Review Article

Medicinal plants for the treatment of dysmenorrhea: A review

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Abstract

The agonising disorder known as dysmenorrhea, which is characterized by painful menstruation, affects women all over the world. Due to their apparent efficacy and lack of side effects, traditional and herbal treatments for the management of dysmenorrhea have attracted increasing interest in recent years. The goal of this review is to offer a thorough examination of the most recent scientific research on the use of herbal remedies for the treatment of dysmenorrhea. We thoroughly investigate a wide range of medicinal plants, their active ingredients, their modes of action, and the clinical data demonstrating their effectiveness. This review emphasises the potential of medicinal plants as alternative or complementary options for the management of dysmenorrhea through an in-depth examination of botanical interventions. The dearth of comprehensive clinical trials and disparities in study design, however, highlight the need for more investigation into the safety and effectiveness of these therapies. This study provides a helpful resource for healthcare professionals, researchers, and individuals looking for alternative methods to lessen the burden of dysmenorrhea by highlighting the knowledge gaps now in existence and providing insights into prospective future research areas.

Key words

Dysmenorrhea, Medicinal plants, Bioactive compounds, Mechanism of action, Natural medicine.

Introduction

Numerous women still experience serious health issues related to dysmenorrhea that affect their everyday lives and quality of life. A growing corpus of study is looking into the therapeutic potential of the medicinal plants that have been used traditionally by different cultures to relieve menstrual pain. Dysmenorrhea is the medical term for uncomfortable menstruation as a symptom. There are two broad categories that it falls under: primary and secondary [1]. Dysmenorrhea, whether primary or secondary, can be extremely painful and have a detrimental impact on a woman's quality of life. Elevated prostaglandins (PGs) are the cause of primary dysmenorrhea, which also causes uterine ischemia and pain but no obvious pelvic illness. In addition to uterine diseases such endometriosis and pelvic inflammation, secondary dysmenorrhea has elevated PG levels [2]. A frequent gynaecological complaint is primary or secondary dysmenorrhea, which affects 30 to 60% of women of reproductive age. Of these, 13.5% have severe pain for one to three days throughout their monthly cycle [3].

Dysmenorrhea is a crampy labor-like discomfort in the lower abdomen that spreads to the upper abdomen, waist, and thighs. Systemic symptoms like nausea, vomiting, diarrhoea, headaches, and dizziness can also occasionally accompany dysmenorrhea [4, 5]. There have been varying estimates of the prevalence of dysmenorrhea, ranging from 30 to 85%. According to Loudermilk, between 10 and 18% of persons have severe dysmenorrhea, which has a prevalence of between 50 and 80% [6, 7].

Nonsteroidal anti-inflammatory medications (NSAIDs) and hormone treatments are commonly used in dysmenorrhea therapy [8]. Although these methods can offer relief to a large number of people, they may also have drawbacks in terms of their effectiveness and side effects. Exploring alternative and complementary therapy approaches, such as the use of medicinal plants, has gained popularity in recent years. According to current research, medicinal plants' ability to effectively cure dysmenorrhea may be due to a number of mechanisms, including changes in PGs levels, nitric oxide levels, calcium channel blockage, endorphin upregulation, and microcirculation regulation [9].

Many civilizations have used traditional herbal medicines to treat menstruation pain and discomfort throughout history. Due to their abundant supply of bioactive chemicals, medicinal plants have been utilised for centuries to treat a variety of medical ailments. This has sparked scientific interest in looking into the efficacy of various natural treatments for dysmenorrhea. The goal of this review is to offer a thorough evaluation of the state of our understanding on the use of medicinal plants in the treatment of dysmenorrhea. We want to clarify the numerous medicinal plants and their bioactive components that have been investigated for their potential usefulness in treating dysmenorrhea by methodically analysing the existing literature. We also intend to explore the possible mechanisms of action by which these plant chemicals may exert their effects, offering light on the complex interplay between conventional wisdom and contemporary scientific knowledge.

