

Association between leisure-time physical activity and menstrual cycle characteristics among female undergraduates with primary dysmenorrhea in Nigeria

Akintayo ND¹[ID](#), Ajayi BO¹, Kajero OO¹, Idowu OA¹

¹Department of Physiotherapy, Faculty of Basic Medical Sciences, Redeemer's University, Ede, Osun State, Nigeria

Submitted: 24th January 2025

Accepted: 7th July 2025

Published: 31st December 2025

[ID](#): Orcid ID

Abstract

Objective: Women, especially young girls affected by Primary dysmenorrhea (PD), do not pay much attention to their health. Given the significance of LTPA in promoting health, this study investigated the impact of LTPA on the menstrual cycle characteristics of female undergraduates with polycystic ovary syndrome (PCOS) in Nigeria.

Methods: A convenience sample of 388 female undergraduates was cross-sectionally surveyed. The International Physical Activity Questionnaire-Long form and Numerical Pain Rating Scale assessed LTPA and pain intensity of respondents. Furthermore, a pro-forma was used to document other menstrual cycle characteristics, including menarche, regularity of menstruation, perceived volume of menstrual flow and duration of dysmenorrhea pain. The level of significance was set at $p < 0.05$.

Results: Respondents' mean age was 20.02 ± 2.78 years (range = 15-27 years), while 256 (67.3%) were physically active. The mean pain intensity of respondents was 6.13 ± 2.23 , with 329 (84.8%) having moderate-to-severe levels of pain. LTPA was significantly associated with perceived volume of menstrual flow ($X^2 = 11.44$; $p = 0.02$) and duration of menstrual pain ($X^2 = 14.86$; $p = 0.01$). In addition, LTPA was associated with perceived volume of menstrual flow (OR = 0.413; CI: 0.258 – 0.663; $p = 0.001$) and the duration of dysmenorrhea pain (OR = 0.584; CI: 0.381 – 0.895; $p = 0.014$).

Conclusion: Overall, LTPA is significantly associated with the volume of menstrual flow and duration of menstrual pain among females with PD. Therefore, women should be educated on the positive influence of LTPA in reducing menstrual cycle disturbances.

Keywords: Menstrual Cycle, Exercise, Menstrual Disorders, Menstrual Pain, Physical Activity

Plain English Summary

Primary dysmenorrhea refers to one or more episodes of menstrual cramps or pain during the menstrual cycle. It is a very common complaint among young females and is responsible for significant absenteeism both in school and at work. Amongst other treatment options, physical activity, especially that which is performed during leisure time, has been documented to be safe and without complications or side effects. This study investigated the association between physical activity during leisure time and menstrual cycle characteristics (intensity and duration of pain, age at first menstruation, regularity, and volume of menstrual

Correspondence:

Akintayo Niyi D

Department of Physiotherapy, Faculty of Basic Medical Sciences

Redeemer's University, Ede

Osun State, Nigeria.

+234 8166702375, akintayon@run.edu.ng

flow) among female undergraduates with primary dysmenorrhea in a Nigerian university. 388 female respondents were conveniently sampled using a cross-sectional study design. The International Physical Activity Questionnaire-Long form and Numerical Pain Rating Scale assessed LTPA and pain intensity of respondents. Furthermore, a pro-forma was used to document other menstrual cycle characteristics, including menarche, regularity of menstruation, perceived volume of menstrual flow and duration of dysmenorrhic pain. The result showed a significant association between LTPA and volume of menstruation and duration of pain in participants. However, no significant association was found between LTPA and menarche, regularity of menstrual flow, pain intensity and the most painful day of menstruation. It was therefore concluded that participation in regular physical activity is an important tool in ameliorating the menace of dysmenorrhea among the female population.

Introduction

Dysmenorrhea is a common complaint among women of reproductive age, characterised by menstrual-related abdominopelvic discomfort, as well as significant emotional, psychological, and functional health consequences (1, 2). It refers to one or more episodes of menstrual cramps or pain in the previous 12 months (3). Dysmenorrhea can be of unknown pathology (primary dysmenorrhea) or related to other disease conditions (secondary dysmenorrhea) (4, 5). Primary dysmenorrhea can occur before or during menstruation with accompanying symptoms such as sweating, headaches, nausea, vomiting, and diarrhoea (6). Besides, primary dysmenorrhea is associated with fatigue, dizziness, reduced quality of life, and decreased participation in sporting and social activities (7, 8). The prevalence of dysmenorrhea varies between 16% and 91% among women of reproductive age, with severe pain in 2% to 29% of cases (7). Previous epidemiological studies have reported a prevalence rate of dysmenorrhea to be between 53.3% and 82.2% among university undergraduates (7, 9, 10). Dysmenorrhea leads to absenteeism, poor performance at school and other activities of daily living, altered pain perception, and sleep problems among undergraduates (7, 9, 10).

