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SYSTEMATIC REVIEW

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Effectiveness of physical therapy on pain, disability and quality of life in women with lumbopelvic pain in postpartum period: a systematic review with evidence gap map and meta-analysis

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Abstract

Background The majority of women experience a recovery from pregnancy-related lumbopelvic pain (LPP) within three months of delivery. However, a postpartum follow-up study reported that approximately 8–20% of women still experience persistent non-specific LPP two to three years after delivery, which can interfere with daily activities. The present study aims to investigate the effect of physical therapy on pain severity, disability and quality of life in women with LPP in the postpartum period.

Methods The present literature search was conducted from inception to December 2024 in the following electronic databases: PubMed, Web of Science and Cochrane Library. The inclusion criteria were met by studies written in English that were reviewed to investigate the effect of physical therapy on pain, disability, and quality of life in women over the age of 18 years old with LPP in the postpartum period. The meta-analysis was conducted using the Cochrane Review Manager software. Risk of bias was assessed using the Cochrane RoB 2 tool. A meta-analysis was performed, and the evidence levels and gaps were determined. The outcomes were also analyzed according to follow-up periods as short-term(< 3 months), mid-term(≥ 3 to 12 months) and long-term(> 12 months).

Results The systematic review incorporated a total of 37 randomized controlled trials, encompassing 57 different treatment groups. These treatment groups included 1,739 women diagnosed with LPP during the postpartum period. Stabilization exercises (I2 = 92%, effect size = 2,70, 95% confidence interval (CI) = 1.87–3.54, $p < 0.001$ is effective in the short term with a high level of evidence. High level of evidence showed that stabilization exercises (I2 = 91%, effect size = 2.78, 95%CI = 1.87–3.69, $p < 0.001$) is effective in the short term. Other exercises (I2 = 87%, effect size = 1.54, 95%CI = 0.79–2.29, $p < 0.001$) and manipulative therapy (I2 = 98%, effect size = 10.52, 95%CI = 4.64–16.39, $p = 0.0005$) are effective at a moderate level of evidence in the short term.

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Conclusions The findings of this study indicate that the implementation of stabilization exercises is associated with a significant reduction in pain severity in the short term, a conclusion that is supported by high-quality evidence. The evidence base indicates that manipulative therapy and other forms of exercise may also contribute to a reduction in pain severity. Evidence supports the hypothesis that stabilization exercises represent the most effective intervention for reducing disability.

Systematic review registration number (PROSPERO) CRD42023485978.

Keywords Exercises, Postpartum period, Lumbo pelvic pain, Physiotherapy and rehabilitation interventions, Postnatal care

Background

Lumbo-pelvic pain (LPP) refers to self-reported pain in the lower back, anterior pelvis, posterior pelvis, or any combination of these locations (1). During pregnancy, LPP is a very common occurrence and is expected to subside after delivery (2). Although most women recover from pregnancy-related LPP within three months of delivery(3), postpartum follow-up study reported approximately 8–20% of women still experience persistent non-specific LPP 2–3 years after delivery, which can interfere with daily activities (4). A considerable number of women continue to experience discomfort during the postnatal period, with varying degrees of intensity and duration. A higher range of variation is reported in the prevalence of LPP during the postnatal period compared to its prevalence during pregnancy, due to apparent differences in follow-up times, measurement methods and definitions (5).

In women experiencing postpartum LPP, the intensity of pain, the quality of life experienced by the patient, and the fear of movement all have a significant impact on the level of disability (6). In women diagnosed with LPP, the pain intensity and low quality of life experienced by the patient result in limitations in daily living activities (7). Despite the established correlation between quality of life and pain intensity, as well as the impact of daily living activities, a review of the extant literature revealed an absence of studies that specifically addressed the quality of life in women afflicted with postpartum LPP.

Postpartum LPP typically does not result from a specific disease or pathoanatomical abnormality. Instead, the pain and disability experienced are influenced by multiple biological, psychosocial, and lifestyle factors. (8) Similar to other musculoskeletal problems, pharmacological and physical therapy methods are used in the treatment of postpartum LPP (9). Several physical therapy interventions are used to alleviate LPP, including exercise, acupuncture, hot and cold therapies, traction, laser, ultrasound, massage, and braces (10). In the study conducted by Tseng et al., it was reported that studies with women with LPP were insufficient (5). In the study by Ruchat et al., (11) strengthening exercises targeting the trunk were reported to reduce pain severity and disability in postpartum musculoskeletal pain. However, that study had several limitations, including focusing on general musculoskeletal pain rather than specifically on LPP, not examining the effects of the intervention across different follow-up periods, excluding quality of life as an outcome, and not presenting an evidence gap map(11). Similarly, Maisaroh et al.(12) reported that acupuncture and dry cupping therapy were effective in reducing pain severity in women with postpartum LPP. However, this study compared the interventions only with control groups rather than using pre- and post-treatment comparisons, did not analyze the outcomes over short-, mid-, and long-term periods, failed to assess disability and quality of life, and also did not include an evidence gap map (12). Moheboleslam et al.(13) found that stabilization exercises were more effective than control interventions in reducing pain and disability in postpartum LPP, while having no effect on quality of life. However, this study also relied solely on between-group comparisons, focused only on stabilization exercises, did not assess effects across different follow-up durations, and did not evaluate quality of life in detail or provide an evidence gap map (13). These limitations in the existing literature highlight the necessity for a comprehensive synthesis. Our study addresses these gaps by evaluating the effectiveness of a wide range of physiotherapy interventions using both meta-analysis and an evidence gap map, while also considering pain, disability, and quality of life across multiple time frames. Therefore, the aim of this systematic review was to demonstrate the effectiveness of physical therapy interventions in treating post-partum LPP.

Methods

Protocol and registration

Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) statement (14) was followed for this systematic review. The protocol was registered in the PROSPERO database (CRD42023485978).

Eligibility criteria

Studies written in English were reviewed to investigate the effect of physical therapy on pain, disability, and quality of life in women over 18 years old with LPP in postpartum. The studies selected exclusive treatments that were applied in isolation. It is evident that no other treatment was given to the groups selected in the studies. Studies other than randomized controlled trials were excluded.

Information sources and search strategy

PubMed, Web of Science, and the Cochrane Library databases were searched from inception to December 2024 using the PICO(S) (15) model. The population was defined as patients with LPP in postpartum period, while all types of interventions were included with pain, disability, and quality of life as outcome measures. The supplementary provides detailed search strategy.

Study selection

The studies identified by the search strategy were downloaded into Mendeley Desktop (version 2.95, Mendeley Ltd., London, UK) by two authors (FO and EU) and duplicates were removed. Subsequently, the authors independently screened all titles and abstracts based on the eligibility criteria. Finally, full texts of the studies retained during the screening of titles and abstracts were evaluated for inclusion. Disagreements were resolved at a consensus meeting with a third author (TA). The reference lists and citing articles of retained studies were also checked.

Quality assessment

Two authors (FO and EU) independently assessed the methodological quality of included studies using the Physiotherapy Evidence Database (PEDro) checklist (16), which has a maximum score of 10. A score of ≥6 was considered high quality, while a score<6 was considered low quality (Table 1).

Risk of bias assesment

The risk of bias (RoB) assessment was conducted independently by two authors (FO and EU) using the Cochrane RoB 2 tool (17) Any disagreements were resolved through discussion or arbitration with a third author (TA). The assessment examined five domains: randomization process, deviations from the intended intervention (intention-to-treat), missing outcome data, measurement of the outcome, and selection of the reported results. The included studies were judged to be at low risk, some concerns, or high risk (Table 1).

Publication bias

To evaluate the robustness of the meta-analytic results against potential publication bias, Rosenthal's Fail-safe N analysis was conducted for each pooled outcome. This method estimates the number of unpublished null-result studies that would be required to reduce the overall effect to non-significance ($p > 0.05$). Interpretation was based on the criterion proposed by Rosenthal (1979), which suggests that a result is robust if: where is the number of included studies in the meta-analysis. Values above this threshold indicate strong resistance to potential publication bias (18) (Table 3).

Data extraction

Descriptive information including publication details (author and year), sample sizes, participant characteristics, type of treatment, intervention groups, and outcome measurements were extracted (Table 2). To calculate effect sizes (mean and standard deviation) for each outcome, we extracted the required data and contacted the corresponding authors for any additional information needed.

Certainty of evidence

The level of certainty for each outcome was assessed using the Grading of Recommendation Assessment, Development and Evaluation (GRADE) (https://www.gradepro.org/) framework (19) This framework considers five key domains: risk of bias, inconsistency, imprecision, indirectness, and publication bias, to determine the level of evidence (19). Although pain, disability and quality of life are subjective outcome, we considered the risk of bias due to lack of blinding within the GRADE framework. In several cases, the certainty of evidence was downgraded accordingly. However, in instances where blinding was not feasible but validated outcome measures (e.g., VAS, NPRS, ODI, RMDQ, PGQ, SF36) were used and large, consistent effect sizes were observed, we judged the impact of lack of blinding to be minimal and did not downgrade the evidence further. This decision aligns with GRADE guidance, which allows consideration of context and robustness of effect estimates (19).

