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Systematic review

Prevention of low back and pelvic girdle pain during pregnancy: a systematic review and meta-analysis of randomised controlled trials with GRADE recommendations☆

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Abstract

Background Low back (LBP) and pelvic girdle pain (PGP) during pregnancy are related to high direct and indirect costs. It is important to clarify evidence regarding interventions to manage and prevent these conditions.
Objective Investigate the efficacy and acceptability of the interventions to prevent LBP and PGP during pregnancy.
Data sources Searches were conducted up to January 6th, 2021 in the MEDLINE, PEDro, Cochrane Library, SPORTDiscus, CINAHL, AMED, Embase and PsycInfo databases
Study eligibility criteria (1) Pregnant women without LBP and/or PGP; (2) any prevention strategy on incidence of LBP and PGP and sick leave; (3) comparison to control; (4) quasi and randomised controlled trial.
Study appraisal and synthesis methods Two reviewers performed screening, data extraction and methodological quality assessments. Meta-analysis was performed and Relative Risks (RRs) and 95% confidence intervals (CIs) were reported.
Results Six randomised controlled trials involving 2231 participants were included in the review. Evidence of moderate quality was found that "stand-alone" exercise is acceptable to pregnant women with lumbopelvic pain (LBPP) (RR 0.60 [95%CI 0.42–0.84]) and prevents episodes of LBP (RR 0.92 [95%CI 0.85–0.99]) in the long-term. Moderate to very-low quality evidence was found detailing the lack of efficacy of other interventions in the prevention of these problems in the short and long-term.
Limitations Small number of trials included.
Conclusions Efficacy of prevention strategies for episodes of LBPP and the use of sick leave during pregnancy is not supported by evidence of high quality. Current evidence suggests that exercise is acceptable and promising for the prevention of LBP in the long-term. However, further high-quality trials with larger samples are needed.

Contribution on paper

- Low back pain and pelvic girdle pain are widespread problems during pregnancy that cause distress and disability in many women. However, knowledge regarding primary and secondary prevention is scarce.
- "Stand-alone" exercise is acceptable and promising for the prevention of episodes of low back pain in the long term. Education combined with exercise did not reduce the risk of low back pain or pelvic girdle pain in pregnant women.

☆ Registration: PROSPERO (CRD42020216377) and Open Science Framework (https://osf.io/sha7k/)
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• Exercise can be recommended during pregnancy for its general health benefits, but is not supported by high-quality evidence for preventing lumbopelvic pain.

Keywords: Low back pain; Pelvic girdle pain; Pregnancy; Primary Prevention; Meta-analysis

Introduction

Biopsychosocial factors during pregnancy may lead to low back pain (LBP), pelvic girdle pain (PGP) or a combination of both (lumbopelvic pain [LBPP]) [1]. The incidence of LBP and PGP during pregnancy ranges from 57% to 90% and 4–76%, respectively [2,3]. Up to half of women who experience an episode of LBP or PGP during pregnancy continue to have such pain complaints one year after childbirth [3–5]. LBP is defined as pain or discomfort located between the 12th rib and the gluteal fold [6], whereas PGP is defined as posterior pain arising from the region of the sacroiliac joints, anterior pain from the pubic symphysis, or both [7]. Although considered different, both conditions exert an impact on activities of daily living and quality of life among pregnant women [3,8,9].

LBP and PGP during pregnancy are associated with disability, poor sleep quality, diminished social and sexual life, distress and loss of productivity [3,10,11]. Pregnant women turn to health care to manage this situation [12,13] and many seek the induction of labour or elective caesarean section to achieve relief from their symptoms [3]. Therefore, the direct and indirect costs of these conditions are high, and it is important to clarify evidence of effective interventions for the prevention of LBP and PGP and the associated use of sick leave. It is also important to clarify whether such interventions are accepted by pregnant women.

Systematic reviews on strategies for the prevention of LBP and PGP offer conflicting results and have important methodological limitations [14–16], such as the inclusion of symptomatic participants at the onset of the study [14–16], failure to assess the quality of evidence using the Grading of Recommendations: Assessment, Development and Evaluation (GRADE approach) [15] and the absence of a registered protocol [14,15]. Therefore, a comprehensive review of quality is needed to provide an overview of the effectiveness of prevention strategies.

The aim of the present systematic review was to investigate the short-term and long-term effectiveness and acceptability of interventions for the prevention of episodes of LBP, PGP or LBPP and the use of sick leave due to these conditions during pregnancy.

Methods

Design

This systematic review of quasi-randomised and randomised controlled trials was conducted in accordance with the Cochrane recommendations and was reported following the checklist of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA statement) [17,18]. The protocol was prospectively registered in PROSPERO (CRD42020216377) and the Open Science Framework (https://osf.io/sha7k/) [19]. Searches for relevant articles were performed in the MEDLINE, PEDro, Cochrane Library, SPORTDiscus, CINAHL, AMED, Embase and PsycInfo databases up to January 6th, 2021, with no restrictions imposed regarding language or year of publication. The main search terms were “randomised controlled trial”, “low back pain” and “pregnancy”. The detailed search strategy is presented in Appendix 1. Hand searches were also performed of the reference lists of previous systematic reviews published in the field for the inclusion of additional potential trials.

