Abstract:

Premenstrual syndrome (PMS) is a common disorder affecting women of reproductive age. PMS often begins 6 to 12 days before menstruation and ends two to four days after its onset. PMS has a negative impact on physical and mental health. The aim of this study is to determine the effectiveness of various physiotherapeutic approaches in managing PMS-related discomfort, enhancing overall well-being, and improving quality of life. The Google Scholar, PubMed, and Medline databases were searched for articles published in the period 2013-2023. This systematic review with meta-analysis was conducted from February 2024 to April 2024. The study corpus comprised randomized controlled trials, randomized clinical trials, and pre-post experimental studies. The Visual Analog Scale (VAS), Premenstrual syndrome scale (PMSS), Numeric Pain Rating Scale (NPRS), and Beck Depression Inventory scale (BDI) were used as outcome measures. The 14 studies included in this review were screened independently by the three authors, who also extracted the data. The meta-analysis was performed using a random-effect model. Physiotherapy interventions were found to significantly reduce depression compared to controls (p < 0.001). Additionally, physiotherapy was more effective in reducing pain compared to controls, with a mean difference in VAS score (95% CI) of 2.84 [-1.75, 7.43] between the two groups. The present results show that physiotherapy interventions can be promising and very effective in alleviating premenstrual symptoms and improving quality of life.

Keywords: female, physical therapy modalities, premenstrual syndrome, quality of life

Introduction

Premenstrual syndrome (PMS) is a common disorder experienced by women of reproductive age [1]. The term premenstrual tension was first coined in 1931 by Franklin, and premenstrual syndrome by Greene and Dalton in 1953 [2]. PMS is characterized by a variety of symptoms that appear during the luteal phase of the menstrual cycle and subside with the onset of menstruation, or a few days later [3]. The symptoms often become apparent six to twelve days before menstruation, and can last until two to four days after its end [4]. PMS symptoms are reported to varying degrees. One study reports a prevalence of 70–90% among women, with 20–40%
experiencing disruption in daily activities [5]; another indicates that around 48% of women of reproductive age report a negative impact on mental and physical wellness [6], which another found the global prevalence of PMS to range from 14.3%-74.4% [7]. According to a population-based study, major depression is experienced by 11.3% of women with mild PMS and 24.6% of those with severe PMS; furthermore the prevalence depression range from 20% to 76% throughout their reproductive lives [8].

PMS symptoms include fatigue, bloating, irritability and melancholy, as well as anxiety, tenseness, mood swings, difficulty concentrating, changes in appetite, sleeplessness, swelling, exhaustion, and vertigo. Changes in sexual desire and food cravings are also common [6]. Physical symptoms include weight gain, limb swelling, back pain, stomach pain, nausea, muscle and joint pain, and tenderness and swelling of the breasts [9]. Despite the significant symptoms associated with PMS and its high frequency, the precise causes of the condition have not yet been identified, and existing treatments merely aim to manage the symptoms [10,11].

The most common treatment options for PMS include surgery, pharmaceutical therapy, and nonpharmacological therapy [12]. In addition, engaging in regular physical activity and exercising boosts confidence and promotes a positive body image, both of which diminish the likelihood of developing depression [13]. Exercise is generally speaking, an excellent way for women, and men, to reduce stress and restore the physiological balance in the brain, and this makes it a beneficial treatment for PMS. By raising endorphins and lowering adrenal cortisol, exercise appears to improve pain tolerance and lessen anxiety, depression, and other symptoms associated with PMS [13]. It can help lower physical stress and enhance the lipid profile [14].

Pharmacological treatments can be applied such as oral contraceptives and selective serotonin reuptake inhibitors (SSRIs) [5]. Other treatments for PMS include mefenamic acid, fluoxetine, bromocriptine, GnRH agonist, progesterone, as well as diuretics, lithium, and gamma-linolenic acid; the patients may also be asked to limit the use of alcohol, nicotine, caffeine and salt [15].

This systematic review aims to determine the effectiveness of physiotherapy interventions in alleviating the physical symptoms linked to premenstrual syndrome and enhancing the quality of life.

Materials and methods

The protocol for this systematic review was registered in PROSPERO (registration number CRD42023459622).

Study design

The study reviewed randomised controlled trials (RCTs), non-randomised controlled trials, pre-post experimental studies, and randomized clinical trials published during the period 2013-2023. Papers including different groups, different outcome measures other than VAS and BDI and interventions other than physiotherapy were excluded.

