

Fluctuation in the serum calcium and the serum magnesium level during luteal phase of menstrual cycle in women with premenstrual syndrome - a cross sectional study

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Abstract

Background: Most women in reproductive age group have one or more emotional and physical symptoms in the premenstrual phase of the menstrual cycle, which are grouped as premenstrual tension (PMT) or premenstrual syndrome (PMS). Alterations in the concentration of various minerals have been associated with many affective disorders. Recently it has been proposed that the fluctuation in serum calcium and serum magnesium level in the luteal phase of menstrual cycle might be responsible for multiple symptoms in women with premenstrual syndrome. **Aim:** The aim of the study was to assess the serum calcium and serum magnesium level during the luteal phase of menstrual cycle in women with premenstrual syndrome. **Materials and Methods:** It was a cross sectional study conducted among 70 unmarried women of 18-25 years after obtaining ethical committee clearance. Questionnaire was explained to the participants in their native language after obtaining informed written consent. Premenstrual Syndrome Scale (PMSS) was structured in such a way to obtain information about various symptoms of Premenstrual Syndrome. About 3 ml of venous blood was collected during luteal phase of menstrual cycle for serum calcium and magnesium level estimation. The data thus obtained were tabulated and analyzed statistically by using SPSS software. **Results:** Serum calcium and magnesium level were reduced in the PMS group significantly (p value - <0.05) but the calcium level was within the normal range. Of all study population 5.7 % of women had hypocalcemia and 34.3% had hypomagnesemia. **Conclusion:** There is a statistically significant fall in calcium and magnesium levels in women with premenstrual syndrome.

Keywords: calcium and magnesium deficiency, premenstrual syndrome, reproductive age

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Introduction

Premenstrual syndrome (PMS) is a cyclical disorder presenting with physical, psychological, and

emotional changes in the late luteal phase which affect the normal daily activities and interpersonal relationships.¹ Clinical characteristics may be divided as physical, psychological, and behavioral

symptoms in the affected women.²In India, the prevalence of PMS ranges from 14.4% to 74.5%. Almost 94% of women in child-bearing age group had experienced any one symptom of PMS.³

Various studies in literature suggested that ovarian hormones were influencing electrolyte metabolism during various phases of the menstrual cycle which in turn might lead to premenstrual edema and various psychological symptoms.⁴Progesterone, a predominant hormone secreted during luteal phase play a main role in the pathogenesis of premenstrual syndrome.⁵

Micronutrients like zinc, magnesium, and calcium were also involved in the pathogenesis of premenstrual syndrome apart from hormonal influences.⁶Among them magnesium deficiency has been implicated in depletion of dopaminergic stores in the brain without affecting the brain's nor-epinephrine and serotonin level.⁷

Magnesium increases the threshold level for stressful stimuli so in its deficiency the level of aldosterone increases in response to various environmental stimuli.^{4,7} As an agonist of GABA (γ -aminobutyric acid), the principle inhibitory neurotransmitter and an antagonist of NMDA (N-methyl D- aspartate) magnesium plays a key role in sleep regulation.⁶⁻⁸

Materials and methods

This was a cross sectional study carried out in 70 unmarried women in the age group of 18 to 25 years, after getting approval from the Institutional Ethical Committee. The study was preceded by giving questionnaires to the patients with complaints of premenstrual symptoms and to the healthy female unmarried attenders of 18-25 years accompanying the patients in the Obstetrics and Gynecology Department to diagnose premenstrual syndrome.

Inclusion Criteria

1. Female gender
2. Age group 18 – 25 years
3. Regular 28-35 days menstrual cycle for the past 6 months
4. Women in luteal phase (15-28 days) of menstrual cycle
5. Unmarried

Exclusion Criteria

1. Women with irregular menstrual cycle
2. Any Chronic disorders and Endocrine disorders

The subjects were explained about the purpose of the study and a prior informed written consent was obtained.

The study tool was a self-administered and structured scale called Premenstrual Syndrome Scale (PMSS) (Table 1). The questions were explained to them in their local regional language for better understanding. The subjects were also informed that the data collected would be confidential. This scale was structured with three sub-scales comprising of 40 questions totally, in such a way to diagnose women with Premenstrual Syndrome relating to various premenstrual symptoms such as physiological, psychological, and behavioral symptoms. The measurements on the scale were set accordingly: 1- never, 2- rarely, 3- sometimes, 4- very often and 5- always.

The scale's highest score was 200 and the lowest score was 40. If the total score was more than 80 or above, that indicates the presence of PMS. Based on the level of symptoms they were categorized as mild (score- 81-120), moderate (score- 121-160) and severe (score- 161-200) PMS.⁹ There were 35 women categorized with premenstrual symptoms and were considered as case group and age matched healthy unmarried 35 women with same inclusion criteria without the symptoms of PMS were considered as control group.

