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Recommendations for Physical Therapists on the Treatment of Lumbopelvic Pain During Pregnancy: A Systematic Review

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STUDY DESIGN: Systematic review of the literature.

OBJECTIVES: To review and assess the peer-reviewed literature on the effectiveness of physical therapy interventions in treating lumbopelvic pain during pregnancy.

BACKGROUND: Current guidelines on interventions for lumbopelvic pain during pregnancy differ in their recommendations for assessment and intervention. Recent publications may allow revising current recommendations for the treatment of this complex problem.

METHODS: An electronic search strategy was conducted in PubMed, PEDro, Scopus, and CINAHL of literature published from January 1992 to November 2013. Two authors independently assessed all abstracts for eligibility. Articles were independently rated for quality by 2 authors, using the Cochrane Back Review Group criteria for methodological quality. Where possible, effect sizes were calculated for the different interventions.

RESULTS: A total of 22 articles (all randomized controlled trials) reporting on 22 independent studies were included. Overall, the methodological quality of the studies was moderate. Data for 4 types of interventions were considered: a combination of interventions (7 studies, n = 1202), exercise therapy (9 studies, n = 2149), manual therapy (5 studies, n = 360), and material support (1 study, n = 115).

CONCLUSION: All included studies on exercise therapy, and most of the studies on interventions combined with patient education, reported a positive effect on pain, disability, and/or sick leave. Evidence-based recommendations can be made for the use of exercise therapy for the treatment of lumbopelvic pain during pregnancy.

LEVEL OF EVIDENCE: Therapy, level 1a–. *J Orthop Sports Phys Ther 2014;44(7):464-473. Epub 10 May 2014. doi:10.2519/jospt.2014.5098*

KEY WORDS: *back pain, gravida, intervention, pelvis*

Lumbopelvic pain during pregnancy, defined as pregnancy-related low back pain (LBP) and/or pregnancy-related pelvic girdle pain (PGP), is a complex problem, with both a physical and psychological burden.[4,6] The prevalence is reported to range from 24% to 90%, mainly due to the lack of a clear definition and classification of the condition.[4,5,46] In the Netherlands, 20% of all pregnant women with lumbopelvic pain seek medical help between weeks 34 and 40 of pregnancy.[3] Guidelines for physical therapists would be helpful for optimal evidence-based assessment, as well as for intervention. However, the Dutch national guidelines[4] and the European guidelines[4,6] on lumbopelvic pain for physical therapists differ in regard to recommendations for both assessment and intervention. In the European guidelines, various assessments and interventions are discussed and recommended. In contrast, the Dutch national guidelines recommend very limited or no intervention in the majority of patients with lumbopelvic pain with an uncomplicated pregnancy, with the main focus of the limited intervention being to provide information and improve the patient's physical condition. Because physical therapists in the Netherlands can follow both the Dutch national and the European guidelines, inconsistencies in treatment approach exist and there is lack of transparency. Given the most recently published literature on the treatment of lumbopelvic pain, it is necessary to update the guidelines for physical therapists, with the aim to reach consensus.

Recently, a systematic review of the Cochrane Collaboration by Pennick and Liddle[33] discussed a variety of interventions for lumbopelvic pain during preg-

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nancy. However, that review did not consider patient education and providing information to the patient to be part of the intervention, though many of the included studies did. Providing information to the patient is an important part of the therapeutic process. Patient information is not only recommended by the Dutch national guidelines for lumbopelvic pain but is also defined for physical therapy in general by the World Confederation for Physical Therapy. "Functional training in self-care," "home management," "work," and "patient-related instruction" are all components of an intervention that can be included in the category "patient education." The present review also considers providing information to be part of an intervention to be provided by physical therapists; therefore, this review adds valuable information to earlier reviews and provides new recommendations for future research.

The aim of this review was to determine the level of evidence of the treatment of lumbopelvic pain that has been reached using methods established by the Cochrane Back Review Group (CBRG).[44] All treatment approaches considered are listed in the policy statement "Description of Physical Therapy" by the World Confederation for Physical Therapy.

METHODS

Literature Search

A systematic electronic search strategy was conducted using PubMed, PEDro, Scopus, and CINAHL (**APPENDIX**, available online). Studies were limited to those published in English in peer-reviewed journals between January 1992 and November 2013. An additional search of the reference lists of the included articles was conducted, and all systematic reviews published on the treatment of pregnancy-related lumbopelvic pain were carefully read. The reference lists of these earlier reviews were compared with the reference list of the present review. Randomized controlled trials (RCTs) that were not identified in the search but met the inclusion criteria were included. Studies for which the full-text article could not be obtained were excluded (**FIGURE**).

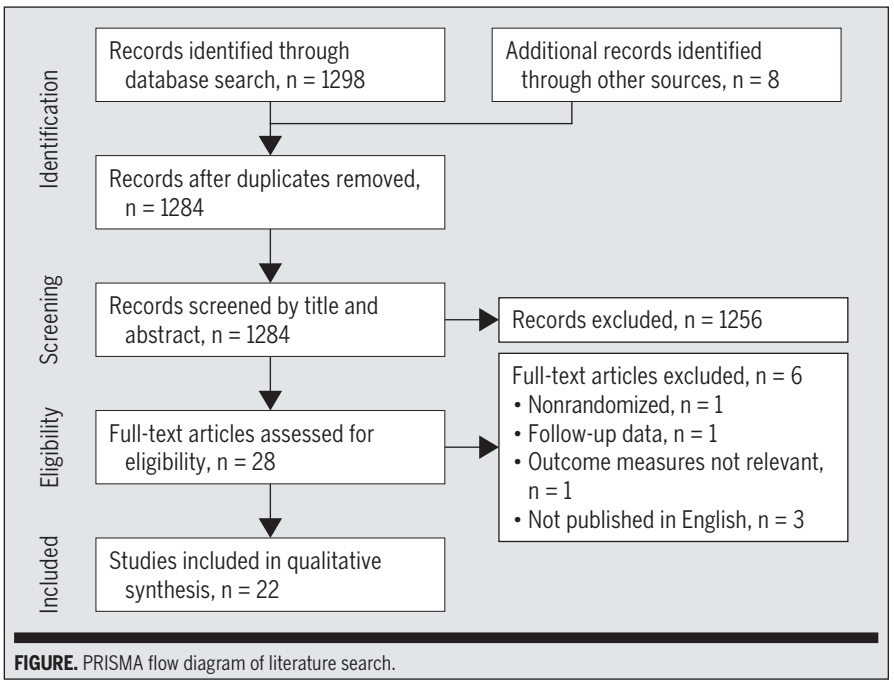

FIGURE. PRISMA flow diagram of literature search.

Study Selection

Two authors (E.B. and A.P.) independently assessed the selected articles for relevance and eligibility. All articles were assessed with regard to the inclusion criteria for design, study sample, interventions, and relevant outcome measures. Any disagreement was resolved by discussion and consensus.

Eligibility of the Studies

Inclusion Criteria Only RCTs studying pregnant women with or without lumbopelvic pain were included. All nonpharmacological interventions performed by physical and manual therapists, osteopaths, or chiropractors were considered for inclusion. Although there were no restrictions for the outcome measures, pain, disability, and sick leave were considered to be the primary variables of interest.

Exclusion Criteria Studies were excluded if the intervention was either medical or invasive (eg, drug use, surgery, acupuncture) or addressed gynecological or obstetric issues only (eg, condition of the fetus or labor-related items).

Quality Assessment

Included RCTs were independently rated for quality by 2 authors (E.B. and A.P.) using the CBRG Internal Validity Checklist, which consists of 11 items related to methodology in clinical trials.[44] This assessment tool has been shown to have good interrater agreement.[16,44] Any disagreement in rating was resolved by discussion and consensus; a third assessor (J.P.) was consulted if no consensus was reached. No cutoff point was used as an exclusion criterion to include the study in the review. The score for each study was used as an indication of the quality of evidence for the results and conclusions of the study. A score of 5 or less was considered relatively poor, and a score of 6 or greater relatively good. All decisions were made according to the recommendations of the CBRG.[44]

Data Extraction and Synthesis

A standardized template was used to extract data from the included RCTs (study design, population, interventions,

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outcome measures, results, and conclusions). For the readability of the tables, outcome measures were reported in the same order: pain, disability, sick leave, and other outcome measures. If possible, effect size was calculated to assess the magnitude of the change in scores within groups. Effect size was defined as the mean change score in a group of patients, divided by the standard deviation of the baseline scores of that same group (**TABLES 1** through **4**, available online).[36] Due to different inclusion criteria, interventions, and outcome measures, it was not possible to pool the data and perform a meta-analysis. Qualitative conclusions on the level of evidence are based on the definitions from the CBRG (**TABLE 5**).[44]

TABLE 5 Levels of Evidence According to the Cochrane Back Review Group

Level of Evidence	Description
Strong	Consistent findings among multiple high-quality RCTs
Moderate	Consistent findings among multiple low-quality RCTs and/or CCTs and/or 1 high-quality RCT
Limited	One low-quality RCT and/or CCT
Conflicting	Inconsistent findings among multiple trials (RCTs and/or CCTs)
No evidence from trials	No RCTs or CCTs

Abbreviations: CCT, controlled clinical trial; RCT, randomized controlled trial.