Data synthesis and statistical analysis

The meta-analysis was conducted using the Cochrane Review Manager software (version 5.4, Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration, 2014). Standardised mean differences (SMD) with 95% confidence intervals (CIs) were calculated for variables of interest as the difference between the pre treatment and post-treatment. Heterogeneity was analysed by using I^2 and was considered as low (<25), moderate (>25–50%), high (>50–75%) or very high (>75%) (20,21). In this meta-analysis, the random-effects model was chosen due to moderate statistical heterogeneity (I^2 = 38.5%) and the expected clinical and methodological diversity among the included studies. The studies applied various non-pharmacological interventions (e.g., physical exercises, manual therapies, heat applications) aimed at reducing low back pain in postpartum women, using

Table 1 Results of the quality and risk of bias assessments of the included studies

Studies	PEDro Items													Cochrane RoB Tool 2 Domains					
	1	2	3	4	5	6	7	8	9	10	11	Total (x/10)	Quality	D1	D2	D3	D4	D5	Overall
Mens et al. 2000	1	1	1	1	0	0	1	1	1	1	1	8	H	Green	Green	Green	Green	Amber	Amber
Stuge et al. 2004	1	1	1	1	0	0	1	1	0	1	1	7	H	Green	Green	Green	Green	Amber	Amber
Bastiaenen et al. 2006	1	1	1	1	1	0	1	1	1	1	1	9	H	Green	Green	Green	Green	Green	Green
Elden et al. 2008	1	1	1	1	0	0	1	0	1	1	1	7	H	Green	Green	Green	Red	Amber	Red
Bastiaenen et al. 2008	1	1	1	1	0	0	1	1	1	1	1	8	H	Green	Green	Green	Green	Green	Green
Gutke et al. 2010	1	1	1	1	0	0	1	0	0	1	1	6	H	Green	Red	Green	Green	Amber	Red
Akbarzadeh et al. 2014	1	1	0	1	0	0	0	1	1	1	1	6	H	Red	Green	Green	Red	Green	Red
Lee et al. 2015	1	1	1	1	0	0	0	1	1	1	1	7	H	Amber	Green	Green	Red	Amber	Red
Schwerla et. Al. 2015	1	1	1	1	0	0	0	1	1	1	1	7	H	Amber	Green	Green	Green	Green	Amber
Embaby et al 2016	1	1	0	1	0	0	0	0	1	1	1	5	L	Red	Red	Green	Red	Amber	Red
Kamel et al. 2016	1	1	0	0	0	0	0	0	0	1	1	3	L	Red	Amber	Green	Green	Amber	Red
Yazdanpanahi et al. 2017	1	1	0	1	0	0	0	0	0	1	1	4	L	Red	Red	Green	Green	Amber	Red
Sakamoto et al. 2018	1	1	1	1	0	0	0	1	0	1	1	6	H	Green	Amber	Green	Green	Amber	Amber
Teymuri et al. 2018	1	1	1	1	0	0	1	0	0	1	1	6	H	Green	Red	Green	Green	Green	Red
el Deeb et al. 2019	1	1	1	1	1	0	1	1	0	1	1	8	H	Green	Red	Green	Green	Green	Red
Saleh et al. 2019	0	1	1	1	0	0	0	1	1	1	1	7	H	Green	Red	Green	Red	Green	Red
Cheng et al. 2020	1	1	0	1	1	0	1	1	1	1	1	8	H	Red	Green	Green	Green	Amber	Red
Ehsani et al. 2020	1	1	0	1	1	0	1	1	0	1	1	7	H	Red	Green	Green	Green	Amber	Red
Elhosary et al. 2021	1	1	1	1	0	0	1	1	1	1	1	8	H	Green	Red	Green	Green	Amber	Red
Khorasani et el. 2020	1	1	1	1	0	0	1	0	1	1	1	7	H	Green	Green	Green	Green	Green	Green
Patil et al. 2020	1	1	0	0	0	0	0	0	1	1	1	4	L	Amber	Red	Red	Red	Amber	Red
Adnan et al. 2021	1	1	1	1	0	0	1	1	1	1	1	8	H	Green	Green	Green	Green	Green	Green
Conde et al. 2021	1	1	1	1	0	0	1	1	0	1	1	7	H	Green	Green	Green	Green	Green	Green
Nayyab et al. 2021	1	1	1	1	1	0	0	1	0	1	1	7	H	Green	Red	Green	Amber	Green	Red
Saleem et al. 2021	1	1	1	1	0	0	1	0	0	1	1	6	H	Green	Green	Green	Red	Amber	Red
Wang et al. 2021	1	1	1	1	0	0	1	1	1	1	1	8	H	Green	Green	Green	Green	Amber	Amber
Ghavipanje et al. 2022	1	1	1	1	0	0	1	1	0	1	1	7	H	Green	Green	Green	Red	Amber	Red
Mahmoud et al. 2022	1	1	1	1	0	0	1	1	0	1	1	7	H	Green	Amber	Green	Green	Amber	Amber
Rishi et al. 2022	1	1	1	1	0	0	0	1	0	1	1	6	H	Amber	Green	Green	Red	Amber	Red
Sabrina et al. 2022	1	1	0	1	0	0	1	0	1	1	1	6	H	Red	Green	Green	Green	Amber	Red
Shafiq et al 2022	0	1	1	1	0	0	1	0	0	1	1	6	H	Green	Green	Green	Green	Amber	Amber
Teaima et. Al 2022	1	1	1	1	0	0	1	1	1	1	1	8	H	Amber	Green	Green	Green	Amber	Amber
Li et al. 2022	1	1	0	1	0	0	1	1	1	1	1	7	H	Amber	Green	Green	Red	Amber	Red
Cheng et al. 2023	1	1	1	1	0	0	1	1	0	1	1	7	H	Green	Green	Green	Green	Green	Green
Tan et al. 2024	1	1	1	1	0	0	0	1	0	1	1	6	H	Green	Green	Green	Green	Amber	Amber
Kuo et al. 2024	1	1	1	1	0	0	0	0	0	1	1	5	L	Green	Green	Green	Red	Green	Red
Safyeldeen et al. 2024	1	1	1	1	0	0	0	0	1	1	1	7	H	Green	Green	Green	Red	Green	Red

High quality ≥ 6 > Low Quality, Item 1: Eligibility criteria were specified, Item 2: Subjects were randomly allocated to groups, Item 3: Allocation was concealed, Item 4: Groups were similar at baseline regarding the most important prognostic indicators, Item 5: There was blinding of all subjects, Item 6: There was blinding of all therapists who administered the therapy, Item 7: There was blinding of all assessors who measured at least one key outcome, Item 8: Measures obtained from more than 85% of the subjects , Item 9: All subjects for whom outcome measures were available received the treatment, Item 10: Results of between-group statistical comparisons are reported for at least one key outcome , Item 11: Both point measures and measures of variability for at least one key outcome, 0: No, 1, Yes.Green: Low risk, Amber: Some Concerns, Red: High risk, D1: Randomisation process, D2: Deviations from the intended interventions, D3: Missing outcome data, D4: Measurement of the outcome, D5: Selection of the reported result

different durations, intensities, and methods. Additionally, variation was observed in the outcome measurement tools employed. In line with the Cochrane Handbook's recommendation that model selection should be based not only on statistical heterogeneity but also on clinical and methodological differences, we determined that the random-effects model was most appropriate to reflect inter-study variation.

The effect size of the results was interpreted as small (d = 0.2), medium (d = 0.5), and large (d ≥ 0.8) (22). An evidence gap map displaying the level of evidence available in the literature, along with its findings, and identifies areas that require further research was also provided