Under sterile precautions about 3ml of venous blood was collected from both study and control group during luteal phase (15 to 28 days). The serum was separated by centrifugation and stored in deep freezer. Serum Calcium level was estimated using arsenazo reagent by autoanalyzer and serum magnesium level was estimated by spectrophotometer atomic absorption technique.

Data were collected, entered, and tabulated in MS Excel and analyzed by using Statistical Package for Social Sciences (SPSS) version 20. The continuous variables were expressed in mean and standard deviation. The categorical variables were expressed in frequency and percentage. Mean and standard deviation was calculated for parameters like age, height, weight, BMI and biochemical parameters for the PMS group and control group. Chi-square test was applied to find the significant differences between the variables in the study groups. P-value ≤ 0.05 was considered as statistically significant.

Results

Among 70 women in the study (35-case group and 35-control group), there were no statistical difference between them in their basic characteristics which includes their age, height, weight, and BMI. The age of the women participated in the study were between 18 to 25 years with the mean age of 21.19 ± 3.54 years in PMS group and 22.42 ± 2.32 years in control group. The mean BMI of PMS group was 21.32 ± 0.45 Kg/m² and control group was 21.43 ± 1.09 Kg/m². Serum Calcium and Magnesium level were reduced in the PMS group significantly (p value -

<0.05) but the calcium level was within the normal range. Of all the total study population 5.7 % of women had hypocalcemia and 34.3% had hypomagnesemia.

Discussion

Premenstrual syndrome (PMS) is a clinical syndrome characterised by cyclical occurrence of physiological, psychological and behavioural symptoms that are not related to any organic disorders that appear 5 days prior to menstruation in the last 3 cycles and those symptoms will disappear within 2 days of onset of menstruation.^{1,2,10-12} In our study, we evaluated the fluctuations in serum calcium and magnesium level in PMS group with that of age matched control group. Serum calcium and magnesium level were significantly reduced in the PMS group compared to the control group although in the normal range.

There are hormonal changes during normal menstrual cycle and those changes are the reason for fluctuation in psychological and physiological wellbeing of the individual.¹³ There were many studies in the literature which highlighted the changes in the serum calcium and magnesium level in various phases of menstrual cycle.¹⁴⁻¹⁸ Vani Lanke et al suggested that the serum calcium level was significantly elevated during proliferative phase and reduced during luteal phase.¹⁹ In proliferative phase, estrogen induced hypercalcemia occurs which is mainly due to increased parathyroid gland activity. Kia et al also showed lower serum calcium level in PMS group than control group but within normal reference range which was consistent with our study.¹⁹

Fluctuation in the serum calcium and the serum magnesium level during luteal phase of menstrual cycle in women with premenstrual syndrome- a cross sectional study

S. NO	Table 1 :Premenstrual syndrome scale (PMSS)	SCORES				
		Never(1)	Rarely(2)	Some times(3)	Very often(4)	Always(5)
	Physiological symptoms					
1	Breast Tenderness and swelling					
2	Abdominal bloating					
3	Weight gain					
4	Headache					
5	Dizziness/fainting					
6	Fatigue					
7	Palpitations					
8	Pelvic discomfort and pain					
9	Abdominal cramps					
10	Change in bowel habits					
11	Increased appetite					
12	Generalized aches and pain					
13	Food cravings (sugar/salt)					
14	Skin changes,rashes,pimples					
15	Nausea/vomiting					
16	Muscle and joint pain					
	Psychological symptoms					
17	Irritability					
18	Anxiety					
19	Tension					
20	Mood swings					
21	Loss of concentration					
22	Depression					
23	Forgetfulness					
24	Easycrying/crying spells					
25	Sleep changes					
26	Confusion					
27	Aggression					
28	Hopelessness					
	Behavioural symptoms					
29	Social withdrawal					
30	Restlessness					
31	Lack of self control					
32	Feeling guilty					
33	Clumsiness					
34	Lack of interest in usual activities					
35	Poor judgement					
36	Impaired work performance					
37	Obsessional thoughts					
38	Compulsive behavior					
39	Irrational thoughts					
40	Being over sensitive					
	Total					

