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Dysmenorrhea decoded: Unravelling the complex interplay of pathophysiology, socioeconomic disparities and therapeutic innovations

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Abstract

Dysmenorrhea, commonly experienced as painful menstrual cramps, can significantly impact the quality of life for many individuals. It is primarily categorized into two types: primary dysmenorrhea, which occurs without any underlying pathological condition, and secondary dysmenorrhea, associated with reproductive disorders such as endometriosis and uterine fibroids. Primary dysmenorrhea is often characterized by spasmodic pain originating from uterine contractions, triggered by an increase in prostaglandin levels during menstruation. This pain is commonly felt in the lower abdomen, but it may radiate to the lower back and thighs. In addition to the pelvic discomfort, individuals with primary dysmenorrhea may experience symptoms such as nausea, vomiting, fatigue, headaches, dizziness, and disturbed sleep. Risk factors contributing to the severity and frequency of dysmenorrhea include age (under 30), low body mass index, smoking, early menarche, prolonged menstrual bleeding, irregular cycles, and a family history of dysmenorrhea. Psychological factors such as stress and anxiety, as well as lifestyle choices including high caffeine consumption, can further exacerbate the intensity of symptoms. Treatment options for primary dysmenorrhea are varied, with physiotherapy emerging as a key intervention. Regular physical activity, particularly aerobic exercises like walking, swimming, and cycling, plays a significant role in alleviating menstrual pain. Exercise helps to regulate hormone levels, improve blood circulation, and trigger the release of endorphins, the body's natural painkillers. These physiological changes help reduce uterine contractions and decrease pain intensity. Psychological interventions such as cognitive-behavioural therapy, biofeedback, mindfulness-based stress reduction, and stress management techniques have also shown effectiveness in managing the emotional and psychological aspects of dysmenorrhea. Additionally, complementary therapies such as acupuncture, local heat application, and herbal remedies like ginger and fennel have been explored for their potential to alleviate pain. Manual therapies, including post-isometric relaxation and trigger point therapy, have demonstrated positive results in improving blood flow to the pelvic region and reducing muscle tension. Moreover, pelvic floor exercises, such as Kegel exercises, have been found to improve muscle tone, reduce pelvic pain, and enhance circulation. Pilates, with its emphasis on controlled movements, flexibility, and strengthening of core muscles, also serves as an effective intervention for managing dysmenorrhea. A comprehensive approach, combining physical, psychological, and manual therapies, is essential for the effective management of primary dysmenorrhea. This multi-faceted treatment strategy not only targets the physical symptoms but also addresses the psychological and emotional challenges associated with painful menstruation.

Keywords: Primary dysmenorrhea, uterine contractions, prostaglandins, exercise, physiotherapy, cognitive-behavioural therapy, acupuncture, manual therapy, kegel exercises, pilates, psychological management

Introduction

Menstruation is a normal physiological process in adolescent females which refers to the periodic and cyclical shedding of the uterine lining (endometrium) that occurs in response to hormonal changes. During menstruation most complained some gynaecological problem such as irregular menstrual cycle, menorrhagia, dysmenorrhea, and others symptoms. Dysmenorrhea, or painful menstruation, is a common cause of acute pelvic pain, affecting approximately two-thirds of adult women in the post menarche age group. Menarche marks

the onset of sexual maturation in females, signifying the first occurrence of menstruation. It typically happens during puberty and represents the body's transition into reproductive capability. [1,8]

The term Dysmenorrhea comes from Greek roots i.e., "dys" (painful, difficult, abnormal), Meno (month), rhea (flow). It is characterized by cramping pain in the lower abdomen, which can occur just before or during menstruation. dysmenorrhea, which refers to painful menstrual cramps, is one of the most common gynaecological concerns among adolescent and adult females.

