

The Relationship Between Physical Activity and Menstrual Cycles in Urban Adolescents Girls

Dessy Amelia^{✉1)}, Rizqie Putri Novembriani¹⁾, Alifia Candra Puriastuti¹⁾, Fitriana Nur Rahmawati²⁾, Khamdan Mukharam³⁾, Moh. Andi Arif Billah³⁾

¹ Department of Midwifery, Universitas Negeri Malang, Malang, East Java, Indonesia 65139

² University of Osaka (Department of Signal Transduction, Research Institute for Microbial Diseases, Osaka, Japan 565-0871

³ Department of Sport Science, Universitas Negeri Malang, Malang, East Java, Indonesia 65139

✉ Email: dessy.amelia.fk@um.ac.id

ABSTRACT

Background: Many adolescents face barriers to physical activity due to sociocultural factors, which may deter them from engaging in regular exercise. Sedentary lifestyles typical of urban adolescents may be associated with increased menstrual irregularities due to factors such as unhealthy weight gain, stress, and poor nutrition, all of which could be exacerbated by low levels of physical activity. This study aims to determine the relationship between physical activity and menstrual regularity in urban adolescents in Malang City. **Method:** An institutional-based cross-sectional study was conducted on public vocational high school students in Malang City from July until August 2025. The total calculated sample size is 96 respondents. Logistic regression is used to find the relationship between dependent and independent variables. **Result:** Logistic regression analysis showed that the level of physical activity was not significantly associated with menstrual cycle regularity ($p > 0.05$ across all activity categories). The $\text{Exp}(B)$ value for moderate activity was 1.545 (95% CI: 0.424-5.633) and for high activity was 0.800 (95% CI: 0.247-2.596), indicating no meaningful difference in the likelihood of having a regular menstrual cycle compared to the low physical activity group. Model fit testing revealed Cox & Snell R Square of 0.020 and Nagelkerke R Square of 0.027, suggesting that physical activity explained only about 2-3% of the variation in menstrual cycle regularity. **Conclusion:** Therefore, physical activity level cannot be considered a significant predictor of menstrual cycle regularity in this study.

Keywords: Adolescents, Menstrual Cycle, Physical Activity

INTRODUCTION

Urban adolescents report a significant prevalence of menstrual irregularities, often linked to lifestyle factors common in urban environments. For instance, one study found that urban schoolgirls reported a considerable percentage of irregular menstrual cycles and discomfort during menstruation due to psychological and physical stressors, including academic pressures and social expectations (Daniel *et al.*, 2023). The World Health Organization (WHO) recommends that adolescents aged 5 to 17 should get at least 60 minutes of moderate to vigorous physical activity (MVPA) every day. This should include muscular and bone-strengthening activities at least three times per week (Chaput *et al.*,

2020); (Yang, Wang and Luo, 2023). These guidelines aim to promote physical and mental well-being, facilitate growth and development, and reduce the risk of chronic illnesses in the future (Moller *et al.*, 2023); (Pinto, Ribeiro and Pelegrini, 2025). Studies indicate that a significant portion of adolescents globally are insufficiently active, with estimates suggesting that approximately 81% of adolescents do not meet these guidelines, highlighting disparities in participation rates across different genders and socioeconomic groups (Gomes *et al.*, 2022). Some studies reveal that sedentary lifestyles typical of urban adolescents may be associated with increased menstrual irregularities due to factors such as unhealthy weight gain, stress, and poor nutrition, all of which could be

exacerbated by low levels of physical activity (Bhandari *et al.*, 2024); (Saleh *et al.*, 2023).

While some studies indicate a correlation between physical activity and menstrual cycle regularity, this relationship is not straightforward. For instance, highly trained female athletes often experience menstrual irregularities, suggesting that while physical activity can enhance regular cycles, excessive training or high-intensity exercise can lead to disruptions due to stress on the body and hormonal imbalances (Amoruso *et al.*, 2024). Increased physical activity with longer menstrual cycles and a higher prevalence of amenorrhea among those who engage in excessive exercise (Angelidi *et al.*, 2024). Rigorous training regimens may influence the hypothalamic-pituitary-adrenal (HPA) axis, which modulates key hormonal pathways essential for maintaining a regular menstrual cycle (Witkoś *et al.*, 2022). Thus, rather than physical activity level being a direct predictor, the type, duration, and intensity of the activity play critical roles (Jones *et al.*, 2024); (Balqis, Herawati and Budi, 2024). In urban settings, where adolescents exhibit diverse physical activity patterns, the impact of exercise on menstrual regularity can be negligible.