RESULTS

Search Results

The **FIGURE** shows the process of study selection and inclusion. In the initial database search, 1298 potentially relevant articles were identified. A hand search of the reference lists of the other systematic reviews yielded 8 additional potentially relevant articles. After removing duplicate studies, 1284 articles remained. After screening by title and abstract, 1256 articles were excluded, leaving 28 articles for full-text assessment. Of these, 6 articles were excluded because the study design was not randomized (n = 1), only postpartum follow-up data of an RCT that was already included were presented (n = 1), the measured outcomes were hemodynamics of mother and fetus (n = 1), and the manuscript was not published in English (n = 3). This left 22 RCTs to be included in the review.

Methodological Quality

Overall, the methodological quality of the included RCTs was moderate. Of the 22 studies, the median score on methodological quality according to the CBRG was 6/11 (mean, 6; range, 2-10). **TABLES 1** through **4** (available online) present the scores per study and **TABLE 6** the calculation of the scores.

Study Characteristics

Study Population and Type of Lumbopelvic Pain All studies focused primarily on a sample population of pregnant women, mostly recruited from antenatal health care centers. However, the studies differed in their inclusion and exclusion criteria. Of the 22 RCTs, 3 examined women with PGP.[5,24,31] One study focused on LBP, confirmed by palpation.[35] Five studies examined women with a combination of both or did not distinguish between LBP and PGP.[14,19,23,28,39] Thirteen studies did not specifically focus on lumbopelvic pain and included pregnant women.[6,10-13,17,21,22,26,29,32,38,40]

Outcome Measures The effectiveness of treatment was measured by a variety of outcome measures, but most studies used pain or disability. For pain, the visual analog scale[19,22,24,28,31,39,40] and numeric pain rating scale[5,6,14,23,26,35] were the most commonly used measurement tools. For disability, the Roland-Morris Disability Questionnaire[5,6,21,23,26,35] and the Disability Rating Index[31,40] were the most often used instruments. Other outcome measures included physical tests, anxiety, and overall treatment experience (**TABLES 1** through **4**, available online).

Interventions for Lumbopelvic Pain The interventions included in the studies were divided into 4 categories that fit the interventions, as recommended by the World Confederation for Physical Therapy: a combination of interventions (often with educational programs), exercise therapy, manual therapy, and material support. Only studies with a methodological quality score of 6 or greater, according to the CBRG,[44] are described here in more detail (**TABLE 6**). Effect sizes were calculated (if possible) and are reported in the corresponding tables. It should be noted that all included studies were pragmatic trials and, therefore, all control groups received standard antenatal care, unless otherwise indicated.

Combination of Interventions Seven studies (n = 1202) assessed the effect of combinations of interventions (**TABLE 1**, available online).[5,6,14,24,31,32,39] With the exception of the study by Eggen et al,[6] all studies showed a positive effect on pain, disability, or sick leave. Three studies scored 6 or better for methodological quality,[5,14,31] and 4 had a score less than 6.[6,24,32,39] Depledge et al[5] presented evidence for the effect of muscle-training exercises on improvement of pain and disability in activities of daily living (ADL) with the use of a pelvic belt compared to no belt, and found that use of the pelvic belt did not increase the effect of training. This finding contrasts that of Kordi et al,[24] who showed that the group wearing a pelvic belt had a significantly greater reduction in pain and disability than the group that only performed exercises. The study by Eggen et al[6] showed that supervised exercises in combination with ergonomic advice did not influence the prevalence and severity of lumbopelvic pain. However, all studies that investigated multimodal programs that included education about anatomy, pathology, posture physiology, changes during pregnancy, relaxation, and modification and advice on ADL showed positive effects on pain, disability, and sick leave. Positive

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TABLE 6 Methodological Quality Scores According to the Cochrane Back Review Group

Study	Risk of Bias	Items*										
		1	2	3	4	5	6	7	8	9	10	11
Depledge et al[5]	10/11	1	1	1	1	1	1	0	1	1	1	1
Eggen et al[6]	5/11	1	1	0	0	0	0	0	1	0	1	1
Field et al[12]	3/11	0	0	1	0	0	0	0	0	0	1	1
Field et al[11]	2/11	0	0	0	0	0	0	0	0	0	1	1
Field et al[10]	4/11	0	0	1	0	0	1	0	0	0	1	1
Garshasbi and Faghih Zadeh[13]	5/11	1	0	1	0	1	0	0	0	0	1	1
George et al[14]	6/11	1	1	1	0	0	0	0	0	1	1	1
Granath et al[17]	6/11	0	1	1	0	1	0	1	0	0	1	1
Kalus et al[19]	6/11	1	1	1	1	0	0	0	0	1	1	0
Kashanian et al[21]	3/11	0	0	1	0	0	0	0	0	0	1	1
Kihlstrand et al[22]	7/11	1	1	1	0	0	0	0	1	1	1	1
Kluge et al[23]	7/11	1	1	1	0	0	0	1	0	1	1	1
Kordi et al[24]	5/11	1	0	1	0	0	0	0	0	1	1	1
Licciardone et al[26]	8/11	1	1	0	1	0	1	1	1	1	1	0
Martins and Pinto e Silva[28]	7/11	1	1	1	0	0	1	0	1	0	1	1
Mørkved et al[29]	8/11	1	1	1	0	0	1	0	1	1	1	1
Nilsson-Wikmar et al[31]	7/11	1	0	1	0	1	1	1	0	0	1	1
Östgaard et al[32]	5/11	0	0	1	0	0	0	1	0	1	1	1
Peterson et al[35]	6/11	1	1	0	0	0	1	1	1	1	0	0
Sedaghati et al[38]	2/11	0	0	1	0	0	0	0	0	0	1	0
Shim et al[39]	3/11	0	0	1	0	0	0	0	0	1	0	1
Stafne et al[40]	8/11	1	1	1	0	0	1	0	1	1	1	1

*Items:
1. Was the method of randomization adequate?
2. Was the treatment allocation concealed?
3. Were the groups similar at baseline regarding the most important prognostic indicators?
4. Was the patient blinded to the intervention?
5. Was the care provider blinded to the intervention?
6. Was the outcome assessor blinded to the intervention?
7. Were cointerventions avoided or similar?
8. Was the compliance acceptable in all groups?
9. Was the dropout rate described and acceptable?
10. Was the timing of the outcome assessment similar in all groups?
11. Did the analysis include an intention-to-treat analysis?

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effects were shown for a combination of education and exercise therapy,[5,24,31,32,39] the use of a pelvic belt,[24,31] and manual therapy[14] during pregnancy (**TABLE 7**).

Exercise Therapy Nine studies (n = 2149) assessed the effect of exercise therapy in different forms (**TABLE 2**, available online).[13,17,21-23,28,29,38,40] All studies reported a positive effect on pain, disability, and sick leave (**TABLE 8**). Studies of relatively high methodological quality demonstrated a positive effect on functional status[29] and sick leave.[17,22,40] There were differences in pain outcomes. Six studies reported a decrease in pain intensity in the intervention group[13,17,21-23,28] ; however, 1 study also reported an increase in pain with advancing pregnancy in all groups.[22] Stafne et al[40] found no significant between-group difference in self-reported pain but significantly less sick leave in the intervention group compared to the control group.

Manual Therapy Five studies (n = 360) assessed the effect of manual therapy (**TABLE 3**, available online). All 5 studies presented positive effects on back pain and disability; however, the specific interventions varied. Only 2 of the studies investigated manual therapy performed as joint mobilization[26,35]; the other 3 studies investigated massage therapy[10-12] and were of relatively poor quality. Licciardone et al[26] demonstrated that osteopathic manual therapy in combination with usual obstetric care, compared to usual

TABLE 7 Summary of Positive Results of Interventions Combined With Education

Study	Risk of Bias	Pain	Disability	Sick Leave
Depledge et al[5]	10/11	+	...	...
Nilsson-Wikmar et al[31]	7/11	=	...	...
George et al[14]	6/11	+	+	...
Kordi et al[24]	5/11	+	+	...
Östgaard et al[32]	5/11	=	...	=
Shim et al[39]	3/11	+	...	...

Abbreviations: =, no significant difference between groups; +, significant difference between groups in favor of the study group.

