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Prevalence of premenstrual syndrome, anxiety and depression, and impact of anthropometric indices and physical activities among menstruating adolescents

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Abstract
Background: Premenstrual syndrome (PMS) is a common gynecological condition among adolescents, often accompanied by psychological symptoms such as anxiety and depression. Anthropometric indices and physical activity levels may influence menstrual health, yet their associations with PMS remain unclear.
Objective: To determine the prevalence of PMS, anxiety, and depression, and to assess the impact of anthropometric indices and physical activity among menstruating adolescents of 11-17years.
Methods: A cross-sectional study was conducted among 704 menstruating adolescents recruited from schools and communities in Thiruvananthapuram district, Kerala. Data collection tools included the Premenstrual Syndrome Questionnaire, State-Trait Anxiety Inventory, Patient Health Questionnaire-9 (PHQ-9), and Physical Activity Questionnaires (PAQ-A & PAQ-C). Anthropometric indices measured were body mass index (BMI), waist-hip ratio (WHR), and waist-height ratio (WHtR). Statistical analysis was performed using the Chi-square test, with significance set at $p \leq 0.05$.
Results: PMS prevalence was 89.35%, with mild (37.4%), moderate (25.1%), severe (19.3%), and very severe (7.5%) categories. Anxiety was reported by 98.72% of participants and depression by 75%. A significant association was observed between PMS and depression ($p = 0.030$), but not with anxiety ($p = 0.064$), anthropometric indices (BMI, WHR, WHtR), or physical activity ($p > 0.05$). Most participants (88.22%) had low to mild physical activity levels.
Conclusion: PMS, anxiety, and depression are highly prevalent among menstruating adolescents, with depression showing a significant correlation with PMS. Anthropometric indices and physical activity did not significantly impact PMS. The findings underscore the need for early screening and psychosocial support programs in adolescent health and physical education settings.

Keywords: Premenstrual syndrome, Anxiety, Depression, Anthropometric indices, Physical activity, Adolescents, Menstrual health

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Introduction

Adolescence, defined by the World Health Organization as the period between 10 and 19 years of age, is a critical stage of physical, psychological, and social development. In females, this phase is marked by the onset of menarche and the establishment of menstrual cyclicity, both of which can be influenced by lifestyle, nutrition, and psychosocial factors. Menstrual irregularities and associated symptoms such as premenstrual syndrome (PMS), anxiety, and depression are common during these years and may impact school attendance, sports participation, and overall quality of life.

PMS is a psychoneuroendocrine disorder characterized by the cyclical recurrence of physical, behavioral, and psychological symptoms in the luteal phase of the menstrual cycle, subsiding after menstruation begins. Symptoms include irritability, mood swings, abdominal discomfort, breast tenderness, and headaches, with prevalence estimates ranging from 30% to 80% among adolescents worldwide. Severe PMS can impair daily functioning and limit engagement in academic and physical activities, including sports and physical education programs. Recent studies suggest that PMS in adolescence is not only a reproductive health concern but also a determinant of mental well-being, with strong links to depressive symptoms (Patil *et al*., 2024; Gupta *et al*., 2023) [2, 3].

Lifestyle factors such as physical activity and body composition have been investigated for their potential influence on menstrual health. Anthropometric indices, including body mass index (BMI), waist-hip ratio (WHR), and waist-height ratio (WHtR) have been associated

with hormonal profiles, ovulatory function, and menstrual regularity. Excess adiposity, particularly central obesity, has been linked to greater menstrual discomfort, altered cycle length, and an increased risk of polycystic ovary syndrome. Conversely, regular moderate-to-vigorous physical activity may reduce menstrual pain severity, improve pelvic blood flow, and stabilize hormonal fluctuations (WHO, 2023; Lee *et al.*, 2024) [8]. However, evidence regarding the relationship between these factors and PMS remains inconsistent.

Adolescent mental health is another crucial component of this interplay. Anxiety and depression are highly prevalent in this age group and may be exacerbated by menstrual symptoms. While anxiety has been variably linked to PMS, depression appears to have a more consistent and stronger correlation. The comorbidity of PMS and mental health disorders underscores the need for integrated health promotion strategies in school and community settings, particularly those involving physical education and sports participation (UNICEF, 2024).