This condition is typically classified into three types: primary dysmenorrhea, which occurs without an underlying medical condition, often starting with adolescent and associated with onset of ovulatory cycles whereas secondary dysmenorrhea, is caused by disorders like endometriosis, fibroids, or pelvic inflammatory disease. Mostly 16-25 years of age group are the highest prevalence of Primary dysmenorrhea.

dysmenorrhea, which refers to painful menstruation, can significantly impact an individual's daily activities and work performance. If the pain felt only on either right or left side then it is known as Unilateral Dysmenorrhea. Unilateral Dysmenorrhea mostly occurs in rudimentary horn of a bicornuate uterus. The severity of the pain can lead to limitations in physical activity, reduced productivity, and in many cases, absence from work or school. Women experiencing severe dysmenorrhea often report difficulty concentrating, fatigue, and reduced quality of life during their menstrual periods [1, 2, 3, 4, 5, 7].

Etiology

The aetiology of Primary dysmenorrhea is still not clear. [7] primary dysmenorrhea, which refers to menstrual pain without an underlying medical condition, is a common issue affecting many women, its prevalence and severity can vary due to several factors, including race, socioeconomic status, and access to healthcare. Research shows that while dysmenorrhea itself is widespread, socioeconomic factors can influence how it is experienced and managed. Women with lower socioeconomic status may have reduced access to healthcare, which affects their ability to receive treatment or manage the pain effectively. Additionally, cultural differences and healthcare disparities can lead to variations in reporting and treatment-seeking behaviours [4, 5].

Few articles also suggested that weakness of abdominal muscles i.e. Rectus abdominis, Transverse abdominis and External oblique muscles can be reason for Dysmenorrhea.

Menstrual pain (dysmenorrhea) is primarily caused by the release of prostaglandins, which play a central role in initiating uterine contractions during menstruation.

Prostaglandins are hormone-like substances that are produced by the endometrial lining of the uterus. During menstruation, higher levels of prostaglandins are released, leading to increased uterine contractions, vasoconstriction (narrowing of blood vessels), and reduced blood flow to the uterine muscles. This combination of factors causes the pain and discomfort associated with dysmenorrhea. Prostaglandins, particularly prostaglandin F_{2α} (PGF_{2α}), are responsible for the intensity of uterine contractions, and higher concentrations are often found in women who experience severe menstrual cramps.

Prostaglandins following causes are

1. Spiral artery vasospasm

This leads to reduced blood flow (ischemia) to the endometrium, causing ischemic necrosis. The lack of oxygen triggers pain, muscle spasms, and cramping in the uterus. This ischemic process contributes to the shedding of the superficial layer of the endometrium, leading to menstruation.

2. Increased myometrial contractions

Prostaglandins stimulate the muscles of the uterus (myometrium) to contract more strongly, which helps expel the menstrual blood but also contributes to the cramping and discomfort associated with menstruation. The higher the levels of prostaglandins, the more intense the contractions and the more severe the pain tends to be. [1,3,5,7,10]

Symptoms

Dysmenorrhea refers to painful menstrual cramps that occur just before or during menstruation. Primary dysmenorrhea, the most common type, is not associated with any underlying pathology of the uterus or other reproductive organs. The pain is typically spasmodic, originating from the uterus, and is commonly felt in the lower abdomen. It may also radiate to the lower back and thighs. The pain results from uterine contractions that are triggered by the release of prostaglandins during menstruation. Secondary dysmenorrhea, on the other hand, is related to underlying reproductive system disorders, such as endometriosis or fibroids [2, 3, 8].

Primary dysmenorrhea often comes with additional symptoms beyond pelvic pain. These can include:

Nausea: Feeling sick or uneasy in the stomach, which may sometimes lead to vomiting.

Vomiting: This may accompany intense cramps or be triggered by nausea. **Fatigue:** Feeling tired or exhausted is common, likely due to the physical stress and hormonal changes.

Headache: Hormonal fluctuations during menstruation may contribute to headaches or migraines.

Dizziness: Some individuals may experience light headedness, possibly due to blood loss or hormonal shifts.

Sleep disturbances: The pain and discomfort associated with primary dysmenorrhea can interfere with normal sleep patterns, leading to trouble falling or staying asleep.

