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# NONSTEROIDAL ANTI-INFLAMMATORY DRUGS, PHYSICAL EXERCISE AND GINGER SUPPLEMENTATION AS ACCESSIBLE THERAPEUTIC OPTIONS IN THE MANAGEMENT OF PRIMARY DYSMENORRHEA: A LITERATURE REVIEW

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**ABSTRACT**

**Background:** Primary dysmenorrhea (PD) constitutes the most prevalent gynecological disorder among women of reproductive age and is associated with a substantial reduction in quality of life and social functioning. While nonsteroidal anti-inflammatory drugs (NSAIDs) remain the first-line treatment due to their proven analgesic efficacy, their use may be limited by the risk of adverse effects. Consequently, increasing scientific attention has been directed toward non-pharmacological alternatives, including physical activity and ginger supplementation, which demonstrate a more favorable safety profile.
**Aim:** The objective of this review is to systematize and evaluate the effectiveness of physical activity, nonsteroidal anti-inflammatory drugs (NSAIDs) and ginger supplementation in the management of primary dysmenorrhea.
**Material and Methods:** A comprehensive literature search in PubMed was conducted. The review covered RCTs, observational studies and meta-analyses on the effects of NSAIDs, exercise and ginger on menstrual pain intensity and duration in women with primary dysmenorrhea.
**Results:** The analysis of current literature indicates that NSAIDs, physical activity and ginger extract each contribute to alleviating pain associated with primary dysmenorrhea. Among the interventions examined, NSAIDs demonstrated the highest short-term analgesic efficacy. Physical exercise provided comparable reductions in pain intensity and duration, with the added benefit of improved psychological well-being. Ginger significantly reduced pain symptoms and showed efficacy comparable to NSAIDs.
**Conclusions:** According to current guidelines, NSAIDs remain the first-line pharmacological treatment for primary dysmenorrhea due to their proven efficacy. However, regular physical activity and ginger supplementation represent safe and effective alternatives, particularly for women who experience adverse effects from NSAID use.

**KEYWORDS**

Primary Dysmenorrhea, Pain Management, Ginger, Physical Exercise, Stretching, Menstrual Pain

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## Introduction

Primary dysmenorrhea (PD) is defined as cyclic lower abdominal pain occurring in the absence of underlying pelvic pathology. In contrast, when menstrual pain is associated with identifiable abnormalities — such as uterine fibroids, endometrial polyps, endometriosis, pelvic inflammatory disease, ovarian cysts, adenomyosis, congenital anomalies or complications related to hormonal contraception — the condition is classified as secondary dysmenorrhea [1].

PD is the most prevalent gynecological disorder in women of reproductive age [2], affecting between 41% and 91.5% of school-aged girls [3]. It is a leading cause of school absenteeism among adolescents and work absenteeism in adult women [4]. A study involving 180 adolescent girls aged 12–18 years demonstrated that moderate to severe menstrual pain significantly reduced physical activity and increased school absenteeism compared to peers with mild or no symptoms [5]. PD negatively impacts social participation and overall quality of life.

Identified risk factors for PD include: age between 20–30 years, positive family history, early menarche (<12 years), long or irregular menstrual cycles, heavy or prolonged menstrual bleeding, BMI (Body Mass Index) below 20, stress, caffeine intake, smoking, skipping breakfast, poor sleep quality, sleep deprivation (<8 hours), lack of physical exercise, consumption of cold or spicy foods during menstruation, selective eating habits, weight loss history and exposure to cold during menstruation [2,6,7].

PD typically appears within 12 months following menarche, although the onset may be delayed up to 24 months [2]. The most intense pain is generally reported by patients within the first 72 hours of the menstrual

cycle [8]. The pain is usually cramping in nature, localized to the midline lower abdomen or suprapubic region and may radiate around the abdomen, to the lumbar area, or along the thighs. The location, timing of onset relative to the beginning of menstruation and intensity of pain generally remain consistent across cycles, which is characteristic of primary dysmenorrhea. If pain worsens or extends in duration over time, secondary causes should be considered. PD is frequently accompanied by both somatic and psychological symptoms, such as headaches, nausea, vomiting, diarrhea, fatigue, mood disorders and sleep disturbances [7]. A decrease in both frequency and intensity of symptoms is often observed with age. Similarly, the experience of a full-term pregnancy and uncomplicated childbirth is associated with symptom relief and less frequent occurrence of moderate to severe manifestations [10].