Selection criteria

To be deemed eligible, the articles needed to (1) include pregnant women without LBP or PGP at the onset of the study; (2) investigate the effects of a prevention strategy aimed at preventing LBP, PGP or LBPP during pregnancy; (3) compare the experimental group to a group submitted to no intervention, placebo or sham treatment or patients on a waiting list; (4) include at least one of the outcomes of interest for this review (incidence of LBP, PGP or LBPP, sick leave and acceptability in the short term [< 12 weeks] and long term [> 12 weeks]); and (5) have a quasi-randomised or randomised controlled trial design.

Usual/standard care was not considered due to the lack of consistency in the definition across trials. If a trial denominated a comparator group “usual care” or “standard care” but clearly stated that the participants did not receive any active intervention that began during the study, we included it in the "no intervention" category. The incidence of episodes of LBP, PGP or LBPP and sick leave was determined by the number of participants having an event of LBP, PGP or both out of the total number of participants randomly assigned to each group. The discontinuation of the intervention for any reason was used to assess acceptability, which was measured by the number of participants who withdrew due to any reason out of the total number of participants randomly assigned to each group and was collected at the same time points considered for the assessment of the incidence of LBP, PGP or LBPP and sick leave.

Data extraction

Two independent reviewers (FFS and BML) appraised the risk of bias and extracted data from the included trials. Divergences of opinion between reviewers were resolved by a third reviewer (MBS). The risk of bias of the trials was assessed using the 0-to-10-point Physiotherapy Evidence Database (PEDro) scale [20]. We used PEDro scores when available in the database (http://www.pedro.org.au/). The characteristics extracted from the trials were source of the participants, age, sex, type and length/frequency/duration of the prevention sessions, comparator, outcomes and time points. The number of participants with an episode of LBP, PGP or LBPP in each group (intervention and control) and sample sizes of the different groups were also extracted to investigate short- and long-term effects. The short-term effect was investigated in a follow-up period up to 12 weeks after randomisation, whereas the long-term effect was investigated in a follow-up period of more than 12 weeks after randomisation. For outcome data not reported in the trials, the authors were contacted twice with one-week interval in an attempt to obtain further information.

Data analysis

Meta-analysis was conducted using a random-effects model, when possible, with the reporting of relative risk (RR) and respective 95% confidence intervals (CI). The trials were grouped by specific prevention strategy, outcome for LBP, PGP and LBPP (i.e., incidence, sick leave and acceptability of intervention); and time points (i.e., short- and long-term effects). All analyses were conducted using the Comprehensive Meta-Analysis software, version 2.2.04 (Biostat, Englewood, NJ, USA).

Two independent reviewers (FFS and BML) assessed the quality of the evidence using the GRADE approach [21,22], which categorises the quality of evidence on four levels ranging from high to very low, with low levels of evidence indicating that future trials with high quality are likely to change the estimates. In the present review, the quality of evidence began as moderate because it was not possible to assess the occurrence of publication bias (small number of trials [less than 10] included) [17] and was downgraded one level for each of the following issues: serious imprecision when less than 400 participants were analysed (very serious imprecision when less than 200 participants were analysed was downgraded two levels) [23]; serious risk of bias when > 25% of the participants analysed were from trials with a high risk of bias (i.e., PEDro score < 6 out of 10) [24]; and serious inconsistency when the I^2 statistic was > 50% or when pooling was not possible (very serious inconsistency when there was no overlap among confidence intervals of the trials analysed was also downgraded two levels) [17]. Divergences of opinion between reviewers were resolved by a third reviewer (MBS).

Results

Search results

The initial search of the databases led to the retrieval of 2448 references. After screening the titles and abstracts, 14 potentially eligible full texts were analysed [25–38] and six original randomised controlled trials with a total of 2231 participants were included in the present review. Fig. 1 displays the flowchart of the article selection process and Appendix 2 presents the reasons why eight trials [26–28,30,32,33,35,36] were excluded.

Study characteristics and risk of bias

Detailed characteristics of the trials included in this review are displayed in Table 1.

Participants

The trials included pregnant women aged 23–31 years and gestational ages of 12–24 weeks. The sample size ranged from 105 to 855 participants. All were low-risk single-child pregnancies and the women could be nulliparous or multiparous. About 30% of the women investigated in two trials had episodes of pain prior to the pregnancy [25,31]. Previous levels of exercise were investigated in three trials [25,34,37] and most women were considered sedentary. Women in the control arms were not discouraged from exercising on their own and continuing their usual physical activities.

