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DYSMENORRHEA: PATHOPHYSIOLOGY AND CONTEMPORARY PHARMACOLOGICAL AND NON- PHARMACOLOGICAL TREATMENT APPROACHES

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ABSTRACT

Purpose: This paper aims to analyze current scientific evidence regarding the pathophysiology of primary dysmenorrhea and to evaluate the effectiveness of both pharmacological and non-pharmacological treatment strategies used to reduce menstrual pain and improve the quality of life of affected women.

Methodology: A comprehensive literature review was conducted using scientific databases such as PubMed and Google Scholar. The search included keywords such as “primary dysmenorrhea”, “menstrual pain”, “NSAIDs”, “hormonal therapy”, “non-pharmacological treatment”, “TENS”, “thermotherapy”, and “physical activity”. Particular attention was given to systematic reviews, meta-analyses, randomized controlled trials (RCTs), and clinical recommendations from international medical organizations. Publications analyzing both pharmacological and non-pharmacological therapeutic approaches were included, with emphasis on studies assessing treatment effectiveness, safety, and their impact on quality of life.

Findings: Primary dysmenorrhea is a common gynecological condition significantly affecting the physical, psychological, and social functioning of women. Nonsteroidal anti-inflammatory drugs (NSAIDs) remain the first-line pharmacological treatment due to their ability to reduce prostaglandin production and alleviate menstrual pain. Hormonal therapy is an effective alternative, particularly in women not planning pregnancy. In addition, non-pharmacological interventions such as thermotherapy, transcutaneous electrical nerve stimulation (TENS), physical activity, physiotherapy, and complementary therapies may contribute to pain reduction and improved well-being. However, the quality of evidence supporting some non-pharmacological methods remains limited.

Conclusions: Effective management of primary dysmenorrhea requires an individualized and comprehensive therapeutic approach that integrates both pharmacological and non-pharmacological strategies. Increasing awareness of available treatment options and promoting multidisciplinary care may significantly improve patient outcomes and quality of life.

KEYWORDS

Primary Dysmenorrhea; Menstrual Pain; NSAIDs; Hormonal Therapy; Non-Pharmacological Treatment; Physical Activity; TENS

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Introduction

One of the most common menstrual disorders among young women is dysmenorrhea, defined as painful menstruation. This condition affects a large proportion of the female population, with menstrual pain estimated to occur in approximately 50–90% of adolescent girls and women of reproductive age. (McKenna & Fogleman, 2021) In many cases the symptoms are mild to moderate; however, in a considerable proportion of patients the pain is severe enough to significantly limit daily activities and negatively affect overall functioning. For this reason, dysmenorrhea represents an important public health concern that requires appropriate diagnosis and effective therapeutic management. Dysmenorrhea should not be considered solely as a somatic disorder characterized by pain localized to the lower abdomen or pelvic region. Increasing evidence suggests that this condition may also affect the psychological and emotional well-being of affected women. Chronic or recurrent menstrual pain may lead to a deterioration in quality of life, reduced well-being, and an increased risk of depressive and anxiety symptoms. (Balik et al., 2014; Nur Azurah et al., 2013) Menstrual pain is frequently accompanied by additional systemic symptoms such as nausea, fatigue, headaches, and dizziness, which further diminish patients' overall comfort and daily functioning. Another important aspect of dysmenorrhea is its significant impact on everyday activities. Among adolescents and young women, dysmenorrhea is one of the most common causes of school absenteeism and limitations in educational and social participation. Epidemiological analyses indicate that recurrent episodes of severe menstrual pain may lead to several days of absence from school during each menstrual cycle. (Gutman et al., 2022) A similar pattern is observed among