Treatment of primary dysmenorrhea is often centred around pain relief and return to activities of daily living (11, 12), and may comprise pharmacological treatment (drug therapies such as non-steroidal anti-inflammatory drugs, and hormonal therapy such as oral contraceptives) and non-pharmacological treatments (acupuncture, acupressure, exercise, aromatherapy, TENS [Transcutaneous Electrical Nerve Stimulation], and herb remedy) (13, 14, 15, 16). Non-steroidal anti-inflammatory drugs (NSAIDs) are the first line of management for primary dysmenorrhea; however, long-term usage of NSAIDs is associated with several side effects such as nausea, gastrointestinal bleeding, headache, drowsiness, and a higher risk of cardiovascular incidence (13, 17, 18). While hormonal therapy, such as oral

contraceptives, reduces episodes of uterine cramps by inhibiting endometrial proliferation and the production of prostaglandin, there is often an increased risk of oligoovulation (19). Among the various non-pharmacological treatments that have been proven as valid alternatives for improving symptoms of primary dysmenorrhea without the side effects is physical activity (20, 21, 22, 23, 24, 25).

Physical activity (PA) is any bodily movement produced by skeletal muscles and requires energy expenditure (26). Previous studies have reported an inverse relationship between PA and primary dysmenorrhea among female undergraduates (27, 28). In addition, studies have reported physical inactivity to be associated with a higher risk and increased severity of primary dysmenorrhea and its symptoms (29, 30, 31). Physical activity, especially that which is engaged in during one's leisure time (i.e. leisure-time PA), has been shown to reduce the severity of menstrual symptoms (32, 33). For instance, a systematic review by Matthewman et al. (21) showed that PA had positive effects on both primary dysmenorrhea pain intensity and pain duration. Furthermore, leisure-time physical activity (LTPA) is a key component for preventing and managing several chronic diseases (34). The World Health Organisation recommends that adults engage in 150-300 minutes of moderate-to-vigorous intensity PA per week (35). Despite these reported associations between PA and primary dysmenorrhea, there is still a dearth of studies investigating such among female undergraduates in Nigeria. Therefore, this study investigated the association between LTPA and menstrual cycle characteristics among female undergraduates with primary dysmenorrhea in a Nigerian university.

Materials and Methods

Study design, study area, and study population

A cross-sectional design was adopted for this study using quantitative measures among female undergraduates of Redeemer's University, Ede, Nigeria, between February 2023 and July 2023. The Redeemer's University, Ede, Nigeria, a faith-

based private university, was established in 2005. Currently, the university has a student population of about 6000 and a staff strength of about 600, excluding casual workers. The university currently comprises eight faculties and two international institutes (36).

Inclusion and exclusion criteria

All female undergraduates from the different faculties of Redeemer's University who were available and willing to participate were included in the study. Eligible participants were screened by a primary health physician in Redeemer's university health centre, and individuals with underlying medical pathologies like endometriosis, adenomyosis, and fibroids, which could lead to abdominal cramping or pain during menstruation, were excluded from the study. In addition, students who had a recent history of abdominal surgery or current use of hormonal supplements were excluded from the study.

Data collection protocol

A Pro forma was used to collect participants' characteristics including age, level of study, menarche (years), regularity of menstrual flow (regular vs irregular), volume of menstrual flow (high, moderate, or low), most painful day of the menstruation (1 to 3 days before, first day, or after the first day) and the duration of menstrual pain (days). The pain intensity of primary dysmenorrhea was assessed using the Numerical Pain Rating scale (37). The Numerical Pain Rating Scale (NPRS) is an 11-point (0- no pain, 10-worst imaginable pain). Respondent selected a whole number that best reflects the intensity of their pain. NPRS has been found to have a good test-retest reliability score of ($r = 0.96$) and construct validity scores ranging from 0.86 to 0.95. (37). The LTPA domain of the International Physical Activity Questionnaire Long (IPAQ-L) form was used to measure the LTPA levels of the participants. The IPAQ-L is a 27-item self-reported measure of physical activity with an LTPA domain comprising 6 items. Scores can be calculated for walking, moderate and vigorous intensity activities. Following the stipulated criteria, those with less than 600 METS were categorised as low/inactive.

