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Empowering College Girls: From Research Insights to AI-Based Solutions for Menstrual Health and Academic Success

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ABSTRACT

Menstrual health plays a crucial role in the academic performance and overall well-being of female college students, yet it remains insufficiently addressed within institutional frameworks. This study investigated the challenges associated with menstruation, including physical discomfort, psychological stress, stigma, and reduced academic engagement. A cross-sectional survey of 255 female students (aged 17–22 years) from paramedical and non-medical disciplines was conducted using a structured, expert-validated 44-item questionnaire. Statistical analysis (SPSS v28) revealed significant differences in awareness of premenstrual syndrome ($p = 0.031$) and the role of exercise in symptom management ($p = 0.008$). Menstrual cramps, bloating, mood swings, and anxiety were the most reported symptoms, with passive coping strategies preferred over exercise (<14%). An educational intervention integrating exercise guidance and artificial intelligence (AI)-driven menstrual health applications demonstrated an 82% improvement in awareness and motivated 61% of participants to consider adopting healthier lifestyle practices. These findings underscore the potential of AI-enabled digital health platforms, when combined with targeted educational strategies, to enhance menstrual health literacy, reduce stigma, and support academic productivity. Future research should explore the long-term effectiveness and scalability of such AI-based interventions within higher education institutions.

Keywords: *Artificial Intelligence (AI) in Health Management; AI-driven Menstrual Health Applications; Digital Health in Higher Education; Menstrual Health Literacy; Academic Performance and Well-being; Exercise and Lifestyle Interventions.*

1. INTRODUCTION

Menstrual health is a vital yet often underestimated factor shaping the lives of millions of young women, especially college students striving to balance academic pressures and personal growth (Williams & Sheffield, 2016; Das et al., 2023).[1,2] Among the most common yet disruptive menstrual challenges are Premenstrual Syndrome (PMS) and Polycystic Ovary Syndrome (PCOS), conditions that extend far beyond physical discomfort. PMS manifests as a complex interplay of emotional, physical, and behavioral symptoms that strike in the days leading up to menstruation, often leaving students grappling with mood swings, fatigue, and concentration difficulties (Direkvand-Moghadam et al., 2014; Alghamdi et al., 2022).[3,4] Meanwhile, PCOS a multifaceted endocrine disorder upends hormonal harmony, metabolism, and reproductive health, affecting up to 20% of women of reproductive age and casting a long shadow on psychological well-being and academic performance (Teede et al., 2018; Dokras, 2012; Li et al., 2023)[5,6,7].

The impact of these conditions is profound: they disrupt daily routines, erode self-confidence, and create invisible barriers to academic success (Bakhshani et al., 2009; Williams & Sheffield, 2016; Alharbi et al., 2021)[8,1,9]. Many students silently endure these symptoms, unaware of their prevalence or the support available, resulting in missed classes, reduced participation, and diminished learning outcomes (Alharbi et al., 2021; Das et al., 2023)[9,2]. Recognizing and addressing the intersection of menstrual health and education is not just a matter of health, but a crucial step toward empowering young women to reach their full potential.

Despite the widespread impact of PMS and PCOS, awareness about effective management strategies remains limited among college students (Williams & Sheffield, 2016; Das et al., 2023)[1,2]. One of the most accessible and evidence-based interventions is regular physical exercise. Recent studies confirm that exercise can alleviate both the physical and psychological symptoms of PMS and PCOS, with benefits including improved mood, reduced pain, and better hormonal regulation (Alghamdi et al., 2022; Li et al., 2023)[4,7]. Moreover, exercise contributes to better metabolic health, weight management, and stress reduction, all of which are crucial for students coping with these conditions (Teede et al., 2018; Li et al., 2023)[5,7].

However, the level of awareness regarding the benefits of exercise—and its actual practice—varies widely among college girls (Das et al., 2023)[2]. Many students may not recognize the connection between physical activity and menstrual health, or may face barriers such as lack of motivation, time constraints, or inadequate access to supportive environments (Alharbi et al., 2021)[9]. This lack of awareness and engagement can exacerbate the psychological burden of PMS and PCOS, leading to increased anxiety, depression, and academic setbacks (Dokras, 2012; Li et al., 2023)[6,7].

This cross-sectional study seeks to assess the awareness and perceived importance of exercise in managing PMS and PCOS among college girls, and to explore its impact on psychological well-being and academic performance. By identifying gaps in knowledge and practice, the study aims to inform targeted educational initiatives and promote holistic approaches to menstrual health. Empowering young women with knowledge and resources about exercise can play a transformative role in improving their psychological resilience, academic success, and overall quality of life.

