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ORIGINAL RESEARCH

Sedentary Time, Menstrual Cycle Characteristics, and Pain Intensity Among Female Undergraduates with Primary Dysmenorrhea

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Abstract

Background: Primary Dysmenorrhea (PD) and its associated menstrual cycle characteristics affect the quality of life and social activities of women and it is also reported to be worsened by sedentary behaviour.
Objective: To examine the relationship between sedentary time (ST), menstrual cycle characteristics, and pain intensity among female undergraduates in a Nigerian university with PD.
Methods: This cross-sectional study was conducted among 388 female undergraduates. The International Physical Activity Questionnaire (IPAQ) Long Form sitting item, a self-developed questionnaire, and the Numerical Pain Rating Scale were used to collect information on ST, menstrual cycle characteristics, and pain intensity during menstruation, respectively.
Results: The mean pain intensity of respondents during menstruation was 6.13±2.23 while the average weekday and weekend day ST was 4.5±1.03 hours and 7.75±1.83 hours. Significant correlation was found between pain intensity and menarche ($r = -0.11$, $p = 0.04$), perceived volume of menstrual flow ($r = -0.18$, $p = 0.001$) and duration of pain ($p = 0.32$, $p = 0.001$). Multiple regression analysis revealed that early menarche ($\beta = -0.14$, $p = 0.02$), heavy menstrual flow ($\beta = 0.55$, $p = 0.03$), and with pain duration lasting for more than 24 hours ($\beta = -1.36$, $p = 0.001$) are more likely to experience increased intensity of pain.
Conclusion: Menarche, perceived volume of menstrual flow and duration of pain are significant contributing factors to the pain intensity among females with PD.

Keywords: Exercise, Menarche, Menstrual pain, Menstrual flow, Physical inactivity, Female undergraduates.

Introduction

Primary dysmenorrhea (PD) is a common gynaecological complaint reported among

females in daily clinical practice. [1] It has a detrimental effect on the productivity and health-related quality of life of adolescents.[2] PD, also known as menstrual pain, often occurs among adolescents and young adults, with pain felt around the pelvis, lower abdomen, back or thighs. [3, 4] PD occurs in the absence of any specific pelvic pathology, unlike secondary dysmenorrhea which is associated with an underlying condition such as adenomyosis and endometriosis. [5, 6] The worldwide prevalence of PD ranges between 1.7% and 97% with adolescents accounting for the higher prevalence. [7] Among Nigerians, the prevalence rates of dysmenorrhea ranges from 42.5% to 71.8%. [8, 9]

The high incidence of PD may compromise the physical, social and psychological health of young adults. [10] Depending on the level of its severity, PD may lead to school or work absenteeism, a halt in household chore activities, emotional stress and avoidance of physical activity. [10, 11] Further, the psychological consequences of PD include anxiety, discomfort, reduced enthusiasm about learning activities in school, disruption of sleep patterns and daily activities. [12] Aside PD, other menstrual cycle characteristics reported in studies include menarche, menstrual irregularity, menstrual flow volume, duration and intensity of pain. [11 - 13] Menstrual cycle characteristics is an important health indicator which has been found to be mostly common among the adolescents especially the undergraduates. [13,14] Several factors including socio-demographic characteristics have been shown to affect PD.[12] However, there is an increasing interest in sedentary behaviour as a risk factor for PD and its associated menstrual cycle characteristics.[10,15,16]

Sedentary behaviour (SB) has been shown to influence PD greatly.[17] SB has been described to be a lifestyle involving minimal physical activity often defined by prolonged periods of lying down, reclining and sitting while engaging in low energy activities.[3,17] A study done by Wiratni and colleagues revealed that around 87.6% of women who do not exercise, experience PD.[17] SB has been shown globally to increase all-cause mortality, and cardiovascular mortality with up to 2 million deaths.[18] Several health conditions are linked to SB such as musculoskeletal disorders, osteoporosis, increased risk of cancer, metabolic disorders (diabetes mellitus and hypertension), depression and cognitive impairment.[19] During menstruation, women who are sedentary have been shown to have a higher prevalence of irregular periods and increased pain intensity.[19] Existing studies have proven that physical activity level can affect menstrual cycle characteristics, [19,20] however, there is a dearth of research showing a relationship between SB and menstrual characteristics among females with PD in Nigeria. This study, therefore, aimed to find out the relationship between SB as typified by ST, menstrual cycle characteristics and pain intensity among Nigerian female undergraduates with PD.