Those between 600 METS and 3000 METS were categorised as active, and those with more than 3000 METS were categorised as highly active. The IPAQ-L is reliable for use among the adolescent population with a Cronbach's alpha of 0.75 (38).

Sample size estimation

The sample size of 371 was calculated using the formula for determining sample size from a known population (36). $n = N / (1 + N(e)^2)$, where n = the sample size, N = the population of female students, e = the margin of error and an addition of 5% of n to account for non-response.

Data Analysis

Descriptive statistics of frequency and percentages were used to summarise socio-demographic data and LTPA level. Chi-square and logistic regression were used to determine the association between LTPA and menstrual cycle characteristics (i.e. intensity and duration of pain, menarche, regularity, and volume of menstrual flow).

Results

A total of 388 female undergraduates participated in this study. The participants' mean age was 20.02 ± 2.78 years, with ages ranging from 15-27 years (Table 1). Most of the participants (213, 54.9%) had their menarche between the ages of 12 and 14. Menstruation was regular for 285 (73.5%) respondents, while the volume of menstruation was moderate for 232 (59.8%). The median (Interquartile range) LTPA score was 795.0 (1131.3) METS. The mean pain intensity score was 6.13 ± 2.23 . A total of 132 (34.0%), 196 (50.5%), and 60 (15.5%) participants had low, moderate, and high levels of PA, respectively (Table 2). The result showed a significant association between LTPA and volume of menstruation ($X^2 = 11.442$; $p = 0.022$), and duration of pain ($X^2 = 14.856$; $p = 0.005$) of participants. Regarding the dysmenorrhic pain intensity and LTPA, the result showed no association ($X^2 = 4.195$; $p = 0.380$). From the binary logistic regression analysis, LTPA was associated with volume of menstrual flow ($p = 0.001$, OR = 0.413) and the duration of dysmenorrhic pain ($p = 0.014$, OR = 0.584) (Tables 3 and 4).

Table 1: Sociodemographic Characteristics of the respondents

Variable	Frequency (n)	Percentage (%)
Age		
≤ 17	53	13.7
≥ 18 – 25	335	77.8
≥ 26	33	8.5

Level		
100	129	33.2
200	126	32.5
300	53	13.7
400	45	11.6
500	35	9.0

Table 2: Menstrual Cycle Characteristics of the respondents

Variable	Frequency (n)	Percentage (%)
Menarche		
< 12	124	32.0
12 – 14	213	54.9
≥ 15	51	13.1
Regularity of menstruation		
Regular	285	73.5
Irregular	103	26.5
Volume of menstrual flow		
Heavy	98	25.3
Moderate	232	59.8
Light	58	14.9
Pain intensity		
Mild	59	15.2
Moderate	146	37.6
Severe	183	47.2
Duration of Pain		
0 – 24 hours	206	53.1
> 24 hours	149	38.4
Full length	33	8.5
Most painful day		
1 – 3 days before	63	16.2
First day	260	67.0
After 1 st day	65	16.8

Table 3: Chi-Square analysis showing the association between Menstrual Cycle Characteristics and Leisure-time physical activity level of the respondents

Variable	High	Moderate	Low	Total (%)	X ²	P-value
Menarche						
< 12	16	70	38	124 (32.0%)	2.70	0.61
12 – 14	38	105	70	213 (54.9%)		
≥ 15	7	25	19	51 (13.1%)		
Regularity of menstruation						
Regular	45	145	95	285 (73.5%)	0.22	0.90
Irregular	16	55	32	103 (26.5%)		
Volume of menstrual flow						
Heavy	6	57	35	98 (25.3%)	11.44	0.02*
Moderate	41	119	72	232 (59.8%)		
Light	14	24	20	58 (14.9%)		

Pain intensity						
Mild	7	34	18	59 (15.2%)	4.20	0.38
Moderate	27	66	53	146 (37.6%)		
Severe	27	100	56	183 (47.2%)		
Duration of Pain						
0 – 24 hours	29	100	77	206 (53.1%)	14.856	0.01*
> 24 hours	21	89	39	149 (38.4%)		
Full length	11	11	11	33 (8.5%)		
Most painful day						
1 – 3 days before	8	33	22	63 (16.2%)	1.394	0.85
First day	40	135	85	260 (67.0%)		
After 1 st day	13	32	20	65 (16.8%)		

*Indicates significance at $p < 0.05$

Table 4: Binary logistic regression showing the influence of LTPA on volume of menstruation and duration of pain