These symptoms are often linked to the release of prostaglandins during menstruation, which can cause inflammation and affect other parts of the body beyond the uterus [2].

Primary dysmenorrhea risk factors

Dysmenorrhea, or painful menstruation, can be influenced by several risk factors. Based on these factors include:

- 1. Age under 30 years:** Younger women are more likely to experience dysmenorrhea.
- 2. Low BMI (< 20):** Lower body mass index has been associated with higher prevalence of painful periods.
- 3. Smoking:** Smoking is linked to increased menstrual pain due to its effect on blood flow and inflammation.
- 4. Early menarche (before age 12):** Women who start menstruating early are at greater risk for dysmenorrhea.
- 5. Longer than normal bleeding time:** Heavy or prolonged menstrual bleeding often correlates with more intense pain.

6. **Irregular menstrual cycles:** Unpredictable cycles can be associated with hormonal imbalances contributing to pain.
7. **Excessive menstrual bleeding (menorrhagia):** Increased bleeding may intensify uterine cramping.
8. **History of sexual abuse:** Trauma can be linked to heightened pain sensitivity, including during menstruation.
9. **Family history of dysmenorrhea:** Genetics plays a role in the likelihood of developing painful periods.

Addressing these risk factors through lifestyle changes, medical interventions, or psychological support may help in managing or reducing symptoms [3,7].

Premenstrual Syndrome (PMS), characterized by symptoms such as mood swings, fatigue, and discomfort prior to menstruation, is commonly associated with dysmenorrhea. Additionally, conditions like Pelvic Inflammatory Disease (PID) and somatization (the expression of psychological distress through physical symptoms) can exacerbate menstrual pain. Other factors contributing to dysmenorrhea include:

1. **Weak mental health:** Stress, anxiety, and other psychological disturbances can intensify the perception of pain.
2. **Coffee consumption:** High intake of caffeine may be a risk factor due to its stimulant effects, which could increase muscle contractions.
3. **Menstrual bleeding lasting longer than 7 days:** Prolonged menstruation is often linked to more severe cramping and discomfort.
4. **Family history:** A genetic predisposition to dysmenorrhea may exist, making it more likely if relatives also experience severe menstrual pain [1,8,12]

Physiotherapy in the treatment of primary dysmenorrhea

Regular exercise and physical activity have been shown to be effective in both preventing and treating dysmenorrhea (painful menstrual cramps). Exercise helps regulate circulating steroid hormone levels, including oestrogen and progesterone, which can reduce the severity of menstrual cramps by balancing hormonal fluctuations. Additionally, physical activity stimulates the release of endorphins, which are the body's natural painkillers. These endorphins raise the pain threshold, making menstrual cramps less painful. Exercise also improves blood flow, which can reduce uterine contractions and alleviate cramping. Incorporating moderate aerobic exercise, such as walking, swimming, or cycling, into a routine can have beneficial effects on menstrual pain [6, 16, 13, 14, 9].

stress can influence menstrual symptoms and uterine contractions through the activation of the sympathetic nervous system. When stress levels are high, the body releases stress hormones like cortisol and adrenaline, which can lead to increased uterine contractions and exacerbate menstrual cramps, pain, and other symptoms. Exercise, on the other hand, can help alleviate stress by releasing endorphins, which are natural mood elevators and pain relievers. Regular physical activity is known to reduce cortisol levels, promote relaxation, and improve overall mood. This reduction in stress can decrease the activity of the sympathetic nervous system, thereby reducing the

intensity of uterine contractions and lessening menstrual symptoms [9, 19, 24, 35].

Primary dysmenorrhea, which refers to painful menstrual cramps without an underlying medical condition, can be managed through various approaches:

1. **Medications:** Nonsteroidal anti-inflammatory drugs (NSAIDs) like ibuprofen or naproxen are commonly used to reduce pain and inflammation. Hormonal treatments, such as oral contraceptives, various vitamins, and minerals B1, B6, E & Magnesium are also effective in regulating menstrual cycles and reducing pain [5].
2. **Acupuncture:** This traditional Chinese therapy involves inserting thin needles into specific points on the body. It is believed to help in balancing the body's energy, which may alleviate menstrual pain.
3. **Local application of heat:** Applying heat to the lower abdomen using a heating pad or warm water bottle can help relax the muscles, improving blood flow and reducing cramping [5].
4. **Psychological management:** Primary dysmenorrhea (painful menstrual cramps without an underlying pelvic condition) can significantly affect mental and emotional well-being.

