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Original Research Article

DIET AND THE CYCLE: EXPLORING THE LINK BETWEEN NUTRITION AND PREMENSTRUAL SYNDROME

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ABSTRACT

Background: Premenstrual syndrome (PMS) is a common disorder among women of reproductive age, characterized by a range of physical, psychological, and behavioral symptoms that affect daily functioning. Despite its high prevalence, the role of modifiable factors such as nutrition and lifestyle in PMS remains underexplored in the Indian population. This study aimed to assess the prevalence of PMS and examine its association with dietary and lifestyle factors among young adults in South India.

Materials and Methods: A cross-sectional study was conducted among 240 female undergraduate students at a tertiary medical institution. Data were collected using a structured online questionnaire comprising demographic information, menstrual history, the Premenstrual Syndrome Scale (PMSS), and dietary and lifestyle patterns. Statistical analysis was performed using Spearman correlation and Mann–Whitney U tests.

Results: The prevalence of PMS was 67.09%, with 43.75% experiencing moderate and 20.42% severe symptoms. Commonly reported symptoms included pelvic pain, abdominal cramps, mood swings, and food cravings. Significant positive correlations were found between PMS scores and the intake of refined sugars ($p = 0.0003$) and salty foods ($p < 0.0001$). A statistically significant negative correlation was observed between PMS severity and adequate sleep duration ($p = 0.0002$). No significant associations were found with BMI, caffeine, or physical activity.

Conclusion: PMS is highly prevalent among female medical students and is significantly associated with the consumption of refined sugars, salty foods, and inadequate sleep. These findings underscore the need for targeted nutritional and behavioral interventions to mitigate PMS severity and improve students' well-being.

Keywords: Premenstrual syndrome, nutrition, lifestyle, medical students, refined sugar, sleep, India

INTRODUCTION

Premenstrual syndrome (PMS) encompasses a constellation of physical, emotional, and behavioral symptoms that cyclically occur during the luteal phase of the menstrual cycle and resolve shortly after menstruation begins. These symptoms may significantly interfere with academic performance, interpersonal relationships, and overall quality of life among women of reproductive age, particularly in young adults such as college students and medical trainees.[1]

Globally, the prevalence of PMS among women of reproductive age varies widely, ranging from 30% to 80%, depending on the population studied and diagnostic criteria used.[2] In India, studies among college-going females have reported prevalence rates between 60% and 76%, with higher rates observed in medical students likely due to increased awareness and stress levels inherent in medical education.[3,4]

Despite the high burden of PMS, its etiology remains multifactorial and incompletely understood. Hormonal fluctuations, particularly involving estrogen and progesterone, have been implicated, along with serotonergic dysregulation, inflammatory mediators, and psychological stress.[5] More recently, modifiable lifestyle and nutritional factors have gained attention as potential contributors to PMS symptomatology. Diets high in refined sugars, salt, caffeine, and fat have been associated with greater severity of PMS symptoms, while diets rich in complex carbohydrates, calcium, magnesium, and vitamin B6 may offer a protective effect.[6,7]

Given the critical role of nutrition in modulating neurotransmitter synthesis, hormonal balance, and inflammatory pathways, it is plausible that dietary habits can influence the onset or intensity of PMS symptoms. Furthermore, inadequate sleep, sedentary behavior, and irregular eating patterns—common among students—may further exacerbate the condition.[8,9]

Medical students, in particular, represent a vulnerable group due to academic pressures, irregular routines, and higher health literacy, which might influence symptom perception and reporting. Yet, data exploring the relationship between PMS and nutrition in this demographic remain limited, especially in the Indian context.

Therefore, this study was aimed to estimate the prevalence of PMS and explore its association with dietary and lifestyle factors among female medical and dental students at a tertiary institution in South India. By identifying modifiable risk factors, the study hopes to contribute to targeted interventions for PMS management and symptom relief in young women.

MATERIALS AND METHODS

A cross-sectional descriptive study was conducted during the academic year 2022–2023 among undergraduate medical and dental students at the Kamineni Institute of Medical and Dental Sciences, Telangana, after obtaining approval from the Institutional Ethics Committee.

