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LITERATURE REVIEW

Current evidence supporting physiotherapy treatment for women with low back pain or lumbopelvic pain during pregnancy

A. Banning & C. Pollard
Physiotherapy Department, St Thomas' Hospital, Guy's and St Thomas' NHS Foundation Trust, London, UK

Abstract
Estimates suggest that 50% of women experience problems with lumbopelvic pain during pregnancy. Previous cross-sectional reviews have suggested that most musculoskeletal physiotherapists lack confidence when treating this patient group. The existing physiotherapy treatment protocols for this condition are based on evidence derived from systematic reviews published in 2015. Since then, new evidence has been published, but it has not been comprehensively appraised. Consequently, an updated review and clear guideline for the management of low back pain has potential value. The main databases were searched for studies published from 2014 onwards, and the reference lists were checked. Six randomized controlled trials were identified and appraised using the Critical Appraisal Skills Programme tool. There is low-quality evidence to support the use of kinesiology tape (K-tape) and progressive muscle relaxation (PMR) in a low-risk pregnancy population. There is moderate- and good-quality evidence for, respectively, supervised land-based exercise, and unsupervised water-based exercise and acupuncture in this specific group. These findings differ from previous updates published in 2015, which did not contain data on either PMR or K-tape. The evidence regarding exercise is unchanged, and there has been no new evidence about the effect of belts. However, it must be noted that research is applicable only to the low-risk pregnancy group, who may not accurately reflect the whole population. Further high-quality studies are required to determine optimal practice in both low- and, especially, high-risk pregnant patients. It is anticipated that this review, which is based on contemporary evidence, will help to guide physiotherapy treatment pathways and increase practitioners' confidence when treating pregnant patients with lumbopelvic pain.

Keywords: low back pain, lumbopelvic pain, pelvic girdle pain, physiotherapy, pregnancy.

Introduction

Low back pain (LBP) in pregnancy is defined as pain occurring below the ribs, but above the gluteal folds, with or without radiation into the legs (Van Tulder *et al*. 2006). More than 50% of women struggle with lumbopelvic pain during pregnancy. Within this group, 17% of such women have LBP and 33% have combined lumbopelvic pain (Vleeming *et al*. 2008). A recent cross-sectional study found that LBP decreased physical and psychosocial health during pregnancy (Ibanez *et al*. 2017). Consequently, better management of LBP could have a beneficial impact on pregnant patients' quality of life (QoL).

Discriminating between pelvic girdle pain and LBP is difficult, both in practice and when reviewing the literature. Much of the obstetric physiotherapy research describes pelvic girdle pain (PGP) as opposed to LBP. Vleeming *et al*. (2008) outlined the European Guidelines for the diagnosis and treatment of PGP. Subsequently, Stuge *et al*. (2011) examined this guideline, and summarized the best management plans and

Correspondence: Amy Banning, Physiotherapy Department, Ground Floor, Chelsea and Westminster Hospital, 369 Fulham Road, Chelsea, London SW10 9NH, UK (e-mail: amy.a.banning@gmail.com).

potential areas for further improvement in clinical practice.

Notably, there have been no guidelines issued for the physiotherapy management of pregnant women with LBP or lumbopelvic pain. The National Institute for Health and Care Excellence (NICE) LBP guidelines (NICE 2016) did not include patients with pregnancy-related back pain. Importantly, the pathophysiology of back pain in pregnancy differs from that of non-specific LBP in the general population. Gestational biomechanical changes include an increased body mass index, postural changes and the development of diastasis of the rectus abdominis muscle.

In an earlier cross-sectional review, Bishop *et al*. (2016) demonstrated that physiotherapists generally prescribe advice and exercise, and less commonly, acupuncture to manage lumbopelvic pain in pregnancy. Importantly, this study indicated that many practitioners would ideally wish to refer their patients to a specialist women's health physiotherapist. This suggests that non-specialist physiotherapists have a widespread lack of confidence with regard to this particular area of practice.

