


**Review article**

# Exercise Therapy and Electrotherapy as an Intervention for Primary Dysmenorrhea: A Systematic Review and Meta-Analysis

Sunita Sharma<sup>1</sup>, Kamran Ali<sup>2</sup>, Harneet Narula<sup>3</sup>, Nitesh Malhotra<sup>4</sup>, Richa Hirendra Rai<sup>5</sup>, Nitesh Bansal<sup>6</sup>, Karthick Balasubramanian<sup>7</sup>, Sheetal Kalra<sup>5</sup>, Ramya Ramasamy Sanjeevi<sup>7</sup>, Aksh Chahal<sup>1,8,\*</sup>

<sup>1</sup>Department of Musculoskeletal Physiotherapy, Maharishi Markandeshwar Institute of Physiotherapy and Rehabilitation, Maharishi Markandeshwar (Deemed to be University), Mullana, Haryana, India

<sup>2</sup>Department of Physiotherapy School of medicine and allied sciences GD Goenka University, Sohna, Gurugram, Haryana, India

<sup>3</sup>Department of Radiology, Maharishi Markandeshwar Institute of Medical Sciences and Research, Maharishi Markandeshwar (Deemed to be University), Mullana, Haryana, India

<sup>4</sup>Department of Physiotherapy, Faculty of Allied Health Science, Manav Rachna International Institute of Research and Studies Faridabad, Haryana, India

<sup>5</sup>School of Physiotherapy, Delhi Pharmaceutical Sciences and Research University (DPSRU), Pushp vihar, New Delhi, India

<sup>6</sup>Chief Compliance Officer, Professor & Vice Dean, OP Jindal Global University, Sonapat, Haryana, India

<sup>7</sup>Department of Physical Therapy, faculty of Applied Medical Sciences, Jazan University, Jazan, Saudi Arabia

<sup>8</sup>Department of Physiotherapy, School of Medical and Allied Health Science, Galgotias University Greater Noida, Uttar Pradesh, India

Received November 4, 2022

Revised January 11, 2023

Accepted February 16, 2023

\*Corresponding author:

Aksh Chahal

Department of Physiotherapy,  
 School of Medical and Allied  
 Health Science, Galgotias  
 University Greater Noida,  
 Uttar Pradesh 203201, India  
 Tel: 97-1177-4174

E-mail:

drakshchahal@gmail.com

Primary Dysmenorrhea (PD) is characterized by painful cramps before or during menstruation. It is generally treated with nonpharmacological methods. However, with the advancement of research and the passage of time, physiotherapy plays an increasingly important role in treating patients with PD. Electrotherapy and exercise therapy are conservative methods to treat PD. Alternative methods to minimize reliance on medicinal-based treatments are the need of the hour. This review aims to determine the efficacy of exercise-based therapies and electrotherapy modalities in treating PD. Preferred Reporting Items for Systematic Reviews and Meta-Analyses standards have been used in the present systematic review and meta-analysis. Cochrane, PubMed, and Google Scholar were searched to facilitate the same. The articles from 2011 to 2021 were included in this review. The quality of the review was assessed using the Cochrane risk of bias tool. The visual analog scale was taken as a measure of pain intensity in the meta-analysis, and other outcomes have been included in the systematic review discussed. A total of 15 publications have been included, with a meta-analysis of 7. All included studies were of high quality (PEDro  $\geq$  5), and demonstrated the efficacy of exercise-based therapies and electrotherapy modalities in treating pain in females with PD. This review aims to check the impact of exercise and electrotherapy in females suffering from PD.

**Keywords:** Dysmenorrhea, Electric stimulation therapy, Exercise, Primary dysmenorrhea, Treatment efficacy

© This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/4.0>) which permits unrestricted noncommercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

## INTRODUCTION

Menstrual cramps occurring during or shortly after menstruation in the lower abdomen referred as Primary Dysmenorrhea (PD). Basically, it occurs in the pelvic and or thigh region with no recognizable pelvic pathology [1]. Pain may start a couple of hours prior or at the beginning of menstruation, reaching its peak when the stream turns into the heaviest on the very first day or second day of the menstrual cycle [2]. Pathophysiology of the PD depends on increased emission of prostaglandin, leading to uterine contraction and decreased uterine blood flow. These contractions and reduced blood flow are known to induce pain during PD [3]. PD imposes negative effects on one's lifestyle, school or work attendance and social or physical activity of the female [4,5]. But unfortunately, most females do not seek medical care to control dysmenorrhea pain [6].

According to a Canadian report comparing 1,546 female, 60% female experienced moderate to severe PD, 51% announced distress because of limited or restricted activities and 17% detailed non-attendance from work or school following PD. Pain diminishes with Non-Steroidal Anti-Inflammatory Drugs and oral preventative pills [7]. But unfortunately, these specialities are regularly connected with side effects such as breast tenderness, vomiting, diarrhoea, sleep disturbance, abdominal pain, cramps in thigh, back pain and inter-menstrual draining [8]. Thus, it is important to isolate alternative methods reducing from minimalist to in PD. Alternate methods had been proposed to provide relief from pain in thigh lower back, pelvis [9,10]. Alternative methods such as Acupuncture, Exercise plan based on Frequency, Intensity, Time and Type (FITT) protocol, Acupressure, Needling methods, Heat therapy, Stretching, Aerobic exercise, Relaxation therapy, Moxibustion, Electrical modalities-Transcutaneous electrical nerve stimulation (TENS), Interferential Therapy (IFT), Diadynamic Current etc., are actively being engaged in PD.

Randomized controlled trials published in the last 10 years meeting the inclusion criteria were considered for included in the present review articles not relevant to treatment of PD or comparing pharmacology as primary therapy method were excluded. Aims and criteria were met by 15 articles focusing techniques comprised aerobic exercises, stretching, core strengthening, Zumba, TENS, FITT and Diadynamic Current as treatment methods in PD.

