



How physical exercises ameliorate dysmenorrhea in adolescence

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Abstract: Dysmenorrhea is frequently reported by adolescents. Physical exercises is one method of overcoming the symptoms of primary dysmenorrhea. Consistent physical activity has been shown to induce the synthesis of endorphins, which function as analgesics within the body. This study presents a comprehensive review to synthesize evidence regarding the relation between physical activity or exercise with dysmenorrhea and how exercise can ameliorate dysmenorrhea in adolescents. This study followed the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) method to identify articles published within the last three years (2021-2023) via PubMed, Scopus, ScienceDirect, and Google Scholar. This process yielded seven pertinent studies. The studies have demonstrated that engaging in physical activity can effectively alleviate the symptoms associated with menstrual discomfort. Physical exercise in regular time for a minimum of thirty minutes, three times per week, can also contribute to the alleviation of pain associated with menstrual discomfort among adolescent females diagnosed with primary dysmenorrhea. Isometric exercise, massage therapy, yoga, electrotherapy, connective tissue manipulation, stretching, kinesio tape, progressive relaxation exercise, aviva stretching exercise, stretching exercises, core strengthening exercise and aerobic exercise are the recommended forms of physical exercise in reducing the impact of primary dysmenorrhea. However, the extent to which one experiences these benefits is contingent upon the nature and intensity of the exercise.

Keywords: physical activity, exercise, adolescence, dysmenorrhea.

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INTRODUCTION

Adolescence is the period between the ages of 10 and 19 that marks the transition from childhood to adulthood, as defined by the WHO (WHO, 2015). During this stage, adolescents undergo a developmental process known as puberty, during which they transition from childhood to adulthood (Csikszentmihalyi, 2023). Several discomforting conditions are frequently reported by adolescents, including dysmenorrhea (abnormal menstrual bleeding, excessive menstrual blood, and irregular menstrual cycles) (Natalia et al., 2020)

Dysmenorrhea has a global prevalence of over 50% among women. An estimated 107,673 individuals in Indonesia were diagnosed with dysmenorrhea, of which 59,671 (54.89%) had primary dysmenorrhea and 9,496 (9.36%) had secondary dysmenorrhea (Tahir et al., 2021). Primary dysmenorrhea is defined by cramping in the lower abdomen or pelvis that persists for 1-3 days before or during menstruation, without any physical examination abnormalities (McKenna & Fogleman, 2021). One symptom of dysmenorrhea is soreness in the lower abdomen that arises from pathological factors



within the pelvis, including but not related to endometriosis, cysts, and pelvic tumors (Vlachou et al., 2019).

Physical activity serves as an alternative, non-pharmaceutical treatment for dysmenorrhea (Jaleel et al., 2022). In order to improve or sustain physical fitness, athletics refers to deliberate and systematic repetitions of movements (American College of Sports Medicine, 2021). Stress reduction, mood enhancement, and hormonal regulation are all mechanisms by which exercise prevents and alleviates dysmenorrhea. Physical activity can aid in fat loss when obesity is accompanied by severe dysmenorrhea. Regular physical activity in three days before menstruation increases blood flow to the pelvis, prevents prostaglandin accumulation throughout the body, and postpones menstrual discomfort (Pelliccia et al., 2021).

It is hypothesized that hormonal changes in the uterine membrane induced by exercise alleviate the symptoms of primary dysmenorrhea. This is because, according to a review of the relevant literature, physical activity stimulates the release of analgesics, specifically endorphins, which play a significant role in pain relief (Jaleel et al., 2022). Endorphins also referred to as analgesics, assist the body in combating potential distractions and stress-induced discomfort (Schoenfeld & Swanson, 2021). The aim of this article is to synthesize the evidence in the literature regarding the impact of physical exercise to the menstrual discomfort among adolescent females diagnosed with primary dysmenorrhea.