women who are professionally active, where dysmenorrhea may contribute to reduced work productivity, increased use of sick leave, and limitations in physical and social activities. Over time, these consequences may affect not only the individual's functioning but also broader social and economic aspects. Despite the high prevalence of dysmenorrhea, the condition is still frequently underrecognized or underestimated both by patients themselves and by society. In many cases menstrual pain is perceived as a natural element of the menstrual cycle, which may lead to delayed diagnosis and a lack of appropriate treatment. However, available scientific evidence indicates that properly selected therapeutic strategies can effectively reduce pain intensity and improve the quality of life of women affected by this condition. The aim of this paper is to discuss the issue of dysmenorrhea with particular emphasis on its underlying mechanisms and the currently available methods of prevention and treatment of menstrual pain. Both pharmacological and non-pharmacological therapeutic approaches are presented, as they may contribute to the reduction of menstrual pain and improvement of women's functioning in everyday life.

Materials and Methods

For the purposes of this study, a review of current scientific literature concerning dysmenorrhea and the available treatment methods was conducted. The literature search was performed using electronic scientific databases, primarily PubMed and Google Scholar. During the search process, keywords such as "primary dysmenorrhea," "menstrual pain," "NSAIDs," "hormonal therapy," "non-pharmacological treatment," "TENS," "thermotherapy," and "physical activity" were used, along with other related terms. The analysis mainly included systematic reviews, meta-analyses, and randomized controlled trials (RCTs), as well as recommendations developed by international scientific organizations, including the American College of Obstetricians and Gynecologists (ACOG). Publications addressing both pharmacological and non-pharmacological approaches to the treatment of dysmenorrhea were taken into account. Particular attention was given to studies evaluating the effectiveness of commonly used therapeutic methods, including non-steroidal anti-inflammatory drugs (NSAIDs), hormonal therapy, various forms of physical activity, physiotherapeutic interventions, and other supportive treatment strategies. The analysis also included studies addressing the safety of these therapies and their impact on quality of life and daily functioning in women with primary dysmenorrhea.

Pathophysiology of Dysmenorrhea and Risk Factors

Dysmenorrhea can be classified into primary dysmenorrhea, secondary dysmenorrhea, and algomenorrhea. Primary dysmenorrhea is defined as cramping pain in the lower abdomen and/or pelvic region occurring shortly before or during menstruation in the absence of any identifiable pelvic pathology, typically lasting from one to three days. (Gutman et al., 2022) In contrast, secondary dysmenorrhea develops after a period of previously painless menstrual cycles and is associated with underlying gynecological conditions such as endometriosis, pelvic inflammatory diseases, or ovarian cysts. Algomenorrhea refers to a condition in which menstrual pain is accompanied by autonomic symptoms, including nausea, vomiting, and fainting. (Drozdol-Cop et al., 2020) The exact etiology of dysmenorrhea has not yet been fully elucidated. However, the most widely accepted explanation attributes a key role to the excessive production of prostaglandins. (Bernardi et al., 2017) Evidence indicates that prostaglandins produced during menstruation are associated with inflammatory processes within the endometrium. Two prostaglandins are considered particularly important in the pathophysiology of dysmenorrhea: prostaglandin F_{2α} (PGF_{2α}) and prostaglandin E₂ (PGE₂). PGF_{2α} contributes to the constriction of arcuate vessels, leading to local hypoxia within endometrial tissues. Additionally, PGF_{2α} stimulates contraction of smooth muscle cells, which enhances uterine contractility and intensifies menstrual bleeding. The effects of PGE₂ depend on the type of receptors involved but may include vasodilation of endometrial blood vessels, which may contribute to increased tissue edema. Research has demonstrated a significant association between prostaglandin concentrations in plasma and endometrial tissue and the occurrence of menstrual pain. Studies have shown significantly higher levels of PGF_{2α} metabolites both in plasma and in the endometrium among women experiencing dysmenorrhea compared with those without menstrual pain. (Barcikowska et al., 2020) Various risk factors have been identified that may contribute to the development of primary dysmenorrhea. These include demographic, environmental, psychological, and gynecological factors. Primary dysmenorrhea has been reported more frequently in women who are underweight, consume caffeine, skip breakfast, or maintain an irregular lifestyle. Additional contributing factors include sleep disturbances, such as poor sleep quality, late bedtimes, or a sleep duration shorter than seven to eight hours per night, as well as lack of regular physical activity. An increased risk of