## METHODS

### 1. Data sources search terms and strategies

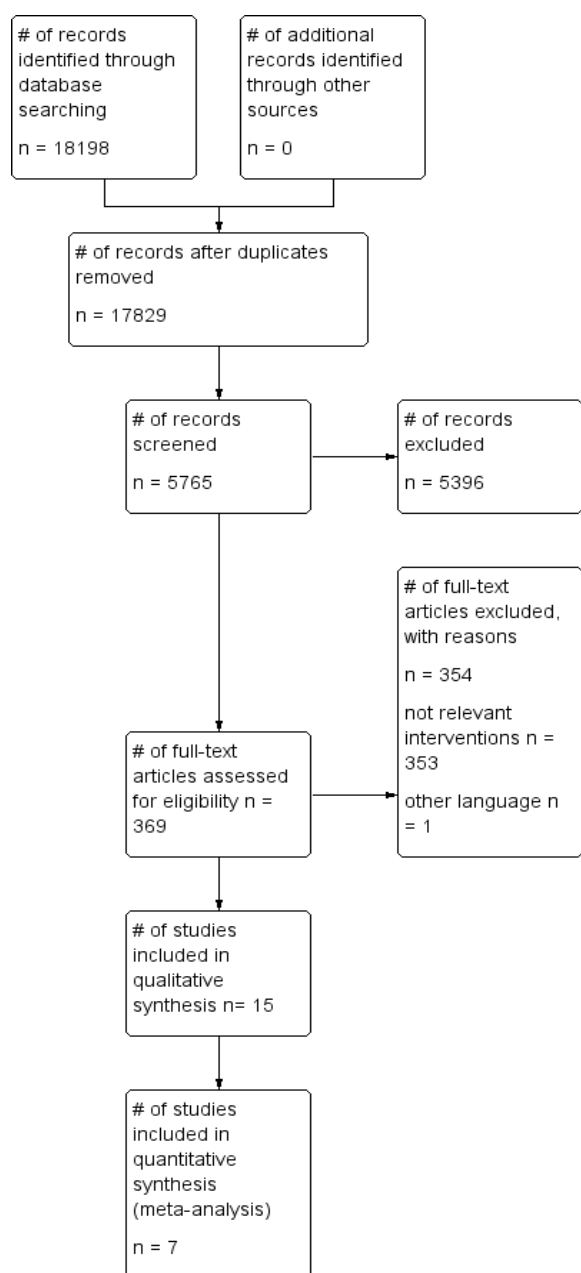
This systemic review and meta-analysis has been for-

ulated following PRISMA guideline [11]. Prefer reporting items for systemic review and meta-analysis in addition. This review is also registered done in PROSPERO (International prospective registration of systemic reviews). This study is based on systemic searches picked up from databases such as PubMed, Google Scholar, and Cochrane. All the published randomized controlled trials and clinical trials (CT) are included in the study. The included articles were published till May 2021. Medical Subject Heading (MESH) terms or titles/abstracts keywords and synonyms are used and modified for every database. Systemic searches were performed for the possible combinations of two categories of keywords to know any particular eligible studies every reference of the included study were assessed. The strategy for the search was built in such a way that the risk of possible selection and selection bias was reduced. Manual screening was there for all the studies in order to know the other related studies (Fig. 1). The study was approved by the Institutional Review Board of Maharishi Markandeshwar (Deemed to be University), Mullana, Ambala (MMDU/IEC/1827).

### 2. Study characteristics

Summary of articles included for review is shown in Table 1. The initial searches identified potentially relevant papers. In final 15 articles were taken with total of 1,179 participants. The main consideration for every included study was "Pain". Visual Analog Scale (VAS) is an outcome measure, where 0 to 10 show from minimum to maximum level of pain respectively. McGill pain scale was also used in a few studies and the Menstrual Symptom Questionnaire (MSQ) was used to measure menstrual symptoms in relation to pressure and magnitude. The therapy interventions were varied. In the publications that were chosen random allocation, groups that were similar at baseline, disguised allocation, 15% dropout rate and reports of between-group differences were satisfied by almost all of the trials. Data pooled from all RCTs were methodological of moderate quality, providing grade evidence for impact of exercise when compared with control. Trials used VAS to assess pain severity, and the results showed that the effect was statistically significant. A total of 15 studies were carefully reviewed with seven of them being qualified for meta-analysis. The methodological quality of the systematic review was moderate, with a mean of 5.75 out of 10 on the Pedro quality scale. The included trials produced sample sizes ranging from 28 to 150. The participants in the included studies ranged in age from 15 to 40 years old.

Assessment of methodological quality (risk of bias) to lessen risk of bias search was done independently, and the quality of each RCT was assessed by Pedro scale. Method-



**Fig. 1.** Identification of studies via database and registers.

ological quality assessment of Pedro was given as 0–2 = unacceptable, reject; 3–5 = low-quality high risk of bias; 6–8 = acceptable quality moderate risk of bias; 9–10 = high-quality low risk of bias. Table 2 shows the methodological quality of included study. We included 15 RCT in this review and 7 for the meta-analysis. Cochrane risk of bias assessment tool is also followed to evaluate the risk of bias and these biases are also further divided in integrated studies grades as high risk, low risk, and unclear risk. This meta-analysis included only articles published in the English. Conference abstracts, dissertations and grey literature are not included. Initially, publications were chosen based on their relevant titles and

abstracts, and then the full-text description of each study was examined for methodological excellence.

### 3. Registration number

The systematic review and meta-analysis is part of a main study titled “exercise therapy and electrotherapy as an intervention for primary dysmenorrhea. A systematic review and meta-analysis.” PROSPERO, Centre for Review and Dissemination 42021268923.