TABLE 8 Summary of Results of Exercise Therapy

Study	Risk of Bias	Pain	Disability	Sick Leave
Stafne et al[40]	8/11	=	=	+
Mørkved et al[29]	8/11	...	+	=
Kihlstrand et al[22]	7/11	+	...	+
Kluge et al[23]	7/11	+	+	...
Martins and Pinto e Silva[28]	7/11	+	...	...
Granath et al[17]	6/11	+	...	+
Garshasbi and Faghih Zadeh[13]	5/11	+	...	...
Kashanian et al[21]	3/11	+	...	...
Sedaghati et al[38]	2/11	=	...	...

Abbreviations: =, no significant difference between groups; +, significant difference between groups in favor of the study group.

obstetric care or a sham intervention, led to significantly better decrease of pain and regression of disability. Peterson et al[35] reported positive effects on disability and pain as a result of chiropractic mobilization and stabilization techniques; however, no significant differences between groups were found.

Material Support One study[19] (n = 115) of moderate quality assessed the effect of material support on PGP, and found that wearing a BellyBra or a Tubigrip had a positive effect on pain intensity. The intervention group using a BellyBra had a significantly decreased impact of pain on sleeping and some daily activities compared with the group using the Tubigrip. Although no significant difference between groups was found for pain reduction, both groups reported significantly less pain.

Level of Evidence There is moderate evidence for the efficacy of several types of exercise training, such as daily training of the pelvic floor, weekly training of muscle strength, aerobic training, and water aerobics.[17,22,23,28,29] Training should be performed at a frequency of 1 to 2 times a week[17,22,28,29] and focus on improving balance; active stability; strength of the muscles of the lower back, pelvis, and pelvic floor; and cocontraction of the transverse abdominal and pelvic floor muscles with other muscle groups.[13,17,22,23,28,29] Data for the other interventions did not achieve a moderate level of evidence.

DISCUSSION

The aim of this systematic review was to evaluate the evidence provided by the literature on the treatment of lumbopelvic pain during pregnancy and to inform physical therapists about the best available evidence for intervention in this population. The primary finding was moderate evidence for the ability of exercise therapy to reduce pain intensity,[5,22-24,28,29,35] disability,[5,24,29,35] and sick leave.[17,22,40] This is of importance for future guidelines and is likely to improve consistency across guidelines.

The main strength of this systematic review was its broad and thorough literature search. In addition, where possible, effect sizes were calculated and *P* values reported, which improved the ability to draw conclusions and make comparisons.

The primary limitation of this review is that the heterogeneous study populations and variety of interventions and outcome measures precluded pooling the data. This was also a limitation reported in previous systematic reviews by Stuge et al[41] and Pennick and Liddle.[33] Although categorizing the interventions into 4 intervention groups helped the analysis, allocation to specific interventions was not always clear. Nevertheless, the advantages of this categorization seem to outweigh the disadvantages. Furthermore, many authors did not report all of the data, for example, baseline measurements and variance in the data (ie, standard deviations), which often precluded calculation of effect sizes.

Methodological Quality

The methodological quality of the included studies was moderate. As shown in **TABLE 6**, most studies had adequate randomization, treatment allocation, and timing of measurements. In regard to data reporting, most studies had groups with similar characteristics at baseline and used intention-to-treat analysis to account for missing data. However, most studies lacked adequate blinding. Blinding patients is a difficult process in nonpharmacological trials, but blinding outcome assessors and care providers may be possible and could improve methodological quality. The methodological quality of several trials could have been

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higher if the authors had reported their data more thoroughly and/or effectively. In many studies, compliance and dropout rates were not reported. Surprisingly, little attention was given to describing or avoiding cointerventions. These methodological flaws were present for all therapeutic interventions. In summary, improvement can be achieved in the methodology of the studies.

Combination of Interventions

All studies that included extensive education (in terms of anatomy, pathology, changes during pregnancy, posture physiology, self-management, modification of and advice on ADL, and relaxation) showed positive results on pain, disability, and/or sick leave (**TABLE 7**).[5,14,24,31,32,39] In those studies, this information was provided verbally or in writing, or individually or in groups. **TABLE 1** (available online) presents details on all studies using a combination of interventions.

It cannot be determined whether the positive results were due to the multidimensional nature of these treatment programs or whether education added value to the interventions, because the RCTs did not include groups receiving the same intervention but without education. The European guideline[46] states that there is no evidence for the effect of providing information as a standalone treatment. Nevertheless, Vleeming et al[46] consider it useful to reduce fear and allow patients to take an active part in their rehabilitation, a recommendation that appears to be based on opinion. In contrast, Bastiaenen et al[4] stated that no intervention is needed except for advice (giving information and encouraging physical activity), because pregnancy-related lumbopelvic pain is a self-limiting disease, with most women recovering postpartum. Based on the results of this review, advice and education seem to be important components of treatment, resulting in positive effects on pain and disability.[5,14,24,32,39] However, the self-limiting aspect of this condition is debatable, given that a considerable number of women do not recover after delivery. Throughout pregnancy, 73% of the cohort reported pain in the lumbopelvic area, decreasing to 35.9% 3 weeks after delivery and to 34.4% 1 year after delivery.[2] If it is possible to reduce complaints of lumbopelvic pain during pregnancy, as demonstrated by studies in the present review,[5,32,39] this prognosis could be improved.

Exercise Therapy

Exercise therapy has a positive effect on pain, disability, and/or sick leave in those with LBP. The evidence was less robust and the effect sizes were smaller for those with PGP (**TABLE 2**, available online). Seven of 9 RCTs, all of moderate quality, investigated exercise therapy alone and showed a positive effect of exercise on pain and/or disability.[13,17,21,23,28,29,38] In contrast, 2 RCTs reported no effect on pain but a positive effect on disability and/or sick leave.[22,40] In these RCTs, a potential explanation for the lack of effect on pain is that, in all studies, the control groups received usual antenatal care; this can also be seen as a form of treatment or at least an important influence. Education seems to be an important factor of treatment.[5,31,32,39] Midwives are likely to give relatively specific information and advice on anatomy, postural changes, and, perhaps, home exercises for pregnant women with lumbopelvic pain. This does not justify the assumption that usual antenatal care is the same as "doing nothing"; however, this issue is not discussed in these studies. This may not be a study flaw but, rather, a result of being a pragmatic trial. To overcome the considerable amount of advice given during usual antenatal care, the effect size of the exercise group should be larger than that of the control group. In one study the effect sizes could not be calculated,[22] and in another the difference was relatively small[40] (**TABLE 2**, available online), which might have influenced the outcomes. Stafne et al[40] reported no positive effect of exercise on pain. However, it should be noted that lumbopelvic pain was not the primary outcome measure of that study, as it focused on gestational diabetes and glucose metabolism, and the reduction of lumbopelvic pain was included as 1 of 6 possible effects. Prevalence of lumbopelvic pain was measured by asking the subjects, "Do you have pain in the pelvic and/or lumbar area? Yes/No." It is not surprising that pregnant women occasionally experience pain in the pelvic or lumbar area. This seems to be the case, because no difference between the groups was found for prevalence. The lack of a proper definition for the condition seems to be a limitation of this study.[40] No differences between the groups were found for disability, pain intensity, and fear-avoidance beliefs; however, there was a difference in sick leave, which was significantly lower among the women who exercised. Exercise had a positive influence of some kind, because women in the study of Stafne et al[40] seemed to handle the disorder better when they exercised regularly.

As stated above, there was moderate evidence for the positive effect of several types of exercise therapy.[13,17,22,23,29,35] **TABLE 2** (available online) provides detailed information on exercise therapy for all studies, and **TABLE 7** provides the detailed outcomes showing that 8 of 9 studies had a positive effect on pain, disability, or sick leave. These outcomes are consistent with the European guideline,[46] which recommends individualized exercises focusing on advice for ADL and avoiding maladaptive movements. However, an important difference is that, in the European guideline, stabilization exercises were recommended only for the postpartum period. Several studies included in the present review demonstrated that stabilization exercises are effective to reduce pain and disability in the prepartum period.[5,23,28,40]

Manual Therapy

Limited research has focused on the use of manual therapy techniques for the treatment of lumbopelvic pain during pregnancy. There is relatively high-quality evidence for the positive effect of osteopathic manual therapy in combination with usual obstetric care on improvement

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of pain and disability.[26] In the study by George et al,[14] although manual therapy seemed to add to the positive findings, no conclusions can be drawn because manual therapy treatment was part of a multimodal therapeutic approach. Licciardone et al[26] performed the only study that investigated osteopathic joint mobilization and soft tissue techniques and showed a significant difference in disability between the groups; however, this between-group difference was not found for back pain. The study by Peterson et al[35] showed improvement in pain and disability in all 3 groups, but, again, no significant differences were found between the groups. Studies that investigated massage therapy did not have pain as a primary outcome measure and were of relatively poor quality.[10-12]

Consistent with both previously mentioned guidelines, based on the current evidence, there is no evidence that manual therapy should be recommended for the treatment of lumbopelvic pain during pregnancy. Additional RCTs investigating manual therapy treatment approaches for lumbopelvic pain in this population are needed.