Two systematic reviews from 2012 examined the effect of physiotherapy or exercise on antenatal back pain (Boissonnault *et al*. 2012; Richards *et al*. 2012). These studies largely relied on research conducted between 2005 and 2010. Two more systematic reviews investigating the use of belts, acupuncture and exercise were published in 2015 (Gutke *et al*. 2015; Liddle & Pennick 2015). These authors concluded that there is good evidence for the efficacy of belts and acupuncture. More-recently-published research has not been assessed for its applicability to clinical practice.

Therefore, current approaches to the treatment of LBP in pregnancy would benefit from being appraised in order to clarify optimal practice. This would ensure that physiotherapists offer their patients the best possible evidence-based care. It would also serve to increase non-specialist musculoskeletal (MSK) physiotherapists' confidence when treating pregnant patients with LBP.

The aim of the present literature review was to summarize and appraise current approaches to the physiotherapy management of pregnant women with LBP.

Materials and methods

A literature review was conducted in order to summarize and appraise the current literature on the treatment of women with pregnancy-related LBP or lumbopelvic pain, and assess the application of the findings to clinical practice. A population, intervention, comparator, outcome, study type and time frame (PICOST) search strategy (Table 1) was identified by defining clear inclusion and exclusion criteria (Table 2). Six randomized control trials (RCTs) were identified by searching relevant healthcare databases (i.e. the Cochrane Library, Embase and MEDLINE/PubMed), and hand-searches of the relevant articles, systematic reviews and the associated reference lists were also performed. This process is illustrated in Fig. 1. Critical Appraisal Skills Programme (CASP 2018) analysis was used to appraise the studies (Table 3), and these were then considered in context for relevance.

Results

The present literature review identified six RCTs. Three of these studies were of low quality, one had moderate validity and two were good-quality research. Foster *et al*. (2016) concluded that acupuncture was an effective intervention. Two of the RCTs found exercise to be effective for the treatment of lumbopelvic pain (Backhausen *et al*. 2017; Sklempe Kokic *et al*. 2017). Kaplan *et al*. (2016) reported that the application of kinesiology tape (K-tape) was helpful. One study found that supervised group exercise was ineffective (Haakstad & Bø 2015).

All the RCTs involved a group of low-risk pregnant women who had no significant obstetric history. Sklempe Kokic *et al*. (2017) only studied a population of women with diet-controlled type 2 diabetes because their paper was a secondary analysis. In comparison, Haakstad & Bø (2015) only investigated nulliparous women. Kaplan *et al*. (2016) looked at women who had no significant history of back pain, including orthopaedic and rheumatological conditions, as well as spinal injuries and a history of LBP. Similarly, Akmeşe & Oran (2014) studied women with no history of previous back pain prior to pregnancy, and also excluded women with a visual analogue scale (VAS) score of >6 at baseline.

The specific forms of treatment provided varied between the RCTs. Three studies investigated exercise as an intervention: Backhausen *et al*. (2017) evaluated the effects of an unsupervised water-based programme; Haakstad & Bø (2015) looked at a group fitness class; and Sklempe

Table 1. Population, intervention, control, outcome, study type and time (PICOST) criteria and search strategy: (LBP) low back pain; (QoL) quality of life; and (RCT) randomized controlled trial