Sample Size Calculation: Assuming a 95% confidence level, a 5% margin of error, and an estimated PMS prevalence of 70% (based on prior studies showing prevalence between 60% and 80%),[2,4] the initial sample size was calculated to be 323. Since the total number of female students was approximately 500, finite population correction was applied, yielding an adjusted sample size of 197. Accounting for a 10% non-response rate, the final required sample size was 219 students.

To assess the association between PMS and nutritional status, the sample size was calculated for comparing two proportions. Based on literature suggesting a PMS prevalence of 80% among students with unhealthy diets and 60% among those with healthy diets,[10] the required sample size was 79 participants per group (158 total), assuming a 95% confidence level and 80% power. After adjusting for a 10% non-response rate, the sample size increased to 176. However, since the sample size needed to estimate prevalence (n = 219) was larger, it was adopted to sufficiently address both objectives of the study.

Study Participants: Female undergraduate medical (MBBS) and dental (BDS) students from all academic years, including interns, were invited to participate in the study.

Data Collection Tool: Data were collected using a structured, self-administered digital questionnaire created via Google Forms. The questionnaire consisted of three sections:

1. Participant Demographics and Menstrual History: Included age, academic year, height, weight, age at menarche, menstrual cycle regularity, medication use, and comorbidities.
2. The Premenstrual Syndrome Scale (PMSS): a validated tool developed and tested for reliability by Padmavathi et al,[11] was used to assess the presence and severity of PMS symptoms. The scale evaluates physical, psychological, and behavioral symptoms experienced over the previous three months. Each item is rated on a 5-point Likert scale ranging from “Never” (1) to “Always” (5).
3. Nutrition and Lifestyle Assessment: Included frequency of consumption of specific food items and lifestyle habits including sleep, exercise, breakfast.

Informed consent was obtained, and responses were collected anonymously. Confidentiality was maintained throughout the study.

Statistical Analysis: Data were analysed using STATISTICA 10 PL software. Descriptive statistics were used to summarize demographic data, PMS severity, and nutritional/lifestyle patterns. Categorical variables were expressed as frequencies and percentages, and continuous variables as means ± standard deviations.

Associations between PMS and dietary or lifestyle variables were assessed using Spearman’s rank correlation coefficient, given the ordinal and non-normally distributed nature of the data. Comparisons between PMS-positive and PMS-negative groups were performed using the Mann–Whitney U test. A p-value < 0.05 was considered statistically significant.

RESULTS

The total number of students who participated in the study was 350. Students with menstrual irregularities, thyroid disorders, depression and anxiety were excluded from the study. After applying the exclusion criteria, the number of data points included in the analysis was 240.

Among the participants, 91 students were pursuing BDS, and 149 were studying MBBS. Distribution of

students according to their year of study is shown in Table 1.

The age of the participants ranged from 17 to 25 years with a mean age of 20.04± 1.71. The mean age at menarche was 12.89±1.34, with a range of 9-16 years. The average menstrual cycle length was 28.7 ± 2.17 days (range: 21-40) and the mean duration of menstrual flow per cycle was 4.61±1.03 days (range:2-8). The Mean BMI of the participants was 22.39±4.19 Kg/m^2 (range:14.53-41.27). Distribution of the students according to their BMI is given in Table 2.

Using the modified MOOS questionnaire, 161 students (67.09%) were classified as PMS Positive (score ≥ 80) with a mean score of 112.55±23.10 and 79 students (32.91%) were categorized as PMS negative (score<80) with a mean score of 62.24±10.82 [Figure 1].

The severity of PMS symptoms is detailed in Table 3.

The mean BMI among PMS-positive students was 22.24 ± 4.01 Kg/m^2, compared to 22.68 ± 4.56 Kg/m^2 among PMS-negative students. A Pearson correlation analysis revealed a weak, non-significant negative correlation (R=−0.0414, P=0.4462) between BMI and PMS score indicating no significant linear relationship.