## RESULTS

Using Google Scholar + PubMed + Cochrane database, 21,970 article searches were conducted. Fifteen publications were included in the systematic review with meta-analysis of 7. Those studies were included based on the pre-and post-mean with standard deviation previously mentioned in the VAS scale outcome or subgroup 1.1 VAS, studies = 7, Participants = 512, Statistical Method: Std. mean difference (IV, Random, 95% CI) 8.15 (3.97, 12.33) and test for overall effect is 3.82. Pedro scores of included trial (n = 7). Representation of the forest plot for comparison of exercise therapy and electrotherapy in addition to pain.

### 1. Forest plot

From this Plot, we confirm 7 studies (A to G) and their respective (95% CI). Green box represents effect size (in this case, OR) of each study. Bigger the box more the study weight (i.e., bigger sample size) and vice versa. The black diamond shape represents the pooled OR of the 7 studies. We can see the blue diamond cross the vertical line OR = 1, indicating no significance for the association as the diamond is almost equalized on both sides. We can also confirm this from the 95% confidence interval that includes one and the p-value > 0.05.

Meta-analysis forest plot Fig. 2; from this plot, we can see seven studies (A to G) and their respective OR (95% CI). The green box represents the effect size (in this case, OR) of each study. The bigger the box means the study weighted more (i.e., bigger sample size). The black diamond shape represents the average of the seven studies’ odd ratios. The blue diamond crosses the vertical line OR = 1, indicating that the association has no significance because the diamond is about equal on both sides. The 95% CI, which contains one and the p-value > 0.05, also confirms this.

Biennial risk shows a graph that depicts the risk of bias. Risk of bias for every item showed the judgment of the authors for the study.

**Table 1.** Summary of articles included for review

Author (yr)	Objectives	Participants (age)	Outcome measures	Intervention/ Duration	Result	Conclusion
Kirmizigil and Dermiralp (2020) [24]	To investigate the effects of a combined exercise program on pain, sleep and menstrual symptoms in patients with primary dysmenorrhea.	28 (18 to 35)	Visual Analog Scale (VAS), Menstrual Symptom Questionnaire (MSQ) and Pittsburgh Sleep Quality Index (PSQI).	3 times a week for 8 weeks. For exercise group, two stretching exercises, one yoga position, two core-strengthening exercises, two pelvic area exercises and Kegel exercises for 45 min. Warm-up exercises performed 5 min before the combined exercise and deep breathing exercise. Control group did not perform any activity.	The comparisons between the groups revealed statistically significant difference in abdominal pain severity, MSQ total score and the subscale scores of negative outcomes and management methods ( $p < 0.05$ ). The intragroup comparisons of the exercise group demonstrated that the scores of the low back pain and abdominal pain and the MSQ and PSQI scores were found to be significantly difference after the 8-week program ( $p < 0.05$ ).	Combined exercise therapy is an effective way to manage symptoms associated with primary dysmenorrhea.
George et al. (2019) [23]	To evaluate the effect of physical activity and relaxation techniques in reducing symptoms of primary dysmenorrhea.	30 (18 to 23)	VAS, beck depression inventory scale.	3 times per wk for 4 wks. Experimental group was given physical activities including stretching, core strengthening and relaxation technique with warm up and cool down. Control group was given only relaxation technique.	In this study, both groups are showed reduction in pain and depression within the group comparison. In between the groups there is change in mean value but the p-value is greater than 0.05 and hence it is not significant and it shows there are no comparable changes between groups.	Both physical activity and relaxation techniques are very effective in reducing menstruation related pain and depression.
Heidarimoghdam et al. (2019) [22]	To investigate the effects of exercise based on a specific protocol on the severity and duration of primary dysmenorrhea in students.	86	McGill Pain scale and the duration of pain per day.	In experimental group, exercise based on the Frequency, Intensity, Time and Type protocol (Intensity of exercise, time of exercise, and type of exercise) was implemented for 3 session per wk for 8 wks.	Severity after the intervention in group was lower than the control group [3.06 (1.78) and 4.74 (2.14)], individually and in the second cycle [2.01 (1.54) and 4.61 (2.01) separately] ( $P < 0.001$ ). The mean duration after the intervention was less than control group 1.29 (0.92) and 2.32 (1.26) individually $p < 0.001$ and in the second monthly cycle 0.94 (0.93) and 2.13 (1.24) (separately $p < 0.001$ ).	Sports activities based on a certain and organized protocol could improve dysmenorrhea.
Samy et al. (2019) [21]	To study the effectiveness of Zumba exercise on the reducing severity and duration of pain in young female with primary dysmenorrhea.	98 (18 to 25)	VAS.	Intervention group received 16 classes of 60-min Zumba for 2 consecutive menstrual cycles (8 wks, twice weekly) with recovery period of at least 48 hr. Control group did not receive any interventions.	There was significantly decreased menstrual pain in the Zumba group after 4 and 8 wks of Zumba compared with the control group respectively; $p < 0.001$ and the duration of pain was shorter in the Zumba group than the control group at 8 wks.	Zumba can reduce the severity and duration of menstrual pain thus suggesting that regularly performing Zumba might be a possible complementary treatment for primary dysmenorrhea.