Intervention

The trials investigated two strategies for the prevention of episodes of LBP, PGP or LBPP and sick leave due to these conditions during pregnancy in the short and long terms – education combined with exercise and “stand-alone” exercise. Education comprised meetings conducted either as an open group or individual sessions. The women received information on normal changes and the prevention of pain during pregnancy as well as ergonomic advice [31,37]. The intervention consisted of home-based and/or group-based exercises [25,29,34,38]. The sessions lasted 45–60 min for a 12-week period. Details on the interventions are displayed in Table 1.

Outcome measures

Raw data on the number of new events (e.g., incidence of LBP, PGP or LBPP) and number of participants were available for the all six trials [25,29,31,34,37,38]. Outcome data on sick leave due to LBP, PGP or LBPP were reported in four trials [25,29,34,38]. RRs and 95% CIs were calculated for all studies. Three trials [31,34,37] followed up the

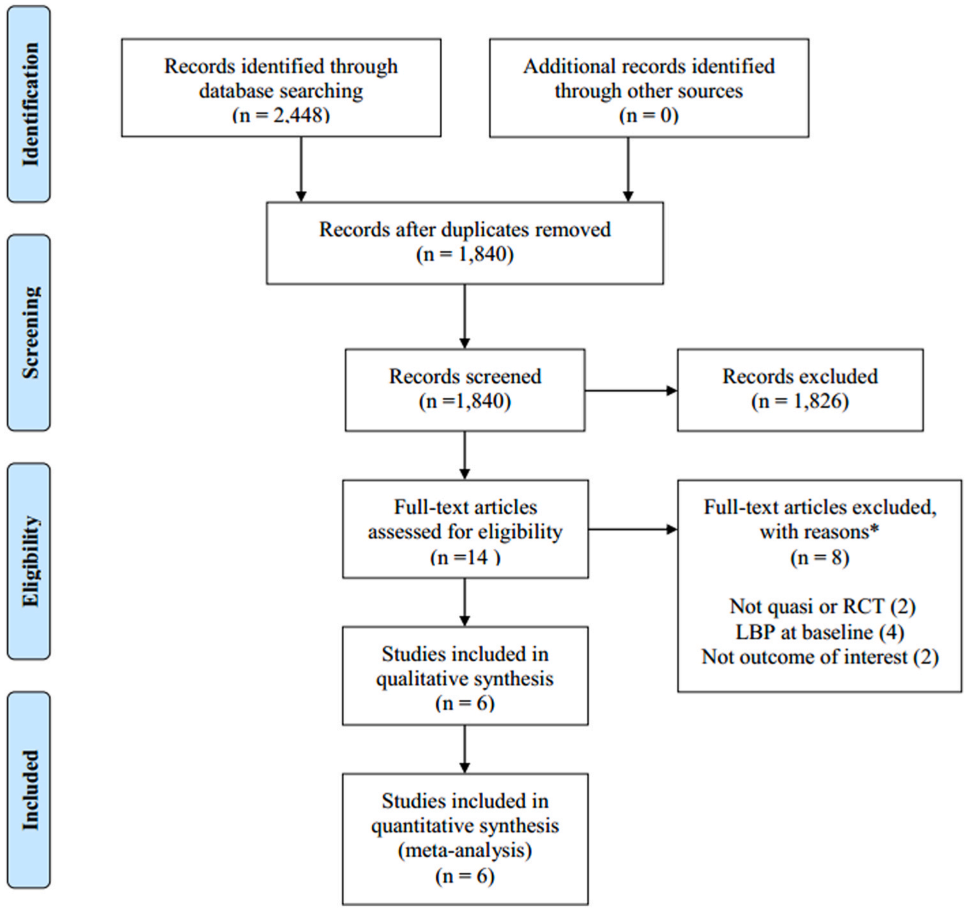

Fig. 1. Flow of studies through review. * Papers may have been excluded for failing to meet more than one inclusion criteria.

participants for < 12 weeks (short-term follow-up) and all six trials followed up participants for > 12 weeks (long-term follow-up).

Risk of bias

Median (min. - max.) methodological quality was 7 points (6–8) on the PEDro scale. Out of the six trials, six failed to use blinding, one [37] presented losses to follow-up greater than 15% and one [31] failed to use intention-to-treat analysis. None of the trials had a high risk of bias (i.e., PEDro score < 6 of 10). Details on the methodological quality of the trials included in this review are displayed in Table 2.

Effects of prevention strategies on incidence of low back pain, pelvic girdle pain or lumbopelvic pain and sick leave due to these conditions during pregnancy

The effects of education combined with exercise and “stand-alone” exercise on the incidence of LBP, PGP or LBPP and sick leave due to these conditions during pregnancy as well as the acceptability of the interventions were investigated in the trials included in the present review. Table 3 summarises the findings and the quality of evidence.