Diagnosis is primarily based on a detailed medical history, including current symptoms, past medical and gynecological history, menstrual patterns and sexual activity. In the majority of cases, the diagnosis of PD can be made based on typical symptoms, and empirical treatment may be initiated accordingly. If symptoms do not improve with empirical therapy, or if atypical signs are present — such as irregular or delayed bleeding, heavy menstrual flow, progressive symptom worsening, signs suggestive of endometriosis, infections, or other gynecological disorders — secondary dysmenorrhea should be suspected. In such cases, a thorough pelvic examination is warranted, and additional tests may be considered, including pregnancy testing and screening for sexually transmitted infections. Furthermore, imaging techniques such as transvaginal ultrasound or magnetic resonance imaging (MRI) may be indicated. In adolescent, sexually inactive patients, transabdominal ultrasound is recommended instead of transvaginal ultrasound for comfort reasons [11,12].

Treatment of PD focuses primarily on alleviating pain symptoms. The gold standard includes the use of NSAIDs or hormonal contraception, which reduce prostaglandin synthesis by inhibiting ovulation and endometrial proliferation [13]. Notably, many studies have demonstrated the beneficial effect of physical activity — particularly stretching exercises—on reducing the severity of menstrual pain. Similar outcomes have been reported with the supplementation of certain substances, such as ginger rhizome extract. The aim of this article is to conduct a comparative analysis of existing evidence regarding the efficacy of NSAIDs, physical activity and ginger supplementation in relieving the symptoms of primary dysmenorrhea. These three methods were chosen due to their widespread availability and the fact that they often do not require medical consultation or prescription.

**Research materials and methods**

The aim of this review was to collect, analyze and summarize the current state of knowledge on primary dysmenorrhea, focusing especially on available therapeutic approaches. A comprehensive literature search was conducted using the PubMed database; articles published between 1995 and 2025 were included. Keywords included: "primary dysmenorrhea," "pain," "NSAIDs," "ginger rhizome extract" and "physical activity."

The analysis included randomized controlled trials (RCTs), prospective observational studies, systematic reviews and meta-analyses assessing the impact of NSAIDs, physical exercise and ginger on the intensity and duration of menstrual pain in women with primary dysmenorrhea.

After the search was completed, abstracts were screened for the relevance to the topic of primary dysmenorrhea and its treatment. Full-text articles meeting the inclusion criteria were then subjected to qualitative content analysis.

**Pathophysiology**

The pathophysiology of primary dysmenorrhea involves increased intrauterine secretion of prostaglandins (PGs), particularly PGF2α and PGE2, released from disintegrating endometrial cells. Elevated levels of these prostaglandins trigger excessive uterine muscle contractility. This, in turn, leads to ischemia and hypoxia of the uterine muscle, which are the direct causes of pain [14]. The correlation between peak prostaglandin levels — typically observed within the first 48 hours of menstruation — and the highest intensity of menstrual pain occurring within the first 72 hours of the cycle highlights the key role of these mediators in dysmenorrheic pain [15]. Moreover, there is a positive correlation between the concentration of PGs in menstrual fluid and the severity of pain reported by patients [15].

Prostaglandins also participate in various physiological and pathological processes, such as sleep regulation, thermoregulation, inflammation and pain perception [16]. Another potential contributor to dysmenorrheic pain is increased baseline uterine tone and intrauterine pressure during menstruation. Studies have found higher concentrations of leukotrienes in the menstrual fluid and elevated levels of vasopressin in the blood serum of women suffering from primary dysmenorrhea compared to women without menstrual pain

[2]. However, vasopressin antagonists have not demonstrated a significant effect on menstrual pain, intrauterine pressure, or uterine blood flow [17]. Therefore, due to the limited number of studies and insufficient evidence supporting the role of vasopressin in pain induction, its contribution to the pathophysiology of primary dysmenorrhea remains unclear.