dysmenorrhea has also been associated with exposure to cold during menstruation and with certain dietary habits, including frequent consumption of cold or spicy foods, frequent snacking, specific dietary preferences, and previous weight loss. Among gynecological factors, important predictors include a family history of dysmenorrhea, irregular menstrual cycles, and the presence of blood clots during menstruation. Conversely, the use of oral contraceptives has been associated with a lower prevalence of primary dysmenorrhea. Furthermore, the condition has been reported more frequently in women experiencing high levels of stress, negative emotions related to menstruation, and symptoms of anxiety or depression. (Wang et al., 2022) The diagnosis of primary dysmenorrhea is typically based on a detailed medical history and physical examination. Routine ultrasound examination is generally not required; however, it may play an important role in differential diagnosis and in excluding secondary causes of menstrual pain, such as endometriosis or adenomyosis. (Bernardi et al., 2017)

Treatment

The primary goal of treatment for primary dysmenorrhea is the effective relief of pain associated with menstrual bleeding. An important component of therapy is educating patients about the physiology of the menstrual cycle and the mechanisms responsible for the occurrence of menstrual pain, as well as providing appropriate emotional support. Various therapeutic approaches are used in clinical practice, although their effectiveness may vary. In general, treatment strategies can be divided into pharmacological and non-pharmacological methods.

Pharmacological Treatment

Pharmacological therapy remains the most commonly used form of treatment for dysmenorrhea. Its main objective is the rapid and effective reduction of pain intensity as well as the alleviation of accompanying symptoms such as nausea, headaches, and general weakness. Pharmacotherapy primarily focuses on modulating inflammatory and hormonal processes responsible for the excessive production of prostaglandins and increased uterine contractility, which are considered key pathophysiological mechanisms underlying dysmenorrhea. Due to their well-documented efficacy and relatively rapid onset of action, medications remain the first-line treatment in clinical practice, although their use may be associated with potential adverse effects.

Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)

Non-steroidal anti-inflammatory drugs (NSAIDs) are currently the mainstay of treatment for dysmenorrhea and are considered the first-line therapy. Their introduction into clinical practice in 1969 marked a new era in pain management, and the availability of many of these medications without prescription has allowed women to independently manage menstrual pain. (Oladosu et al., 2018) The primary mechanism of action of NSAIDs involves the inhibition of cyclooxygenase (COX), an enzyme responsible for prostaglandin synthesis, which leads to a reduction in prostaglandin levels. (Bofill Rodriguez et al., 2019) Decreased prostaglandin production results in reduced uterine muscle contractions and consequently alleviates menstrual pain. Two main isoforms of cyclooxygenase are currently recognized: COX-1 and COX-2. Traditional NSAIDs such as ibuprofen, naproxen, and diclofenac inhibit the activity of both enzymes and are therefore classified as non-selective inhibitors. Studies have demonstrated that the use of naproxen in women with dysmenorrhea is associated with decreased prostaglandin production, leading to reduced uterine contractility and pain relief. (Barcikowska et al., 2020) The most favorable therapeutic outcomes are observed when treatment is initiated one to two days before the expected onset of menstruation and continued during the first two to three days of bleeding, when prostaglandin levels are highest. (American College of Obstetricians and Gynecologists [ACOG], 2018) No significant differences have been demonstrated between individual NSAIDs in terms of analgesic efficacy or safety profile. (Sachedina & Todd, 2020; Feng & Wang, 2018) The most commonly prescribed agents include ibuprofen (initial dose 800 mg, followed by 400–800 mg every eight hours) and naproxen (initial dose 500 mg, followed by 250–500 mg every 12 hours). Both medications are widely available without prescription and are generally associated with relatively low monthly treatment costs. (McKenna & Fogleman, 2021) It is estimated that 20–25% of patients do not respond adequately to NSAID therapy, and in some women these medications may be contraindicated or poorly tolerated. Due to their acidic properties, NSAIDs may damage the gastrointestinal mucosa, potentially leading to erosions, ulcers, or bleeding. The most frequently reported adverse effects include nausea, dyspeptic symptoms, headaches, dizziness, drowsiness, and dry mouth. Furthermore, prolonged or inappropriate use of NSAIDs may negatively affect renal, hepatic, and cardiovascular function, increasing the risk of thromboembolic complications.

