A Wholistic Approach to Non-Pharmacological Intervention for Primary Dysmenorrhea

Article *in* Current Women s Health Reviews · January 2023

DOI: 10.2174/1573404819666230109105829

5 authors, including:

Pranay Wal
Pranveer Singh Institute of Technology
242 PUBLICATIONS **930** CITATIONS
SEE PROFILE

Divyanshi Gupta
Pranveer Singh Institute of Technology
11 PUBLICATIONS **6** CITATIONS
SEE PROFILE

Ankita Wal
Pranveer Singh Institute of Technology
181 PUBLICATIONS **674** CITATIONS
SEE PROFILE

MINI REVIEW ARTICLE

A Wholistic Approach to Non-Pharmacological Intervention for Primary Dysmenorrhea

Pranay Wal[1], Divyanshi Gupta[1], Ankita Wal[1,*], Shiv Shankar Pandey[2] and Karthickeyan Krishnan[3]

[1]*Pranveer Singh Institute of Technology (pharmacy) Kanpur;* [2]*Tahira Institute of Medical Sciences GIDA Gorakhpur;* [3]*Department of Pharmacology, School of Pharmaceutical Sciences, Vels Institute of Science, Technology and Advanced Studies (VISTAS), Pallavaram, Chennai- 600117, Tamil Nadu, India*

ARTICLE HISTORY

Received: July 28, 2022
Revised: November 07, 2022
Accepted: November 10, 2022

DOI:
10.2174/1573404819666230109105829

Abstract: ***Background*:** Primary dysmenorrhea is a prevalent complaint among women nowadays. Primary dysmenorrhea is a painful disorder that occurs during the menstrual cycle. It is described as unpleasant menstrual cramps or period discomfort that occurs without the presence of any pelvic illness. Primary dysmenorrhea is one of the most common causes of absence from school, work, and social activities. It has an impact on women's daily quality of life.

***Objective*:** To investigate the efficacy and safety of non-pharmacological treatments for women suffering from primary dysmenorrhea.

***Methods*:** We looked up information on gynaecology in the Cochrane library, PubMed, ScienceDirect, and other databases. We looked at multiple clinical trial databases from the year before as well as systematic reviews that had been done before.

***Result*:** As per qualitative assessment, non-pharmacological management for primary dysmenorrhea is extremely effective and wonderful for overall health. Primary dysmenorrhea can be treated with any of the approaches outlined in this study.

***Conclusion*:** The study revealed that non-pharmacological approaches, such as yoga, physical activity, heat treatment, massage therapy, water therapy, dietary supplements, acupressure, aromatherapy, massage therapy, and other non-invasive techniques, have a significant role in the management of dysmenorrhoea. It was observed that women who engage in regular physical activity do not experience severe dysmenorrhea. Additionally, it was discovered in this study that dietary nutrients like vitamin D and other nutraceuticals ameliorate the symptoms of dysmenorrhea.

Keywords: Dysmenorrhea therapy, "dysmenorrhea, prevention", "yoga", "acupressure, standards", "trigger points, blood supply", "extracorporeal, shockwave therapy".

1. INTRODUCTION

Dysmenorrhea is a combination of the ancient Greek terms "Dys" and "menorrhea," with Dys referring to something unpleasant or painful and menorrhea referring to menstruation [1]. Dysmenorrhea is a condition characterized by painful monthly bleeding throughout the menstrual cycle, as well as pain in the lower abdomen and unpleasant menstrual cramps. Primary Dysmenorrhea and Secondary Dysmenorrhea are the two types of dysmenorrhea. Pain in the lower abdomen that is not caused by a disease or pathology is known as primary dysmenorrhea. Prostaglandin F (PGF) is a prominent cause of pain in primary dysmenorrhea. Endometrial cells create PGF during endometrial shedding, which occurs at the start of menstruation. Uterine contractions are caused by prostaglandin (PG), and the strength of the cramps is proportional to the number of PGs generated following sloughing. Due to a decline in hormone surge, the process began, resulting in pain or monthly cramps [2, 3]. Secondary dysmenorrhea, on the other hand, is commonly associated with other disorders within or outside the uterus. In secondary dysmenorrhea, menstrual pain can be caused by an underlying sickness, ailment, or anatomical abnormalities inside or outside the uterus. Endometriosis, fibroids (endometriomas), adenomyosis, endometrial polyps, pelvic inflammatory disease, and maybe even using an intrauterine contraceptive device can cause secondary dysmenorrhea.

Eighty percent of adolescent females are affected by dysmenorrhea. Depending on the girl's health, primary dysmenorrhea discomfort might range from mild to severe. Most women with primary dysmenorrhea have stomach pain, pelvic pain, thigh pain, bloating, nausea, diarrhea, headaches, and pain in the lower back [4].

Dysmenorrhea is induced by tissue ischemia, which is produced by increased intrauterine pressure, vascular con-

*Address correspondence to this author at the Pranveer Singh Institute of Technology (pharmacy) Kanpur; Tel/Fax: ????????????????;
E-mail: walankita@gmail.com

striction, and decreased uterine blood flow, as seen in (Fig. **1**). The cyclooxygenase (COX) pathway produces prostaglandins (PGs), which are created from arachidonic acid and play a key role in dysmenorrhea. Nitric oxide, vasopressin, calcium, inflammation, and oxidative damage are all involved in the process. Prostaglandins are the main cause of menstrual pain. Under the influence of progesterone, which is generated in the ovary during the secretory phase of the cycle, these are synthesized in the endometrium. The endometrium breaks it down.

During menstruation, the myometrium makes and spreads prostaglandins. This is why prostaglandins are made and spread. They cause crampy menstrual discomfort in the myometrium by inducing twitching myometrial movements [5, 6].

2. NON-PHARMACOLOGICAL INTERVENTION IN PRIMARY DYSMENORRHEA

Non-pharmacological interventions aided in the early and middle stages of treatment and prevented disease onset during late dysmenorrhea presentations. The use of these strategies was examined in numerous research studies, including those that measured vitamin D levels through resistance training, lipid profiles using the photometric method, and physical exercise using the Standing Seat Test, lower limb muscle strength tests, static and dynamic balance assessments, and physical flexibility tests. Several studies employed anthropometric measurements to determine three indicators: body height, body weight, and BMI. The Stork test was used to measure static equilibrium for water therapy. As part of the Vienna Test System, which is a computerized psychological test used to study psychometric performance, many women with dysmenorrhea go through heat treatment testing.

3. THE ROLE AND IMPACT OF EXERCISE THERAPY

Regular physical activity is one of the most important things you can do for your health. Physical activity can help you maintain a healthy weight, reduce your risk of disease, strengthen your bones and muscles, and improve your ability to do daily chores. Adults who sit less and exercise moderately or vigorously improve their health. Physical activity is one of the few lifestyle choices that may have such a big impact on your health. People who exercise on a daily basis can better manage their chronic diseases and disabilities. For adults with arthritis, for example, regular physical activity can help to decrease pain and enhance function, mood, and quality of life. They can also aid in blood sugar regulation and reduce the risk of heart disease.

Exercise has been advised as a therapy for primary dysmenorrhoea (painful mensuration or menstrual cramps), but the evidence supporting its effectiveness for primary dysmenorrhoea is conflicting. It was found that physical exercise reduces prostaglandin levels, which results in a relief of pain [7]. Regular exercise, on the other hand, aids in stress reduction by raising blood circulation and endorphin and nerve transmitter levels. Dysmenorrhea reduces blood supply to the uterus as a result. Stress inhibition is one of the most prominent causes of the link between exercise and menstruation [8]. The majority of studies discovered that physical exercise reduces pain intensity during menstruation and aids in the treatment of dysmenorrhea [9]. According to the evidence, women who exercise frequently have fewer negative emotional and physical symptoms during the menstrual cycle. Menstrual cycle issues and dysmenorrhea can be exacerbated by emotional and behavioral issues. The negative effects of dysmenorrhea on the psychological state may have an impact on the health-related quality of life (HRQoL) of young women. Exercise is an important part of many women's everyday routines nowadays. Women who exercise regularly and modestly have various health benefits, as illustrated in (Fig. **2**). Exercise can help with cardiovascular health, bone mineral density, dysmenorrhea, and premenstrual syndrome symptoms [10, 11].

In a study, it was discovered that regular exercise lowers leptin secretion and adipose tissue mass, which helps ease of primary dysmenorrhea. And outdoor activity is also crucial for health, as are different vitamin D dosages, body composition, and baseline vitamin D status [12]. Additionally, it's crucial to exercise for 30 minutes every morning in the sun since sunshine affects vitamin D levels. A study also showed that jogging is a physiological requirement. The main goal of jogging is to improve balance, strength, and flexibility through exercises [13].

Due to the belief that dysmenorrhea is strongly related to women who are underweight or overweight, physical activity is especially crucial for these groups of women. It was found in a study that dysmenorrhea is highly associated with physiological changes in women like slowed metabolism, less physical exercise, and hormonal imbalance that give rise to abdominal obesity [15]. Obesity, overweight, dyslipidemia, arterial stiffness, and decreased cardiorespiratory capacity are all correlated with a loss of muscle strength and endurance [14]. Managing body weight helps in the management of abdominal obesity and pelvic obesity.

4. YOGA THERAPY

Yoga is gaining popularity throughout the globe. It is a godsend to the sick, and it is the fashion of the day to keep one's everyday health and attractiveness. Because some individuals use it to increase memory, intellect, and creativity, it is becoming a part of schooling [16]. Yoga is an ancient Indian exercise and meditation technique that dates back at least 2000–4000 years. There are several forms of yoga, each with their own unique set of techniques, but all with the same objective of mind and bodily control [17]. Many types include long-held postures (asanas), as well as controlled breathing techniques (pranayama) and meditation. Yoga attempts to help the body, mind, and breath evolve and integrate in order to attain structural, physiological, and psychological benefits [18]. The development of a pain-free, robust, and flexible body, a balanced autonomic nervous system that allows all physiological systems to function properly, and a serene, clear, and tranquil mind, in particular [19].

