ORIGINAL RESEARCH ARTICLE

Effects of physical activity in menstrual health and psychological wellbeing among Chinese female university students

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Abstract

This study examined how physical activity affects Chinese female university students' menstrual health and psychological well-being, with particular emphasis on how it affects the reproductive health indicators of premenstrual syndrome and dysmenorrhea. Menstrual health (dysmenorrhea and premenstrual symptoms), psychological wellbeing (stress, anxiety, depressive symptoms, and sleep quality), and physical activity levels were all gathered using a cross-sectional analytical design. Multivariate regression analyses adjusted for lifestyle and sociodemographic variables. The results demonstrated a significant correlation between improved psychological wellbeing and less severe menstrual symptoms and higher levels of moderate-to-vigorous physical activity. Stress levels, depressive symptoms, and sleep quality were all lower among active students. Physical activity and menstrual health were mediated by perceived stress and sleep quality. We conclude that exercise is an effective comprehensive strategy for improving perceived stress and menstrual health. *(Afr J Reprod Health 2026; 30 [9s]: 82-91).*

Keywords: Physical activity, Reproductive Health, menstrual health, psychological wellbeing, university students, China

Résumé

Cette étude examine comment l'activité physique affecte la santé menstruelle et le bien-être psychologique des étudiantes universitaires chinoises, en mettant particulièrement l'accent sur son impact sur les principaux indicateurs de santé reproductive que sont le syndrome prémenstruel et la dysménorrhée. Une conception analytique transversale a été utilisée pour recueillir des données sur la santé menstruelle (dysménorrhée et symptômes prémenstruels), le bien-être psychologique (stress, anxiété, symptômes dépressifs et qualité du sommeil) et les niveaux d'activité physique. Des analyses de régression multivariée ont été ajustées pour les variables liées au mode de vie et sociodémographiques. Les résultats ont démontré une corrélation significative entre une amélioration du bien-être psychologique, une réduction de la sévérité des symptômes menstruels et des niveaux plus élevés d'activité physique modérée à vigoureuse. Les étudiantes actives présentaient des niveaux de stress, des symptômes dépressifs et une qualité de sommeil inférieurs. Le stress perçu et la qualité du sommeil ont médiatisé la relation entre l'activité physique et la santé menstruelle. L'étude conclut que l'exercice est une stratégie complète et peu coûteuse pour améliorer la santé menstruelle et le bien-être perçu. *(Afr J Reprod Health 2026; 30 [9s]: 82-91).*

Mots-clés: Activité Physique, Santé reproductive, Santé Menstruelle, Bien-Être Psychologique, Étudiants Universitaires, Chine

Introduction

Menstrual health is a critical yet often poorly explored component of women's overall health and wellbeing, particularly among young adult populations. Menstrual-related problems including dysmenorrhea, premenstrual syndrome (PMS), and premenstrual dysphoric disorder (PMDD)—are highly prevalent and have been shown to adversely affect academic performance, daily functioning, and psychological wellbeing[1]. Among female university students, these issues frequently coexist with elevated levels of stress, anxiety, sleep disturbance, and depressive symptoms, creating a compounded burden on both physical and mental health[2].

In China, the prevalence of menstrual discomfort and PMS among female students is substantial, yet menstrual health remains culturally stigmatized and insufficiently addressed within university health promotion systems. Empirical evidence suggests that many Chinese female students rely on self-management strategies or medication, while preventive and lifestyle-based interventions—such as regular physical activity—remain underutilized [3]. This gap is concerning given the growing body of international and regional

research highlighting the role of physical activity as a non-pharmacological, low-cost, and accessible intervention for improving menstrual symptoms and psychological outcomes[4].

Physical activity has been shown to influence menstrual health through multiple physiological and psychosocial pathways. Regular moderate-to-vigorous physical activity contributes to hormonal regulation, improved pelvic blood circulation, reduced systemic inflammation, and enhanced endorphin release, all of which are associated with reduced menstrual pain and severity of premenstrual symptoms[5]. In addition, exercise is widely recognized for its protective effects against anxiety, depression, and stress conditions that often exacerbate menstrual-related distress[6]. Recent studies among Chinese and East Asian female students have reported inverse associations between physical activity levels and PMS severity, as well as improvements in mood, sleep quality, and perceived wellbeing.