Material Support

The present review provides no substantial evidence for the use of material support. Although this is consistent with the recommendation of the European guidelines,[46] the guidelines nevertheless advise that a pelvic belt may be fitted to test for symptomatic relief. Bastiaenen et al[4] did not advise against the use of a belt or crutches, but left it up to the patient to decide on the usefulness of these devices. The present review included 1 RCT that compared the effect of 2 different supports,[19] with promising results related to pain. However, the use of a pelvic belt in combination with other treatment interventions has more often been investigated.[5,24,31] Conflicting evidence, ranging from a positive effect on pain and disability[5,24,32] to no added benefits, was found for exercises and advice.[5] The present evidence is insufficient to recommend the use of any material support. More studies focusing on the effects of the use of a pelvic belt are needed.

Comparison With Other Systematic Reviews

Six other systematic reviews studied interventions for lumbopelvic pain during pregnancy.[18,20,33,37,41,45] The reviews by Stuge et al[41] and Pennick and Liddle[33] included mostly clinical trials, whereas the reviews by Vermani et al[45] and Kanakaris et al[20] also included other study designs. The authors of the last 2 reviews mentioned studies of high and low methodological quality, but did not explain if and how this was objectively determined. In contrast, both Stuge et al[41] and Pennick and Liddle[33] assessed methodological quality using clearly defined criteria. The present review adds to the strength of both these studies by also applying these criteria in more detail, in accordance with the CBRG Internal Validity Checklist[44] (**TABLE 6**).

Five of these reviews included articles on LBP and/or PGP in both the prepartum and postpartum stages; only Pennick and Liddle[33] did not. It may be useful to distinguish between these 2 stages to estimate different practical implications. With regard to the inclusion of the RCTs, estimating the methodological quality, and reporting on the interventions during the prepartum stage alone, the greatest similarity exists between the design of the present review and that of the most recent review of Pennick and Liddle.[33] Therefore, comparison of only these 2 reviews is discussed in more detail below.

Pennick and Liddle[33] assessed 26 RCTs and the present review included 22 RCTs. Of these studies, 14 are discussed in both reviews.[5,6,13,14,19,21-23,26,28,29,35,38,40] Twelve RCTs included by Pennick and Liddle[33] were not included in our review, because 4 were not published in an English peer-reviewed journal,[1,15,34,42] 1 was published prior to 1992,[43] and another 7 investigated acupuncture.[7-9,25,27,47,48] On the other hand, our review assessed 8 studies[10-12,17,24,31,32,39] that were not included in the review by Pennick and Liddle.[33]

Although Pennick and Liddle[33] also calculated effect sizes, no comparison can be made between our calculations and theirs because of missing data. We believe that the calculations we made have added value to the reported results. Large to medium effect sizes were calculated for the effect of the combination of exercise and information on disability and pain[5] (**TABLE 1**, available online), flexibility of the spine[13] (**TABLE 2**, available online), massage on anxiety and leg and back pain[10-12] (**TABLE 3**, available online), and the use of a support garment on pain during ADL (**TABLE 4**, available online). However, we should mention that, for most of the included RCTs, the effect sizes could not be calculated due to missing data.

Pennick and Liddle[33] concluded that there is moderate evidence for the effect of physical therapy in treating lumbopelvic pain. There was some indication that adding acupuncture, physical therapy, or exercise therapy to standard antenatal care seemed to relieve lumbopelvic pain to a greater extent than standard antenatal care alone. The present review supports that conclusion and provides additional information regarding education and information. Adding information and advice to other treatment interventions (eg, exercise therapy) seems to have a positive effect in treating lumbopelvic pain.[5,31,32,39] However, more research on the influence of education is needed. Education is not specifically mentioned in the review by Pennick and Liddle,[33] but is only referred to as a part of a multimodal approach in 1 of the included RCTs.[14] However, patient education during early pregnancy is mentioned as a possible focus for future research. The present review included 7 RCTs that specifically mentioned education as a part of the treatment provided. Four of these RCTs[24,31,32,39] were not included in the review by Pennick and Liddle,[33] and of the 3 RCTs that were included,[5,6,14] no specific mention of education was made in the discussion of results.

Pennick and Liddle[33] presented their results according to the condition. Thus,

the effect of treatment of LBP, pelvic pain, or lumbopelvic pain is presented and calculated. Although a number of tests are validated to distinguish between LBP and PGP,[45] not all of the included studies in their study sample used these tests as inclusion or exclusion criteria. Thus, various studies ended up in the same category, even though they used different criteria for diagnosing a condition, or did not distinguish between LBP and PGP. Until a universally recognized classification system for these conditions is available, it may be more useful to focus on different treatment interventions and not to distinguish between LBP and PGP when presenting conclusions. From this perspective, the moderate evidence for exercise therapy and patient education seems promising. Exercise combined with education, when added to usual antenatal care, had a positive effect on the rehabilitation (pain, disability, and/or sick leave) of these patients as a whole. However, when analyzing these conditions separately, this finding is more robust for LBP than for PGP.

Although it seems that there is no strong evidence for any of the interventions provided by physical therapists, we would like to put this conclusion into perspective. Moderate evidence is present for exercise therapy. Treating lumbopelvic pain during pregnancy with this form of therapy generally yielded better results on pain, disability, and sick leave than use of standard antenatal care alone. Therefore, physical therapists can play an important role in the rehabilitation of patients with lumbopelvic pain by providing exercise. Providing patient education also seems to be a promising option, but requires further research.

In their systematic review, Nascimento et al[30] discussed different forms of exercise during pregnancy and found them to be associated with control of gestational weight gain, gestational diabetes, and prevention of urinary incontinence and LBP. No contraindications were found, and exercise at moderate intensity was safe for both mother and fetus. Their recommendation to encourage pregnant women to participate in aerobic and strength training at moderate intensity (at least 3 times a week for 30 minutes or more) is, for the most part, consistent with our findings of effectiveness of aerobic and strength training at moderate intensity.[17,22,23,28,29] Our review adds to this point by specifying training goals, such as improving balance; active stability; strengthening the muscles of the lower back, pelvis, and pelvic floor; and cocontraction of the transverse abdominal and pelvic floor muscles with other muscle groups.[13,17,22,23,28,29] For this, we recommend a frequency of 1 to 2 times a week.[17,22,28,29] This difference between reviews may be attributed to the inclusion of different trials. For example, Nascimento et al[30] based their conclusions on trials that not only included pain as an outcome but also outcomes such as depression, blood pressure, excessive gestational weight gain, gestational diabetes, urinary incontinence, quality of life, and birth weight.

Future Research

The present review shows that positive results are reached with various forms of exercise therapy. In addition, patient education seems promising as an adjunct to other interventions. Therefore, it may be warranted to perform an RCT in which precisely described exercise therapy and structured education on LBP and PGP (anatomy, pathology, changes during pregnancy, posture physiology, self-management, modification and advice on ADL, and relaxation) are investigated as both separate and combined interventions in 3 groups, compared with a control group. Moreover, a classification system for LBP and PGP is required to establish whether the same or different types of treatment should be applied in these 2 conditions.

For future research, considerable improvement in study methodology is required. Similar inclusion criteria and outcome tools should be used in high-quality RCTs to enable pooling of data and proper comparison of the different treatment interventions. Also, attention should be paid to report all data, such as the dropout rate, compliance rate, and cointerventions provided. Researchers should also try to achieve better blinding. When it is impossible to blind the patients, which is often the case in physical therapy treatment, it would be beneficial to blind care providers and outcome assessors. The present systematic review indicates that there is evidence to support exercise therapy and providing information; however, the development of a template, based on consensus in outcome measures (eg, which study sample to choose and which results and data to report), would enable one to define and specify such a statement and to calculate effect sizes properly.

CONCLUSION

According to the available literature, there is moderate evidence for the positive effect of exercise therapy on pain, disability, and/or sick leave for the treatment of lumbopelvic pain during pregnancy. Moreover, data show that patient education seems to also be a helpful intervention. Physical therapists can apply these interventions and thereby improve treatment of this condition. All included studies on exercise therapy (all of moderate quality) reported a positive effect on 1 or more of the 3 outcomes in rehabilitation: pain, disability, and sick leave. Six of 7 studies on interventions combined with education showed a positive effect on pain and/or disability or sick leave. There is limited evidence for the effect of material support and manual therapy, and the studies involved have methodological limitations. For future research, more homogeneous populations, as well as standardization of methods and reporting of data, are required. ◉

KEY POINTS

FINDINGS: Exercise therapy is effective in treating pregnancy-related lumbopelvic

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pain. The evidence is more robust for treating pregnancy-related LBP than for pregnancy-related PGP. Patient education seems to be a promising option.