As of late 2002, yoga was increasingly being recommended for dysmenorrhea [20], premenstrual syndrome, and other diseases. Yoga incorporates breathing methods that calm the body, which can help relieve tension associated

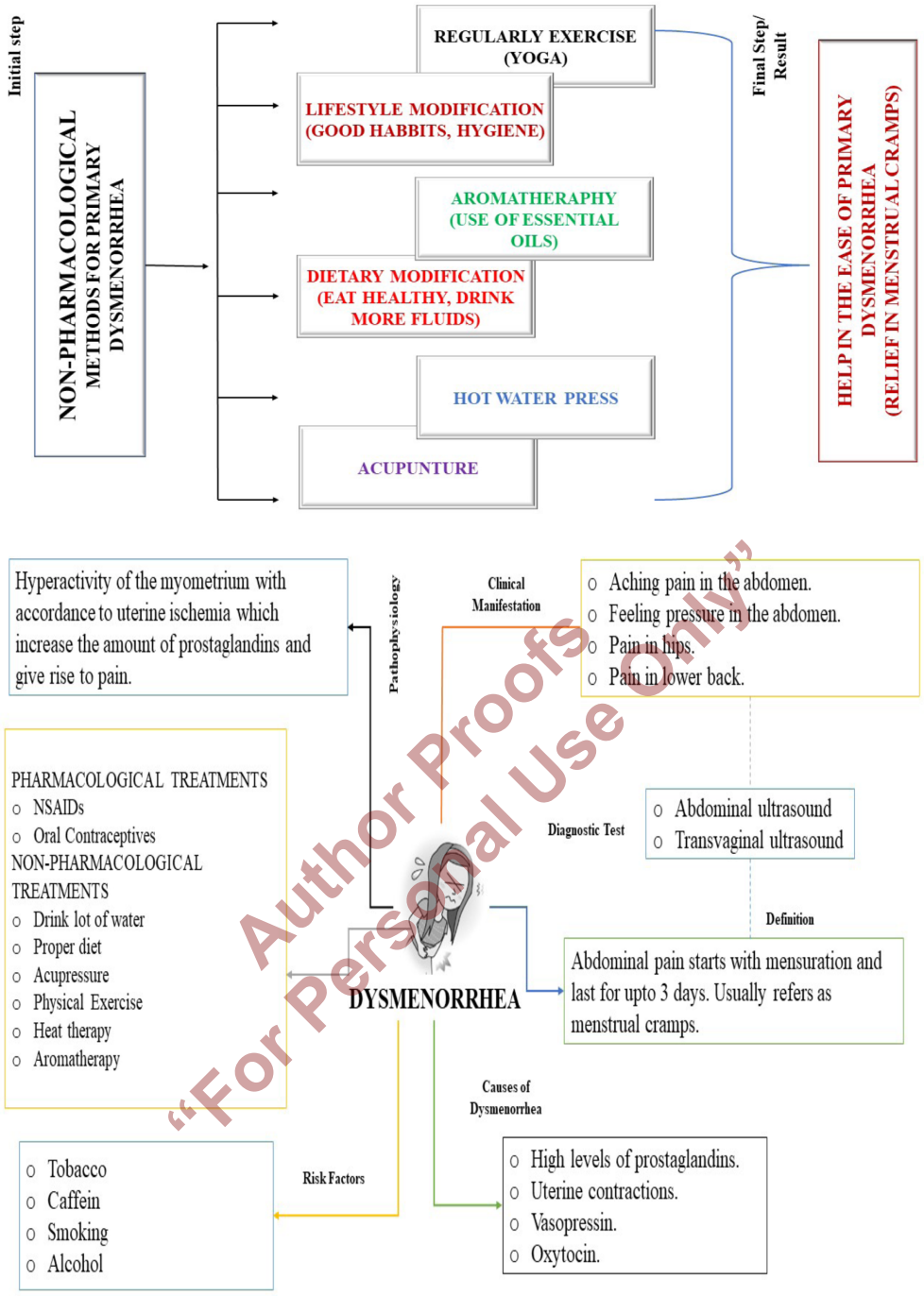


Fig. (1). Detailing about primary dysmenorrhea including its pathophysiology, clinical manifestation, causes, risk factor followed by diagnostic test. (*A higher resolution / colour version of this figure is available in the electronic copy of the article*).

with menstruation. Yoga enhances body flexibility and muscular suppleness, which aids in the elimination of discomfort caused by menstrual cramps and other reasons. Yoga is beneficial to one's health. Yoga encourages women to accept life's unavoidable changes rather than focus too much on the problem. Yoga helps improve blood circulation since it is a physical breathing activity. As a consequence, the menstrual cycle will no longer be an issue, reducing discomfort [21]. Table **2** shows a number of yoga poses that can help with cramps and other problems related to having your period.

5. HEAT THERAPY

Heat is a common treatment for dysmenorrhea. About 37–50% of women who have pain during their periods use heat to feel better. As proven, giving topical heat to women with dysmenorrhea can help to relieve muscle spasms by lowering muscular tension and relaxing abdominal muscles. Heat enhances pelvic blood circulation, which aids in the removal of localized blood and body fluid retention, reduces congestion and edema, and relieves nerve compression discomfort. Heat applied to the skin in the form of hot water bags, towels, or bottles has long been used to treat menstrual

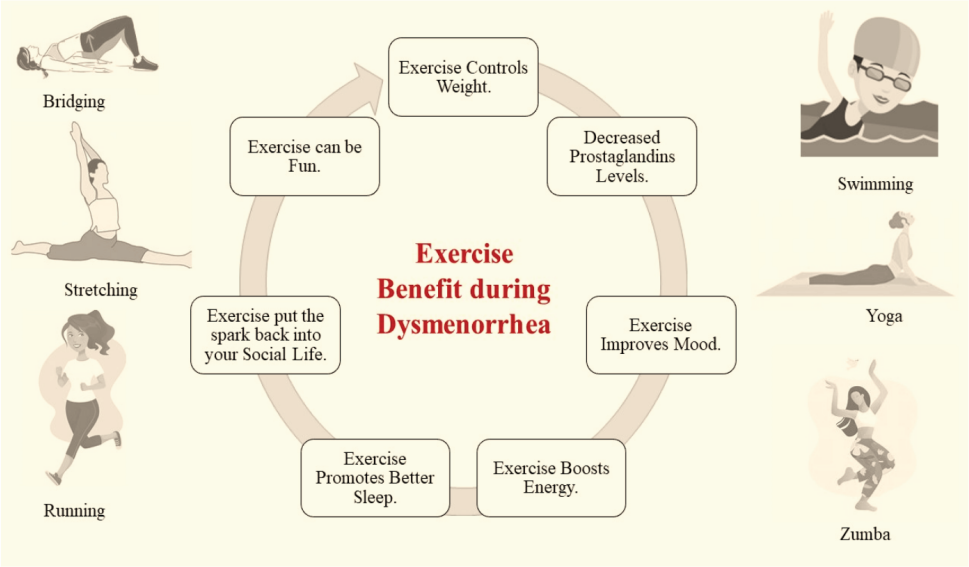


Fig. (2). Different exercise that have beneficial effects on primary dysmenorrhea. (*A higher resolution / colour version of this figure is available in the electronic copy of the article*).

Table 1. Different physical exercise along with their description for primary dysmenorrhea.

S. No.	Physical Exercise	Description	Duration	Ref.
1.	Aerobic Exercise	Studied 12 trial with 856 women and performed meta-analysis on 754 women who regularly does physical exercise results that aerobic exercise decrease the intensity of dysmenorrhea.	30 minutes (4-5 days/week)	[31,32]
2.	Zumba	It helps in reducing the pain during mensuration and reduces stress.	-	[32]
3.	Stretching	Not only can exercise help with dysmenorrhea, but it also helps to lessen the need for medicine to regulate period cramps and other symptoms.	10-25 minutes (2-3 days/week)	[33]
4.	Running and jogging	It was found in a study that running and jogging helps in the treatment of muscle pain and relieving relax from other dysmenorrhea symptoms. Primary outcome of exercise may be not effective much but secondary outcomes	30 minutes (Daily or 6 days/week)	[34]
5.	Swimming	It was found during study that swimming decreases the severity of dysmenorrhea, also help in reducing bloating during mensuration.	50-80 minutes (5days/week)	[35,36]

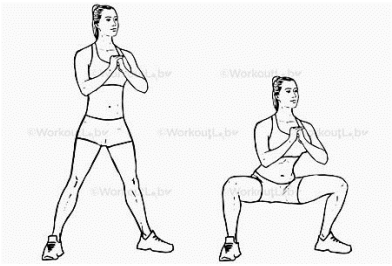
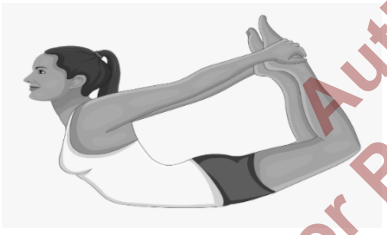
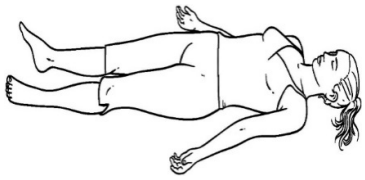
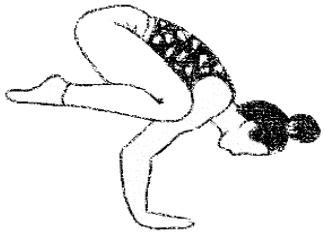
pain. Surface heat in the range of 40–45 °C is effective up to a depth of about 1 cm at the application point [22-37]. Deep heat is exemplified by shortwave and microwave diathermy.

For example, shortwave and microwave diathermy can reach and treat deeper structures at depths of 2–5 cm. Deep heat also has an effect on deeper tissues and organs, altering circulation and metabolism. After a thorough investigation, it was found that heat treatment helps women with primary dysmenorrhea who have pain during their periods. Heat has fewer adverse effects than typical drugs, but it's uncertain if this translates to long-term therapeutic benefits. Despite these hopeful findings, they should be interpreted with caution because they are based on a small number of studies with uncertain selection bias [38, 39]. Suppose the safety and efficacy of heat therapy for the treatment of dysmenorrhea can be established in the short and long term. In that case, it has the potential to become a first-line non-pharmacologic therapy for lowering menstrual pain in women with primary dysmenorrhea, particularly for those who are unable to use NSAIDS. It is important to compare the short-term and long-term effects of different heating methods with other general treatments, as well as how much they cost [40, 41]. They are used for heat therapy, shown in Fig. (**3**).

