that were within the normal reference range (18.5-24.9 kg/m^2) and regular menstrual cycles of 28±3 days for at least 6 months. Participants were divided two groups equally, 30 women in each group. Group B (PMS group) was young unmarried woman with premenstrual syndrome for at least 3 consecutive symptomatic cycles before starting treatment, and Group A (Non-PMS group) was young unmarried woman without premenstrual syndrome.

Data collection procedures

All the subjects of PMS and non-PMS groups were inquired to attend again in their late luteal phase (any of the day from 24-26th day of the menstrual cycle) to assess their study parameters. To measures the serum electrolyte levels, serum sodium, potassium were estimated by integrated multisensor technology (IMT), serum calcium and magnesium were estimated by o-cresolphthalein complexone (OCPC) method and methylthymol blue (MTB) complexometric method in the Department of Biochemistry, BSMMU, Dhaka. For the assessment of glycemic status and renal function, random blood glucose level and serum creatinine level were estimated by using glucose oxidase (GOD-POD) method and fixed time kinetic method respectively in a semi-autoanalyzer in the Department of Physiology, SSMC. Again, for the assessment of ovarian hormonal status, serum estrogen and progesterone levels were assessed by chemiluminescent microparticle immunoassay (CMIA) method in ARCHITECT plus ci8200 system in the Department of Biochemistry, BSMMU, Dhaka.

Statistical analysis

The data analyses were done by IBM SPSS v22. Descriptive statistics such as mean, standard deviation and percent were computed for continuous variables of the participants. Unpaired 't' test and Pearson's correlation coefficient test were done to assess the significance of associations. A p-value of <0.05 at a 95% confidence interval was taken as significant. The results were presented in tables and charts.

Ethical approval

Data confidentiality was ensured, and inappropriate access to data was cleaned. The Institutional Ethics Committee (IEC) at Sir Salimullah Medical College, Dhaka 1000, Bangladesh, obtained ethical approval. (Reference: SSMC/2017/40)

Results

Figure 1 shows the mean age of the participant was 20.30±1.15 and 20.53±1.17 years; and mean BMI was 20.48±1.14 and 20.65±1.27 kg/m^2 in the group A and B respectively.

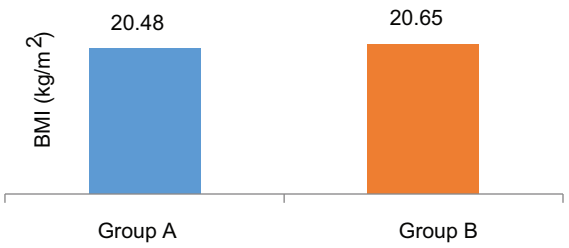

Figure 1: *Mean BMI of the women (n=60)*

Table I represents the serum electrolytes and ovarian hormones level of the women. The mean of serum sodium level was 139.97±1.30 and 140.93±1.68 mmol/L, and serum potassium level was 4.20±0.32 and 4.17±0.31 mmol/L in group A and B respectively. The mean serum calcium level was 9.34±0.53 and 8.85±0.55 mg/dl and serum magnesium level was 2.36±0.37 and 2.08±0.38 mg/dl in the group A and B respectively. The mean of serum estrogen level was 177.10±6.90 and 283.53±5.73 pg/ml and serum progesterone was 19.35±2.55 and 14.67±2.20 ng/ml in group A and B respectively.

Table II demonstrations the pre- and post-menstrual scores of PMS symptoms in the PMS group. The mean of the premenstrual symptoms scores for irritability, abdominal bloating, backache, depression, fatigue, breast tenderness, headache, anxiety, food craving, cramp and difficulty in concentrating were 10.60±7.75, 9.37±6.92, 9.27±7.83, 6.67±7.86, 6.10±7.13, 6.33±7.90, 3.37±5.81, 1.73±4.57, 1.33±4.10, 0.53±2.03 and 0.70±2.67. The mean of the postmenstrual symptoms scores for irritability, abdominal bloating, backache, depression, fatigue, breast tenderness, headache, anxiety, food craving, cramp and difficulty in concentrating were 1.90±2.38, 0.43±1.17, 0.53±1.22, 0.33±1.03, 1.50±2.51, 0.17±0.65, 1.00±1.80, 0.17±0.65, 0.27±1.01, 0.10±0.55 and 0.23±0.90. Premenstrual scores of irritability, abdominal bloating, backache, depression, fatigue, breast tenderness, headache, anxiety were significantly higher in comparison to those of postmenstrual scores in PMS group ($p<0.05$).