Table 1. Continued 1

Author (year)	Objectives	Participants (age)	Outcome measures	Intervention/ Duration	Result	Conclusion
Fallah and Mirfeizi (2018) [25]	To evaluate the effect of 3 exercise programs on reducing symptoms of primary dysmenorrhea.	70 (15 to 18)	VAS, McGill's questionnaire.	3 sessions a wk, twice a d, 8 wks, 10 mins for massage group, 20 mins for stretching group, and 20 mins for combination group (stretch and massage), and without exercise for control group.	The results revealed that performing a regular physical activity led to a significant reduction in the severity of dysmenorrhea pain Rate Index, visual analogue scale (VAS), present pain intensity (PPI) and total pain according to McGill's short form questionnaire, and volume of bleeding in the 3 groups.	Exercises such as massage and stretch and combination of both would reduce the quality and quantity of pain in primary dysmenorrhea including the duration and intensity of pain.
Tharani et al. (2018) [20]	To compare the effects of stretching exercise versus aerobic exercise in primary dysmenorrhea.	30 girls age (17-23)	VAS, Depression Anxiety Stress Scale-21.	Group A received stretching exercise for 8 wks and Group B received aerobic dance for 3 d/wk for 45 min on alternate d for a period of 8 wks period and both group was advised to avoid aerobic dance during the menstrual cycle.	Both groups shows reduction in pain and stress but aerobic group shoes more significant in reducing pain and stress than stretching group.	Aerobic dance is effective in reducing the symptoms of primary dysmenorrhea.
Bai et al. (2017) [19]	To investigate the effectiveness of trans cutaneous electrical nerve stimulation (TENS) therapy for relieving symptoms of primary dysmenorrhea (PD).	134 (18 to 30)	Numerical rating scale (NRS), World Health Organization Quality of Life- Brief Version (WHOQOL-BREF) score.	Intervention group received TENS, at the painful lower abdominal area, at a frequency of 2 to 100 Hz for 30 min from first day to last day of menstruation for 3 menstrual cycles. TENS was kept off in the sham group.	TENS had significant effect in pain relief with regard to the NRS, duration of relief from dysmenorrhoeal pain, and number of ibuprofen tablets taken. But there was no significant differences in the quality of life between 2 group.	TENS was more effective and safe in relieving pain in participants with primary dysmenorrhea.
Sutar et al. (2016) [18]	To investigate the effect of aerobic exercises on primary dysmenorrhoea.	100 (17 to 23)	VAS, SF-36 health survey (SF-36) for quality of life.	In intervention group, 8 wks of aerobic training for 3 d/wk, 45 min/d were performed between the three menstrual cycles with warm up exercises for 10 min and cool down for 10 min. Control group did not received any treatment.	The VAS scores started to decrease subsequent in three visits and is statistically significant and Health-related quality of life was increased significantly in intervention group.	Treatment with Aerobic exercises may be the preferred treatment for dysmenorrhea as it is also cost effective.
Saleh et al. (2016) [17]	To investigate the effect of physical exercises on primary dysmenorrhoeal i.e (stretching and core strengthening exercises) and compare between them in the intensity and duration of pain.	150	VAS and pain duration by hours.	Two Intervention groups received active stretching (A) or core strengthening protocol (B) for (4 d per wk, 2 times a d, 10 min) for 8 wks and control group did not received any treatment.	Both stretching and core strengthening group had significant reduction of intensity and duration of the pain compared to control group but not significant different between group.	Performing exercise in various forms including stretching and core strengthening exercises reduces pain intensity and duration of primary dysmenorrhea.



Table 1. Continued 2

Author (year)	Objectives	Participants (age)	Outcome measures	Intervention/ Duration	Result	Conclusion
Lee et al. (2015) [16]	To investigate the safety and effectiveness of the high-frequency transcutaneous electrical nerve stimulation (hf-TENS) combined with thermotherapy in relieving primary dysmenorrhoeal pain.	115	VAS, duration of pain relief, brief pain inventory (BPI) score, number of ibuprofen tablets taken, and WHOQOL-BREF score.	In intervention group, TENS was given when dysmenorrhoeal pain was felt for 30 min until the end of the menstruation as determined based on disappearance of bleeding, but not longer than 8 d, immediately followed by 20 min of thermotherapy. "Sham" group had tens with turned off.	There was significant reduction of pain in intervention group but the duration of pain relief was significantly increased in the study group compared to the control group. There was no significant differences in in the brief pain inventory scores, numbers of ibuprofen tablets taken orally, and WHOQOL-BREF scores between the groups.	The combination of hf-TENS and thermotherapy was effective in relieving acute pain in women with moderate or severe primary dysmenorrhea.
Lauretti et al. (2015) [26]	To evaluate the effectiveness and safety of a new portable TENS device (TANX <sup>®</sup> ) for. Control of primary dysmenorrhea cramp pain.	40	VAS, diclofenac intake and quality of life.	TENS was applied, for 30-min at 8 hr intervals, up to 7 d in supra pubic region in intervention group. The placebo group received "sham" device.	There was significant reduction of pain, diclofenac intake and increase of quality of life in intervention group as compared to placebo group.	The portable, TENS device is useful in pain relief and improved the quality of life, without adverse effects, in patients with painful cramps associated with dysmenorrhea.
Muragod et al. (2017) [15]	To investigate the effectiveness of transcutaneous electrical nerve stimulation and diadynamic current on primary dysmenorrhea.	32 (18 to 25)	McGill pain questionnaire, VAS.	Group A was given conventional TENS with pulse width 40–75 ms with a frequency of 50–100 Hz. Group B was given diadynamic currents modulation 2 (Diphase Fixe), for a frequency of 50–100 Hz and the pulse duration of 10 milliseconds. Both group received treatment for 20 min for 5 d.	There was significant difference in pain and Multidimensional Personality Questionnaire within the group on both groups but Group B had significant reduction of pain than Group A on between group comparisons.	Diadynamic current have better results than TENS in relieving pain in dysmenorrhea.
Chaudhuri et al. (2013) [14]	To find out the prevalence of PD among school girls and to investigate the impact of exercise and hot water bottle on reducing the symptoms of primary dysmenorrhoea among the study population.	128	Menstrual Distress Questionnaire (MDQ), VAS.	Exercise group received exercise therapy in which 5 exercise were asked to be done for 15–20 min in 2 sessions throughout the month except on periods. Group 2 is for hot water bottle in which bottle were to be applied over the lower abdomen when pain occurred during the menstrual period, for 15–20 mins each time.	60.7% was the prevalence of dysmenorrhea with median age of 14 yrs. The mean Visual Analog Scale for Pain score decreased from 5.75 to 2.96 and from 5.16 to 2.06 at 3 mo, in the activity and hot water bottle group separately. The mean MDQ score diminished from 14.53 to 7.85 and from 14.92 to 8.16 at 3 mon, in the exercise and hot water bottle group respectively.	Both exercise & hot water bottle can be used in dysmenorrhea girls in home setting to provide relief from pain and menstrual distress.

