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The Impact of Physical Activity on Premenstrual Syndrome in Female Students at the Faculty of Medicine, Tarumanagara University

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Abstract

Background: Premenstrual syndrome (PMS) is a common disorder among women of reproductive age that can disrupt daily activities and quality of life. Various factors, including physical activity, may influence the incidence and severity of PMS. However, limited studies focus on medical students, a group with high academic demands and potentially unbalanced physical activity.

Objective: To analyze the relationship between physical activity level and the incidence and severity of PMS among female students of the Faculty of Medicine, Universitas Tarumanagara.

Methods: This was an analytical observational study with a cross-sectional design conducted at the Faculty of Medicine, Universitas Tarumanagara, from December 2024 to February 2025. A total sampling approach was used, involving 233 female students; after exclusions, 226 respondents (aged 17–24 years) were included. Data on physical activity (IPAQ) and PMS symptoms (SPAF) were collected via questionnaires and analyzed using the chi-square test.

Results: Most respondents reported engaging in light physical activity (71.2%). PMS was more frequent and severe among those with light activity (21.7% severe PMS) compared to moderate (14.0% severe) and heavy activity (4.5% severe, majority asymptomatic). Statistical analysis showed a significant relationship between physical activity level and PMS incidence and severity (p=0.004).

Conclusion: Higher levels of physical activity (moderate to heavy) are associated with a reduced risk and severity of PMS symptoms among female medical students. Routine physical activity is recommended to support reproductive health.

Keywords: Premenstrual Syndrome, Physical Activity, Medical Students, Cross-sectional Study, Women's Health

Introduction

Premenstrual syndrome (PMS) is a collection of recurring physical and emotional symptoms that appear during the luteal phase of the menstrual cycle, which occurs after ovulation and before menstruation begins, typically lasting 2–14 days.[1] When menstruation starts, PMS symptoms usually subside, although they may persist in some cases. The manifestations vary among women in type and severity, commonly including physical complaints such as headaches, fatigue, breast tenderness, abdominal and back pain, muscle aches, bloating, nausea, and water retention, as well as psychological symptoms such as irritability, anxiety, mood swings, crying easily, and difficulty concentrating.[2] PMS affects approximately 40% of women, with 5–10% experiencing symptoms severe enough to interfere with daily life.[3] A systematic review and meta-analysis by Moghadam et al. (2014) reported that PMS prevalence varies widely, 47.8% in Europe, 85% in Africa, 60% in South America, 12% in France (the lowest), and as high as 98% in Iran; other Asian countries, such as China, show lower rates at around 21%.[4]

In Indonesia, a 2015 survey by the Indonesian Ministry of Health indicated that around 50-60% of women in Indonesia experience PMS with symptoms ranging from mild to severe. This shows that premenstrual syndrome is a problem experienced by women, with moderate to severe symptoms that interfere with daily activities and often affect their quality of life, social life, and psychological well-being. Many factors contribute to the occurrence of premenstrual syndrome, including hormonal, genetic, environmental, social, and dietary factors, such as nutrition and body mass index[2]. Premenstrual syndrome is also influenced by physical activity and psychological factors, including depression, stress, and anxiety. Physical activity does not directly cause PMS but can affect its symptoms, either positively or negatively, depending on the intensity and frequency of activity. Reduced or excessive physical activity affects PMS symptoms through various mechanisms, including hormones (such as estrogen and progesterone), endorphins, stress hormones (such as cortisol), and metabolic mechanisms.[5]

Regular physical activity is said to help balance estrogen and progesterone, which fluctuate during the menstrual cycle, ultimately increasing the production of endorphins, which are mood-enhancing hormones, reducing pain, facilitating oxygen transport in muscles, lowering cortisol levels, and improving psychological well-being.[6]

The balance of these hormones can be disrupted by excessive or insufficient physical exercise, which may exacerbate PMS symptoms and negatively affect other aspects of life. Previous research in Indonesia conducted by Nurbaiti and Noerfitri demonstrated a significant relationship between dietary patterns, physical activity, and the occurrence of PMS among adolescent girls.[2] However, their study did not specifically explore how variations in exercise intensity interact with academic or psychological stress, nor did it focus on populations with distinctive lifestyle characteristics such as medical students. Medical students represent a particularly vulnerable group due to chronic stress, irregular sleep patterns, long study hours, and a heavy workload that can disrupt hormonal and metabolic balance. These factors may amplify PMS symptoms and influence physical activity habits, making this population an important yet underexplored subject of investigation. To address this research gap specifically, the lack of studies examining the relationship between physical activity intensity and PMS severity within the unique academic and psychological context of medical students, this study aims to analyze

the association between physical activity levels and the occurrence of premenstrual syndrome among female medical students at Tarumanagara University.