Table 2 Study characteristics

Authors, year	Participants	Type of Treatment	Intervention's characterictics	Out-come
Menst et al. 2000 (1)	16 (30.7 ± 3.7 years)	Other Exercises	Training of diagonal trunk muscles once a day and three times per week for a total eight weeks	VAS NHP
Menst et al. 2000 (2)	14 (32.3 ± 3.3 years)	Other Exercises	Training of longitudinal trunk muscles once a day and three times per week for a total eight weeks	VAS NHP
Stuge et al. 2004	40 (32.4 ± 4.0 years)	Stabilization Exercise	Physical therapy with Specific Stabilizing Exercises 30 to 60 min, 3 days a week for 18 to 20 weeks.	VAS ODI SF-36
Bastiae-nen et al. 2006	62 (31.4 ± 3.6 years)	Self Manage-ment Education	Educational program: Topics included back and pelvis anatomy, "red flags" indicating a serious medical condition, factors contributing to fluctuations in pain, appropriate pacing of exercise and activity, handling pain flare-ups, cognitive restructuring, some graded exposure techniques, communication and social persuasion. 7–9 sessions for 30 min once a week.	VAS RMDQ SF-36
Elden et al. 2007 (1)	125 (30.6 ± 4.0 years)	Acupunture	Acupunture 10 segmental point, 30 min, 2 days a week for 6 weeks.	VAS
Elden et al. 2007 (2)	131 (30.0 ± 4.0 years)	Stabilization Exercise	Stabilizing Exercises Total six hours during six weeks	VAS
Bastiae-nen et al. 2008	62 (31.4 ± 3.6 years)	Self Manage-ment Education	Edutacional Programs: Self-management refers to the individual's ability to manage the symptoms, treatment, physical and psychosocial consequences and life style changes inherent to living with a chronic condition	VAS RMDQ MGPQ SF-36
Gutke et al. 2010	32 (32 ± 4 years)	Stabilization Exercise	Specific muscle stabilizing 10 repetitions of each exercise, 2 times per day, every day, for 3 months	ODI EQ-5D
Akbarza-deh et al. 2014	50 (25.0 ± 4.2 years)	Cupping Therapy	Cupping Therapy 15–20 min every day up to 4 consecutive times.Cupping glasses were removed after 5 to 15 min	VAS SF-MGPQ
Lee et al. 2015	30 (34.0 ± 2.9 years)	Massage Therapy	Back Massage 20 min of back massage once a day for five consecutive days	VAS
Schwerla et al. 2015	40 (33.9 ± 4.4 years)	Manipulative therapy	Osteopathic Manipülation Direct and indirect techniques, 40–60 min, 1 session every 2 weeks, 4 sessions in total	VAS ODI
Embaby et al. 2016	20 (25.50 ± 2.0 years)	Acupunture	Acupunture 4 segmental points, three times per week for 8 weeks(24 sessions)	PPP ODI
Kamel et al. 2016 (1)	15 (37.46 ± 3.9 years)	Conventional Physiotherapy	Ultrason: 1 W/cm2, 1 MHz, %100 duty cycle, stroking technique, 5 min Infrared: 400 + 2 N, 400w, 220 V, 50/60 Hz, 75 cm distance, 15 min	VAS ODI
Kamel et al. 2016 (2)	15 (37.40 ± 5.8 years)	Manipulative therapy	Lomber 3 spinous process segment, grade 1–4 mobilization, 2 min, 3 sessions/week for 4 weeks.	VAS ODI
Yazdanpa-nahi et al. 2017	50 (25.0 ± 4.2 years)	Cupping Therapy	Cupping therapy Every other day in four 15–20 min sessions a week.	SF-MPGQ
Yazdanpa-nahi et al. 2017 (2)	50 (25.1 ± 4.8 years)	Acupressure	Acupressure Every other day in four 20 min sessions a week.	SF-MPGQ
Sakamoto et al. 2018 (1)	25 (32.4 (3.8) years)	Back Belt	Back Belt The device is designed to make the pelvis symmetrical and stable by applying focal forces on both anterior superior iliac spines and compressive forces on the sacroiliac joint. The device was attached to the pelvis and shifted in the superior direction so that the top belt was located over the anterior superior iliac spines. 4 weeks total during exercise only.	VAS PGQ
Sakamoto et al. 2018 (2)	25 (31.4 (4.8) years)	Stabilization Exercise	Stabilization exercise The stabilization exercises were repeated 10–20 times per session, and were performed twice a day for 4 weeks after delivery.	VAS PGQ
Teymuri et al. 2018 (1)	18 (33.55 ± 6.9 years)	Stabilization Exercise	Stabilization execise 3 times per weeks for 6 weeks.	VAS ODI

Table 2 (continued)

Authors, year	Participants	Type of Treatment	Intervention's characterictics	Outcome
Teymuri et al. 2018 (2)	18 (36.77 ± 9.2 years)	Conventional Physiotherapy	Conventional TENS, pulse ultrasound and hot pack for 45 min per sessions 3 times per weeks for 6 weeks	VAS ODI
el Deeb et al. 2019 (1)	20 (29.25 ± 2.88 years)	Stabilization Exercise	Stabilizating Exercise: Exercise 10 sn contraction,10 sc relaxation. Activation of transverse abdominis and multifidus muscles was 15 to 30 min for 180 each muscle. 15–20 repetitions per set for 3 sets with an interval rest of 2 to 3 min. 3 sessions/week for 12 weeks (36 sessions)	VAS ODI
el Deeb et al. 2019 (2)	20 (29.05 ± 3.0 years)	Stabilization Exercise	Stabilzating Exercise + Pelvic Floor Muscle Training 10–20 repetitions per set for 2 to 3 sets with an interval rest of 2 to 3 min. Repetition volume started at 30–60 repetitions/day during weeks 1–2; 60–120 repetitions/day during weeks 3–4; and 120–150 repetitions/day during weeks 5–6, and 150–180 repetitions/day during weeks 7–12. Exercises program was performed 3 sessions/week for 12 weeks	VAS ODI
Saleh et al. 2019 (1)	17 (29.88 ± 3.0 years)	Stabilization Exercise	Stabilization Group: Core stability exercises 3 times a week for 6 weeks.	VAS ODI
Saleh et al. 2019 (2)	17 (29.52 ± 2.6 years)	Conventional Physiotherapy	Ultrason: Continuous ultrasound was used with 1.5 W/cm2,1 MHz, lumbosacral area Infrared: Lumbosacral spine for 15 min at a 50–75 cm distance. This conventional treatment was repeated 3 times a week for 6 weeks.	VAS ODI
Cheng et al. 2020	35 (34.8 ± 3.87 years)	Acupressure	Acupressure: 2 min on five acupoints per day, bilaterally (The total session lasted for 10 min)10 acupressure sessions (1 session per day, 5 days per week, total 2 week)	VAS ODI RMDQ
Ehsani et al. 2020 (1)	35 (28.74 ± 4.53 years)	Stabilization Exercise	Stabilization Exercise for three sessions per week during 8 weeks. (total 24 sessions)	VAS
Ehsani et al. 2020 (2)	35 (27.69 ± 6.75 years)	Other Exercises	Other Exercises: without emphasis on the contraction of the TrA, for three sessions per week during 8 weeks. (total 24 sessions)	VAS
Elhosary et al. 2021 (1)	20 (25.55 ± 3.06 years)	ESWT	ESWT: 8 Hz frequency, 2400 pulses, and pressure was set at 4 bars that correspond to an energy flux density of 0.11 mJ/mm2. All patients in this group received 2 sessions every week for 4 weeks.	VAS BPFS
Elhosary et al. 2021 (2)	20 (24.15 ± 2.66 years)	Other Exercises	General Exercise: Postural correction exercise (by dorsiflexion of both ankles, press knee down, contract glutei, press lumber against the plinth, contract abdominal muscles, perform costal breathing, and chin in) and then hold for 3 s and relax for 6 s. In each session this exercise was repeated 10 times. All patients in this group received 2 sessions every week for 4 weeks.	VAS BPFS
Khorasani et el. 2020	40 (30.75 ± 5.09 years)	Stabilization Exercise	Stabilization exercises: Each set consisted of ten repetitions of three different types of exercise each week. Each contraction involved 8–10 s hold time and the same rest time. 12- week home-based program (3 days a week, 3 sets a day).	VAS ODI
Patil et al. 2020 (1)	13 (NI years)	Back Belt	Conventional sacroilliac belt: Lack of low back and abdominal support for 1 months.	RMDQ PGPQ
Patil et al. 2020 (2)	13 (NI years)	Back Belt	Modified sacroilliac belt: More low back and abdominal support for 1 months.	RMDQ PGPQ
Adnan et al. 2021 (1)	13 (28.38 ± 4.8 years)	Stabilization Exercise	Stabilization exercise: 3 days per week for 2 months Total 2 sets of 15 repetitions for each strengthening exercise were performed.	NPRS ODI
Adnan et al. 2021 (2)	14 (29.57 ± 3.3 years)	Other Exercises	Group B Swiss ball exercises included stability-Ball-Elevated Split Squat, Stability-Ball Hamstring Curl, Dead Bug, and Stability-Ball Y-Ups 3 days per week for 2 months. Total 2 sets of 15 repetitions for each strengthening exercise were performed.	NPRS ODI
Conde et al. 2021	12 (35 ± 4 years)	Shoe	Unstable Shoe: The subjects wore their shoes for one hour per day starting on the first day; on the third day, they increased the duration of the intervention to three hours per day; and on the fifth day, they reached four hours of intervention per day. Through this gradual increase in utilization, From the fifth day to the end of the intervention at nine weeks, all the patients wore the shoes for four hours per day.	VAS

Table 2 (continued)