IMPLICATIONS: Physical therapists can implement active exercise in their treatment strategy.

CAUTION: In the current literature, strong evidence is lacking for the use of material support, manual therapy, and for combining interventions, due to the small number of studies and methodological limitations. However, this does not imply that these interventions should not be further investigated. More transparency and homogeneity are required.

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TABLE 1 DESCRIPTION OF THE 7 STUDIES (N = 1202) USING A COMBINATION OF INTERVENTIONS

Study	Risk of Bias (CBRG)	Study Sample	Intervention Groups	Outcome Measures	Effect Size	Results: Within-Group Differences	Results: Between-Group Differences	Conclusion
Depledge et al[5]	10/11	90 pregnant women with symphysis pubis dysfunction	EX: specific muscle-strengthening exercises; verbal and written education about anatomy and pathology of symphysis pubis dysfunction and self-help management, including the modification of daily activities EX+RB: EX plus rigid pelvic belt EX+NRB: EX plus nonrigid pelvic belt All during 1 wk. How many times exercises were performed and how long the belts were worn were not specified	Pain (NRS for maximum pain over preceding wk) Pain (NRS for average pain over preceding wk) Disability (RMDQ) Disability (PSFS)	Pain (NRS for maximum pain over preceding wk): EX, −1.65; EX+RB, −0.41; EX+NRB, −0.51 Pain (NRS for average pain over preceding wk): EX, −1.07; EX+RB, −0.27; EX+NRB, −0.79 Disability (RMDQ): EX, −1.06; EX+RB, −0.49; EX+NRB, −0.65 Disability (PSFS): EX, −2.45; EX+RB, −1.06; EX+NRB, −1.50	Significant reduction in RMDQ score ($P<.001$), PSFS score ($P<.001$), and NRS scores (average and worst) ($P<.001$) in all 3 groups	Average pain was significantly reduced in the EX and EX+RB, but not for EX+NRB No significant differences between groups for disability and maximum pain	Use of pelvic belts did not add to the effects provided by a muscle-strengthening program and advice It would seem beneficial in the long term for women to use their muscles to provide stability to the pelvis rather than to rely on an external device
Nilsson-Wikmar et al[31]	7/11	118 women with PPP	EG (n = 40): use of a nonelastic sacroiliac belt, information and education about PPP HEG (n = 41): EG, home exercises (muscle strengthening and stretching) not specified how often CEG (n = 37): EG, training program with equipment in clinic (muscle strengthening and stabilization) twice per wk	Pain (VAS) Pain (marked squares in pain drawing) Disability (DRI)	Pain (VAS), NC Pain (marked squares in pain drawing), NC Disability (DRI), NC	Pain decreased in all groups Disability decreased between gestation 38 wk and 12 mo postpartum	No significant difference among groups during pregnancy or at the follow-ups postpartum	Women with PPP seemed to improve in all groups Neither exercises at home nor in the clinic had any additional value above giving a nonelastic sacroiliac belt and information

Table continues on page A2.

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TABLE 1 DESCRIPTION OF THE 7 STUDIES (N = 1202) USING A COMBINATION OF INTERVENTIONS (CONTINUED)

Study	Risk of Bias (CBRG)	Study Sample	Intervention Groups	Outcome Measures	Effect Size	Results: Within-Group Differences	Results: Between-Group Differences	Conclusion
George et al[14]	6/11	169 pregnant women with PPP or LBP or both (gestation weeks 24-28)	MOM (n = 87): weekly visits for an individually designed combination of education, manual therapy, stabilization exercises, home exercise program, twice daily STOB (n = 82): possibility of rest, aerobic exercise, heating pad application, acetaminophen, narcotics, or referral to orthopaedic or neurologic services Actual number of visits was not recorded for either group	Pain (NRS) Pain (QDQ for impact of pain)	Pain (NRS): MOM, 1.32; STOB, 0.05 Pain (QDQ for impact of pain): MOM, 0.45; STOB, −0.32	STOB: no significant improvements	MOM: significantly more reduction in NRS and QDQ scores than in STOB ($P<.001$)	A multimodal approach to low back and pelvic pain in mid pregnancy benefits patients more than STOB
Eggen et al[6]	5/11	257 healthy pregnant women (gestation week, less than 20)	SG (n = 129): supervised exercises in groups once per wk, ergonomic advice, advice to do home exercises CG (n = 128): standard care	Pain (prevalence: % women with self-reported PGP) Pain (prevalence: % women with self-reported LBP) Pain (NRS for worst pain in morning) Pain (NRS for worst pain in evening) Disability (RMDQ) Physical health (SF-36 PCS) Mental health (SF-36 MCS)	Pain (prevalence: % women with self-reported PGP): NC Pain (prevalence: % women with self-reported LBP): NC Pain (NRS for worst pain in morning): NC Pain (NRS for worst pain in evening): NC Disability (RMDQ): NC Physical health (SF-36 PCS): SG, 0.70; CG, 0.49 Mental health (SF-36 MCS): SG, −0.25; CG, −0.29	The main analyses showed no effect of the training on prevalence of LBP or PGP For the secondary outcomes, no significant differences were found	Mean differences between the groups: pain intensity morning, −0.4 (95% CI: −0.8, 0.1); pain intensity in evening, −0.4 (95% CI: −1.0, 0.2); disability, −1.0 (95% CI: −2.2, 0.0); SF-36 PCS, 1.8 (95% CI: 0.0, 3.7); SF-36 MCS, −0.6 (95% CI: −2.2, 1.4)	Supervised group exercises had no influence on the prevalence and severity of LBP and PGP in pregnancy

Table continues on page A3.

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TABLE 1 Description of the 7 Studies (n = 1202) Using a Combination of Interventions (continued)

Study	Risk of Bias (CBRG)	Study Sample	Intervention Groups	Outcome Measures	Effect Size	Results: Within-Group Differences	Results: Between-Group Differences	Conclusion
Kordi et al[24]	5/11	105 pregnant women with PGP (gestation weeks, 20-32)	CG (n = 35): general information (anatomy, body posture, and ergonomic advice regarding sitting, walking, and lying) EG (n = 35): general information, exercises at home: (1) aerobic exercises (25 min, 3 times per wk); (2) stretching exercises for hamstrings, inner thigh, side waist, quadriceps, and back (3 times per wk); (3) strengthening exercises for the pelvis (3-5 times each exercise session, 2 exercise bouts per d and 3 d per wk) BG (n = 35): general information, constantly wearing a nonrigid lumbopelvic belt (only removed while sleeping)	Pain (VAS at 3 wk) Pain (VAS at 6 wk) Disability (ODQ at 3 wk) Disability (ODQ at 6 wk) QoL (WHOQOL-BREF PH at 3 wk) QoL (WHOQOL-BREF PH at 6 wk) QoL (WHOQOL-BREF PsH at 3 wk) QoL (WHOQOL-BREF PsH at 6 wk) QoL (WHOQOL-BREF SR at 3 wk) QoL (WHOQOL-BREF SR at 6 wk) QoL (WHOQOL-BREF EH at 3 wk) QoL (WHOQOL-BREF EH at 6 wk)	Pain (VAS at 3 wk): CG, 0.49; EG, 1.00; BG, 3.27 Pain (VAS at 6 wk): CG, 0.42; EG, 1.95; BG, 3.83 Disability (ODQ at 3 wk): CG, 0.58; EG, 1.05; BG, 1.52 Disability (ODQ at 6 wk): CG, 0.56; EG, 1.37; BG, 1.86 QoL (WHOQOL-BREF PH at 3 wk): CG, 0.34; EG, 0.25; BG, 1.02 QoL (WHOQOL-BREF PH at 6 wk): CG, 0.31; EG, 0.63; BG, 1.34 QoL (WHOQOL-BREF PsH at 3 wk): CG, 0.04; EG, 0.13; BG, 0.37 QoL (WHOQOL-BREF PsH at 6 wk): CG, 0.06; EG, 0.25; BG, 0.45 QoL (WHOQOL-BREF SR at 3 wk): CG, 0.03; EG, 0.08; BG, 0.12 QoL (WHOQOL-BREF SR at 6 wk): CG, 0.03; EG, 0.08; BG, 0.13 QoL (WHOQOL-BREF EH at 3 wk): CG, 0.01; EG, 0.06; BG, 0.10 QoL (WHOQOL-BREF EH at 6 wk): CG, 0.03; EG, 0.06; BG, 0.12	Pain intensity decreased in all groups Disability decreased in all groups Quality of life increased in all groups	Pain intensity decreased significantly more in BG compared to EG and CG at both 3 wk and 6 wk ($P<.001$) Pain intensity in EG decreased significantly more than CG at 6 wk ($P<.001$) Decrease of ODQ scores in BG significantly more than CG ($P<.001$) at 3 wk and 6 wk and significantly more than EG at 3 wk ($P = .005$) and 6 wk ($P = .008$) Decrease of mean ODQ scores in EG significantly more than in CG ($P<.001$) at 6 wk In all but social relation component of the WHOQOL-BREF, scores in BG significantly increased more than EG and CG at 3 wk and 6 wk ($P<.05$)	In short term, use of a lumbopelvic belt and information in treatment of PGP is superior to exercise plus information or information alone