Methods

This study used an observational analytical design with a cross-sectional approach to examine the relationship between physical activity levels and the incidence of premenstrual syndrome (PMS) among female medical students at Tarumanagara University (FK Untar). The research was conducted from December 2024 to February 2025. The target population consisted of all 310 active female students at FK Untar within the reproductive age range. A sample size calculation was initially performed using the cross-sectional analytical formula for two proportions to ensure statistical adequacy:

$$n = \frac{Z^2_{1-\frac{\alpha}{2}} P(1-P)}{d^2}$$

Where the expected prevalence of PMS (P) was assumed to be 0.50 based on national estimates, the confidence level (α) was set at 0.05, and the desired power at 0.80 (β = 0.20). The calculation yielded a minimum required sample of 178 respondents, which was increased by 10% to account for potential nonresponse or bias, giving a target of 195 participants. However, instead of using probability sampling, a census (total-population approach) was employed; all 310 eligible students were invited to participate. From this total population, 226 respondents completed the questionnaire and met the inclusion criteria, representing the final analyzed sample and a response rate of 72.9%.

The inclusion criteria were active female medical students who had experienced regular menstrual cycles for at least the previous six months and were willing to complete the questionnaire and provide informed consent. Exclusion criteria included a history of gynecological disorders, use of hormonal contraception affecting the menstrual cycle, irregular menstruation, or refusal to participate. Data were analyzed using IBM SPSS Statistics version 26, employing the Chi-square test to determine the relationship between physical activity and PMS severity, with a significance threshold of $p < 0.05$. Although potential confounding factors such as body mass index (BMI), psychological stress, sleep duration, and dietary patterns may influence PMS symptoms, these variables were not controlled in this study and are acknowledged as limitations to interpreting causal relationships.

Data were collected via an online questionnaire (Google Form) comprising an identity sheet, a physical activity questionnaire, and a PMS questionnaire. Physical activity was assessed using the International Physical Activity Questionnaire (IPAQ), which categorizes activity levels as follows: light (<600 MET-min/week), moderate (600–3000 MET-min/week), and heavy (>3000 MET-min/week). Premenstrual syndrome symptoms were assessed using the Shortened Premenstrual Assessment Form (SPAF), which classifies PMS severity as no symptoms (scores 1–10), mild (11–19), moderate (20–29), or severe (≥30). The independent variable in this study was the level of physical activity, and the dependent variable was the occurrence and degree of PMS. The collected data were analyzed using the chi-square statistical test to examine the relationship between physical activity level and PMS severity. This study obtained ethical clearance from the Health Research Ethics Committee (Komite Etik Penelitian Kesehatan, KEPK) of the Faculty of Medicine, Tarumanagara University, under approval number 499/KEPK/FK

UNTAR/XII/2024, issued on December 3, 2024. All research procedures complied with the principles of the Declaration of Helsinki and ensured participants' confidentiality and anonymity. Informed consent was obtained electronically from all respondents prior to participation.[7]

Results

1. Subject Characteristics

This study included 226 eligible respondents, all female students in the Faculty of Medicine at Tarumanagara University, from the 2022 to 2024 cohorts. Seven respondents were excluded due to a history of gynecological disease or contraceptive use that could potentially bias the results. Based on cohort distribution, most respondents were from the 2023 cohort (115 students; 50.9%), followed by the 2024 cohort (97 students; 42.9%) and the 2022 cohort (14 students; 6.2%). The mean age of respondents was 19.0 ± 1.0 years.

The respondents' physical activities were dominated by light physical activities (MET<600) among 161 people (71.2%), followed by moderate activities (MET 600-3000) among 43 people (19.0%), and heavy physical activities (MET>3000) among 22 people (9.7%). Regarding premenstrual syndrome, the majority of respondents experienced mild premenstrual syndrome (score 11-19) with 92 people (39.5%), followed by moderate symptoms (score 20-29) 69 people (29.6%), severe symptoms (score 30) in 45 people (19.3%), and no symptoms at all (1-10) in 27 people (11.6%).

