

## A Study on Association of Premenstrual Syndrome with BMI, Waist-Hip Ratio, Visceral and Body Fat Percentage in College Going Girls

Ashwin Aneja<sup>2</sup>, Shweatha H E<sup>1</sup>, Pooja Anudhar G<sup>1</sup> and Veena B M<sup>1\*</sup>

<sup>1</sup>Assistant professor, Department of Nutrition and Dietetics, JSS Academy of Higher Education, Mysore, Karnataka, India

<sup>2</sup> Postgraduate, Department of Nutrition and Dietetics, JSS Academy of Higher Education, Mysore, Karnataka, India

\*Corresponding Author Email ID: [veenajanu@jssuni.edu.in](mailto:veenajanu@jssuni.edu.in)

### Abstract:

**Background:** Premenstrual syndrome (PMS) is a prevalent condition affecting women in their reproductive years. It manifests with at least one symptom, whether physical, emotional, or behavioural, occurs during the luteal phase of the menstrual cycle and typically subsides shortly after menstruation begins. Abdominal obesity has been linked to increased systemic inflammation which could be a common denominator for the pathways linked to the pathophysiology of PMS. **Objective:** The aim of this study is to associate PMS with various aspects of body composition in healthy menstruating young adult women. **Materials and Methods:** An observational study was conducted on 30 healthy females with regular menstrual cycles. PRISM calendar was used to diagnose PMS. Body composition analysis (BCA) was done using InBody 270. **Results:** 89% of subjects were diagnosed with PMS. The average BMI was in the normal range ( $21.69 \pm 4.58 \text{ kg/m}^2$ ), but Body Fat Percentage (BFP) was higher than normal ( $33.72 \pm 8.19\%$ ). 59% of the participants had higher waist-to-hip ratio. The average visceral fat level was normal for approximately 78% of subjects ( $8.44 \pm 4.33$ ). **Conclusion:** The study concluded that BFP was higher in subjects with PMS. The correlation of PMS with BMI is limited as it is a collective value of several physical parameters (including BFP). Further research is required to study this association better.

**Keywords:** PMS; Body Composition Analysis; PRISM calendar; Body Mass Index; body fat

**Introduction:** Premenstrual syndrome (PMS) is the most prevalent condition affecting women in their reproductive years. It manifests with at least one symptom, whether physical, emotional, or behavioural, which occurs during the luteal phase of the menstrual cycle and typically subsides shortly after menstruation begins (Farha *et al.*, 2023). The range of symptoms associated with PMS is extensive, with prevalent examples including breast tenderness, bloating, headaches, mood fluctuations, feelings of sadness, anxiety, frustration, and irritability. These symptoms significantly disrupt a person's daily life, personally and professionally (Arti and Mesquita, 2019).

As per systematic review published in 2021, the prevalence rate of PMS in India, was found to be 43%. The estimated prevalence of PMS during adolescence was even higher, accounting for approximately 49.6% (Dutta and Sharma, 2021) and a study carried out among college going girls reported that 85% of undergraduates suffered from PMS (Upadhyay *et al.*, 2023). A recent meta-analysis, has found that premenstrual symptoms are highly prevalent, impacting approximately 50% of women in their reproductive years globally (Direkvand-Moghadam *et al.*, 2014). However, the specific rate of prevalence vary significantly across different studies and countries due to variations in diagnostic criteria and research

methodologies. In the United States, it is estimated that PMS affects around 20 to 30% of women, whereas the minimum and maximum prevalence was found in France (12%) and Iran (98%) respectively (Direkvand-Moghadam *et al.*, 2014).

Endocrine disorders leading to increased secretion of sex hormones in overweight and obese women is linked to the onset of PMS symptoms (Farpour 2023). Leptin, hormone produced by adipose tissue, is known to regulate gonadotropin production. Overweight or obese women may have higher leptin levels due to increased number of fat cells, potentially explaining the association between adiposity and PMS (Thakur *et al.*, 2022). Studies have shown significant relationship between anthropometric measurements such as waist circumference, waist to hip ratio (WHR) and PMS symptoms. A higher WHR and visceral fat (VF) are an indication of abdominal obesity and has been linked to increased systemic inflammation. The inflammation could be a common denominator for the pathways linked to the pathophysiology of PMS (Kolb, 2022 and Farpour, 2023). Thus, an observational study was designed to study the association of PMS with various aspects of body composition in healthy menstruating young adult women, focusing on BMI, BFP, WHR and VF.