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TABLE 1 Description of the 7 Studies (n = 1202) Using a Combination of Interventions (continued)

Study	Risk of Bias (CBRG)	Study Sample	Intervention Groups	Outcome Measures	Effect Size	Results: Within-Group Differences	Results: Between-Group Differences	Conclusion
Östgaard et al[32]	5/11	407 pregnant women, with or without PPP and/or LBP	Group A: controls (n = 145): standard care maternity-care unit Group B (n = 123): back school education and training program: 2 group-wise lessons of 45 min before gestation week 20: simple anatomy, posture physiology, lifting and working technique, muscle training, relaxation training. Nonelastic sacroiliac belt in PGP Group C (n = 139): 5 individual lessons of 30 min between gestation weeks 18-32. Content of lessons same as group B, but training and education were specified for individual situation. Nonelastic sacroiliac belt in PGP	Pain (VAS) Pain (drawing for location) Sick leave Standardized physical examination	Pain (VAS): NC Pain (drawing for location): NC Sick leave: NC Standardized physical examination: NC	Serious LBP or PGP developed in 47% of all women PGP was more common than LBP Muscular and body posture training reduced subjective pain problems in groups B and C ($P<.05$) Ergonomic and vocational techniques were found useful in group C Objective pain intensity did not significantly decrease in any of the groups Sick leave was significantly reduced in group C ($P<.01$) Reduction of PGP by a nonelastic pelvic belt in 82% of the women with PGP (mainly walking)	No statistics about differences between groups mentioned	An individually designed program seems beneficial to reduce sick leave because of LBP in pregnancy Groupwise lessons were less effective The program was not effective for reducing sick leave or pain for patients with PGP A pelvic belt partly reduced pain-related problems; the reason why remains unknown
Shim et al[39]	3/11	56 pregnant women with LBP (gestation weeks 17-22)	SG (n = 29): 12 wk of education (anatomy, changes during pregnancy, posture), pamphlet, audiotape, home exercises (5-7 times per wk) CG (n = 27): not described; probably no intervention	Pain (VAS) Pain (drawing for distribution) Disability (ODQ) Anxiety (SAS)	Pain (VAS): SG, 0.66; CG, −0.18 Pain (drawing for distribution): NC Disability (ODQ): SG, 0.07; CG, −0.57 Anxiety (SAS): SG, −0.61; CG, −1.07	No statistically significant differences in functional limitations and anxiety	12 wk after intervention, LBP intensity was significantly lower in SG than in CG ($P = .006$)	This pain-reducing program was effective in reducing the intensity of LBP in pregnant women Promoting good posture and regular exercise should be an integral component of any prenatal counseling

Abbreviations: BG, belt group; CBRG, Cochrane Back Review Group; CEG, clinic exercise group; CG, control group; CI, confidence interval; DRI, Disability Rating Index; EG, education group; EH, environmental health; EX, exercise group; EX+NRB, exercise plus nonrigid belt group; EX+RB, exercise plus rigid belt group; HEG, home exercise group; LBP, pregnancy-related low back pain; MOM, multimodal musculoskeletal and obstetric treatment; NC, not able to calculate effect sizes due to missing data; NRS, numeric rating scale; ODQ, Oswestry Disability Questionnaire; PGP, pregnancy-related pelvic girdle pain; PH, physical health; PPP, posterior pelvic pain; PSFS, Patient-Specific Functional Scale; PsH, psychological health; QDQ, Quebec Disability Questionnaire; QoL, quality of life; RMDQ, Roland-Morris Disability Questionnaire; SAS, State Anxiety Scale; SF-36 MCS, 8-item Short-Form Health Survey mental component summary; SF-36 PCS, 8-item Short-Form Health Survey physical component summary; SG, study group; SR, social relation; ST, standard treatment; ST+AC, standard treatment plus acupuncture; ST+EX, standard treatment plus specific stabilizing exercises; STOB, standard obstetric care; VAS, visual analog scale; WHOQOL-BREF, World Health Organization Quality of Life Questionnaire brief version.

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TABLE 2 Description of the 9 Studies (n = 2149) Using Exercise Therapy

Study	Risk of Bias (CBRG)	Study Sample	Intervention	Outcome Measures	Effect Size	Results: Within-Group Differences	Results: Between-Group Differences	Conclusion
Stafne et al[40]	8/11	761 pregnant women	SG (n = 396): weekly 60-min exercise program in groups for 12 wk: aerobic activity, strength training, balance exercises. Advice on ergonomics and ADL during pregnancy. Home exercise program at least twice per wk, similar to exercises in group sessions, and endurance training CG (n = 365): standard antenatal care	Pain (VAS for pain in morning) Pain (VAS for pain in evening) Disability (DRI) Sick leave due to lumbopelvic pain Prevalence of lumbopelvic pain Fear-avoidance beliefs (FABQ)	Pain (VAS for pain in morning): SG, −0.66; CG, −0.41 Pain (VAS for pain in evening): SG, −0.60; CG, −0.31 Disability (DRI): SG, −0.80; CG, −0.81 Sick leave due to lumbopelvic pain: NC Prevalence of lumbopelvic pain: NC Fear-avoidance beliefs (FABQ): SG, −0.10; CG, −0.20	SG: 74% experienced lumbopelvic pain in gestational weeks 32-36 CG: 75% experienced lumbopelvic pain in gestational weeks 32-36 SG: 22% of women were on sick leave CG: 31% of women were on sick leave	No significant differences between SG and CG in self-reported lumbopelvic pain at 36 wk of gestation No differences between SG and CG regarding disability, pain, or fear-avoidance beliefs Sick leave lower in SG than in CG (P = .01)	Exercise during pregnancy does not influence the prevalence of lumbopelvic pain, but regular exercise and home exercises seem to make women handle the disorder better, because significantly fewer women in SG were on sick leave
Mørkved et al[29]	8/11	301 healthy nulliparous women	SG (n = 148): training program for 12 wk: daily pelvic floor muscle training at home, weekly group training over 12 wk. CG (n = 153): no intervention	Pain (prevalence of self-reported symptoms of PGP) Pain (drawing of location) Disability (DRI) Sick leave Urinary incontinence	Pain (prevalence of self-reported symptoms of PGP): SG, −0.38; CG, 0.23 Pain (drawing of location): NC Disability (DRI): NC Sick leave: NC Urinary incontinence: NC	SG: 44% experienced lumbopelvic pain in gestational weeks 32-36 (P = .033) CG: 56% experienced lumbopelvic pain in gestational weeks 32-36 (P = .033) SG: 21% of women were on sick leave (P = .42) CG: 25% of women were on sick leave (P = .42)	36 wk of gestation in SG: significantly less lumbopelvic pain than in CG (P = .03) Significantly higher functional status in SG than in CG (P = .011) No difference between groups in sick leave	At 12 wk, a specially designed training program during pregnancy was effective in preventing PGP
Kihlstrand et al[22]	7/11	255 pregnant women	SG (n = 127): weekly 1-h water gymnastics during second half of pregnancy (17-20 times) CG (n = 128): no intervention	Pain (VAS) Questionnaires about pregnancy and back pain in weeks 18 and 34, and week 1 postpartum (including sick leave)	Pain (VAS): NC Questionnaires about pregnancy and back pain in weeks 18 and 34, and week 1 postpartum (including sick leave): NC	Pain intensity increased with advancing pregnancy Water gymnastics significantly reduced LBP intensity at 31 wk of gestation and gestational weeks 33-38 (no P value reported)	Significantly fewer women on sick leave in SG (P = .031)	Water gymnastics during pregnancy can be recommended as a method to relieve LBP and may reduce sick leave

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TABLE 2 Description of the 9 Studies (n = 2149) Using Exercise Therapy (continued)