The mean subscale scores for Physiological, Psychological and Behavioural symptoms among PMS positive participants are presented in Table 4.

Table 5 categorizes the different symptoms of PMS into physiological, psychological, and behavioural domains, rating their severity on a scale from 1 to 5. The mode values indicate the most frequently reported severity level for each symptom.

Among the PMS positive students most of them agreed to suffer from Pelvic discomfort and pain (Mode-5) with 34 students (21.12%) reporting the use of painkillers to alleviate the symptoms. Additionally, students reported experiencing abdominal cramps, food cravings (sugar/salt), irritability, and mood swings with high severity.

Spearman correlation analysis for association between nutritional factors and PMS score is presented in [Table 6].

A statistically significant positive correlation was observed between PMS score and consumption of Refined sugars (p=0.0002568) and Salty foods (p=0.00002545) [Figure 2 & 3].

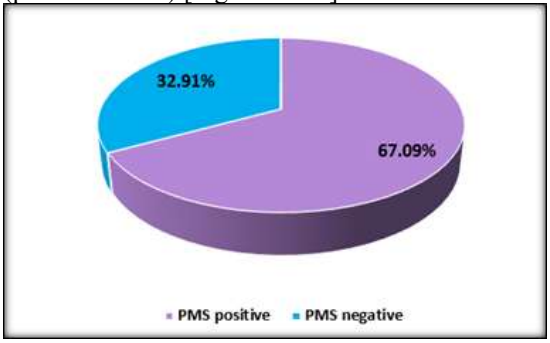

Figure 1: Distribution of PMS-Positive and PMS-Negative Participants

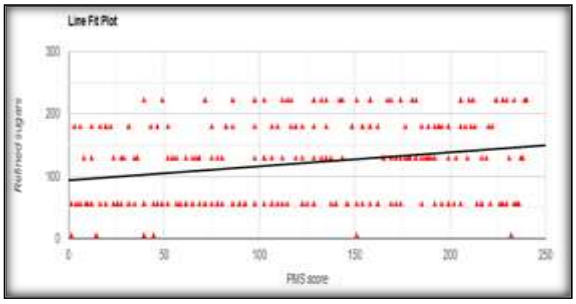

Figure 2: Scatter plot showing the relationship between PMS score and refined sugar intake among study participants.

A positive linear trend is observed, suggesting a potential association between higher PMS scores and increased refined sugar consumption

It can also be observed [Table 6] that there is a positive correlation which is marginally significant between PMS score and consumption of Bananas/potatoes(p=0.05622) and Eggs(p=0.0548).

Spearman correlation analysis for association between lifestyle factors and PMS score is presented in [Table 7].

A statistically significant negative correlation was observed between adequate sleep (6-8 hours per day) and PMS scores [Figure 4] suggesting that students who reported regular sleep had lower PMS severity.

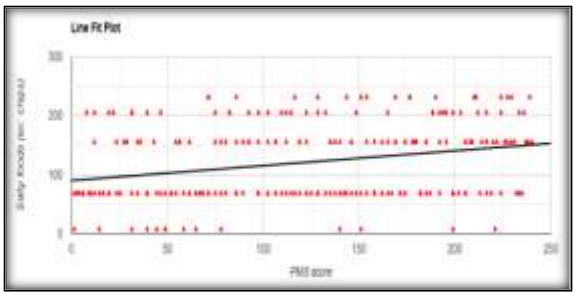

Figure 3: Scatter plot depicting the association between PMS score and intake of salty foods among study participants.

The positive trend line indicates a potential increase in PMS scores with higher salty food consumption.

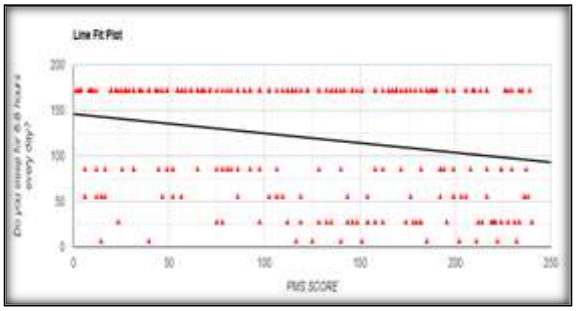

Figure 4: Scatter plot illustrating the relationship between PMS score and sleep duration

A negative trend is observed, suggesting that higher PMS scores may be associated with shorter or irregular sleep duration.