Search strategy

Google Scholar, PubMed, and Medline were searched for randomised controlled trials (RCTs), pre-post experimental studies, and randomized clinical trials published in the period 2013 to 2023. The search used the terms “premenstrual syndrome” and “physiotherapy interventions”, as well as the following keywords: premenstrual syndrome, Quality of life, PMS, Physical therapy modalities, Anxiety, Depression, Premenstrual pain, Premenstrual Tension, Menstrual Disturbances, Premenstrual Dysphoric Disorder, Premenstrual Dysphoric syndrome, Premenstrual treatment, and females. The search strategy was prepared using Mesh terms.

Criteria for review (PICO)

Participants: Women with premenstrual syndrome. All studies included participants aged 18-50 years. Interventions: Physiotherapy intervention to reduce physical symptoms and improve quality of life. The modalities included stretching exercises, relaxation exercises, aerobic exercises, pilates, cognitive behavioural therapy, yoga, pelvic rocking exercises, and other physiotherapy modalities. Comparison: The studies compared acupuncture, alternative medicines, pelvic rock exercises, yoga, pilates, and diet.

Outcomes and variables:

Main outcome: Visual Analog Scale (VAS), Premenstrual syndrome scale (PMSS), Numeric Pain Rating Scale (NPRS), Beck Depression Inventory Scale (BDI). Additional outcome: Exercise self-efficacy scale (EXSE), Food Frequency Questionnaire.

Data extraction

The data extraction process was carried out by three authors working together. Initially, the first author (S) identified articles that met the study’s inclusion criteria. Subsequently, two other authors, GS and SK, extracted information regarding outcomes and the statistics required for effect size estimation. Any discrepancies were resolved through consensus. The data was extracted using a standardized table which included the study design, study population, outcome measures, and intervention specifics for each study.

Assessment of risk of bias

The internal validity of the included studies was evaluated using the Cochrane risk of bias, and their level of evidence using the PEDro scale. Bias risk was determined...
using various parameters, including blinding of participants and outcome assessors, allocation concealment, incomplete outcome data, and selective outcome reporting.

Data synthesis

Statistical analysis was conducted using Review Manager 5.4.1 software. Effect size was calculated using post-intervention means and standard deviations. Outcome allocation concealment was analysed using the standardized mean difference with a 95% confidence interval. Clinically comparable results were aggregated using a meta-analysis utilizing the random-effects model. In studies where meta-analysis was not possible, narrative synthesis was used.

Results

Study selection

A total of 283 records were identified through the searches. After removing duplicates and excluding studies that did not match the inclusion criteria, 50 articles were screened. Of these, seven studies were included in the meta-analysis, as shown in Figure 1.

