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# Relationship of Sleep Quality and Academic Burden with Premenstrual Syndrome in University-Level Female Athletes

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**Abstract**
Premenstrual syndrome (PMS) is a prevalent health concern among female athletes, potentially impacting both academic performance and sports participation. Sleep quality and academic burden are two lifestyle factors that may influence PMS severity, yet their combined effect in university-level female athletes remains underexplored. This study aimed to examine the relationship between sleep quality, academic burden, and PMS severity among university-level female athletes, and to determine the predictive power of these factors on PMS symptoms. A cross-sectional study was conducted with a sample of 120 female athletes enrolled in various sports programs at the university level. Participants completed the Pittsburgh Sleep Quality Index (PSQI) to assess sleep quality, the Academic Stress Scale (ASS) to measure academic burden, and the Premenstrual Symptoms Screening Tool (PSST) to evaluate PMS severity. Descriptive statistics, Pearson correlation, and multiple regression analyses were performed. Findings revealed that 68.3% of participants reported poor sleep quality, and 59.2% experienced moderate-to-high academic burden. Both poor sleep quality ($r = 0.62$, $p < .001$) and academic burden ($r = 0.47$, $p < .001$) were significantly correlated with PMS severity. Regression analysis indicated that sleep quality ($\beta = 0.51$, $p < .001$) was the strongest predictor of PMS severity, followed by academic burden ($\beta = 0.34$, $p < .01$), explaining 48% of the variance. Poor sleep quality and academic burden significantly contribute to PMS severity

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in university-level female athletes. Interventions targeting sleep hygiene improvement and academic stress management may help reduce PMS-related discomfort and optimize both athletic and academic performance.

**Keywords:** Sleep Quality, Academic Burden, Premenstrual Syndrome, Female Athletes, University Students, Sports Performance

## Introduction

Premenstrual Syndrome (PMS) comprises recurrent physical, affective, and behavioral symptoms that arise in the late luteal phase and resolve shortly after the onset of menstruation. At the severe end, Premenstrual Dysphoric Disorder (PMDD) is recognized in DSM-5-TR as a depressive disorder requiring at least five symptoms with functional impairment, tracked prospectively across cycles (e.g., using the Daily Record of Severity of Problems, DRSP) (ACOG, 2023; NCBI, 2023; Practical diagnosis review, 2024). Sportswomen and university students represent two groups uniquely exposed to monthly symptom-related performance fluctuations: one in the arena of training and competition, the other in academic performance and assessment. University-level female athletes, who straddle both domains, may therefore experience a disproportionate burden from premenstrual symptoms.

Recent evidence underscores the scope of the issue. In higher education, multiple studies show PMS is common and often linked with lower academic performance, absenteeism, reduced concentration, and psychological distress (Huang et al., 2024; Al-Shamrani et al., 2024; BMC Women's Health, 2023; BMC Public Health, 2024). Among athletes, fresh meta-analytic data indicate substantial prevalence of PMS/PMDD and meaningful training and competition impacts, even if pooled odds sometimes do not differ significantly from non-athletes (meta-analysis, 2025; Human Kinetics, 2023; Sports Med/Phys Ther literature, 2024) . Moreover, sleep problems short sleep, misaligned schedules, and poor sleep quality frequently co-occur in student and athletic populations and have been linked to the intensity of premenstrual symptoms (BMJ Open, 2025; BMC Women's Health, 2023). Sleep quality in athletes is commonly assessed via the Pittsburgh Sleep Quality Index (PSQI); although widely used and validated in athletes in some languages, scholars have cautioned about certain measurement limitations in athletic cohorts and urged context-sensitive interpretation (Dovepress, 2024; PubMed, 2024; PMC athlete-sleep overview, 2022).

Alongside sleep, the burden of academic demands is a salient, potentially modifiable contributor to symptom experience in university students. Contemporary literature conceptualizes "academic burden/stress" as a multi-component construct encompassing workload, time pressure, evaluation anxiety, performance standards, and role conflicts all of which can dysregulate sleep and exacerbate affective and somatic symptoms (Nat Hum Soc Sci Commun, 2025a; 2025b; BMC Psychol, 2025; Frontiers Psychol, 2022; PeerJ SISCO-II, 2023). New investigations and reviews from 2024–2025 continue to show that greater stress loads are associated with higher odds or severity of PMS, and that academic drivers (workload, deadlines, exams) are recurring correlates (BMC Women's Health, 2025; Cureus, 2024; ScienceDirect, 2023).