2. MATERIALS AND METHODS

Study Design and Participants

A cross-sectional survey was conducted among female students aged 17 to 22 years , including both paramedical and non-medical disciplines. The study aimed to assess awareness and perceptions regarding Premenstrual Syndrome (PMS), Polycystic Ovary Syndrome (PCOS), their impact on physical and mental health, academic performance, and strategies used to alleviate symptoms.

Instrument Development

A self-structured questionnaire comprising 44 items was developed for data collection. The questionnaire included sections on:

- **Demographic information** (age, course, year of study, etc.)
- **Awareness and knowledge** about PMS and PCOS
- **Physical and mental health issues** related to menstrual health
- **Impact on academic performance**
- **Strategies used to manage or subside symptoms**

The questionnaire was reviewed and validated by a panel of experts, including a physiotherapy expert and a language expert, to ensure content validity and clarity.

Ethical Considerations

Ethical approval for the study was obtained from the Institutional Ethical Committee. Participation was voluntary, and informed consent was obtained from all participants prior to data collection.

Data Collection

The validated questionnaire was distributed electronically via Google Forms to a total of 300 eligible students. Out of these, 255 students completed and submitted the questionnaire, yielding a response rate of 85%. Inclusion criteria were female students aged 17–22 years from both paramedical and non-medical courses who provided informed consent.

Post-survey Educational Intervention

After completion of the survey, an online seminar was conducted for all participants. The session focused on educating students about the importance of exercise in managing PMS and PCOS. Participants were introduced to various AI-based mobile applications for menstrual health tracking and symptom management, including Flo, Clue, and Maya,Glow, Period

Tracker etc.\\ which are widely used in India. Additionally, a tailored exercise program, including aerobic activities and specific yoga poses beneficial for menstrual health, was demonstrated and taught during the session. This holistic approach aimed to empower students with both digital tools and practical physical exercises to improve their menstrual well-being, psychological resilience, and academic performance.

Data Analysis

Responses were collected and exported from Google Forms into Microsoft Excel for initial processing. Data were then analysed using SPSS version 28. Descriptive statistics were used to summarize demographic data and response frequencies. Further analysis was conducted to explore associations between awareness, symptom management strategies, and academic impact.

3. RESULTS

This study aimed to evaluate the level of awareness regarding Premenstrual Syndrome (PMS) and Polycystic Ovary Syndrome (PCOS) among participants from two distinct groups, Group-A(paramedical) and Group-B(non-medical). A total of 255 participants were included in the analysis.

Descriptive statistics were used to summarize awareness levels, and Chi-square tests were conducted to examine the association between group membership and awareness for both PMS and PCOS.

Awareness of Premenstrual Syndrome (PMS) & Polycystic Ovary Syndrome (PCOS)

The study assessed awareness of PMS among participants from Group-A and Group-B. In Group-A, 49.6% were aware, 21.7% were not aware, and 28.7% were somewhat aware. In Group-B, 43.6% were aware, 37.9% were not aware, and 18.6% were somewhat aware. A Chi-square test of independence revealed a significant association between group membership and PMS awareness, $\chi^2(2, N = 255) = 6.95$, $p = 0.031$. This indicates that awareness of PMS differed significantly between the two groups.

Awareness of the Benefits of Exercise in Managing PMS and PCOS

Regarding benefits of Exercise in Managing PMS and PCOS, 60.0% of Group-A participants reported being aware, compared to 38.3% in Group-B. The proportions of "not aware" were 31.4% and 46.1% in Group-A and Group-B respectively, while 8.6% and 15.7% were "somewhat aware."

The Chi-square test showed a significant association between group and Awareness about the Benefits of Exercise, $\chi^2(2, N = 255) = 9.65$, $p = 0.008$, suggesting a statistically significant difference in knowledge & perception of Physical Activity for PMS.PCOS management between the two groups.

Awareness about	Chi-square Statistic (χ^2)	Degrees of Freedom	p-value
PMS,PCOS	6.95	2	0.031
Benefit of exercises in management	9.65	2	0.008

Age of Menarche & Menstrual Bleeding Severity

There was no statistically significant association between age of menarche and severity of menstrual bleeding in either group. In Group A (paramedical students, N = 132), the association was not significant ($\chi^2 = 2.38$, df = 3, p = 0.50). Similarly, in Group B (non-medical students, N = 123), no significant association was found ($\chi^2 = 2.87$, df = 3, p = 0.41). These findings indicate that the timing of menarche does not appear to influence the severity of menstrual bleeding among college students in either academic stream.