Methods

Study design/study population

This was a cross-sectional study.

Ethical considerations

Ethical approval for the study was obtained from the Redeemer's University Research Ethics Committee (RUN/REC/2023/021). Permission to distribute the study questionnaire was also obtained from the respective Heads of Department within the University. Informed consent was obtained from the prospective study participants (female undergraduate with PD). Those younger than 18 years gave assent while informed consent was obtained from their parents/guardians.

Study population

The study population comprised female undergraduates of the Redeemer's University, Ede, Osun State, Nigeria. Redeemer's

University is a faith-based privately-owned institution established in the year 2005. The university currently has a student population of about 5000 and a staff population of about 600, excluding all forms of casual workers. The university presently has eight faculties and in addition, international reputable institutes.

Inclusion criteria

All female undergraduate students from the different faculties of the university who were available during the time of data collection and were willing to participate in the study, were included in the study. Based on a previous study, [21] the primary investigator (NDA) screened participants for PD using a single item question "Have you experienced one or more periods of menstrual cramps or abdominal pain during your menstrual cycle in the past year?"

Exclusion Criteria

Students who have been diagnosed with other abdominal pathologies like endometriosis, fibroids, adenomyosis, pelvic inflammatory disease and secondary dysmenorrhea were excluded from the study. Primary investigator (NDA) asked participants regarding diagnosis "Do you have any of the following diseases or symptoms?".

Sample size /Sampling technique

The sample size was calculated using the Taro Yamane formula for determining sample size from a finite population: $n = N/ (1+N(e)^2$ where N is the study population (2990) and e is the margin of error allowed at 0.05. Therefore, the minimal sample size was 352.8 and with the addition of 10% for non-response, the sample size became 388.

Convenience sampling technique was used to select the study subjects using the inclusion criteria. All consenting participants who had dysmenorrhea and were present or readily available at the time the questionnaires were studied.

Data collection instruments

A short socio-demographic form was used to collect necessary demographic data (age, level of study) and menstrual cycle characteristics such as menarche, regularity of menstruation (regular or irregular), perceived volume of menstrual flow (heavy, moderate, light), duration of menstrual pain (0-24 hours, > 24 hours, entire duration of the menstruation), most painful day of the menstruation (1-3 days before, first day or after first day). The International Physical Activity Questionnaire IPAQ-L (the time spent sitting domain consisting of 2 items) was used to assess the ST (hours per day) of participants. The first item assessed how much time was spent sitting on a typical weekday in the last seven days and the second item assessed how much time was spent sitting on a typical weekend day in the last seven days. To determine the average ST per day, the weekday and weekend day STs was summed and divided by two. The Numerical Pain Rating Scale (NPRS), an 11-point (0- no pain, 10-worst imaginable pain) outcome measure scale was used to assess pain intensity during PD. The respondents selected a whole number that best reflects the intensity of their pain. NPRS has been found to have good test-retest reliability score of (r = 0.96) and construct validity scores ranging from 0.86 to 0.95.

Data analysis

The data were analysed using IBM for Window Statistical Package for Social Science version SPSS version 27 (Armonk, NY, IBM Corp.). Normality of continuous variables was checked using Shapiro Wilks test and histogram; the data was normally distributed ($p>0.05$). Descriptive and inferential statistics were applied as necessary. The proportion of participants who accumulated sedentary time in the excess of 7 hours were compared with those who accumulated ST ≤ 7 hours per day. Furthermore, the following menstrual characteristics were dichotomized: regularity of menstruation (regular; irregular), perceived volume of menstrual flow (heavy menstrual flow; light to moderate menstrual flow), duration of menstrual pain (0-24 hours; > 24 hours), most painful day of the menstruation (1-3 days before; first day or after first day). Multiple regression analysis was used to determine the comparative influence of variables that correlated with pain intensity in

the bivariate analysis. The level of significance was set at $p<0.05$.

