

Correlation between physical activity and menstrual cycle disorders: A literature review

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Magna Scientia Advanced Research and Reviews, 2024, 10(01), 046–051

Publication history: Received on 29 November 2023; revised on 09 January 2024; accepted on 11 January 2024

Article DOI: <https://doi.org/10.30574/msarr.2024.10.1.0002>

Abstract

One of physiology elements of female's reproduction is menstruation. It is an important consideration for optimizing the performance and maintaining the health of females. The menstrual cycle can be said normal if the interval between 21-35 days. Physical activity is said as one of the several factors that cause menstrual cycle disorders. Therefore, this literature review study aims to determine the correlation between physical activity and irregular menstrual cycle based on secondary data or previous research journal articles. The articles collected for this literature review according to the inclusion and exclusion criteria. The search engine used was PubMed, Google Scholar, Scopus, Medline, Embase, and the Cochrane Library. The result of the literature review showed 10 journals. Eight articles stated there were significant relation between physical activity and the menstrual cycle disorder, however 2 articles presented no significant between them. The conclusion of this study is physical activity can have correlation with the menstrual cycle disorders. The different result can be found according to the level of the physical activity and the level of the reproduction endocrine, which all those needs further investigation.

Keywords: Exercise; Menstrual cycle; Healthy lifestyle; Irregular menstrual

1. Introduction

Changes in women experienced biologically are characterized by the growth and development of primary sex and secondary sex and psychologically characterized by unstable or erratic attitudes, feelings, and emotions [1]. Physical and psychological changes, one of which is called puberty, One of the most significant changes that occur during puberty is the onset of menstruation accompanied by changes in sex hormones [2]. It continues to be a typical physiological phenomenon from menarche to menopause and occurs once a month in a regular rhythm cycle. Menstrual disorders are common in females because they are closely related to the processes that influence a woman's pubertal development. The menstrual cycle is an important indicator of women's endocrine and reproductive health [3].

In a study [4] it was mentioned that the third factor affecting irregular menstrual cycles was physical activity. In the study, the results of 3 out of a total of 7 studies were found to discuss physical activity as a factor of menstrual cycle irregularities [4]. According to the results of the literature review, there is a correlation between physical activity and menstrual cycle irregularities. This is supported in a study [5], that there is a correlation between physical activity and menstrual cycle irregularity among adolescent. Activity is a body movement that will be produced by muscles that require energy expenditure including activities that will be carried out while playing, working, engaging in recreational activities, and doing household chores [6] There is a growing recognition that the menstrual cycle's impact on physical performance is an important factor in women's sports and an area that needs more investigation [5].

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2. Material and methods

This research uses the Literature Review method. The data used is secondary data obtained not from direct research by researchers, but from previous research results by other researchers. Data came from relevant journals from Pubmed databases, Google Scholar, PubMed, Scopus, Medline, Embase, and the Cochrane Library. The article search used keywords (AND OR NOT or AND NOT) which were used to expand and describe the search, making it easier to determine the journals and scientific articles that would be used by researchers. Key terms such as "Menstruation Cycle" "Menstrual Disorder" AND "Physical Activity".

2.1. Inclusion and Exclusion

All relevant articles published from 2013 to 2023 in the English language, to address the physical activity, menstrual cycle and the impact of physical activity on menstrual cycle or menstrual disorders were included in our review. We excluded all reviews and duplicate publications to ensure the uniqueness and relevance of the data analyzed.

3. Results and discussion

Based on a systematic search conducted by researchers through secondary data, research on the correlation between physical activity and the menstrual cycle. Various journal findings that researchers conducted searches by doing specific keywords, namely choosing the right keywords, not using long keywords and not writing the wrong term words. Journals that have been obtained from databases, Google Scholar, PubMed, Research Gate and Scient Direct which are then carried out study selection and quality based on predetermined inclusion and exclusion criteria, there are 10 journals.

An analysis of the correlation between physical activity and menstrual cycle found 8 literature that explained that physical activity significantly correlates with menstrual cycle disorders [7]–[14]. This occurs through the mechanism of disruption of the hypothalamus, pituitary, and adrenal (HPA) axis. High-intensity exercise will cause GnRH suppression so that the secretion of FSH and LH hormones is reduced which causes menarche to be delayed and menstrual cycle disorders [14]. The study conducted [7] shows that there is a correlation between menstrual cycle disorders with the level of physical activity and the intensity of physical exercise. Based on statistical tests the p-value (0.042). In another study [8], there is a significant correlation between physical activity and menstrual cycle disorders. This correlation has a high incidence where someone with menorrhagia (78% have low category activity), besides the incidence of dysmenorrhea (94% of low physical activity). Evidenced by the results of the correlation test p-value <0.0001. The results of the study conducted [9] are in line with previous research on Female Rhythmic Gymnasts showing that the hyperamnorhea group suffered more when practicing gymnast than the control group.