Variable	Search	Search terms/keywords	Reasoning
Population	Women with LBP in pregnancy	LBP + pregnancy LBP + pregnancy Postural LBP + pregnancy Recurrent LBP + pregnancy Mechanical LBP + pregnancy Antenatal + LBP Lumbopelvic pain	Currently-pregnant women with LBP who can be any age Over 12 weeks' gestation because there is a high risk of miscarriage in the first trimester
Intervention	Physiotherapy	Physiotherapy Physical therapy Exercise Manual therapy Education	Evidence for physiotherapy This includes exercise, education and manual therapy
Control	Standard obstetric care	Standard obstetric care	Literature comparing intervention to a control such as standard obstetric care allows decisions to be made regarding the effectiveness of interventions Waiting list is not an ethical control for this subgroup of patients
Outcome	At least one primary outcome of patient with LBP with validated measure or questionnaire	QoL Questionnaires Outcome	To focus review on QoL outcomes and pain reduction
Study type	RCTs, systematic reviews in English	RCTs Systematic review	To ensure the highest-quality primary evidence is reviewed within the limited pool of evidence for this topic
Time	Papers published after 2014	2014	To ensure up-to-date guidelines because LBP best practice is constantly changing The literature review will include papers from 2015 to ensure all relevant RCTs are included

Table 2. Inclusion and exclusion criteria: (LBP) low back pain

Inclusion criteria	Exclusion criteria
Lumbopelvic pain because this is an umbrella term that includes LBP	Postnatal because there are differing aetiologies between pregnancy-related and non-specific LBP, and therefore, treatment typically differs
Physiotherapy, exercise, acupuncture, hydrotherapy, group exercise and advice because these interventions are available on the National Health Service, and are routinely offered by physiotherapists	Cohort studies because higher-quality studies are available
	Labour because pain relief in labour varies from that for LBP because of differing aetiologies
Randomized controlled trials because these are the highest level of filtered and unfiltered evidence, respectively, according to the evidence pyramid	Osteopathy, chiropractic and reflexology
	Symphysis pubis joint and pelvic girdle pain alone because these are defined in the literature as separate conditions
Later than 2014 because two systematic reviews were published in 2015 assessing treatment prior to this date	Older than 2014 because two systematic reviews were published in 2015 assessing treatment prior to this

Kokic *et al*. (2017) assessed a supervised exercise programme. Akmeşe & Oran (2014) studied a progressive muscle relaxation (PMR) technique, whereas Kaplan *et al*. (2016) evaluated the effects of K-tape. Foster *et al*. (2016) investigated acupuncture as an intervention.

All the authors compared their interventions to standard obstetric care. Importantly, Foster *et al*. (2016) contrasted sham acupuncture, acupuncture and standard obstetric care.

Backhausen *et al*. (2017) concluded that an unsupervised water-based exercise programme for a low-risk population of pregnant women was effective as a method of improving the participants' VAS scores for lumbopelvic pain. Similarly, Sklempe Kokic *et al*. (2017) found that a supervised exercise programme decreased both VAS scores and levels of disability assessed using the Pelvic Girdle Questionnaire (PGQ). Haakstad & Bø (2015) found no significant difference between a fitness group and controls. Kaplan *et al*. (2016) reported that K-tape application improved their patients' VAS scores in the short term, and Akmeşe & Oran's (2014) results