Table 1: Distribution of the participants by Year of study

Year of study	Frequency(n)	Percentage (%)
First year	140	58.33
Second year	21	8.75
Third year	41	17.08
Fourth year	13	5.42
Internship	25	10.42
Total	240	100

Table 2: Distribution of Participants Based on BMI categories

BMI categories	BMI(kg/m2)	Frequency(n)	Percentage
Underweight	< 18.5	40	16.66
Normal weight	18.5 - 24.9	148	61.66
Overweight	25.0- 29.9	38	15.84
Obese	> 30	14	5.84
Total		240	100

Table 3: Severity of PMS symptoms

Severity level	PMS score range	Mean ± SD	Frequency(n)	Percentage (%)
Mild	40-80	62.68 ± 11.04	81	33.75
Moderate	81- 120	99.30 ±11.41	105	43.75
Severe	121-160	136.14 ±10.51	49	20.42
Very severe	161-200	172.6±13.01	5	2.08
Total			240	100

Table 4: subscale scores of PMS positive participants

Subscale	Total possible score	Mean ± SD
Physiological	80	44.05±9.16
Psychological	60	35.47±8.61
Behavioural	60	33.04±9.98
Total	200	112.55±23.10

Table 5: PMS Severity scale analysis

	MODE(scale- 1 to 5)*
Physiological symptoms	
Breast tenderness and swelling, weight gain Headache, Dizziness/fainting, Palpitations	1
Nausea/vomiting	2
Abdominal bloating, Fatigue, Change in bowel habits (diarrhoea/constipation), Increased appetite, Generalized aches and pains, Skin changes, Muscle and Joint pain	3
Pelvic discomfort and pain, Abdominal cramps, Food cravings (Sugar/ Salt)	5
Psychological symptoms	
Depression, Forgetfulness, Confusion	1
Anxiety, Tension, Easy crying/ Crying spells, Sleep changes (Insomnia/ hypersomnia), Loss of concentration, Aggression, Hopelessness	3
Irritability	4
Mood swings	5
Behavioural symptoms	
Poor judgment, Obsessional thoughts, Compulsive behaviour	1
Social withdrawal, Restlessness, Lack of self-control, Feeling guilty, Clumsiness, Lack of interest in usual activities, Impaired work performance, Irrational thoughts, Being over sensitive	3

*1-Never, 2- Rarely, 3-Sometimes, 4- Very often, 5-Always

Table 6: Correlation between PMS and Dietary factors

Food item	PMS positive Mean±SD	PMS negative Mean±SD	rs value	p (2-tailed)
Refined Sugar (sweets, chocolates, biscuits, cakes etc)	3.26±1.18	2.65±1.03	0.2339	0.0002568*
Caffeine(coffee)	2.40±1.40	2.38±1.43	0.01064	0.8698
Salty foods(chips)	2.91±1.02	2.35±0.93	0.2682	0.00002545*
Soft drinks/soda	2.12±0.96	1.99±0.69	0.1113	0.08521
Alcohol	1.16±0.38	1.13±0.43	0.08906	0.169
Red meat (mutton) and poultry(chicken)	2.31±0.94	2.23±0.83	0.09173	0.1566
Milk & other Dairy products	3.70±1.36	3.85±1.41	-0.04225	0.5148
Cereals/ whole grains (rice, oats etc)	4.67±0.81	4.57±1.00	0.04385	0.4989
Beans/Legumes	3.20±1.19	3.01±1.08	0.1006	0.12
Green leafy vegetables	3.01±1.04	2.86±0.98	0.07729	0.2329