Furthermore, stress levels present a significant confounding variable in assessing the impact of physical activity on menstrual regularity. Studies demonstrate that high levels of perceived stress are correlated with irregular menstrual cycles, often overshadowing the effects of physical activity (Matsumura *et al.*, 2025); (Mittiku *et al.*, 2022). For instance, the physical demands and emotional stress associated with certain professions, such as nursing, have been documented to influence menstrual regularity more profoundly than physical activity levels alone (Kim *et al.*, 2022); (Matsumura *et al.*, 2025). Therefore, it emerges that stress management may be more crucial in addressing menstrual irregularities than merely focusing on increasing physical activity.

Moreover, body mass index (BMI) and dietary habits have shown stronger associations with menstrual health than physical activity. Increased adipose, for instance, is connected to estrogen dominance, which can disrupt the regularity of menstrual cycles (MacGregor,

Gallagher and Moran, 2021). In populations where lifestyle factors like diet and obesity are controlled, the influence of variable physical activity levels diminishes significantly (Itriyeva, 2022); (Balqis, Herawati and Budi, 2024). Data show that disturbances in normal hormonal cycles are more directly influenced by body composition and metabolic syndrome conditions rather than physical activity alone (Liyis, David and Gunawan, 2024) (MacGregor, Gallagher and Moran, 2021). Physical activity may contribute positively to menstrual health within certain contexts; it cannot be considered a standalone significant predictor of menstrual cycle regularity. Influencing factors such as exercise intensity, the physical demand involved, stress levels, and metabolic health indices play dominant roles in determining menstrual health. This study aims to determine the relationship between physical activity and menstrual regularity in urban adolescents in Malang City.

METHODS

This research is a cross-sectional study. The physical activity instrument in this study used the Global Physical Activity Questionnaire (GPAQ) and a structured questionnaire administered to collect data on menstrual cycle patterns. The questionnaire collection will be conducted from July to August 2025.

Sample

The research sample consisted of 96 respondents from public vocational high school students in Malang City in grades X, XI, and XII, aged 14-19 years.

Data Collection Process

Eligible responders received self-administered surveys in the form of an online form. Participation in the survey is optional. The questionnaire begins with a brief paragraph informing participants of the study's goals and the confidentiality of their answers. All subjects granted informed consent. Data were collected anonymously, and participants retained the right to access their responses and withdraw from the study at any time. The research protocol received approval from the Ethics Committee for Research at Malang State University

(12.06.10/UN32.14.2.8/LT/2025).

Statistical Analysis

Quantitative variables are expressed as mean values (standard deviation) or median (interquartile range), depending on their data distribution. Qualitative variables are presented as absolute frequency (n) and percentage (%). A binary logistic regression analysis was conducted to examine the association between physical activity levels and menstrual cycle regularity. The Odds Ratio (Exp(B)) and a 95% Confidence Interval (CI) show the findings of the analysis. The regression equation includes the main independent variable (level of physical activity) as well as potential covariate menstrual cycle regularity. The model's goodness-of-fit was evaluated using the Cox & Snell R² and Nagelkerke R² values to determine the proportion of variation in menstrual cycle regularity that could be explained by the model. All statistical tests were two-tailed with a significance level set at p < 0.05.

RESULTS AND DISCUSSION

Table 1 displays the descriptive characteristics of the participants. The sample primarily consisted of mid-adolescents with a uniform age distribution (mean = 16.07 years), indicating that the majority of respondents fell within the late secondary school age range. The average age at menarche was 12.63 years, concentrated in early adolescence and consistent with previously documented epidemiological patterns.

Table 1. Descriptive Statistics of Study Variables (n = 96)

Variable	Mean	Mode	SD	Min.	Max.
Age (years)	16.07	16	1.028	14	19
Total METs	1970.67	400	2659.19	0	15840
Moderate-Vigorous Activity Duration (minutes /week)	378.26	0 ^a	507.80	0	3240
Sedentary Duration (minutes /week)	1653.85	180 ^a	2486.20	45	21600
Transportation	89.11	0	163.67	0	1260

Variable	Mean	Mode	SD	Min.	Max.
Duration (minutes /week)					
Age at Menarche (years)	12.63	12	1.386	9	16

^a Multiple modes exist. The smallest value is shown.