Authors, year	Participants	Type of Treatment	Intervention's characterictics	Out-come
Nayyab et al. 2021	15 (32.8 ± 4 years)	Stabilization Exercise	Core stability exercise programme consisting of three levels. Each level lasted 2 weeks,. At each level, 3 sessions per week were given with 2 sets of 10 repetitions and 10 s hold. (Total 6 weeks, 18 sessions)	NPRS ODI
Saleem et al. 2021 (1)	20 (30.2 ± 4.3 years)	Other Exercises	General exercise Double straight leg raise, Static glutei, Kegels, and Isometric back strengthening exercise. 6 weeks of core strengthening exercises. 3 alternate days for 6 weeks. Three sets with 10 repetitions of each exercise	ODI
Saleem et al. 2021 (2)	20 (29.8 ± 4.1 years)	Other Exercises	Abdominal crunch training 3 alternate days for 6 weeks, Three sets with 10 repetitions of each exercise per sessions,	ODI
Wang et al. 2021 (1)	48 (29.0 ± 1.6 years)	NMES	NMES with biofeedback-assisted pelvic floor muscle training (BAPFMT), 4 treatment sessions per week over the first 4-week period, followed by twice and once a week over the second and third 4-week periods. The sessions lasted 40 min. The BAPFMT consisted of biofeedback and electrical stimulation therapy, lasting 20 min. The parameters were set a frequency of 80 pulses/min, pulse width of 0.1–0.5 ms and on: off ratio of 4 s:10 s. Each patient was scheduled for 4 treatment sessions per week over the first 4-week period, followed by twice and once a week over the second and third 4-week periods, respectively. The session lasted 20 min. Total 12 weeks,	NPRS MODQ
Wang et al.2021 (2)	48 (28.4 ± 4.1 years)	NMES	The NMES was applied bilaterally to the lumbar paraspinal muscles. Four rectangular electrodes were used. The parameters were set a frequency of 80 pulses/min, pulse width of 0.1–0.5 ms and on: off ratio of 4 s:10 s. 4 treatment sessions per week over the first 4-week period, followed by twice and once a week over the second and third 4-week periods.	NPRS MODQ
Ghavipanje et al. 2022 (1)	20 (29.25 + 4.14 years)	Other Exercises	Dynamic Neuromuscular Stabilization 6 sessions per week (3 45–60 min sessions of supervised exercise and 3 sessions of home-based exercise) for 6 weeks/ 3 days a week	NPRS MODQ
Ghavipanje et al. 2022 (2)	20 (29.35 + 3.48 years)	Other Exercises	General Exercise 6 sessions per week (3 45–60 min sessions of supervised exercise and 3 sessions of home-based exercise) for 6 weeks/ 3 days a week	NPRS MODQ
Mahmoud et al. 2022 (1)	20 (27.3 ± 3.9 years)	Stabilization Exercise	Lumber stabilization exercises 8 weeks with a frequency of 3 sessions/ week. Each session onsisted of 10 repetitions of 5 stabilization exercises.	VAS ODI
Mahmoud et al. 2022 (2)	20 (26.7 ± 4.2 years)	Stabilization Exercise	Lumber stabilization exercises + internal rotation exercises 8 weeks with a frequency of 3 sessions/ week, Each session onsisted of 10 repetitions of 5 stabilization exercises + 10 repetitions of three internal hip rotation range-of-motion exercises, preceded by 3 times, twice a day, piriformis stretching exercise.	VAS ODI
Rishi et al. 2022	20 (27 ± 2.96 years)	Kinesiotaping	Kinesiotaping Kinesio Taping on the abdominal muscles.Tape was applied using I band with a tension of 50%. The tape was applied for three days	RMDQ
Sabrina et al. 2022 (1)	26 (27.84 ± 4.37 years)	Kinesiotaping	Kinesio-Taping Application on the hip region: In total 12 sessions/each session was comprised of 20 min, three times a week. Long I-shaped piece of Kinesio tape was applied with 80% tension transverse to the patient's painful area and the bilateral SIJ region, with no tension applied to the ends of the tape. Another short piece of Kinesio tape was applied with 80% tension at an angle from the painful point to the hip.	*NPRS RMDQ*
Sabrina et al. 2022 (2)	26 (27.04 ± 4.48 years)	Muscle Energy Technic	Muscle Energy Technic MET was applied to the erector spinal muscle using the active assisted technique for 10 min. 7–10 s and rest for 2–3 s; A total of 10 repetitions were performed for 4 weeks. (total 12 sessions)	NPRS RMDQ
Shafiq et al. 2022	35 (38.17 ± 7.99 years)	Coventional Physiotherapy	NI	NPRS MODQ
Teaima et al. 2022	20 (26.50 ± 4.27 years)	Other Exercises	Therapeutic Exercises exercise program composed of muscle energy techniques, core stability exercises, and pelvic floor exercises, 3 times/week for 6 weeks	VAS
Li et al. 2022 (1)	38 (32.1 ± 2.8 years)	Manipulative therapy	Manipulative therapy T shaped, subtle adjustment, modified lumbar rotation manipulation, subtle adjustment for sacroilliac joint disclocaiton, gun rolling, 3 times a week, for 3 weeks.	VAS ODI

Table 2 (continued)

Authors, year	Participants	Type of Treatment	Intervention's characterictics	Out-come
Li et al. 2022 (2)	38 (31.8 ± 3.2 years)	Stabilization Exercise	Core muscle strentghening exercises Arch bridge movement, cross-knee movement, plank exercises, 3 times a week for 3 weeks	VAS ODI
Cheng et al. 2023	53 (34.3 ± 3.71 years)	Laser Acupunture	5 sessions for a week, total 2 weeks (total 10 sessions) A gallium aluminum arsenide Laser Pen. Each point for 5 s, for a total treatment dose of 4.5 J/cm 2. These acupoints are mainly located on the lower back and lower leg.	VAS RMDQ ODI
Tan et al. 2024	30 (30.7 ± 0.72 years)	Focused ESWT	The treatment was administered every 2 days, and a course of therapy lasted for 2 weeks. For the shock wave therapy, 4 bone markers, namely the anterior superior iliac spine, posterior superior iliac spine, iliopubic eminence, and ischial tuberosity, were chose to receive the shock. Each bone marker is symmetrical left and right. Hence, a total of 8 points were administrated the shock. The 500 shocks were set for each bone marker point, and a total of 4000 shocks were finally applied.	VAS ODI
Tan et al. 2024	30 (30.56 ± 0.73 years)	Manipulative therapy	Massage and sacroiliac joint mobilization were applied to the muscles around the sacro-iliac joint.	VAS ODI
Kuo et al. 2024	18 (34 ± 3 years)	Stabilization Exercise	8-week pelvic floor muscle training was applied	NPRS PGQ
Safyel-deen et al. 2024 (1)	30 (28.70 ± 2.56 years)	Other Exercises	All women performed progresivve muscle relaxation exercises three times a week for four weeks, as three sets with five repetitions for each muscle group.	ODI
Safyel-deen et al. 2024 (2)	30 (28.70 ± 2.56 years)	Pilates exercises	The women received this treatment three times a week, with each session lasting half an hour, for a total of four weeks.	ODI

ESWT: Extracorporeal Shock Wave Therapy, NMES: Neuromuscular Electrical Stimulation, VAS: Visual Analog Scale, NPRS: Numeric Pain Rating Scale, PPP: Present pain intensity, NHP: Nottingham Health Profile, ODI: Oswetry Disability Index, MODI: Modifiye Oswestry Disability Questionnaire, RMDQ: Rolland Morris Disability Questionnaire, PGQ: Pelvic Girdle Questionnaire, SF-36: Short Form 36, SMPQ: Short Form McGill Pain Questionnaire, BPFS: Back Pain Function Scale

to guide future studies (23,24). Outcomes were also analysed according to follow up periods as short-term (< 3 months), mid-term (≥ 3 to 12 months) and long-term (> 12 months) (24,25).

Result

Study selection

Search results were shown in Fig. 1. The systematic review included 37 randomized controlled trials with 57 treatment groups including 1739 women with LPP in postpartum period.

Study characteristisc

Treatment groups included stabilization exercises (26,27,36–39,28–35), other exercises (e.g. lower extremity strengthening exercises, dynamic neuromuscular stabilization) (33,35,40–45), conventional therapy (TENS, ultrasound and infrared) (30,32,46,47), manipulative therapy (38,46,48,49), back belt (29,50), acupressure (51,52), acupuncture (27,53), cupping therapy (51,54), self management education (55,56), kinesiotaping (57,58), neuromuscular electrical stimulation (NMES) (59), extracorporeal shock wave therapy (ESWT) (41,49), shoes (60), laser acupuncture (61), massage therapy (62), pilates exercises (45), and muscle energy techniques (57).

Risk of bias of included studies

Quality assessment and risk of bias assessment results are presented in Table 1, while characteristics of the included studies are presented in Table 2. We identified only five studies with low-quality (39,46,50,51,53), and the rest was high quality. Only 6 studies (34,35,52,55,56,60) had low risk of bias, 9 studies (26,29,37,40,44,47–49,59) had some concerns and > 50% of the studies had high risk of bias. Based on outcome measures and time periods, findings with their level of evidence and gaps in the literature are presented as evidence gap map in Fig. 3.

Meta-analysis

Pain

Stabilization exercises ($I^2 = 92\%$, effect size = 2,70, 95% confidence interval (CI) = 1.87–3.54, $p < 0.001$) (Fig. 2A) (26,27,29,32,33,35–37,39) is effective in the short term with a high level of evidence. Other exercises ($I^2 = 87\%$, effect size = 1.54, 95%CI = 0.79–2.29, $p < 0.001$) (Fig. 2B) (33,35,40,41,43,44) and manipulative therapy ($I^2 = 98\%$, effect size = 10.52, 95%CI = 4.64–16.39, $p = 0.0005$) (Fig. 2C) (46,48,49) are effective at a moderate level of evidence in the short term. Conventional physiotherapy ($I^2 = 68\%$, effect size = 2.47, 95%CI = 1.75–3.20, $p < 0.001$) (Fig. 2D) (30,32,46,47), acupressure ($I^2 = 0\%$, effect size = 2.37, 95%CI = 1.98–2.77, $p < 0.001$) (Fig. 2E) (51,52) and ESWT ($I^2 = 78\%$, effect size = 4.33, 95%CI = 3.60–5.07,

