

Association of Premenstrual Syndrome with Calcium Intake and Dysmenorrhea: A Cross-Sectional Study of High School Female Students in Karachi

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ABSTRACT

Objectives: To determine the prevalence of PMS among adolescent high school girls in Karachi and to evaluate its association with dysmenorrhea and dietary calcium intake.

Methods: A cross-sectional study was conducted from April 2025 to December 2025 among 185 unmarried female students aged 14–19 years from selected high schools in Karachi, Pakistan. Data were collected using a pre-tested, self-administered questionnaire, which included demographic details, menstrual history, dietary calcium intake, and PMS diagnosis based on American College of Obstetrics and Gynecology (ACOG) criteria. Statistical analysis was performed using SPSS version 26, with chi-square test applied at a significance level of $p < 0.05$.

Results: The mean age of participants was 16.7 ± 1.08 years. A total of 166 (89.7%) students met the diagnostic criteria for PMS, with the highest prevalence observed among 17-year-olds (39.1%). Dysmenorrhea was reported by 160 (86.5%) participants, of whom 148 (89.1%) also fulfilled PMS criteria ($p = 0.002$). PMS significantly interfered with educational activities in 93 (56%) participants ($p < 0.001$). Dietary assessment revealed that 59% of participants consumed inadequate calcium, and among them, 62.3% were diagnosed with PMS.

Conclusion: PMS is highly prevalent among adolescent girls in Karachi and is significantly associated with dysmenorrhea and low dietary calcium intake. It adversely affects academic and social life. Health education and preventive strategies focusing on nutrition and early management are urgently needed.

Keywords: Premenstrual syndrome, Dysmenorrhea, Calcium intake, Adolescents.

INTRODUCTION

Premenstrual syndrome (PMS) refers to a wide range of physical, psychological and behavioral changes, typically begin prior to the onset of menstruation and regress shortly after the end of menstruation.^{1,2} Symptoms of PMS are more pronounced among young females between 15–24 years as compared to the adult women in the reproductive age.³ Prevalence of PMS varies with the population in different regions of the world. A meta-analysis study documents 47.8% females are

affected by PMS.⁴ In Asia every tenth women experience PMS. Researches from China, India and Iran document its occurrence as 67%, 86% and 53.5% respectively.^{5,6,7} Statistics from Pakistan report 48–69% of women in 2022, experience PMS and about 40.5% women belong to young age group.^{8,9} High rate of work abstention, role limitations due to physical and mental unwellness and low health quality of life has been observed in these women.¹⁰ Women with history of depressive disorders along with other factors such as age, education and marital status are susceptible for

PMS.^{11,12} An aberrant response of central neurotransmitters especially serotonin to altered endorphin modulation of gonadotropin secretion has found to play an important role in PMS severity.¹³ Although various measures have been taken to overcome this syndrome. Combined oral contraceptives and serotonergic antidepressants are proven to be potent approaches.¹⁴ Natural progesterone, vitamins and minerals supplements, exercise, diet modification and stress reduction are also found to be effected in reducing the severity.¹⁵ Despite of the huge burden of this syndrome, no proper diagnostic tool (biochemical or imaging) is accessible to establish the diagnosis however the diagnosis usually relies upon the symptomatology of women.¹⁶ The American college of obstetrics and gynecology (ACOG) has introduced ten clinical criteria for diagnosing PMS. The criteria are based on the presence of at least one of the six affective and one out of four somatic symptoms, five days prior to the onset of menstrual cycle and regress within first four days of menstruation, in three successive cycles.¹⁷ Calcium also plays an important role in the severity of PMS. About 1200mg/day intake of calcium carbonate improves the symptoms by half, particularly when given in three consecutive cycles.¹⁸ The calcium requirement varies with the age and is maximum during adolescent period.¹⁹

Despite the high global prevalence of premenstrual syndrome, limited data are available regarding its burden among adolescent schoolgirls in Pakistan, particularly in Karachi. Adolescence is a critical stage where menstrual health problems can significantly affect academic performance, social interactions, and quality of life. Furthermore, factors such as dysmenorrhea and inadequate dietary calcium intake may influence the severity of PMS symptoms, yet evidence from local populations remains scarce. Therefore, this study was conducted to determine the prevalence of premenstrual syndrome among adolescent high school girls in Karachi and to assess its association with dysmenorrhea and dietary calcium intake.