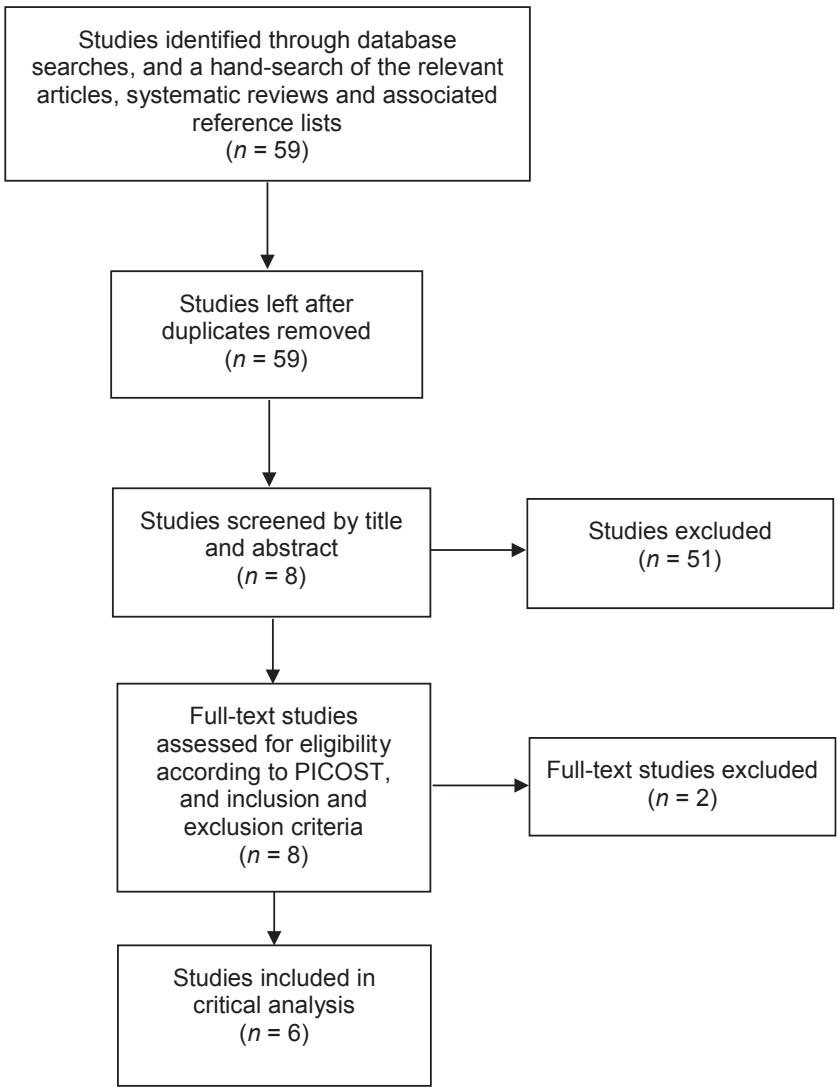

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart illustrating the literature search strategy (Moher *et al.* 2009; PRISMA 2009): (PICOST) population, intervention, control, outcome, study type and time.

showed that PMR also did the same. Foster *et al*. (2016) found that acupuncture may improve VAS scores and levels of disability in patients from a low-risk pregnant population with lumbopelvic pain.

Table 3 summarizes the quality of the six RCTs reviewed according to the CASP tool for RCTs. Table 4 summarizes the findings of each study and what these measured.

Discussion

The six RCTs discussed in the present literature review were selected on the basis of the inclusion and exclusion criteria. The studies investigated different physiotherapy interventions for LBP and/or lumbopelvic pain in pregnant women. These conditions were broadly diagnosed either by a physician, or using baseline data from a VAS, the Roland Morris Disability Questionnaire (RMDQ) or the PGQ. The presence of pain anywhere between T12 and the gluteal fold without leg pain was also used as a diagnosis of LBP. Intervention was compared against normal antenatal care, including standard health promotion.

Population

It should be noted that the findings of the six RCTs are only applicable to the low-risk pregnancy group. In the clinical setting, we see pregnant women in both the high- and low-risk groups, but there is no research to support physiotherapy treatment in higher-risk cases. Furthermore, it could be considered unethical to conduct research with a control group consisting of high-risk patients.

Table 3. Critical Appraisal Skills Programme (CASP 2018) analysis of research papers identified: (VAS) visual analogue scale; (SF-36) Short Form (36) Health Survey; (PGP) pelvic girdle pain; (LBP) low back pain; (PGQ) Pelvic Girdle Questionnaire; (ODI) Oswestry Disability Index; (RMDQ) Roland Morris Disability Questionnaire; (EQ-5D) EuroQol-5D; and (CI) confidence interval; and (PEDro) Physiotherapy Evidence Database