Psychological wellbeing represents a key but frequently overlooked dimension in menstrual health research. University-aged women experience unique psychosocial pressures related to academic demands, social transitions, and future career uncertainty, which may intensify both menstrual symptoms and mental health vulnerabilities. Evidence indicates that stress, poor sleep quality, and emotional dysregulation act as mediating factors linking menstrual symptoms and psychological distress. Physical activity may serve as a critical protective factor by simultaneously improving emotional regulation, sleep quality, and resilience, thereby offering holistic benefits for menstrual and mental health[7].

Despite growing international literature, integrated research examining the relationship between physical activity, menstrual health, and psychological wellbeing among Chinese female university students remains limited. Existing studies often focus on isolated outcomes—such as PMS prevalence or mental health indicators—without adopting a comprehensive framework that captures their interconnections. Furthermore, culturally grounded evidence from China is essential, given differences in lifestyle patterns, academic environments, and sociocultural attitudes toward menstruation and exercise.

Therefore, this study aims to examine the role of physical activity in shaping menstrual health and psychological wellbeing among Chinese female university students. By adopting an integrated approach, this research seeks to contribute empirical evidence to support lifestyle-based interventions and inform university health policies that promote both reproductive health and mental wellbeing in young women.

Literature review

Menstrual health challenges among university students

Menstrual health problems such as dysmenorrhea, premenstrual syndrome (PMS), and premenstrual dysphoric disorder (PMDD) are widely reported among adolescent and young adult women and are particularly prevalent among university students[8]. These conditions are associated with physical discomfort, emotional instability, fatigue, and impaired daily functioning, often resulting in absenteeism and reduced academic productivity. University students constitute a vulnerable group due to academic pressure, irregular sleep patterns, dietary changes, and psychosocial stressors, all of which may exacerbate menstrual symptoms[9].

In the Chinese context, several studies have documented a high prevalence of menstrual discomfort and PMS among female students, with many reporting moderates to severe symptoms. Cultural taboos surrounding menstruation and limited institutional support further constrain effective menstrual health management. Consequently, students frequently rely on self-medication or passive coping strategies, while preventive and lifestyle-based approaches remain underutilized[10].

Physical activity and menstrual health outcomes

Physical activity has been increasingly recognized as a protective factor against menstrual-related symptoms. Empirical evidence suggests that regular moderate-to-vigorous physical activity can reduce the severity of dysmenorrhea and PMS through improved blood circulation, hormonal balance, and reduced prostaglandin production. Exercise-induced endorphin release has also been linked to pain modulation and improved mood during the menstrual cycle[11].

Systematic reviews and meta-analyses have demonstrated that aerobic exercise, yoga, and traditional movement-based practices significantly

alleviate menstrual pain and premenstrual symptoms. Studies conducted among Asian and Chinese female students report inverse associations between physical activity levels and PMS severity, indicating that students who engage in regular physical activity experience fewer and less intense menstrual symptoms[12]. Despite this evidence, physical activity participation among female university students in China remains suboptimal, largely due to academic workload, sedentary lifestyles, and limited awareness of its reproductive health benefits.

Psychological wellbeing and menstrual symptoms

Psychological wellbeing is closely intertwined with menstrual health. Stress, anxiety, and depressive symptoms have been identified as both predictors and consequences of menstrual-related disorders. Elevated stress levels can disrupt hypothalamic–pituitary–ovarian axis functioning, intensifying menstrual pain and emotional symptoms[13]. Conversely, recurrent menstrual discomfort may contribute to emotional distress, creating a bidirectional relationship between menstrual health and psychological wellbeing.

Among university students, psychological distress is highly prevalent due to academic demands, social transitions, and uncertainty about future employment. Research indicates that female students experiencing severe PMS or dysmenorrhea are more likely to report higher stress levels, sleep disturbances, and depressive symptoms[14]. In China, studies have highlighted the compounded burden of menstrual symptoms and mental health challenges among female students, emphasizing the need for integrated health promotion strategies.