Table I. *Serum electrolytes and ovarian hormones level of the women (n=60)*

Parameters	Group A (n=30) Mean± SD	Group B (n=30) Mean± SD
Serum electrolytes		
Serum sodium (mmol/L)	139.97±1.30	140.93±1.68
Serum potassium (mmol/L)	4.20±0.32	4.17±0.31
Serum calcium (mg/dl)	9.34±0.53	8.85±0.55
Serum magnesium (mg/dl)	2.36±0.37	2.08±0.38
Serum ovarian hormones		
Serum estrogen (pg/ml)	177.10±6.90	283.53±5.73
Serum progesterone (ng/ml)	19.35±2.55	14.67±2.20)

Table II. *Pre- and post-menstrual scores of PMS symptoms in the PMS group (n=30)*

PMS symptoms	Pre-menstrual scores Mean± SD	Post-menstrual scores Mean± SD	p value
Irritability	10.60±7.75	1.90±2.38	*0.001
Backache	9.27±7.83	0.53±1.22	*0.001
Abdominal bloating	9.37±6.92	0.43±1.17	*0.001
Depression	6.67±7.86	0.33±1.03	*0.001
Fatigue	6.10±7.13	1.50±2.51	*0.001
Breast tenderness	6.33±7.90	0.17±0.65	*0.001
Headache	3.37±5.81	1.00±1.80	*0.004
Anxiety	1.73±4.57	0.17±0.65	*0.049
Food craving	1.33±4.10	0.27±1.01	0.095
Cramp	0.53±2.03	0.10±0.55	0.172
Difficulty in concentrating	0.70±2.67	0.23±0.90	0.165

Unpaired 't' test was done, *Statistically significant value

Table III. *Correlation of different parameters with PMS symptoms scores (n=30)*

Parameters		r value	p value
Serum electrolytes	Serum sodium	+0.194	0.304
	Serum potassium	-0.139	0.462
	Serum calcium	-0.504	*0.004
	Serum magnesium	-0.490	*0.006
Serum ovarian hormones	Serum estrogen	+0.558	*0.002
	Serum progesterone	-0.408	*0.025

Pearson's correlation coefficient test was done, *Statistically significant value

Table III interprets that there were significant correlations between calcium (r= -0.504) and magnesium (r= -0.490) levels with PMS symptoms score in PMS group ($p<0.05$). Serum estrogen level (r= +0.558) and serum progesterone level (r= -0.408) were correlated with PMS symptoms scores in PMS group. This relationship was statistically significant ($p<0.05$).

Figure 2 presentations that among the PMS group, 66.7% had complaints of abdominal bloating and irritability, 60.0% had backache, 43.3% had depression and fatigue and 40.0% had breast tenderness.

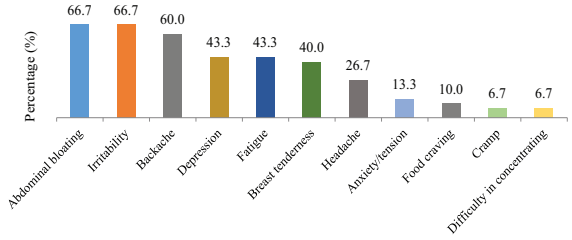

Fig. 2: *Percentage of PMS symptoms in PMS group (n=30)*

Discussion

This study was undertaken to assess the correlation of serum electrolytes and ovarian hormones levels in young unmarried women with PMS. The mean of serum sodium level was 139.97±1.30 and 140.93±1.68 mmol/L, and serum potassium level was 4.20±0.32 and 4.17±0.31 mmol/L in group A and B. These findings were almost in consistent with those studies.[14,15] The mean serum calcium level was 9.34±0.53 and 8.85±0.55 mg/dl and serum magnesium level was 2.36±0.37 and 2.08±0.38 mg/dl in the group A and B. These findings were almost similar with the studies.[16,17]

In the present study, the mean of serum estrogen level was 177.10±6.90 and 283.53±5.73 pg/ml and serum progesterone was 19.35±2.55 and 14.67±2.20 ng/ml in group A and B. The mean estrogen level was significantly higher in group B in comparison to group A; whereas, serum progesterone level was significantly lower in group B in comparison to group A ($p<0.05$). These findings were similar with the studies among the women with premenstrual syndrome.[13,18]

The study revealed that premenstrual scores of irritability, abdominal bloating, backache, depression, fatigue, breast tenderness, headache, anxiety were significantly higher in comparison to those of postmenstrual scores in PMS group ($p<0.05$) which was similar to the study.[19] Serum calcium and magnesium levels showed negative correlation with PMS symptoms score in PMS group and these relationship were statistically significant ($p<0.05$). Similar observation was found in the study.[20] Serum estrogen level showed positive correlation with PMS symptoms score in PMS group and this relationship was statistically significant ($p<0.05$). Similar observation was found in the study.[21] Serum progesterone level showed negative correlation with PMS symptoms score in the PMS group and this relationship was statistically significant ($p<0.05$); which was similar to the study.[21]

Conclusion

The present study revealed that the fluctuation in ovarian hormonal levels with biochemical parameters during late luteal phase of the menstrual cycle develops some physical and psychological symptoms score in the PMS group during the premenstrual days. Early detection and

management of premenstrual syndrome is essential for young unmarried women with PMS to live a healthy reproductive life.

Acknowledgments:
All participants had their sincere cooperation acknowledged by the authors.

Competing interests: No competing interests were declared.

Funding: Did not receive any fund.

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