**Selected Treatment Methods for Primary Dysmenorrhea**

1. Nonsteroidal Anti-inflammatory Drugs (NSAIDs)

a) Mechanism of Action in the Management of Menstrual Pain

The analgesic mechanism of NSAIDs is based on the inhibition of cyclooxygenase (COX) enzymes — specifically COX-1 and COX-2. Cyclooxygenase enzymes are responsible for the production of prostaglandins and other prostanoids. The pain-relieving effects of NSAIDs are primarily mediated by the inhibition of COX-2, while the most common side effects, particularly gastrointestinal disturbances, are associated with the inhibition of COX-1 [18].

b) Effect of NSAIDs on Menstrual Pain

The best analgesic effect of NSAIDs is achieved when they are taken at the onset of menstruation, even before the pain actually begins [19]. A meta-analysis that included 35 studies with a total of 4,383 participants demonstrated that drugs such as naproxen, diclofenac, ibuprofen and ketoprofen were significantly more effective in managing menstrual pain than placebo. Among these, ibuprofen and diclofenac showed the strongest analgesic effect. Notably, ibuprofen and ketoprofen had the lowest incidence of adverse effects, whereas diclofenac was more frequently associated with side effects [20]. Although no specific NSAID has shown clear superiority in clinical outcomes, many comparative studies reference mefenamic acid as a comparator, which may indicate its potentially high effectiveness [21]. In clinical practice, naproxen is also frequently used and its twice-daily dosing schedule may be more convenient than ibuprofen, which requires administration every 6 hours [22]. Another review compared the analgesic effect of NSAIDs with that of paracetamol (acetaminophen), a commonly used over-the-counter analgesic. The findings indicated that NSAIDs were more effective in relieving menstrual pain [23,24]. With regard to safety, NSAIDs appear to be well-tolerated among menstruating women, especially when used for short durations of less than 72 hours [25].

2. Physical exercises and stretching

a) Mechanism of Action in the Treatment of Menstrual Pain

Regular physical activity lowers cortisol levels and promotes the synthesis of endorphins and anti-inflammatory cytokines, which in turn reduce the release of prostaglandins (26). β-Endorphin, secreted by hypothalamic neurons and the pituitary gland, affects thermoregulation, the respiratory and cardiovascular systems, as well as mood regulation and pain perception by increasing the pain threshold (27). This mechanism is believed to be responsible for the reduction of pain experienced during menstruation. One of the main advantages of exercise is the absence of adverse side effects.

Connective tissue massage (CTM) involves applying firm pressure to ligaments and subcutaneous tissues and is used in physiotherapy to treat both somatic and visceral disorders. The analgesic mechanism of CTM is believed to rely on the release of enkephalins - endogenous opioids - from the dorsal horn of the spinal cord. These opioids inhibit the transmission of pain signals through small sensory fibers after the stimulus reaches the spinal cord via the sympathetic ganglia (28).

b) The Effect of Physical Exercise on Menstrual Pain

Numerous studies and analyses support the beneficial effect of physical activity not only on general health but also on the reduction of menstrual pain and even premenstrual syndrome symptoms (29, 30, 31). In a prospective observational study, 30 women participated in eight 60-minute sessions held twice a week. The interventions included manual therapy (MT), pelvic floor muscle exercises (PFE) and a combination of both (MT + PFE). Regardless of the protocol used, a reduction in menstrual pain was observed, with the combination of MT and PFE yielding the most favorable results (32). A systematic review encompassing nine studies with a total of 3,129 participants found that multicomponent exercise programs and stretching exercises were the most effective in reducing the intensity of menstrual pain. Promising results regarding CTM were reported in a randomized controlled trial involving 44 women, in which the CTM group experienced a statistically significant reduction in pain compared to the control group (33). Multicomponent exercise programs, which typically combine strength, stretching, and aerobic training, were shown not only to alleviate pain intensity but also to significantly shorten the duration of painful episodes. This effect may be attributable to the strengthening of deep core muscles (34, 35). Preliminary data also suggest that abdominal massage may

serve as a beneficial adjunctive treatment for primary dysmenorrhea. In certain cases, its analgesic effect surpassed that of physical exercise (35). Nonetheless, beyond its pain-relieving effects, physical activity confers additional psychological benefits, including mood enhancement and reduced emotional tension.