Results

A total of 388 adolescents and young adults participated in this study. The mean age of participants was 19.96±2.69 years with a range of 15-27 years. The mean age at menarche was 12.24±1.70 years. Most of the respondents (285; 73.5%) had regular menstruation and moderate volume of menstrual flow (232; 59.8%). Measuring the intensity of the PD of participants using the NPRS, the mean scores was 6.13±2.23, while the duration of the menstrual pain was between 0 - 24 hours (206; 53.1%). Socio-demographic characteristics and menstrual characteristics of participants are presented in Table I. The average ST during weekend day (mean = 7.75±1.83 hours) was significantly higher than ST during the weekday (4.5±1.03 hours) ($t = 30.42$, $p = 0.001$). Participants who accumulated ≤7 hours of ST were higher than those who accumulated >7 hours of ST during the week and weekend ($X^2 = 6.26$, $p = 0.01$) (Figure 1).

Table I: Socio-demographic characteristics and menstrual cycle characteristics

Variable	*Category*	*Mean (±SD)*	*n (%)*
Mean age (years)		19.96±2.69	
Level of study	100		129 (33.2)
	200		126 (32.5)
	300		53 (13.7)
	400		45 (11.6)
	500		35 (9.0)
Mean sedentary time (hours)	Weekday	4.5±1.03	
	Weekend day	7.75±1.83	
	Average per day	6.21±1.17	
Mean pain intensity		6.13±2.23	
Mean menarchal age (years)		12.24±1.70	
Regularity of menstruation	Regular		285 (73.5)
	Irregular		103 (26.5)
Perceived volume of menstrual flow	Light		58 (14.9)
	Moderate		232 (59.8)
	Heavy		98 (25.3)
Duration of pain	0 – 24 hours		206 (53.1)
	> 24 hours		149 (38.4)
	Entire duration		33 (8.5)
Most painful day during menstruation	1 – 3 days before		63 (16.2)
	First day		260 (67.0)
	After 1st day		65 (16.8)

Correlation between pain intensity, ST, age and menstrual cycle characteristics of the respondents are shown in Tables II and III. Pain intensity significantly correlated with menarche ($r = -0.11$, $p = 0.04$), perceived volume of menstrual flow ($r = -0.18$, $p = 0.001$) and duration of pain ($r = 0.32$, $p = 0.001$). All other factors did not significantly correlate with pain intensity. Following standard multiple regression, menarche, perceived volume of

menstrual flow and duration of pain explained 36.1% of the variance in pain intensity (R^2 = 0.13, p = 0.001). Of the three variables, duration of pain (32.7% of model's total variance, β= -1.38, p = 0.001) made the most statistically significant contribution to pain intensity (Table IV).

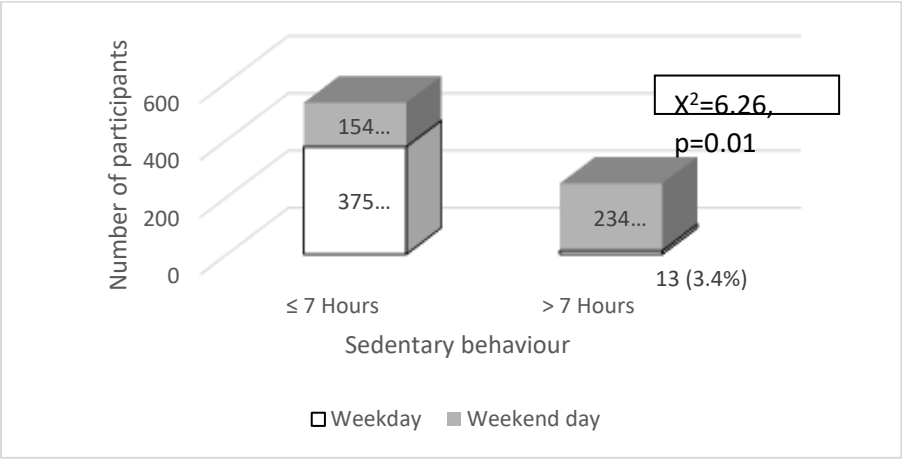

Figure 1: Proportion of participants that are sedentary in the excess of seven hours or less during the week or weekend day

Table II: Pearson's Correlation between pain intensity, age, sedentary time and menarche