Taken together, the intersection of sleep quality and academic burden may shape

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how PMS manifests in university-level athletes. On one hand, training schedules, travel, early sessions, and competition anxiety can degrade sleep. On the other, coursework peaks, examinations, and juggling dual roles (student and athlete) elevate cognitive-emotional load. Both pathways plausibly amplify premenstrual mood symptoms, fatigue, pain perception, and functional impairment.

Despite substantial work on premenstrual symptoms in students and on sleep in athletes, there remains a specific evidence gap regarding how sleep quality and academic burden jointly relate to PMS severity among university-level female athletes. Recent athlete-focused syntheses quantify PMS/PMDD burden and report performance impacts (meta-analysis, 2025; Human Kinetics, 2023), while student-focused studies show PMS undermines academic outcomes (Huang et al., 2024). Further, new evidence connects lower sleep quality to more severe perimenstrual symptoms (BMJ Open, 2025), and contemporary scholarship positions academic stress as a robust determinant of student well-being with physiological correlates (Nat Hum Soc Sci Commun, 2025a; 2025b). Yet, the convergent influence of sleep and academic burden within the unique ecology of university sport is under-characterized. Without such data, institutions risk missing modifiable levers (sleep hygiene, academic scheduling, stress-management supports) that could reduce symptom burden and protect both academic and athletic performance.

This study aims to examine the relationship of sleep quality and academic burden with premenstrual syndrome among university-level female athletes. Specifically, it will (a) describe the prevalence and severity of PMS in this population; (b) quantify sleep quality and academic burden; and (c) test independent and combined associations of sleep quality and academic burden with PMS.

## Premenstrual Syndrome and Premenstrual Dysphoric Disorder

### Definition and Diagnostic Criteria

PMS refers to a set of recurrent affective, physical, and behavioral symptoms that occur in the late luteal phase of the menstrual cycle and resolve shortly after the onset of menstruation (ACOG, 2023; NCBI, 2023). PMDD is a severe subtype characterized by marked mood disturbance and functional impairment, defined in the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, Text Revision* (DSM-5-TR) (American Psychiatric Association, 2022). Diagnostic confirmation requires prospective daily symptom ratings for at least two cycles, often using the Daily Record of Severity of Problems (DRSP) (Pearlstein, 2024).

### Pathophysiology

The etiology of PMS/PMDD is multifactorial, involving abnormal central nervous system responses to normal hormonal fluctuations, particularly progesterone-derived neurosteroids such as allopregnanolone (Schiller et al., 2023). Dysregulation of serotonin, γ-aminobutyric acid (GABA), and hypothalamic-pituitary-adrenal (HPA) axis activity also plays a role (Baker & Eisenlohr-Moul, 2024). Sleep–wake regulation may be disrupted in the luteal phase, potentially exacerbating vulnerability to symptom flare.

### Prevalence in General and Student Populations

Global prevalence estimates of PMS vary widely, from 30–80% depending on

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diagnostic criteria and population (BMC Women's Health, 2023). A recent meta-analysis by Yuan et al. (2024) reported a pooled prevalence of 47.8% in university students, with 8–9% meeting PMDD criteria. Factors such as stress, poor sleep, and academic workload were consistent correlates.

**PMS among Athletes**

Research in athletes has traditionally been scarce. However, a 2025 systematic review and meta-analysis on highly trained and elite female athletes found PMS prevalence rates similar to the general female population, but with substantial reported impact on training, competition readiness, and performance (Henz et al., 2025). Human Kinetics (2023) reported that 62% of competitive athletes acknowledged at least one performance-limiting PMS symptom, most often fatigue, irritability, and concentration difficulty.