(Barcikowska et al., 2020) Taking these medications with food and ensuring adequate fluid intake may reduce adverse effects related to the gastrointestinal tract and kidneys. (ACOG Committee Opinion No. 760, 2018) However, it should be emphasized that menstrual pain typically lasts only two to three days, which limits the risk of serious adverse effects associated with short-term NSAID use. (Barcikowska et al., 2020)

Paracetamol

Paracetamol (acetaminophen) may be used as one of the options for relieving pain associated with dysmenorrhea. The exact mechanism of action of paracetamol is not fully understood; however, it is known to influence the cyclooxygenase (COX) pathway and to exert predominantly central analgesic effects. Unlike classical NSAIDs, paracetamol primarily affects the peroxidase activity of COX isoenzymes, particularly COX-2, especially in cellular environments characterized by low concentrations of arachidonic acid and peroxides. This explains its predominant central mechanism of action, as COX-2 is constitutively expressed in neural tissues even in the absence of inflammation, and also accounts for its relatively limited efficacy in inflamed peripheral tissues where peroxide and arachidonic acid levels are higher. (McCrae et al., 2018) For this reason, paracetamol is generally considered a second-line analgesic, particularly in situations where non-steroidal anti-inflammatory drugs are contraindicated or poorly tolerated. Its analgesic mechanism also involves the activation of descending serotonergic pathways in the central nervous system and possible interactions with the endocannabinoid system, which contribute to its analgesic and antipyretic effects. Although paracetamol may be less effective than NSAIDs in reducing menstrual pain, it remains a safe alternative for women who cannot use or tolerate these medications. Additionally, studies have shown that combining paracetamol with pamabrom, a mild diuretic agent, or caffeine may enhance its therapeutic effect in alleviating symptoms of dysmenorrhea while maintaining a favorable safety profile. (Kirsch et al., 2024)

Hormonal Contraception

Hormonal therapy is considered one of the fundamental treatment strategies for dysmenorrhea and may be used as an alternative or adjunct to NSAID therapy in women who do not plan to become pregnant. Its mechanism of action primarily involves reducing endometrial thickness and decreasing cyclooxygenase-2 activity, which leads to reduced prostaglandin production responsible for uterine contractions and pain. In addition to alleviating menstrual pain, hormonal therapy may provide several additional benefits, including reduced menstrual bleeding, alleviation of premenstrual syndrome symptoms, improvement of skin conditions such as acne and hirsutism, beneficial effects on bone mineral density, and a reduced risk of certain cancers, including endometrial, ovarian, and colorectal cancer. (McKenna & Fogleman, 2021) Hormonal methods include oral contraceptive pills, vaginal rings, transdermal patches, levonorgestrel-releasing intrauterine systems, subdermal implants containing etonogestrel, and intramuscular or subcutaneous injections of depot medroxyprogesterone acetate (DMPA). (Barcikowska et al., 2020) Each of these methods has specific benefits and potential adverse effects; therefore, the choice of therapy should be tailored to the patient's clinical situation and preferences, and the final decision should be made in consultation with a physician. (ACOG Committee Opinion No. 760, 2018) Combined oral contraceptives, containing both estrogen and progestin, have demonstrated effectiveness in the treatment of both primary and secondary dysmenorrhea in adolescents and adult women. (McKenna & Fogleman, 2021) Their mechanism of action involves suppression of ovulation and reduction of endometrial proliferation, which leads to decreased menstrual blood loss and reduced prostaglandin synthesis, ultimately lowering intrauterine pressure and uterine contractility. These agents may be administered in either cyclic or continuous regimens. Continuous regimens appear to be more effective than cyclic regimens, as they reduce the number of menstrual episodes and consequently decrease the frequency of dysmenorrhea symptoms. (Guimarães & Póvoa, 2020; Schroll et al., 2023) Progestin-only methods may also be beneficial in the treatment of dysmenorrhea, as they induce endometrial atrophy, which contributes to pain reduction. However, their effectiveness has not been as extensively documented as that of combined oral contraceptives. Desogestrel-containing progestin-only pills reduce menstrual bleeding, and approximately 10 % of women may develop amenorrhea. These preparations can serve as an alternative to combined contraceptives and are often associated with fewer adverse effects. Long-acting medroxyprogesterone acetate injections may induce amenorrhea in approximately half of treated women due to endometrial atrophy; however, their use is currently limited because of the potential negative impact on bone mineral density. The levonorgestrel-releasing intrauterine system (LNG-IUS) reduces both menstrual blood loss and endometrial thickness, which results in decreased pain. In contrast, the non-hormonal copper intrauterine device may increase menstrual bleeding and pain and is therefore not recommended in the treatment of dysmenorrhea.