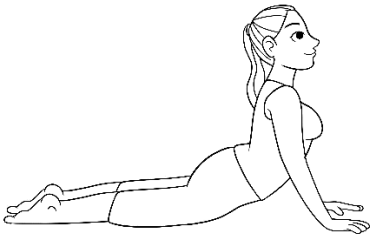
6. MASSAGE THERAPY

Massage therapy is the process of relaxation of muscles. During mensuration, massage therapy involves pressing specific points and moving hands around your abdomen, side, and back. Endometriosis-related menstrual discomfort can be lessened with a massage treatment. Massage therapy

Table 2. Different toga posses for primary dysmenorrhea along with their description.

S. No.	Yoga Aasen	Description	Ref.
1.	Wide squat pose (Malasana Yoga) 	This yoga position is commonly used to relieve discomfort in the lower back and ankles. This yoga stance calms the stomach and relieves menstruation pains. In this yoga stance, you must stretch your thigh as far as possible. This stance should be repeated 4-5 times.	[22]
2.	Pigeon pose (Eka Pada Rajakapotasana) 	Pigeon stance extends the thighs, pelvis, back, piriformis, and psoas muscles. It's wonderful for improving blood flow and strengthening the lower back, muscles, and pelvic region. In this position, the psoas and other hip flexors are stretched by extending the leg to the back. On the other hand, the rotators and outer hip are extended. It's a fantastic way to break up lengthy periods of sitting. It prepares you for backbends and seated positions. During studies, this stance was discovered to relax the mind and body while also relieving stress.	[23, 24]
3.	Bow pose (Dhanurasana) 	Dhanurasana is a yoga pose that is frequently used to alleviate period discomfort. The muscles in the spine, ankles, and thighs are all strengthened. By improving blood flow to your abdominal organs, especially the uterus. It also aids in the relief of period symptoms throughout your next period. Daily practise of this position relieves menstrual pain and rejuvenates the reproductive system. Although asanas are not suggested during menstruation, daily dhanurasana practise may aid with cramps.	[25, 26]
4.	Corpse Pose (Shavasana) 	In this position, the body components are progressively stretched and muscles are relaxed, promoting entire body relaxation.	[27]
5.	frog poses 	This position opens the hip joints, relieves knee discomfort, strengthens the back, and improves posture, as well as stimulating the digestive and circulatory systems, improving circulation, and reducing menstrual cramps. It can be used to cure hypertension, hyperlipidemia, severe headaches, bronchitis, difficulty breathing, aching joints, diarrhea, diabetes, menopausal, sclerosis, peripheral arterial disease, carpal tunnel syndrome, and other serious diseases. It can also be utilised to help with stress relief and relaxation.	[28]

(Table 2) contd….

S. No.	Yoga Aasen	Description	Ref.
6.	Hatha yoga 	This pose focuses on physical purification, development, and self-transformation. It consists of a series of asanas (postures) that assist to enhance mental and physical well-being, with an emphasis on keeping the spine supple and healthy, boosting circulation, and letting the mind to focus and become distraction-free for lengthy periods of meditation, as well as pranayama (breathing exercises) (breath control). It's a sophisticated system of over 200 physical postures, movements, and breathing techniques aimed at re-establishing the body's natural equilibrium.	[28]
7.	Cobra Pose (Bhujangasana) 	It is a strong backward bending asana in Hatha Yoga that is good for persons who suffer from lower back pain. This position relieves lower back tightness, expands the chest, and strengthens the arms and shoulders. This asana can also aid with menstruation irregularities and stress relief. It has a long list of advantages that affect all of the body's systems. It helps to relieve gynaecological problems including leucorrhea, dysmenorrhea, and amenorrhea in women by toning the ovaries and uterus.	[29]
8.	Hero's pose (Adho mukha Virasana) 	It energizes our body and might simply assist in keeping a positive outlook on life. This asana can assist you in achieving complete calm and balance. The digestive system is calmed when performing this asana. It can also help with headaches, back pain, and other health issues. this Yoga's offers a number of benefits, one of which is that it can help with irregular periods. It helps the reproductive organs function better by stretching abdominal muscles.	[30]

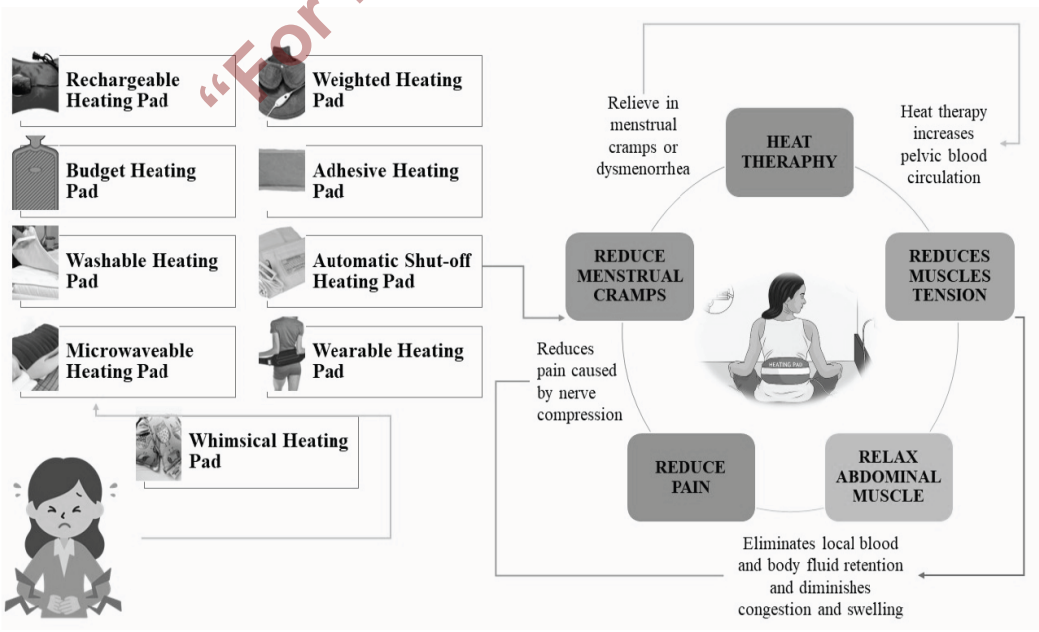


Fig. (3). Heat therapy. (*A higher resolution / colour version of this figure is available in the electronic copy of the article*).

is a low-cost treatment option that may be used in medicine to help endometriosis patients feel less discomfort. It could also be considered an effective supplemental treatment [42]. Massage treatment lessens pelvic discomfort, cervix adhesion, and uterine spasms. It has been proven that both massage and aromatherapy help lessen menstrual discomfort. Lavender, peppermint, rose, and fennel are a few essential oils that might be of assistance.

7. FLUID INTAKE/ WATER THERAPY

Dehydration affects 16% to 28% of adults [43], with water being the most popular beverage among those over the age of six. Iran's average daily liquid intake, including water, is 1.7 and 1.9 liters for men and women, respectively. Adults aged 20–54 years consume an average of 1307 mL of water each day. For senior citizens in France, this quantity is 1198 mL/day, whereas in the United States, it is 3563 mL/day [44]. Human water requirements should not be based on a 'minimal' consumption level since this might result in a shortage and perhaps bad performance and health results. According to many studies, drinking at least 8 glasses of water daily is helpful because water may help you get rid of pollutants and improve your health. However, little study has been done on how water consumption impacts dysmenorrhea and menstrual characteristics [12].

According to multiple studies, drinking 1600–2000 ml of water daily and consistently reduces the severity of primary dysmenorrhea, shortens menstrual flow, and reduces the average number of pharmaceutical pain relievers used during menstruation. According to pain theory [45], pain is organized into a cyclic pattern that includes pain/tension/fear/pain. Drinking more water tends to help minimize uterine contractions, relieve tension and fear, and serve as a natural analgesic in the body since it lowers vasopressin levels. Drinking the recommended amount of water after intervention decreased dysmenorrhea and pelvic pain. Also, during the second cycle of intervention, there was a big drop in menstrual pain [46, 47].

8. DIETARY SUPPLEMENTS AND NUTRACEUTICALS

A number of natural minerals are used to treat a wide range of diseases. These nutrients have the ability to help people recover from diseases and maintain their health. Since the beginning of time, raw plant compounds such as turmeric and ginger have been used to treat pain. Today, scientists are doing a lot of research on these nutrients in order to make dietary supplements that people can use every day. There are a few nutrients that have been related to menstrual pain treatment as well. These herbs are supposed to act by decreasing inflammatory chemicals and hormones that induce menstrual discomfort. Vitamin A, vitamin D [12], vitamin B1, iron, manganese, and calcium are active principles found in a variety of nutritious herbs, including coriander, as well as green leafy vegetables, which help in the management of primary dysmenorrhea (shown in Fig. **4**). Vitamin A, vitamin D, vitamin B1, iron, manganese, and calcium are all active ingredients that can be found in nutritional herbs and green leafy vegetables like coriander. These ingredients can help treat menstrual problems.