	Pain intensity	*Age*	*Sedentary behaviour (weekday)*	*Sedentary behaviour (weekend day)*	*Sedentary behaviour (average per day)*	*Menarche*
	r (p-value)	r (p-value)	r (p-value)	r (p-value)	r (p-value)	r (p-value)
Pain intensity						
Age	0.01 (0.84)					
Sedentary time (weekday)	0.03 (0.62)	0.06 (0.23)				
Sedentary time (weekend day)	0.01 (0.89)	-0.06 (0.25)	0.18 (0.01) **			
Sedentary time (Average per day)	0.01 (0.85)	-0.01 (0.91)	0.63 (0.001) **	0.84 (0.001) **		
Menarche	-0.11(0.04) *	-0.07 (0.18)	-0.04 (0.45)	-0.04 (0.45)	-0.03 (0.50)	

***Significance at p < 0.05; ** Significance at p < 0.01**

Discussion

Investigating the relationship between ST, menstrual cycle characteristics and pain intensity among female undergraduates with PD is necessary as the understanding between these factors and pain intensity may help to develop preventive strategies and promote behaviours that can prevent or minimize the onset of severe menstrual pain. Findings from this study showed that while there was no significant relationship between pain intensity and ST, menarche, volume of menstrual flow, and duration of pain during menstruation significantly predicted pain intensity among female undergraduates with PD.

The mean daily ST among undergraduates with PD in this study (6.2 hours/day) is lower than what was reported in the general population. For instance, previous studies have found the

mean daily ST to be 8.3 hours among Korean population and 7.7 hours among American adult population.[18] However, the mean ST in the current study is higher than those reported by previous studies among students with PD (3.5 hours/week). [17, 22] Whilst a previous systematic review and meta-analysis identified spending greater than seven hours per day on sedentary activities to be linked to serious health consequences such as all course mortality, [23] majority of participants in this study can be regarded to be less sedentary. The burden of sedentary lifestyle in this study is at variance with other studies where most of the undergraduate females were reported to be sedentary. [17,21,22,24]

Table III: Spearman ranks correlation between pain intensity, regularity of menstruation, menstrual flow, duration of pain and most painful day

	Pain intensity	*Regularity of menstruation*	*Perceived volume of menstrual flow*	*Duration of pain*	*Most painful day*
	r (p-value)	r (p-value)	r (p-value)	r (p-value)	r (p-value)
Pain intensity					
Regularity of menstruation	0.06 (0.26)				
Perceived volume of Menstrual flow	-0.11 (0.03) **	-0.12 (0.02)			
Duration of pain	0.32 (0.001) **	-0.03 (0.60)	-0.09 (0.09)		
Most painful day	-0.09 (0.07)	-0.15 (0.004) **	0.12 (0.02) *	-0.17 (0.001) **	

***Significance at p < 0.05; **Significance at p < 0.013**

Table IV. Multiple regression showing the influence of menarche, perceive volume of menstruation and duration of pain, on pain intensity

Predictor variable	*B*	*Coefficient standard error*	*B*	*T*	*P*	*Partial correlation coefficient*
Menarche	-0.14	0.06	-0.11	-2.27	0.02	-0.11
Perceived volume of menstrual flow[a]	0.55	0.25	0.11	2.22	0.03	0.11
Duration of pain[b]	-1.36	0.22	-0.31	-6.43	0.001	-0.31

Key: a - reference value; light/moderate flow; comparison heavy flow; b - reference value; ≤24 hours; comparison > 24 hours; B-unstandardized Beta; β-standardized coefficients Beta, t-value, p-value

The reason for the differences in ST across studies could be attributed to varying existing circumstances during the period which the study was conducted (for example, exam period or beginning of the session), and school-built environment. Considering that the study was not a prevalence study, this finding should be interpreted with caution. However, it is important to note that ST during the weekend was significantly higher than during the weekday. Anecdotally, during the weekends, school schedules are less busy, and students relax more, sit and engage in less physically active endeavours. It is recommended that school-based interventions targeted at sedentary behaviour be implemented during weekends to aid reduction in the ST of students.