Although the use of transdermal patches and vaginal rings has not been extensively studied in primary dysmenorrhea, the estrogen-progestin effects on the endometrium appear to be similar regardless of the route of administration, suggesting comparable therapeutic effectiveness. The etonogestrel-releasing subdermal implant provides long-term contraception for up to three years. Available data indicate that its use may also be associated with a significant reduction in dysmenorrhea symptoms. (Guimarães & Póvoa, 2020) Despite their effectiveness, hormonal therapies may also cause adverse effects, most commonly nausea, headaches, and weight gain. (McKenna & Fogleman, 2021) Modern hormonal contraceptives contain lower doses of hormones, which reduces the frequency of side effects while maintaining therapeutic effectiveness. Nevertheless, even with lower hormone doses, the risk of complications cannot be completely excluded. (Barcikowska et al., 2020)

Antispasmodic Treatment

Because primary dysmenorrhea is associated with increased uterine contractility, medications that reduce uterine contractions have been investigated as potential treatment options. These include nitric oxide donors, nitroglycerin, and calcium channel blockers; however, none of these therapies are currently used as standard treatment for dysmenorrhea. Transdermal nitroglycerin has been shown to be less effective than NSAIDs and is more frequently associated with adverse effects, particularly migraine-type headaches, which limits its clinical use. Calcium channel blockers, such as nifedipine, reduce uterine smooth muscle contractility by inhibiting calcium influx into smooth muscle cells, which may result in pain relief. Studies have demonstrated that administration of 20–40 mg of nifedipine may provide relief from menstrual pain. (Barcikowska et al., 2020) However, its use may be associated with adverse effects such as facial flushing, tachycardia, palpitations, and headaches. (Guimarães & Póvoa, 2020) Current evidence is insufficient to conclusively confirm the effectiveness of nifedipine in the treatment of primary dysmenorrhea, as available studies have included relatively small sample sizes. Larger and well-designed clinical trials are required to determine its potential role in the treatment of this common condition. If future research confirms both its efficacy and tolerability, nifedipine could expand the range of available treatment options, particularly for women who have contraindications to currently used medications or who are planning pregnancy. The safety profile of nifedipine in women of reproductive age is well established due to its use in the management of preterm labor, and clinicians are familiar with its off-label application in this context. An additional advantage of this medication is its low cost and wide availability. (Earl & Grivell, 2021)

Non-Pharmacological Treatment Methods

Non-pharmacological approaches are frequently used in the management of dysmenorrhea symptoms and may serve as an alternative or complementary option to analgesic medications. Among the most commonly discussed therapeutic strategies are superficial and deep thermotherapy, transcutaneous electrical nerve stimulation (TENS), manual therapy, physical exercise, dietary supplementation and nutritional interventions, as well as acupuncture.