Education combined with exercise

Two trials [31,37] with a total of 438 participants investigated the effectiveness of education combined with exercise on the incidence of LBP and PGP (Figs. 2–3). The pooled estimates showed that education combined with exercise likely does not reduce the risk of LBP or PGP in the short or long term (i.e., moderate quality evidence). RRs (95% CIs) for the short- and long-term effects were respectively RR 1.06 (95% CI 0.85–1.31) and RR 1.05 (95% CI 0.85–1.30) for the incidence of LBP and RR 1.19 (95% CI 0.71–1.98) and RR 1.02 (95% CI 0.80–1.29) for the incidence of PGP. One trial [37] with 197 participants had a very uncertain level of evidence (i.e., very low quality of evidence) regarding the effect of education combined with exercise at reducing the risk of the incidence of LBPP in short-term (RR 2.06 [95% CI 0.73–5.81]) and long-term (RR 1.67 [95% CI 0.72–3.86]) follow-up when compared to the control group (Fig. 4).

The short- and long-term acceptability of education combined with exercise for LBPP was reported in two trials [31,37] (454 participants) (Fig. 4). Pooled estimates suggested no difference when compared to the control group: RR 0.93 (95% CI 0.10–8.37) for the short-term effect (i.e., very low quality of evidence) and RR 0.81 (95% CI

Table 1
Summary of included studies.

Study	Design	Participants	Intervention	Outcome measures
Backhausen et al. (2017) [25]	RCT	n = 516 Pregnant women at 16–17 weeks	Exp = Stand-alone exercise (unsupervised group water exercise programme) [n = 258; age: 31 y (SD 4 y)] 45 min x 2/wk x 12 wk Con = no intervention (standard prenatal care) [n = 258; age: 31 y (SD 4 y)]	• Incidence of LBP • Sick leave due LBP • Acceptability • Follow up > 12 weeks
Eggen et al. (2012) [31]	RCT	n = 257 Pregnant women at 16–20 weeks	Exp = Education combined with exercise (group- and home-based exercises: aerobics, strengthening, stretching and relaxation) [n = 129; age: 31 y (SD 5 y)] 60 min x 1/wk x 16–20 wk Con = no intervention (standard prenatal care) [n = 128; age: 30 y (SD 5 y)]	• Incidence of LBP and PGP • Acceptability • Follow up < 12 and > 12 weeks
Haakstad & Bo (2015) [34]	RCT	n = 105 Pregnant women at 12–24 weeks	Exp = Stand-alone exercise (exercise group: endurance, aerobic dance, strength, stretching and relaxation) [n = 52; age: 31 y (SD 4 y)] 60 min x 2/wk x 12 wk Con = no intervention (standard prenatal care) [n = 53; age: 30 y (SD 4 y)]	• Incidence of LBP and PGP • Sick leave due to LBP and PGP • Acceptability • Follow up < 12 and > 12 weeks
Miquelutti et al. (2013) [37]	RCT	n = 197 Pregnant women at 18–24 weeks	Exp = Education combined with exercise (group- and home-based exercises: stretching and pelvic floor exercises) [n = 97; age: 23 y (SD 5 y)] 30–50 min x 1/wk x 12 wk Con = no intervention (standard prenatal care) [n = 100; age: 23 y (SD 5 y)]	• Incidence of LBP, PGP and LBPP • Acceptability • Follow up < 12 and > 12 weeks
Morkved et al. (2007) [38]	RCT	n = 301 Pregnant women at 18–20 weeks	Exp = Stand-alone exercise (exercise group: aerobics, strengthening, light stretching and relaxation) [n = 148; age: 28 y (SD 5 y)] 60 min x 1/wk x 12 wk Con = no intervention (standard prenatal care) [n = 153; age: 27 y (SD 4 y)]	• Incidence of LBPP • Sick leave due to LBPP • Acceptability • Follow up > 12 weeks
Stafne et al. (2012) [29]	RCT	n = 855 Pregnant women at 18–22 weeks	Exp = Stand-alone exercise (exercise group: aerobics, strengthening and balance exercises) [n = 429; age: 31 y (SD 4 y)] 60 min x 1/wk x 12 wk Con = no intervention (standard prenatal care) [n = 426; age: 30 y (SD 4 y)]	• Incidence of LBPP • Sick leave due to LBPP • Acceptability • Follow up > 12 weeks

Exp = experimental group, Con = control group, wk = week(s), LBP = low back pain, PGP = pelvic girdle pain, LBPP = lumbopelvic pain.

Table 2
PEDro scores of included studies.