Variable	B	Standard Error	Exp (B)	95% Confidence Interval	P-value
LTPA	-0.88	0.241	0.413	0.258 – 0.663	0.001
Constant (Volume of menstruation)	-0.53	0.184	0.588		0.004
LTPA	-0.54	0.218	0.584	0.381 – 0.895	0.014
Constant (Duration of pain)	0.24	0.179	1.268		0.184

Key: LTPA = Leisure Time Physical Activity; Exp (B) = Unadjusted odds ratio

Discussion

This study investigated the association between LTPA and menstrual cycle characteristics of female undergraduates with primary dysmenorrhea at a private university in Nigeria. The majority of the female undergraduates had their menarche between the ages of 12-14 years and were mostly physically active. In addition, LTPA of the respondents significantly predicted of duration of pain and volume of menstrual flow of respondents. Our study revealed that the highest number of participants with primary dysmenorrhea were within the age range of 18 to 25 years. This result is similar to other studies where most participants with primary dysmenorrhea were between 21 to 23 years old (39, 40). The explanation that has been given to this is that the prevalence of primary dysmenorrhea decreases with increasing age, with primary dysmenorrhea reaching its peak in late adolescence by the 20s, and thus the incidence falls with increasing age (39).

Furthermore, findings from our study that most participants experienced menarche between the ages of 12 and 14 (54.9%) years are in tandem with

previous studies (41, 42). Experiencing early menarche among individuals with primary dysmenorrhea may be due to increased exposure to uterine prostaglandins, which contribute to a greater likelihood of experiencing menstrual pain (41). In addition, more than two-thirds (n=329, 84.8%) of the females sampled in this study described their dysmenorrhea as moderate to severe. In a similar study done by Omar et al. (43) among female college students, 91.2 % of the population sampled reported moderate to severe dysmenorrhic pain. In another study, 63.9% (n=1539) undergraduate students with primary dysmenorrhea reported moderate to severe pain (44). These findings suggest that dysmenorrhea is widespread among undergraduate students.

About two-thirds (66%) of the respondents in this study had moderate to high levels of LTPA and met the World Health Organisation's recommended physical activity guideline of ≥ 600 MET min per week. This is in tandem with the result of the study done by Ning et al. (39), where the majority of the respondents with PD met the WHO PA guideline. This may not be unconnected with the awareness

of the WHO recommended guideline among the student population, and also the reported effects of PA on PD among this group of students. According to the World Health Organisation, it is suggested that all adults should undertake 150–300 min of moderate-intensity, or 75–150 minutes of vigorous-intensity physical activity, or some equivalent combination of moderate-intensity and vigorous-intensity aerobic physical activity, per week.

In the present study, LTPA was associated with the volume of menstrual flow. This result aligns with a 2021 study of 128 women who reported that those who do not exercise during menstruation reported heavier menstrual flow, longer periods, and fatigue (45). In addition, a prospective cohort study done among 10,618 females in Australia buttressed the influence of physical activity on the menstrual flow (46). The authors reported that individuals with higher levels of physical activity have lower odds of experiencing heavier menstrual flow (46). This may be explained by the inhibitory role of physical activity on the normal pulsatile secretion pattern of gonadotropins. Physical activity, especially when it is intense or prolonged, could trigger a stress response in the body by suppressing the hypothalamic-pituitary-gonadal axis, thereby increasing the levels of Gonadotropin-Inhibitory Hormone, which is an inhibitor of Gonadotropin-releasing hormone and subsequently reduces gonadotropin secretion (47).

Furthermore, the present study found LTPA to be associated with the duration of dysmenorrhea pain. This result is in tandem with the evidence provided by Samperio and Pardo (20) in a systematic review that showed an association between physical exercise and duration of dysmenorrhea pain. Our findings further extend the findings of other authors on the association between physical activity and dysmenorrhea pain duration (48, 49, 50, 51). The reason for this is explained by Kannan et al. (52) that high-intensity aerobic exercises will increase the level of progesterone, resulting in reduced levels of prostaglandin with a resultant reduction in pain duration. In addition, physical exercises stimulate the production of natural painkillers such as endorphins, oestrogens, and dopamine, which are natural painkillers (53, 54). The release of endocannabinoids, which contributes to the control of pain transmission within the brain and spinal cord and the secretion of anti-inflammatory cytokines, which act to reduce pain level (52). Physical activity and/ or exercise is one of the non-pharmacological approaches that is being used in the treatment of PD, which has helped to reduce signs and symptoms of PD and also provided greater positive effects such as improved quality of

life, reduction in menstrual distress, reduction in pain intensity, and pain duration (1, 20, 48, 49, 50, 51, 54).