METHODS

A cross-sectional study was conducted from April 2025 to December 2025 in selected high schools of Karachi, Pakistan, among unmarried female students aged 14–19 years. All students fulfilling the inclusion criteria i.e. unmarried female students between the ages of 14-19 years, enrolled in 10th, 11th and 12th grades, with regular monthly cycle (22-35days) for the last 6 consecutive months and were willing to participate in the study were asked for a verbal as well as a written informed consent in both Urdu and English before filling the questionnaire. In case of under 18 year's old participants, the consent was taken from parents (preferably mothers) whereas students with known gynecological disorders, chronic medical illness, hormonal therapy use, or incomplete questionnaire responses were excluded from the study. The sample size was calculated using an expected prevalence of PMS of 68.6% from previous south Asian study²⁰, with a 95% confidence level and 5% margin of error, resulting in a minimum required sample size of approximately 185 participants. Data was collected in the form of a pre-tested self-administered questionnaire, divided into four parts. Part A and B contained demographic questions and assessment of menstrual cycle respectively whereas Part C consisted of calcium intake questions. Part D had American College of Obstetrics and Gynecology (ACOG) criteria for PMS to assess severity, functional impairment, appearance and resolution of PMS symptoms along with their presence in the last 3 cycles. According to American College of Obstetrics and Gynecology (ACOG), participants were considered to meet the ACOG criteria for PMS if they rated their experience of at least one of the six behavioral symptoms and one of the four somatic symptoms. Behavioral symptoms included depression, irritability, anxiety, mood swings, confusion, and social withdrawal, while somatic symptoms included breast tenderness, abdominal bloating, headache, and swelling of extremities. Symptoms should begin five days prior to menstruation and

lasts within four days of the onset of the cycle in at least three consecutive cycles.²¹

The demographical data, menstrual history, American College of Obstetrics and Gynecology (ACOG) designed standards for PMS were recorded. Dietary calcium intake was assessed using a food frequency questionnaire that recorded the frequency and portion size of commonly consumed calcium-rich foods, including milk, yoghurt, and cheese. The estimated daily calcium intake was calculated using standard nutritional values for these foods. The calculated intake was then compared with the Recommended Dietary Allowance (RDA) for adolescents and young adults (1000–1300 mg/day) as recommended by the National Institutes of Health. Participants consuming <1000 mg/day were categorized as having inadequate calcium intake, whereas those consuming $\geq$ 1000 mg/day were considered to have adequate calcium intake.

Data obtained was analysed using SPSS software version 26.0 and a chi square test was used to assess relation between categorical variables associated to PMS. The statistical analysis was conducted with 95% confidence interval and a p-value of <0.05 was taken as the threshold of statistical significance. Ethical approval for the study was obtained from the Institutional Review Board of Liaquat College of Medicine and Dentistry (Reference No: IRB/M-000118-25) prior to data collection.

RESULTS

The demographic characteristics of the study participants showed that the majority were aged below 17 years, approximately 61%, while about 39% were above 17 years. Regarding class level, most participants were studying in 12th grade approximately 63%, followed by 11th grade approximately 30%, and 10th grade approximately 7%. Family income was almost equally distributed, with about 49% of participants having a family income of less than 50,000 PKR, while approximately 51% had a family income of more than 50,000 PKR.

A total of 185 female participants were included in the study. The age at menarche was less than 13 years in 113 participants (61.1%), while 72 participants (38.9%) reported menarche at more than 13 years of age. Regarding the duration of menstruation, the majority of participants 127 (68.6%) reported an average menstrual duration of 3–6 days, followed by 33 participants (17.8%) reporting a duration of $\geq$ 7 days, while 25 participants (13.5%) reported a duration of 1–2 days.

When menstrual characteristics were compared with PMS diagnostic criteria, no statistically significant association was observed between age at menarche and PMS status ($p = 0.479$). Similarly, the average duration of menstruation was not significantly associated with PMS status ($p = 0.877$) (Table 1).