METHODS

This study adhered to the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) protocol on studies examining the impact of physical exercise on menstrual discomfort among female’s adolescent diagnosed with primary dysmenorrhea. The systematic review was conducted in PubMed, Scopus, ScienceDirect, and Google Scholar databases using the following key words the terms "primary dysmenorrhea" and "exercise" “olahraga” or "dismenore primer". By conducting an electronic data search on the Internet, 130 articles were obtained. Six of the obtained articles are subsequently subjected to a comprehensive analysis to serve as the foundation for the analysis in this paper. Studies were deemed eligible if they met the inclusion criteria;

1. This review was designed to include original studies conducted with cross-sectional, cohort, case-control and experimental study designs.
2. Although the search was not limited to specific language, only articles published in the English language were returned during the search process.
3. The articles included are articles published in the last four years (2021-2024).
4. Full texts were available in English and were peer reviewed.

The procedure for selecting articles is illustrated in Figure 1.

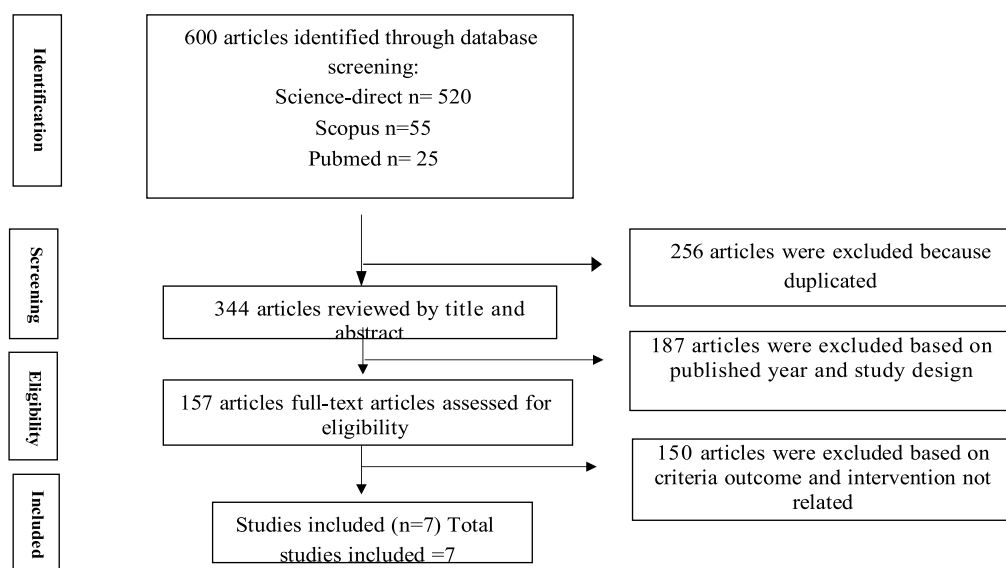


Figure 1. Prisma Flow Chart

RESULT AND DISCUSSION

The characteristics of the article are explained in table 1.