**Table 1.** Continued 3

Author (year)	Objectives	Participants (age)	Outcome measures	Intervention/ Duration	Result	Conclusion
Shahr-Jerdy et al. (2012) [13]	To assess the effect of stretching exercise on primary dysmenorrhea in high school students.	179 (15 to 17)	VAS, pain duration, and the use of sedative tablet.	Experiment group were given active stretching exercise for 8 wks (3 d per wk, 2 times per d, 10 min each time) at home. Control group did not received any treatment.	In experimental group, pain intensity, pain duration and number of sedative tablet taken significantly reduced from 7.65 to 4.88, 7.48 to 3.86 hrs, and 1.65 to 0.79 tablets in the experimental group ( $p < 0.05$ ) respectively. In the control group, only pain duration was significantly different ( $p < 0.001$ ).	Stretching exercises can be conservative treatment in reducing symptoms, and the amount of painkillers used by girls with primary dysmenorrhea.
Onur et al. (2012) [12]	To investigate the impact of home-based exercise on reducing pain intensity and increase quality of life in women with primary dysmenorrhoea.	45 (16 to 39)	VAS, International physical activity questionnaire (International Physical Activity Questionnaire), SF-36 questionnaire.	A home-based exercise programme was taught to the patients by a physical therapist, in which each session lasted 40 min and comprised 10 min of stretching, 20 min of aerobic, and 10 min of relaxation exercise for 3 times a wk for 12 wks.	There was significant reduction of pain intensity on VAS on each menstrual cycle and significant improvement in the eight domains of the SF-36 and the physical and mental component.	The positive impact is shown in quality of life and pain of the home based exercise plan on girls with primary dysmenorrhoea.

**Table 2.** Pedro scores of included trial (N = 7: 40/70)

Trial	Random allocation	Concealed allocation	Groupssimilar at baseline	Participant blinding	Therapist blinding	Assessor blinding	< 15 % dropout	Intention-to-treat analysis	Between-group difference reported	Point estimate and variability	Total (0–10) × 7 40/70
Samy et al. (2019) [21]	Yes	No	Yes	No	No	No	Yes	Yes	Yes	Yes	6
Muragod et al. (2017) [15]	Yes	No	Yes	No	No	No	No	Yes	Yes	Yes	5
Lee et al. (2015) [16]	Yes	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	7
Kirmizigil and Demiralp (2020) [24]	Yes	No	Yes	No	No	No	Yes	Yes	Yes	Yes	6
Tharani et al. (2018) [20]	Yes	No	Yes	No	No	No	Yes	Yes	Yes	Yes	5
Shahr-Jerdy et al. (2012) [13]	Yes	No	Yes	No	No	No	Yes	Yes	Yes	Yes	6
George et al. (2019) [23]	Yes	No	Yes	No	No	No	No	Yes	Yes	Yes	5

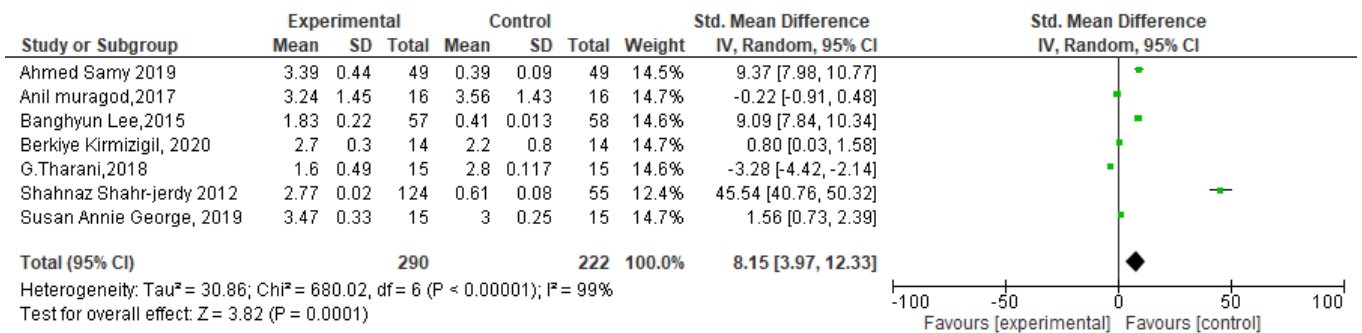


Fig. 2. Forest plot.

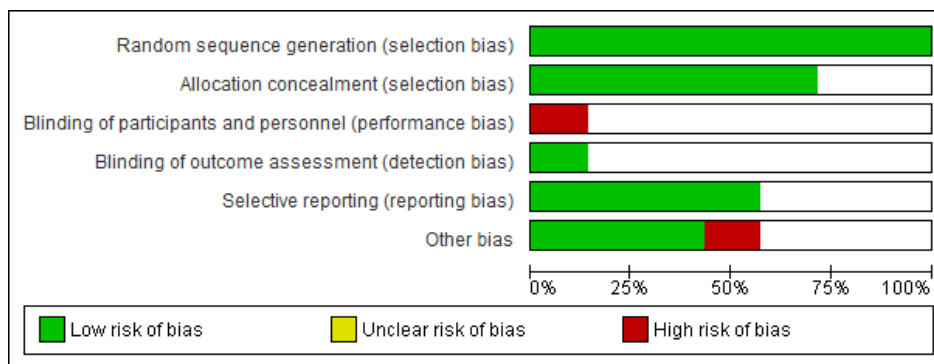


Fig. 3. Risk of bias graph for included studies.