Table 1. Frequency Distribution of Respondent Characteristics

Variable	Category	Frequency (n)	Percentage (%)	Mean (±SD)	Median (Min, Max)
Cohort	2022	14	6.2		
	2023	115	50.9		
	2024	97	42.9		
Age (years)				19.01 (±1.05)	19 (17–24)
Physical Activity (MET-min/week)	Light (<600)	161	71.2		
	Moderate (600–3000)	43	19.0		
	Heavy (>3000)	22	9.8		
Premenstrual Syndrome (SPAF Score)	Severe (≥30)	42	18.6		
	Moderate (20–29)	69	30.5		
	Mild (11–19)	88	39.0		
	No symptoms (1–10)	27	11.9		

2. Relationship Between Physical Activity and Premenstrual Syndrome

The results of this study show that the severity of premenstrual syndrome varies with physical activity levels. It is known that most respondents who had light physical activity experienced mild premenstrual syndrome, totaling 56 people (34.8%), 55 (34.2%) experienced moderate premenstrual syndrome, and 35 people (21.7%) experienced severe premenstrual syndrome.

Among respondents who reported moderate physical activity, the proportion with mild premenstrual syndrome remained high at 18 (41.9%), whereas the proportion with severe premenstrual syndrome decreased to 6 (14.0%). In the group with heavy physical activity, only 1 person (4.5%) experienced severe premenstrual syndrome, while the majority of 14 respondents (63.6%) experienced mild premenstrual syndrome, and 6 people (27.3%) did not experience any symptoms at all.

The results of the chi-square test showed p=0.004, indicating a statistically significant relationship between physical activity level and the incidence and severity of premenstrual syndrome. This p-value <0.05 indicates that higher levels of physical activity are associated with a lower likelihood of severe premenstrual syndrome. In other words, higher physical activity (moderate to heavy) may reduce the likelihood of severe premenstrual syndrome symptoms.

Table 2. Relationship Between Physical Activity and Premenstrual Syndrome

Physical Activity	Severe PMS(n, %)	Moderate PMS(n, %)	Mild PMS(n, %)	No Symptoms(n, %)	Total (n)	p-value
Light (<600 MET-min/week)	35 (21.7)	55 (34.2)	56 (34.8)	15 (9.3)	161	
Moderate (600–3000 MET-min/week)	6 (14)	13 (30.2)	18 (41.8)	6 (14)	43	
Heavy (>3000 MET-min/week)	1 (4.5)	1 (4.5)	14 (63.7)	6 (27.3)	22	0.004
Total (n)	42	69	88	27	226	

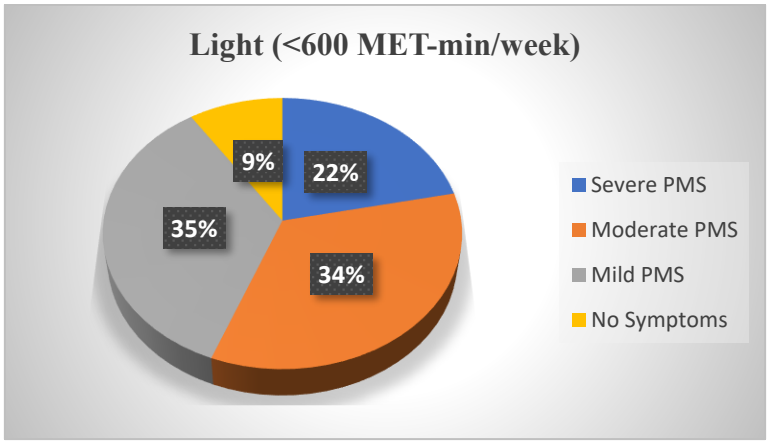

Figure 1. Light Physical Activity (<600 MET-min/week)

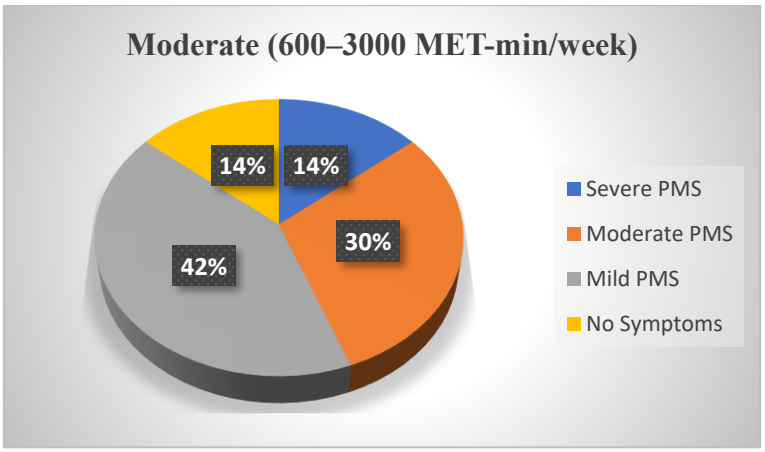

Figure 2. Moderate Physical Activity (600–3000 MET-min/week)

