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Original Research Article

Assessment of serum calcium and magnesium levels in subjects with pre-menstrual syndrome

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ABSTRACT

Background: Women's health is one of the main goals of social and economic development of societies; therefore, problems and diseases compromising women's physical and mental health, such as premenstrual syndrome (PMS), are among health priorities.
Aim and Objectives: To estimate and compare the serum levels of calcium and magnesium in subjects with pre-menstrual syndrome and subjects without premenstrual syndrome during pre-and post-menstrual phases.
Materials and Methods: Healthy women (intern students, hospital staff, non-teaching staff, class 3 and class 4 staff) in the age group of 18-26 years having regular menstrual cycles for the past 6 months were included based on inclusion and exclusion criteria. PMS was diagnosed based on ACOG criteria. 5 mL of venous blood sample was collected in red stoppered plain tube and used for estimation of serum calcium and magnesium levels during premenstrual phase of menstrual cycle.
Results: We found that there was no significant difference in the serum calcium levels between cases and controls, but there was significant difference in serum magnesium levels between the cases and controls.
Discussion and Conclusion: Several factors like culture, socioeconomic status, cigarette smoking, alcohol consumption, exercise, dietary habits, age of menarche etc. have also been implicated. Prolonged stress exposure is believed to lead to persistent malfunctions of neuroendocrine system and cause PMS. Lack of micronutrients and certain hormonal agents and are also implicated in the development of PMS. We strongly recommend Lifestyle modifications which include mind-body approaches, aerobic exercise, and supplementation with vitamins, minerals, and complex carbohydrates. Early nutritional supplementation of with the diet rich in these minerals will be effective as preventive and therapeutic strategy.

1. Introduction

Women's health is one of the main goals of social and economic development of societies; therefore, problems and diseases compromising women's physical and mental health, such as premenstrual syndrome (PMS), are among health priorities.[1] PMS is characterized with a set of physical and emotional symptoms, including mood swings, tender breasts, food craving, fatigue, irritability, and depression beginning in the luteal phase of the menstrual cycle and resolving with the start of menstruation.[2]

A recent meta-analysis estimated a worldwide prevalence of 10%-98%.[3] The syndrome is associated with significant economic burden. Distress and impairment in interpersonal or workplace functioning occur in a regular basis every month which can lead to significant amount of absenteeism at work and increase in medical costs.[4] Therefore, sufficient attention is needed to decrease its undesirable effects.

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The aetiology of PMS appears to be related to ovarian function, as suppression of ovarian hormone secretion markedly attenuates PMS,[5] although differences in ovarian steroid hormones have not been consistently observed between symptomatic and asymptomatic women. Several biological, social, and behavioural factors have consistently been positively associated with PMS, whereas demographic factors, education, employment, and marital status have shown inconsistent relationships.[6] Younger age, less education, and higher levels of perceived stress have been reported to be risk factors for premenstrual emotional symptoms.[7,8]

Among various pharmacological treatments recommended for women with PMS, selective serotonin reuptake inhibitors (SSRIs) have been evaluated as the first-line of therapy.[9]These therapies may be effective at resolving PMS in many women, but they are also associated with significant side effects and can be expensive. Alternatives to hormone therapy, such as dietary supplementation, are being evaluated.[10] Non-pharmacologic management with some evidence for efficacy includes cognitive-behavioral relaxation therapy, aerobic exercise, as well as magnesium, vitamin B6/D, or L-tryptophan supplementation or intake of complex carbohydrates.[11]

Also, scientific evidence suggests that cyclic fluctuations in calcium levels may help to explain some features of PMS. Changes in extracellular calcium concentration could have stimulatory effects on neuromuscular junctions,[12] and irritability, mania and agitation have been reported in conjunction with hypocalcemia.[13]

Calcium supplementation may act by resolving an underlying physiologic deficit, suppressing parathyroid hormone secretion, and, ultimately, reducing neuromuscular irritability and vascular reactivity. The possibility that calcium can be useful in alleviating mood disorders associated with PMS has been evaluated in various studies. Several interventional studies found that calcium and magnesium supplementation was associated with reductions in the incidence of several symptoms of PMS.[5–13]

2. Aim and Objectives

2.1. Aim

The aim of the study is to estimate serum levels of calcium and magnesium in subjects with premenstrual syndrome.

2.2. Objectives

The objectives of the study include

1. To estimate the serum levels of calcium and magnesium in subjects with pre-menstrual syndrome and subjects without premenstrual syndrome.
2. To compare the serum levels of levels of calcium and magnesium in subjects with pre-menstrual syndrome and subjects without premenstrual syndrome during pre-and post menstrual phases.

3. Materials and Methods

3.1. Place of study

A case-control study on “Assessment of Serum Calcium and Magnesium Levels in Subjects with Pre-Menstrual Syndrome” was conducted at Raipur Institute of Medical Sciences, for duration of 4 months from April 2021 to July 2021 after taking informed consent and institutional ethical committee clearance.

3.2. Study population

Healthy women (intern students, hospital staff, non-teaching staff, class 3 and class 4 staff) in the age group of 18-26 years having regular menstrual cycles for the past 6 months were included.

3.3. Sample Size

100.

1. Healthy premenopausal women with PMS in the age group of 18 to 26 years: 50 (Test group)
2. Healthy premenopausal women without PMS in the age group of 18 to 26 years: 50 (Control group).

3.4. Inclusion criteria

Healthy women (intern students, hospital staff, non-teaching staff, class 3 and class 4 staff) in the age group of 18-26 years having regular menstrual cycles of 27 to 33 days for the past 6 months were included.