The present study showed that early menarche significantly predicted the intensity of dysmenorrhoeic pain among undergraduate females, which is in concordance with previous studies. [21,25,26] Early menarche has been previously associated with a higher incidence of PD. [21, 25] With early menarche, the reproductive organs are still immature and undergoing changes, resulting in increased uterine activities and endometrial sensitivity; this may predispose to painful menstruation.[27]

Other mechanism that has been proposed for this outcome is related to ovulatory efficiency and increased production of uterine prostaglandins leading to uterine contractions.[28]

Furthermore, the findings that the intensity of PD is predicted by heavy menstrual flow is consistent with existing literature. [29 - 32] The mechanism that can explain this is related to the release of prostaglandins which can disturb the homeostatic mechanisms of the endometrium thereby increasing blood flow. [33] In addition, this study suggests that the intensity of PD is associated with the duration of pain. Available studies have revealed that the duration of pain during menstruation in women with PD usually peaked between 23 to 48 hours after the onset of the menstruation and lasts not more than 72 hours. [34] The reason could be the release of prostaglandins, uterine sensitivity which can contribute to pain and individual variation.

The present study did not find any relationship between ST and PD. There is conflicting evidence in the literature regarding the relationship between ST and PD. While some studies have showed ST to be associated with PD, [17,21.24] others have shown no relationship between ST and PD. [22, 35 - 37] The proponents of the association between ST and PD opined that, young women who are less active may experience uterine ischaemia due to decreased oxygen release, stimulating pain during menstruation. [17, 21.24] Conversely, the finding of our study along with other studies suggesting no association between ST and PD, may be attributed to various factors. One possible explanation is that the menstrual pain experience in our study may not be primarily due to sedentary lifestyle. Instead, other factors such as nutritional status, family history, and stress may have played a more significant role.[38] The duration of pain appears to play a superior role in explaining the intensity of pain among female undergraduates with PD. This implies that the likelihood that the pain intensity of PD among female undergraduates will decrease is higher, when there are interventions targeted at reducing the duration of pain to one day.

Limitations

Firstly, the cross-sectional design of the study does not allow the establishment of causal relationships. Also, the study was carried out in one university in Nigeria, limiting the generalisability of the findings to other parts of the country. Future research should be larger in scale and spread across the country and socio-economic backgrounds, to provide a more representative sample and improve the generalisability of findings across different populations. It is also attractive to desire the inclusion of objective measures of physical activity such as accelerometers. This approach will reduce recall bias and provide more accurate insights into participants' sedentary level.

Conclusion

Menarche, perceived volume of menstrual flow and the duration of menstrual pain are significant contributing factors to pain intensity among female undergraduates with PD.

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Authors' Contributions: AND and ABO conceived and designed the study and did literature review. AND and IOA did data analysis and interpretation. AND, KOO and IOA drafted the manuscript while KOO, AJO and IOA revised the manuscript for sound intellectual content. All the authors approved the final version of the manuscript.
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References

1. Hernanto ADP, Polim AA, Vetinly. Does lifestyle affect dysmenorrhea intensity? A

cross-sectional study. Indones J Obstet Gynecol. 2022;10:121-126. https://doi.org/10.32771/inajog.v10i3.1559.