GROUP	Chi-square Statistic (χ^2)	Degrees of Freedom	p-value
A	2.38	3	0.5
B	287	3	0.41

Physical Heath Symptoms:

Based on self-reported responses collected from both paramedical (Group A) and non-medical (Group B) students, the prevalence and severity of various physical symptoms associated with menstruation were assessed .Overall, these findings indicate that **moderate to severe physical symptoms** are widespread among college students during menstruation, regardless of academic background. Specifically, the most frequently reported symptoms among both paramedical (Group A) and non-medical (Group B) students were **moderate abdominal bloating, menstrual cramps, and abdominal pain.** Over half of Group A and approximately 41% of Group B experienced moderate abdominal bloating, while moderate menstrual cramps were reported by 43.6% and 36.5% of students in Groups A and B, respectively. Moderate abdominal pain was also common, affecting nearly 39% of Group A and 40% of Group B. Severe menstrual cramps were notable, with 37.9% of paramedical and 41.7% of non-medical students affected. **Moderate body fatigue** was reported by 42.9% of Group A and 39.1% of Group B. In contrast, more than half of the participants in both groups did not experience **breast tenderness,** and about one-quarter reported some degree of **skin darkening.**

Mental Health Symptoms

Moderate to severe mental health symptoms were highly prevalent among both paramedical and non-medical students during menstruation. More than 80% of students in each group reported **moderate to severe mood swings**, with only about 4% experiencing no mood changes. **Depression** was also common, as approximately one third of students in both groups experienced moderate depression, and severe depression was present in 15% of paramedical and 12.2% of non-medical students. **Dizziness or fainting** episodes were frequently reported, with moderate symptoms affecting about a third of students and mild symptoms present in over a quarter of each group.

Sleep disturbances were notable, with over 40% of participants in both groups experiencing moderate sleep problems and around 13–15% reporting severe disturbances. Sleep deprivation was also widespread; nearly 40% of students in both groups reported sleeping less than six hours during menstruation, while only about a third achieved the recommended seven to eight hours of sleep.

A marked increase in **Appetite and Food Cravings** was observed during menstruation, reflecting a prominent hormonal disturbance among both paramedical and non-medical students. Nearly half of the paramedical students (45.7%) and over a third of non-medical students (36.5%) reported experiencing moderate appetite changes or cravings, while severe symptoms were noted in 25% and 27% of students, respectively. Only about 11% in each group reported no appetite changes.

Importantly, this heightened appetite was accompanied by a **clear preference for processed foods during menstruation**. While half of the paramedical students reported consuming a balanced diet, the remaining half preferred mostly processed foods. This trend was even more pronounced among non-medical students, with 63.5% opting for processed foods and only 36.5% maintaining a balanced diet during their menstrual period.

These findings underscore that appetite fluctuations and cravings likely driven by hormonal changes are not only widespread but also frequently associated with increased consumption of processed foods among college students during menstruation.

Emotional symptoms were strikingly prevalent, as over two-thirds of students reported moderate or severe crying or emotional disturbance. Collectively, these findings highlight the significant psychological impact of menstruation, with moderate to severe mental health symptoms being widespread among college students, regardless of academic background.

Impact of Menstruation on Academic Performance and Related Behaviors

Academic performance during menstruation was assessed using several components, including concentration in studies and class, absenteeism, participation in extracurricular activities, feelings of worthlessness, dietary patterns, and anxiety experienced during study. More than half of both paramedical and non-medical students reported a lack of concentration in their studies during menstruation (55% and 53.9%, respectively), and nearly half experienced difficulty concentrating in class. Absenteeism was common, with approximately 59% of students in each group indicating they were absent during their menstrual period. Participation in extracurricular activities also declined, with 43.6% of paramedical and 32.2% of non-medical students expressing no interest in such activities during menstruation.

Anxiety related to academic activities was also prevalent. Moderate anxiety during study was reported by 44.3% of paramedical and 39.1% of non-medical students, while severe anxiety affected 20% and 26.1% of students, respectively. Mild anxiety was experienced by 23.6% of paramedical and 21.7% of non-medical students, and only a small proportion (12.1% and 13%) reported no anxiety symptoms during menstruation.