Table 2: Basic characteristic features of both case and control groups

	Case group n= 35 n (%)	Control group n= 35 n (%)	p-value
	MEAN $\pm$ SD	MEAN $\pm$ SD	
Age (years)	21.19 $\pm$ 3.54	22.42 $\pm$ 2.32	0.542
Weight (kg)	52.2 $\pm$ 7.2	50 $\pm$ 6.4	0.243
Height (cm)	161.4 $\pm$ 3.3	161 $\pm$ 2.4	0.865
BMI (Kg/m ²)	21.32 $\pm$ 0.45	21.43 $\pm$ 1.09	0.254

p-value $\leq$ 0.05 -statistically significant

Table 3: Fluctuations in serum calcium and magnesium level during luteal phase

	CASE Group n=35	CONTROL Group n= 35	p value
Serum Calcium Level (mg/dl)	9.654 $\pm$ 0.94	9.844 $\pm$ 0.65	0.012*
Serum Magnesium Level (mg/dl)	1.786 $\pm$ 0.187	1.943 $\pm$ 0.435	0.005*

p-value $\leq$ 0.05 -statistically significant

Table 4: Prevalence of magnesium deficiency in study groups

Serum level Magnesium level (mg/dl)	PMS group n= 35 n (%)	Control group n= 35 n (%)	p- value
Low -< 1.8 Normal- 1.8 - 3	16 (45.7%) 19 (54.3%)	8 (22.8%) 27 (77.2%)	0.028*

p-value $\leq$ 0.05 -statistically significant

Figure 1:

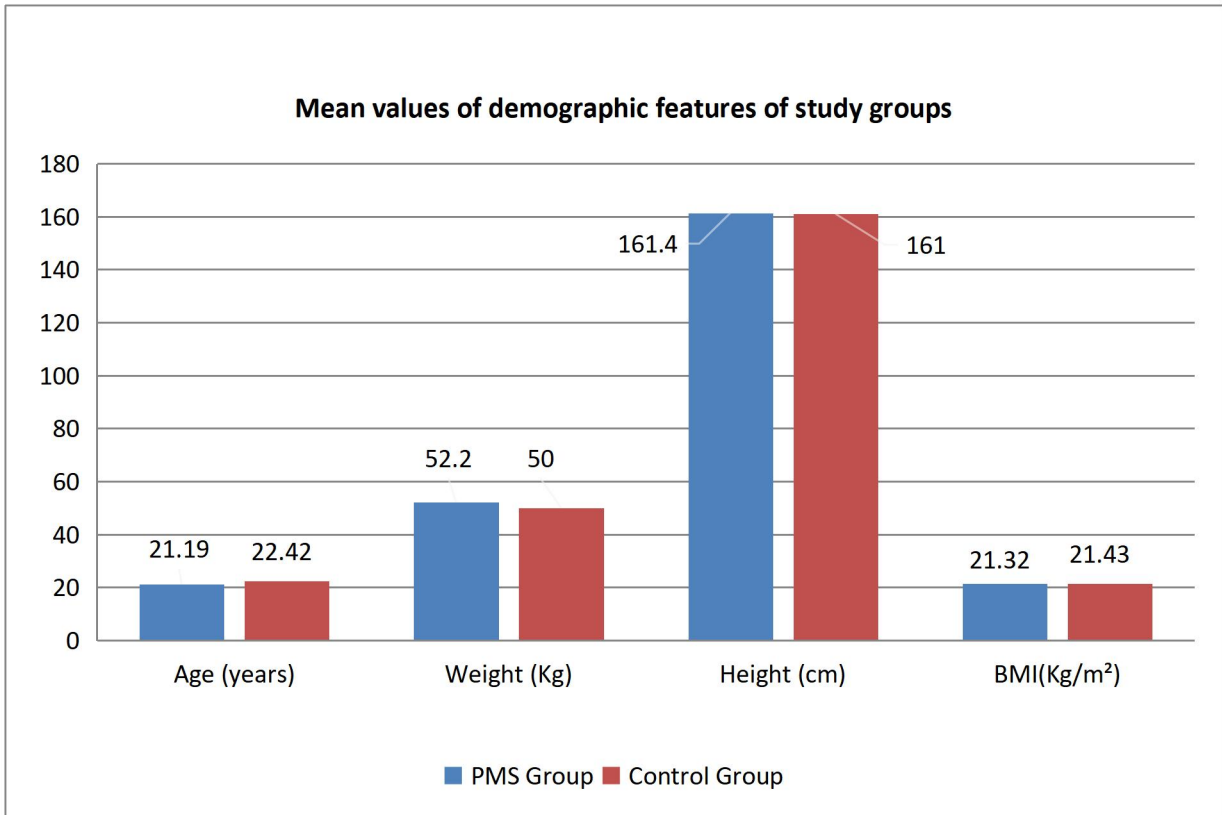
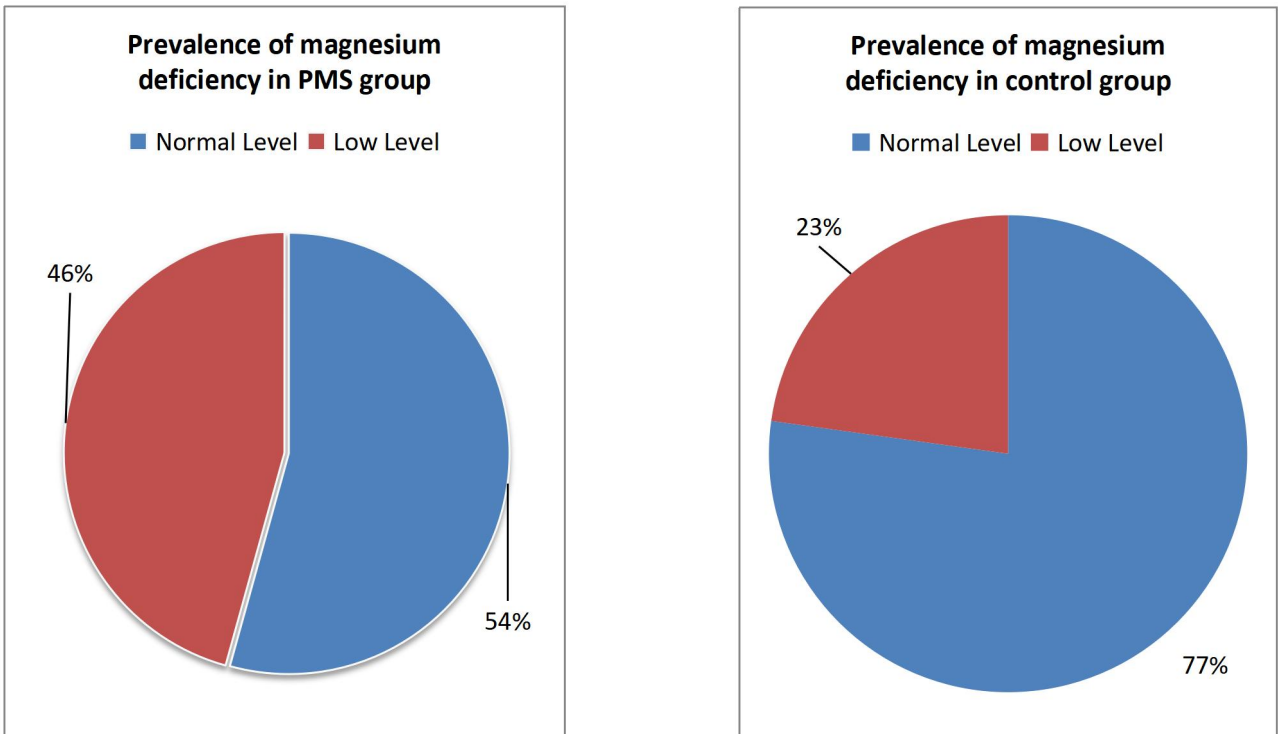