Bioactive compounds and mechanism of action

Alternative therapeutic modalities are being investigated for the treatment of dysmenorrhea, a common and distressing gynaecological condition marked by painful menstruation. Alkaloids, flavonoids, terpenes, and phenolic compounds, among others, that have been given medical characteristics are among the bioactive compounds found in medicinal plants [10]. These substances have a crucial role in the biological functions displayed by these plants, making them suitable candidates for the treatment of dysmenorrhea. Numerous plant species contain the alkaloid berberine, which exhibits opioid receptor interactions resembling those of morphine-like substances and affects pain perception. On the other hand, flavonoids and polyphenols have strong anti-inflammatory effects by inhibiting pro-inflammatory cytokines and enzymes [11]. The possible mechanism of actions of bioactive compounds derived from medicinal plants along with detailed description for the treatment of dysmenorrhea have been demonstrated in the following table (**Table - 1**).

Table - 1: The possible mechanism of actions of bioactive compounds for the treatment of dysmenorrhea.

Mechanism of action	**Description**
Analgesic and Anti-Inflammatory Effects	The pain and inflammation connected to dysmenorrhea can be significantly reduced by substances with analgesic and anti-inflammatory effects [12]. Bioactive substances' interactions with opioid receptors result in analgesic effects that provide relief from menstrual cramps. By controlling inflammatory pathways, flavonoids and polyphenols reduce prostaglandin synthesis, lessen the inflammatory cascade, and lessen the severity of dysmenorrhea [13].
Uterine Tone Regulation and Muscle Relaxation	It is crucial to relax the smooth muscles in the uterine wall in order to relieve the symptoms of dysmenorrhea [14]. Essential oil, terpene, and flavonoid-rich medicinal plants have demonstrated potential in inducing muscular relaxation, thereby reducing uterine contractions and the pain they cause. These bioactive substances alter intracellular signalling networks and calcium channels, allowing the uterine smooth muscle to relax [15].
Endocrine Balance with hormone regulation	The complex interaction between endocrine balance and hormonal control is crucial to understanding the aetiology of dysmenorrhea [16]. Phytoestrogens are bioactive substances that have estrogenic or anti-estrogenic properties that can affect hormonal changes and possibly lessen menstruation discomfort [17, 18].

	By modulating the hypothalamic-pituitary-adrenal (HPA) axis and so treating stress-induced hormonal imbalances that might exacerbate dysmenorrhea, adaptogens, which can be found in some plants, support hormonal stability.
Cellular Protection and antioxidant Defence	The symptoms of dysmenorrhea are lessened by reducing oxidative stress and cellular damage [19]. Antioxidant-rich medicinal plants, such as those high in vitamins C and E, flavonoids, and polyphenols, act as free radical scavengers, reducing oxidative stress and inflammation [20, 21]. This antioxidative potential offers a defence mechanism against the intensity of symptoms associated with dysmenorrhea.
Central Nervous System Effects via Neurotransmitter Modulation	The analgesic and mood-stabilizing effects of medicinal plants are essential to the management of dysmenorrhea due to their effects on neurotransmitter regulation and the central nervous system (CNS). Specific plant species contain terpenes, alkaloids, and cannabinoids that interact with GABA and serotonin receptors, among others, to affect how pain and emotions are perceived. This neuropharmacological interaction offers a multimodal strategy for reducing discomfort brought on by dysmenorrhea.

Medicinal plants used for the treatment of dysmenorrhea

Zingiberofficinale

Ginger, or *Zingiberofficinale*, has bioactive substances including gingerol and shogaol that have been shown to have anti-inflammatory and analgesic qualities, making it a promising choice for treating the symptoms of dysmenorrhea [22]. The regulation of several molecular pathways involved in pain perception and inflammation is theorised to be the mechanism through which ginger's bioactive components exert analgesic and anti-inflammatory effects [23]. It has been demonstrated that gingerols suppress the enzyme cyclooxygenase-2 (COX-2), which lowers the production of prostaglandins and lessens uterine contractions and accompanying menstrual pain [24, 25]. Additionally, the antioxidative potential of ginger components helps to reduce oxidative stress linked to dysmenorrhea and modulate pain pathways. For relief from dysmenorrhea, ginger can be taken by boiling it in water and drinking the resulting liquid at least three times each day. Ginger is one of the natural therapies for dysmenorrhea since studies and clinical trials by Iranian researchers Ozgoli, et al. have shown that it has the same pain-killing properties as ibuprofen or mefenamic acid [26].