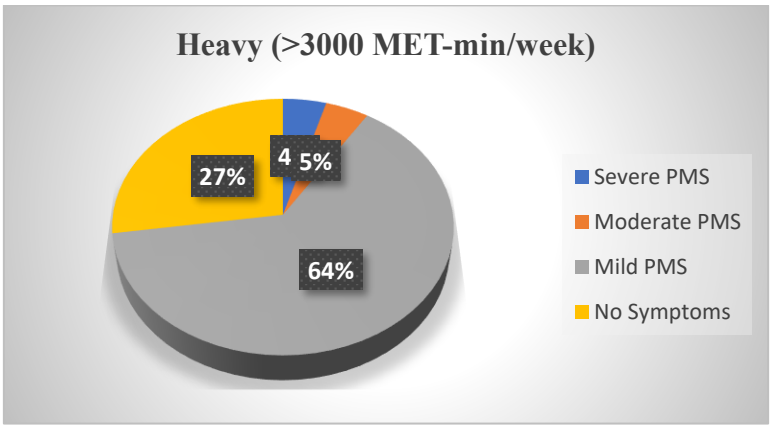

Figure 3. Heavy Physical Activity (>3000 MET-min/week)

Discussion

The results of this study demonstrate a statistically significant relationship between physical activity level and the severity of premenstrual syndrome ($p = 0.004$), with a significance threshold of $p < 0.05$. Respondents with higher levels of physical activity tended to experience milder PMS symptoms, whereas those with lower levels reported more severe symptoms. This finding supports the hypothesis that regular physical activity reduces PMS severity by influencing hormonal balance and psychological well-being.

This study is also consistent with the results of a study conducted by Rohmanisa Ary Apriliana at SMK Bhakti Indonesia Medika in Mojokerto, involving 75 female respondents. In her study, Rohmanisa found that the majority of respondents with light physical activity experienced severe PMS symptoms, namely 23 people (30.7%). In her study, she also reported that those with moderate physical activity levels experienced more PMS symptoms with mild intensity/severity. Furthermore, none of the respondents who engaged in heavy physical activity experienced severe PMS. This served as the basis for her to reveal the pattern of correlation between physical activity and the occurrence of premenstrual syndrome experienced by her respondents. This was also proven by statistical test results, which showed a p-value of 0.001, implying a statistically significant relationship between physical activity and the severity of PMS,

namely that the higher the respondents' physical activity, the milder the severity of premenstrual syndrome they experienced compared to those with low physical activity or those who did little physical activity.[8]

This finding is also in line with theories in the field of health, specifically, those on reproductive physiology and endocrinology, which highlight the mechanisms underlying hormonal changes in women of reproductive age. This theory explains that there are hormonal fluctuations that contribute to the occurrence of premenstrual syndrome.[6] After ovulation, which generally occurs around day 14 of the menstrual cycle, the body enters the luteal phase. During this luteal phase, there are noticeable hormonal changes, namely an increase in the hormone progesterone produced by the corpus luteum to prepare the endometrium (the inner lining of the uterus) for implantation.[9] Meanwhile, estrogen levels, which had been high, begin to decline gradually, a natural feature of the menstrual cycle. If pregnancy does not occur, both progesterone and estrogen levels will experience a drastic decline before menstruation. It is this sharp decline in both hormones that is one of the main triggers of premenstrual syndrome (PMS) symptoms.[10]

In other words, this hormonal imbalance is believed to be one of the factors that trigger PMS symptoms. This imbalance also contributes to neurotransmitter instability in the brain, particularly of serotonin and gamma-aminobutyric acid (GABA), which play crucial roles in regulating mood, pain perception, and sleep cycles. A decrease in estrogen and progesterone levels during the late luteal phase can reduce serotonergic activity by lowering tryptophan hydroxylase expression, the rate-limiting enzyme in serotonin synthesis, and by decreasing serotonin receptor sensitivity in cortical and limbic regions. This decline contributes to mood instability, irritability, and depressive symptoms frequently observed in PMS. Meanwhile, fluctuations in progesterone metabolites such as allopregnanolone modulate GABA_A receptor activity. Reduced progesterone results in lower allopregnanolone levels, leading to decreased GABAergic inhibition in the amygdala and hypothalamus, thereby increasing neuronal excitability and anxiety-related symptoms.[11]