The frequent use of nutraceuticals and multivitamins has reduced the incidence of dysmenorrhea-related pain. Multivitamins and a well-balanced, well-nutritional diet can help women maintain their health while also providing therapeutic benefits during menstruation. In the treatment of dys-

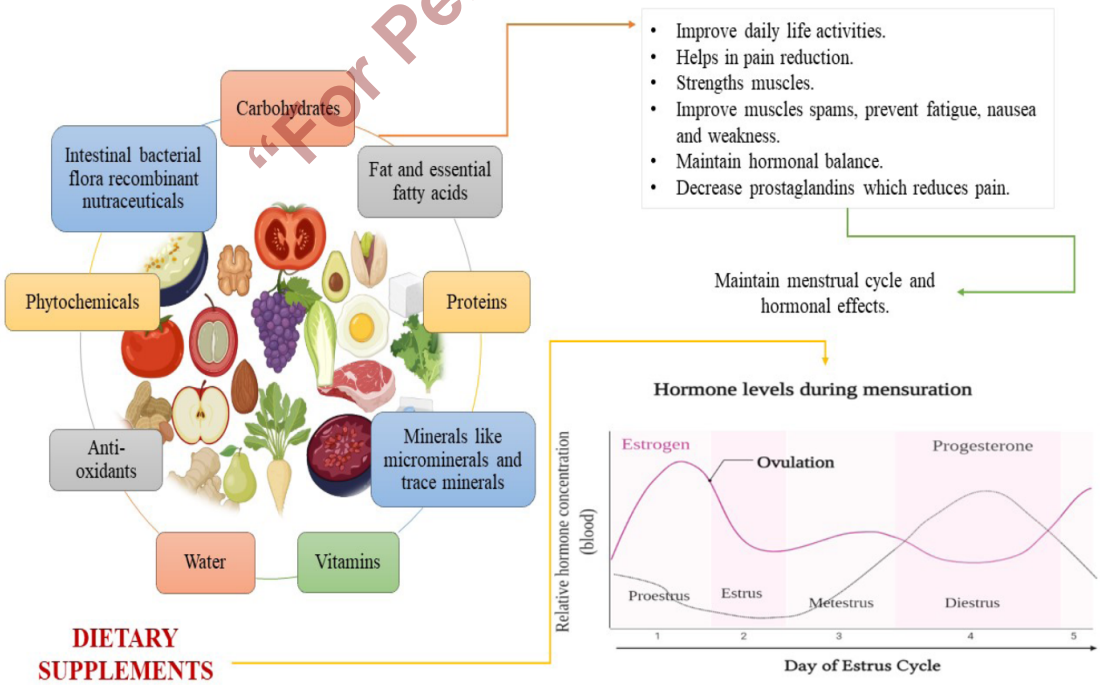


Fig. (4). Different dietary supplement maintain hormonal level during mensuration and ease in the discomfort during primary dysmenorrhea. (*A higher resolution / colour version of this figure is available in the electronic copy of the article*).

menorrhoea, a variety of herbs and nutritional supplements might be helpful. In one study, the anti-spasmodic and anti-inflammatory effects of several therapeutic plants were revealed, including ginger and turmeric. By stopping or slowing down the production of prostaglandins, these herbs help reduce inflammation and spasms in muscles [48].

Due to restricted uterine blood flow, low calcium levels cause uterine muscle contractions to increase, causing pain. Low vitamin D levels may further aggravate primary dysmenorrhea by increasing prostaglandin production and decreasing intestinal calcium absorption. As a result, supplementing with vitamin D and calcium may help to minimize the severity of primary dysmenorrhea and the use of analgesics. Increased vitamin D and calcium deficiency are inversely related to the severity of primary dysmenorrhea, and increasing vitamin D and calcium intake can help reduce primary dysmenorrhea and its associated systemic symptoms. As a result, calcium and vitamin D supplements may be recommended to aid in the treatment of dysmenorrhea [49]. Many investigations have discovered that different kinds of micronutrients [vitamins] have distinct effects, and minerals (calc, mg, zinc sulfate, and boron) may help relieve the symptoms of primary dysmenorrhea. In this study, vitamin E was linked to the most articles in both the vitamin group (25%) and the minerals group (zinc) [50, 51].

9. ACUPUNCTURE

Acupuncture is a type of Chinese medicine based on the theory that a blockage or disruption in the body's life energy, or qi, can cause health issues. Acupuncturists insert small needles into certain points throughout the body by acupuncturists to balance the body's energy, induce healing, and promote relaxation. Acupuncture may cause the body's natural analgesics, endorphins, to be released, as well as change the autonomic nervous system, with needle placement altering breathing, blood pressure, and heart rate [52]. As the acupuncture needle is placed, you may experience a minor sting, pinch, soreness, or pain. Some acupuncturists reposition the needle after it has been inserted into the body, causing further pressure. You may get a tingling or heavy sensation known as "de qi" after the needle has been successfully inserted [53].

According to the Smith AC study, acupuncture reduced menstrual mood symptoms in women with primary dysmenorrhea throughout the treatment phase. However, the trend in symptom improvement during the active period of therapy, as well as after 6 and 12 months, was non-significant, implying that acupuncture may have a moderate dysmenorrhea therapeutic impact [54]. Acupuncture-related therapies may have anti-inflammatory properties that help with menstrual pain relief. When progesterone levels are low, leukotrienes (LTs), cytokines, chemokines, and matrix metalloproteinases (MMPs) all increase [55, 56]. Inflammatory factors increase leukocyte recruitment and activation, aggravating inflammation and uterine hypoxia and ischemia while also increasing menstrual pain in a vicious cycle. As shown in Fig. (**5**), acupuncture may stop the release of PGs and inflammatory cytokines by changing the nuclear factor-B (NF-B) signaling pathway. This reduces the inflammatory environment in the uterus as well as uterine ischemia and hypoxia [57, 58]. Some studies have shown that interactions

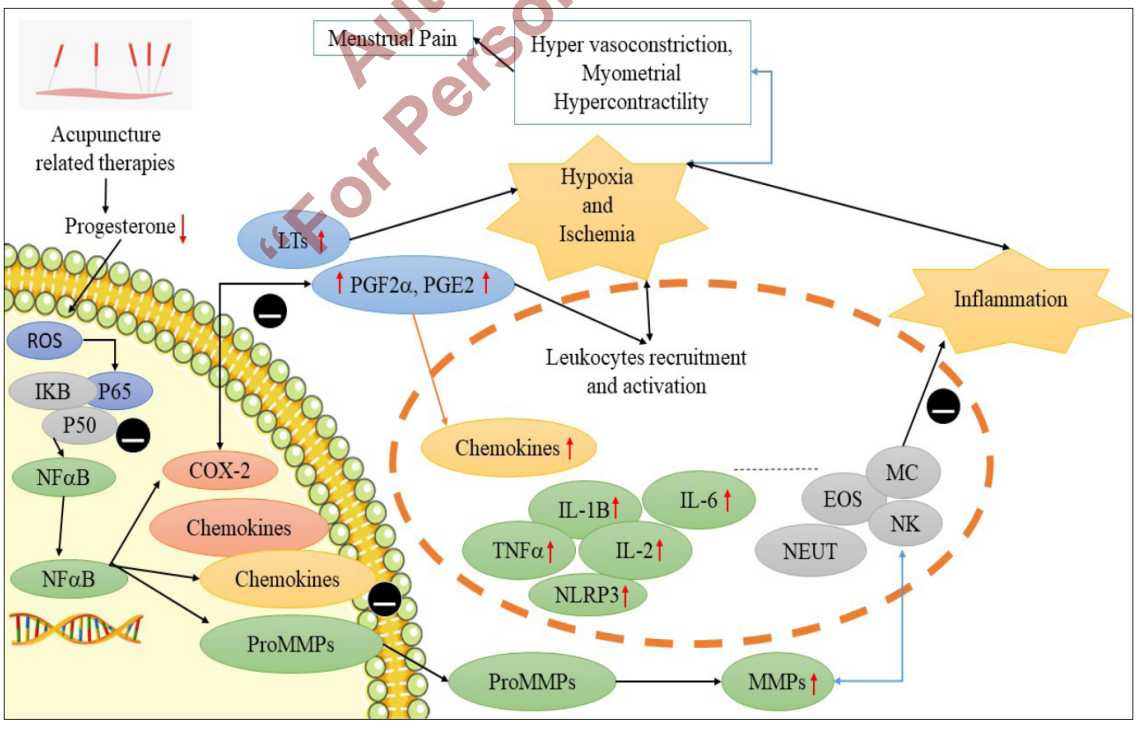


Fig. (5). Mechanism of acupuncture during PD. During menstruation discomfort, the figure symbols " ↑ " signify an increasing trend. Acupuncture inhibition is represented by the symbol "—". Primary Dysmenorrhea (PD); prostaglandins (PGs); leukotrienes (LTs); matrix metalloproteinases increase (MMPs); nuclear factor-B (NF-B). (*A higher resolution / colour version of this figure is available in the electronic copy of the article*).

between chemokines and leukocytes add to the complexity of acupuncture-induced analgesia [59].

Acupuncture has been shown to improve pain symptoms and quality of life in women with dysmenorrhea in various studies. In randomised control trials, it was discovered that alternating wave therapy helped manage primary dysmenorrhea and enhanced women's quality of life when it came to chronic pelvic pain [60]. This therapy has been shown to help irritable bowel syndrome (IBS) symptoms like pain, gas, bloating, and a composite score for stool consistency [61-63].

10. ACUPRESSURE

Acupressure is an alternative medicine technique that has been used to treat sickness since ancient times. Acupressure is similar to acupuncture in that it stimulates the same energy points and channels. According to traditional Chinese philosophy, the flow of energy is managed by precise pathways in the human body (called Qi), and an uneven flow of Qi causes sickness. By unblocking channels and harmonizing energy in the body, acupuncture is said to restore health [64]. Sanyinjiao (SP6) is an acupressure point that is used to treat gynecologic and digestive issues, as well as dystocia and pain relief during labor. It lies three cuns above the medial malleolus and posterior to the tibial boundary on the medial part of the calf [65]. Another acupressure point for pain treatment in an emergency is the DiJi (SP8) point, which is used for stomach discomfort, bloating, diarrhoea, dysuria, dysmenorrhea, and irregular menses. It's one of the greatest places to go for any type of dysmenorrhea treatment, and it's probably the best for dysmenorrhea caused by stasis. It may be discovered on the medial-lateral side of the calf, three cuns below the SP9 point, below the inferior border of the tibia and gastrocnemius, On the line connecting the malleolus to the Sanyinjiao (SP6) point, on the medial-lateral aspect of the calf, below the inferior margin of the tibia and gastrocnemius [66], three cuns below the SP9 point on the spleen meridian, on the line connecting the malleolus to the Sanyinjiao (SP6) point, on the medial-lateral aspect of the calf, below the inferior margin.

A number of clinical investigations [67] have validated the use of acupressure in the treatment of "dysmenorrhea" or "menstrual pain." In a study of 69 teens with menstrual pain [68], Chen and Chen discovered that 20 minutes of acupressure at SP6 on the first day of menstruation was useful in lowering dysmenorrhea compared to a control group that had a rest period at the school health centre in a study of 69 teens with menstrual pain [69]. On a continuous basis, Taylor and his colleagues wore acupressure underwear that administered acupressure to different parts of the body. These pants were useful in lowering dysmenorrhea and the number of doses of pain medicine taken daily compared to a control group (n = 58) who received standard treatment. Acupressure has also been shown to help treat a wide range of health problems [70, 71].