Study limitations

This study is not without limitations. We used a cross-sectional design, which does not infer causality. In addition, the tools used are subject to recall and reporting bias.

Conclusion

Overall, LTPA is significantly associated with the volume of menstrual flow and duration of menstrual pain among females with PD. Regular physical activity is a safe and effective method for reducing the symptoms caused by PD and improving overall health. Therefore, participation in regular physical activity should be recommended as an important tool to combat the menace of dysmenorrhea among the female population.

List of Abbreviations

LTPA: Leisure-Time Physical Activity
PA: Physical Activity
PD: Primary Dysmenorrhea
WHO: World Health Organisation
IPAQ-L: International Physical Activity Questionnaire Long
NPRS: Numerical Pain Rating Scale
NSAIDs: Non-steroidal anti-inflammatory drugs
TENS: Transcutaneous Electrical Nerve Stimulation

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the Redeemer's University Research Ethics Committee (RUN/REC/2023/021). Permission to distribute the study questionnaire was obtained from the respective Heads of Departments within the University. The informed consent of the female undergraduate with primary dysmenorrhea was obtained. Those younger than 18 years gave assent while informed consent was obtained from their parents/guardians. The survey instruments were self-administered to the university students. Participants filled in the questionnaires and returned them to the researcher the same day. In addition, verbal and written informed consent of the participants was sought and obtained. The ethical approval and informed consent. Strict confidentiality was maintained throughout the study.

Consent for Publication

The authors hereby transfer all copyright ownership exclusively to the journal if this work is accepted and published by the journal.

Availability of Data

Data for this work are available from the authors and may be presented on request

Conflict of Interest

The authors declare no conflict of interest.

Funding

No funding was received for this study

Authors Contributions

All authors contributed substantially to the manuscript development from the conceptualisation of the title (AND, ABO). AND, ABO, IOA and KOO did the literature review and methodology. AND and ABO analysed the data. AND, ABO, IOA and KOO developed and did the finalisation of the manuscript. AND, ABO, IOA and KOO corrected the reviewed manuscript.

Acknowledgments

The authors would like to thank all the participants for this study who voluntarily gave their consent to participate in this study.

References

1. Prazeres LM, Brito RG, Ramos ES. Regular physical exercise, sedentarism and characteristics of dismenorrhea and premenstrual syndrome. *Fisioterapia em Movimento*. 2018;31:e003118. <https://doi.org/10.1590/1980-5918.031.ao18>
2. Chauhan M, Kala J. Relation between dysmenorrhea and body mass index in adolescents with rural versus urban variation. *The journal of obstetrics and gynecology of India*. 2012 Aug;62:442-5. <https://doi.org/10.1007/s13224-012-0171-7>
3. Tomás-Rodríguez MI, Palazón-Bru A, Martínez-St. John DR, Toledo-Marhuenda JV, Asensio-García MD, Gil-Guillén VF. Effectiveness of medical taping concept in primary dysmenorrhoea: a two-armed randomized trial. *Scientific reports*. 2015 Nov 13;5(1):16671. <https://doi.org/10.1038/srep16671>
4. Burnett M, Lemyre M. No. 345-primary dysmenorrhea consensus guideline. *Journal of Obstetrics and Gynaecology Canada*. 2017 Jul 1;39(7):585-95. <https://doi.org/10.1016/j.jogc.2016.12.023>
5. Ning CH, Vasanthi RK, Muniandy Y. Study on the Prevalence of dysmenorrhea and its relationship with physical activity among young adults. *International Journal of Health Sciences and Research*. 2020;10(10):39-45.
6. Lentz GM, Lobo RA, Gershenson DM, Katz VL. *Comprehensive gynecology E-book*. Elsevier Health Sciences; 2012 Feb 21.
7. Ju H, Jones M, Mishra G. The prevalence and risk factors of dysmenorrhea. *Epidemiologic reviews*. 2014 Jan 1;36(1):104-13. <https://doi.org/10.1093/epirev/mxt009>
8. Armour M, Smith CA, Steel KA, Macmillan F. The effectiveness of self-care and lifestyle interventions in primary dysmenorrhea: a systematic review and meta-analysis. *BMC complementary and alternative medicine*. 2019 Dec;19:1-6. <https://doi.org/10.1186/s12906-019-2433-8>
9. Esan DT, Ariyo SA, Akinlolu EF, Akingbade O, Olabisi OI, Olawade DB, Bamigboye TO, Ogunfowokan AA. Prevalence of dysmenorrhea and its effect on the quality of life of female undergraduate students in Nigeria. *Journal of Endometriosis and Uterine Disorders*. 2024 Mar 1;5:100059. <https://doi.org/10.1016/j.jeud.2024.100059>
10. Ezebialu IU, Ezenyeaku CC, Umeobika JC. Prevalence of dysmenorrhea and its contribution to school absenteeism among Nigerian undergraduate students. *Annals of Health Research (The Journal of the Medical and Dental Consultants Association of Nigeria, OOUTH, Sagamu, Nigeria)*. 2021 Mar 3;7(1):59-66. <https://doi.org/10.30442/ahr.0701-07-116>
11. Urbina VG, Gutiérrez MT, Arce VR. Dismenorrea primaria en las adolescentes: manejo en la atención primaria. *Revista Médica Sinergia*. 2019;4(11):7. <https://doi.org/10.31434/rms.v4i11.296>
12. de Oliveira Nunes JM, do Amaral Rodrigues J, de Freitas Moura MS, Batista SR, Coutinho SK, Hazime FA, dos Reis Barbosa AL. Prevalência de dismenorreia em universitárias e sua relação com absenteísmo escolar, exercício físico e uso de medicamentos. *Revista Brasileira em Promoção da Saúde*. 2013;26(3):381-6. <https://doi.org/10.5020/18061230.2013.p381>
13. Li X, Hao X, Liu JH, Huang JP. Efficacy of non-pharmacological interventions for primary dysmenorrhoea: a systematic review and Bayesian network meta-analysis. *BMJ Evidence-Based Medicine*. 2024 Jun 1;29(3):162-70. <https://doi.org/10.1136/bmjebm-2023-112434>