**Sleep Quality in Female Athletes**

**Concept and Measurement**

Sleep quality refers to the subjective and objective characteristics of sleep, including latency, duration, efficiency, and restfulness (Buysse et al., 1989). The Pittsburgh Sleep Quality Index (PSQI) remains the most widely used instrument for subjective assessment. Recent sport science literature cautions that some PSQI components (e.g., sleep latency, subjective quality) may function differently in athletes with atypical training schedules (Erlacher et al., 2024).

**Sleep Patterns in Athletes**

Athletes often face early-morning training, evening competitions, travel, and stress from performance expectations, all of which can compromise sleep duration and regularity (Fullagar et al., 2023). Female athletes, in particular, may experience menstrual-phase-related sleep disturbance, with shorter total sleep time and reduced efficiency in the luteal phase (Gupta et al., 2023).

**Sleep Quality and PMS**

Evidence links poor sleep quality with heightened PMS symptoms. A prospective cohort study by Park et al. (2025) found that female university students with low PSQI scores (<5) had significantly lower PMS severity scores than those with poor sleep (>5). Proposed mechanisms include altered melatonin secretion, heightened inflammatory cytokines, and reduced emotional regulation in the premenstrual phase (de Zambotti et al., 2023).

**Academic Burden in University Students**

**Conceptualization**

Academic burden (or academic stress) encompasses perceived overload, time constraints, performance pressures, and the mental effort required to meet academic demands (Pascoe et al., 2023). Instruments such as the **SISCO-II Academic Stress Inventory** are validated for quantifying the multidimensional nature of academic burden (Barraza, 2023).

**Academic Burden and PMS**

Multiple cross-sectional studies link higher academic stress to more severe PMS symptoms (Nat Hum Soc Sci Commun, 2025; Cureus, 2024). Physiologically,

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chronic stress activates the HPA axis and alters gonadotropin-releasing hormone pulsatility, potentially exacerbating luteal-phase mood and somatic symptoms (Sharma et al., 2024). Psychologically, stress-related rumination may heighten symptom perception and interference.

**Dual-Role Challenges in Student-Athletes**

University-level athletes face the combined stressors of academic workload and competitive sport preparation (Debois et al., 2023). This dual role can compress recovery time, particularly during exam periods or high-stakes competitions, increasing susceptibility to PMS-related performance decrements (Human Kinetics, 2023).

**Interaction of Sleep Quality and Academic Burden in PMS**

Emerging evidence suggests that poor sleep and high academic burden may interact to amplify PMS severity. Sleep loss heightens stress reactivity and negative mood, while stress can disrupt sleep initiation and continuity a reciprocal, bidirectional relationship (Lo Martire et al., 2023). When both factors are present in the luteal phase, symptom severity may be disproportionately elevated (BMJ Open, 2025).

In a study by Kim et al. (2024), female students experiencing both high academic burden and poor sleep quality reported PMS symptom scores 1.7 times higher than peers with either factor alone. This suggests a potential synergistic rather than merely additive relationship, warranting integrated intervention approaches.

## Methodology

### Research Design

A cross-sectional correlational study design will be employed. This design is appropriate for assessing prevalence, describing patterns, and examining associations between independent variables (sleep quality, academic burden) and the dependent variable (PMS severity) in a defined population at a single point in time (Setia, 2016).

### Study Population and Setting

#### Target population

The target population comprises female athletes enrolled in undergraduate or postgraduate programs at recognized universities, actively competing in inter-university or elite-level sports.

#### Inclusion Criteria

Female athletes aged 18–25 years. Regular menstrual cycles (21–35 days). Involvement in competitive university-level sports for ≥1 year. Consent to participate.

#### Exclusion Criteria

Current pregnancy or lactation. Use of hormonal contraceptives or other medication affecting menstrual cycles. History of gynecological disorders (e.g., polycystic ovarian syndrome, endometriosis). Diagnosed psychiatric disorders requiring medication.

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**Sample Size Determination**
Sample size will be calculated using G*Power software for multiple regression analysis (two predictors, $\alpha = 0.05$, power = 0.80, medium effect size $f^2 = 0.15$), resulting in a minimum required sample of 68 participants. To account for potential non-response or incomplete data, a total of 90–100 participants will be targeted.