Our study consists of 185 samples with a mean age of study population 16.72 (Standard deviation $\pm$ 1.082). Out of 185 study participants, a majority of 166 (89.7) met the criteria for being diagnosed with Premenstrual syndrome. In these 166 participants, the most commonly involved age group was of 17-year-old adolescent high school female students i.e. 65 individuals (39.1%). When age was compared with both PMS diagnosed and healthy groups of individuals, the results were found to be significant i.e. prevalence of PMS in adolescent high school female students was high ($p\text{-value} < 0.001$)

A total of 93 (56.02%) out of 166 individuals reported the symptoms of PMS to be affecting their educational life, followed by 37 (22.2%) individuals who found these socially disturbing. Hence, the relation between PMS and part of life affected was found significant. The p-value in chi-square test is ($p\text{-value} < 0.001$) (Table 2).

Total 160 (86.5%) individuals from our study population experienced dysmenorrhea and out of these, 148 (89.15%) individuals met the PMS diagnostic criteria, highlighting dysmenorrhea as an important criterion for PMS ($p\text{-value} = 0.002$). Day one of menstrual cycle was reported to be the most common day of dysmenorrhea in 111 participants

(60%). 82 (44.3%) participants used home remedies for pain control followed by 72 (38.9%) girls who used painkillers. Frequency of using painkillers was once a day for 63 (34.1%) participants. Only 19 (10.3%) participants had visited doctors for pain control (Table 3)

Out of the 185 students, more than half of the participants (109; 59%) had inadequate dietary calcium intake, while 76 (41%) reported adequate calcium consumption. The daily intake of calcium was assessed using food frequency questions documenting the quantity (portions) and frequency of consumption of milk, yoghurt, cheese, cream, butter, and fortified juices according to recommended dietary guidelines.

Among the 109 participants with inadequate calcium intake, 68 (62.3%) fulfilled the American College of Obstetrics and Gynecology (ACOG) diagnostic criteria for premenstrual syndrome, while 41 (37.7%) did not. Although a higher proportion of PMS was observed among participants with inadequate calcium intake, the association was not statistically significant ($p > 0.05$).

DISCUSSION

The present study demonstrates a high prevalence of PMS (89.7%) among adolescent students, consistent with findings from Ibrahim et al. (80.1%) and Shahbazi et al. (73.6%)^{22,23} In contrast, studies reporting lower prevalence (32.1% and 14.5%) may reflect differences in ethnicity, sociocultural factors, and diagnostic criteria.^{24,25} The mean age of PMS occurrence (16.7 years) in our study closely aligns with prior studies reporting 16–17 years.²⁶

Similar to previous findings, PMS most commonly interfered with educational performance,^{27,28} underlining its academic and social burden. Dysmenorrhea was significantly associated with PMS in our participants, a relationship also documented in studies from Turkey and Poland.^{29,30} The first day of menstruation was most frequently reported as the most painful, which corroborates earlier findings.³¹

Health-seeking behavior was notably low, with only 10.3% consulting a physician, paralleling trends in other studies.^{29,32} Instead, most girls resorted to home remedies (45.7%) or painkillers (39.7%), echoing prior observations of self-management practices.³¹ This reflects limited awareness and highlights the need for targeted health education programs.

Sociodemographic factors such as family income, education, and menstrual duration showed no significant association with PMS in this study, consistent with some reports^{32,33} but contrary to others.³⁴ Early menarche (<13 years) was associated with PMS, in agreement with previous findings.³⁴ Furthermore, a recent systematic review supports our observation of an inverse association between calcium intake and PMS severity.³⁵

These results are in agreement with other epidemiological studies, which have indicated an inverse relation between the consumption of calcium and the incidence or intensity of PMS symptoms. Indicatively, Nanri et al. had shown that an increased intake of calcium and dairy products had a negative relation with the occurrence of premenstrual symptoms in young women.²⁸ On the same note, a systematic review by Arab and colleagues found that proper calcium intake can play an important role in preventing psychological and physical symptoms of PMS due to its impact on neuromuscular functioning and homeostatic equilibrium.³⁵ Calcium is thought to control intracellular calcium and control the release of neurotransmitters which are thought to stabilize fluctuations in mood and decrease somatic symptoms during the luteal phase of the menstrual cycle. Hence, the encouragement of the proper dietary intake of calcium in adolescents could become a relatively straightforward and inexpensive measure to decrease the burden of PMS and enhance the outcomes of menstrual health.