Study	Random allocation	Concealed allocation	Groups similar at baseline	Participant blinding	Therapist blinding	Assessor blinding	< 15% dropouts	Intention-to-treat analysis	Between-group difference reported	Point estimate and variability reported	Total (0–10)
Backhausen et al. (2017)[25]	Y	Y	Y	N	N	N	Y	Y	Y	Y	7
Eggen et al. (2012)[31]	Y	Y	Y	N	N	Y	Y	N	Y	Y	7
Haakstad & Bo (2015)[34]	Y	Y	Y	N	N	N	Y	Y	Y	Y	7
Miquelutti, Cecatti & Makuch (2013)[37]	Y	Y	Y	N	N	N	N	Y	Y	Y	6
Morkved et al. (2007)[38]	Y	Y	Y	N	N	Y	Y	Y	Y	Y	8
Stafne et al. (2012)[29]	Y	Y	Y	N	N	N	Y	Y	Y	Y	7

PEDro = Physiotherapy Evidence Database, Y = yes, = N = no.

0.34–1.89) for the long-term effect (i.e., moderate quality of evidence).

Stand-alone exercise

Two trials [25,34] involving a total of 621 participants investigated the effectiveness of stand-alone exercise on the incidence of LBP in the long term (Fig. 2). The pooled results showed that the intervention likely reduces the risk of LBP in the long term (i.e., moderate quality of evidence: RR 0.92 (95% CI 0.85–0.99). One trial [34] involving 105 participants had very uncertain evidence (i.e., very low quality of evidence) regarding the effectiveness of exercise at reducing the risk of the incidence of PGP in the long term (RR 0.87 [95% CI 0.53–1.44]) compared to the control group (Fig. 3). Two trials [29,38] involving a total of 1156 participants showed that intervention likely does not reduce the incidence of LBPP in the long term (i.e., moderate quality evidence) (RR 0.92 [95% CI 0.68–1.25]) (Fig. 4).

The use of sick leave during pregnancy related to LBP, PGP or LBPP was investigated in the long term [25,29,34,38] (Figs. 2–4). The moderate to very low quality of evidence suggests that exercise does not reduce the risk of sick leave due to LBP, PGP or both conditions ($p > 0.05$). Regarding the acceptability of stand-alone exercise in the long term, one trial [25] showed uncertain evidence for women with LBP (i.e., low quality of evidence) (Fig. 2) and three trials [29,34,38] showed that the intervention is likely acceptable among women with LBPP (i.e., moderate quality evidence) (RR 0.60 [95% CI 0.42–0.84]) (Fig. 4).

Discussion

The current quality of evidence from six randomised controlled trials investigating prevention strategies for LBP and PGP ranged from moderate to very low. The results of this systematic review and meta-analysis suggest that "stand-alone" exercise is likely acceptable and reduces the risk of long-term LBP in pregnant women. However, there is a need for larger high-quality trials to clarify the effectiveness of prevention strategies regarding episodes of LBP and PGP or the use of sick leave due to these health conditions in the short and long term among pregnant women.

The strengths of this systematic review include strict methodological standards with a prospectively registered protocol, the inclusion of all investigated prevention strategies from any care setting and the use of the GRADE approach to summarise the quality of the evidence. This systematic review was designed to be comprehensive and had a robust search strategy. A potential limitation of this study relates to the "acceptability" outcome. Although acceptability is often used to provide insights on the feasibility of interventions, it has important limitations, such as the fact that participants may stop the intervention for reasons not related to the trial (eg, change of residence, illness) and not because they did not find the treatment "acceptable". A

Table 3
Summary of findings and GRADE approach.