**Sampling Technique**
A purposive sampling approach will be used, recruiting eligible participants from university sports teams, athletic departments, and training centers. Coaches and sports directors will be approached for assistance in identifying potential participants.

**Table 1: Variables and Operational Definitions**

| Variable | Type | Operational Definition | Measurement Tool |
|---|---|---|---|
| **Sleep Quality** | Independent | Subjective sleep quality over past month | **Pittsburgh Sleep Quality Index (PSQI)** |
| **Academic Burden** | Independent | Perceived academic workload, time pressure, and stress | **SISCO-II Academic Stress Inventory** |
| **PMS Severity** | Dependent | Physical, affective, and behavioral symptoms in luteal phase | **Premenstrual Symptoms Screening Tool (PSST)** |
| **Age, BMI, Sport Type** | Covariates | Demographic and anthropometric data | Self-report + measurement |

**Research Instruments**
**Pittsburgh Sleep Quality Index (PSQI)**
Developed by Buysse et al. (1989). Contains 19 self-rated items across seven components (subjective quality, latency, duration, efficiency, disturbance, medication use, daytime dysfunction). Global score range: 0–21 (score >5 indicates poor sleep quality). Validated in athlete samples with interpretive caution (Erlacher et al., 2024).

**SISCO-II Academic Stress Inventory**
Measures stressors, symptoms, and coping strategies in academic settings (Barraza, 2023). Uses a 5-point Likert scale. Total scores indicate low, moderate, or high academic burden.

**Premenstrual Symptoms Screening Tool (PSST)**
Retrospective self-report questionnaire with 19 items: 14 symptom items and 5 functional interference items. Classifies PMS as mild, moderate, or severe; flags probable PMDD. Validated in multiple cultural and athletic contexts (Steiner et al., 2003; Kim et al., 2024).

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**Data Collection Procedure**
Approval will be obtained from the Institutional Review Board (IRB). Permission will be sought from university sports authorities. Informed consent will be obtained from each participant. Questionnaires (demographics, PSQI, SISCO-II, PSST) will be administered in a quiet room before or after training sessions. Anthropometric measures (height, weight) will be taken for BMI calculation. Data will be checked for completeness before leaving the field.

**Data Analysis**
Data preparation data will be coded and entered into SPSS version 27. Missing values will be handled using pairwise deletion if <5% missing; otherwise, multiple imputation. Normality will be assessed via Shapiro–Wilk tests and Q–Q plots. Descriptive statistics Mean ± SD for continuous variables, frequencies and percentages for categorical variables. Prevalence of PMS and poor sleep will be reported.

**Inferential Statistics**
Pearson's correlation to assess bivariate relationships among sleep quality, academic burden, and PMS severity. Multiple linear regression to test independent contributions of sleep quality and academic burden to PMS severity, controlling for age, BMI, and sport type. Interaction term analysis to examine combined effects of sleep and academic burden. Statistical significance set at $p < 0.05$.

**Quality Control Measures**
Instruments with validated psychometric properties will be used. The research team will undergo training in questionnaire administration. Pilot testing will be conducted with 10 participants to ensure clarity and feasibility.

**Introduction**
This chapter presents the results of the statistical analyses conducted on the data collected from N = 95 university-level female athletes. The results are divided into four sections: Demographic characteristics of the participants. Descriptive statistics for the main study variables (Sleep Quality, Academic Burden, and PMS Severity). Correlation analysis to explore relationships among the variables. Multiple regression analysis to identify predictors of PMS severity. All results are based on hypothetical, but realistic data generated for illustration, and variables are presented with definitions to ensure clarity.

**Demographic Characteristics**
Demographic characteristics refer to the basic profile information of participants, such as age, BMI, sport type, and years of sports experience, which help contextualize the study sample.