**Materials and methods:** In this observational study, 30 healthy female subjects belonging to the age group of 18 to 28 years having regular menstrual cycle (24 to 35 days) were randomly selected. Subjects diagnosed with PCOS/PCOD and/or dysmenorrhea were excluded from the study. The study was conducted in three phases. Phase one included the selection of candidates based on inclusion and exclusion criteria. In the phase two, diagnosis of PMS was carried out using PRISM calendar, followed by body composition analysis using InBody 270 in phase three. Data was compiled and analysed using suitable statistical methods.

## PRISM CALANDER

The PRISM calendar (Fig 1) involves a catalogue of 23 physical symptoms and assessment is done using a month long calendar. The patient rates each symptom on a scale of 1-3 based on severity (1-mild symptom; 2-moderate symptoms; 3-severe symptom). Scores were divided into follicular and luteal phases. The 14th day of the menstrual cycle was taken as the border between the follicular and luteal phases of a 28-day cycle. For other cycle duration, the mid-day of the cycle duration was taken as the border. The cumulative scores for each symptom at the end of one month are separated into follicular and luteal phases. If the total score for symptomatology increases by 30% or more from the follicular to luteal phases of the cycle, the patient is considered to have PMS.

Day 9 & Day 24 (or later)  
Fill in Beck Inventory  
& Self-rating Scale for PMS

## PRISM CALENDAR

Name \_\_\_\_\_  
Baseline Weight On Day 1: \_\_\_\_\_ lbs. or kg. (circle one)

Day of Menstrual Cycle	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	
<b>BLEEDING</b>																																																		
<b>WEIGHT CHANGE</b>																																																		
<b>SYMPTOMS</b>																																																		
Irritable																																																		
Fatigue																																																		
Inward Anger																																																		
Labile Mood (crying)																																																		
Depressed																																																		
Restless																																																		
Anxious																																																		
Insomnia																																																		
Lack of Control																																																		
Edema or rings tight																																																		
Breast Tenderness																																																		
Abdominal Bloating																																																		
Bowels: const. (c) loose (l)																																																		
Appetite: up ↑ down ↓																																																		
Sex Drive: up ↑ down ↓																																																		
Chills (C) / Sweats (S)																																																		
Headaches																																																		
Crave: sweets, salt																																																		
Feel Unattractive																																																		
Guilty																																																		
Unreasonable Behaviour																																																		
Low self image																																																		
Nausea																																																		
Menstrual Cramps																																																		
<b>LIFESTYLE IMPACT</b>																																																		
Aggressive towards others																																																		
Physically Verbally																																																		
Wish to be alone																																																		
Neglect Housework																																																		
Time off work																																																		
Disorganized, distractable																																																		
Accident Prone/Clumsy																																																		
Uneasy about driving																																																		
Suicidal Thoughts																																																		
Stayed at Home																																																		
Increased use of Alcohol																																																		
<b>LIFE EVENTS</b>																																																		
Negative Experience																																																		
Positive Experience																																																		
Social Activities																																																		
Vigorous Exercise																																																		
<b>MEDICATIONS</b>																																																		

### INSTRUCTIONS FOR COMPLETING THIS CALENDAR

1. On the first day of menstruation prepare the calendar: Considering the first day of bleeding as day 1 of your menstrual cycle enter the corresponding calendar date for each day in the space provided below.
2. Each Morning: Take weight after emptying bladder and before breakfast. Record **WEIGHT CHANGE** from baseline.
3. Each Evening: At about the same time complete the column for that day as described below.

**BLEEDING:** Indicate if you have had bleeding by shading the box above that days date ■; for spotting use an ☐

**SYMPTOMS:** If you do not experience any symptoms leave the corresponding square blank. If present indicate severity.

MILD: 1 (noticeable but not troublesome)  
MODERATE: 2 (interferes with normal activity)  
SEVERE: 3 (temporarily incapacitating)

**LIFESTYLE IMPACT:** If the listed phrase applies to you that day enter an ☐

**LIFE EVENTS:** If you experienced one of these events that day enter an ☐

Experiences: For positive (happy) or negative (sad or disappointing) experiences unrelated to your symptoms

specify the nature of the events on the reverse side of this form.

Social Activities: imply events such as a special dinner, show or party etc. involving family or friends.

Vigorous Exercise: implies participation in a sporting event or exercise programme lasting more than 30 minutes.