This process is complex, involving the nervous and endocrine systems through the hypothalamic-pituitary-ovarian (HPO) axis. The mechanism begins with the release of gonadotropin-releasing hormone (GnRH) by the hypothalamus, which then stimulates the anterior pituitary gland to produce luteinizing hormone (LH) and follicle-stimulating hormone (FSH). These two hormones stimulate the ovaries to produce estrogen and progesterone, which then provide negative feedback to the hypothalamus to maintain hormonal balance.[12]

However, instability in the HPO axis can occur during this process, which is an important factor in the emergence of PMS symptoms. This instability in the HPO axis can be disrupted by external factors, such as excessive stress or physical inactivity. Disruption of this axis can cause more unstable hormonal fluctuations and exacerbate the PMS symptoms experienced by individuals.[13]

Regular physical activity, such as exercise, can provide significant benefits for PMS symptoms. During physical activity, the body releases endorphins, neurotransmitters produced by the hypothalamus and pituitary gland that are known as "feel-good chemicals." Endorphins function to suppress pain perception and improve mood, thereby alleviating PMS symptoms such as pain, anxiety, irritability, and other affective symptoms.[14] More than just acting as a natural opioid, regular physical activity also plays a role in stabilizing the body's hormonal system through

several mechanisms, such as increasing receptor sensitivity to hormones, reducing the accumulation of free estrogen that can trigger symptoms such as breast pain and cramps, and balancing the HPO axis so that hormone release becomes more regular and stable. Thus, regular physical activity not only helps reduce but also has the potential to prevent the severity of PMS symptoms.[15]

On the other hand, research conducted by Kartijia and Sudaryanto among 78 female students at SMK Surakarta reported different results, with a p-value of 0.238 ($p > 0.05$), indicating no significant relationship between physical activity and premenstrual syndrome. However, this finding does not necessarily contradict the theory that physical activity affects PMS, as the result must be understood within the methodological and contextual limitations of their study. The relatively small sample size reduced statistical power, while purposive sampling introduced a risk of selection bias, potentially limiting the representativeness of the findings. Furthermore, contextual differences such as socioeconomic background, daily routines, dietary patterns, and levels of academic stress may have influenced symptom perception and reporting among vocational students in Surakarta. In contrast, the study by Rohmanisa, which involved 75 respondents from a health vocational school (SMK Bhakti Indonesia Medika), showed a significant association ($p = 0.001$) between physical activity and PMS severity. This difference can be explained by respondents' higher health literacy within the health-related school environment, which leads to more accurate recognition and self-reporting of PMS symptoms. Moreover, the homogeneity of lifestyle factors among health students, such as exercise habits, menstrual health awareness, and a more structured daily routine, could enhance the reliability of self-assessment compared with more heterogeneous populations. Thus, although the sample size was comparable to that of Kartijia's study, differences in respondent characteristics, disciplinary backgrounds, and data quality may explain why Rohmanisa's study achieved statistical significance.[16]

Overall, the present study aligns more closely with Rohmanisa's findings, confirming that regular physical activity contributes to milder PMS symptoms through physiological and hormonal mechanisms, including stabilization of the hypothalamic–pituitary–ovarian axis and modulation of endorphin release. Differences across studies highlight that both contextual and methodological factors play a crucial role in determining whether a statistically significant relationship is observed.

This study has several limitations. The cross-sectional design restricts the ability to determine causal relationships between physical activity and premenstrual syndrome (PMS). The reliance on self-reported questionnaires such as the IPAQ and SPAF may also introduce recall bias and subjective interpretation of symptoms. Although the total sample size ($n = 226$) was considered sufficient, the uneven distribution across physical activity categories, with relatively few respondents in the heavy activity group, could affect the strength of subgroup comparisons. In addition, potential confounding factors such as body mass index (BMI), psychological stress, sleep duration, and dietary patterns were not measured or controlled, which may have influenced both physical activity levels and PMS severity. These unmeasured variables should be explicitly considered in interpreting the findings. To strengthen future research, longitudinal or experimental studies that incorporate objective measures of physical activity (e.g., accelerometers) and control for these confounders are recommended to confirm and extend the present results.

Conclusion

This study aimed to analyze the relationship between physical activity levels and the severity of premenstrual syndrome (PMS) among female medical students. The findings indicate that increased physical activity is associated with a lower likelihood of experiencing severe PMS. Higher levels of physical activity are associated with milder PMS symptoms. Therefore, maintaining regular physical activity can be considered an effective non-pharmacological strategy to help reduce PMS severity and improve overall well-being among young women.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this article. All authors have contributed to the research design, data collection, analysis, and manuscript preparation, and have no financial or personal relationships that could inappropriately influence the results.

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