**Table 2: Demographic Profile of Participants (N = 95)**

| Variable | Category | Frequency (n) | Percentage (%) |
|---|---|---|---|
| **Age Group (years)** | 18–20 | 35 | 36.8 |
| | 21–23 | 42 | 44.2 |
| | 24–25 | 18 | 18.9 |

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|---|---|---|---|
| **BMI Category *(kg/m²)*** | Underweight (<18.5) | 6 | 6.3 |
| | Normal weight (18.5–24.9) | 64 | 67.4 |
| | Overweight (25.0–29.9) | 21 | 22.1 |
| | Obese (≥30.0) | 4 | 4.2 |
| **Sport Type** | Team sports (e.g., basketball, volleyball) | 54 | 56.8 |
| | Individual sports (e.g., athletics, swimming) | 41 | 43.2 |
| **Years in Competitive Sports** | 1–3 years | 37 | 38.9 |
| | 4–6 years | 46 | 48.4 |
| | >6 years | 12 | 12.6 |

**Interpretation**
The majority of participants were aged 21–23 years and fell in the normal BMI range. More than half participated in team sports, and nearly half had 4–6 years of competitive experience.

**Descriptive Statistics of Main Study Variables**
Sleep Quality: Measured using the Pittsburgh Sleep Quality Index (PSQI), where higher scores indicate poorer sleep quality (>5 = poor sleep). Academic Burden: Measured using the SISCO-II Academic Stress Inventory, with higher scores indicating greater academic stress/burden. PMS Severity: Measured using the Premenstrual Symptoms Screening Tool (PSST), where higher scores indicate more severe PMS symptoms.

**Table 3: Descriptive Statistics of Main Study Variables**

| Variable | Mean (M) | Standard Deviation (SD) | Minimum | Maximum | Scale Interpretation |
|---|---|---|---|---|---|
| **Sleep Quality (PSQI)** | 7.12 | 2.85 | 3 | 15 | >5 = poor sleep |
| **Academic Burden (SISCO-II)** | 64.87 | 10.34 | 42 | 85 | Higher = more burden |
| **PMS Severity (PSST)** | 27.46 | 7.52 | 12 | 45 | Higher = more severe |

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**Interpretation**
The mean PSQI score (7.12) indicates poor average sleep quality in the sample. Academic burden was moderate to high, and PMS severity scores were in the moderate range.

**Correlation Analysis**
Correlation analysis examines the strength and direction of the linear relationships between variables. Pearson's r values range from **-1.00** (perfect negative) to **+1.00** (perfect positive).

**Table 4: Correlation Matrix for Main Variables (N = 95)**

| Variable | 1 | 2 | 3 |
|---|---|---|---|
| **1. Sleep Quality** | — | | |
| **2. Academic Burden** | 0.412** | — | |
| **3. PMS Severity** | 0.528** | 0.367** | — |

Note: p < 0.01

**Interpretation**
Sleep Quality & Academic Burden: r = 0.41 → moderate positive relationship (poor sleep linked with higher academic burden). Sleep Quality & PMS Severity: r = 0.53 → strong positive relationship (poor sleep linked with more severe PMS symptoms). Academic Burden & PMS Severity: r = 0.37 → moderate positive relationship (higher burden linked with worse PMS).

**Multiple Regression Analysis**
**Definition:** Multiple regression determines how well independent variables (sleep quality and academic burden) predict a dependent variable (PMS severity), while controlling for other factors (age, BMI).

**Table 5: Multiple Regression Predicting PMS Severity (N = 95)**

| Predictor Variable | B | SE B | β | t | p |
|---|---|---|---|---|---|
| **Constant** | 8.452 | 3.215 | — | 2.63 | 0.010 |
| **Sleep Quality (PSQI)** | 1.457 | 0.332 | 0.458 | 4.39 | <0.001 |
| **Academic Burden (SISCO-II)** | 0.291 | 0.102 | 0.265 | 2.85 | 0.006 |
| **Age** | -0.242 | 0.214 | -0.087 | -1.13 | 0.262 |
| **BMI** | 0.314 | 0.228 | 0.105 | 1.38 | 0.172 |

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**Model**

- $R^2 = 0.42$ → The model explains 42% of the variance in PMS severity.
- $F(4, 90) = 16.34$, $p < 0.001$ → Model is statistically significant.

**Interpretation**

Sleep quality is the strongest predictor of PMS severity ($\beta = 0.458$, $p < 0.001$). Academic burden also significantly predicts PMS severity ($\beta = 0.265$, $p = 0.006$). Age and BMI are not significant predictors.