Thermotherapy

Thermotherapy is based on the intentional application of heat energy to achieve therapeutic effects. Heat may be applied superficially or may penetrate deeper tissue structures. Superficial heat methods are widely used in clinical practice, and their analgesic effects are considered comparable to, and in some cases even more effective than, anti-inflammatory pharmacotherapy or exercise-based interventions. Techniques affecting deeper tissues include microwave diathermy, among others. Its mechanism of action is associated with vasodilation and increased local blood flow, which results in modulation of pain signal transmission and reduction of nociceptive stimulation. These effects may occur through mechanisms such as reduced prostaglandin concentrations, decreased muscle tension, and improved tissue oxygenation by reducing local hypoxia and ischemia. Due to its ability to penetrate deeper tissue layers, microwave diathermy is thought to potentially act directly on uterine structures, which could provide a stronger analgesic effect compared with superficial heat techniques. However, it should be emphasized that the use of this modality still raises certain concerns due to the limited number of high-quality studies confirming its effectiveness. (Machado et al., 2019) Heat therapy has the potential to become one of the preferred treatment methods. A systematic review conducted by Junyoung Jo and Sun Haeng Lee demonstrated clear benefits of heat therapy in reducing menstrual pain among women with primary dysmenorrhea. However, it remains unclear whether the observed reduction in pain translates into long-term clinical benefits. A potential advantage of heat therapy is the lower risk of adverse effects compared with pharmacological treatment, although current studies have not

conclusively confirmed this benefit. If future research demonstrates that thermotherapy is both effective and safe in the short- and long-term, it may be considered a preferred non-pharmacological treatment option for dysmenorrhea, particularly in patients with contraindications to NSAIDs. Nevertheless, further studies are required to compare different types of heat therapy with other interventions, both in terms of clinical effectiveness and cost-effectiveness. (Jo & Lee, 2018)

Transcutaneous Electrical Nerve Stimulation (TENS)

Transcutaneous electrical nerve stimulation (TENS) is a therapeutic method that involves the application of electrical impulses delivered through electrodes placed on the skin, aimed at stimulating peripheral nerves and inducing physiological responses, primarily analgesia. The analgesic mechanism of this technique is mainly associated with the activation of opioid receptors in both the central and peripheral nervous systems. During high-frequency stimulation, δ -opioid receptors are predominantly activated, whereas μ -opioid receptors are mainly activated during low-frequency stimulation. In primary dysmenorrhea, TENS may also promote vasodilation within the corresponding dermatome through axonal reflex mechanisms, which can reduce uterine ischemia by improving local blood circulation. (Machado et al., 2019) High-frequency stimulation (approximately 100 Hz) is generally recommended because it has demonstrated effectiveness and is well tolerated by patients. Low-frequency stimulation (LF) may be considered in specific clinical situations, for example in women who regularly use analgesic medications. The most important treatment parameter is current intensity, which should be set at the maximum level tolerated by the patient without causing pain. During the treatment session, the intensity should be gradually increased in order to maintain a strong sensory stimulus and prevent physiological habituation to the electrical impulses. However, the effectiveness of TENS may be limited in women who are unable to achieve or maintain sufficiently high stimulation intensity. (Elboim-Gabyzon & Kalichman, 2020)