14. Chao MT, Wade CM, Abercrombie PD, Gomolak D. An innovative acupuncture treatment for primary dysmenorrhea: a randomized cross-over pilot study. *Alternative therapies in health and medicine*. 2014 Jan;20(1):49. <https://doi.org/10.1186/1472-6882-12-S1-P100>
15. Hosseinlou A, Alinejad V, Alinejad M, Aghakhani N. Effects of fish oil capsules and vitamin B1 tablets on duration and severity of dysmenorrhea in students of high school in Urmia-Iran. *Global journal of health science*. 2014 Sep 18;6(7):124. <https://doi.org/10.5539/gjhs.v6n7p124>
16. Kooti W, Mansouri E, Ghasemiboroon M, Harizi M, Ashtary-Larky D, Afrisham R. The effects of hydroalcoholic extract of *Apium graveolens* leaf on the number of sexual cells and testicular structure in rat. *Jundishapur journal of natural pharmaceutical products*. 2014 Oct 11;9(4):e17532. <https://doi.org/10.17795/ijnp-17532>
17. Guimarães I, Póvoa AM. Primary dysmenorrhea: assessment and treatment. *Revista Brasileira de Ginecologia e Obstetrícia*. 2020 Sep 25;42:501-7. <https://doi.org/10.1055/s-0040-1712131>
18. Navvabi Rigi S, Kermansaravi F, Navidian A, Safabakhsh L, Safarzadeh A, Khazaian S, Shafie S, Salehian T. Comparing the analgesic effect of heat patch containing iron chip and ibuprofen for primary dysmenorrhea: a randomized controlled trial. *BMC women's health*. 2012 Dec;12:1-6. <https://doi.org/10.1186/1472-6874-12-25>
19. Sharghi M, Mansurkhani SM, Larky DA, Kooti W, Niksefat M, Firoozbakht M, Behzadifar M, Azami M, Servatyari K, Jouybari L. An update and systematic review on the treatment of primary dysmenorrhea. *JBRA assisted reproduction*. 2019 Jan;23(1):51. <https://doi.org/10.5935/1518-0557.20180083>
20. Millares Samperio M, Corrales Pardo A. Effects of physical exercise on primary dysmenorrhoea. *Systematic review. MLS Sport Res*. 2021;1(1):51-68.
21. Matthewman G, Lee A, Kaur JG, Daley AJ. Physical activity for primary dysmenorrhea: a systematic review and meta-analysis of randomized controlled trials. *American journal of obstetrics and gynecology*. 2018 Sep 1;219(3):255-e1. <https://doi.org/10.1016/j.ajog.2018.04.001>
22. Govindaraj R, Karmani S, Varambally S, Gangadhar BN. Yoga and physical exercise—a review and comparison. *International Review of psychiatry*. 2016 May 3;28(3):242-53. <https://doi.org/10.3109/09540261.2016.1160878>
23. Tsai IC, Hsu CW, Chang CH, Lei WT, Tseng PT, Chang KV. Comparative effectiveness of different exercises for reducing Pain Intensity in primary dysmenorrhea: a systematic review and network Meta-analysis of Randomized controlled trials. *Sports Medicine-Open*. 2024 May 30;10(1):63. <https://doi.org/10.1186/s40798-024-00718-4>
24. López-Liria R, Torres-Álamo L, Vega-Ramírez FA, García-Luengo AV, Aguilar-Parra JM, Trigueros-Ramos R, Rocamora-Pérez P. Efficacy of physiotherapy treatment in primary dysmenorrhea: a systematic review and meta-analysis. *International journal of environmental research and public health*. 2021 Jul 23;18(15):7832. <https://doi.org/10.3390/ijerph18157832>
25. Carroquino-Garcia P, Jiménez-Rejano JJ, Medrano-Sanchez E, De La Casa-Almeida M, Diaz-Mohedo E, Suarez-Serrano C. Therapeutic exercise in the treatment of primary dysmenorrhea: a systematic review and meta-analysis. *Physical therapy*. 2019 Oct;99(10):1371-80. <https://doi.org/10.1093/ptj/pzz101>
26. World Health Organization. Physical activity. Available from: <https://www.who.int/news-room/fact-sheets/detail/physical-activity>. Accessed on 27 Dec 2024.
27. Triwahyuningsih RY, Rahfiludin MZ, Sulistiyani S, Widjanarko B. Role of stress and physical activity on primary dysmenorrhea: A cross-sectional study. *Narra J*. 2024 Apr 30;4(1):e685. <https://doi.org/10.52225/narra.v4i1.685>
28. Kusumaningrum T, Nastiti AA, Dewi LC, Lutfiani A. The correlation between physical activity and primary dysmenorrhea in female adolescents. *Indian Journal of Public Health Research and Development*. 2019 Aug 1;10(8). <https://doi.org/10.5958/0976-5506.2019.02252.6>
29. Omidvar S, Amiri FN, Firouzbakht M, Bakhtiari A, Begum K. Association between physical activity, menstrual cycle characteristics, and body weight in young south indian females. *Age (y)*. 2019;11(15):226. <https://doi.org/10.15296/ijwhr.2019.47>
30. Babil DA, Dolatian M, Mahmoodi Z, Baghban AA. A comparison of physical activity and nutrition in young women with and without primary dysmenorrhea. *F1000Research*. 2018 Jan 16;7:59.