## 2. Risk of bias

Measurement of risk of bias for the studies included for review is depicted in Fig. 3.

## 3. Graph representing: risk of bias

Risk of bias for every item that showed the judgment for the study of the authors.

## DISCUSSION

As viewed by authors' best search it is found that no other meta-analysis is done on the "Effectiveness of exercise therapy and electrotherapy in patients with respect to primary dysmenorrhea". Seven studies have met the inclusion criteria for meta-analysis and 15 studies for the review but only randomized controlled trials were included. Menstrual discomfort is a common occurrence, but it is a social taboo for discussion. As a result, it is difficult to make any diagnosis and identify an acceptable treatment plan. Communication between the doctor and the patient is also a critical obstacle. Moreover, a multidisciplinary therapy plan varies on the patients' specific experiences, needs, and goals. In this study, fifteen studies were analysed for concluding the different effects of exercise therapy and electrotherapy in

PD patients.

Onur et al. [12] performed a study in 2012 to find the impact of the home environment on PD patients. It included 48 participants' outcome measures which were based upon VAS, International Physical Activity Questioner, and Metabolic Equivalent scores. All the outcome measures significantly improved. The conclusion was regarding the positive impact reflected in the quality of life ( $p < 0.05$ ). Similarly, Shahr-jerdy et al. [13] conducted randomized clinical research to see if stretching exercises could help adolescent females with PD. A total of 124 females were requested to stretch at home, whereas 55 females were merely required to complete a questionnaire. Researcher discovered that stretching exercises help female with PD and can the reduce pain severity and the number of medicines they take ( $p < 0.001$ ).

According to Chaudhuri et al. [14] conducted a randomized controlled experiment in 2013 to study any impact of combination could help exercise and hot water combination could helpful in PD. The outcome measure was based upon VAS, and mental distress questionnaire (NSQ). 53 girls were given exercise therapy and 75 girls received hot water bottle treatment. They concluded both, can be used in a home setting to relieve menstrual pain ( $p < 0.0001$ ). Similarly, Muragod et al. [15] in 2014 performed a study in which they included 32 subjects for the effectiveness of transcutaneous electrical nerve stimulation and diadynamic current on elec-



tric stimulation. Outcome measures were based upon VAS, McGill pain questionnaire, MDQ. They divided the subjects into two groups for two different treatments and the results were significant for 1st intragroup with  $p < 0.001$  but insignificant for 2nd intergroup with  $p = 0.53$ . So, they concluded that Diadynamic current has better results than TENS in relieving pain in PD.

Similarly Lee et al. [16] performed a study in 2015 to investigate the efficacy and safety of combined therapy with high-frequency TENS and thermotherapy in relieving PD pain. It comprised 115 participants. VAS was the outcome measure and the results showed that this combination was effective in relieving acute pain in women with PD. Another study Saleh et al. [17] performed a randomized controlled trial in 2016 and included 150 participants for the stretching or core strengthening exercise for managing primary dysmenorrhea which had VAS as the outcome measure. 44 females were referred for stretching exercises and 44 females for strengthening exercises and 38 females were in the controlled group and the conclusion was a decrease in pain intensity with these exercises ( $p < 0.001$ ). Similarly Sutar et al. [18] in 2016 performed a systematic review on the effect of aerobic activities on PD in college students, with 100 participants randomized into two groups equally and randomly. The outcome measures were the Short Form 36 Health Survey Questionnaire for quality of life and VAS for pain. The criteria were interventional and control groups, and they concluded that aerobic activities may be the best treatment because it is also post-effective. Bai et al. [19] performed a study on 134 participants to know the effectiveness of TENS as compared to sham TENS in PD in 2017. Outcome measures were based upon NPRS, VAS, World Health Organization Quality of Life-Brief Version-BREF score. Participants of the sham group received TENS. The conclusion was derived that TENS was more effective and safe in relieving pain. Tharani et al. [20] performed a study on a comparison of the effects of stretching exercise vs. aerobic exercises for PD in 2018. It included 30 subjects divided into two groups. It used outcome measure as VAS and it concluded that aerobic dance is effective in reducing symptoms of PD [20] and Samy et al. [21] performed a study in 2019 on 98 participants to know the effect of Zumba exercise on young women with PD. Two groups were divided and intervention and control and VAS were taken as the outcome measure. It was identified that Zumba exercise can reduce the severity of pain.