Tabel 1. Characteristics of the Researched Article

No	Author and Year of Published	Journal Source	Research Design	Objectives	Participants /Studies	Result	Conclusion
1	Wen-Ching Huang, Pei Chi Chiu, and Chi Hong Ho. (2022)	Journal of Sports Science and Medicine	Randomized controlled trial	To examine the potential impacts of exercise on physiological modulation, physical fitness, and the severity of primary dysmenorrhea.	45	A study involving university students with dysmenorrhea was conducted. Participants were divided into a control group and a (DysmenHIIT) group with the latter randomly assigned to either an untreated group or a dysmenorrhea group that underwent 10 weeks of high intensity interval training (HIIT). The DysmenHIIT group showed significantly improved premenstrual symptoms ratings and higher total scores on the Short Form McGill Pain Questionnaire (SF-MPQ) and Visual Analogue Scale (VAS) surveys. No significant differences were found in grip strength, core strength, or endurance between groups.	The study found that HIIT training significantly improved participants' physical and cardiovascular endurance, suggesting it could be incorporated into an educational health plan for women with Primary Dysmenorrhea (PD). Exercise intensity play an important role in encouraging participant adherence to the practical application of the prescribed exercise intervention.
2	Rami MN, Noriaki M, Makoto, Yuta S, Tsubasa T, Kazuki K, Shogo T, Honoka I, Sayo K and Yukio U. (2022)	BMC Women's Health.	Cross-sectional online survey	To compare the severity of perimenstrual symptoms in young Japanese women who engaged in regular exercise and those who did not.	282	A study among 500 Japanese women aged 18-25 found that exercise habits significantly reduced primary dysmenorrhea (PD). The severity of perimenstrual symptoms was assessed using the Menstrual Distress Questionnaire (MDQ). The study found that exercise was associated with negative emotions preceding menstruation and a behavioral change specifically the avoidance of social interaction. The study also found a significant association between exercise habits and menstrual symptoms.	Physical activity may mitigate the intensity of perimenstrual symptoms and aid in the development of a non-pharmaceutical coping mechanism, according to this study. The limitations from this study are ; the participants were not diagnosed with PD by a medical doctor, this study was a cross-sectional survey, recall bias was a possibility because this study was a retrospective survey. These limitations could be a recommendations for next studies.
3	Asmaa M. Elbandrawy and Sahar M.	Acta Gymnica	Randomized clinical trial	To determine whether aerobic and isometric	105	The study involved 105 females aged 18-25 with primary dysmenorrhea. They were divided into three groups: aerobic	Isometric and aerobic exercises have been shown to contribute significantly to the

No	Author and Year of Published	Journal Source	Research Design	Objectives	Participants /Studies	Result	Conclusion
	Elhakk (2021)			exercises have comparable effects on primary dysmenorrhea.		exercise, isometric exercise, and a control group. Participants were assessed using the plasma progesterone levels, visual analogue scale, and modified menstrual symptom questionnaire. The aerobic exercise group performed exercises three times a week for eight weeks, while the isometric exercise group showed no significant changes. After the exercise program, no significant differences were found between the isometric and aerobic groups in terms of the visual analog scale or plasma progesterone levels. However, the aerobic exercise group showed a greater degree of agreement on the modified menstrual symptoms questionnaire.	amelioration of dysmenorrhea. The limitations from this study are; menstrual characteristics of the participants were not reported in statistical analysis. Further researcher need to do this analysis first.
4	Zoltán Kovács, Ekine Atombosiye, Gabriella Hegy, and Henrik Szóke (2024)	Medicina	Prospective observational trial	To examine whether a twice-weekly thirtyminute Aviva exercise intervention could result in improvements in pain level and body awareness in patients with primary dysmenorrhea	78	The study compared menstrual pain levels between the intervention group (IG) and control group (CG) using the Numeric Rating Scale (NRS) questionnaire. Secondary outcomes included differences in Body Awareness Questionnaire subscales, IG's Borg scale results, and adherence to the intervention. Results showed a significant change in pain levels between the IG and CG, but no significant difference in BAQ-H subscales.	The Aviva exercise could contribute to pain relief from PD. Regarding body awareness, no significant difference was found between the two groups. Due to the short detection period and prospective observational design, our results are preliminary and need to be confirmed in larger clinical trials.
5	Fatma TF, Amina SG, Mohammed MED, Sabah LM, Nabila SM (2022)	Tobacco Regulatory Science	Experimental study	To compare the effects of aerobic and stretching exercises on intensity of primary dysmenorrhea among nursing students	150	Sample who complained of mild to moderate dysmenorrhea were divided into control group and two intervention groups performed exercises 3 times a week for 12 weeks. The tools that been used are a structured interview questionnaire, Visual Analogue Scale (VAS), WaLIDD Scale and Moo's Menstrual Distress Questionnaire (MDQ). The	Both aerobic and stretching exercises were effective in reducing intensity of dysmenorrhea and improving menstrual distress symptoms. Female can choose between aerobic or stretching exercises to improve their health and to