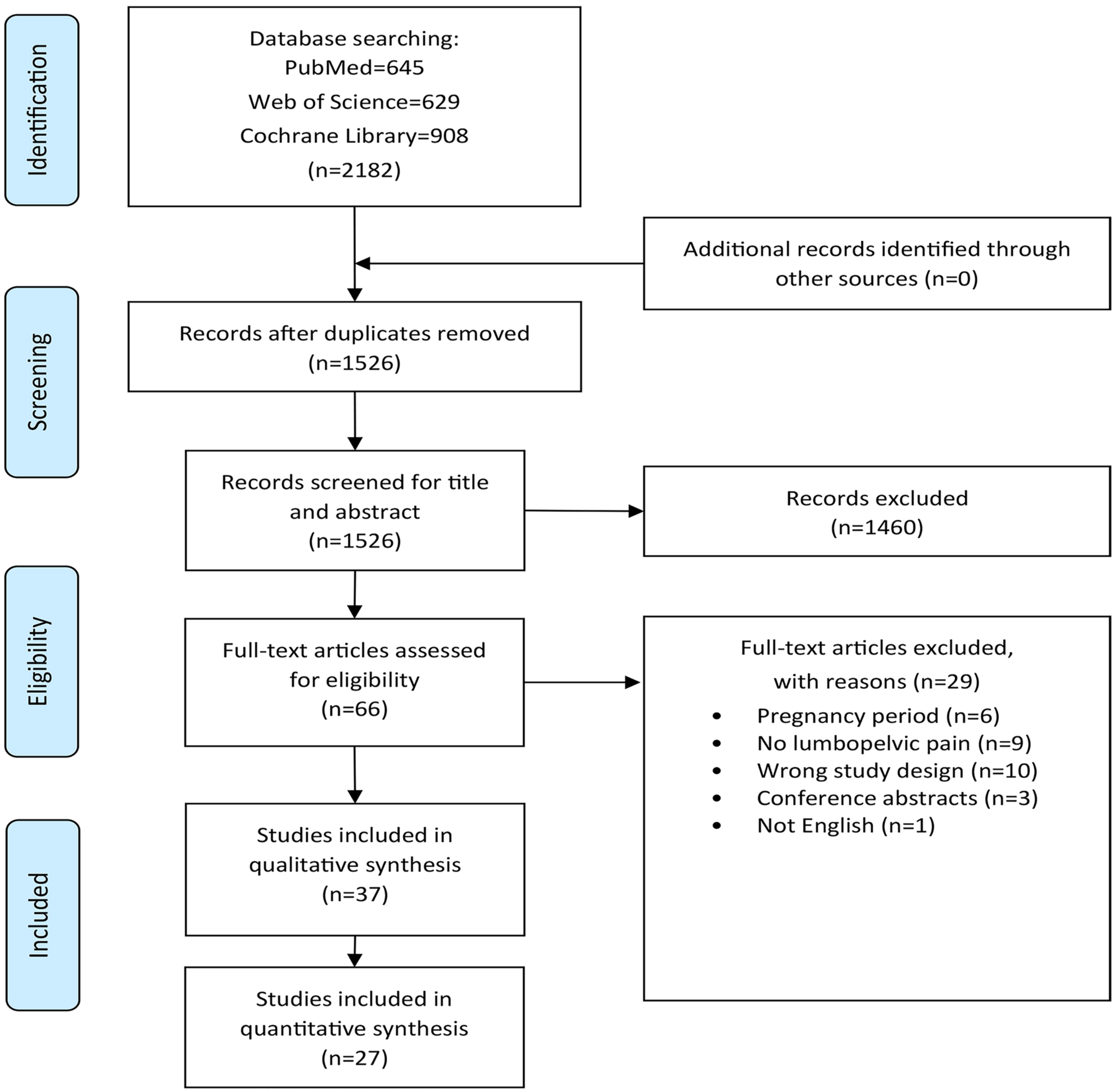

Fig. 1 Flow Chart

$p < 0.001$) (Fig. 2F) (41,49) are effective with a low level of evidence. Kinesiotaping ($I^2 = 0\%$, effect size = 6.68, 95%CI = 5.59–7.77, $p < 0.001$) (Fig. 2G) (57,58), back belt (29), acupunture (27,53), cupping therapy (51,54), muscle energy techniques (57), pilates exercise (45), laser acupunture (61) and massage therapy (62) are also may show potential benefit but level of evidence is very low. In contrast, NMES (59) and different type shoe (60) are not effective in the short term with a very low level of evidence (Fig. 3; Table 3).

Stabilization exercises ($I^2 = 89\%$, effect size = 1.84, 95%CI = 0.78–2.90, $p = 0.007$) (Fig. 2H) (26,27,29,31,34) are also effective in the mid-term at a moderate level of evidence. NMES (59), back belt (29) and acupunture (27) are also may show potential benefit but level of evidence is very low. In contrast, self-management education (55,56) is not effective at a very low level of evidence (Fig. 3; Table 3). On the other hand, pain was measured in 2 interventions only in the long term with very low level of evidence (Fig. 3). While stabilization exercises (26) are effective on long-term pain, self-management education (55) is ineffective.

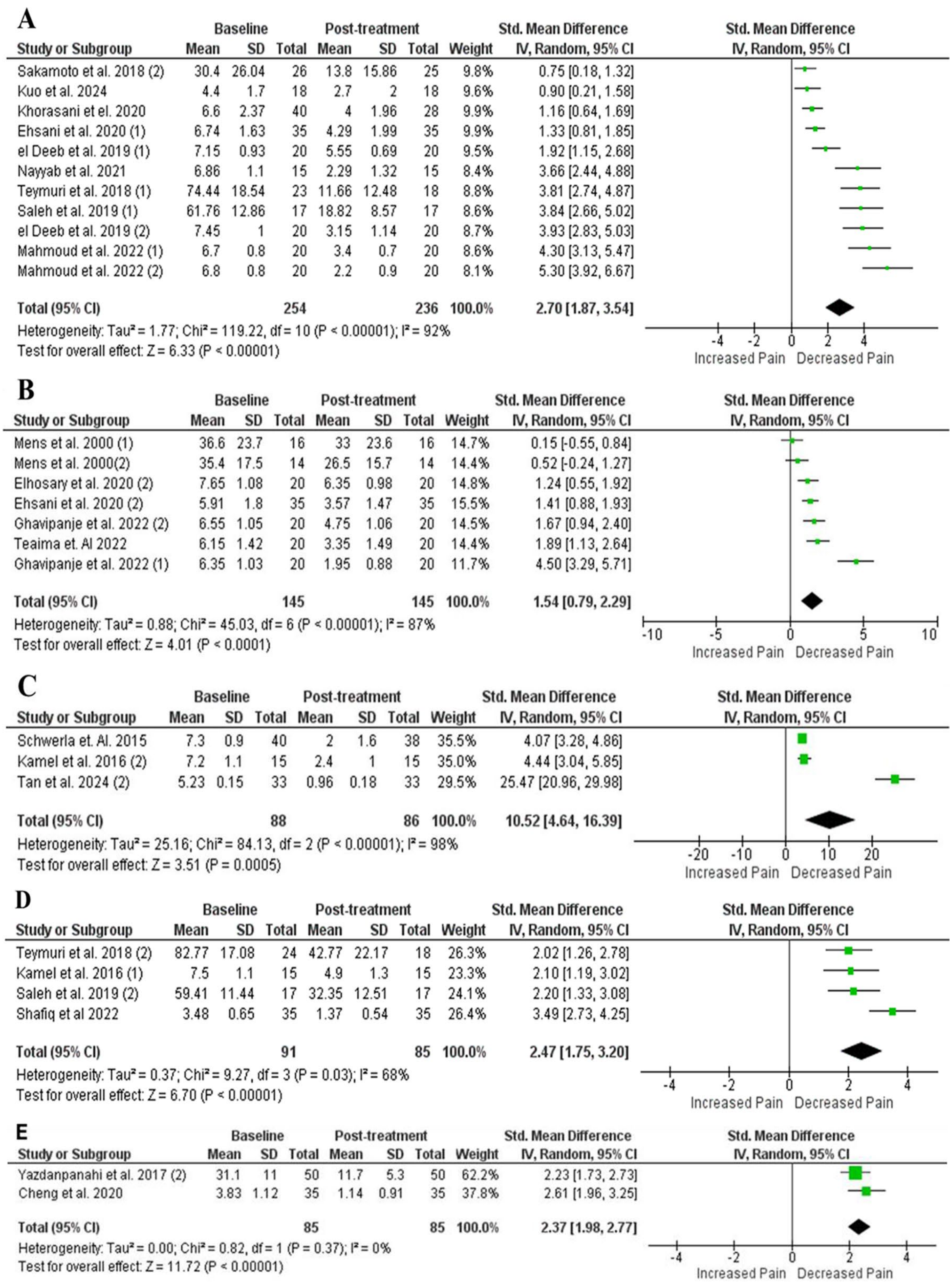

Fig. 2 Meta analysis. (**A**) Effects of stabilization exercises on pain in short term, (**B**) Effects of other exercises on pain in short term, (**C**) Effects of manipulative therapy on pain in short term, (**D**) Effects of conventional physiotherapy on pain in short term, (**E**) Effects of acupressure on pain in short term, (**F**) Effect of extracorporeal shock wave therapy on pain in short term, (**G**) Effects of kinesiotaping on pain in short term, (**H**) Effects of stabilization exercises on pain in mid term, (**I**) Effects of stabilization exercises on disability in short term, (**J**) Effects of manipülative therapy on disability in short term, **K.** Effects of other exercises on disability in short term, **L.** Effects of conventional physiotherapy on disability in short term, **M.** Effects of back belt on disability in short term, **N.** Effects of stabilization exercise on disability in mid term