This study has several limitations. First, the use of a retrospective self-reported questionnaire may have introduced recall bias. Prospective daily symptom diaries would provide more accurate

assessments. Second, the sample was limited to a few institutions in Karachi, restricting the generalizability of findings to other regions and populations. Third, calcium intake was assessed using food frequency questions rather than precise nutrient analysis, which may have led to underestimation or overestimation of actual intake. Finally, the presence of undiagnosed chronic medical or psychological conditions could have acted as confounding factors.

CONCLUSION

Premenstrual Syndrome (PMS) affects a significant number of college ladies, having a major negative impact on academic performance. Young age, early menarche, dysmenorrhea on day one of menstrual cycle are all risk factors for PMS. PMS has established a strong correlation with dysmenorrhea and low dietary calcium intake. College students' understanding and health-seeking behavior about PMS are extremely low. Strategies for early detection and management of PMS in college girls should be developed and adopted.

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Table 1. General menstrual history of the study population

Variable	Category	PMS ≥ 5 n (%)	PMS 0–4 n (%)	P-value
Age at Menarche	<13 years	100 (60.2)	13 (68.4)	0.479
	≥ 13 years	66 (39.8)	6 (31.6)	
Average Duration of Menstruation	1–2 days	23 (13.8)	2 (10.5)	0.877
	3–6 days	114 (68.6)	13 (68.4)	
	≥ 7 days	29 (17.4)	4 (21.1)	

Table 2. Influence of PMS on various aspects of life

	Characteristics	PMS Criteria of Diagnosis “5” n (%)	PMS Criteria of Diagnosis “0-4” n (%)	P-value
Affected aspects of life	Educational life	93 (56.02)	7 (36.8)	< 0.001
	Family life	24 (14.4)	4 (21.05)	
	Social life	37 (22.2)	0 (0)	
	None	12 (7.2)	8 (42.1)	

Table 3. Relationship of characteristics of dysmenorrhea and PMS

	Characteristics	PMS Criteria of Diagnosis “5” n (%)	PMS Criteria of Diagnosis “0-4” n (%)	P-value
Dysmenorrhea	Yes	148 (89.1)	12 (63.1)	0.002
	No	18 (10.8)	7 (36.8)	
Days of menstrual cycle with severe dysmenorrhea	Day – 01	104 (62.6)	7 (36.8)	<0.001
	Day – 02	27 (16.3)	1 (5.2)	
	Day – 03	4 (2.4)	0 (0)	
	After periods	22 (13.2)	4 (21.05)	
	Never	9 (5.4)	7 (36.8)	
Methods of pain relief	Home remedies	76 (45.7)	6 (31.6)	0.046
	Pain killers	66 (39.7)	6 (31.6)	
	Nil	24 (14.4)	7 (36.8)	
Frequency of using the method of pain relief	Once a day	58 (34.9)	5 (26.3)	0.223
	Twice a day	17 (10.2)	0 (0)	
	Thrice a day	5 (3.01)	0 (0)	
	Rarely	55 (33.1)	7 (36.8)	
	Never	31 (18.7)	7 (36.8)	
Frequency of using painkillers	Once a day	58 (34.9)	5 (26.3)	0.223
	Twice a day	17 (10.2)	0 (0)	
	Thrice a day	5 (3.01)	0 (0)	
	Rarely	55 (33.1)	7 (36.8)	
	Never	31 (18.7)	7 (36.8)	

Conflict of Interest:

The authors declare that there is no conflict of interest regarding the publication of this paper.

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Author’s contribution:

Syeda Aqeela Zehra, Javeria Khan: Conception of the study, study design, methodology, overall supervision, critical revision, final approval, and accountability for all aspects of the work.

Syeda Areeba Fatima, Sara Zohaib: Contributed to study design, data collection, data interpretation, drafting of the manuscript, final approval, and accountability for all aspects of the work.

Syeda Amna Ghuyoor-Ul-Hassan, Romesa Nadeem: Data analysis, interpretation of results, critical revision, final approval, and accountability for all aspects of the work.

All the authors have approved the final version to be published and agree to be accountable for all aspects of the work.



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