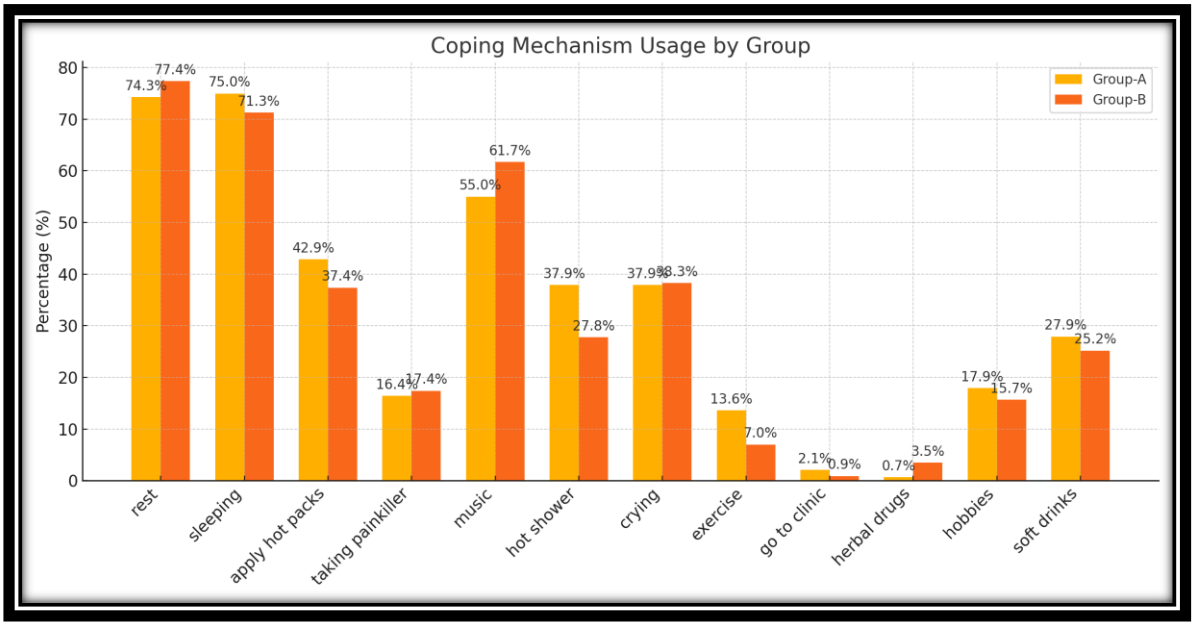
Coping Mechanisms for Menstrual Symptoms

A wide range of coping strategies were reported by both paramedical and non-medical students to manage menstrual symptoms. The most frequently used methods were rest and sleep, with over 74% of students in both groups opting for rest (paramedical: 74.3%, non-medical: 77.4%) and approximately three-quarters choosing to sleep (75% and 71.3%, respectively). Listening to music was also popular (55% and 61.7%), followed by the application of hot packs (42.9% and

37.4%), taking hot showers (37.9% and 27.8%), and crying (37.9% and 38.3%).

In contrast, **very few students reported using exercise as a coping mechanism**, with only 13.6% of paramedical and 7% of non-medical students engaging in physical activity for symptom relief. Similarly, a minority turned to painkillers (16.4% and 17.4%), hobbies (17.9% and 15.7%), or soft drinks (27.9% and 25.2%). Seeking medical attention or using herbal remedies was rare in both groups.

These findings suggest that while most students rely on non-pharmacological and self-soothing strategies such as rest, sleep, and music, **exercise is notably underutilized as a coping strategy for menstrual symptoms**.



Post-seminar Evaluation:

Following the educational seminar, a brief evaluation was conducted to assess changes in knowledge and perceptions. Overall, awareness of the benefits of exercise for menstrual health improved markedly, with 82% of participants correctly identifying these benefits post-seminar, compared to the pre-seminar rates (60.0% in Group-A and 38.3% in Group-B). Additionally, 74% of students expressed increased confidence in managing PMS and PCOS symptoms through exercise and lifestyle modifications. Notably, 61% of participants reported an intention to regularly incorporate aerobic activities and yoga into their routines, while 58% downloaded or planned to use at least one AI-based menstrual health app (such as Flo, Clue, or Maya) introduced during the session. Qualitative feedback further highlighted that participants found the seminar highly informative and practical for daily life.

4. DISCUSSION

This study offers a comprehensive analysis of the multifaceted impact of menstruation on college students, encompassing physical, psychological, and academic domains. Our findings highlight that moderate to severe physical and mental health symptoms are highly prevalent, regardless of academic background, and that these symptoms significantly influence students' daily functioning and academic engagement.