Heidarimoghadam et al. [22] performed a study in 2019 to investigate the effect of exercise based on the specific protocol on the severity and duration of PD. In the study, 86 students were involved; with 43 students in the intervention and 43 students in the controlled group. The exercise was based on the FITT protocol. McGill pain scale research was analysed using SPSS 20.0 (SPSS Inc.). The result can

be summarized as sports activity based on a certain and organized protocol which could improve dysmenorrhea  $p < 0.001$ . George et al. [23] performed a study in 2019 to evaluate the effect of physical activity and relaxation techniques in reducing the function of primary dysmenorrhea. In this study, 36 subjects were involved and VAS pain scale was the outcome measure. The participants were divided into intervention and control groups. The intervention group received stretching, strengthening and relaxation techniques. The controlled group received only relaxation techniques. The protocol given to the experiment group was effective in reducing symptoms. Kirmizigil and Demiralp [24] study in 2020 was on 28 subjects for examining the effectiveness of functional exercise on pain and sleep quality of patients suffering from primary dysmenorrhea. VAS and MSQ were the outcome measure used in the study. Subjects were divided into two groups-the exercise group and the Controlled group. Combined exercises were effective in reducing the symptoms of primary dysmenorrhea ( $p < 0.05$ ). Similarly Fallah et al. [25] in 2018 evaluated effect of three exercises programs on reducing symptoms of PD in 70 students who were randomly divided into 4 groups stretch, massage, combined and control a group. Outcome measure were based upon McGill questionnaire, VAS, where the exercises reduced the quality and quantity of pain in primary dysmenorrhea and Lauretti et al. [26] in 2015 performed a randomized controlled trial which used a new portable transcutaneous electrical nerve stimulation device that was efficient in the control of PD cramp pain. Here 50 female were analysed and VAS was the outcome measure. The results concluded significant ( $p < 0.001$ ). Limitation of studies are discussed below, thus with all the above electro and exercise therapy intervention showing one direction on reducing pain related symptoms on PD we can state that the above conservative intervention can be treatment of choice for female with PD. One of the limitations is the use of small sample size in some of the studies. Another drawback is that none of the studies continued the treatment for longer than three months, i.e., three menstrual cycles fluid intake, which is known to be an effective factor on menstrual symptoms and was not questioned in this study, the prostaglandin levels could not be evaluated objectively during periods, Hospital Anxiety and Depression scale was not used, anxiety and depression results of individuals were obtained, the possible effect of emotional changes on the perception of pain could also be seen. The last limitation was the small sample size of the study [24]. Exercise did not affect severity and duration of PD, but they were affected by weight, fat mass and quality of life. Pain assessment scale is the limitation [22]. Participants have not received any follow-up assessments after the 8 weeks of intervention study was limited up to the nonathletic students aged 18–25 years.

## NOTES

Further studies should be conducted for among other populations, such as athlete women, and older adults with same protocol, finally, there was a small sample size, and lack of blinding of participants and outcome assessors, as well as subjective outcome measures with inconsistent assessment so further studies should be to improve this [21]. They have not evaluated dieting behaviour and habitual eating routines, there is lack of any radiological exam such as colour and also there was small sample size [25]. Small sample size, short study duration, no long-term follow-up of the subjects, a study was done only between the age group of 17–23 years, only students were taken as subjects [20]. The researchers were not blinded to the assigned intervention or outcomes, and the lack of a control group (“sham”exercise) may have exaggerated the effect of the intervention [12]. The cross-sectional nature of the research, as it does not reflect any temporal changes. Furthermore, the study was performed on a relatively small sample; therefore, generalizations of results in terms of the entire female population ought to be made with caution [13]. The diagnosis of primary dysmenorrhea was depending on history and since blinding was not feasible in these behavioural interventions, there may have been some bias among the respondents in subjective measurement of pain and menstrual distress [14]. The present study was conducted by giving treatment for duration of one cycle. Long term benefits couldn't be observed in the same. The treatment protocol can be given in increased frequency of either two or three times a day, since our study is limited to only once in a day [15]. Many additional keywords or MESH terms linked to “physiotherapy topic” could have been included in the search method; this has resulted in the omission of certain papers. Likewise, for databases such as PubMed or Cochrane, many other databases could have been involved in the study.

## CONCLUSION

This study's practical applications can cause a reduction in the usage of pharmaceutical treatment which is in favour of physiotherapy-based treatment options. As a result, there would be fewer side effects and patients will spend less money on Non-Steroidal Anti-Inflammatory Drugs, contraceptive pills, and other medications. Exercise and electrotherapy provide a diverse and sufficient arsenal of treatments that if implemented in a tailored manner then can help the patients to lessen the side effects and improve their quality of life.

### • ORCID

Sunita Sharma, <https://orcid.org/0000-0002-1761-6691>  
 Kamran Ali, <https://orcid.org/0000-0001-6492-3398>  
 Harneet Narula, <https://orcid.org/0000-0003-1737-3375>  
 Nitesh Malhotra, <https://orcid.org/0000-0003-4104-4520>  
 Richa Hirendra Rai, <https://orcid.org/0000-0003-0102-2773>  
 Nitesh Bansal, <https://orcid.org/0000-0002-1662-8981>  
 Karthick Balasubramanian, <https://orcid.org/0000-0003-2304-8405>  
 Sheetal Kalra, <https://orcid.org/0000-0003-3317-4624>  
 Ramya Ramasamy Sanjeevi, <https://orcid.org/0000-0003-3486-0482>  
 Aksh Chahal, <https://orcid.org/0000-0003-2871-3697>

- **Authors' contributions:** S.S., K.A., H.N., and A.C. participated in conceptualization. N.M., R.H.R., N.B., and S.K. participated in data curation. S.S., K.B., S.K., and R.R.S. participated in formal analysis. N.M., R.H.R., N.B., K.B., and A.C. participated in result analysis. S.S., K.A., H.N., N.M., and A.C., participated in drafting methodology. N.M., K.B., S.K., R.R.S., and A.C. participated in project administration. S.S., K.B., S.K., and R.R.S., participated in visualization. S.S., K.A., H.N., and A.C. participated in validation. S.S., N.M., R.H.R., N.B., and A.C., participated in supervision. S.S., K.A., H.N., and A.C. participated in writing original draft. N.M., R.H.R., N.B., K.B., and A.C. participated in review and editing of final draft.
- **Conflicts of Interest:** No conflict of interest.
- **Funding:** None.
- **Acknowledgements:** The present study titled “Exercise Therapy and Electrotherapy as an Intervention for Primary Dysmenorrhea-A systematic Review and Meta-Analysis” has been Registered in PROSPERO, with ID (CRD42021268923).