**MEDICATION:** In the bottom 3 rows list medications if any and indicate days when taken by entering an ☐

**Figure 1: Prism calendar**

**Source:** Reid, R. L., & Soares, C. N. (2018). Premenstrual dysphoric disorder: contemporary diagnosis and management. *Journal of obstetrics and gynaecology Canada*, 40(2): 215-223.

## BODY COMPOSITION

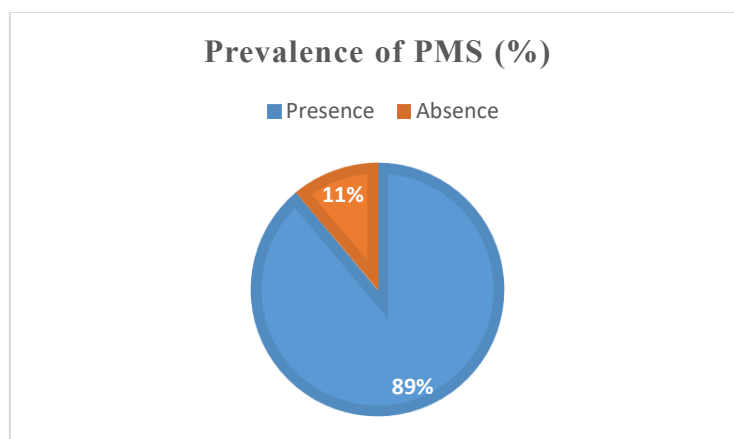
Body composition assessment involves dividing an individual's total body mass into the proportions of fat mass (FM) and fat-free mass (FFM), which includes muscles, bones, organs, ligaments, tendons, and water. The measurement of fat, muscle, bone, and water content is crucial in diagnosing, managing, and treating various nutrition-related conditions that affect individual and population health. Body composition analyser, InBody 270, was used

to measure visceral fat, fat percentage, fat mass, skeletal muscle mass, bone mass and body water levels.

**Results and discussion:** Out of 30 subjects, 2 subjects defaulted and one had an irregular menstrual cycle. Hence, Total of 27 subjects remained till the end of study. According to the diagnosis carried out using PRISM calendar, 24 subjects (88.88%) confirmed the presence of PMS (Fig.2). The mean increment of scores from the follicular phase to the luteal phase was ten times higher than the diagnostic criteria used for this study ( $393\% \pm 6.02\%$ ) (Table 1). Most of the studies conducted in relation to PMS shows the higher prevalence. According to systematic review and meta-analysis (Dutta and Sharma, 2021), 43% of menstruating women in India experience symptoms of PMS. Since sample size in the current study was small, higher prevalence was observed. Further studies with large sample size is necessary for accuracy of the results.

**Table 1: PMS score diagnosis and evaluation using PRISM calendar (n=27)**

Measurements	Mean $\pm$ SD
Follicular Score (FS)	$18.44 \pm 18.23$
Luteal Score (LS)	$29.81 \pm 32.34$
Difference (FS-LS)	$29.81 \pm 32.34$
% increase	$393\% \pm 6.02\%$



**Fig 2: Prevalence of PMS diagnosed using PRISM calendar (n=27)**

**Table 2: Mean Anthropometric Measurements and Body Composition of the participants diagnosed with PMS (N=24)**

Measurements	Mean $\pm$ SD
Weight (Kg)	$54.51 \pm 10.99$
Skeletal Muscle Mass (Kg)	$18.92 \pm 2.96$
BMI (kg/m <sup>2</sup> )	$21.69 \pm 4.59$
Waist-Hip Ratio	$0.85 \pm 0.03$
Visceral Fat Level (%)	$8.75 \pm 4.40$
Percentage Body Fat (%)	$33.72 \pm 8.19$
Bone Mass (Kg)	$2.55 \pm 0.36$
Body Fat Mass (Kg)	$19.06 \pm 7.93$

Mean anthropometric measurements and body composition of the participants diagnosed with PMS is depicted in table 2. Mean BMI ( $21.69 \pm 4.59 \text{ kg/m}^2$ ) was found in normal range as per the Asian standards (Lim *et al.*, 2017), whereas, mean body fat percentage (BFP) was found higher than the normal (Ho-Pham *et al.*, 2011) ( $33.72 \pm 8.19\%$ ). The results



of the present study were similar to the results of obtained by Thakur *et al.*, (2022), where BFP was found to be higher for subjects with PMS ( $33.95 \pm 4.89\%$ ) and BMI of the participants fell within the range considered normal ( $21.76 \pm 4.81 \text{ kg/m}^2$ ).