2. Karout S, Soubra L, Rahme D, Karout L, Khojah HMJ, Itani R. Prevalence, risk factors, and management practices of primary dysmenorrhea among young females. BMC Womens Health 2021;21:392. https://doi.org/10.1186/s12905-021-01532-w.
3. Nagy H, Carlson K, Khan MAB. Dysmenorrhea. [Updated 2023 Nov 12]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK560834/
4. Chua HN, Vasanthi RK, Muniandy Y. A study on the prevalence of dysmenorrhea and its relationship with physical activity among young adults. Int J Health Sci Res. 2020;10:1-6.
5. Gebeyehu MB, Mekuria AB, Tefera YG, Andarge DA, Debay YB, Bejiga GS, *et al.* Prevalence, impact, and management practice of dysmenorrhea among University of Gondar students, Northwestern Ethiopia: A cross-sectional study. Int J Reprod Med. 2017;2017:3208276. https://doi.org10.1155/2017/3208276.
6. Burnett MA, Antao V, Black A, Feldman K, Grenville A, Lea R, *et al.* Prevalence of primary dysmenorrhea in Canada. J Obstet Gynaecol Can. 2005;27:765-770. https://doi.org/10.1016/s1701-2163(16)30728-9.
7. Latthe P, Latthe M, Say L, Gulmezoglu MK, Khan SK. WHO systematic review of prevalence of chronic pelvic pain: a neglected reproductive health morbidity. Biomed Cent Public Health. 2016;6:177. https://doi.org/10.1186/1471-2458-6-177
8. Garba I, Rabiu A, Abubakar IS. Menstrual hygiene among adolescent school girls in Kano. Trop J Obstet Gynaecol. 2018;35:153-157. https://doi.org/10.4103/tjog.tjog_81_17.
9. Saka J, Olaoye OM, Nneka O, Saka AO, Omolola DO, Rabiyyah HA. Primary dysmenorrhea among the adolescents in Kwara state, Nigeria: The prevalence, knowledge, and management. Nurs Pract Today 2018;5:395-402. https://doi.org/10.18502/npt.v5i4.118.
10. Kural M, Noor NN, Pandit D, Joshi T, Patil A. Menstrual characteristics and prevalence of dysmenorrhea in college students. Int J Sci Res Public 2015;4:426-431. https://doi.org/10.4103/2249-4863.161345.
11. Ansong E, Arhin SK, Cai Y, Xu X, Wu X. Menstrual characteristics, disorders, and associated risk factors among female international students in Zhejiang Province, China: a cross-sectional survey. BMC Womens Health. 2019;19:35. https://doi.org/10.1186/s12905-019-0730-5.
12. Medina-Perucha L, López-Jiménez T, Pujolar-Díaz G, Martinez-Bueno C, Munros-Feliu J, Valls-Llobet C, *et al.* Menstrual characteristics and associations with sociodemographic factors and self-rated health in Spain: a cross-sectional study. BMC Womens Health. 2024;24:88. https://doi.org/10.1186/s12905-023-02840-z.
13. Kim G, Harley A, Watson A, Robertson S, Vitzthum VJ, Shea A. Menstrual cycle characteristics of U.S. adolescents according to gynecologic age and age at menarche. J Pediatr Adolesc Gynecol 2024;37:415-420. https://doi.org/10.1016/j.jpag.2024.03.005.
14. Chan SS, Yiu KW, Yuen PM, Sahota DS, Chung TK. Menstrual problems and health-seeking behaviour in Hong Kong Chinese girls. Hong Kong Med J 2009;15:18–23.
15. Inyang P, Stella O. Sedentary lifestyle: health implications. Beijing Huagong Daxue Xuebao (Ziran Kexueban)/J Beijing Univ Chem Technol. 2015;4:20-25. https://doi.org/10.9790/1959-04212025.
16. Tavallaee M, Joffres MR, Corber SJ, Bayanzadeh M, Rad MM. The prevalence of menstrual pain and associated risk factors among Iranian women. J Obstet Gynaecol Res 2011;37:442-451. https://doi.org/10.1111/j.1447-0756.2010.01362.x.
17. Wiratni IGA, Thanaya SAP, Tianing NW, Kamayoga IDGA. The relationship

between sedentary lifestyle and intensity of primary dysmenorrhea in adolescent. Phys Ther J Indones 2024;5:178-181. https://doi.org/10.51559/ptji.v5i2.218