Psychological interventions are valuable for managing symptoms and improving overall quality of life. Here are the key approaches:

A. Cognitive-Behavioral Therapy (CBT)

Purpose: Helps reframe negative thought patterns about pain and menstrual cycles.

Techniques: Relaxation training (e.g., progressive muscle relaxation). Pain coping strategies. Cognitive restructuring to reduce catastrophizing.

Benefits: Reduces pain perception, enhances coping skills, and alleviates anxiety and depression associated with dysmenorrhea.

B. Biofeedback

Purpose: Teaches individuals to gain control over physiological processes linked to pain.

How it works: Using devices to monitor physiological data (e.g., muscle tension), patients learn relaxation and tension-reducing techniques.

Effectiveness: May lower pain intensity by promoting relaxation.

C. Mindfulness-Based Stress Reduction (MBSR)

Focus: Builds awareness and acceptance of pain without judgment.

Techniques: Meditation. Mindful breathing. Body scans to relax tense muscles.

Outcome: Reduces perceived pain intensity and enhances emotional well-being.

D. Stress management and coping skills training

Goal: Reduces stress, which can exacerbate dysmenorrhea symptoms.

Methods

- Time management techniques.
- Problem-solving skills.
- Emotional regulation strategies.

E. Supportive therapy and counselling

Provides a safe space for individuals to discuss the emotional impact of dysmenorrhea.

Helps address any underlying issues like anxiety, low self-esteem, or relationship challenges.

F. Psychoeducation

Educates individuals about the causes and management of primary dysmenorrhea. Focuses on lifestyle factors such as nutrition, exercise, and sleep, which influence menstrual pain.

G. Behavioural activation

Encourages engagement in enjoyable and meaningful activities to counteract pain-related avoidance behaviours.

H. Hypnotherapy

Uses guided imagery and hypnosis to reframe pain perception and promote relaxation.

I. Integration with other approaches

Psychological treatments are most effective when combined with medical and lifestyle interventions, such as: Nonsteroidal anti-inflammatory drugs (NSAIDs). Hormonal therapies (e.g., oral contraceptives). Regular physical activity. Balanced diet and hydration [36].

1. **Massage:** Abdominal massage or general body massage can improve blood circulation and reduce tension, providing relief from menstrual pain.
2. **Herbal therapy:** Certain herbal remedies, such as ginger, cinnamon, or fennel, have been reported to provide relief from menstrual discomfort, although more studies are needed to confirm their effectiveness.
3. **Transcutaneous Electrical Nerve Stimulation (TENS):** This involves applying low-voltage electrical currents to the skin, which may reduce the perception of pain by interrupting pain signals sent to the brain. [11,15,18,20,26]
4. **Exercise:** Physical activity, particularly stretching and strengthening exercises, has shown promising results in reducing menstrual pain. Some exercises include: Core Muscle Strengthening: Strengthening the core can help support the lower back and pelvis, reducing pain [22, 23, 37].
5. **Aerobic exercises:** Light activities such as walking or chair exercises help in increasing circulation and reducing pain [17, 21, 25].
6. **Stretching Exercises** also applied in treatment of primary dysmenorrhea which is found to be as effective as NSAIDs. [3, 10, 22, 27, 38]. These include:
 - Forward bend stretch
 - Lunges (both legs)
 - Squats
 - Forward standing cross stretch
 - Dorsolumbar fascia stretch
 - Pectoral stretch
 - Adductor stretches
 - Prone knee bending
7. **Strengthening exercises: These include**
 - Pelvic bridging
 - Plank
 - Cat and Camel
 - Curl-Up

Each of these approaches works differently, and combining them based on individual needs can provide more comprehensive relief from primary dysmenorrhea [34, 33, 38, 12].