In addition, there is also research [10] reporting that there is a significant correlation between BMI, physical activity with menstrual cycle length, regularity of menstrual cycle periods and dysmenorrhea severity. In a further study [13] showed physical activity such as lack of exercise is associated with menstrual cycle irregularities. Furthermore, a study conducted [14] with athlete respondents showed that most athletes experienced primary amenorrhea and as many as 30% experienced menstrual cycle disorders due to the intensity of physical activity and too heavy exercise. From all the results of the two-sided statistical test conducted, $p < 0.05$ was obtained, this is considered a significant correlation between physical fitness performance and the menstrual cycle. Another analysis of the correlation between physical activity with menstrual cycle phase and metabolism. In this study, the variables studied were not only the menstrual cycle, but also the outcome variables (total Tyg Index, HDL, LDL, HDL cholesterol). The results of the study [11] showed that in low and/or medium categories of physical activity there was a correlation between the menstrual cycle and the hormone levels studied.

Table 1 Summary of Studies

No	Author	Year	Title	Study Design Sample Analysis	Research Outcomes
1	Ahrens, <i>et al.</i>	2015	<i>The effect of physical activity across the menstrual cycle on reproductive function</i>	Bio Cycle Study (n=259) Fisher & ANOVA	The results showed that there was no association between the characteristics of the menstrual cycle or the proportion of cycles that experienced anovulation with physical activity. The results of the Fisher & ANOVA test showed (p=0.08) That physical activity does not substantially change hormone levels during the menstrual cycle or significantly does not affect sporadic anovulation.
2.	Peinado-Molina, <i>et al.</i>	2020	<i>Association between Non-Competitive Physical Exercise and Menstrual Disorders</i>	Descriptive Observation (n=122) Nonparametric Mann-Whitney U & Chi-square	The results of this study found an association between menstrual disorders with body type, physical activity level, and physical exercise intensity (hours/week). Proven by the results of the Nonparametric Mann-Whitney U & Chi-square test (p<0.05).
3.	Gupta, <i>et al.</i>	2021	<i>Effect of Diet, Physical Activity, and Psychosocial Factors, on Menstrual Cycle Abnormalities in College Students of Karad, Maharashtra, India</i>	Observational study (n=300) Chi-square	Based on the results of the study, with the results of the chi-square test obtained (P < 0.0001), it shows that there is a significant correlation between less physical activity or no physical activity with a higher incidence of dysmenorrhea and menorrhagia.
4.	Czajkowska, <i>et al.</i>	2019	<i>Menstrual Cycle Disorders in Professional Female Rhythmic Gymnasts</i>	The prospective study Female athletes (n=85) Kolmogorov-Smirnov, uji Wilcoxon (Z), Mann-Whitney (U)	In the control group that received greater physical activity, it was found that athletes who experienced dysmenorrhea and menstrual cycle irregularities were lower. In the control group, the menstrual cycle interval was also longer and most of them experienced hypermenorrhea. This is evidenced by the results of the Kolmogorov-Smirnov test, Wilcoxon (Z) test, and Mann-Whitney (U) with (p, 0.0002).
5.	Omidvar, <i>et al.</i>	2019	<i>Association Between Physical Activity, Menstrual Cycle Characteristics, and Body Weight in Young South Indian Females</i>	Cross-sectional Females (n=1000) Chi-square	In this study, it was found that women who had a sedentary lifestyle were more likely to experience short and long periods. In addition, a weak correlation was found between cycle duration and physical activity level. Physically active women had a higher proportion in terms of menstrual regularity, as indicated by the data obtained, which showed that most participants experienced regular menstruation in terms of menstrual duration and consistency. This is evidenced by the results of the chi-square test, namely (p, 0.005).
6.	MacGregor, <i>et al.</i>	2023	<i>Association between menstrual cycle phase and metabolism in UK Biobank, and effect modification by</i>	Cross-sectional cohort study using UK Biobank (n= 259)	The results showed that there was a substantial correlation between glucose and total cholesterol, HDL, and LDL in the low or moderate physical activity category. the level of physical activity during the menstrual cycle was positively