11. AROMATHERAPY

Aromatherapy is a procedure that uses essential oils extracted from plants as aromatics to improve the health of the body, mind, and soul. Aromatherapy uses essential oils, which are volatile components derived from aromatic plant material by steam distillation or mechanical expression. Essential oils are made up of a variety of chemical components, including metabolites that may be found in a variety of plant sources. The main chemical components of essential oils include monoterpenes, esters, aldehydes, ketones, alcohols, phenols, and oxides. They are volatile and can generate distinct scents. As a result, their essential oils can come in a variety of chemotypes, each with a different chemical makeup and potentially varied therapeutic consequences. Aromatherapy is used or claimed to be effective for a wide range of symptoms and illnesses. Aromatherapy can also be used as a stress reliever or anxiolytic drug or as a topical treatment for skin diseases [72].

Adding essential oils to an aromatherapy style of massage may have additional benefits. As a supplementary therapy, aromatherapy can be used to treat dysmenorrhea [73]. Aromatherapy abdominal massage using essential oils, including ginger, cinnamon, geranium, mandarin, and sage, diluted in almond oil, can assist in relieving dysmenorrhea symptoms. Massage, when combined with lavender aromatherapy, has been shown to lessen the intensity of primary dysmenorrhea pain [74]. Aromatherapy is a natural remedy for PMS that is both safe and effective. Lavender oil, clary sage oil, peppermint oil, cypress oil, and other essential oils act by reducing prostaglandin levels and increasing circulation. It also relieves unpleasant cramps due to the presence of rich, aromatic components in them. Aromatherapy is the most common alternative treatment in nursing, and it involves utilizing essential oils produced from aromatic plants to cure physical ailments and improve the overall quality of life. Because they can go deep into the skin, essential oils can be used in many ways, including massage [75, 76].

The essential oils include Aamhaldi, Chinese motherwort, *Curcuma longa* (rhizomes), *Prunus persica, Carthamus tinctorius, Siphonostegia Chinensis, Salvia miltiorrhiza, cyathula terpenoids, disqui-aliphatic, and phthalates*. By limiting the entrance of extracellular Ca2+ and releasing intracellular Ca2+, Curcuma phaeocaulis essential oil enhances uterine relaxation and can be used as an anti-dysmenorrhea treatment. Curcuma phaeocaulis essential oil contains chemicals that can stop smooth muscle contractions in the uterus. This makes it a possible way to treat dysmenorrhea [77, 78].

12. OTHER NON-INVASIVE METHODS FOR TREATING DYSMENORRHEA

12.1. Hypnotherapy and Sleep Therapy

Sleep is an important parameter for a healthy life for every individual. According to research, sleeping during menstruation releases pressure from the abdominal muscles and allows the skeletal muscles surrounding the abdomen to relax, relieving period cramps. Regular strength training may be used to improve sleep quality and, in turn, improve elderly people's attention and concentration because sleep quality and psychomotor performance are linked. So, for dysmenorrhea conditions, sleep may play a role in the ease of menstrual cramps and aid in the relaxation of the body. Along with this, sleep also helps in reducing obesity by reducing abdominal and pelvic obesity in women. [15]. Hyp-

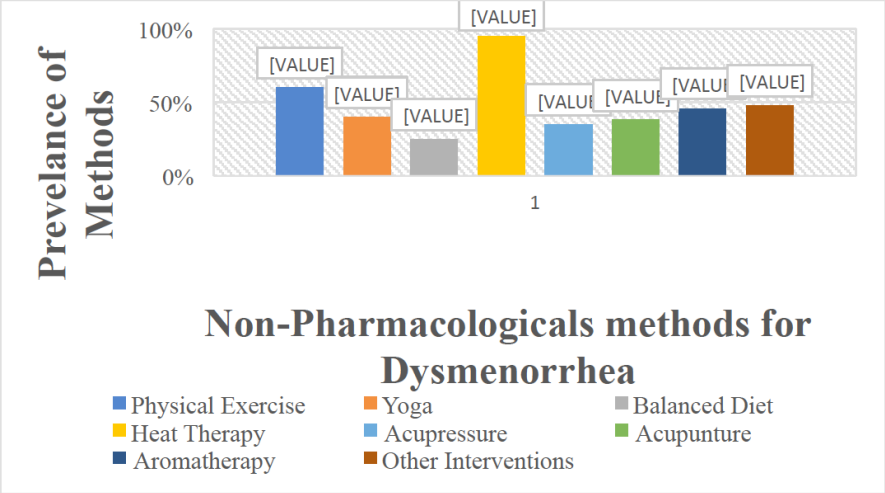


Fig. (6). Prevalence of non-pharmacological methods used for ease in primarydysmenorrhea. (*A higher resolution / colour version of this figure is available in the electronic copy of the article*).

notherapy is an additional treatment option for dysmenorrhea. The altered state of consciousness brought on by hypnosis resembles a peaceful reverie more than sleep. Hypnotherapy is typically preferred by women who struggle with insomnia. The purpose of sleep hypnosis is not to induce sleep while under hypnosis. Instead, it aims to alter unfavorable sleep-related beliefs or routines so that a woman can sleep better after hypnotherapy.

Hypnosis has a long history of being used to relieve pain. Hypnosis is a temporary state that changes a person's consciousness and memory, making them more sensitive, more open to others, and more likely to have strange thoughts and responses [79].

12.2. Chiropractic Therapy

Chiropractic adjustments, often known as manipulations, are performed by chiropractors on the spine or other regions of the body to correct alignment issues, relieve pain, and promote the body's innate capacity to heal itself. According to the majority of women, the most frequent symptoms of dysmenorrhea are lower back discomfort and generalized body pain. This approach may aid pain alleviation and encourage body relaxation and healthy sleep. Menstrual discomfort and classic spinal cord pain have been treated with chiropractic techniques (manual therapy of the spine) (chiropractic). Despite the fact that it is better than no therapy at all, four clinical interventional studies have demonstrated that the effect of this method on the intervention and control groups is statistically equal [80].

12.3. Transcutaneous Electrical Nerve Stimulation

In the treatment of primary dysmenorrhea, transcutaneous electrical nerve stimulation (TENS) has been recommended as an efficient pain management technique. TENS is a non-invasive, affordable, portable technology with a limited number of contraindications and very little risk. It can be self-administered daily while engaging in routine activities [81]. Discovered research, the main benefits of TENS include its simplicity, safety, portability, battery-operation, and affordability. It is used to transmit electrical currents *via* skin at a high frequency. The augmentation of endogenous inhibition and the decrease of central excitability form the basis of TENS's action mechanism [82, 83].

Menstrual pain was shown to be effectively reduced with TENS. Prostaglandin production that is too high and low levels of the ovarian steroid hormones in the endometrium have been implicated in developing primary dysmenorrhea (PD). These modifications cause the uterus to contract excessively for several hours, possibly with increased intrauterine pressure and reduced blood flow, which results in uterine hypoxia and ischemia, which are thought to be the underlying causes of the discomfort and cramps. TENS may affect prostaglandins in menstrual fluid, vasodilation, and blood flow, which might indirectly result in analgesic effects.

12.4. Radial Extracorporeal Shock Wave Treatment

In radial extracorporeal shock wave treatment, a series of acoustic pulses with a high peak pressure, quick speed, short duration, and low energy density are employed. This pain-relieving therapy, especially for lower back discomfort, is safe, cost-effective, and non-invasive. This technique is used to treat a number of chronic soft tissue pain conditions. It increases cell proliferation while reducing prostaglandin levels [84, 85].

12.5. Herbal Footbaths

Herbal footbaths, which have been used in China for over 3,000 years to treat a range of diseases, are becoming increasingly popular among patients. Patients suffering from dysmenorrhea may benefit from this treatment [86, 87]. Women receiving aromatherapy abdominal massage for menstruation pain reported a noticeably greater percentage of alleviation than the acetaminophen group in the study [88]. The feet and legs of the patient should be bathed in a hot herbal solution for around half an hour as part of this therapy. Reflective, thermal, and medicinal effects of herbal treatments are all included in this holistic manner. Prosta-

glandin production is regulated by these herbal formulations, which also limit calcium channels and cyclooxygenase activity. They make more nitric oxide and its synthetase and lower the number of many hormones [89-91].

CONCLUSION

In this study, we discovered that yoga and physical activity have significant roles in the treatment of dysmenorrhea. It has been shown that 75% of women who exercise regularly do not have acute pain during their periods. Others Non-pharmacological treatments like acupuncture, heat therapy, water therapy, aromatherapy, yoga, acupuncture, and acupressure should be used to lessen the severity of primary dysmenorrhea. The reduction of adipose tissue brought on by resistance training and the improvement of signaling pathways brought on by vitamin D ingestion were likely the main causes of the observed improvements. Additionally, resistance training's impact on reverse cholesterol transport may cause HDL alterations to happen more quickly than LDL changes. Additionally, it seems that longer exercise sessions and medication therapy improve LDL-C. Most women prefer heat therapy to relieve pain, but nowadays, most young women are focused on physical activity and a healthy diet, which are effective in the treatment of primary dysmenorrhea. Regular strength training can help older people with their attention and focus because sleep quality and psychomotor performance are largely correlated. Fig. (**6**) illustrates how common non-pharmacological treatments are. Primary dysmenorrhea affects both young and old women, and it significantly affects their daily lives [92]. Non-steroidal anti-inflammatory drugs (NSAIDs) and non-pharmacological methods like exercise, acupressure, and heat therapy are used to relieve this discomfort. Some women think analgesics are necessary even before pain manifests itself. Due to the potential for side effects and the development of tolerance or reliance, many people, on the other hand, choose to put up with discomfort instead of using drugs. Participants described how they occasionally avoided seeking expert medical assistance out of fear that their discomfort would be minimized. People usually choose a non-drug approach because they like it or because a close friend or family member told them to [93]. Finally, we came to the conclusion that among all the non-pharmacological approaches mentioned above, physical exercise and yoga performed by women on a daily basis for at least 30 minutes would be effective in treating dysmenorrhea. Eighty percent of women utilise heat therapy as one of their go-to ways for relieving menstrual cramps. All non-pharmacological techniques are helpful, but because there isn't enough literature on them, women aren't aware of them. Therefore, we attempted to summarise all the approaches that are useful for the treatment of dysmenorrhea in this review.