8. **Manual therapy, particularly Post-Isometric Relaxation (PIR)** of pelvic region muscles and trigger point therapy, has shown effectiveness in managing dysmenorrhea by reducing menstrual pain. PIR helps in relaxing tight muscles by stretching them after a brief isometric contraction, which can alleviate pain and improve blood flow to the pelvic region. Trigger point therapy focuses on releasing specific areas of muscle tightness or knots, contributing to pain reduction. Interestingly, research suggests that after the application of these manual therapies, there can be a decrease in progesterone levels in patients with primary dysmenorrhea. This could be due to the influence of manual therapy on the autonomic nervous system and hormonal regulation [29].

Kegel exercises (pelvic floor exercises) have been shown to have positive effects on primary dysmenorrhea. These exercises strengthen the pelvic floor muscles, which can help improve blood circulation to the pelvic region and support uterine function, potentially alleviating menstrual pain [28, 32].

A regimen involving Kegel exercises for 15 minutes, 3 sessions per week for 8 weeks could potentially help in managing primary dysmenorrhea by:

- Reducing cramping by improving muscle tone and circulation.
- Relieving tension in the pelvic region, which may contribute to pain relief.
- Helping the body manage pain through increased muscle control.

Though Kegel exercises have effects on muscle tone, pelvic floor strength, and circulation can support overall pelvic health and contribute to lessening menstrual discomfort [29, 32].

9. Pilates exercise

Pilates is a form of mind-body exercise that emphasizes controlled movement, posture, and breathing. It offers a variety of benefits, both mental and physical, including:

Improved mental well-being: The focus on controlled movements and deep breathing enhances mindfulness, reduces stress, and promotes relaxation.

Increased flexibility: Pilates stretches and strengthens muscles, improving overall flexibility and range of motion.

Muscle strengthening: The exercises target core muscles, improving overall body strength and stability.

Enhanced muscular endurance: Regular practice builds stamina and resilience in muscles through repetitive and controlled movements.

Improved cardiorespiratory endurance: Certain dynamic Pilates sequences boost heart rate, contributing to better cardiovascular health.

Positive hormonal effects: In women, Pilates has been noted to positively influence sex hormones, potentially helping with hormonal balance.

Pilates can be performed as mat exercises or with specialized equipment, focusing on precise, controlled movements to strengthen the body while aligning the mind [7, 31].

Conclusion

Primary dysmenorrhea, though a common condition affecting many individuals, extends far beyond the physical discomfort of menstrual cramps. The pain, originating from uterine contractions, is often accompanied by a cascade of symptoms nausea, fatigue, headaches, and emotional distress that influence not just physical health but also mental well-being. A complex interplay of risk factors, from age and body mass index to stress and psychological trauma, contributes to the intensity and frequency of dysmenorrhea. Recognizing these factors is key in understanding the broader impact this condition has on daily life.

To manage this pervasive condition effectively, a holistic approach is paramount. Physiotherapy plays a central role, with exercise being a cornerstone in the treatment of dysmenorrhea. Regular physical activity does more than relieve pain; it fosters a hormonal balance, enhances circulation, and triggers the body's natural pain-relief mechanisms, offering sustainable relief. Psychological support, through therapies like cognitive-behavioural therapy and mindfulness, helps individuals not only cope with pain but also with the emotional toll it brings. Furthermore, integrative therapies such as acupuncture, manual treatments, and herbal remedies provide complementary pathways for relief.

The intersection of physical, emotional, and lifestyle-based interventions creates a well-rounded approach to managing primary dysmenorrhea. By combining exercise, stress management, manual therapies, and psychological support, individuals can find a more comprehensive, personalized, and empowering way to navigate this challenging condition. Ultimately, fostering both physical and emotional well-being offers the best opportunity for reducing the burden of primary dysmenorrhea, enhancing quality of life, and enabling individuals to thrive despite its challenges.