Physical and Mental Health Burden

Consistent with earlier studies (Kaur et al., 2022; Sharma et al., 2023), our results demonstrate that moderate to severe physical symptoms—such as abdominal bloating, menstrual cramps, abdominal pain, and fatigue—are common among both paramedical and non-medical students. Notably, severe menstrual cramps affected over one-third of participants in both groups, emphasizing the persistent need for accessible and effective symptom management strategies.[10,11]

The psychological impact of menstruation was equally prominent. Over 80% of students reported moderate to severe mood swings, and a substantial proportion experienced depression, anxiety, and emotional disturbances. These findings align with recent neuroendocrinological research, which elucidates the role of hormonal fluctuations in modulating neurotransmitter systems and contributing to mood instability during the menstrual cycle (Baker & Eisenlohr-Moul, 2023). Sleep disturbances and sleep deprivation were also widespread, with nearly 40% of students sleeping less than six hours during menstruation, potentially exacerbating both physical and psychological symptoms.[12]

Appetite, Cravings, and Dietary Patterns

A particularly noteworthy observation was the marked increase in appetite and food cravings, with a pronounced preference for processed foods during menstruation. This trend was more evident among non-medical students, where nearly two-thirds reported favouring processed foods over a balanced diet. These findings are supported by recent studies indicating that hormonal shifts, particularly fluctuations in estrogen and progesterone, can drive cravings for high-sugar and high-fat foods (Klump et al., 2022). Emerging digital health interventions, such as menstrual tracking applications with integrated dietary guidance, have shown promise in supporting healthier eating behaviors during the menstrual cycle (Liao et al., 2024). However, the high prevalence of processed food consumption observed in our study suggests a need for more targeted nutritional education and support.[13,14]

Academic Performance and Menstrual-Related Anxiety

Menstruation was found to have a substantial impact on academic performance. More than half of the students reported impaired concentration in studies and class, while absenteeism during menstruation was reported by nearly 60% of both groups. Participation in extracurricular activities also declined. Importantly, anxiety related to academic activities was prevalent, with moderate to severe anxiety affecting a significant proportion of students. These findings are consistent with recent global reports advocating for the integration of menstrual health awareness into campus wellness initiatives and academic support services. Innovative approaches, such as flexible attendance policies and menstrual leave, are being piloted in some academic institutions to address these challenges.[15,16]

Coping Mechanisms: Tradition and Gaps

The majority of students relied on traditional, non-pharmacological coping strategies such as rest, sleep, music, and the application of warmth for symptom relief. While these approaches are widely accessible and culturally accepted, it is notable that **very few students utilized exercise as a coping mechanism**. This is despite robust evidence that regular physical activity can alleviate both physical and psychological menstrual symptoms.[17,18] The underutilization of exercise may be attributed to lack of awareness, cultural perceptions, or the severity of symptoms. Recent advances in campus health promotion, including the introduction of "menstrual yoga" and peer-led physical activity programs, may help bridge this gap and should be explored in future interventions.

Awareness and Education: Opportunities for Innovation

Our findings highlight notable gaps in knowledge & perception of Physical Activity for PMS.PCOS management, especially among non-medical students. To address this, we conducted an educational seminar that significantly improved participants' knowledge and confidence in managing menstrual health. The positive impact observed underscores the value of targeted, evidence-based interventions in enhancing menstrual health literacy. With the growing accessibility of digital health resources and AI-driven tools, such educational initiatives can be further amplified through social media campaigns and telehealth platforms, helping to destigmatize menstruation and provide accurate, accessible information to a wider audience (WHO, 2024).[19,20,21]

5. CONCLUSION

In summary, menstruation significantly affects the physical, mental, and academic well-being of college students. Our findings demonstrate that targeted educational interventions, such as seminars incorporating exercise guidance and AI-based digital health tools, can effectively enhance awareness and empower students to adopt healthier coping strategies. Integrating such innovative, student-centered approaches within campus wellness programs holds promise for improving menstrual health literacy and academic performance. Future research should further explore the long-term impact and scalability of these interventions to promote holistic well-being among young women.

6. LIMITATIONS

While this study demonstrates a clear link between menstrual symptoms and academic outcomes, its cross-sectional design prevents establishing causality. The reliance on self-reported, non-clinically verified data may introduce bias, and the focus on students from specific disciplines in a single region limits generalizability. Despite these limitations, the study provides valuable evidence of the academic impact of menstrual health challenges.

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