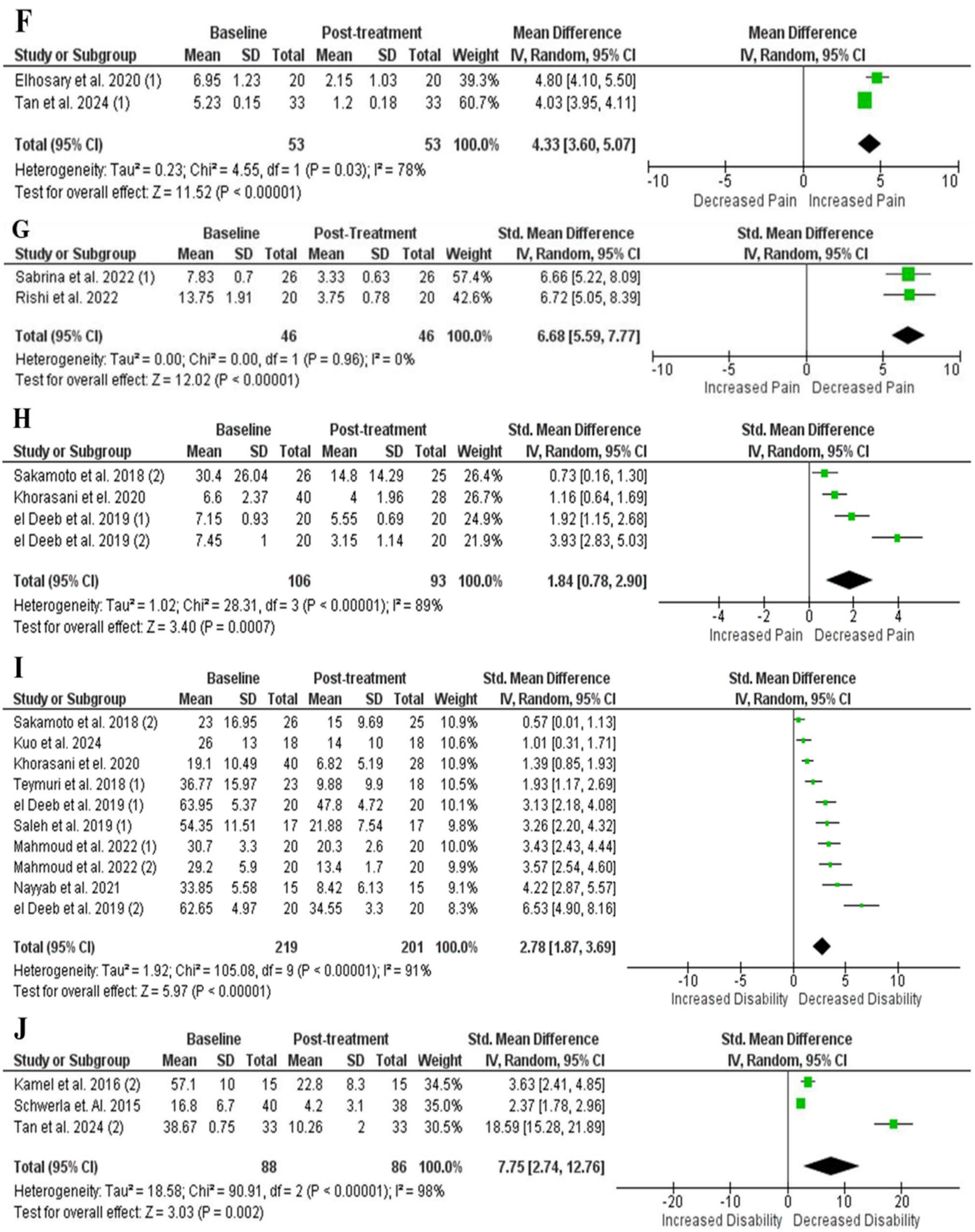

Fig. 2 (continued)

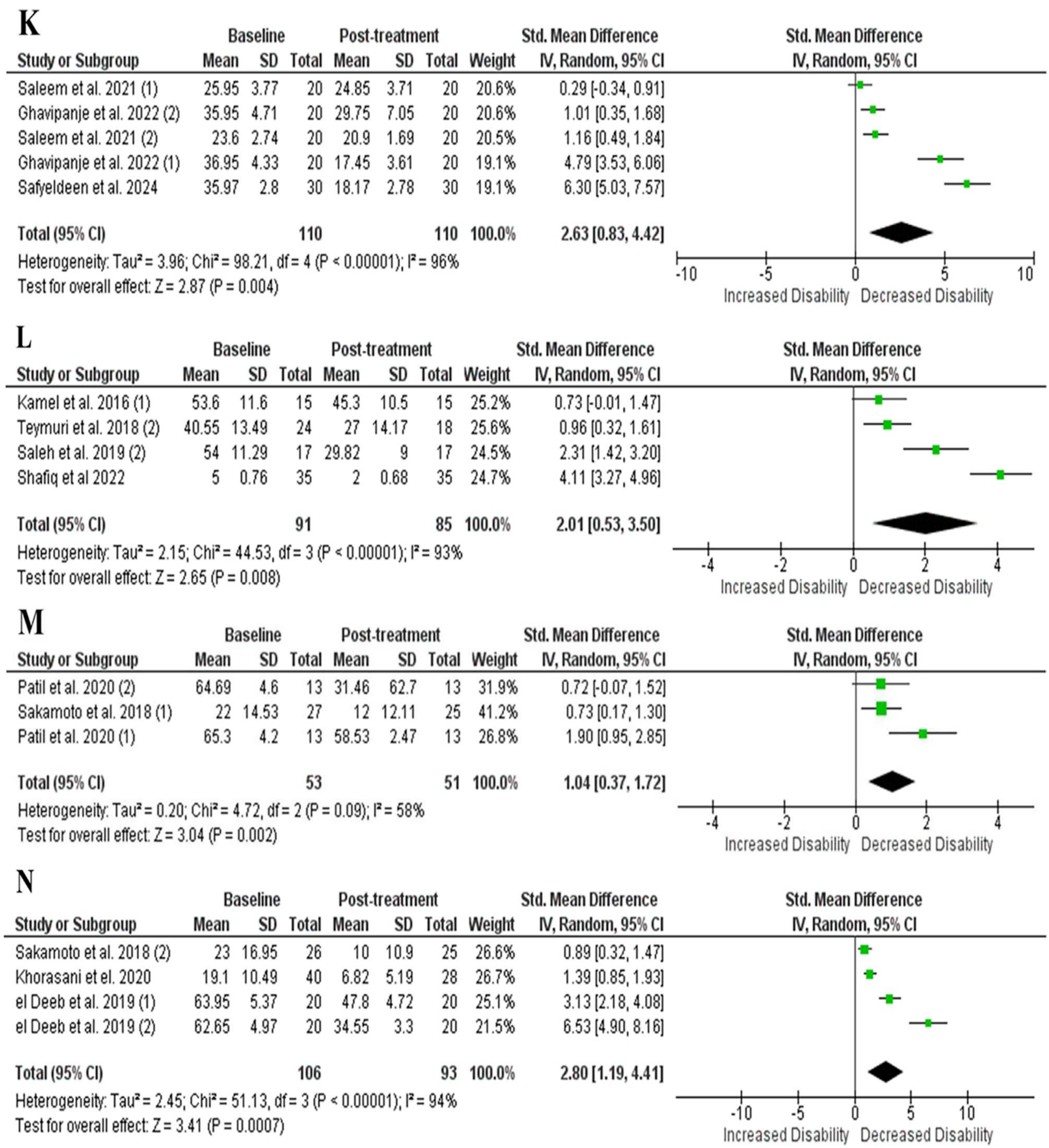

Fig. 2 (continued)

Disability

High level of evidence showed that stabilization exercises ($I^2 = 91\%$, effect size = 2.78, 95%CI = 1.87–3.69, $p < 0.001$) (Fig. 2I) (29–32,34,36,37,39) is effective in the short term. Manipulative therapy ($I^2 = 98\%$, effect size = 7.75, 95%CI = 2.74–12.76, $p = 0.002$) (Fig. 2J) (46,48,49) is effective at a moderate level of evidence in the short term. Other exercises ($I^2 = 96\%$, effect size = 2.63, 95%CI = 0.83–4.42, $p = 0.004$) (Fig. 2K) (41–43,45) and conventional physiotherapy ($I^2 = 93\%$, effect size = 2.01, 95%CI = 0.53–3.50, $p = 0.008$) (Fig. 2L) (30,32,46,47) are effective at a low level of evidence. Back belt ($I^2 = 58\%$, effect size = 1.04 95%CI = 0.37–1.72, $p = 0.002$) (Fig. 2M) (29,50) NMES (59), kinesiotaping (57), acupressure (52), acupunture (53), muscle energy techniques (57), ESWT