References

- Gerzson LR, Padilha JF, Braz MM, Gasparetto A. Physiotherapy in primary dysmenorrhea: literature review. *Rev Dor*. 2014;15:290-295.
- Samad A, Ahmad HI, Dar FA. Implication of Riyazat (Exercise) in Primary Dysmenorrhoea (Usr-E-Tams). *J Integr Community Health*. 2021;10(1):17-21.
- Sharma S, Augustina SJ. Efficacy of core muscle strengthening in women with dysmenorrhea. *Int J Physiother Res*. 2022;10(2):4204-4208.
- Gopal SR, Premkumar M, Kavitha S, Shipnu P. Benefits of core stability exercise and relaxation technique for primary dysmenorrhea in an unmarried girl: A case report. *J Educ Health Promot*. 2024;13(1):252.
- Desai RG. Physiotherapy intervention for primary dysmenorrhea: A narrative review. *Int J Res Rev*. 2022;9(3):441-449.
- Azima S, Bakhshayesh HR, Abbasnia K, Kaviani M, Sayadi M. The effect of isometric exercises on primary dysmenorrhea: A randomized controlled clinical trial. *Galen Med J*. 2015;4(1):26-32.
- Khadiga S, Eman M, Mohamad F, Asmaa M. Effect of pilates exercise on primary dysmenorrhea. *Med J Cairo Univ*. 2019;87(March):1187-1192.
- Yilmaz B, Sahin N. The effects of a dysmenorrhea support program on university students who had primary dysmenorrhea: a randomized controlled study. *J Pediatr Adolesc Gynecol*. 2020;33(3):285-290.
- Bayraktar M, Sincan S, Çınar Tanrıverdi E, Cayir Y. Primary dysmenorrhea and yoga: A mini-review. *World J Yoga Phys Ther Rehabil*. 2020;2(4).
- Rejeki S, Pratama FY, Ernawati E, Yanto A, Soesanto E, Pranata S *et al*. Abdominal stretching as a therapy for dysmenorrhea. *Open Access Maced J Med Sci*. 2021;9(G):180-183.
- Elboim-Gabyzon M, Kalichman L. Transcutaneous electrical nerve stimulation (TENS) for primary dysmenorrhea: an overview. *Int J Womens Health*. 2020;1-10.
- Mohamed HA, Habib FM, Gamal RA, Abu Setta S. Comparison between the effect of rocking, stretching, and Kegel exercises on pain intensity of primary dysmenorrhea among university female students. *Egypt J Health Care*. 2024;15(2):735-752.
- Çelik AS, Apay SE. Effect of progressive relaxation exercises on primary dysmenorrhea in Turkish students: A randomized prospective controlled trial. *Complement Ther Clin Pract*. 2021;42:101280.
- Seales P, Seales S, Ho G. Exercise for dysmenorrhea. *Am Fam Physician*. 2021;103(9):525-526.
- Mannheimer JS, Whalen EC. The efficacy of transcutaneous electrical nerve stimulation in dysmenorrhea. *Clin J Pain*. 1985;1(2):75-84.
- Parikh H, Khokhar SM, Kazi SA. Comparative study of effect of moist pack vs. effect of core strengthening exercises in primary dysmenorrhea for three consecutive months. *Indian J Physiother Occup Ther*. 2021;15(4):32-38.
- Elbandrawy AM, Elhakk SM. Comparison between the effects of aerobic and isometric exercises on primary dysmenorrhea. *Acta Gymnica*. 2021;51:0-4.
- Mistry M, Vardhan V, Palekar T, Panse R. Effect of conventional TENS versus spinal mobilization in primary dysmenorrhea in adolescent girls: A comparative study. *Int J Physiother Res*. 2015;3(5):1227-1232.
- Shah S, Verma N, Begani P, Nagar H, Mujawar N. Effect of exercises on primary dysmenorrhea in young females. *Int J Physiother Res*. 2016;4(5):1658-1662.
- Rejeki S, Sholechan A, Nuroini F, Pranata S. Image of TNF as indicator of inflammation in women taking regiosacral counter-pressure therapy for reducing menstrual pain level. *Lawang Sewu Int Symp Health Sci*. 2022;123-127.
- Aganoff JA, Boyle GJ. Aerobic exercise, mood states, and menstrual cycle symptoms. *J Psychosom Res*. 1994;38(3):183-192.
- Onur O, Gumus I, Derbent A, Kaygusuz I, Simavli S, Urun E, *et al*. Impact of home-based exercise on quality of life of women with primary dysmenorrhea. *S Afr J Obstet Gynaecol*. 2012;18(1):15-18.
- Kaur S, Kaur P, Shanmugam S, Kang MK. To compare the effect of stretching and core strengthening exercises on primary dysmenorrhea in young females. *IOSR J Dent Med Sci*. 2014;13:22-32.