## REFERENCES

1. Lee CH, Roh JW, Lim CY, Hong JH, Lee JK, Min EG. A multi-center, randomized, double-blind, placebo-controlled trial evaluating the efficacy and safety of a far infrared-emitting sericite belt in patients with primary dysmenorrhea. *Complement Ther Med* 2011;19(4):187-93.
2. Dawood MY. Primary dysmenorrhea: Advances in pathogenesis and management. *Obstet Gynecol* 2006;108(2):428-41.
3. Iacovides S, Avidon I, Bentley A, Baker FC. Reduced quality of life when experiencing menstrual pain in women with primary dysmenorrhea. *Acta Obstet Gynecol Scand* 2014;93(2):213-7.
4. Burnett MA, Antao V, Black A, Feldman K, Grenville A, Lea R, et al. Prevalence of primary dysmenorrhea in Canada. *J Obstet Gynaecol Can* 2005;27(8):765-70.
5. Wong LP. Attitudes towards dysmenorrhoea, impact and treatment seeking among adolescent girls: A rural school-based

- survey. *Aust J Rural Health* 2011;19(4):218-23.
6. Lefebvre G, Pinsonneault O, Antao V, Black A, Burnett M, Feldman K, et al. Primary dysmenorrhea consensus guideline. *J Obstet Gynaecol Can* 2005;27(12):1117-46.
  7. Proctor M, Farquhar C. Diagnosis and management of dysmenorrhoea. *BMJ* 2006;332(7550):1134-8.
  8. Kannan P, Claydon LS. Some physiotherapy treatments may relieve menstrual pain in women with primary dysmenorrhea: A systematic review. *J Physiother* 2014;60(1):13-21.
  9. Pan RY, Hsu YC, Wong CS, Lin SL, Li TY, Cherng CH, et al. Comparing complementary alternative treatment for chronic shoulder pain of myofascial origin: Collateral meridian therapy versus local tender area-related meridians therapy. *Medicine (Baltimore)* 2016;95(35):e4634.
  10. Yang G, Sun P. Introduction of acupuncture for pain relief. *Eur J Bio Med Res* 2015;1(12):12-7.
  11. Moher D, Liberati A, Tetzlaff J, Altman DG; PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *Ann Intern Med* 2009;151(4):264-9, W64.
  12. 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 dysmenorrhoea. *South Afr J Obstet Gynaecol* 2012;18(1):15-8.
  13. Shahr-jerdy S, Hosseini RS, Gh ME. Effects of stretching exercises on primary dysmenorrhea in adolescent girls. *Biomed Hum Kinet* 2012;4(1):127-32.
  14. Chaudhuri A, Singh A, Dhaliwal L. A randomised controlled trial of exercise and hot water bottle in the management of dysmenorrhoea in school girls of Chandigarh, India. *Indian J Physiol Pharmacol* 2013;57(2):114-22.
  15. Muragod A, Mathias O, Bhoir P. Effectiveness of transcutaneous electrical nerve stimulation and Diadynamic Current on Primary Dysmenorrhea: A randomized clinical trial. *J Med Sci Clin Res* 2017;05(03):18557-62.
  16. Lee B, Hong SH, Kim K, Kang WC, No JH, Lee JR, et al. 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.
  17. Saleh HS, Mowafy HE, El Hameid AA. Stretching or core strengthening exercises for managing primary dysmenorrhea. *J Women's Health Care* 2016;5(1):1000295.
  18. Sutar A, Paldhikar S, Shikalgar N, Ghodey S. Effect of aerobic exercises on primary dysmenorrhoea in college students. *J Nurs Health Sci* 2016;5(5):20-4.
  19. Bai HY, Bai HY, Yang ZQ. Effect of transcutaneous electrical nerve stimulation therapy for the treatment of primary dysmenorrheal. *Medicine (Baltimore)* 2017;96(36):e7959.
  20. Tharani G, Dharshini E, Rajalaxmi V, Kamatchi K, Vaishnavi G. To compare the effects of stretching exercise versus aerobic dance in primary dysmenorrhea among collegiates. *Drug Invent Today* 2018;10(Special Issue 1):2844-8.
  21. Samy A, Zaki SS, Metwally AA, Mahmoud DSE, Elzahaby IM, Amin AH, et al. The effect of Zumba exercise on reducing menstrual pain in young women with primary dysmenorrhea: A randomized controlled trial. *J Pediatr Adolesc Gynecol* 2019;32(5):541-5.
  22. Heidarimoghadam R, Abdolmaleki E, Kazemi F, Masoumi SZ, Khodakarami B, Mohammadi Y. The effect of exercise plan based on FITT protocol on primary dysmenorrhea in medical students: A clinical trial study. *J Res Health Sci* 2019;19(3):e00456.
  23. George SA, Suresh G, Fathima P, Alias H. Effectiveness of physical activity and relaxation techniques in primary dysmenorrhea among college students. *Int J Sci Res* 2019;8(11):531-3.
  24. Kirmizigil B, Demiralp C. Effectiveness of functional exercises on pain and sleep quality in patients with primary dysmenorrhea: A randomized clinical trial. *Arch Gynecol Obstet* 2020;302(1):153-63.
  25. Fallah F, Mirfeizi M. How is the quality and quantity of primary dysmenorrhea affected by physical exercises? A study among Iranian students. *Int J Women's Health Reprod Sci* 2018;6(1):60-6.
  26. Lauretti GR, Oliveira R, Parada F, Mattos AL. The new portable transcutaneous electrical nerve stimulation device was efficacious in the control of primary dysmenorrhea cramp pain. *Neuromodulation* 2015;18(6):522-6; discussion 522-7.