No	Author and Year of Published	Journal Source	Research Design	Objectives	Participants /Studies	Result	Conclusion
6	Aslı Çelik Serap Ejder Apay (2022)	Sis a, e Medicine	A randomized prospective controlled study	To examine the effects of progressive relaxation exercises on the reduction of pain in primary dysmenorrhea	60	results are there are reduce decreasing of pain intensity in intervention groups.	Progressive relaxation exercises are an effective method for reducing dysmenorrhea when they are performed on a regular basis. Similar research may be conducted in the future with participants having different levels of education.
7	Ronika Agrawal, Rushda Ahmed (2021)	Eropean Journal of Biomed ical And Pharmaceu tical Science s	Experime ntal study	To compare stretching exercises and core strengthenin g exercise on reducing pain and menstrual symptoms	60	Samples were assigned in two group, stretching exercises and core streghtening group. Exercises were given six days/week for 8 weeks. Pre Distress Questionnaire, Number of pain killer Tablets, Core Muscle Strength and Sit Reach Test scores were taken. All tests showed reduction in both the group.	The study shows that stretching exercises and core strengthening exercise to girls suffering from primary dysmenorrhea can reduce pain and menstrual symptoms and no of tablets consumed during menstruation. Thus it could be performed as an effective treatment method for girls suffering from primary dysmenorrhea.

After conducting additional searches using the identified keywords, a total of 600 articles were obtained; of these, seven were included in the present literature review. Five articles employ experimental designs, one Prospective observational trial and one utilizes a cross-sectional design. This review included all article from 2021 until 2024 because this is the updated from the previous version. This is also the limitation from this study. The author only included articles from several years to this review. For future researcher could set their review year scope wider than this article.

Table 1 presents an overview of the attributes of the articles that were analyzed, including the research design, objectives, samples, results, and conclusions derived from the conducted research. In addition to enhancing cardiovascular function and body strength, exercise is one of the non-pharmacological methods for alleviating the severity of symptoms associated with primary dysmenorrhea, as demonstrated by the results of the analysis in Table 1. People with primary dysmenorrhea are advised by the American College of Obstetricians and Gynecologists (ACOG) to engage in regular exercise for a minimum of 30 minutes, three to five times per week. Isometric exercises, massage therapy, yoga, electrotherapy, connective tissue manipulation, stretching, kinesio tape, progressive relaxation exercises, and aerobic exercise are among the recommended forms of physical activity.

The results of a study by Mizuta et al. show that women who exercise and those who do not have different levels of perimenstrual symptoms. This implies that starting an exercise regimen can be a useful non-pharmacological coping strategy (Mizuta et al., 2022). Consistent with the findings of Seales et al., which concluded that exercise is a safe and efficacious lifestyle intervention for alleviating dysmenorrhea symptoms, these results support this conclusion. The professional guidelines of the American College of Obstetricians and Gynecologists also recommend that patients engage in physical activity as a means of managing dysmenorrhea (Seales et al., 2021).

The Greek terms *dys* which means difficult, *mens* which means month, and *rhoia* which means flow are the source of the term dysmenorrhea, an adversity related to the menstrual cycle. The condition is distinguished by the presence of discomfort during menstruation and was categorized as primary, secondary, or unspecified in the 10th edition of the International Statistical Classification of Diseases and Related Health Problems, published by the World Health Organization in 1992 (Jiménez-Rejano et al., 2019).

Primary dysmenorrhea is distinguished by an exaggerated inflammatory reaction, with prostaglandin F₂ serving as the critical constituent of uterine hypercontraction. This substance induces vasoconstriction and hyperalgesia. However, physical activity alleviates pain associated with primary dysmenorrhea. Synergistic interaction between the opioid and non-opioid systems may account for pain relief. Physical activity induces alterations in hormone levels, including heightened progesterone levels during the late luteal phase, an accelerated metabolic clearance rate of prostaglandins, and a conversion of arachidonic acid metabolism to the Cytochrome P450 (CYP) pathway (Jaleel et al., 2022).