Study	Risk of Bias (CBRG)	Study Sample	Intervention	Outcome Measures	Effect Size	Results: Within-Group Differences	Results: Between-Group Differences	Conclusion
Kluge et al[23]	7/11	50 pregnant women with LBP (gestation weeks 16-24)	SG (n = 26): 30-45 min of training every second wk for 10 wk (transverse abdominal and pelvic floor muscles and cocontraction with other muscle groups), daily exercise at home CG (n = 24): no specific instruction	Pain (NRS) Disability (RMDQ)	Pain (NRS): NC Disability (RMDQ): NC	Pain intensity and functional ability improved in SG Pain intensity and functional ability did not significantly change in CG	Pain intensity significantly improved more in SG than in CG ($P<.01$)	A specific exercise program decreased back pain intensity and increased functional ability during pregnancy in women with LBP and PGP
Martins and Pinto e Silva[28]	7/11	60 pregnant women with LBP and/or PGP (gestation weeks 12-32)	SG (n = 30): 10 group sessions of supervised Hatha yoga, once per wk (34 poses to stimulate and improve breathing, range of motion of joints, flexibility, strengthening, balance, stimulation of introspection, self-confidence, self-control, concentration, and mental relaxation). CG (n = 30): unsupervised individual postural orientation on daily activity, according to an instruction pamphlet, during 10 wk	Pain (VAS per session) Lumbar pain provocation tests (flexion of trunk, palpation of spinal muscles, decreased circular motion of trunk, pain on circular motion of trunk, confirmation of pain site) Posterior pelvic pain provocation tests (femoral compression, pain while turning in bed at night, feelings of weight in the posterior pelvis, confirmation of pain site)	Pain (VAS): NC Lumbar pain provocation tests: NC Posterior pelvic pain provocation tests: NC	Lumbar pain provocation tests showed significantly decreased response at the end of the intervention in both groups Clinical posterior pelvic pain provocation tests did not show any significant modification in either group at the end of the intervention Mean pain intensity scores per session progressively decreased in SG ($P<.024$)	Pain intensity was significantly lower in SG than in CG ($P = .0058$)	Yoga exercises were more effective at reducing lumbopelvic pain intensity than postural orientation

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TABLE 2 Description of the 9 Studies (n = 2149) Using Exercise Therapy (continued)

Study	Risk of Bias (CBRG)	Study Sample	Intervention	Outcome Measures	Effect Size	Results: Within-Group Differences	Results: Between-Group Differences	Conclusion
Granath et al[17]	6/11	390 healthy pregnant women	45 min of exercise and 15 min of relaxation of different muscle groups, once per wk from 11-12 wk of gestation throughout pregnancy in 2 different forms LBPE (n = 198): set of exercises developed by physiotherapists for fitness during pregnancy. Focus was on improving aerobic and movement capacity, including light jogging, sit-ups, and pelvic mobility exercises WA (n = 192): WA had the same focus on aerobic and movement capacity as LBPE, but with considerably less risk for unwanted weight-bearing loading of anatomic structures Both interventions focused on strength, flexibility, and fitness, and included warming up, stretching, and relaxation at the end of each session. Specifics about exercises/targeted muscle groups were not mentioned	Pain (presence of LBP or PPP or both) Sick leave	Pain: NC Sick leave: NC	WA significantly diminished LBP ($P = .04$)	Significantly fewer women on sick leave ($P = .03$) in WA than in LBPE	WA can be recommended for treating LBP during pregnancy

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TABLE 2 Description of the 9 Studies (n = 2149) Using Exercise Therapy (continued)

Study	Risk of Bias (CBRG)	Study Sample	Intervention	Outcome Measures	Effect Size	Results: Within-Group Differences	Results: Between-Group Differences	Conclusion
Garshasbi and Faghih Zadeh[13]	5/11	212 pregnant, primigravid women (gestation weeks 17-22)	SG (n = 107): for 12 wk, 60 min of exercise 3 times per wk, supervised by a midwife (muscle strengthening for abdominal and hamstring muscles and to increase traction of iliopsoas and paravertebral muscles) The exercises were recommended by Tarbiat Modares Faculty of Sport and tested for pregnant women by physiotherapists CG (n = 105): no intervention	Pain (KEBK) Flexibility of spine (sidebending test right) Flexibility of spine (sidebending test left) Lordosis angle of lumbar spine	Pain (KEBK): SG, −0.38; CG, −0.07 Flexibility of spine (side-bending test right): SG, 1.95; CG, 1.83 Flexibility of spine (side-bending test left): SG, 2.04; CG, 1.25 Lordosis angle of lumbar spine: SG, 2.13; CG, −1.66	Back pain significantly decreased in SG ($P<.001$) and increased in CG ($P<.001$) Flexibility of spine significantly increased in both groups ($P<.001$) Lordosis significantly increased in both groups ($P<.001$)	No major differences between groups	Exercise during second and beginning of third trimester could reduce back pain and increase flexibility of the spine
Kashanian et al[21]	3/11	30 pregnant nulliparous women	SG (n = 15): exercise sessions, 3 times per wk during 8 wk from gestational weeks 16-24 Exercise sessions consist of 4.5 min of preparation (shoulder muscles, hands, stretching the neck and arm muscles) followed by walking, stretching (spine extensors, hamstrings, thigh adductor muscles, and lumbar paravertebral), and strengthening exercises (thigh extensor muscles and abdominal oblique muscles) for 21 min, then relaxation (relax the shoulders, arms, hands, knees, and legs) for 4.5 min CG (n = 15): no intervention	Disability (RMDQ) Lordosis angle	Disability (RMDQ): SG, 0.32; CG, −1.57 Lordosis angle: SG, −0.27; CG, −0.44	Increase of disability in SG ($P = .035$) Decrease of disability in CG ($P = .001$)	Increased lordosis angle in both groups, but greater in CG	Not specifically mentioned in article

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TABLE 2 Description of the 9 Studies (n = 2149) Using Exercise Therapy (continued)

Study	Risk of Bias (CBRG)	Study Sample	Intervention	Outcome Measures	Effect Size	Results: Within-Group Differences	Results: Between-Group Differences	Conclusion
Sedaghati et al[38]	2/11	90 pregnant women (gestation weeks 20-22)	SG (n = 40): 60-min exercise program, 3 times per wk for 8 wk (15 min warming up, 30 min cycling, 15 min cooling down) CG (n = 50): intervention not specified	Disability (QBPDS)	Disability (QBPDS): NC	No significant increase of pain intensity in SG (P = .109); significant increase in CG (P<.001)	No between-group differences calculated with respect to LBP	Exercise during the second half of the pregnancy prevented the increase of pain intensity

Abbreviations: ADL, activities of daily living; CBRG, Cochrane Back Review Group; CG, control group; DRI, Disability Rating Index; FABQ, Fear-Avoidance Beliefs Questionnaire; KEBK, pain questionnaire; LBP, pregnancy-related low back pain; LBPE, land-based physical exercise program; NC, not able to calculate effect sizes due to missing data; NRS, numeric rating scale; PGP, pregnancy-related pelvic girdle pain; PPP, pregnancy-related pelvic pain; QBPDS, Quebec Back Pain Disability Scale; RMDQ, Roland-Morris Disability Questionnaire; SG, study group; VAS, visual analog scale; WA, water aerobics.

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TABLE 3 Description of the 5 Studies (n = 360) Using Manual Therapy

Study	Risk of Bias (CBRG)	Study Sample	Intervention	Outcome Measure/Group	Effect Size	Results: Within-Group Differences	Results: Between-Group Differences	Conclusion
Licciardone et al[26]	8/11	146 pregnant women (gestation weeks 30-39)	UOBC+OMT (n = 49): soft tissue techniques; myofascial release; muscle energy; range-of-motion mobilization; no high-velocity, low-amplitude thrusts, for 7 visits between gestation weeks 30-39 UOBC+SUT (n = 48): sham ultrasound treatment, for 7 visits between gestation weeks 30-39 UOBC only (n = 49)	Pain (NRS) Disability (RMDQ)	Pain (NRS): UOBC+OMT, 0.14; UOBC+SUT, 0.00; UOBC only, −0.13 Disability (RMDQ): UOBC+OMT, −0.13; UOBC+SUT, −0.34; UOBC only, −0.98	Back pain decreased with UOBC+OMT Back pain remained unchanged with UOBC+SUT Back pain increased with UOBC only RMDQ score increased in all groups	Back pain: between-group differences were not statistically significant RMDQ score increased to a significantly lesser extent with UOBC+OMT ($P<.01$)	OMT slows or halts the deterioration of back-specific functioning during third trimester of pregnancy Evidence for reduction of back pain by OMT is not as conclusive as it is for back-specific functioning

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TABLE 3 Description of the 5 Studies (n = 360) Using Manual Therapy (continued)

Study	Risk of Bias (CBRG)	Study Sample	Intervention	Outcome Measure/Group	Effect Size	Results: Within-Group Differences	Results: Between-Group Differences	Conclusion
Peterson et al[35]	6/11	57 pregnant women with LBP	NET (n = 20): combination of desensitization procedures, elements of 5-element Chinese medicine, and chiropractic medicine to address cognitive distortions SMT (n = 15): high-velocity, low-amplitude thrusts for hypomobile joints; stabilizing by creating a fulcrum with patient lying on padded blocks for hypermobile joints EX (as control) (n = 22): 15 min of home exercises, 5 times per wk for low back stability, flexibility, and strength of pelvic floor, according to a booklet); instruction on postural and movement patterns (booklet); additional individualized stretching and strengthening exercises The treatment schedule paralleled the prenatal care schedule (once monthly until 28 wk of gestation; twice monthly until 36 wk of gestation; and weekly thereafter)	Pain (NRS) Disability (RMDQ)	Pain (NRS): NET, 0.57; SMT, 1.45; EX, 1.00 Disability (RMDQ): NET, 0.97; SMT, 1.12; EX, 0.94	Clinically meaningful improvement in NET, SMT, and EX in function and pain intensity	No between-group differences detected as statistically significant	SMT and EX generally performed slightly better than NET for improving function and decreasing pain All 3 interventions need further investigation