LIST OF ABBREVIATIONS

???

???

???

???

CONSENT FOR PUBLICATION

Not applicable.

FUNDING

None.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

ACKNOWLEDGEMENTS

The pharmacy department of P.S.I.T (Pranveer Singh Institute of Technology) in Kanpur, Uttar Pradesh, India, has been really helpful in instructing us and helping us write this review article.

REFERENCES

[1] Vlachou, E.; Owens, D.A.; Lavdaniti, M.; Kalemikerakis, J.; Evagelou, E.; Margari, N.; Fasoi, G.; Evangelidou, E.; Govina, O.; Tsartsalis, A.N. Prevalence, wellbeing, and symptoms of dysmenorrhea among university nursing students in greece. *Diseases,* **2019**, *7*(1), 5. Available from:https://www.mdpi.com/2079-9721/7/1/5/htm http://dx.doi.org/10.3390/diseases7010005 PMID: 30626091

[2] Proctor, M.; Farquhar, C. Diagnosis and management of dysmenorrhoea. *BMJ,* **2006**, *332*(7550), 1134-1138. Available from:https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1459624/ http://dx.doi.org/10.1136/bmj.332.7550.1134 PMID: 16690671

[3] Mrugacz, G.; Grygoruk, C.; Grusza, M.; Ratomski, K.; Pietrewicz, P. The effect of functional status of the ovaries on the embryological results of controlled ovarian hyperstimulation. *Med. Stud.,* **2013**, *4*, 281-286. http://dx.doi.org/10.5114/ms.2013.39976

[4] Alsaleem, M. Dysmenorrhea, associated symptoms, and management among students at King Khalid University, Saudi Arabia: An exploratory study. *J. Family Med. Prim. Care,* **2018**, *7*(4), 769-774. http://dx.doi.org/10.4103/jfmpc.jfmpc_113_18 PMID: 30234051

[5] Simon, P.; Ena, G. Dysmenorrhea. *Rev. Med. Brux.,* **2011**, *32*(4), 252-255. Available from:https://pubmed.ncbi.nlm.nih.gov/22034754/ PMID: 22034754

[6] Morrow, C.; Naumburg, E.H. Dysmenorrhea. *Prim. Care,* **2009**, *36*(1), 19-32. http://dx.doi.org/10.1016/j.pop.2008.10.004 PMID: 19231600

[7] Geneen, L.J.; Moore, R.A.; Clarke, C.; Martin, D.; Colvin, L.A.; Smith, B.H. Physical activity and exercise for chronic pain in adults: an overview of Cochrane Reviews. *Cochrane Database Syst. Rev.,* **2017**, *4*(4), CD011279. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5461882/ PMID: 28436583

[8] 4 Ways Exercise Affects Your Period. *Bustle,* Available from: https://www.bustle.com/articles/163976-4-ways-exercise-affects-your-period#:~:text=Keep%20reading%20for%20four%20major%20ways%20that%20exercise[cited: 2022 Jun 11].

[9] Carroquino-Garcia, P.; Jiménez-Rejano, J.J.; Medrano-Sanchez, E.; de la Casa-Almeida, M.; Diaz-Mohedo, E.; Suarez-Serrano, C. Therapeutic exercise in the treatment of primary dysmenorrhea: a systematic review and meta-analysis. *Phys. Ther.,* **2019**, *99*(10), 1371-1380. Available from: https://academic.oup.com/ptj/article/99/10/1371/5608544 http://dx.doi.org/10.1093/ptj/pzz101 PMID: 31665789

[10] Health Benefits of Exercise for Women | Sutter Health. *Sutterhealth.org.,* **2019**. Available from: Available from: https://www.sutterhealth.org/health/womens-health/health-benefits-of-exercise-for-women. [cited: 2022 Jun 11].

[11] Tanji, J.L. The benefits of exercise for women. *Clin. Sports Med.,* **2000**, *19*(2), 175-185, vii.

http://dx.doi.org/10.1016/S0278-5919(05)70197-6 PMID: 10740753

[12] Najafi, M; Fatolahi, H The effect of resistance training and vitamin D on leptin and HDL-C in overweight women. *IJSSH,* **2020**, *3*(1)

[13] Taheri, M; Farzian, S; Esmaeili, A; Shabani, E. The effect of water therapy and jogging exercises on the health-related factors of physical fitness of elderly women. *IJSSH,* **2020**, *3*(2)

[14] Abdelkarim, O.; Ammar, A.; Trabelsi, K.; Cthourou, H.; Jekauc, D.; Irandoust, K.; Taheri, M.; Bös, K.; Woll, A.; Bragazzi, N.L.; Hoekelmann, A. Prevalence of underweight and overweight and its association with physical fitness in Egyptian schoolchildren. *Int. J. Environ. Res. Public Health,* **2019**, *17*(1), 75. http://dx.doi.org/10.3390/ijerph17010075 PMID: 31861878

[15] Irandoust, K.; Taheri, M. The effect of strength training on quality of sleep and psychomotor performance in elderly males. *Sleep Hypn,* **2018**, *20*(3), 5-160.

[16] Kothari, A. Yoga and mental health: A review on efficacy of yoga in managing stress, anxiety and depression. *Int. Res. J. Ayurveda Yoga,* **2021**, *4*(3), 185-193. http://dx.doi.org/10.47223/IRJAY.2021.4323

[17] Birdee, G.S.; Yeh, G.Y.; Wayne, P.M.; Phillips, R.S.; Davis, R.B.; Gardiner, P. Clinical applications of yoga for the pediatric population: A systematic review. *Acad. Pediatr.,* **2009**, *9*(4), 212-220. http://dx.doi.org/10.1016/j.acap.2009.04.002 PMID: 19608122

[18] Roland, K.P.; Jakobi, J.M.; Jones, G.R. Does yoga engender fitness in older adults? A critical review. *J. Aging Phys. Act.,* **2011**, *19*(1), 62-79. http://dx.doi.org/10.1123/japa.19.1.62 PMID: 21285476

[19] Danielly, Y.; Silverthorne, C. Psychological benefits of yoga for female inmates. *Int. J. Yoga Therap.,* **2017**, *27*(1), 9-14. http://dx.doi.org/10.17761/1531-2054-27.1.9 PMID: 29131730

[20] Bayraktar, M.; Sincan, S.; Tanriverdi, E.; Cayir, Y. Primary dysmenorrhea and yoga: A mini-review. Available from: https://irispublishers.com/wjypr/pdf/WJYPR.MS.ID.000542.pdf[cited: 2022 May 11].

[21] Literature On Yoga And Dysmenorrhea. *NursingAnswers.net,* Available from: https://nursinganswers.net/essays/literature-on-yoga-and-dysmenorrhea.php[cited: 2022 Jun 11].

[22] Sharma, N. Yoga poses for women to get relief from menstrual cramps. *BleBur,* **2020**. Available from:https://blebur.com/yoga-poses-for-women-to-get-relief-from-menstrual-cramps/[cited: 2022 Jun 11].

[23] Pizer, A. How to do pigeon pose (Eka Pada Rajakapotasana) in Yoga. *Verywell Fit. Verywellfit,* **2004**. Available from: https://www.verywellfit.com/pigeon-pose-eka-pada-rajakapotasana-3567103 [cited: 2022 Jun 11].

[24] Busch, F. Benefits of pigeon pose. *Fred Busch's Miami Yoga,* **2019**. Available from:https://www.miamiyoga.com/benefits-of-pigeon-pose/#:~:text=Benefits%20of%20Pigeon%20Pose.%20Suitable%20for%20beginners%20as[cited: 2022 May 21].

[25] Yoga E at SO. Dhanurasana – Bow Pose. *School of Yoga,* Available from:https://schoolofyoga.in/yoga-asana/dhanurasana [cited: 2022 May 15].

[26] Ayurveda, M. Yoga for menstrual cramps. *Mekosha,* **2020**. Available from:https://mekosha.com/yoga-for-menstrual-cramps/ [cited: 2022 Jun 6].

[27] The importance of savasana: Learning how to rest your mind.. *Very well Fit,* Available from:https://www.verywellfit.com/corpse-pose-savasana-3567112 [cited: 2022 Jun 15].

[28] Grillo-Ardila, CF What are the benefits and harms of exercise for women with dysmenorrhea? *Coch Clin Ans,* **2019**. http://dx.doi.org/10.1002/cca.2763

[29] Jawad, N.K.; Ali, Z.; Khail, S.K.; Fozia, A.; Pervaiz, N.; Rehman, F. Prevalence and predictors of dysmenorrhea, its effects and coping mechanism among adolescent. *Pak. J. Med. Health Sci.,* **2021**, *15*(8), 2472-2476.

[30] Benefits And Importance Of Adho Mukha Svanasana. *Robert JR Graham,* **2015**. Available from: https://robertjrgraham.com/benefits-and-importance-of-adho-mukha-svanasana/ [cited: 2022 Jun 7].

[31] Armour, M.; Ee, C.C.; Naidoo, D.; Ayati, Z.; Chalmers, K.J.; Steel, K.A.; de Manincor, M.J.; Delshad, E. Exercise for dysmenorrhoea. *Cochrane Database Syst. Rev.,* **2019**, *9*(9), CD004142. PMID: 31538328

[32] Dehnavi, Z.; Jafarnejad, F.; Kamali, Z. The Effect of aerobic exercise on primary dysmenorrhea: A clinical trial study. *J. Educ. Health Promot.,* **2018**, *7*(1), 3. Available from: http://www.jehp.net/text.asp?2018/7/1/3/222749 http://dx.doi.org/10.4103/jehp.jehp_79_17 PMID: 29417063

[33] Daley, A.J. Exercise and primary dysmenorrhoea : A comprehensive and critical review of the literature. *Sports Med.,* **2008**, *38*(8), 659-670. http://dx.doi.org/10.2165/00007256-200838080-00004 PMID: 18620466

[34] Running during your period actually has some great benefits.. *Here's why. Flo. Health - #1 mobile product for women's health.,* **2022**. Available from: https://flo.health/menstrual-cycle/lifestyle/fitness-and-exercise/running-on-periods#:~:text=Sticking%20with%20a%20running%20routine%20can%20alleviate%20some [cited: 2022 May 15].