Manual Therapy

Based on the results of a comparative study conducted between June 2019 and November 2021 at the Medical University of Gdańsk, the use of manual therapy in women with primary dysmenorrhea appears to be a justified approach for symptom reduction. The aim of the study was to evaluate whether manual therapy, compared with ibuprofen treatment, affects the concentrations of inflammatory markers, sex hormones, and the severity of dysmenorrhea symptoms in young women. In one of the study groups, participants underwent manual therapy during a single menstrual cycle. Therapeutic sessions were performed once a week and lasted 45 minutes. Depending on the length of the menstrual cycle, three or four therapy sessions were conducted. The therapeutic program included diaphragm mobilization, normalization of pelvic floor muscle tension (performed in the supine position with flexed knees; the physiotherapist assessed the pelvic floor muscles by palpation from the inner aspect of the ischial tuberosities and applied gentle cranial mobilization of the pelvic floor), post-isometric muscle relaxation, and trigger point therapy according to the Simons and Travell concept. Manual therapy was individually tailored for each patient and included only those muscles in which functional disturbances were identified during physiotherapeutic examination. The study demonstrated that both manual therapy and ibuprofen effectively reduced the severity of dysmenorrhea symptoms. However, the application of post-isometric relaxation techniques and trigger point therapy resulted in a reduction in the number of muscles presenting functional disturbances, an effect that was not observed in the ibuprofen-treated group. These findings suggest that the analgesic effect of manual therapy may be associated with improved tissue elasticity and compliance, enhanced neural conduction, reduced tissue hypoxia, and beneficial effects on the functioning of internal organs. Moreover, manual therapy may activate the parasympathetic nervous system and modulate the release of β -endorphins, which may indirectly influence hormonal regulation and pain perception mechanisms. The presented results provide additional arguments supporting the inclusion of manual therapy as part of a comprehensive management strategy for dysmenorrhea. Physiotherapy appears to be a modern, effective, and non-pharmacological approach to pain management. Furthermore, manual techniques are non-invasive and demonstrate a favorable safety profile, with a potentially lower risk compared with pharmacological treatments such as ibuprofen. (Barcikowska et al., 2022)

Physical Activity

Numerous scientific reports indicate that various forms of physical activity, including isometric exercises, stretching, yoga, and aerobic training, may effectively reduce the intensity of menstrual pain and improve quality of life, particularly in women with low levels of daily physical activity. (López-Liria et al., 2021) There are plausible biological mechanisms explaining how regular physical activity may alleviate dysmenorrhea symptoms. Prostaglandins produced in the endometrium play a key role in the development of menstrual pain by increasing uterine muscle contractions. Pain perception may also be influenced by pain sensitization mechanisms as well as psychosocial and cultural factors. Physical activity has been shown to reduce stress, exert antinociceptive effects, and decrease prostaglandin F2 α levels, a mediator strongly associated with the pathophysiology of primary dysmenorrhea. (Matthewman et al., 2018) A study evaluating the effects of a specially designed yoga program on menstrual pain intensity, physical fitness, and quality of life was conducted among non-athlete women aged 18–22 years with primary dysmenorrhea. Participants in the intervention group performed 30-minute yoga sessions twice weekly for 12 weeks at home, whereas the control group did not participate in any exercise program. At the end of the intervention period, women in the yoga group demonstrated significant reductions in menstrual pain intensity, improved physical fitness, and higher quality-of-life scores compared with the control group. These findings suggest that appropriately designed yoga programs may serve as a valuable complementary treatment for primary dysmenorrhea. (Yonglithipagon et al., 2017) Positive effects have also been observed with Pilates-based exercise programs, which were associated with reductions in pain intensity. However, clear evidence regarding the effectiveness of these interventions in regularly exercising women remains limited, and the considerable variability of exercise protocols makes direct comparisons difficult. Systematic reviews suggest that exercise performed at least three times per week for 45–60 minutes per session may lead to clinically significant reductions in menstrual pain. (López-Liria et al., 2021; Armour et al., 2019) Another systematic review indicates that therapeutic exercise programs lasting 8–12 weeks may represent a valuable supportive intervention for young women with dysmenorrhea, contributing to reductions in pain intensity and, to a lesser extent, in pain duration. The findings also suggest potential improvements in quality of life; however, the number of high-quality studies remains limited. Therefore, further research with robust methodological design is required, particularly studies that include quality-of-life assessments given the substantial impact of dysmenorrhea on daily functioning. (Carroquino-Garcia et al., 2019) Particularly beneficial outcomes have been attributed to yoga and combined exercise programs, which not only reduce pain but may also improve sleep quality and overall well-being. (López-Liria et al., 2021)