To control the menstrual cycle, the hypothalamus-pituitary gonadal system secretes the hormones luteinizing hormone (LH) and follicle-stimulating hormone (FSH). These hormones promote follicle maturation and growth throughout the early stages of the menstrual cycle and produce estrogen. During the late phase (luteal phase), progesterone levels increase as follicles form through the corpus luteum. Progesterone levels decrease in the absence of fertilization, and Arachidonic Acid (AA) and its metabolites Prostaglandin (PG) and Leukotrienes (LT) arise on the cell membrane via the Cyclooxygenase (COX) and 5-lipoxygenase (LOX) pathways. The active constituents of the PG are PGE₂ and PGF₂. PGE₂ facilitates vasodilation of the endometrial blood vessels, which increases inflammation and swelling and attracts the LT to the site of action. In contrast, PGF₂ induces ischemia by causing myometrial contraction and vasoconstriction. Ultimately, pain develops as a result of decreased pain sensitivity at the free nerve endings. LT simultaneously stimulates vasoconstriction and muscle contraction with the assistance of PGF₂. By increasing PG production, proinflammatory cytokines also contribute significantly to the etiology of Parkinson's disease (Jaleel et al., 2022).

As stated in the research article by Huang et al., a variety of treatments have been widely used to alleviate the symptoms of dysmenorrhea, including alternative medicine, nutrition, hot compresses, and physiotherapy. (Guthold Regina et al., 2021; Itani et al., 2022; Jiménez-Rejano et al., 2019; López-Liria et al., 2021; López-Toribio et al., 2021) Currently, exercise is being considered as a potential treatment option for this issue (Huang et al., 2022).

Physiotherapy treatment encompassing progressive relaxation exercises, aerobic exercise, isometric exercises, massage therapy, yoga, electrotherapy, connective tissue manipulation, stretching, and kinesio tape are the recommended forms of physical activity. Nwaezuke and Gbonjubola (2022); López-Liria et al. (2021); Elbandrawy and Elhakk (2021) Additionally, there are additional suggestions regarding 10-week HIIT. In addition to improving the cardiovascular fitness and power of the participants, the 10-week HIIT spinning bike training alleviated the discomfort and symptoms associated with the premenstrual and menstrual cycles by modulating hormones, inflammation, and prostaglandins. Although the results are promising, additional investigation is necessary to treat primary and secondary symptoms of dysmenorrhea with HIIT-compatible exercise approaches and to include a broader range of study participants (e.g., age group and complementary diet). Moreover, empirical evidence suggests that exercise intensity is a substantial factor in both attaining the desired physiological adaptation parameters and enhancing participant compliance with the prescribed exercise intervention. Consequently, the exercise intervention outlined in this research may be perceived as a potential means of enhancing the health of women, a suitable approach to improving study and work productivity, a means of enhancing quality of life, and a prospective preventive measure against gynecological issues among adolescents (Elbandrawy & Elhakk, 2021; Huang et al., 2022; López-Liria et al., 2021; Nwaezuke & Gbonjubola, 2022).

Exercise acts as a non-specific analgesic by increasing pelvic blood circulation and endorphin release. Physical activity contributes to the prevention and/or mitigation of dysmenorrhea symptoms by alleviating tension and enhancing mood (Daveneghi et al., 2016; Dehnavi et al., 2018; Nwaezuoke & Gbonjubola, 2022). Additional research indicates that athletes experience menarche at a considerably older age than the general population; therefore, early or precocious puberty can be prevented. Regular exercise has the potential to decrease body fat, which is significant due to the correlation between obesity and a heightened prevalence of dysmenorrhea and the accumulation of excess fat. Fat burning induced by physical activity may hasten the aging process during menarche. The following are the effects of exercise on inflammatory markers and hormones (Bavil et al., 2018)

The Hormone Progesterone

Progesterone, by its regulatory function in the synthesis of prostaglandin and luteinizing hormone, exerts control over inflammation. Considerable alterations take place throughout the luteal phase of menstruation, wherein its concentration exhibits variability in response to the intensity of exercise and peaks at the threshold of fatigue. All of these modifications are more pronounced in untrained individuals than in trained individuals. By manipulating metabolic clearance, the concentration of circulatory hormones can be increased or decreased. During exercise, there is an estimated 60% decrease in hepatic blood flow within 40 minutes. As metabolic clearance increases, instructed participants' concentration returns to normal levels. Physical activity induced an elevation in progesterone levels while luteinizing hormone concentrations exhibited minimal variation throughout the menstrual cycle. Given the interplay among progesterone, luteinizing hormone, and follicle-stimulating hormone, it appears that an elevation in progesterone levels functions autonomously from the hypothalamus-pituitary gonadal system. On the contrary, lactate influences cAMP within the ovary, leading to an increase in progesterone concentrations (Jaleel et al., 2022).