Foeniculumvulgare

Fennel, or *Foeniculumvulgare*, contains bioactive substances, such as anethole [27], that have spasmolytic and analgesic qualities, making it a strong choice for treating the symptoms of dysmenorrhea [28, 29]. The bioactive components of fennel are thought to have spasmolytic and analgesic properties due to their capacity to adjust uterine contractions and lessen smooth muscle spasms. It is thought that anethole, a key ingredient in fennel's essential oil, contributes to these outcomes by affecting calcium fluxes and ion channels, ultimately resulting in uterine muscle relaxation and a decrease in menstruation pain. Additionally, fennel may have the ability to lessen discomfort brought on by dysmenorrhea due to its anti-inflammatory qualities [30]. In a 2015 study published in the Iranian Journal of Nursing and Midwifery Research, it was discovered that fennel and vitagnus both had a stronger impact than mefenamic acid after two days of intervention on 105 women with primary dysmenorrhoea [31].

Matricariachamomilla

Matricariachamomilla, sometimes known as chamomile, may have therapeutic benefits such as anti-inflammatory, stress reliever and anti-

axiety activity used for treating the symptoms of dysmenorrhea [32]. Numerous bioactive substances found in chamomile, such as chamazulene and flavonoids, are thought to be responsible for the herb's anti-inflammatory and muscle-relaxing effects [33]. These characteristics make chamomile a viable option for reducing pain and discomfort brought on by dysmenorrhea. The bioactive chemicals in chamomile have anti-inflammatory properties that may help lower the release of prostaglandins and other inflammatory mediators linked to menstrual cramps, resulting in fewer uterine contractions and, as a result, less pain-inducing sensations. *M. Chamomoilla* demonstrated a higher rate of improvement in dysmenorrhea than a placebo in two studies [34, 35]. There are several ways to ingest chamomile, including tea or extract. The best way to consume chamomile during menstruation is as a tea [36]. Although dosage and administration may differ, research has frequently employed doses of chamomile extract capsules or 1 to 3 cups of chamomile tea each day. Before using chamomile in their regimen, people should speak with a doctor, especially if they have sensitivities to plants in the Asteraceae family or are taking drugs that might interact with chamomile.

MenthaPiperita

Peppermint, or *Menthapiperita*, includes bioactive substances, notably menthol, which has been shown to have analgesic and muscle-relaxant qualities effects in alleviating dysmenorrhea symptoms [37]. These qualities make peppermint a strong contender for easing pain and discomfort brought on by dysmenorrhea. Menthol's muscle-relaxant properties, which may lessen uterine contractions responsible for menstrual cramps, are a result of its capacity to alter calcium channels in smooth muscle cells. There are several ways to consume peppermint, including tea, pills, or aromatherapy. Although dosage and delivery may differ, studies have frequently used dosages of diluted essential oils or 0.2 to 0.4 mL of peppermint oil in capsule form for aromatherapy. Before using peppermint, like with any herbal medicine, people should seek medical advice, especially if they have menthol allergies or are taking medications that might interfere with peppermint.

ValerianaOfficinalis

The herb valerian, or *Valerianaofficinalis,* has drawn interest due to its possible medicinal benefits in treating the symptoms of dysmenorrhea. Bioactive substances found in valerian, such as valtrate and valrenic acid, are thought to be responsible for the herb's analgesic and muscle-relaxing effects. These characteristics make valerian a possible contender for easing the discomfort and uterine contractions related to dysmenorrhea. The central nervous system's GABA receptors are involved in the action of valerian, which interacts with them to induce relaxation and maybe pain alleviation [38]. No adverse effects or hypersensitivity reactions were reported in clinical studies, so valerian officinalis is safe to use during pregnancy and breastfeeding and is classified by the Food and Drug Administration as a safe drug. Valerian is frequently given in teas or capsules containing valerian root extract. Although dosage and administration may differ, studies typically used dosages of valerian root extract ranging from 150 to 300 mg daily. It is advised that people get medical advice before using valerian, particularly if they are using drugs that could interact with valerian as it may intensify the effects of sedatives.