Given the lack of consensus and limited large-scale epidemiological data from the Indian adolescent population, particularly in relation to both anthropometric indices and physical activity, this study was designed to address these gaps. Specifically, it aimed to determine the prevalence of PMS, anxiety, and depression among menstruating adolescents aged 11–17 years and to evaluate the influence of anthropometric measurements and physical activity levels on PMS.

Materials and Methods
Study Design and Setting: A cross-sectional study was conducted over six months among menstruating adolescents from schools and community settings in Thiruvananthapuram district, Kerala, India. Ethical clearance was obtained from the Institutional Ethics Committee of the Medical Trust Institute of Medical Sciences, Ernakulam.

Participants: A total of 704 participants aged 11–17 years were recruited using convenience sampling. Inclusion criteria were: (1) post-menarcheal adolescent girls, (2) willingness to participate, and (3) parental/guardian consent. Exclusion criteria included: (1) known uterine dysfunction or congenital anomalies, (2) psychological disabilities impairing comprehension, (3) neurological illness, and (4) current use of medications or medical conditions influencing bone health.

Sample Size Calculation: Sample size was determined using the formula: $n = Z^2 \times p \times q / m^2$ where $Z = 1.96$, $p = 49.6\%$ (prevalence from prior studies), $q = (1 - p)$, and $m = 5\%$ allowable error, yielding a minimum sample size of 665. To account for potential dropouts, 704 participants were included.

Data Collection Instruments: Demographic and socioeconomic data were collected using a structured questionnaire and the Modified Kuppuswamy Scale (2022). PMS was assessed using the 40-item Premenstrual Syndrome Questionnaire, anxiety with the State-Trait Anxiety Inventory (STAI), depression with the Patient Health Questionnaire-9 (PHQ-9) modified for adolescents, physical activity with the Physical Activity Questionnaires for Adolescents (PAQ-A) and for Older Children (PAQ-C), and anthropometric indices using standardized BMI, WHR, and WHtR calculations.

Data Collection Procedure: Participants completed questionnaires under researcher supervision in classrooms or community halls. Anthropometric measurements were taken using standardized equipment: stadiometer, calibrated weighing scale, and non-stretchable measuring tape.

Statistical Analysis: Data were analyzed using IBM SPSS Statistics version 25. Descriptive statistics summarized demographic and outcome variables. The Chi-square test assessed associations between PMS and depression, anxiety, physical activity, and anthropometric indices. Statistical significance was set at $p \leq 0.05$.

Results
Participant Characteristics: The mean age of participants was 14.13 ± 2.02 years, with mean weight was 43.03 ± 7.14 kg and mean height was 143.40 ± 8.61 cm. The mean BMI was 20.98 ± 3.51 kg/m², mean WHR was 0.87 ± 0.04, and mean WHtR was 0.24 ± 0.15. Prevalence of PMS, Anxiety, and Depression: PMS was present in 89.35% of participants, with mild (37.4%), moderate (25.1%), severe (19.3%), and very severe (7.5%) categories. Anxiety was reported by 98.72% of participants, and depression by 75%. Physical Activity Levels: Most participants (88.22%) had low to mild physical activity.

Association Analysis: PMS was significantly associated with depression ($p = 0.030$) but not with anxiety, BMI, WHR, WHtR, or physical activity.

Discussion
This study found a high prevalence of PMS, anxiety, and depression among menstruating adolescents. Depression was significantly associated with PMS, supporting previous research linking menstrual symptoms with mood disturbances. The lack of association with anthropometric indices and physical activity may reflect the predominance of low activity levels and normal BMI in the sample. The findings have implications for school-based health and physical education programs, emphasizing the integration of menstrual health and mental health support.

Conclusion
PMS, anxiety, and depression are highly prevalent among menstruating adolescents. Depression showed a significant association with PMS, while anxiety, anthropometric indices, and physical activity levels did not. Early screening and integrated interventions are essential.

Recommendations
1. Implement school-based screening for PMS and depression.
2. Integrate mental health support into physical education.
3. Promote physical activity among adolescent girls.
4. Conduct educational campaigns to reduce stigma.
5. Carry out longitudinal studies to explore causality.

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