Certainty assessment					No. of participants			Quality of evidence	
No. of studies	Risk of bias	Inconsistency	Publication bias	Imprecision	Intervention	Control	Relative Risk (95% CI)		
LBP Incidence: Education combined with exercise vs Control (follow up < 12 weeks)									
2 [31,37]	Not serious	Not serious	Serious[b]	Not serious	214	224	1.06 (0.85–1.31)	(+)(+)(+)	Moderate
LBP Incidence: Education combined with exercise vs Control (follow up > 12 weeks)									
2 [31,37]	Not serious	Not serious	Serious[b]	Not serious	200	207	1.05 (0.85–1.30)	(+)(+)(+)	Moderate
PGP Incidence: Education combined with exercise vs Control (follow up < 12 weeks)									
2 [31,37]	Not serious	Not serious	Serious[b]	Not serious	214	224	1.19 (0.71–1.98)	(+)(+)(+)	Moderate
PGP Incidence: Education combined with exercise vs Control (follow up > 12 weeks)									
2 [31,37]	Not serious	Not serious	Serious[b]	Not serious	200	207	1.02 (0.80–1.29)	(+)(+)(+)	Moderate
LBPP Incidence: Education combined with exercise vs Control (follow up < 12 weeks)									
1 [37]	Not serious	Serious[c]	Serious[b]	Very serious[a]	97	100	2.06 (0.73–5.81)	(+)	Very low
LBPP Incidence: Education combined with exercise vs Control (follow up > 12 weeks)									
1 [37]	Not serious	Serious[c]	Serious[b]	Very serious[a]	97	100	1.67 (0.72–3.86)	(+)	Very low
LBPP Acceptability: Education combined with exercise vs Control (follow up < 12 weeks)									
2 [31,37]	Not serious	Very serious[b]	Serious[b]	Not serious	226	228	0.93 (0.10–8.37)	(+)	Very low
LBPP Acceptability: Education combined with exercise vs Control (follow up > 12 weeks)									
2 [31,37]	Not serious	Not serious	Serious[b]	Not serious	226	228	0.81 (0.34–1.89)	(+)(+)(+)	Moderate
LBP Incidence: Stand-alone exercise vs Control (follow up > 12 weeks)									
2 [25,34]	Not serious	Not serious	Serious[b]	Not serious	310	311	0.92 (0.85–0.99)	(+)(+)(+)	Moderate
PGP Incidence: Stand-alone exercise vs Control (follow up > 12 weeks)									
1 [34]	Not serious	Serious[c]	Serious[b]	Very serious[a]	52	53	0.87 (0.53–1.44)	(+)	Very low
LBPP Incidence: Stand-alone exercise vs Control (follow up > 12 weeks)									
2 [29,38]	Not serious	Not serious	Serious[b]	Not serious	577	579	0.92 (0.68–1.25)	(+)(+)(+)	Moderate
LBP Sick Leave: Stand-alone exercise vs Control (follow up > 12 weeks)									
2 [25,34]	Not serious	Not serious	Serious[b]	Not serious	310	331	0.96 (0.79–1.18)	(+)(+)(+)	Moderate
PGP Sick Leave: Stand-alone exercise vs Control (follow up > 12 weeks)									
1 [34]	Not serious	Serious[c]	Serious[b]	Very serious[a]	52	53	0.90 (0.37–2.16)	(+)	Very low
LBPP Sick Leave: Stand-alone exercise vs Control (follow up > 12 weeks)									
2 [29,38]	Not serious	Not serious	Serious[b]	Not serious	577	579	0.80 (0.65–1.00)	(+)(+)(+)	Moderate
LBP Acceptability: Stand-alone exercise vs Control (follow up > 12 weeks)									
1 [25]	Not serious	Serious[c]	Serious[b]	Not serious	258	278	0.69 (0.39–1.22)	(+)(+)	Low
LBPP Acceptability: Stand-alone exercise vs Control (follow up > 12 weeks)									
1 [29,34,38]	Not serious	Not serious	Serious[b]	Not serious	629	632	0.60 (0.42–0.84)	(+)(+)(+)	Moderate

No, number; LBP, low back pain; PGP, pelvic girdle pain; LBPP, lumbopelvic pain; CI, confidence interval.
[a] Downgraded owing to imprecision: less than 400 participants included in meta-analysis (sample of less than 200 participants was considered very serious imprecision and downgraded two levels).
[b] Downgraded owing to publication bias: not possible to assess publication bias (small number of trials [less than 10] included).
[c] Downgraded owing to inconsistency: I^2 statistic higher than 50% or pooling was not possible (poor overlap among confidence intervals in studies included was considered very serious imprecision and downgraded two levels)

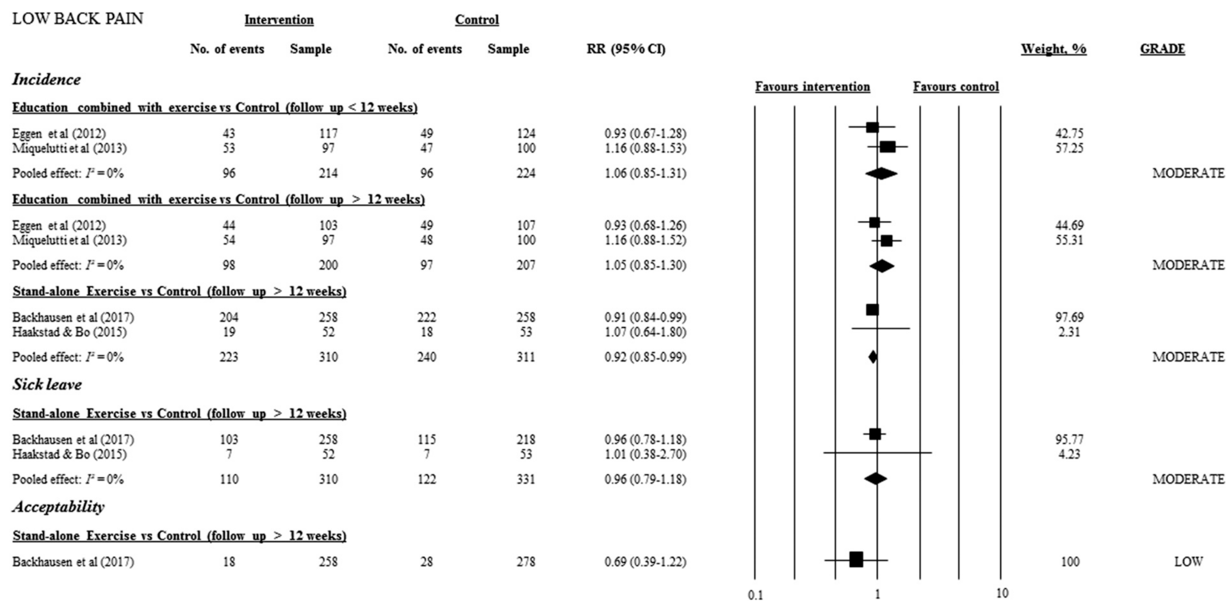

Fig. 2. Effects of prevention strategies on episodes of low back pain (LBP), use of sick leave and acceptability.Abbreviations: GRADE, Grading of Recommendations: Assessment, Development and Evaluation; No, number; RR, Relative Risk; CI, Confidence Interval.