Role of physical activity in psychological wellbeing

A robust body of literature demonstrates that physical activity exerts significant positive effects on psychological wellbeing. Regular exercise has been shown to reduce symptoms of anxiety and depression, enhance emotional regulation, and improve sleep quality through neurobiological and psychosocial mechanisms [15]. Physical activity promotes the release of neurotransmitters such as serotonin and dopamine, which play a critical role in mood stabilization and stress reduction.

Among university students, higher levels of physical activity are consistently associated with better mental health outcomes, including lower perceived stress and improved subjective wellbeing [16]. Evidence from Chinese university populations further supports these findings, indicating that students who engage in regular physical activity report fewer psychological symptoms and better sleep quality compared to their sedentary peers [17].

Integrating physical activity, menstrual health, and psychological wellbeing

While substantial literature exists on physical activity, menstrual health, and psychological wellbeing individually, studies adopting an integrated framework remain limited. Emerging research suggests that psychological factors such as stress and sleep quality may mediate the relationship between physical activity and menstrual health outcomes[18]. Physical activity may improve menstrual health indirectly by reducing stress, enhancing sleep, and strengthening emotional resilience, thereby mitigating both physical and psychological symptomatology[19].

In the Chinese context, most existing studies focus on prevalence estimates or bivariate associations and rarely explore mediating mechanisms linking lifestyle behaviors with reproductive and mental health outcomes. This gap underscores the need for comprehensive investigations that examine physical activity as a holistic intervention addressing both menstrual health and psychological wellbeing among female university students.

Research gaps

Despite growing evidence on menstrual health, physical activity, and psychological wellbeing among young women, several critical research gaps remain. First, existing studies—particularly in the Chinese context tend to examine menstrual symptoms, mental health outcomes, or physical activity in isolation, with limited use of integrated analytical frameworks that capture their interrelationships. Second, much of the available literature relies on prevalence estimates or simple bivariate associations, offering insufficient insight into the underlying mechanisms through which physical activity may influence menstrual health via psychological pathways such as stress, sleep quality, and emotional regulation. Third, culturally

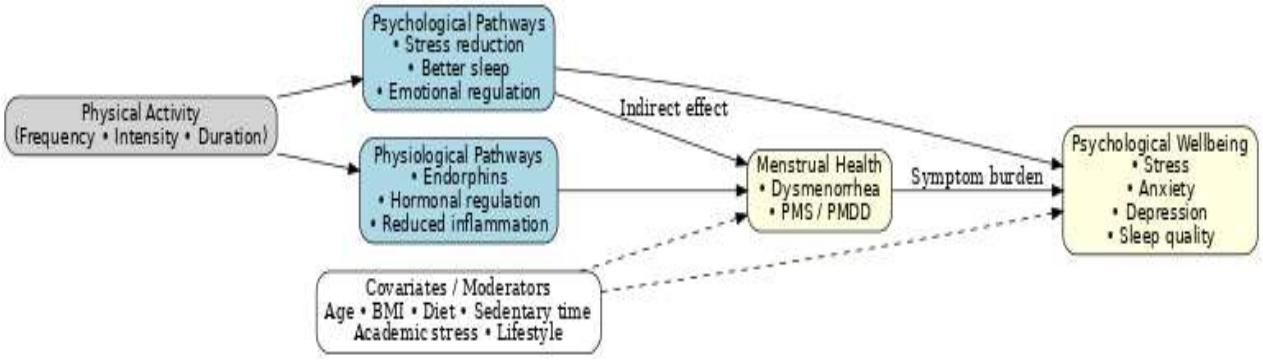


Figure 1: Conceptual framework of this study

grounded evidence focusing specifically on Chinese female university students is scarce, despite their distinct academic pressures, lifestyle patterns, and sociocultural attitudes toward menstruation and exercise. Finally, few studies explicitly assess physical activity as a scalable, preventive, and non-pharmacological intervention within university health settings, limiting the translation of research findings into policy and practice. Addressing these gaps is essential to inform holistic, evidence-based strategies for improving both menstrual health and psychological wellbeing among female university populations in China.