18. Park JH, Moon JH, Kim HJ, Kong MH, Oh YH. Sedentary lifestyle: overview of updated evidence of potential health risks. Korean J Fam Med 2020;41:365-373. https://doi.org/10.4082/kjfm.20.0165.
19. Hahn KA, Wise LA, Riis AH, Mikkelsen EM, Rothman KJ, Banholzer K, *et al.* Correlates of menstrual cycle characteristics among nulliparous Danish women. Clin Epidemiol. 2013;5:311-9. https://doi.org/10.2147/CLEP.S46712.
20. Passoni, P, Inzoli, A, De-Ponti E, Polizzi S, Ceccherelli A, Fantauzzi M, *et al.* Association between Physical Activity and Menstrual Cycle Disorders in Young Athletes. Int J Sports Med 2024;45:543–548. https://doi.org/10.1055/a-2278-3253
21. Hu Z, Tang L, Chen L, Kaminga AC, Xu H. Prevalence and Risk Factors Associated with Primary Dysmenorrhea among Chinese Female University Students: A Cross-sectional Study. J Pediatr Adolesc Gynecol 2020;33:15-22. https://doi.org/10.1016/j.jpag.2019.09.004 .
22. Puteri HS, Dewi YLR, Mulyani S. Relationship Between Sedentary Lifestyle and Fiber Intake Primary Dysmenorrhoea in Overweight Adolescent Girls. Jurnal Penelitian Pendidikan IPA, 2023;9:9454–9460. https://doi.org/10.29303/jppipa.v9i11.5296
23. Ku PW, Steptoe A, Liao Y. Hsueh MC, Chen LJ. A cut-off of daily sedentary time and all-cause mortality in adults: a meta-regression analysis involving more than 1 million participants. BMC Med 2018;16:74. https://doi.org/10.1186/s12916-018-1062-2
24. Wang YL, Zhu HL. The prevalence and associated risk factors of primary dysmenorrhea among women in Beijing: a cross-sectional study. Sci Rep 2025;15:5003. https://doi.org/10.1038/s41598-025-89038-5
25. Zegeye DT, Megabiaw B, Mulu A. Age at menarche and the menstrual pattern of secondary school adolescents in northwest Ethiopia. BMC Women's Health 2009;9:29. https://doi.org/10.1186/1472-6874-9-29.
26. Wronka I, Teul I, Marchewka J. The influence of age at menarche on the prevalence of disorders of the menstrual cycle among healthy university students. In Annales Academiae Medicae Stetinensis 2013;59:94-98.
27. Marques P, Madeira T, Gama A. Menstrual cycle among adolescents: Girls' awareness and influence of age at menarche and overweight. Rev Paul Pediatr 2022;40:e2020494. https://doi.org/10.1590/1984-0462/2022/40/2020494
28. Dawood MY. Primary dysmenorrhea: advances in pathogenesis and management. Obstet Gynecol 2006;108:428-441.
29. Karout S, Soubra L, Rahme D, Karout L, Khojah HMJ, Itani R. Prevalence, risk factors, and management practices of primary dysmenorrhea among young females. BMC Women's Health 2021;21:392. https://doi.org/10.1186/s12905-021-01532-w
30. Habibi N, Huang MSL, Gan WY, Zulida R, Safavi SM. Prevalence of Primary Dysmenorrhea and Factors Associated with Its Intensity Among Undergraduate Students: A Cross-Sectional Study. Pain Manag Nurs 2015;16:855-861 https://doi.org/10.1016/j.pmn.2015.07.001.
31. Zhou HG, Yang ZW. Prevalence of dysmenorrhea in female students in a Chinese university: a prospective study. Health 2010;2:311.
32. Tavallaee M, Joffres MR, Corber SJ, Bayanzadeh M, Rad MM. The prevalence of menstrual pain and associated risk factors among Iranian women. J Obstet Gynaecol Res 2011;37:442-451 https://doi.org/10.1111/j.1447-0756.2010.01362.x
33. Hapangama DK, Bulmer JN. Pathophysiology of heavy menstrual bleeding. Womens Health (Lond) 2016;12:3-13. https://doi.org/10.2217/whe.15.81
34. Nagy H, Carlson K, Khan MAB. Dysmenorrhea. StatPearls [Internet] 2023 [Cited 2025 February 20] Available from: https://www.ncbi.nlm.nih.gov/books/NBK560834/

35. Kartal B, Kıssal A, Kaya M. Comparison of athletes and sedentary students in terms of premenstrual syndrome and dysmenorrhea. Ordu Univ J Nurs Stud 2020;3:125-135. https://doi.org/10.38108/ouhcd.732559
36. Sholihah DM. The Correlation Between Exercise Activity, Genetic Background, Fast Food Consumption, And Dysmenorrhea. Periodic Epidemiol J 2019 [cited 2025 Feb. 22];7:129-36.
37. Blakey H, Chisholm C, Dear F, Harris B, Hartwell R, Daley AJ, *et al.* Is exercise associated with primary dysmenorrhoea in young women? Br J Obstet Gynaecol 2010;117:222-224. https://doi.org/10.1111/j.1471-0528.2009.02220.x.
38. Fasya A, Arjita IPD, Pratiwi MRA, Andika IBY. The Relation of Physical Activity and Stress Levels with The Event of Primary Dysmenorrhea Female Medical Students of The Faculty of Medicine. Kendal Stikes Sci J 2022;12(3):511-526.