	Study					
	Akmeşe & Oran (2014)	Haakstad & Bø (2015)	Foster *et al.* (2016)	Kaplan *et al.* (2016)	Backhausen *et al.* (2017)	Sklempe Kokic *et al.* (2017)
Clearly focused issue	Yes	Yes	No, feasibility study	Yes	Yes	Yes
Randomization	Yes	Yes	Yes	Yes	Yes	Yes
Patients in trial accounted for in conclusion	Unknown, no intention-to-treat analysis	Yes	Unknown, no intention-to-treat analysis	Unknown, no intention-to-treat analysis	Yes	Unknown, no intention-to-treat analysis
Blinding	No	No	No	No	No	No
Group similarity	Yes	Unknown	Yes	No	Yes	Yes
Groups treated equally	Unknown	Unknown	Yes	Unknown	Unknown	Unknown
Treatment effect	Significant difference in VAS and SF-36 scores	No significant difference in prevalence of PGP or LBP	Significant difference in PGQ, ODI and VAS scores	Significant difference in RMDQ and VAS scores	Significant difference in VAS scores, no significant difference in EQ-5D and RMDQ scores	No significant difference in number of women self-reporting pain, significantly lower VAS, PGQ and RMDQ scores
Precision	No CI, no formal sample size calculated, significant *P*-values	95% CI	CIs are imprecise, *P*-values significant	No CI reported, *P*-values significant, no sample size calculated	*P*-values were significant, CIs were within 95%, study overpowered	Significant *P*-values, CIs wide
Applicability in local population	No	No	Yes with regard to low-risk group	No	Yes with regard to low-risk group	No
Important outcomes considered	Yes	No	Yes	Yes	Yes	Yes
Benefits worth the harms and costs	Yes	Yes	Yes	No	Yes	Yes
Overall validity	Poor	Poor	Good	Poor	Good	Moderate
PEDro scale score	5/10	7/10	8/10	6/10	7/10	6/10

Table 4. Treatments, outcome measures and results reported in the studies reviewed: (VAS) visual analogue scale; (EQ-5D) EuroQol-5D; (RMDQ) Roland Morris Disability Questionnaire; (PGQ) Pelvic Girdle Questionnaire; (LBP) low back pain; (PGP) pelvic girdle pain; (ODI) Oswestry Disability Index; and (SF-36) Short Form (36) Health Survey

Study	Treatment	Outcome measures	Result
Akmeşe & Oran (2014)	Progressive muscle relaxation	VAS and SF-36	Significant difference
Haakstad & Bø (2015)	Group fitness	Prevalence of LBP and PGP, and VAS	Significant difference
Foster *et al.* (2016)	Acupuncture	PGQ, ODI and VAS	Significant difference
Kaplan *et al.* (2016)	Kinesiology tape	RMDQ and VAS	Significant difference
Backhausen *et al.* (2017)	Unsupervised water-based exercise programme	VAS, EQ-5D and RMDQ	Significant difference
Sklempe Kokic *et al.* (2017)	Supervised exercise programme	VAS, PGQ and RMDQ	No significant difference

Sklempe Kokic *et al*. (2017) studied the effects of therapeutic exercise on a population of pregnant women with lumbopelvic pain and gestational diabetes. Because this was a secondary analysis, it is not representative of an entire population. Although there is no evidence to suggest that gestational diabetes may or may not affect LBP in pregnancy, this must be considered when interpreting these results for use in clinical practice.

Haakstad & Bø (2015) included only nulliparous women with a high educational level. Therefore, their results do not reflect the general population. Educational levels vary and many women have multiple pregnancies, and therefore, the treatment effect is also likely to differ between these groups.

Kaplan *et al*. (2016) excluded any significant history of back pain, including orthopaedic and rheumatological conditions, spinal injuries, and a history of LBP. This does not reflect the general population because back pain has an 84% lifetime prevalence in the UK (Walker 2000). Excluding pre-existing back pain also excludes the population with chronic LBP. Chronicity is associated with poor long-term outcomes, such as disability and inferior QoL (Patrick *et al*. 2016). Similarly, Akmeşe & Oran (2014) studied women with no history of previous back pain prior to pregnancy, and also excluded those with a VAS score of > 6 at recruitment. These issues affect the validity of these studies.