Conceptual framework

The conceptual framework of this study is designed to explain the interrelationships between physical activity, menstrual health, and psychological wellbeing among Chinese female university students. The framework positions physical activity as the primary independent variable, conceptualized through its frequency, intensity, and duration. Physical activity is hypothesized to influence both menstrual health and psychological wellbeing through distinct yet interrelated physiological and psychological pathways.

At the physiological level, regular physical activity is proposed to improve menstrual health outcomes by enhancing endorphin release, regulating hormonal activity, improving pelvic blood circulation, and reducing inflammatory responses. These mechanisms are expected to alleviate menstrual pain and reduce the severity of premenstrual symptoms, including dysmenorrhea and PMS/PMDD. Accordingly, the framework suggests a direct pathway from physical activity to improved menstrual health outcomes. Simultaneously, physical activity is theorized to affect menstrual health indirectly through psychological pathways. Engagement in regular physical activity is associated with reduced perceived stress, improved emotional regulation, and better sleep quality. These psychological improvements may moderate neuroendocrine and inflammatory processes that exacerbate menstrual symptoms, thereby contributing to reduced symptom severity. This indirect pathway reflects the growing recognition that menstrual health is not solely a biological phenomenon but is closely linked to psychosocial functioning[20].

Psychological wellbeing is treated as a key outcome in the framework and encompasses stress, anxiety, depressive symptoms, and sleep quality. The framework posits a direct association between physical activity and psychological wellbeing, consistent with evidence that exercise enhances mood, reduces anxiety and depression, and improves sleep patterns. Improved psychological wellbeing is expected to contribute to better overall functioning and quality of life among female university students. Importantly, the framework incorporates a bidirectional relationship between menstrual health and psychological wellbeing [16]. Menstrual symptoms, particularly when severe or chronic, may increase psychological distress, while heightened stress and emotional dysregulation may, in turn, intensify menstrual discomfort. This reciprocal linkage underscores the cyclical nature of menstrual health and mental wellbeing. Finally, the framework accounts for key covariates and moderating factors, including age, body mass index, dietary habits, sedentary behavior, academic workload, and lifestyle characteristics. These factors are not conceptualized as causal pathways but are included to control for confounding influences that may affect both menstrual and psychological outcomes.

Methods

Study design and sampling

This study adopted a cross-sectional quantitative design to examine the relationship between physical activity, menstrual health, and psychological wellbeing among Chinese female university students. The study was conducted across selected public and private universities in China such as Central China Normal University (Wuhan), Wuhan University of Technology and Hubei University, between March and June 2025. The target population consisted of female undergraduate and postgraduate students aged 18–30 years who had experienced regular menstruation during the previous six months. Participants with diagnosed gynecological disorders, those using hormonal contraceptives, or those with chronic medical or psychiatric conditions that could influence menstrual or psychological outcomes were excluded to minimize confounding effects. A convenience sampling approach was employed due to feasibility considerations, and participation was voluntary.

The sample size was determined using an a priori power analysis conducted with G*Power version 3.1, appropriate for multivariate linear regression analysis. Given that the primary objective of the study was to examine the association between physical activity and menstrual health outcomes while controlling for multiple covariates, the following statistical assumptions were specified:

Statistical test: Multiple linear regression (fixed model, R^2 deviation from zero)

Effect size (f^2): 0.15 (medium effect size, based on Cohen's criteria)

Alpha level (α): 0.05

Statistical power ($1 - \beta$): 0.80

Data collection instruments

Data were collected using a structured, self-administered online questionnaire. Physical activity was assessed using the International Physical Activity Questionnaire–Short Form (IPAQ-SF)[21], which measures the frequency and duration of walking, moderate-intensity, and vigorous-intensity activities over the preceding seven days. Total physical activity was calculated in metabolic equivalent task minutes per week and categorized into low, moderate, and high activity levels following established scoring guidelines. Menstrual health was evaluated through self-reported measures assessing the presence and severity of dysmenorrhea and premenstrual symptoms, with symptom severity rated on a Likert-type scale. Composite scores were generated to reflect overall menstrual symptom burden. Physical activity was assessed using the International Physical Activity Questionnaire–Short Form (IPAQ-SF), which has been widely used in Chinese college populations[21]. Sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI), a validated instrument commonly applied in studies among Chinese university students[22]. A total of 412 female university students were included in the final analysis. The mean age was 21.8 ± 2.4 years, with most participants enrolled in undergraduate programs (78.2%). The mean body mass index (BMI) was 21.4 ± 3.2 kg/m², with the majority within the normal weight range (69.7%). Average daily sedentary time was 6.3 ± 2.1 hours. Smoking (2.4%) and alcohol use (8.7%) were relatively low, while 63.5% reported regular caffeine consumption. Overall, 62.4% of participants reported moderate to severe menstrual symptoms, and 48.1% reported moderate to high perceived stress. Based on physical activity classification, 36.4% had low activity levels, 41.0% moderate, and 22.6% high levels.