Indicators of physical activity exhibited significant heterogeneity. The mean total MET score was elevated; however, the extensive range from 0 to 15,840 indicated the existence of both very active and entirely sedentary persons. A comparable trend was noted in the duration of moderate-to-vigorous activity, with certain people indicating substantial involvement while others reported none whatsoever. While the average sedentary behavior was low, the substantial standard deviation indicated that some people engaged in significantly more sedentary activities. Transportation-related activities exhibited significant variability, possibly indicative of disparities in daily commuting or mobility habits.

Table 2. Frequency Distribution of Menstrual Cycle and Activity Level

Variable	Category	n	%
Menstrual cycle	Regular	48	50.0
	Irregular	48	50.0
Physical Activity Level	Low	28	29.2
	Moderate	54	56.3
	Vigorous	14	14.6
Total		96	100.0

Table 2 illustrates the distribution of menstrual cycle regularity and levels of physical activity. Fifty percent of the participants indicated regular menstrual cycles, whilst the other fifty percent reported irregular cycles, implying a balanced distribution of menstrual health status within this cohort. Concerning physical activity levels, the majority of individuals (56.3%) were deemed moderately active, whilst lesser percentages were classed as having low (29.2%) or high (14.6%) activity levels. This signifies a prevailing inclination among adolescents in this study to participate in modest levels of physical activity.

Table 3. Association between Physical Activity Level and Menstrual Cycle Regularity

Physical Activity Level	Regular Menstrual Cycle		Irregular Menstrual Cycle		p-value
	n	%	n	%	
Low	11	22.9	17	35.4	0.382
Moderate	30	62.5	24	50.0	
Vigorous	7	14.6	7	14.6	
Total	48	100.0	48	100.0	

Table 3 illustrates the relationship between physical activity levels and the consistency of the menstrual cycle. The chi-square analysis indicated no statistically significant association between physical activity level and menstrual cycle regularity ($p = 0.382$). Descriptive patterns indicated that irregular cycles were considerably more prevalent in the low-activity group, while moderate activity correlated with a higher proportion of regular cycles; nonetheless, these differences were inadequate to establish a definitive association. Logistic regression analysis corroborated this conclusion, as neither moderate activity (OR = 1.545, 95% CI: 0.424-5.633) nor high activity (OR = 0.800, 95% CI: 0.247-2.596) exhibited significant impacts relative to the low-activity group. The broad confidence intervals signify a lack of precision in these estimations, implying that the study may not possess the statistical power to identify tiny or moderate relationships.

Table 4. Logistic Regression of Physical Activity Level and Menstrual Cycle Regularity

Variable	P-value	OR	95% CI
Moderate vs. Low Activity	0.509	1.545	0.424 - 5.633
Vigorous vs. Low Activity	0.710	0.800	0.247 - 2.596

Model fit indices: -2 Log Likelihood = 131.120; Cox & Snell $R^2 = 0.020$; Nagelkerke $R^2 = 0.027$.

The findings of the logistic regression analysis are encapsulated in Table 4. In comparison to the low-activity group, participants exhibiting moderate activity displayed a non-significant

inclination towards more regular cycles (OR = 1.545, 95% CI: 0.424-5.633), while those engaged in high activity exhibited a non-significant inclination towards fewer regular cycles (OR = 0.800, 95% CI: 0.247-2.596). The broad confidence ranges underscore the imprecision of these findings, indicating that the study may lack adequate power to identify minor relationships. Model evaluation demonstrated limited explanatory power (Cox & Snell $R^2 = 0.020$; Nagelkerke $R^2 = 0.027$), signifying that physical activity contributed merely 2-3% to the variation in menstrual cycle regularity.