[35] Rajbhar, S.R.; Singh, R.; Sangada, M. Effect of yoga on primary dysmenorrhoea among adolescent girls – a literature review. *J. Pharm. Res. Int.,* **2021**, •••, 157-161. http://dx.doi.org/10.9734/jpri/2021/v33i47B33107

[36] Effect of selected stretching exercises on the pain level of primary dysmenorrhea among college students. *Int. J. Nurs. Educ.,* **2022**, *14*(2)

[37] Perez Machado, A.F.; Perracini, M.R.; de Morais, C.S.A.; da Silva, B.O.; Driusso, P.; Liebano, R.E. Microwave diathermy and transcutaneous electrical nerve stimulation effects in primary dysmenorrhea: Clinical trial protocol. *Pain Manag.,* **2017**, *7*(5), 359-366. http://dx.doi.org/10.2217/pmt-2017-0021 PMID: 28936905

[38] Potur, D.C.; Kömürcü, N. The effects of local low-dose heat application on dysmenorrhea. *J. Pediatr. Adolesc. Gynecol.,* **2014**, *27*(4), 216-221. http://dx.doi.org/10.1016/j.jpag.2013.11.003 PMID: 24656704

[39] Ke, Y.M.; Ou, M.C.; Ho, C.K.; Lin, Y.S.; Liu, H.Y.; Chang, W.A. Effects of somatothermal far-infrared ray on primary dysmenorrhea: a pilot study. *Evid. Based Complement. Alternat. Med.,* **2012**, *2012*, 1-8. http://dx.doi.org/10.1155/2012/240314 PMID: 23320024

[40] Jo, J.; Lee, S.H. Heat therapy for primary dysmenorrhea: A systematic review and meta-analysis of its effects on pain relief and quality of life. *Sci. Rep.,* **2018**, *8*(1), 16252. http://dx.doi.org/10.1038/s41598-018-34303-z PMID: 30389956

[41] Burnett, M.; Lemyre, M. No. 345-primary dysmenorrhea consensus guideline. *J. Obstet. Gynaecol. Can.,* **2017**, *39*(7), 585-595. http://dx.doi.org/10.1016/j.jogc.2016.12.023 PMID: 28625286

[42] Valiani, M.; Ghasemi, N.; Bahadoran, P.; Heshmat, R. The effects of massage therapy on dysmenorrhea caused by endometriosis. *Iran. J. Nurs. Midwifery Res.,* **2010**, *15*(4), 167-171. PMID: 21589790

[43] Pengpid, S.; Peltzer, K. Prevalence and correlates of functional disability among community-dwelling older adults in india: results of a national survey in 2017-2019. *J. Aging Health,* **2021**.

[44] Athanasatou, A.; Malisova, O.; Kandyliari, A.; Kapsokefalou, M. Water intake in a sample of greek adults evaluated with the water balance questionnaire (wbq) and a seven-day diary. *Nutrients,* **2016**, *8*(9), 559. http://dx.doi.org/10.3390/nu8090559 PMID: 27626443

[45] Joshi, T.; Kural, M.; Agrawal, D.; Noor, N.; Patil, A. Primary dysmenorrhea and its effect on quality of life in young girls. *Int. J. Med. Sci. Public Health,* **2015**, *4*(3), 381. http://dx.doi.org/10.5455/ijmsph.2015.0711201472

[46] Torkan, B.; Mousavi, M.; Dehghani, S.; Hajipour, L.; Sadeghi, N.; Ziaei Rad, M.; Montazeri, A. The role of water intake in the severity of pain and menstrual distress among females suffering from primary dysmenorrhea: A semi-experimental study. *BMC Womens Health,* **2021**, *21*(1), 40. http://dx.doi.org/10.1186/s12905-021-01184-w PMID: 33509179

[47] Yonglitthipagon, P.; Muansiangsai, S.; Wongkhumngern, W.; Donpunha, W.; Chanavirut, R.; Siritaratiwat, W.; Mato, L.; Eungpinichpong, W.; Janyacharoen, T. Effect of yoga on the menstrual pain, physical fitness, and quality of life of young women with primary dysmenorrhea. *J. Bodyw. Mov. Ther.,* **2017**, *21*(4), 840-846. Available from: https://www.ncbi.nlm.nih.gov/pubmed/29037637 http://dx.doi.org/10.1016/j.jbmt.2017.01.014 PMID: 29037637

[48] Ma, C.; Liang, N.; Gao, L.; Jia, C. Danggui Sini Decoction (herbal medicine) for the treatment of primary dysmenorrhoea: A systematic review and meta-analysis. *J. Obstet. Gynaecol.,* **2021**, *41*(7), 1001-1009. http://dx.doi.org/10.1080/01443615.2020.1820461 PMID: 33228406

[49] Abdi, F.; Amjadi, M.A.; Zaheri, F.; Rahnemaei, F.A. Role of vitamin D and calcium in the relief of primary dysmenorrhea: A systematic review. *Obstet. Gynecol. Sci.,* **2021**, *64*(1), 13-26. Available from: https://synapse.koreamed.org/articles/1146382?viewtype=pubreader http://dx.doi.org/10.5468/ogs.20205 PMID: 33406811

[50] Saei Ghare Naz, M.; Kiani, Z.; Rashidi Fakari, F.; Ghasemi, V.; Abed, M.; Ozgoli, G. The effect of micronutrients on pain management of primary dysmenorrhea: a systematic review and meta□analysis. *J. Caring Sci.,* **2020**, *9*(1), 47-56. http://dx.doi.org/10.34172/jcs.2020.008

[51] Pattanittum, P.; Kunyanone, N.; Brown, J.; Sangkomkamhang, U.S.; Barnes, J.; Seyfoddin, V.; Marjoribanks, J. Dietary supplements for dysmenorrhoea. *Cochrane Database Syst. Rev.,* **2016**, *3*(3), CD002124. PMID: 27000311

[52] What Is Acupuncture? What Are the Benefits?. *Verywell Health,* **2019**. Available from:https://www.facebook.com/verywell Available from: https://www.verywellhealth.com/acupuncture-health-uses-88407 [cited: 2022 Jun 15].

[53] NCI Dictionary of Cancer Terms. *National Cancer Institute,* **2011**. Serial on the Internet Available from: https://www.cancer.gov/publications/dictionaries/cancer-terms/def/de-qi-sensation[cited: 2022 Jun 15].

[54] Smith, C.A.; Crowther, C.A.; Petrucco, O.; Beilby, J.; Dent, H. Acupuncture to treat primary dysmenorrhea in women: A randomized controlled trial. *Evid. Based Complement. Alternat. Med.,* **2011**, *2011*, 1-11. http://dx.doi.org/10.1093/ecam/nep239 PMID: 21799683

[55] Mohammadi, A Analgesic effects and hemodynamic mechanisms of perpendicular and transverse needling at Sanyinjiao (SP 6) in patients with primary dysmenorrhea: A randomized controlled trial. *TCM,* **2021**, *8*(3), 248-56.

[56] Afshari, F.M.R.; Mohammadi, A.; Ma, L.X.; Mu, J.; Yu, W.Y.; Song, Y.; Wang, J.X.; Gan, Y.Y.; Tian, Y.; Qian, X.; Sun, T.Y.; Iravani, S. Comparison of the immediate analgesic effect of perpendicular needling and transverse needling at SP6 in patients with primary dysmenorrhea. *Medicine,* **2020**, *99*(3), e18847. http://dx.doi.org/10.1097/MD.0000000000018847 PMID: 32011502

[57] Sato, K.L.; Sanada, L.S.; Silva, M.D.; Okubo, R.; Sluka, K.A. Transcutaneous electrical nerve stimulation, acupuncture, and spinal cord stimulation on neuropathic, inflammatory and, non-inflammatory pain in rat models. *Korean J. Pain,* **2020**, *33*(2), 121-130. http://dx.doi.org/10.3344/kjp.2020.33.2.121 PMID: 32235012

[58] Wang, J.X.; Ma, L.X.; Mu, J.D.; Sun, T.Y.; Qian, X.; Yu, W.Y.; Tian, Y.; Zhang, Z. Anti-spastic effect induced by waggle needling correlates with KCC2-$GABA_A$ pathway in post-stroke spasticity rats. *Neurosci. Lett.,* **2021**, *750*, 135810. http://dx.doi.org/10.1016/j.neulet.2021.135810 PMID: 33705929

[59] Yu, W-Y.; Ma, L-X.; Zhang, Z.; Mu, J.D.; Sun, T.Y.; Tian, Y. Acupuncture for primary dysmenorrhea: A potential mechanism from an anti-inflammatory perspective.ECAM, **2021**, pp. 1-12.

[60] Ochoa, C.B.; Reyes, G.G.M.; Marin, C.M.A.; Quispe, V.B.; Gonzalez, A.G.; Velázquez, R.H. Effectiveness of vaginal analgesic electrostimulation *versus* sacral electroacupuncture in chronic pelvic pain of myofascial origin. *Int. J. Reprod. Contracept. Obstet. Gynecol.,* **2020**, *9*(7), 2686. http://dx.doi.org/10.18203/2320-1770.ijrcog20202562

[61] Huang, Z.; Lin, Z.; Dai, N. Sa1948 – needleless transcutaneous electrical acustimulation improves irritable bowel syndrome with constipation *via* autonomic mechanisms. *Gastroenterology,* **2019**, *156*(6), S-465. http://dx.doi.org/10.1016/S0016-5085(19)38014-X

[62] Kucia, M. Integrating the integrative: Acupuncture in the management of primary dysmenorrhea. *Lynchburg Journal of Medical Science,* **2021**, *3*(3) Serial on the Internet Available from:https://digitalshowcase.lynchburg.edu/dmscjournal/vol3/iss3/68/[cited: 2022 Jun 6].