Data collection procedure

The questionnaire was distributed electronically through university mailing lists and student social media platforms. Prior to the main survey, a pilot test involving 30 participants was conducted to assess clarity, reliability, and completion time, resulting in minor revisions to the questionnaire. Duplicate responses were minimized through IP-based screening, and incomplete responses were excluded from the final analysis.

Data analysis

Statistical analyses were performed using SPSS (version 26). Descriptive statistics were used to summarize participant characteristics and study variables. Bivariate analyses were conducted to examine preliminary associations between physical activity, menstrual health indicators, and psychological wellbeing outcomes. Multivariate linear regression models were then applied to assess the independent associations of physical activity

with menstrual health and psychological wellbeing while controlling for relevant covariates. Mediation analyses were conducted to explore whether psychological factors, particularly perceived stress and sleep quality, mediated the relationship between physical activity and menstrual health outcomes. Statistical significance was set at $p < 0.05$.

Ethical consideration

The Declaration of Helsinki's ethical precepts and China's national ethical guidelines for human research were followed in the conduct of this study. Before each participant filled out the questionnaire, their electronic informed consent was acquired. A thorough explanation of the study's objectives, the voluntary nature of participation, data confidentiality guarantees, the right to withdraw at any time, and the planned application of the results were all part of the consent procedure. No personally identifiable information, like a name or student ID, was gathered in order to protect privacy. All data was processed using unique identification codes in a completely anonymized manner. Under approval code CCNU-IRB-2025-0039, the Central China Normal University Institutional Review Board examined and approved the research protocol, which included the questionnaire and analysis techniques.

Results

Sample characteristics

A total of N = 412 female university students completed the survey and were included in the final analysis after data screening. The mean age of participants was 21.8 ± 2.4 years, with the majority enrolled in undergraduate programs. Approximately 62.4% of respondents reported experiencing moderate to severe menstrual symptoms, while 48.1% reported moderate to high perceived stress levels. Based on IPAQ-SF categorization, 36.4% of participants were classified as having low physical activity levels, 41.0% moderate activity, and 22.6% high activity.

These prevalence estimates are consistent with prior studies reporting high burdens of menstrual discomfort and psychological stress among Chinese female university students[1,2].

Physical activity, menstrual health, and psychological wellbeing

Table 1 presents descriptive statistics for physical activity, menstrual health outcomes, and psychological wellbeing indicators.

Bivariate associations

Pearson correlation analysis revealed significant associations between physical activity and key outcome variables (Table 2). Total physical activity was negatively correlated with dysmenorrhea severity ($r = -0.29$, $p < 0.001$) and PMS symptom scores ($r = -0.31$, $p < 0.001$). Physical activity was also inversely associated with perceived stress, anxiety, depressive symptoms, and poor sleep quality.

These findings align with previous evidence indicating that higher physical activity levels are associated with reduced menstrual symptoms and improved psychological outcomes among female students[3, 4].

Multivariate regression analysis

Multivariate linear regression models were estimated to assess the independent associations between physical activity and menstrual health outcomes after adjusting for age, BMI, academic workload, sedentary behavior, dietary habits, and caffeine intake (Table 3).

Higher physical activity levels were significantly associated with lower dysmenorrhea and PMS severity, independent of covariates. These findings corroborate prior intervention and observational studies demonstrating the protective role of moderate-to-vigorous physical activity against menstrual discomfort[5,6].

Physical activity and psychological wellbeing

Table 4 summarizes regression results examining the relationship between physical activity and psychological wellbeing indicators.