This study found no statistically significant association between physical activity level and menstrual cycle regularity. The study showed that the low-activity group had a significantly higher incidence of irregular cycles, while moderate exercise was associated with a higher proportion of regular cycles. The results of this study are consistent with one study that observed that the majority of physically active women experienced menstrual cycle durations within the normal range, while irregular patterns were reported primarily among those with negligible levels of physical activity (Bhandari *et al.*, 2024). Insufficient physical activity has been shown to correlate with an increased prevalence of menstrual disorders in adolescents. Studies show that a sedentary lifestyle contributes to hormonal imbalances, which can disrupt the timing and regularity of menstrual cycles. For example, adolescents with little or no physical activity were reported to have higher rates of irregular menstrual cycles, oligomenorrhea, and amenorrhea (Dhar, Mondal and Bhattacharjee, 2023). Lack of exercise can worsen conditions like obesity and insulin resistance, both of which are recognized risk factors for menstrual dysfunction (Dhar, Mondal and Bhattacharjee, 2023); (MacGregor, Gallagher and Moran, 2021).

Regular moderate physical activity plays an important role in maintaining hormonal balance, which is crucial for a regular menstrual cycle. Exercise can help regulate hormone secretion, such as estrogen and progesterone, by supporting the function of the hypothalamic-pituitary-gonadal (HPG) axis (Hackney, 2021); (Shahid, Noor and Bashir, 2024). This train highlights that regular engagement in moderate physical activity

can promote the cyclical hormonal activity necessary for consistent menstrual cycles. Additionally, the effects of physical activity on menstrual cycle characteristics found that increased exercise frequency was associated with longer cycle duration and a lower incidence of dysmenorrhea. It is proposed that exercise is influencing the release of hormones such as estrogen and progesterone in a rhythm conducive to regular menstruation (Baker *et al.*, 2024). The World Health Organization (WHO) advises that adolescents participate in a minimum of 60 minutes of moderate to vigorous physical activity daily (Dempsey *et al.*, 2021). However, these recommendations are intended to improve health, not to encourage excessive competition or intensity, which can lead to the side effects.

In comparison to the low-activity group, participants with moderate activity levels shown no significant trend to more regular cycles, whilst those with high activity levels showed no significant trend to fewer cycles. The higher levels of physical activity are correlated with lower menstrual incidence, suggesting that moderate exercise can help proper hormonal pathway function (MacGregor, Gallagher and Moran, 2021). Excessive physical activity can disrupt the HPG axis, which plays a crucial role in regulating reproductive hormones necessary for maintaining the menstrual cycle. When the body experiences intense physical demands, it can trigger a stress response that disrupts normal hormonal signals. This can lead to a decrease in the secretion of gonadotropin-releasing hormone (GnRH), which in turn causes a drop in estrogen and progesterone levels, hormones essential for ovulation and regular menstruation (Dhar, Mondal and Bhattacharjee, 2023).

High levels of physical activity can also lead to significant psychological stress, which further exacerbates menstrual irregularities. Intense exercise regimens can lead to fatigue, anxiety, and a decline in emotional well-being—factors known to negatively impact menstrual health (Yang, Wang and Luo, 2023). Furthermore, when athletes do not consume enough calories to meet their energy expenditure due to high physical demands, this can result in a negative energy balance, which further disrupts hormonal regulation and menstrual cycle regularity (Aghniani, Fikawati and Adha,

2023). Additionally, research indicates that physical stress and excessive fatigue can also lead to increased cortisol levels, a hormone that, when elevated, can disrupt the regulation of reproductive hormones, resulting in irregular cycles (Dhar, Mondal and Bhattacharjee, 2023).

While physical activity has clear benefits, it's crucial to recognize that this relationship is influenced by various factors, including the type and intensity of physical activity performed. For example, excessive high-intensity exercise can disrupt hormonal balance, leading to menstrual irregularities. Therefore, the focus should remain on maintaining balance where moderate activity levels are encouraged (Dhar, Mondal and Bhattacharjee, 2023). The regularity of the menstrual cycle is influenced by many factors beyond physical activity, such as hormonal fluctuations, body mass index (BMI), stress levels, and nutrition (Güzeldere *et al.*, 2024); (Priya, Gunasundari and R. Manivannan, 2024); (Song *et al.*, 2022). For example, a higher BMI is often associated with irregular menstrual cycles, while intense stress can disrupt normal hormonal patterns and menstruation (Liyis, David and Gunawan, 2024).