24. Metheny WP, Smith RP. The relationship among exercise, stress, and primary dysmenorrhea. *J Behav Med.* 1989;12:569-586.
25. Dehnavi ZM, Jafarnejad F, Kamali Z. The effect of aerobic exercise on primary dysmenorrhea: A clinical trial study. *J Educ Health Promot.* 2018;7(1):3.
26. Moran F, Leonard T, Hawthorne S, Hughes CM, McCrum-Gardner E, Johnson MI, *et al.* Hypoalgesia in response to transcutaneous electrical nerve stimulation (TENS) depends on stimulation intensity. *J Pain.* 2011;12(8):929-935.
27. Bustan MN, Seweng A. Abdominal stretching exercise in decreasing pain of dysmenorrhea among nursing students. *J Phys Conf Ser.* 2018;1028(1):012103.
28. Ben J. *Kegel Exercise Book: Kegel exercises: Understanding how to Kegel, vaginal training, healing of pelvic pain, solve incontinence and restore your pelvic floor.* Independently published, 2020.
29. Khan S, Ihsan S, Sehgal S, Hashmi A, Muneeb HN, Akash NK, *et al.* Effects of myofascial release versus pelvic floor muscle exercises in women with primary dysmenorrhea. *Pak BioMed J.* 2022;220-225.
30. Lewers D, Clelland JA, Jackson JR, Varner RE, Bergman J. Transcutaneous electrical nerve stimulation in the relief of primary dysmenorrhea. *Phys Ther.* 1989;69(1):3-9.
31. Oraon A, Kumar P, Sarkar B. Effectiveness of Pilates exercise program on pain, function, and stabilometric parameters in subjects with chronic nonspecific back pain: A randomized clinical trial. *Int J Res Anal Rev.* 2019;6(3):403-408.
32. Nasser Abd ElAziz ElShora S, Ebrahim Abd Elnabi M, Sabry Fathy Elbeltagy E. Effect of a group of merged exercises on primary dysmenorrhea symptoms among nursing students. *Egypt J Health Care.* 2023;14(3):486-501.
33. Sharma S, Augustina SJ. Efficacy of core muscle strengthening in women with dysmenorrhea. *Int J Physiother Res.* 2022;10(2):4204-4208.
34. Sari RY. The effectiveness of abdominal stretching exercise on menstrual pain level in students of semester VIII Prodi S1 Nursing University Nu Surabaya. *Surabaya Int Health Conf.* 2017;1(1).
35. Cronk N, Zweig A, Deane K. Is exercise an effective treatment for dysmenorrhea? *Evid Based Pract.* 2021;24(7):32-33.
36. Khadiga S, Eman M, Mohamad F, Asmaa M. Effect of pilates exercise on primary dysmenorrhea. *The Medical Journal of Cairo University.* 2019 Mar 1;87(March):1187-1192.
37. Çelik AS, Apay SE. Effect of progressive relaxation exercises on primary dysmenorrhea in Turkish students: A randomized prospective controlled trial. *Complementary Therapies in Clinical Practice.* 2021 Feb 1;42:101280.
38. Saleh HS, Mowafy HE, El Hameid A. Stretching or core strengthening exercises for managing primary dysmenorrhea. *J Women's Health Care.* 2016;5(295):2167-0420.