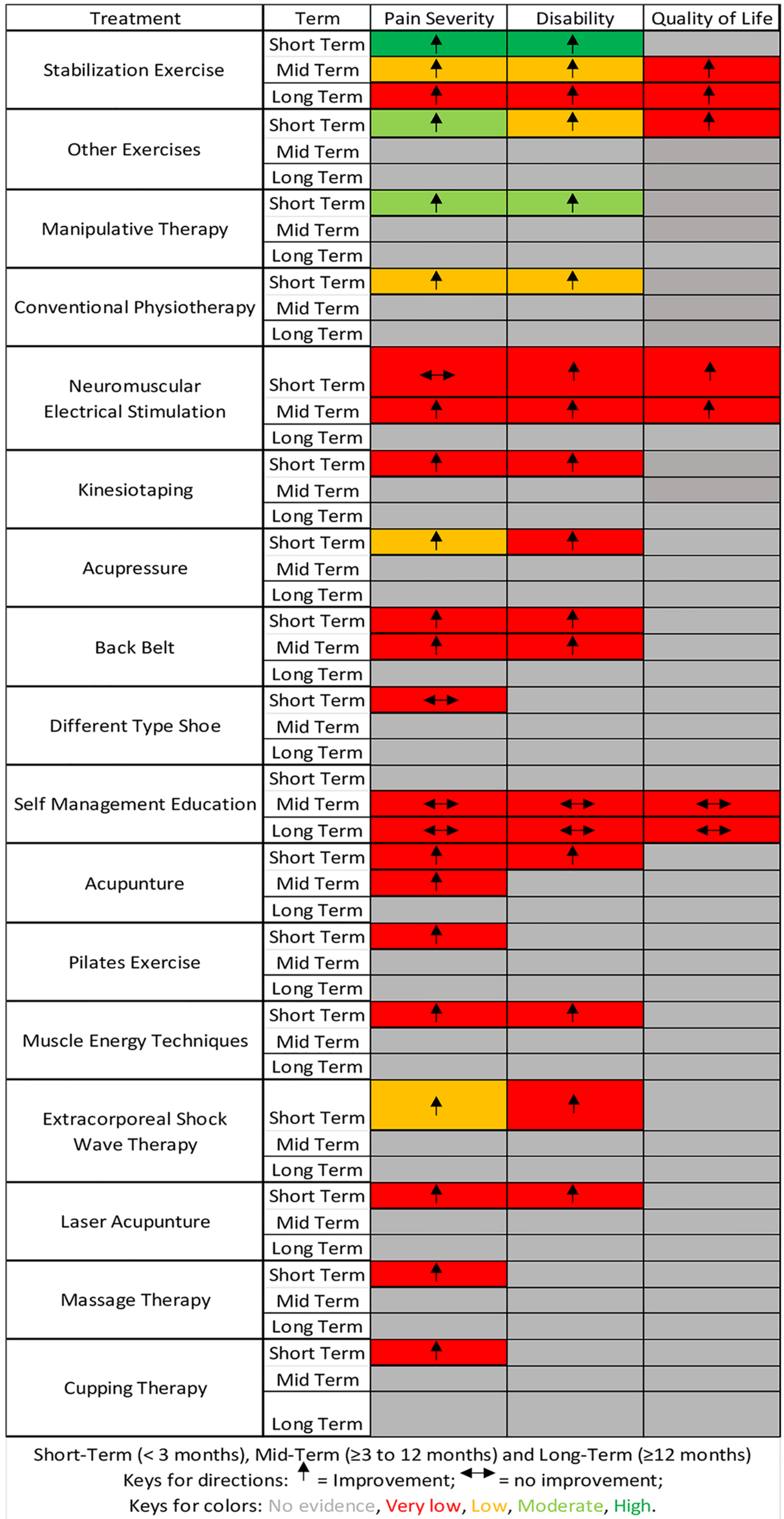

Fig. 3 Evidence gap map

Table 3 GRADE level of evidence for studies

Certainty assessment							Summary of findings			
							Study event rates (%)			
Participants (studies) Follow-up	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Publication bias**	**Overall certainty of evidence**	**With Baseline**	**With Post-treatment**	**Anticipated absolute effects**	**Comments (What Happen)**
Effects of stabilization exercises on pain in short term										
490 (9 RCTs)	serious[a]	serious[b]	not serious	not serious[c]	1193 Very durable	⊕⊕⊕⊕ High[a, b,c]	254	236	SMD **2.9 SD higher** (1.99 higher to 3.81 higher)	Pain severity decreases significantly; clinically meaningful and consistent improvement.
Effects of stabilization exercises on pain in mid term										
199 (3 RCTs)	serious[a]	serious[b]	not serious	very serious[c]	102 Durable	⊕⊕◯◯ Low[a, b,c]	106	93	SMD **1.84 SD higher** (0.78 higher to 2.9 higher)	Pain improvement continues, but with limited consistency and reduced confidence.
Effects of stabilization exercises on disability in short term										
420 (8 RCTs)	serious[a]	serious[b]	not serious	not serious[c]	840 Very durable	⊕⊕⊕⊕ High[a, b,c]	219	201	SMD **2.78 SD higher** (1.87 higher to 3.69 higher)	Disability level improves clearly and consistently with stabilization exercises.
Effects of stabilization exercise on disability in mid term										
199 (3 RCTs)	serious[a]	serious[b]	not serious	very serious[c]	102 Durable	⊕⊕◯◯ Low[a, b,c]	106	93	SMD **2.8 SD higher** (1.19 higher to 4.41 higher)	Functional improvement is observed, but findings are not sufficiently consistent.
Effects of other exercises on pain in short term										
290 (5 RCTs)	serious[a]	serious[b]	not serious	serious[c]	209 Very durable	⊕⊕⊕◯ Moderate[a, b,c]	145	145	SMD **1.45 SD higher** (0.79 higher to 2.1 higher)	Reduces pain moderately; effects are evident but vary between studies.
Effects of other exercises on disability in short term										

Table 3 (continued)

Certainty assessment							**Summary of findings**			
							Study event rates (%)			
Participants (studies) Follow-up	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Publication bias**	**Overall certainty of evidence**	**With Baseline**	**With Post-treatment**	**Anticipated absolute effects**	**Comments (What Happen)**
220 (3 RCTs)	very serious[a]	serious[b]	not serious	serious[c]	45 Durable	⊕⊕◯◯ Low[a, b,c]	110	110	SMD **2.63 SD higher** (0.83 higher to 4.42 higher)	Some functional improvement is seen, though findings are less consistent.
Effects of manipülative therapy on pain in short term										
174 (3 RCTs)	not serious	serious[b]	not serious	very serious[c]	38 Durable	⊕⊕⊕◯ Moderate[b, c]	88	86	SMD **4.16 SD higher** (3.47 higher to 4.85 higher)	Meaningful reduction in pain observed, especially in early postpartum phase.
Effects of manipülative therapy on disability in short term										
174 (3 RCTs)	not serious	serious[b]	not serious	very serious[c]	28 Durable	⊕⊕⊕◯ Moderate[b, c]	88	86	SMD **10.52 SD higher** (4.64 higher to 16.39 higher)	Improves functional status in the short term; moderate confidence in findings.
Effects of conventional physiotherapy on pain in short term										
176 (4 RCTs)	serious[a]	serious[b]	not serious	very serious[c]	260 Very durable	⊕⊕◯◯ Low[a, b,c]	91	85	SMD **2.47 SD higher** (1.75 higher to 3.2 higher)	May help reduce pain; effects are present but confidence in evidence is limited.
Effects of conventional physiotherapy on disability in short term										
176 (4 RCTs)	serious[a]	serious[b]	not serious	very serious[c]	38 Durable	⊕⊕◯◯ Low[a, b,c]	91	85	SMD **2.01 SD higher** (0.53 higher to 3.5 higher)	Some benefit for disability reduction, but findings are not robust.
Effects of kinesiotaping on pain in short term										
92 (2 RCTs)	very serious[a]	not serious	not serious	extremely serious[c]	211 Very durable	⊕◯◯◯ Very low[a, c]	46	46	SMD **6.68 SD higher** (5.59 higher to 7.77 higher)	May provide temporary pain relief, but current evidence is very limited.
Effects of acupressure on pain in short term										

Table 3 (continued)

Certainty assessment							Summary of findings			
Participants (studies) Follow-up	Risk of bias	Inconsistency	Indirectness	Imprecision	Publication bias	Overall certainty of evidence	Study event rates (%)		Anticipated absolute effects	Comments (What Happen)
							With Baseline	With Post-treatment		
170 (2 RCTs)	very serious[a]	not serious	not serious	very serious[c]	202 Very durable	⨁⨁◯◯ Low[a, c]	85	85	SMD **2.37 SD higher** (1.98 higher to 2.77 higher)	Possibly helpful for acute pain, but more data is needed.
Effects of back belt on disability in short term										
104 (2 RCTs)	very serious[a]	serious[b]	not serious	very serious[c]	11 Insufficient	⨁◯◯◯ Very low[a, b,c]	53	51	SMD **1.04 SD higher** (0.37 higher to 1.72 higher)	May aid posture and function, though confidence in effect is very low.
Effect of extracorporeal shock wave therapy on pain in short term										
106 (2 RCTs)	serious[a]	serious[b]	not serious	very serious[c]	195 Very durable	⨁⨁◯◯ Low[a, b,c]	53	53	SMD **4.33 SD higher** (3.6 higher to 5.07 higher)	Some benefit seen in pain levels, but findings are sparse and uncertain.

CI: confidence interval; SMD: standardised mean difference

(a) The certainty of the evidence was downgraded if > 25% of the participants were from high risk of bias studies. (b) The certainty of the evidence was downgraded if there was a significant heterogeneity (I2 > 50%) or a large difference in the estimate of effects, (c) The certainty of the evidence was downgraded if the total number of participants was < 400 for each outcome. Publication bias: Rosenthal's Fail-safe N values, which estimate the number of hypothetical unpublished studies with null results needed to reduce the observed effect to a non-significant level ($p > 0.05$). According to Rosenthal's criterion ($N > 5k + 10$, where k is the number of studies), all three outcomes exceeded the threshold, indicating that the findings are robust against potential publication bias

(41) and laser acupunture (61) are also effective but level of evidence is very low (Fig. 3; Table 3).