Factors including hormone levels, health status, and psychological condition significantly affect the outcomes of physical activity and menstrual health (Jeukendrup *et al.*, 2024); (Liu, Lin and Zhang, 2024). Hormonal fluctuations influence the frequency and characteristics of the menstrual cycle. Estrogen and progesterone have been demonstrated to affect mood and physiological responses to exercise (Harmon *et al.*, 2020) (Mutlu *et al.*, 2016). In the follicular phase, when estrogen levels are at their peak, women may exhibit heightened motivation and energy levels, which could enhance exercise adherence (Harmon *et al.*, 2020). During the luteal phase, characterized by elevated progesterone levels, some women experience heightened fatigue and premenstrual syndrome (PMS) symptoms, potentially leading to decreased physical activity (Mutlu *et al.*, 2016).

The physical condition of an individual can influence the outcomes of physical activity. Chronic conditions, obesity, and nutritional status can influence hormone levels and overall

physical capability (Bueno *et al.*, 2025). Obesity is associated with hormonal dysregulation, resulting in irregular menstrual cycles and a heightened risk of conditions like polycystic ovary syndrome (PCOS). Furthermore, elevated physical activity levels can impact weight management and subsequently hormonal balance, thereby affecting the regularity of menstrual cycles (Lope *et al.*, 2022). Individuals with suboptimal health may encounter greater difficulties in sustaining an active lifestyle, which can inadvertently impact their menstrual health (Lope *et al.*, 2022).

Psychological factors also influence an individual's response to exercise and can significantly affect menstrual health. Elevated stress and anxiety levels may disrupt hormonal balance, resulting in negative consequences for the menstrual cycle (Kim *et al.*, 2017). Psychological well-being correlates with elevated levels of physical activity; individuals exhibiting better mental health tend to participate in regular exercise (Kim *et al.*, 2017). Anxiety, depression, and stress may result in the avoidance of physical activity, thereby establishing a feedback loop that exacerbates menstrual irregularities (Cho, So and Roh, 2016).

This study has revealed some problems in its execution. First, the self-report questionnaire included in the study is susceptible to recall bias and inaccurate reporting. Subjective data regarding physical activity and menstrual cycles may undermine the validity of the findings. Reliance on self-reported data may undermine the accuracy and reliability of longitudinal physical activity tracking, potentially leading to weakened correlations compared to objective measurements (Husu *et al.*, 2024); (Suc *et al.*, 2024).

Second, this study did not include other known significant factors, such as stress, nutrition, and BMI, in the main analysis. Stress can alter the hormonal balance that regulates the menstrual cycle, potentially leading to irregularities (Youssef *et al.*, 2025). Neglecting the evaluation of stress in connection with physical activity and the menstrual cycle may obscure critical correlations and result in an underappreciation of the impact of environmental and psychological factors on physical activity levels and menstrual health. The interplay between

physical activity and diverse lifestyle factors, such as stress, is exceedingly intricate and necessitates thorough evaluation to prevent oversimplification of their interrelation (Tandon *et al.*, 2016).

Additionally, nutrition directly affects hormone levels, body composition, and overall energy balance, all of which significantly impact the menstrual cycle. Nutritional patterns are significantly correlated with BMI and influence menstrual health (Dos Santos *et al.*, 2020). Nutritional and metabolic health factors should be integrated into broader health studies for a comprehensive understanding and management strategies (FRACP *et al.*, 2019). Ignoring dietary context can obscure the complex relationship between physical activity and menstrual health outcomes, as different eating habits can significantly alter the physiological responses associated with exercise.

BMI is also a significant measure of body composition and general health, yet its correlation with physical activity and the menstrual cycle was excluded from the primary analysis of this study. Both high and low BMIs can disrupt menstrual regularity and lead to complications such as polycystic ovary syndrome (PCOS) (Almenning *et al.*, 2015). By ignoring BMI, this study overlooks an important variable that could mediate the association between physical activity and the characteristics of the menstrual cycle.

CONCLUSION

This study intends to ascertain the connection between physical activity and menstrual regularity in urban adolescents in Malang City. In addition, eating habits, stress management, and individual variations in response to physical activity all play a significant role in the overall impact of exercise on menstrual health. Therefore, a multifaceted approach that includes nutrition, mental health support, and adequate physical activity recommendations is crucial for optimal menstrual health management in adolescents. Adolescents should engage in at least 150 minutes of moderate-intensity physical activity or 75 minutes of vigorous-intensity physical activity per week, according to health standards. Participating in mindfulness-based practices may mitigate the adverse effects of stress on the menstrual cycle.

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