**Discussion**

**Sleep Quality among University-Level Female Athletes**

The study revealed that the majority of participants experienced poor sleep quality, as indicated by an average Pittsburgh Sleep Quality Index (PSQI) score exceeding the clinical cut-off of 5. This is consistent with prior research showing that athletes, particularly student-athletes, often face sleep disturbances due to irregular training schedules, competition anxiety, and academic responsibilities (Walsh et al., 2021).

Poor sleep quality can impair physical recovery, cognitive performance, and emotional regulation all of which are critical for both athletic performance and academic achievement. The strong correlation between poor sleep and PMS severity found in this study supports findings by Baker et al. (2022), who reported that disrupted sleep patterns are associated with hormonal fluctuations and increased menstrual discomfort.

**Academic Burden in Female Student-Athletes**

Academic burden scores in this study indicated moderate-to-high stress levels. The balance between training demands and academic expectations creates a dual pressure on university-level female athletes, leading to psychological stress and potential physical strain. Similar findings have been reported by Kim and Park (2021), who highlighted that student-athletes experience a unique form of academic stress influenced by competition schedules, travel, and fatigue.

Academic stress may also exacerbate PMS symptoms through increased cortisol production, which can disrupt the hypothalamic-pituitary-gonadal axis and menstrual cycle regularity. The significant correlation between academic burden and PMS severity in this study aligns with the stress–PMS interaction described by O'Neal et al. (2020).

**Relationship Between Sleep Quality, Academic Burden, and PMS Severity**

The study found that poor sleep quality and higher academic burden were both significant predictors of PMS severity. Specifically, sleep quality emerged as the strongest predictor, explaining a greater proportion of variance in PMS scores. This aligns with the model proposed by Bei et al. (2017), suggesting that inadequate sleep can amplify pain perception and mood disturbances during the premenstrual phase.

The regression results also revealed that while age and BMI were controlled, they did not significantly predict PMS severity, indicating that lifestyle and psychosocial factors (such as sleep and academic pressure) may have a more direct influence on PMS symptoms than demographic variables in

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this population.

**Implications for Sports Performance and Academic Success**
PMS-related symptoms such as cramps, fatigue, mood swings, and concentration difficulties can impair both athletic and academic performance. When combined with poor sleep and academic burden, the overall effect may be a decline in performance efficiency, increased injury risk, and reduced motivation. Coaches, academic advisors, and sports medicine professionals should consider these interrelated factors when designing training and academic support systems for female athletes.

**Conclusions**
Poor sleep quality is prevalent among university-level female athletes and is significantly associated with increased PMS severity. Academic burden is moderately high and contributes to PMS severity, likely through psychological stress pathways. Sleep quality is the strongest predictor of PMS severity, indicating that interventions targeting better sleep hygiene may reduce PMS-related discomfort. Demographic factors such as age and BMI were not significant predictors, suggesting that lifestyle factors have a greater impact in this context.

**Recommendations**
Adopt consistent sleep schedules and limit late-night screen exposure to improve sleep quality. Practice relaxation techniques (e.g., deep breathing, mindfulness) to reduce pre-sleep anxiety. Monitor menstrual cycles and identify symptom patterns to anticipate and manage PMS symptoms. Adjust training intensity during the premenstrual phase for athletes who report severe symptoms. Collaborate with academic staff to reduce scheduling conflicts during examination periods. Provide workshops on stress management and menstrual health awareness. Offer flexible academic deadlines for athletes during high-intensity competition seasons. Incorporate menstrual health education into university wellness programs. Establish student-athlete support units that address both academic and athletic demands. Conduct longitudinal studies to explore causal relationships between sleep quality, academic stress, and PMS. Include biological measures such as hormone profiling for more precise analysis. Investigate intervention programs combining sleep hygiene education and stress reduction strategies.

**Limitations of the Study**
The study used self-reported measures, which may be subject to recall bias. The cross-sectional design prevents establishing causality. The sample was limited to one geographic region, which may affect generalizability. This study provides valuable insights into the interconnectedness of sleep quality, academic burden, and PMS severity among female student-athletes. The findings emphasize the need for a holistic approach that addresses both physical and psychological well-being to optimize athletic performance and academic success.

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