Nuts (almonds, walnuts etc)	2.78±1.25	2.90±1.36	-0.05572	0.3901
Bananas and potatoes	3.26±1.22	2.97±1.14	0.1234	0.05622
Mushrooms	1.35±0.53	1.38±0.56	-0.02464	0.7041
Fish (salmon, tuna etc)	1.45±0.59	1.49±0.57	-0.04058	0.5315
Avocados	1.13±0.45	1.09±0.29	0.003338	0.959
Eggs	2.82±1.08	2.65±0.96	0.1241	0.0548

*P value < 0.001- statistically significant

Table 7: Correlation between PMS and Lifestyle factors

Lifestyle and Eating habits	PMS positive Mean±SD	PMS negative Mean±SD	rs value	p (2-tailed)
Do you eat breakfast every morning	4.57±0.84	4.58±0.91	0.02604	0.6882
Do you regularly exercise at least for 30 mins a day?	2.39±1.32	2.53±1.47	-0.0675	0.2978
Do you sleep for 6-8 hours every day?	3.91±1.35	4.42±0.99	-0.2363	0.00022*

*P value < 0.001- statistically significant

DISCUSSION

Prevalence: The prevalence of PMS among participants, who were medical and dental students with a mean age of 20.04 years, was estimated to be 67.09%. This aligns with findings from a study among college students in Puducherry (62.7%),[12] and another study among medical students reporting a prevalence of 76.35%,[13] both involving similarly aged cohorts. A lower prevalence was observed in a Bulgarian study (32.1%), where the mean participant age was 31.04 years.[14] Similarly, a meta-analysis conducted in Ethiopia reported a pooled prevalence of 53%.[15] The relatively high prevalence in the current study may be attributed to demographic factors, increased awareness among medical students, and the sensitivity of the assessment tool employed. Medical background could have enhanced participants' recognition and reporting of symptoms.

Age at Menarche: The mean age at menarche was 12.89 years, which is consistent with findings from a prospective study in North India (13.13 years),[16] suggesting regional similarity in pubertal timing.

Menstrual Flow: The average menstrual cycle length and duration of flow per cycle were 28.7 days and 4.61 days, respectively aligning with global norms. These findings are consistent with the Apple Women's Health Study, which reported similar values in Western populations. However, regional differences have been noted, with Asian women typically exhibiting slightly longer cycles and shorter flow durations. This variation may be attributed to lower levels of Anti-Müllerian Hormone (AMH) and estrogen among Asian women, affecting follicular development and endometrial growth.[17,18]

Correlation with BMI

A very weak and non-significant negative correlation between BMI and PMS scores (p = 0.4462) was observed. This aligns with studies showing inconsistent associations between BMI and PMS severity,[19,20] though some studies report significant correlations.[21] These discrepancies highlight the multifactorial nature of PMS and the potential influence of other physiological or environmental variables.

PMS Severity Analysis: Students who screened positive for PMS reported a wide array of symptoms. Frequently reported physical symptoms included pelvic discomfort, abdominal cramps, and food cravings (mode = 5), as well as fatigue, bloating, and general aches (mode = 3). These results are consistent with prior findings that identify abdominal and pelvic pain as key physical manifestations of PMS.[22] Psychological symptoms were also highly prevalent, with mood swings (mode = 5) and irritability (mode = 4) being the most notable, echoing prior studies that have identified emotional instability as a core feature of PMS.[23] Behavioral symptoms like social withdrawal and restlessness and lack of self-control also appeared with moderate frequency(mode = 3), highlighting the functional impact of PMS on daily activities.[24]

Correlation Between PMS and Dietary Factors

Significant positive correlations were observed between PMS scores and the intake of refined sugars and salty foods (p < 0.001). These findings are consistent with existing literature linking high sugar and salt consumption to the exacerbation of PMS symptoms.[10,25]