The studies described in table 1 and previous literature highlight various interventions and their effects on PMS symptoms. Interventions such as Myofascial Release Technique (MRT), Progressive Relaxation Exercise (PRE), aerobic exercise, dietary adjustments, aquatic exercises, acupressure, physical activities, relaxation techniques, Progressive Muscular Relaxation (PMR), Laura Mitchell's Progressive Relaxation Technique (PRT), Benson’s relaxation techniques, stretching and walking exercises, breathing exercises, Kinesio tape, pelvic rocking exercises, Barre exercises, Pilates, aerobic exercises, and Mindfulness-Based Cognitive Therapy (MBCT) were studied. These interventions involved women aged between 14 and 45 across different universities and showed significant improvements in relaxation, increased blood flow, better sleep, reduced PMS symptoms, pain, and blood cortisol levels, as well as enhanced quality of life, reduced depression, and anxiety [1,4,18–21,5–9,12,16,17].
<table>
<thead>
<tr>
<th>Study</th>
<th>Sample size (n)</th>
<th>Participants</th>
<th>Intervention</th>
<th>Outcomes</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisel Demiralp Ovgun et al. (2023) [1]</td>
<td>94</td>
<td>Women aged 18 – 30, studying at Mediterranean University</td>
<td>MRT (n=31), PRE (n=32) and Control group (n=31) twice a week, each session for 20 to 30 minutes.</td>
<td>Demographic information form, McGill Pain Questionnaire, Pittsburgh Sleep quality index, Health-related quality of life (HRQOL)</td>
<td>MRT and PRE provide relaxation, increase blood flow, improve symptoms, improve sleep and quality of life</td>
</tr>
<tr>
<td>Mohebbi Dehnavi, Zahra et al (2018)[9]</td>
<td>65</td>
<td>Female students living in dormitories of Mashhad University</td>
<td>Intervention group (n=35) Aerobic exercise for 8 weeks, 3 times a week, 30 minutes each time Control group (n=30) no intervention</td>
<td>Premenstrual syndrome questionnaire, Beck Depression, and Borg scale.</td>
<td>Significant reduction in the physical symptoms of PMS in the intervention group at the end of the study</td>
</tr>
<tr>
<td>Elvan YILMAZ-AKYUZ et al. (2019)[6]</td>
<td>106</td>
<td>Female students aged 18 - 35 studying at the Faculty of Health Sciences of a public university</td>
<td>Exercise Group (n=37); but 35 completed treatment and 2 dropped out, Diet Group (n=37) but 35 completed treatment and 2 dropped out, control group (n=37) 1 dropped out for 12 weeks; training three days a week for 30 minutes</td>
<td>Visual Analogue Scale (VAS), Premenstrual Syndrome Scale (PMSS) and Food Frequency Questionnaire (FFQ)</td>
<td>The diet and aerobic exercise groups mean scores decreased significantly after the intervention. There was a significant difference in VAS scores between the groups after the intervention</td>
</tr>
<tr>
<td>Asmaa M. El-Bandrawy et al. (2020)[4]</td>
<td>50</td>
<td>Women aged 18-25 aged were selected from the Faculty of Physical Therapy, Deraya University</td>
<td>Group A (n=25) received aquatic exercises and relaxation Group B (n=25) relaxation exercises three sessions a week for 8 weeks for 30 min</td>
<td>Premenstrual syndrome scale (PMSS), Visual analogue scale</td>
<td>Both groups showed a significant increase in VO2 max and a significant reduction in PMSS, VAS, and blood cortisol levels</td>
</tr>
<tr>
<td>Fatemeh Bazarganipour et al. (2017)[5]</td>
<td>90</td>
<td>Women aged 18-45 of Hormozgan University</td>
<td>Acupressure on LIV3 point (n=30), Acupressure on LI4 point (n=30), Acupressure on placebo point (n=30)</td>
<td>PSST questionnaire, QOL (Quality of life)</td>
<td>Acupressure and applying pressure at LIV3 and LI4 are an effective method to decrease the physical symptoms and to improve quality of life</td>
</tr>
<tr>
<td>Susan Annie George et al. (2018)[16]</td>
<td>30</td>
<td>Women aged 18-23 years from Medical Sciences</td>
<td>Experimental group (n=15) physical activities stretching, core strengthening and relaxation technique and control group (n=15) given relaxation technique 3 times per week for 28 days</td>
<td>VAS and Beck Depression Inventory Scale</td>
<td>Both groups showed a reduction in pain and depression, comparing the between groups there is a huge change in mean value hence it is not significant</td>
</tr>
<tr>
<td>Study</td>
<td>Sample size (n)</td>
<td>Participants</td>
<td>Intervention</td>
<td>Outcomes</td>
<td>Result</td>
</tr>
<tr>
<td>-------------------------------</td>
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</tr>
<tr>
<td>Veena JasuJa et al. (2014)</td>
<td>60</td>
<td>Women aged 18-40 years from the department of physiology at SBKS MI &amp; RC, Vadodara, Gujarat, India</td>
<td>Group A (Relaxation technique, PMR), Group B (No intervention) for 2 times/week for 1 month</td>
<td>Beck Depression Inventory (BDI-II) and State Trait Anxiety Inventory (STAI)</td>
<td>PMR showed a significant reduction in BDI II and STAI scores</td>
</tr>
<tr>
<td>Anushka Raipure et al. (2023)</td>
<td>70</td>
<td>Women aged 18 to 35 with PMS in tertiary care hospital in Sawangi, Wardha</td>
<td>Group A (n=35) Laura Mitchell’s PRT, and Group B (n=35) received Benson’s relaxation for 30 mins</td>
<td>Premenstrual syndrome questionnaire, and Numerical pain rating scale (NPRS)</td>
<td>The result showed an improvement in both groups whereas Group B shows a more marked decrease in the PMS symptoms</td>
</tr>
<tr>
<td>Karthika. S. R et al. (2022)</td>
<td>25</td>
<td>Women aged 14-30 years at Lakshmi maternity hospital, Chennai</td>
<td>(n=25) given both stretching and walking for three months</td>
<td>Premenstrual syndrome questionnaire and Physical and Mental health</td>
<td>The result of the study shows a reduction in PMS symptoms and there is improvement in the mental health</td>
</tr>
<tr>
<td>Monica H. Ibrahim et al. (2020)</td>
<td>30</td>
<td>Women aged 18-25 selected from Gynecological Clinic, Egypt</td>
<td>Group A (n=15) Breathing exercise, Group B (n=15) Breathing exercise and treadmill walking for 8 weeks</td>
<td>Visual Analog Scale (VAS) and Daily record of severity of problems (DRSP)</td>
<td>Both groups showed no significant differences in serum cortisol levels, resting HR, and DRSP But there were significant decreases in resting RR and abdominal pain</td>
</tr>
<tr>
<td>Heba Embaby et al. (2022)</td>
<td>60</td>
<td>Women aged 17-21 with PMS from Faculty of Physical Therapy, Cairo University</td>
<td>Group A (Kinesio Tape) (n = 30) and Group B (pelvic rocking exercise) (n = 30) 3 times/week for 2 months</td>
<td>Visual analog scale (VAS) and Modified Calendar of Premenstrual Experiences (COPE)</td>
<td>The result showed that both interventions are beneficial in reducing PMS symptoms</td>
</tr>
<tr>
<td>Ghafooreh Ghaffarilaleh et al. (2019)</td>
<td>62</td>
<td>Women aged 20-45; Tabriz, Iran</td>
<td>Group A (n=31) consists of yoga, but only 26 completed the follow-up 2 months, in 3 sessions/week for 60 minutes, Control group (n=31) only 28 completed the follow-up</td>
<td>Premenstrual symptoms screening tool (PSST), Beck Depression Inventory scale (BDI-II)</td>
<td>After giving yoga there is a significant reduction in depression scores</td>
</tr>
<tr>
<td>Hemalatha.R et al. (2023)</td>
<td>45</td>
<td>Women aged 18-25; Department of Physiotherapy, India</td>
<td>Group A- Barre exercise (n=15), Group B- Pilates (n=15), and Group C- Aerobic exercise (n=15) for eight weeks</td>
<td>Premenstrual syndrome scale (PMSS)</td>
<td>Barre exercises group showed more significant improvement in PMS symptoms, whereas Pilates and Aerobic exercises are also effective</td>
</tr>
</tbody>
</table>
Reporting bias assessment