Curcuma longa

Turmeric, also known as *curcuma longa*, has gained attention as a potential treatment for dysmenorrhea symptoms. Curcumin, a bioactive component found in turmeric, has been shown to have analgesic and anti-inflammatory effects [39]. These characteristics make turmeric an intriguing possibility for reducing pain and suffering brought on by dysmenorrhea. The manipulation of several signalling pathways, including the suppression of cyclooxygenase-2

(COX-2) and the reduction of prostaglandin production—both of which are essential for the onset of menstrual cramps - accomplishes curcumin's anti-inflammatory effects [40-43]. Clinical research has looked into turmeric's potential for treating dysmenorrhea. In a randomised, double-blind, placebo-controlled experiment, it was found that women with primary dysmenorrhea who took curcumin supplements experienced much less pain and higher quality of life. Turmeric can be ingested in a number of ways, such as as a spice, a dietary supplement, or in the form of capsules containing curcumin extract. Approximately 2.5 g/day of are believed to be consumed by diet [44]. Up to 12 g of turmeric per day may be eaten safely, according to several researches [45]. Before using turmeric or curcumin in their regimen, people are recommended to speak with healthcare specialists, especially if they are taking drugs that may interact with curcumin. When used in moderation, turmeric is usually regarded as safe for the majority of people. However, before using turmeric as a cure, anyone with gallbladder issues or those using blood-thinning drugs should use caution and consult a doctor.

Angelica sinensis

Angelica sinensis, often known as Dong Quai, has become renowned as a viable natural treatment for treating the symptoms of dysmenorrhea [46]. Bioactive substances found in angelica sinensis, such as ligustilide and ferulic acid, are thought to contribute to the herb's possible analgesic and muscle-relaxant effects. These characteristics make Dong Quai an appealing possibility for reducing pain and suffering brought on by dysmenorrhea. Particularly, liggustilide has been demonstrated to have anti-inflammatory effects and may lessen the force of uterine contractions that cause menstrual cramps [47]. There are many ways to consume angelica sinensis, either as a nutritional supplement or as conventional herbal remedies. Although dosage and administration may differ, research typically employed daily doses of 1 to 3 grammes of Dong Quai root. Before adding Angelica sinensis to their regimen, people are encouraged to speak with a doctor, especially if they are using drugs that could interfere with the herb. When used in moderation, angelica sinensis is usually regarded as safe for the majority of people. However, some people may encounter modest side effects including gastrointestinal pain, like with any herbal therapy. Further research is needed to determine the effectiveness and safety of Angelica sinensis over the long term, particularly in the treatment of dysmenorrhea.

Salvia officinalis

The *Salvia officinalis*, commonly referred to as sage, for its possible therapeutic effects used in treating the symptoms of dysmenorrhea is the result of the search for natural therapies. Rosmarinic acid and flavonoids, two bioactive substances found in Salvia officinalis, have anti-inflammatory and analgesic activities. Sage is an intriguing contender for reducing pain and suffering brought on by dysmenorrhea because of these qualities. Particularly, rosmarinic acid has been demonstrated to control inflammatory pathways and may lessen uterine contractions related to menstruation cramps [48].

Conclusion

A comprehensive strategy for managing dysmenorrhea is necessary due to its complexity. Due to their potential to deliver treatment with fewer side effects, medicinal plants present a tantalising opportunity to improve the current therapeutic environment. However, care is advised because more research is needed to determine how to standardise plant extracts, determine dosages, and determine long-term safety profiles. Collaboration between traditional wisdom and contemporary scientific study holds potential in furthering our understanding of dysmenorrhea and its treatment as the area of natural therapies continues to develop. The potential of medicinal plants as supplemental

treatments or alternative options for the management of dysmenorrhea is clarified by this review's findings. It offers a foundation upon which future studies might build to unleash the full therapeutic potential of nature's pharmacopoeia by integrating current knowledge and identifying research gaps. Harnessing the potential of medicinal plants may provide a road towards more thorough and individualized approaches to addressing the numerous issues offered by dysmenorrhea as women's health and well-being take centre stage.

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