Dietary Supplements and Diet

Dietary supplementation may represent another supportive approach in the management of dysmenorrhea. Vitamin E has potential analgesic properties because it inhibits the activity of phospholipase A2 and cyclooxygenase (COX), thereby reducing prostaglandin production and enhancing the effects of prostacyclin. This may lead to vasodilation and reduced smooth muscle tension. Vitamin B1 (thiamine) may also contribute to symptom relief by alleviating manifestations associated with its deficiency, such as muscle cramps, fatigue, and decreased pain tolerance. From a nutritional perspective, dysmenorrhea has been observed more frequently in individuals consuming diets characterized by a high omega-6 fatty acid intake and insufficient omega-3 fatty acid consumption. Increasing the intake of omega-3 fatty acids, for example through fish oil supplementation, may lead to their incorporation into cell membranes and consequently reduce the production of inflammatory mediators such as prostaglandins and leukotrienes. (Guimarães & Póvoa, 2020) One scientific review analyzed the effectiveness of 12 herbal preparations (including German chamomile, cinnamon, Damask rose, dill, fennel, fenugreek, ginger, guava, rhubarb, uzara, valerian, and zataria) as well as five non-herbal supplements (such as fish oil, melatonin, vitamins B1 and E, and zinc sulfate) administered in various doses and formulations. The authors concluded that the available evidence supporting the effectiveness of these supplements in relieving menstrual pain is of low quality, mainly due to small sample sizes, insufficient methodological reporting, and inconsistent results across studies. (Pattanittum et al., 2016) Although scientific evidence supporting the effectiveness of dietary supplements remains limited, most of these interventions are considered relatively safe and rarely associated with serious adverse effects. Nevertheless, their use should be discussed with a physician or pharmacist in order to avoid potential interactions with other medications.

Acupuncture

Among non-pharmacological approaches used in the treatment of primary dysmenorrhea are also techniques derived from traditional medicine, such as acupuncture. The mechanism of acupuncture is associated with the stimulation of specific nerve fibers and receptors, which initiates complex physiological processes involving, among others, the endorphin and serotonin systems. Some studies suggest that acupuncture may have potential effectiveness in relieving menstrual pain; however, the currently available scientific evidence is insufficient to recommend its routine use in clinical practice. Further well-designed clinical trials are required to confirm its effectiveness. Nevertheless, acupuncture and acupressure may be considered as therapeutic options for women who prefer non-pharmacological treatment approaches. (Zhang et al., 2018; Smith et al., 2016)

Conclusions

Dysmenorrhea is a common health problem with significant consequences for the quality of life and the psychological and social functioning of women. The most well-established pharmacological treatment remains the use of non-steroidal anti-inflammatory drugs (NSAIDs), which reduce pain primarily by inhibiting prostaglandin synthesis. However, it should be noted that a proportion of patients do not respond adequately to NSAID therapy, and their use may also be associated with potential adverse effects. Hormonal therapy represents an effective alternative or complementary treatment to NSAIDs in women who do not plan to become pregnant, and the choice of a specific method should be individualized according to the patient's clinical situation and preferences. In addition to pharmacological interventions, increasing attention has been given to non-pharmacological treatment methods, such as thermotherapy, transcutaneous electrical nerve stimulation (TENS), manual therapy, physical activity, and complementary therapies. These approaches may contribute to reducing menstrual pain, improving overall well-being, and limiting the need for pharmacological treatment. Current evidence suggests that combining pharmacological and non-pharmacological strategies may provide the most comprehensive therapeutic benefit for women with dysmenorrhea. Nevertheless, further high-quality clinical studies are required to better evaluate the effectiveness and long-term outcomes of many non-pharmacological interventions. A comprehensive and individualized therapeutic approach that takes into account the biological, psychological, and lifestyle-related aspects of dysmenorrhea may contribute to improved treatment outcomes and better quality of life for affected women.

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