The risk of bias for the included randomized controlled trials is depicted in Figure 2. Out of the 14 studies included, 11 had random sequence generation, but two did not [17,20]. Allocation concealment was performed in seven studies, but not in three [4,5,16]. Four studies demonstrated blinding of participants and outcome assessors, whereas two did not [1,4]. Additionally, four studies had incomplete outcome data [5,6,13,16], and only one showed performance bias [7].

Effect of physiotherapy intervention on Beck Depression Inventory (BDI) score in participants with PMS

Four RCTs examined the effect on PMS on Beck Depression Inventory (BDI) score [7,8,16,17] (Figure 3). The studies included in the present review examined the effect of mindful-based cognitive therapy (MBCT), stretching, core strengthening with relaxation techniques, yoga, and progressive muscular relaxation (PMR) techniques, which can decrease the severity of PMS symptoms and help reduce depression and anxiety. A total of four studies, including 204 participants, demonstrated considerable heterogeneity in both the experimental and control groups ($I^2 = 98\%$). The mean difference in BDI in these four studies was 4.32 with 95% CI [0.73, 7.92]. All the studies show a significant reduction in BDI score ($p < 0.001$).

Effect of physiotherapy intervention on VAS in participants with PMS

This analysis included four RCTs [4,12,16,19] (Figure 4), comprising a total of 170 participants with PMS; they indicate that physiotherapy interventions were effective in reducing pain, according to the VAS score. The studies examined the effects of aquatic exercises, relaxation training, stretching, relaxation exercises, core strengthening, kinesio-taping, and pelvic rocking exercises, as well as walking and breathing exercises, in reducing pain severity. All four studies found the physiotherapy interventions to significantly reduce pain ($p < 0.001$) compared to the control group. The mean difference in VAS for PMS was found to be 2.84, with a 95% CI of [-1.75, 7.43]. The studies were found to be considerably heterogeneous ($I^2 = 98\%$).