3. Ginger

a) Mechanism of Action in the Treatment of Menstrual Pain

The analgesic effect of ginger is most likely associated with its anti-inflammatory properties, particularly its ability to inhibit the activity of enzymes such as cyclooxygenase-2 (COX-2), 5-lipoxygenase (5-LOX) and nuclear factor kappa B (NF-κB) (36). Bioactive compounds found in ginger, such as 10-gingerol and 10-shogaol, have demonstrated the ability to bind to the COX-2 enzyme in a manner similar to nonsteroidal anti-inflammatory drugs (NSAIDs), thereby blocking its enzymatic activity - an effect confirmed through molecular docking studies (37, 38). Due to its dual inhibitory effect on COX-2 and LOX, ginger use does not lead to increased leukotriene production, which is believed to contribute to common NSAID-related side effects such as gastric ulcers and impaired renal function (38).

Notably, ginger also influences molecular mechanisms such as the inhibition of cytokine expression, reduction of reactive oxygen species (ROS), modulation of hormone levels and regulation of cellular signaling pathways. These effects contribute to ginger's broad systemic benefits, including anti-inflammatory, gastroprotective, nephroprotective, hypoglycemic, antidiabetic, antiemetic and antihypertensive properties (39).

b) Effects of Ginger on Menstrual Pain

In a randomized, placebo-controlled trial involving 150 female university students, the administration of 250 mg of powdered ginger during the first three days of the menstrual cycle significantly reduced both the intensity and duration of menstrual pain compared to placebo (40). The greatest analgesic effect was observed during the second month of supplementation. These findings suggest that prolonged use of ginger over 4 to 6 menstrual cycles may enhance its effectiveness, likely due to the cumulative action of its active compounds over time (41). Other studies comparing the effects of 750–2000 mg of ginger powder administered during the first 3–4 days of the menstrual cycle also reported analgesic benefits (42). Across these studies, no adverse effects related to ginger use were observed. Moreover, no significant differences in analgesic efficacy were found between the various doses ranging from 250 to 2000 mg. Further support comes from a study comparing the effects of ginger, mefenamic acid, and ibuprofen. All three interventions demonstrated comparable effectiveness in alleviating the symptoms of primary dysmenorrhea, with no significant differences in onset or duration of action (43).

Beyond its proven analgesic and anti-inflammatory effects, ginger is considered a safe substance with a low incidence of side effects. Only at high oral doses exceeding 6 grams has it been shown to potentially irritate the gastric mucosa. Inhalation of ginger dust has also been associated with IgE-mediated allergic reactions (44).

**Conclusions**

Primary dysmenorrhea (PD) is the most common gynecological condition among women of reproductive age, significantly affecting quality of life, physical activity and social functioning. The pathophysiology of PD is primarily associated with increased intrauterine prostaglandin secretion, which induces excessive uterine muscle contractility, leading to ischemia and pain.

The aim of this study was to conduct a comparative analysis of the effectiveness of three widely accessible treatment approaches for PD: nonsteroidal anti-inflammatory drugs (NSAIDs), physical activity (including stretching exercises and connective tissue massage [CTM]) and ginger supplementation.

A review of the literature indicates that NSAIDs are effective in reducing pain symptoms; however, their use may be associated with adverse effects. Physical exercise — especially multicomponent training — demonstrates analgesic efficacy without side effects, while also improving psychological well-being. Ginger, through its dual inhibition of COX-2 and LOX enzymes and anti-inflammatory properties, represents an effective and well-tolerated therapeutic alternative.

The findings suggest that each of the analyzed methods can effectively alleviate the symptoms of PD. Given their accessibility and favorable safety profiles, physical activity and ginger supplementation in particular warrant broader implementation in the management of primary dysmenorrhea. Nevertheless, further clinical studies are necessary to optimize dosing and to evaluate long-term efficacy and safety.

**Disclosure**
**Author's contributions:**
**Conceptualization:** Jakub Piotrowski, Karolina Kananowicz
**Methodology:** Karolina Kananowicz, Patryk Heryć
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