- <https://doi.org/10.12688/f1000research.12462.1>
31. Prazeres LM, Brito RG, Ramos ES. Regular physical exercise, sedentarism and characteristics of dismenorrhea and premenstrual syndrome. *Fisioterapia em Movimento*. 2018;31:e003118. <https://doi.org/10.1590/1980-5918.031.ao18>
 32. Kim BR, Kang S, Jeong WS. The association of menstruation and leisure-time physical activity among korean female university students: a preliminary study. *International Journal of Environmental Research and Public Health*. 2022 Jun 18;19(12):7492. <https://doi.org/10.3390/ijerph19127492>
 33. Kajosaari A, Laatikainen TE. Adults' leisure-time physical activity and the neighborhood built environment: a contextual perspective. *International journal of health geographics*. 2020 Dec;19:1-3. <https://doi.org/10.1186/s12942-020-00227-z>
 34. Akintayo ND, Oke KI, Fabunmi AA. Knowledge, Attitude and Counselling Practice of Physiotherapists in the Promotion of Leisure-Time Physical Activity among Patients in Nigerian Hospitals. *Bayero Journal of Evidence-Based Physiotherapy*. 2018;4(1):262-73.
 35. Burtcher J, Millet GP, Burtcher M. Pushing the limits of strength training. *American journal of preventive medicine*. 2023 Jan 1;64(1):145-6. <https://doi.org/10.1136/bjssports-2020-102955>
 36. Directorates and centres – Redeemer's University (Internet) [cited 25th may, 2025]. Available from: <https://run.edu.ng/directorates-centres/>
 37. McCaffery M, Beebe A. Numeric Pain Rating Scale & (VAS). *Pain: Clinical manual for nursing practice*. St. Louis: Mosby; 1999. p. 16.
 38. Oyeyemi AL, Bello UM, Philemon ST, Aliyu HN, Majidadi RW, Oyeyemi AY. Examining the reliability and validity of a modified version of the International Physical Activity Questionnaire, long form (IPAQ-LF) in Nigeria: a cross-sectional study. *BMJ open*. 2014 Dec 1;4(12):e005820. <https://doi.org/10.1136/bmjopen-2014-005820>
 39. Ning CH, Vasanthi RK, Muniandy Y. Study on the Prevalence of dysmenorrhea and its relationship with physical activity among young adults. *International Journal of Health Sciences and Research*. 2020;10(10):39-45.
 40. Jaiprakash H, Myint KK, Chai L, Nasir BM. Prevalence of dysmenorrhea and its sequel among medical students in a Malaysian University. *Br J Med Med Res*. 2016 Jul;16(9):1-8. <https://doi.org/10.9734/BJMMR/2016/25135>
 41. Kural M, Noor NN, Pandit D, Joshi T, Patil A. Menstrual characteristics and prevalence of dysmenorrhea in college going girls. *Journal of family medicine and primary care*. 2015 Jul 1;4(3):426-31. <https://doi.org/10.4103/2249-4863.161345>
 42. Gumanga SK, Kwame-Aryee RA. Menstrual characteristics in some adolescent girls in Accra, Ghana. *Ghana medical journal*. 2012;46(1).
 43. Omar Masoud AM, Bahey El-Deen HA, Hegazy SM. The Impact of Primary Dysmenorrhea on the Level of Physical Activity among College age Students. *Indian Journal of Public Health Research & Development*. 2020 Mar 1;11(3).
 44. Ortiz MI. Primary dysmenorrhea among Mexican university students: prevalence, impact and treatment. *European Journal of Obstetrics & Gynecology and Reproductive Biology*. 2010 Sep 1;152(1):73-7. <https://doi.org/10.1016/j.ejogrb.2010.04.015>
 45. Kolić PV, Sims DT, Hicks K, Thomas L, Morse CI. Physical activity and the menstrual cycle: A mixed-methods study of women's experiences. *Women in Sport and Physical Activity Journal*. 2021 Mar 17;29(1):47-58. <https://doi.org/10.1123/wspaj.2020-0050>
 46. Mena GP, Mielke GI, Brown WJ. Prospective associations between physical activity and BMI with irregular periods and heavy menstrual bleeding in a large cohort of Australian women. *Human Reproduction*. 2021 Jun 1;36(6):1481-91. <https://doi.org/10.1093/humrep/deab055>
 47. Marques P, Lages AD, Skorupskaitė K, Rozario KS, Anderson RA, George JT. Physiology of GnRH and gonadotrophin secretion. *Endotext [internet]*. 2024 Oct 15.
 48. Heidari Moghadam R, Abdolmaleki E, Kazemi F, Masoumi SZ, Khodakarami B, Mohammadi Y. The effect of exercise plan based on FITT protocol on primary dysmenorrhea in medical students: A clinical trial study. *Journal of research in health sciences*. 2019 Aug 24;19(3):e00456.
 49. Fallah F, Mirfeizi M. How is the quality and quantity of primary dysmenorrhea affected by physical exercises? A study among Iranian students. *International Journal of Women's Health and Reproduction Sciences*. 2018 Jan 1;6(1):60-. <https://doi.org/10.15296/ijwhr.2018.11>
 50. Shirvani MA, Motahari-Tabari N, Alipour A. Use of ginger versus stretching exercises for the treatment of primary dysmenorrhea: a