Prostaglandin

Prostaglandin synthesis is increased during exercise, specifically PGE2 and PGF2, in skeletal muscle. This has an impact on muscle protein synthesis and training adaptation. Prostaglandin may potentially contribute to exercise-induced hyperemia following rhythmic or isometric muscular contractions in both males and females. Cyclooxygenase, PGE2, and PGF2 synthase are produced in skeletal muscles during exercise at 50–75% of maximum exertion or 60% of Maximum Voluntary Contraction (MVC), which induces hyperemia (Jaleel et al., 2022)

Arachidonic Acid

Using the cyclooxygenase and 5-lipoxygenase pathways, arachidonic acid is converted to prostaglandin and luteinizing hormone, respectively. Arachidonic acid can also be converted to additional metabolites via cytochrome P450. Arachidonic acid is hydrolyzed by cytochrome P450 into epoxyeicosatrienoic acid, which is subsequently hydrolyzed again into dihydroxyeicosatrienoic acid. Epithelial-derived hyperpolarization factor (EDHF) has the potential to serve as an epoxyeicosatrienoic acid substrate. The process of vascular smooth muscle relaxation is induction by the hyperpolarization of K⁺ channels that are dependent on Ca²⁺. A positive correlation has been observed between physical activity and DHET, a stable metabolite of EET that promotes vasodilation in skeletal muscle and localized circulation, including the heart (Barcikowska et al., 2020; Jaleel et al., 2022).

Cytokines that promote inflammation

The secretion of pro-inflammatory and anti-inflammatory cytokines is influenced by physical activity. Aerobic exercise stimulates macrophages to produce anti-inflammatory cytokines while decreasing pro-inflammatory cytokine levels (Jaleel et al., 2022).

Insufficient or sporadic physical activity has also been identified as a significant predictor and a contributing factor to the development of dysmenorrhea and PMS. The findings presented herein were derived from a meta-analysis conducted by Armour et al., which sought to assess the safety and efficacy of physical activity for women afflicted with primary dysmenorrhea (Armour et al., 2019). The degree of exercise intensity significantly influences the physiological adaptation of a woman's body to menstruation, which is an essential treatment factor (Huang et al., 2022).

Engaging in physical activity three days before the initiation of menstruation enhances blood circulation to the pelvis, impedes the buildup of prostaglandins in the area, and consequently postpones the onset of discomfort. Engaging in physical activity during menstrual pain facilitates the expedited

elimination of surplus substances and prostaglandins from the uterus, which are significant contributors to the development of menstrual pain. Consequently, this action shortens the duration of menstrual pain. In addition to alleviating tension and other menstrual symptoms, exercise can increase parasympathetic nerve activity while decreasing sympathetic nervous system activity during rest. Pain can be alleviated through regular aerobic exercise through the stimulation of endorphin secretion, the body's most potent natural analgesic (Bavil et al., 2018; Jiménez-Rejano et al., 2019).

CONCLUSSION

From this review we can conclude that physical exercise has numerous positive effects to the body. Examples of potential benefits include enhanced cardiovascular function, immunity, strength, and endurance. Physical exercise in regular time for a minimum of thirty minutes, three times per week, can also contribute to the alleviation of pain associated with menstrual discomfort among adolescent females diagnosed with primary dysmenorrhea. Isometric exercise, massage therapy, yoga, electrotherapy, connective tissue manipulation, stretching, kinesio tape, progressive relaxation exercise, aviva stretching exercise, stretching exercises, core strengthening exercise and aerobic exercise are the recommended forms of physical exercise in reducing the impact of primary dysmenorrhea. This could be used as an effective treatment for girls who suffer from primary dysmenorrhea.

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