Discussion

This systematic review and meta-analysis is the first to directly compare the effect of physiotherapy interven-
Tab. 2. The level of evidence for included studies (PEDro checklist)

<table>
<thead>
<tr>
<th>Study</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>Total score</th>
</tr>
</thead>
<tbody>
<tr>
<td>George et al. (2018) [16]</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>6</td>
</tr>
<tr>
<td>Bandrawy et al. (2020) [4]</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>6</td>
</tr>
<tr>
<td>Heba Embaby et al. (2022) [19]</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>9</td>
</tr>
<tr>
<td>Ibrahim et al. (2020) [12]</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>4</td>
</tr>
<tr>
<td>Veena et al. (2014) [17]</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>5</td>
</tr>
<tr>
<td>Ghaffarilaleh et al. (2019) [8]</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>8</td>
</tr>
<tr>
<td>Faeze et al. (2016) [21]</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>9</td>
</tr>
</tbody>
</table>

Y- Yes, N- No.

Fig. 3. Forest plot demonstrating comparison of physiotherapy intervention on BDI score in participants with PMS

Fig. 4. Forest plot of comparison of physiotherapy intervention on VAS in participants with PMS
tions in reducing pain and depression in PMS. The review comprises 14 studies and the meta-analysis seven. Most of the reviewed studies investigate the effects of physiotherapy interventions on reducing pain, depression, and anxiety caused by PMS. The results indicate that physiotherapy approaches such as relaxation therapy, core strengthening, stretching, deep breathing exercises, yoga, and aquatic activities have a significant effect in reducing PMS symptoms. Our findings are supported by those of a previous scoping review suggesting that the psychotherapeutic interventions and complementary and alternative practices such as exercise, yoga, and acupuncture can be very effective in reducing PMS [22].

Our present observation that aerobic exercise reduces pain signals in the spinal cord; this will decrease pain perception, which significantly decreases pain, anxiety, and depression in PMS [35]. Exercise can also relieve muscle cramps by improving blood circulation.

Progressive Relaxation Exercise (PRE), introduced by Jacobson in 1924, helps reduce oxygen consumption, and respiratory rate, and inhibits pain by increasing endorphin production [1]. Relaxation therapy can help in reducing stress, Depression, and reduction of pain [15]. CBT and relaxation therapy can be beneficial in curing the various physical symptoms of PMS [36]. A 10-week program combining CBT with relaxation techniques has yielded notable improvements in premenstrual symptoms [37].

Previous data confirms that performing yoga for three 60-minute sessions per week for 10 weeks can improve the various physical symptoms and vital signs, and can have positive effects on reducing depression and diastolic blood pressure in women [8,38]. A twelve-week yoga program has also been found to be effective in reducing stress, improving muscle strength, and reducing pain and PMS symptoms [34,39]. Also, short yoga programmes can be very effective for improving attention and reducing depressive symptoms, physical symptoms and anger levels, and improving the quality of life [40]. Acupressure combined with yoga was shown to be more effective in reducing the severity of premenstrual symptoms and enhancing overall quality of life [41]. Although both yoga and aerobic exercise appear to be effective in reducing pain intensity and alleviating PMS symptoms, yoga proved to be more effective [42]. Yoga also appears to induce endorphin release, which reduces pain, lowers stress and promote relaxation [43].

Another intervention is Pilates. It has been found to improve physical health, muscle strength, endurance, core stabilization, respiratory muscle strength, psychological health, and motor functions. Both Pilates exercises and Benson relaxation methods are recommended therapies for reducing PMS symptoms [44]. Also, the combination of a 15-minute massage with isometric exercise is effective in reducing menstrual-related pain and discomfort [29]. In addition, myofascial release technique (MRT) combined with connective tissue massage can be effective in reducing menstrual-related pain: MRT increases fascial mobility, reduces adhesions, and eases pain [1].

Limitations
This review solely concentrates on outcomes related to pain and depression, quality of life outcomes were not assessed due to scarcity in the literature. Further studies are needed to compare the effects of different physiotherapy modalities and complementary therapies. Additionally, physiotherapy interventions could be investigated as viable treatment options for addressing PMS symptoms.
Conclusions

Our findings show that physiotherapy interventions can be used as treatment options for treating premenstrual syndrome. These interventions may be promising and highly effective in alleviating premenstrual symptoms and improving quality of life.

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Conflicts of interest

The authors declare no conflict of interest.

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