Students with higher physical activity levels reported significantly lower psychological distress and better sleep quality. These results are consistent with extensive literature highlighting the mental health benefits of physical activity among university populations, including Chinese students[7,8].

Table 1: Descriptive statistics of key study variables (n = 412)

Variable	Mean ± SD / %
Total physical activity (MET-min/week)	1845 ± 912
Dysmenorrhea severity score	2.4 ± 0.83
PMS symptom score	2.3 ± 0.7
Perceived stress score	18. ± 6.1
Anxiety score	7.9 ± 4.2
Depressive symptom score	8.4 ± 4.7
PSQI sleep quality score	6.8 ± 3.1

Higher PSQI scores indicate poorer sleep quality.

Table 2: Correlation matrix between physical activity, menstrual health, and psychological wellbeing

Variable	Physical Activity
Dysmenorrhea severity	−0.2***
PMS symptoms	−0.3***
Perceived stress	−0.3***
Anxiety	−0.2***
Depressive symptoms	−0.3***
Sleep quality (PSQI)	−0.3***

***p* < 0.001

Table 3: Multivariate regression results: physical activity and menstrual health outcomes

Outcome Variable	β (SE)	*p*-value
Dysmenorrhea severity	−0.2 (0.05)	<0.001
PMS symptom score	−0.2 (0.06)	<0.001

Table 4: Multivariate regression results: physical activity and psychological wellbeing

Outcome Variable	β (SE)	*p*-value
Perceived stress	−0.2 (0.07)	<0.001
Anxiety	−0.1 (0.06)	0.002
Depressive symptoms	−0.2 (0.07)	0.001
Sleep quality (PSQI)	−0.2 (0.08)	<0.001

Mediation analysis

Mediation analysis revealed that perceived stress and sleep quality partially mediated the relationship between physical activity and menstrual health outcomes. Approximately 32% of the total effect of physical activity on PMS severity was explained through reductions in stress and improvements in sleep quality. The indirect effects remained statistically significant after controlling for covariates ($p < 0.01$). These findings support emerging evidence that psychological factors act as key mechanisms linking lifestyle behaviors to menstrual health outcomes[9,10]. The results reinforce the conceptual framework proposed in this study, highlighting the interconnected nature of physical activity, psychological wellbeing, and menstrual health.

Discussion

The present study examined the role of physical activity in menstrual health and psychological wellbeing among Chinese female university students using an integrated biopsychosocial framework. The findings demonstrate that higher levels of physical activity were significantly associated with reduced menstrual symptom severity, lower psychological distress, and improved sleep quality. Moreover, perceived stress and sleep quality partially mediated the relationship between physical activity and menstrual health outcomes, providing empirical support for the hypothesized pathways in the conceptual framework[1,5].

Consistent with the biopsychosocial model of women's health, the observed inverse association between physical activity and menstrual symptoms supports the notion that menstrual health is shaped by interactions between physiological regulation and psychosocial functioning[11,20]. Regular physical activity is known to modulate prostaglandin synthesis, enhance pelvic blood flow, and stimulate endorphin release, all of which contribute to pain reduction and improved menstrual comfort[11,14]. The significant associations between physical activity and both dysmenorrhea and PMS severity observed in this study align with prior evidence from Asian and Chinese student populations, reinforcing the external validity of the findings[15,16].

Beyond direct physiological effects, the results highlight the critical role of psychological pathways, particularly stress reduction and sleep quality, in linking physical activity to menstrual health outcomes. The mediation analysis demonstrated that a substantial proportion of the association between physical activity and PMS severity was explained through reduced perceived stress and improved sleep. This finding is consistent with stress-regulation theory, which posits that chronic psychological stress disrupts hypothalamic–pituitary–ovarian axis functioning, thereby exacerbating menstrual symptoms[17,18]. Physical activity may mitigate these effects by enhancing autonomic balance and emotional regulation, thus indirectly improving menstrual health.