**Table 3. Classification of participants according to Body Mass Index (N=27)**

BMI classification	Standard values	N (%)
Underweight	<18.5	6 (22)
Normal	18.5 - 22.9	13 (48)
Overweight	23 - 24.9	3 (11)
Obese	$\geq 25$	5 (19)

Table 3 shows the categories of BMI of the participants. Majority of the participants (418%) had normal BMI (included those without PMS), 22% were underweight, 11% were overweight and 19% were obese according to BMI cut-offs for Asians (Thakur *et al.*, 2022). Although 48% of participants had normal BMI in the present study, 89% of subjects were diagnosed to have PMS. Similar results were found by Mizgier *et al.*, 2019 that subjects who had a BMI  $<25 \text{ kg/m}^2$ , suffered more symptoms of PMS. They also found that women with BMI  $\geq 25 \text{ kg/m}^2$  had higher BFP ( $37.85 \pm 5.85\%$ ), indicating that body fat may play a role in the onset of PMS.

**Conclusion:** PMS is a major gynaecological issue which is prevalent in menstruating women worldwide. In underdeveloped countries like India, talking about menstruation is a taboo and mostly not diagnosed, causing women to suffer silently. Creating awareness among women can help breaking the barrier and proper measures can be included in the treatment of PMS. Study found a linear association between PMS and body fat percent among the subjects diagnosed with PMS, and BMI was less correlated. Though the etiology of PMS is not fully understood, more research is required to understand PMS and its manifestation. Further large scale clinical trials are encouraged to establish relationship between PMS, body fat and nutritional status.

## References

1. Farha S S., Pallavi R and Veena B M, 2023, Premenstrual syndrome and its association with body composition: A comprehensive review. *Int. J of Sci and Res.* **10(1)**:742-744.
2. Arati M and Mesquita JC, 2019, Association of Premenstrual Syndrome with Body Mass Index, and its Effect on the Quality of Life: A Cross-sectional Study. *J South Asian Feder Obst Gynae.* **11(6)**:371–374.
3. Dutta A, and Sharma A, 2021 Prevalence of premenstrual syndrome and premenstrual dysphoric disorder in India: A systematic review and meta-analysis. *Health promotion perspectives.* **11(2)**:161.
4. Upadhyay M, Mahishale A, Kari A, 2023 Prevalence of premenstrual syndrome in college going girls-A cross sectional study. *Clin Epidemiol Glob Health.* **20**:101234. <https://doi.org/10.1016/j.cegh.2023.101234>  
» <https://doi.org/10.1016/j.cegh.2023.101234>
5. Direkvand-Moghadam A, Sayehmiri K and Delpisheh A, 2014, Epidemiology of Premenstrual Syndrome (PMS)-A Systematic Review and Meta-Analysis Study. *JCDR.* **8(2)**. DOI: 10.7860/JCDR/2014/8024.4021.
6. Thakur H, Pareek P, Sayyad MG, Otiv S, 2022, Association of Premenstrual Syndrome with Adiposity and Nutrient Intake among Young Indian Women. *International Journal of Women's Health.* **4**:665-75.

7. Kolb H, 2022 Obese visceral fat tissue inflammation: from protective to detrimental. BMC. **20(1)**:1-4.
8. Farpour, S., Moradinazar, M and Samadi, M., 2023, Relationship of Body Composition and PMS Symptoms: A Systematic Review. Indian J of Endocrinology and metabolism. **20(6)**: [10.2174/0115734048245078231011112638](https://doi.org/10.2174/0115734048245078231011112638).
9. Reid, R. L., & Soares, C. N. 2018. Premenstrual dysphoric disorder: contemporary diagnosis and management. *Journal of obstetrics and gynaecology Canada*, **40(2)**: 215-223.
10. Lim JU, Lee JH, Kim JS, Hwang YI, Kim TH, Lim SY, Yoo KH, Jung KS, Kim YK, Rhee CK. 2017, Comparison of World Health Organization and Asia-Pacific body mass index classifications in COPD patients. *International journal of chronic obstructive pulmonary disease*. **21**:2465-75.
11. Ho-Pham LT, Campbell LV, Nguyen TV. 2011, more on body fat cut-off points. In Mayo Clinic Proceedings. 86(6): 584. Elsevier.
12. Mizgier M, Jarzabek-Bielecka G, Jakubek E, Kedzia W. 2019, The relationship between body mass index, body composition and premenstrual syndrome prevalence in girls. *Ginekologia Polska*. **90(5)**:256-61.