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TABLE 3 Description of the 5 Studies (n = 360) Using Manual Therapy (continued)

Study	Risk of Bias (CBRG)	Study Sample	Intervention	Outcome Measure/Group	Effect Size	Results: Within-Group Differences	Results: Between-Group Differences	Conclusion
Field et al[10]	4/11	84 depressed pregnant women (gestation weeks 18-24)	MT (n = 28): 20 min of massage twice per wk during 16 wk PMR (n = 28): instruction on progressive muscle relaxation, twice per wk at home for 16 wk SPC (n = 28): standard prenatal care only CG (n = 28): nondepressed women	Pain (VITAS for back pain) Pain (VITAS for leg pain) Anxiety (STAI) Mood states (POMS)	Pain (VITAS for back pain): NC Pain (VITAS for leg pain): NC Anxiety (STAI): NC Mood states (POMS): NC	MT decreased leg and back pain ($P<.001$) MT significantly increased serotonin and dopamine levels and decreased cortisol and norepinephrine levels ($P<.05$) Lower levels of anxiety and depression in MT ($P<.001$)	No statistics about differences between groups mentioned	MT is effective for reducing pregnant women's stress hormones, stressful mood states, leg pain, and back pain
Field et al[12]	3/11	26 pregnant women (gestation weeks 14-30)	MT (n = 14): 20 min of massage, twice per wk during 5 wk (head, neck, back, arms, hands, legs, and feet in sidelying position) PMR (n = 12): instruction on progressive muscle relaxation in sidelying position. Conducted by participants at home, twice per wk during 5 wk	Pain (VITAS for back pain) Pain (VITAS for leg pain) Anxiety (STAI) Mood (POMS-D) Sleep scale Stress hormone levels (urine samples)	Pain (VITAS for back pain): NC Pain (VITAS for leg pain): NC Anxiety (STAI): NC Mood (POMS-D): NC Sleep scale: NC Stress hormone levels (urine samples): NC	Significant improvement of mood ($P<.05$), sleep disturbance ($P<.05$), and back pain ($P<.01$) and significantly decreased norepinephrine levels ($P<.01$) in MT Significant decrease of anxiety ($P<.01$) and leg pain ($P<.05$) after first session in both groups Significant dopamine-level increase in both groups ($P<.01$ in MT, $P<.05$ in PMR)	No statistics about differences between groups mentioned	MT is effective for reducing pregnant women's anxiety levels, stress hormones, sleep disturbance, and back pain

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TABLE 3 Description of the 5 Studies (n = 360) Using Manual Therapy (continued)

Study	Risk of Bias (CBRG)	Study Sample	Intervention	Outcome Measure/Group	Effect Size	Results: Within-Group Differences	Results: Between-Group Differences	Conclusion
Field et al[11]	2/11	47 depressed pregnant women (gestation weeks 14-27)	MG (n = 47): 20 min of massage, twice weekly from partners, from 20 wk of gestation until the end of pregnancy CG: no intervention	Pain (VITAS for back pain) Pain (VITAS for leg pain) Anxiety (STAI) Anger (STAXI) Depression (CES-D) Relationship with partner	Pain (VITAS for back pain): MG, 1.24; CG, 0.53 Pain (VITAS for leg pain): MG, 0.83; CG, 0.31 Anxiety (STAI): MG, 1.24; CG, 0.36 Anger (STAXI): MG, 0.38; CG, 0.17 Depression (CES-D): MG, 0.52; CG, 0.27 Relationship with partner: MG, −0.37; CG, 0.05	Women in MG: significantly decreased leg and back pain (both, $P<.001$); significantly decreased depression, anxiety, and anger (all, $P<.001$); and significantly improved relationship with partner ($P<.01$)	All outcomes decreased and improved more than in CG, but no statistics about differences between groups were mentioned	Not only mood states but also relationships improved mutually when depressed pregnant women were massaged by their partners

Abbreviations: CBRG, Cochrane Back Review Group; CES-D, Centre for Epidemiological Studies-Depression Scale; CG, control group; EX, exercise; MG, massage group; MT, massage treatment; NC, not able to calculate effect sizes due to missing data; NET, neuro-emotional technique; NRS, numeric rating scale; OMT, osteopathic manipulative treatment; PMR, progressive muscle relaxation; POMS, Profile of Mood States Scale; POMS-D, Profile of Mood States Depression Scale; RMDQ, Roland-Morris Disability Questionnaire; SMT, spinal manipulative therapy; SPC, standard prenatal care; STAI, State-Trait Anxiety Inventory; STAXI, State-Trait Anger Expression Inventory; SUT, sham ultrasound treatment; UOBC, usual obstetric care; VITAS, visual analog scale anchored with 5 faces.

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TABLE 4 Description of the Study (n = 115) Using Material Support

Study	Risk of Bias (CBRG)	Study Sample	Intervention	Outcome Measures	Effect Size	Results: Within-Group Differences	Results: Between-Group Differences	Conclusion
Kalus et al[19]	6/11	115 pregnant women	SG (n = 55): wearing a BellyBra for 3 wk (frequency not specified). A BellyBra is a nylon/spandex undergarment, worn like a vest. It has a 1-way stretch panel across the thoracolumbar back, designed to provide support and assisted by the involvement of shoulder straps, to improve posture. A wide elastic band sits below the abdomen, supporting the uterus and lifting weight off the pelvis CG (n = 60): wearing a Tubigrip for 3 wk (frequency not specified). A Tubigrip is a more generic form of support, worn as a double layer, extending from the midthoracic spine to the sacral spine and pelvis	Pain (VAS) Disability, physical activity (Likert scores where 0 is never affected and 10 is always affected) SWLS	Pain (VAS): SG, 0.73; Tubigrip CG, 0.65 Disability: SG sleeping, 1.13; CG sleeping, 0.35; SG getting up, 0.89; CG getting up, 0.55; SG sitting down, 0.83; CG sitting down, 0.54; SG sitting, 0.52; CG sitting, 0.22; SG walking, 0.82; CG walking, 0.38; SG working, 0.96; CG working, 0.43; SG overall impact on daily activities, 0.78; CG overall impact on daily activities, 0.47 SWLS: SG, 0.31; CG, 0.47	In both groups, significantly less pain (P = .001 and P = .003). No significant change in SWLS	No difference between groups regarding pain reduction. In the SG, pain had significantly less impact on sleeping (P = .007), getting up from sitting (P = .02), sitting down (P = .04), walking (P = .001), and working (P = .04) than in the CG	BellyBra can be recommended as a method of treatment for PGP

Abbreviations: CBRG, Cochrane Back Review Group; CG, control group; PGP, pregnancy-related pelvic girdle pain; SG, study group; SWLS, satisfaction with life scale; VAS, visual analog scale.

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APPENDIX

SEARCH STRATEGY

1. pregnancy or gestation or gravidity or expecting or pregnant or prepartum [Text Word]
2. low back pain or back pain or posterior pelvic pain or peripartum posterior pelvic pain or pregnancy-related pelvic joint pain or pregnancy-related pelvic girdle pain or peripartum pelvic pain or pelvic girdle relaxation
3. SI-joint or sacroiliac or pubic symphysis or sacroiliac or lumbar or lumbopelvic or lumbosacral [Text Word]
4. SI-joint or pubic symphysis or pelvic ring or pelvis or lumbar or lumbopelvic or lumbosacral or sacroiliac or pelvic capsule or pelvic ligaments or lumbar vertebrae
5. #1 AND (#2 OR #3 OR #4)
6. randomized controlled trial [Publication Type]
7. double blind
8. single blind
9. placebo
10. clinical trial [Publication Type]
11. controlled clinical trial [Publication Type]
12. cohort OR survey [Publication Type]
13. ((((((#6) OR #7) OR #8) OR #9 OR #10) OR #11) OR #12)
14. intervention OR treatment OR manipulation OR manipulative OR mobilisation OR mobilization
15. manual therapy OR physical therapy OR manipulative therapy OR manual physical therapy OR treatment OR spinal manipulation OR passive movement OR chiropractic OR osteopathic
16. exercise OR training OR relaxation OR stabilisation OR stabilization OR strength OR stabilising exercise OR stabilizing exercise OR stretching OR coordination
17. ((#14) OR #15) OR #16
18. (#5) AND #17
19. (#13) AND #18

(Last performed on November 28, 2013.)

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