Figure 2:



Thys – Jacobs et al proposed a positive effect of administering calcium supplements in improving the symptoms of PMS.²⁰ But Bahrami et al showed that the high serum calcium level was responsible for various symptoms in PMS especially the irritability which was not consistent with our study.²¹

Biswajit Das et al proposed that the magnesium level was elevated during the initial days of menstruation, gradually decreased during proliferative phase and with subsequent decrease during luteal phase which was consistent with many other research.²² The estrogen which is elevated during proliferative phase increase the PTH activity thereby decreasing the renal reabsorption of magnesium. And, during luteal phase there was increased basal metabolic rate and increased energy utilisation by the cells which consume more magnesium ions and many oxidative enzymes.¹⁶

The low magnesium levels were responsible for constriction of abdominal and cerebral blood vessels.⁵ Also, the water retention which causes bloating that occurs during the luteal phase results from increase in the constriction of renal arteries. Many studies had demonstrated that low levels of magnesium induce spasm on cerebral, peripheral blood vessels and umbilical-placental blood vessels in – vitro.²³ Many studies in literature had showed evidence that low levels of magnesium were associated with sleep disturbances, it mostly affects the quality, latency, frequency of sleep awakenings.^{24,25} There were many researches ongoing to use magnesium both as prophylactic and therapeutic in treating the symptoms of PMS.^{4,26}

Conclusion

The study participants had no differences in their demographic data. Our study indicated that there was a statistically significant fall in calcium and magnesium levels in women with premenstrual syndrome, but the serum calcium levels were

within the normal range. Also, the prevalence of magnesium deficiency was higher in the PMS group.

Implications

As magnesium is known as anti-stress mineral and a natural detoxifier with muscle relaxing property, our future studies will focus on ameliorating the symptoms of PMS with calcium and magnesium supplementations. We will also aim at establishing the correlation between individual symptoms of PMS and changes in the serum level of various minerals and their therapeutic role in treating those symptoms.

Limitations

The major strength of our study included a comprehensive assessment of various symptoms of premenstrual syndrome. The major limitation of our study was smaller size of the study population. Also, this cross-sectional study did not allow inference on causes. All results were based on subjective symptoms.

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Conflict of interest: Nil

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