No	Author	Year	Title	Study Design Sample Analysis	Research Outcomes
			<i>inflammatory markers and risk factors for metabolic disease</i>	Generalised additive models (GAM)	correlated with the intensity of menstrual cycle symptoms. This is also evidenced by the test results, namely (p, 0.005).
7.	Ergin and Kartal	2020	Menstrual Cycle and Sporting Performance Perception of Elite Volleyball Players	Cross-sectional Elite Volleyball (n=130) chi-square	In this study, volleyball players with high physical activity intensity were found not to experience amenorrhea or delayed menarche. In this study, it can be concluded that there is an association between physical activity and menstrual cycle disorders, but depending on the variety of sports they participate in, sports-related menstrual abnormalities may be more pronounced in athletes who start exercising at a young age or in those who exercise intensely. This is also evidenced by the results of the chi-square test (p<0.005).
8.	Witkos, <i>et al.</i>	2022	The Impact of Competitive Swimming on Menstrual Cycle Disorders and Subsequent on Menstrual Cycle Disorders and Subsequent Sports Injuries as Related to the Female Athlete Triad and on Premenstrual Syndrome Symptoms	Cross-sectional Female athletes (n=64) chi-square	Statistical analysis showed no correlation between menstrual cycle problems, age at menarche, or menstrual pain and physical activity. The mean age at menarche for female subjects was 12.63 ± 1.50 years. Statistical analysis showed that the total number of PMS symptoms relieved by this type of physical exercise did not correlate with the number of years of swimming practice with the results of the chi-square test (p>0.05).
9.	Lim, <i>et al.</i>	2015	Fast Food Consumption alongside socioeconomic status, stress, exercise, and sleep duration are associated with menstrual irregularities in Korean adolescents: Korea National Health and Nutrition Examination Survey 2009-2013	Descriptive correlation (n=86) <i>Pearson</i>	In the group with irregular periods, there was a substantial increase in the frequency of soda, coffee, and fried food consumption. However, there was no significant difference in the nutritional quality index between the two groups. The results of logistic regression analysis showed that menstrual irregularity was associated with younger age at menarche, and lack of exercise. This was evidenced by the Pearson test result (p<0.005).
10.	Solli, <i>et al.</i>	2020	Changes in Self-Reported Physical Fitness, Performance, and Side Effects Across the Phases of the Menstrual Cycle Among Competitive Endurance Athletes.	Cross sectional Elite cross-country skiers and biathletes (n=140) Pearson's chi-squared tests	The results of this study showed that most participants felt that the phase of the menstrual cycle had a good or bad impact on the quality of training and competitive performance. The early follicular phase was considered the worst time for performance. This was evidenced in the Pearson correlation and chi-square tests (p<0.005).

Analysis of the correlation between physical activity and menstrual cycle disorders found three pieces of literature that revealed no significant correlation between physical activity and menstrual cycle disorders. According to [15] study in this cohort study showed that there was no change in physical activity and physical activity of a person could not significantly change hormone levels in each menstrual cycle. This is evidenced by his research that the results of the correlation test show p -values= 0.08 for the correlation between physical activity and the menstrual cycle. Different from our research is the dependent variable. In our study, the focus was on the regularity of the menstrual cycle, while in the [15] study the menstrual cycle was calculated by hormone levels in each cycle. The results of the study conducted [16] are in line with previous research, namely the absence of a significant correlation between physical activity and disorders of the menstrual cycle age of menarche appearance and pain experienced during menstrual bleeding. The subjects in this study were swimming athletes with an average age of menarche between 12 and 14 years old, the results showed a negative correlation of $p < 0.05$ between the number of years of swimming training and the sum of PMS symptoms alleviated by this type of physical activity.

4. Conclusion

After the results of the literature study research are described in detail, a conclusion is drawn that physical activity is related to menstrual cycle disorders seen from the regularity of the menstrual cycle, hormonal levels in each phase of the menstrual cycle and other disorders that occur during menstruation, but there are also other factors as confounders that can cause physical activity and menstrual cycle disorders to be unrelated. Further studies should however be database used to search for literature to be more varied. This study is expected to be a literature review for future researchers to determine whether physical activity is related to and influences menstrual cycle disorders.

Compliance with ethical standards

Acknowledgments

The authors show their gratitude to the Department of Midwifery, Faculty of Medicine, Universitas Airlangga for the administration process to facilitate this project.

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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