further limitation was that heterogeneity was not explored due to the small number of trials included. Larger trials of high quality should investigate the impact on the estimates.

To the best of our knowledge, this is the first systematic review of randomised controlled trials and meta-analysis providing reliable information on the effectiveness of all available prevention strategies for LBP, PGP and LBPP. Previous reviews have attempted to investigate the effectiveness of an education and/or exercise programme at preventing LBP and PGP, but included symptomatic participants at the onset of the study and are out of date [14–16]. One of the previous reviews investigating the effectiveness of exercise at preventing LBP and PGP [15] presented data from eleven trials, but six trials included symptomatic participants at baseline (i.e., the review evaluated both prevention and treatment) [32,39–43]. Previous reviews also analysed education combined with exercise and "stand-alone" exercise [15,16]. Shiri et al. [15] reported a 9% reduction in LBP episodes (n = seven trials; 1175 participants) compared to the control group, which is consistent with our findings regarding "stand-alone" exercise. The lack of a protective effect of exercise regarding the incidence of

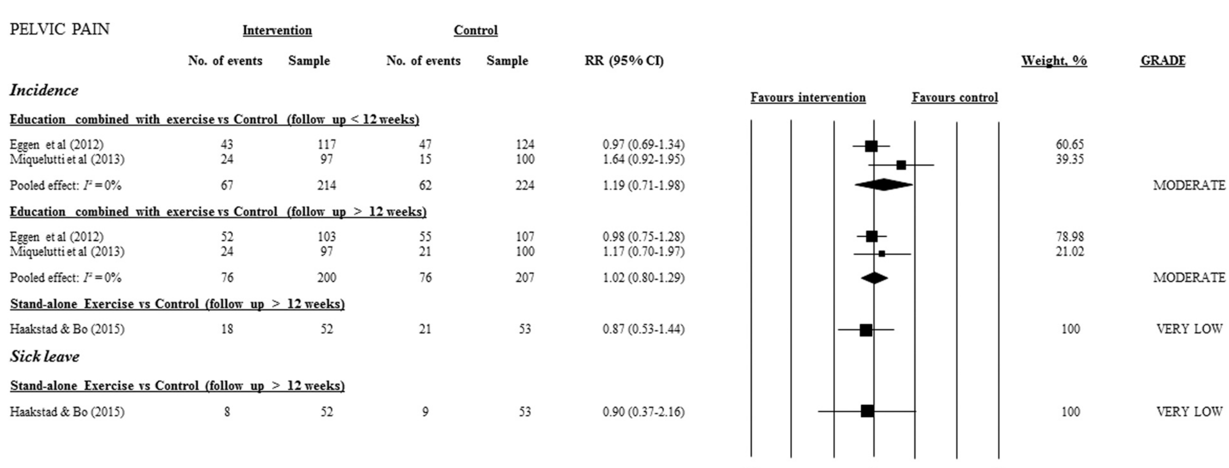

Fig. 3. Effects of all available prevention strategies on episodes of pelvic girdle pain (PGP) and use of sick leave.Abbreviations: GRADE, Grading of Recommendations: Assessment, Development and Evaluation; No, number; RR, Relative Risk; CI, Confidence Interval.