[63] Woo, H.L.; Ji, H.R.; Pak, Y.K.; Lee, H.; Heo, S.J.; Lee, J.M.; Park, K.S. The efficacy and safety of acupuncture in women with primary dysmenorrhea. *Medicine,* **2018**, *97*(23), e11007. http://dx.doi.org/10.1097/MD.0000000000011007 PMID: 29879061

[64] Saremi, A.; Golnavaz, M.; Pooladi, A.; SanayeNaderi, M.; Alaiha, F.M.; Hakkak, N. Evaluation the success rate of treatment failure in patients with unexplained repeated IVF treatments immunization with lymphocytes (LIT) methods. *J. Reprod. Med.,* **2019**, *3*(4), 9-12.

[65] Marcelli, S.; Greenwood, M.T. The active points test: A clinical test for identifying and selecting effective points for acupuncture and related therapies *Med. Acupunct.,* **2015**, *27*(1), 56-57. http://dx.doi.org/10.1089/acu.2014.2713

[66] TorkZahrani, S.; Gharloghi, S.; TorkZahrani, S.; Ali, R.A. The effects of acupressure on severity of primary dysmenorrhea. *Patient prefer adher,* **2012**, 137.

[67] Lee, E.J.; Frazier, S.K. The efficacy of acupressure for symptom management: A systematic review. *J. Pain Symptom Manage.,* **2011**, *42*(4), 589-603. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3154967/ http://dx.doi.org/10.1016/j.jpainsymman.2011.01.007 PMID: 21531533

[68] TZ, H. Acupressure or acupuncture at sanyinjiao (SP6) for primary dysmenorrhea. *JNMTT,* **2018**, *1*(1)

[69] Taylor, D.; Miaskowski, C.; Kohn, J. A randomized clinical trial of the effectiveness of an acupressure device (relief brief) for managing symptoms of dysmenorrhea. *J. Altern. Complement. Med.,* **2002**, *8*(3), 357-370. http://dx.doi.org/10.1089/10755530260128050 PMID: 12165194

[70] Cha, N.H.; Sok, S.R. Effects of auricular acupressure therapy on primary dysmenorrhea for female high school students in South korea. *J. Nurs. Scholarsh.,* **2016**, *48*(5), 508-516. http://dx.doi.org/10.1111/jnu.12238 PMID: 27541067

[71] Aromatherapy with Essential Oils (PDQ®). *Health Professional Version - NCI,* **2005**. Serial on the Internet Available from: www.cancer.gov Available from: https://www.cancer.gov/about-cancer/treatment/cam/hp/aromatherapy-pdq#:~:text=The%20 effects%20of%20aromatherapy%20are%20theorized%20to%20result [cited: 2022 Jun 15].

[72] Kannan, P.; Claydon, L.S. Some physiotherapy treatments may relieve menstrual pain in women with primary dysmenorrhea: A systematic review. *J. Physiother.,* **2014**, *60*(1), 13-21. http://dx.doi.org/10.1016/j.jphys.2013.12.003 PMID: 24856936

[73] Thenmozhi, P.; Bhuvaneshwari, K. Effectiveness of aromatherapy on menstrual distress among adolescent girls. *J. Altern. Complement. Med.,* **2020**, 25-32.

[74] Akin, M.D.; Weingand, K.W.; Hengehold, D.A.; Goodale, M.B.; Hinkle, R.T.; Smith, R.P. Continuous low-level topical heat in the treatment of dysmenorrhea. *Obstet. Gynecol.,* **2001**, *97*(3), 343-349. PMID: 11239634

[75] Widarti, D.; Itha, R.; Lusiana, A. Effectiveness of warm water compress with lemon aromatherapy and lavender aromatherapy against primary dysmenorrhea pain levels. *Midwifery and Nursing Research,* **2021**, *3*(1), 41-48. http://dx.doi.org/10.31983/manr.v3i1.6807

[76] Fujiwara, R. Psychoneuroimmunological benefits of aromatherapy. *IJA,* **2002**, *12*(2), 77-82.

[77] Sut, N.; Kahyaoglu-Sut, H. Effect of aromatherapy massage on pain in primary dysmenorrhea: A meta-analysis. *Complement. Ther. Clin. Pract.,* **2017**, *27*, 5-10. http://dx.doi.org/10.1016/j.ctcp.2017.01.001 PMID: 28438280

[78] Ristiani, A.A.; Arsyad, A.; Usman, A.N.; Syamsuddin, S.; Ahmad, M.; Sinrang, A.W. The use of aromatherapy in primary dysmenorrhea. *Gac. Sanit.,* **2021**, *35*(Suppl. 2), S591-S595. http://dx.doi.org/10.1016/j.gaceta.2021.10.090 PMID: 34929908

[79] Shah, M.; Monga, A.; Patel, S.; Shah, M.; Bakshi, H. The effect of hypnosis on dysmenorrhea. *Int. J. Clin. Exp. Hypn.,* **2014**, *62*(2), 164-178. http://dx.doi.org/10.1080/00207144.2014.869128 PMID: 24568323

[80] Zhang, J.; He, Y.; Huang, X.; Liu, Y.; Yu, H. The effects of acupuncture *versus* sham/placebo acupuncture for insomnia: A systematic review and meta-analysis of randomized controlled trials. *Complement. Ther. Clin. Pract.,* **2020**, *41*(Nov), 101253.

http://dx.doi.org/10.1016/j.ctcp.2020.101253 PMID: 33186824

[81] Elboim-Gabyzon, M.; Kalichman, L. Transcutaneous electrical nerve stimulation (TENS) for primary dysmenorrhea: An overview. *Int. J. Womens Health,* **2020**, *12*, 1-10. http://dx.doi.org/10.2147/IJWH.S220523 PMID: 32021488

[82] Lee, B.; Hong, S.H.; Kim, K.; Kang, W.C.; No, J.H.; Lee, J.R.; Jee, B.C.; Yang, E.J.; Cha, E.J.; Kim, Y.B. Efficacy of the device combining high-frequency transcutaneous electrical nerve stimulation and thermotherapy for relieving primary dysmenorrhea: A randomized, single-blind, placebo-controlled trial. *Eur. J. Obstet. Gynecol. Reprod. Biol.,* **2015**, *194*, 58-63. http://dx.doi.org/10.1016/j.ejogrb.2015.08.020 PMID: 26340453

[83] Aboualsoltani, F.; Bastani, P.; Khodaie, L.; Mohammad, S.; Fazljou, B. Non-pharmacological treatments of primary dysmenorrhea: A systematic review. Available from: https://archivepp.com/storage/models/article/5MHRcYsNhzf0u2pmk6bNUVV4sjKA 88iTeIWotlJLcjqInnPgDRnBvuRQOiWs/non-pharmacological-treatments-of-primary-dysmenorrhea-a-systematic-review.pdf [cited: 2022 Jun 15].

[84] Hochstrasser, T.; Frank, H.G.; Schmitz, C. Dose-dependent and cell type-specific cell death and proliferation following *in vitro* exposure to radial extracorporeal shock waves. *Sci. Rep.,* **2016**, *6*(1), 30637. http://dx.doi.org/10.1038/srep30637 PMID: 27477873

[85] Yu, A. Complementary and alternative treatments for primary dysmenorrhea in adolescents. *NP,* **2014**, *39*(11), 1-12.

[86] Xiao, M.; Liu, L.; Tumilty, S.; Liu, D.; You, Y.; Chen, Y. Efficacy and safety of Chinese herbal footbaths for the treatment of dysmenorrhea: Protocol for a systematic review and meta-analysis.Borrelli, F. PLOS ONE, **2021**, 16, p. (5)e0250685.

[87] Lu, M.; Chu, Z.; Wang, L.; Liang, C.; Sun, P.; Xiong, S.; Mu, Y. Pharmacokinetics and tissue distribution of four major bioactive components in rats after oral administration of xianglian pill. *Biomed. Chromatogr.,* **2020**, *34*(3), e4770. http://dx.doi.org/10.1002/bmc.4770 PMID: 31808576

[88] Lakhan, S.E.; Sheafer, H.; Tepper, D. The effectiveness of aromatherapy in reducing pain: A systematic review and meta-analysis. *Pain Research and Treatment,* **2016**, 1-13.] Available from: Available from: https://www.hindawi.com/journals/prt/2016/8158693/. [cited: 2019 Apr 7]. http://dx.doi.org/10.1155/2016/8158693

[89] Sosorburam, D.; Wu, Z.; Zhang, S.; Hu, P.; Zhang, H.; Jiang, T.; Ahiasi-Mensah, J.; He, X. Therapeutic effects of traditional Chinese herbal prescriptions for primary dysmenorrhea. *Chin. Herb. Med.,* **2019**, *11*(1), 10-19. http://dx.doi.org/10.1016/j.chmed.2018.11.001

[90] Lee, J.H.; Seo, E.K.; Shim, J.S.; Chung, S.P. The effects of aroma massage and foot bath on psychophysiological response in stroke patients. *J. Phys. Ther. Sci.,* **2017**, *29*(8), 1292-1296. Available from:https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5574341/ http://dx.doi.org/10.1589/jpts.29.1292 PMID: 28878450

[91] Ni, H.; Liu, J.; Dai, O.; Feng, R.; Liu, F.; Cao, X.Y.; Peng, C.; Xiong, L. Chemical composition and uterine smooth muscle relaxant activity of essential oils from 10 kinds of blood-activating and stasis-resolving Chinese medicinal herbs. *J. Ethnopharmacol.,* **2021**, *269*, 113713. http://dx.doi.org/10.1016/j.jep.2020.113713 PMID: 33352237

[92] Centers for Disease Control and Prevention. Benefits of physical activity. *CDC,* **2021**. Available from: Available from: https://www.cdc.gov/physicalactivity/basics/pa-health/index.htm. [cited: 2022 Jun 15].

[93] Fernández-Martínez, E.; Pérez-Corrales, J.; Palacios-Ceña, D.; Abreu-Sánchez, A.; Iglesias-López, M.T.; Carrasco-Garrido, P.; Velarde-García, J.F. Pain management and coping strategies for primary dysmenorrhea: A qualitative study among female nursing students. *Nurs. Open,* **2022**, *9*(1), 637-645. http://dx.doi.org/10.1002/nop2.1111 PMID: 34719126