Stabilization exercises ($I^2 = 94\%$, effect size = 2.80, 95%CI = 1.19–4.41, $p = 0.007$) (Fig. 2N) (26,28,29,31,34) are effective on mid-term disability at a low level of evidence. NMES (59) and back belt (29) are may show potential benefit at a very low level of evidence. In contrast, self-management education (55,56) is not effective at a very low level of evidence (Fig. 3; Table 3). On the other hand, disability was measured in 2 interventions only in the long term with very low level of evidence (Fig. 3). While stabilization exercises (26) are effective on long-term disability, self-management education (55) is ineffective.

Quality of life

Quality of life was the outcome with the most gaps in the literature (Fig. 3). It was measured in 2 interventions in the short term, 3 interventions in the mid term, and 2 interventions in the long term. In the short term, other exercises (40) and NMES (59) are may show potential benefit at a very low level of evidence. In the mid term, stabilization exercises (26,28) and NMES (59) are may show potential benefit at a very low level of evidence, while self-management education (55,56) is ineffective at a very low level of evidence. Similarly, stabilization exercises (26) are may show potential benefit in the long term at a very low level of evidence, while self-management education (55) is ineffective at a very low level of evidence.

Discussion

Postpartum LPP has intrinsic, extrinsic and mixed risk factors. Some risk factors are physiological changes that occur during pregnancy, caesarean section, epidural anesthesia, duration of the first stage of labour, age and race of the mother (63). During pregnancy, changes in the cardiovascular, hematological, respiratory, renal, gastrointestinal, endocrine and musculoskeletal systems are observed. In particular, changes in the musculoskeletal system may cause postpartum LPP (64). As the center of gravity shifts forward during pregnancy, there is an increase in lumbar lordosis, pelvic anteversion, thoracic curvature, cervical curvature, shoulder girdle protraction, knee hyperextension and ankle extension (65). The development of back pain is associated with spinal changes, particularly an increase in lumbar curvature, which alters the distribution of loads and causes increased tension in lumbar structures (66). The activation of the extensor muscles during standing in a healthy pregnant woman can also lead to an increase in the bending moment due to the increased abdominal mass.(67) Changes in the activation patterns of the lumbar pelvic extensor muscles have been associated with low back pain in other populations (68). Due to these changes, postpartum LPP appears to be at a rate of 8–20% (4). Physiotherapy and rehabilitation methods are frequently used to cope with all these changes and to prevent and improve LPP (69). So far, there was no comprehensive systematic reviews and meta-analyses to demonstrate the effectiveness of physiotherapy interventions with their level of evidence in post-partum LPP including evidence gaps. With this systematic review, we showed that level of evidence of the existing literature is inadequate to draw strong conclusions, with only three strong and four moderate evidence levels being found out of 49 findings, although most of the findings showed improvement in pain and disability.

Stabilization exercise are effective in each term with various level of evidence. For pain and disability, stabilization exercise are the most effective intervention with high level of evidence in the short term, with a low level of evidence in the mid term, and with a very low level of evidence in the long term. It is also effective on quality of life with a very low level of evidence in both mid and long terms. The musculoskeletal and hormonal changes that occur during pregnancy disrupt the biomechanics of the lumbopelvic region (64). Stabilization exercises restore the stabilizer properties of the muscles in the lumbopelvic region, hence reducing the load on the region. This reduces the level of pain and disability. Quality of life is improved by the reduction in pain and disability (13).

Other type exercises include exercises that are not stabilization exercises such as diagonal trunk exercises, longitudinal trunk exercises, lower extremity strengthening exercises, dynamic neuromuscular stabilization (33,35,40–45). There are no trials that examine the mid and long-term effects of other types of exercise on pain, disability and quality of life. In the short term, they have a moderate level of evidence for improving pain, a low level of evidence for improving disability, and a very low level of evidence for improving quality of life. The mechanism of these exercises, which lead to the correction of the muscular defect, was explained as follows; abdominal contraction increases pressure and transforms the abdomen into a rigid cylinder, which increases spinal stability and improves abdominal strength (70). Abdominal muscle facilitation, stabilization and concentric activation were followed by these exercises (70). It is therefore an improvement in pain, disability and quality of life.

There are no trials that investigate the mid and long-term effects of manipulative therapy on pain and disability, and quality of life in all periods (38,46,48,49). In the short term, it is effective on pain and disability with moderate evidence. The modes of manipulation can be broadly divided into biomechanical and neurophysiological which could explain the potential mechanism for improvin pain and disability. The biomechanical approach suggests that manipulation acts on a manipulable or functional spinal lesion; the treatment is designed to reduce internal mechanical stresses (71). The neurophysiological approach suggests that manipulation acts on primary afferent neurons from paraspinal tissues, the motor control system and pain processing (72). Thus, manipulative therapy might be useful in short term pain and disability.

There are no trials that investigate the mid and long-term effects of conventional physiotherapy on pain and disability, and quality of life in all periods (30,32,46,47). Low level of evidence showed that conventional physiotherapy is effective on pain and disability in the short term. When applied hot, it stimulates the delivery of oxygen to muscles and helps repair damaged tissue. It triggers the skin's sensory receptors, which means that fluid in the area reduces the transmission of pain to the brain and partially relieves discomfort. At the same time, pain can be relieved with the gate control theory (73).

There are no trials that investigate the mid and long-term effects of kinesiotaping on pain and disability, and quality of life in all periods (57,58). In the short term, kinesiotaping is effective on pain and disability with very low evidence. The most widely accepted idea so far is the gate control theory, according to which the mechanical stimuli provided by the KT would act through fast conducting fibres (Aβ) that synapse with inhibitory interneurons when they reach Roland's Gelatinous Substance (posterior horn of the spinal cord), causing the gate to close and therefore not allowing the passage of the notional receptive stimulus (C and Aδ fibres) (74). This reduces the level of pain and disability.

Limitations and considerations for future studies

The heterogeneity of the participants in the studies may be attributed to the varying duration of post-partum LPP. The inclusion or exclusion criteria in the included studies did not consider differences in birth type, such as normal birth, cesarean birth, and premature birth. Additionally, there were differences in the method of application, duration, frequency, and severity of the treatment methods used in the studies. Classification was attempted to address the variation in evaluation times in studies. The meta-analysis results showed a high level of heterogeneity ($I^2 > 75\%$) due to factors such as varying exercise names and implementation of stabilization exercises. Additionally, heterogeneity increased by evaluating pain, disability, and quality of life with different outcome measurements. Most studies focus on the short-term effects of treatments, so it is unclear whether these effects are permanent. Therefore, future studies should include long-term follow-up using treatment programs similar to those used in the past. Although stratified subgroup analyses were performed based on follow-up durations (short-, mid-, and long-term) to address heterogeneity, further analytical methods such as sensitivity or meta-regression analyses could not be performed due to insufficient reporting of key variables in the included studies. This limited our ability to explore other potential sources of heterogeneity, such as intervention intensity, delivery setting, or participant characteristics. For studies with missing outcome data (e.g., means, standard deviations), we contacted corresponding authors to obtain the necessary information. If data could not be retrieved, such studies were excluded from the meta-analysis but were considered in the qualitative synthesis. No statistical imputation was performed for missing data, in accordance with Cochrane guidelines. Future studies with more standardized protocols and a greater number of trials will allow the use of these methods to better explore comparative effectiveness and identify moderators of treatment response.

Additionally, future studies are needed on the effects of acupressure on pain, disability and quality of life in the mid- and long-term. There is a need to study the frequency of use of standardized back belts and the long-term pain, disability and quality of life associated with this use. There is a need for studies of pain, disability and quality of life in the mid- and long-term for different shoe uses and shoe problems. There is a need for more short-, mid- and long-term studies similar to the content of self-management education given to patients. There is a need for studies using similar acupuncture points and investigating pain, disability and quality of life in the short, mid and long term. There is a need for trials investigating pain, disability and quality of life with cupping therapy. One study was found for muscle energy technique, ESWT, laser acupuncture and massage therapy. Therefore, there is a need for short-, medium- and long-term trials using similar treatment protocols to investigate the effectiveness of these treatments.

Conclusion

This systematic review presents findings on post-partum LPP, highlighting both evidence and gaps in the literature. We found that level of evidence of the existing literature is inadequate to draw strong conclusions, with only three strong and four moderate evidence levels being found out of 49 findings, although most of the findings showed improvement in pain and disability. The findings indicate that stabilization exercises are effective in reducing pain severity during the short term (< 3 months) with strong evidence, while stabilization exercise is the only intervention with high level of evidence in reducing disability during the short term. In addition, manipulative therapy and other exercise were found to be effective in reducing the pain in the short term with a moderate level of evidence. The rest of the interventions investigated in the literature for pain and disability has low or very level of evidence. There is a limited amount of research on quality of life, with few studies examining both mid and long-term outcomes. Stabilization exercises demonstrated the strongest evidence among interventions for postpartum LPP.

Implications for rehabilitation

Stabilization exercises reduce pain and disability in the short term.

Other types of exercises reduce pain in the short term.

Manipulative therapy reduces pain and disability in the short term.

Abbreviations

LPP	Lumbo-pelvic pain
NMES	Neuromuscular electrical stimulation
ESWT	Extracorporeal shock wave therapy

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12905-025-03881-2.

Supplementary Material 1

Supplementary Material 2

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Author contributions

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Data availability

The data is available upon request from the corresponding author.

Declarations

Ethical approval

Not Applicable.

Consent for publication

All authors have approved the manuscript and agree with submission to BMC Women's Health.

Competing interests

The authors declare no competing interests.

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