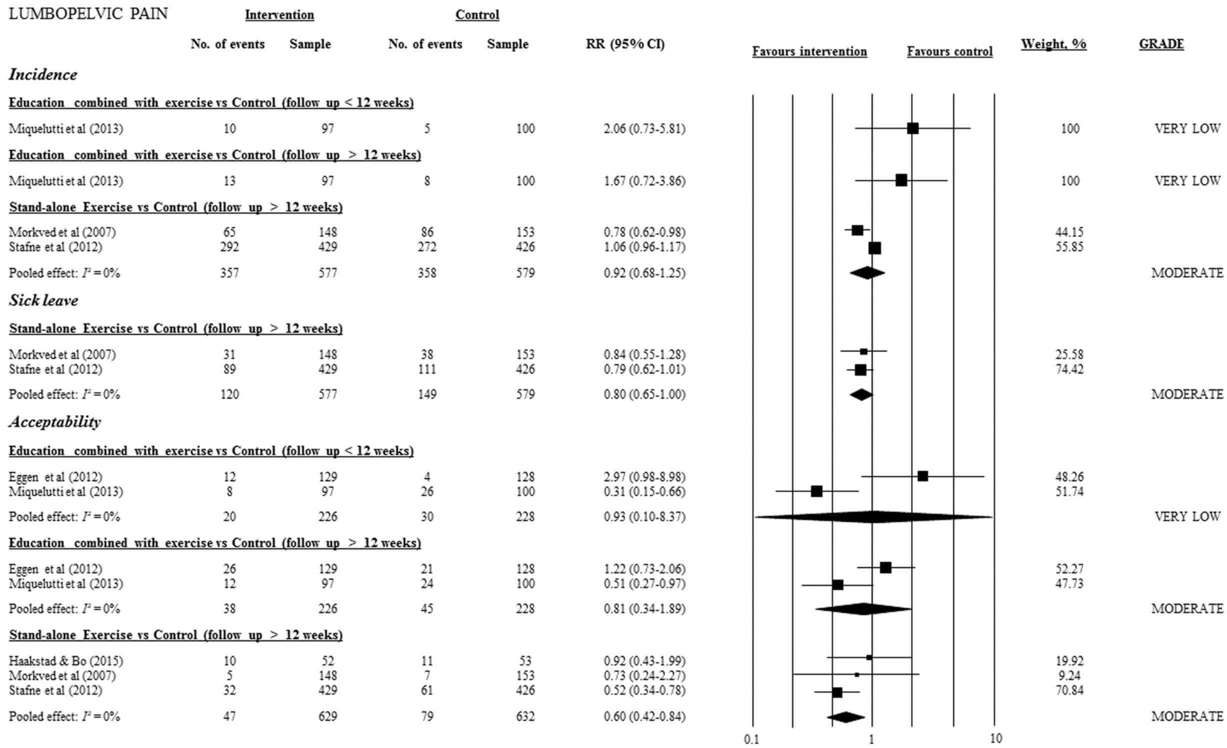

Fig. 4. Effects of all available prevention strategies on episodes of lumbopelvic pain (LBPP), use of sick leave and acceptability. Abbreviations: GRADE, Grading of Recommendations: Assessment, Development and Evaluation; No, number; RR, Relative Risk; CI, Confidence Interval.

PGP in other reviews are also consistent with the present results, although the quality of evidence is uncertain [14,15].

Liddle et al. [14] showed that exercise reduces the risk of women reporting LBPP by 44% (n = 4 trials, 1176 participants), which is not consistent with our findings. However, the review included studies with symptomatic participants, which makes it difficult to differentiate whether the intervention constituted effective prevention, as it is possible that women who had symptoms at baseline improved with treatment and not necessarily that women without symptoms did not experience pain over the course of the study. Moreover, our findings that prevention strategies do not avoid the use of sick leave due to LBP or PGP are not consistent with the results of previous reviews [14,15]. Liddle et al. [14] and Shiri et al. [15] showed that exercise prevents new episodes of sick leave due to LBPP during pregnancy. However, these previous reviews [14,15] included symptomatic participants and analysed data for LBP and LBPP (LBP plus PGP) together, thereby inflating the estimated effect size with inappropriate participants.

Although the effectiveness of prevention strategies regarding episodes of LBPP and the use of sick leave during pregnancy is not supported by evidence of high quality, our findings suggest that “stand-alone” exercise is acceptable to pregnant women with LBPP in the long term. As LBPP affects more than half of all pregnant women [2,3] and is a condition that exerts an impact on activities of daily living, quality of life and productivity [3,8–11], resulting in high direct and indirect health care costs [3,12,13], exercise may be an acceptable, low-cost strategy for pregnant women as part of an approach to prevent the condition in the long term.

Our findings suggest that “stand-alone” exercise is promising in the long-term. Thus, we believe that prevention approaches from the beginning of pregnancy would be welcome. From conception to giving birth, a woman's body goes through wide-ranging physiological changes. Further research is needed involving an early approach that considers the entire maternal biopsychosocial context as well as the complexities and multifactor characteristics of pain. Exercise during pregnancy can be recommended for its general health benefits, including reductions in the severity of LBP, PGP and LBPP. A more comprehensive approach could optimise the prevention of LBP, PGP and LBPP during pregnancy.

Conclusion

The effectiveness of prevention strategies for episodes of LBPP and the use of sick leave during pregnancy is not supported by high-quality evidence. The results of this systematic review and meta-analysis of randomised controlled trials found moderate quality of evidence that "stand-alone" exercise is acceptable to pregnant women with LBPP and has a small protective effect regarding episodes of LBP in the long term. Larger trials of high quality are needed to clarify the effectiveness of preventive strategies for episodes of LBP and PGP and the use of sick leave due to these health conditions in the short and long term among pregnant women.

Ethical Approval

Not applicable, as this is a systematic review.

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Conflict of Interest

The authors declare no conflicts of interest.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.physio.2022.09.004.

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