High intake of refined sugars contributes to PMS through several interconnected mechanisms. One major factor involves blood glucose and insulin fluctuations—diets rich in refined carbohydrates cause rapid glycemic spikes followed by sharp declines, potentially intensifying mood swings, irritability, and fatigue, which are hallmark symptoms of PMS.[26] Such glycemic volatility may also disrupt serotonin regulation, a neurotransmitter critical for mood stabilization. Notably, reduced serotonin levels during the luteal phase are associated with increased carbohydrate cravings, reinforcing a feedback loop of poor dietary choices and worsening symptoms.[27] Furthermore, excessive sugar intake can trigger systemic inflammation and disrupt hormonal balance, particularly estrogen-progesterone ratios, central to PMS pathophysiology.[28] These diets are often low in essential micronutrients such as magnesium, vitamin B6, and calcium—nutrients vital for mood regulation and fluid balance during the menstrual cycle.[29] Collectively, these factors suggest that excessive refined sugar intake may not only trigger PMS onset but also intensify its severity.

Similarly, high dietary salt intake has been associated with worsening PMS symptoms via several physiological mechanisms. Sodium-induced fluid retention can lead to bloating, breast tenderness, and weight gain—symptoms frequently experienced during the premenstrual phase.[12] Additionally, increased sodium may activate the renin-angiotensin-aldosterone system (RAAS), further promoting water retention and contributing to fatigue and headaches.[13] Salt intake may also affect neurotransmitter activity and neuronal excitability, thereby aggravating mood-related symptoms such as anxiety and irritability.[14] Moreover, high-salt diets are often deficient in potassium and magnesium—minerals important for neuromuscular function and emotional stability.[15] These imbalances may exacerbate both the physical and psychological symptoms of PMS, reinforcing the need for dietary salt moderation as a non-pharmacologic intervention. Marginally significant correlations were also observed with the intake of bananas and potatoes ($p = 0.05622$), and eggs ($p = 0.0548$). Bananas are rich in vitamin B6, which has shown some effectiveness in PMS relief,[30] however, the effect may be diminished by nutrient interactions or overconsumption. Eggs, though nutrient-dense, have an unclear relationship with PMS, indicating a need for further focused research.

No significant associations were observed between PMS scores and the intake of caffeine, dairy products, whole grains, or green leafy vegetables. These findings differ from some previous reports that suggest calcium and complex carbohydrates may relieve PMS symptoms.[29] Such discrepancies could be due to differences in portion size, frequency of intake, dietary patterns, or nutrient bioavailability in the studied population.

Correlation Between PMS and Lifestyle Factors: Among lifestyle variables, only sleep duration (6–8 hours per day) showed a statistically significant negative correlation with PMS scores. This finding supports evidence that adequate sleep may reduce PMS severity by stabilizing hormonal rhythms and reducing stress response.[31-33] Conversely, breakfast consumption and physical activity did not correlate significantly with PMS. While previous literature promotes these behaviors for menstrual health,[34,35] variations in dietary content, exercise intensity, and self-reporting accuracy could explain these discrepancies.

These findings underscore the potential role of sleep hygiene in PMS management. Educational interventions aimed at improving sleep patterns may offer a cost-effective strategy for mitigating PMS symptoms among young women.

Implications and Recommendations: The findings underscore the importance of addressing dietary and lifestyle factors to manage PMS symptoms. Interventions focusing on reducing the intake of refined sugars and salty foods and promoting regular sleep patterns could be particularly beneficial. While the study establishes significant correlations between certain dietary habits and PMS, the causative mechanisms remain unclear and warrant further investigation through longitudinal studies or controlled trials.

Limitations: Several limitations should be acknowledged. First, the cross-sectional design limits causal inferences. Second, the reliance on self-reported data for dietary intake and PMS symptoms may introduce recall bias. Finally, the study's findings are specific to a population of female medical students and may not be generalizable to other groups.

CONCLUSION

This study highlights a high prevalence of PMS among female medical students, with dietary and lifestyle factors playing a significant role in symptom severity. Targeted interventions addressing these factors may improve the quality of life and academic performance of affected individuals. Future studies should aim to clarify the causal relationships and explore the potential benefits of dietary modifications and lifestyle interventions in managing PMS.

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