3.5. Exclusion criteria

1. History of Psychiatric disorders.
2. History of ovarian dysfunction.
3. History other Gynaecological disorders.
4. Pregnancy or postpartum period.
5. History of using oral contraceptives within last 3 months.
6. Serious physical illness.
7. History of taking any medications such as psychoactive preparations or hormones.

3.6. Sample selection

Using a self-designed questionnaire basing on relevant studies was randomly asked to select both the test and control groups. The participants were given PMS diagnostic questionnaire developed by University of California, San Diego as per ACOG guidelines. At least one physical

symptom and one affective symptom should be present during the 5 premenstrual days for at least 3 menstrual cycles to be termed as PMS as per ACOG. Each participant will be about symptom experience prior to onset of menstruation for at least 3 months with use of checklist of 9 symptoms as per ACOG criteria.[2]

Table 1: PMS diagonstic quesionnaire

Affective Symptoms	Somatic Symptoms
1. Depression	1. Breast tenderness
2. Angry outbursts	2. Abdominal bloating
3. Irritability	3. Headache
4. Anxiety	4. Swelling of extremities
5. Confusion	
6. Social Withdrawal	

Relief from symptoms from Day 4 through 13 of menstrual cycle participants showing symptomatology as per ACOG criteria Were taken as study or PMS group and those without symptoms were taken as controls.

3.7. Methodology

After taking voluntary informed consent from all the participants, and based on inclusion and exclusion criteria 100 subjects were included. 50 subjects without PMS as control group and 50 subjects with PMS as case group.

3.8. Determination of different phases of menstrual cycle

The regular menstrual cycle of 28 days can be divided in to three phases as per the day of menstrual cycle as follows. Menstrual phase: 1^{st} to 5^{th} day, Proliferative phase: 6^{th} to 14^{th} day and Secretary Phase: 15^{th} to 28^{th} day.

3.9. Blood sample collection and biochemical investigations:[14–16]

5mL fasting venous blood was drawn into plain red colored stoppered tube under aseptic precautions, blood allowed to clot and centrifuged to obtain clear serum. Serum calcium and Magnesium were measured in automated biochemistry analyzer EM200 based on spectrophotometry principle. Serum calcium was estimated by OCPC method and serum magnesium was estimated by calmagite method.

3.10. Statistical analysis

Microsoft Office Excel will be used for data storage, tabulation and generation of descriptive statistics. Data will be expressed in mean and SD and using pie charts. Students unpaired t test will be used for the comparison. P value <0.05 will be considered statistically significant.

4. Results

We included a total of 100 subjects after voluntary consent. 50 subjects without PMS as control group and 50 subjects with PMS as case group. We estimated serum levels of calcium and magnesium in pre-and post menstrual phases in both the groups.

Table 2: Shows mean age and BMI in study population

	Cases	Controls	P value
Age in years	20.8 ± 1.18	20.79 ± 1.16	NS
BMI in kg/m^2	20.42 ± 0.96	20.41 ± 1.21	NS

It is evident from the Table 1 that the mean age and BMI in both cases and controls are matched, there is significant difference in age and BMI between the two groups.

Table 3: Shows serum calcium and magnesium levels during premenstrual phase in study

Subjects	Cases	Controls	P value
Serum Calcium (mg/dL)	8.62 ± 0.32	8.68 ± 0.28	NS
Serum Magnesium (mg/dL)	1.27 ± 0.15	1.98 ± 0.21	S

It is evident form the above table that there was no significant difference in the serum calcium levels between cases and controls, but there was significant difference in serum magnesium levels between the cases and controls.

5. Discussion

Premenstrual Syndrome, as defined by the ACOG, is a clinical condition characterized by cyclic occurrence of physical and emotional symptoms not related to any organic disease that appear during the 5 days premenstrually in each of three prior menstrual cycles and disappear within 2 days of onset of menses, without recurrence until at least day 13. Despite the high prevalence of premenstrual distress among women of reproductive age, its exact aetiology remains largely obscure. Several factors like culture, socioeconomic status, cigarette smoking, alcohol consumption, exercise, dietary habits, age of menarche etc. have also been implicated. Prolonged stress exposure is believed to lead to persistent malfunctions of neuroendocrine system and cause PMS. Lack of micronutrients and certain hormonal agents and are also implicated in the development of PMS.[8–13] The menstrual cycle is the most extensively studied rhythm in women. The hormonal changes during the menstrual cycle are well established and they are commonly associated with fluctuations in electrolytes and subjective feeling in women.

In the present study, we found that the serum calcium levels did not vary significantly between the two groups.

Our results are consistent with other studies in which serum magnesium levels were decreased in premenstrual phase more significantly in PMS women compared to controls. Randomized, double-blind studies have shown that many women with PMS may benefit from supplementation of 200mg of magnesium per day. They reported a significant reduction of several symptoms related to PMS such as mood swings, fluid retention, abdominal bloating etc. [14–16]

6. Conclusion

Because the etiology is not precisely understood, the treatment options for PMS are many. We strongly recommend Lifestyle modifications which include mind-body approaches, aerobic exercise, and supplementation with vitamins, minerals, and complex carbohydrates. Early nutritional supplementation of with the diet rich in these minerals will be effective as preventive and therapeutic strategy. Hence, measures can be taken for early detection and intervention among these subjects.

7. Source of Funding

None.

8. Conflict of Interest

The authors declare no conflict of interest.

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