- randomized controlled trial. Journal of integrative medicine. 2017 Jul 1;15(4):295-301.
[https://doi.org/10.1016/S2095-4964\(17\)60348-0](https://doi.org/10.1016/S2095-4964(17)60348-0)
51. Saleh HS, Mowafy HE, El Hameid A. Stretching or core strengthening exercises for managing primary dysmenorrhea. J Women's Health Care. 2016;5(295):2167-0420.
<https://doi.org/10.4172/2167-0420.1000295>
52. Kannan P, Chapple CM, Miller D, Claydon-Mueller L, Baxter GD. Effectiveness of a treadmill-based aerobic exercise intervention on pain, daily functioning, and quality of life in women with primary dysmenorrhea: A randomized controlled trial. Contemporary clinical trials. 2019 Jun 1;81:80-6.
<https://doi.org/10.1016/j.cct.2019.05.004>
53. Aboushady RM, El-saidy TM. Effect of home based stretching exercises and menstrual care on primary dysmenorrhea and premenstrual symptoms among adolescent girls. IOSR Journal of Nursing and Health Science. 2016;5(2):10-7.
54. Sutar A, Paldhikar S, Shikalgar N, Ghodey S. Effect of aerobic exercises on primary dysmenorrhoea in college students. J Nurs Health Sci. 2016 Oct;5(5):20-4.
<https://doi.org/10.9790/1959-0505052024>