The strong association between physical activity and psychological wellbeing outcomes observed in this study further supports established exercise psychology theories, which emphasize the mental health benefits of regular physical activity through neurochemical and behavioral mechanisms [19, 20]. Participants with higher activity levels reported significantly lower stress, anxiety, and depressive symptoms, as well as better sleep quality. These findings mirror previous studies among Chinese university students demonstrating protective effects of moderate-to-vigorous physical activity against psychological distress [11, 12]. Given that university students often experience high academic and social stress, physical activity may function as a crucial coping resource within this population.

Importantly, the bidirectional relationship identified between menstrual health and psychological wellbeing underscores the cyclical nature of symptom burden and emotional distress. Menstrual discomfort may heighten psychological stress, while elevated stress and poor sleep may intensify menstrual symptoms, creating a reinforcing feedback loop[13]. By positioning physical activity as an upstream intervention capable of disrupting this cycle, the findings contribute to a growing body of literature advocating for lifestyle-based, non-pharmacological approaches to women's reproductive health[14].

From a contextual perspective, the results are particularly relevant for Chinese female university students, among whom sedentary behavior, academic pressure, and limited engagement in structured physical activity are increasingly common[11,15]. Cultural norms and limited institutional emphasis on menstrual health further compound these challenges. The present findings suggest that integrating physical activity promotion into university health programs could yield dual benefits for reproductive health and psychological wellbeing, supporting calls for more holistic student health policies in China[6,16].

Study strengths and limitations

This study has several notable strengths. First, it adopts an integrated biopsychosocial framework to examine the interrelationships between physical activity, menstrual health, and psychological wellbeing within a single analytical model. Second, the use of validated instruments and multivariate regression with mediation analysis enhances the methodological rigor of the findings. Third, the relatively large sample drawn from multiple universities improves internal validity and strengthens the reliability of the observed associations. However, several limitations should be acknowledged. The cross-sectional design precludes causal inference, and the use of convenience sampling may limit generalizability beyond the study population. All measures were self-reported, which may introduce recall or reporting bias. Additionally, unmeasured confounding factors, such as detailed dietary patterns or hormonal profiles, were not assessed.

Despite these limitations, the findings carry important implications for policy and practice. Universities should consider integrating structured physical activity programs and menstrual health awareness initiatives into student wellbeing services. Promoting regular physical activity may serve as a low-cost, non-pharmacological strategy to simultaneously improve reproductive health and psychological outcomes among female students. Policymakers in higher education settings may benefit from adopting holistic health promotion models that address both mental health and menstrual wellbeing in an integrated manner.

Conclusion

This study provides empirical evidence that physical activity plays a significant and multifaceted role in improving menstrual health and psychological wellbeing among Chinese female university students. Grounded in a biopsychosocial framework, the findings demonstrate that higher levels of physical activity are associated with reduced severity of dysmenorrhea and premenstrual symptoms, as well as lower levels of stress, anxiety, depressive symptoms, and sleep disturbances. Importantly, the mediation effects of perceived stress and sleep quality confirm that physical activity influences menstrual health not only through direct physiological mechanisms but also through psychological pathways, thereby reinforcing integrated theoretical models of women's health.

From a theoretical perspective, this research advances existing literature by empirically linking physical activity, psychological regulation, and menstrual health within a single explanatory framework. It extends biopsychosocial and stress-regulation theories by demonstrating how lifestyle

behaviors function as upstream determinants of reproductive health outcomes among young women. By moving beyond isolated outcome analyses and testing indirect pathways, the study contributes a more comprehensive understanding of menstrual health as a dynamic interaction between biological processes and psychosocial contexts.

From a practical standpoint, the findings highlight physical activity as a feasible, low-cost, and non-pharmacological intervention that can be readily integrated into university health promotion strategies. Universities and policymakers should consider embedding structured physical activity programs, awareness campaigns, and supportive environments into student wellbeing initiatives, particularly those targeting female students. Such interventions have the potential to simultaneously reduce menstrual symptom burden and improve mental health, thereby enhancing academic engagement, quality of life, and long-term wellbeing.

In conclusion, promoting regular physical activity among female university students represents a promising strategy for addressing the dual challenges of menstrual health and psychological distress. Future research should build on these findings through longitudinal and intervention-based designs to establish causal pathways and to evaluate the effectiveness of physical activity programs tailored to the sociocultural context of Chinese higher education institutions.

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