Control and intervention

The similarity of the control and intervention groups prior to treatment varied between the RCTs. None of the studies examined any therapy provided outside the intervention. This precludes any analysis of whether one group had more treatment than another overall.

Similarly, previous treatment for LBP was not measured between the control and intervention groups in any of the RCTs. Standard care for LBP includes education (NICE 2016), which influences outcomes (Tavafian *et al*. 2007), and therefore, this could potentially affect a patient's understanding of the condition.

Haakstad & Bø (2015) did not measure pain intensity in either their control or intervention groups at baseline. Similarly, they did not record the duration of LBP at baseline. Pain intensity and chronicity could both alter the outcomes reported in this trial. Patrick *et al*. (2016) stated that chronic back pain is associated with poorer outcomes than acute back pain (< 6 months after onset), and that increased intensity of back pain negatively influences outcomes after intervention. This could potentially affect the validity of their results, which suggest that exercise may improve LBP in pregnant women.

Kaplan *et al*. (2016) did not investigate difference in comorbidities between their intervention and control groups. Furthermore, they did not examine socioeconomic factors, such as marital status, education and disability, which can influence pain. Valencia *et al*. (2011) stated that socioeconomic factors influence the relationship between fear-avoidance beliefs, work and disability. These considerations can affect intervention outcomes, and consequently, could affect the validity of the results, which suggested that the application of K-tape was effective.

In all of the studies except Foster *et al*. (2016), the intervention group received more clinician time compared to the control group. This placebo effect could add to the observed treatment effect. Foster *et al*. (2016) used sham treatment, which could add weight to the effect of acupuncture on lumbopelvic pain in pregnant women compared to the other studies.

There was a risk of crossover in all the RCTs except Foster *et al*. (2015), who recorded extra intervention, and Akmeşe & Oran (2014), who

investigated PMR and discouraged extra intervention. In the other studies analysed, concomitant additional treatment, such as physiotherapy or exercise, was possible. These factors could affect the validity of the results for land- and water-based exercise, and K-tape.

Treatment effects

Physiotherapy intervention was generally found to be effective for improving VAS scores for lumbopelvic pain in the pregnant population, with the exception of a group fitness prescription (Haakstad & Bø 2015) that had no impact on self-reported LBP.

Backhausen *et al*. (2017) showed that the intensity of LBP was significantly reduced after the completion of an unsupervised water-based exercise programme. This result is arguably clinically irrelevant because the secondary outcomes of sick leave, disability measured by RMDQ and self-rated general health (EuroQol-5D and EuroQol-VAS) were not significantly different between the intervention and control groups.

Other studies demonstrated a reduction in VAS scores and other QoL measures. Kaplan *et al*. (2016) found that K-tape significantly decreased the intensity of LBP measured by a VAS, as well as disability measured by the RMDQ ($P < 0.001$). Similarly, Foster *et al*. (2016) showed that acupuncture may significantly improve pain intensity, as well as PGQ and Oswestry Disability Index scores. Akmeşe & Oran (2014) demonstrated that PMR exercises with music significantly improved VAS scores and QoL measured using the Short Form (36) Health Survey.

Sklempe Kokic *et al*. (2017) showed that a supervised exercise programme significantly decreased lumbopelvic pain intensity (VAS, $P = 0.017$) and disability (PGQ, $P < 0.005$; RMDQ, $P < 0.001$). However, it was noted that the exercise programme did not affect the number of women who developed pain in the intervention group compared to the controls.

Based on these results there is some positive evidence for the use of K-tape, PMR exercises, unsupervised water-based exercise and acupuncture, but not for supervised group exercise. However, it should be noted that previous studies by Boissonnault *et al*. (2012) and Richards *et al*. (2012) suggested that supervised group exercise is beneficial.

The treatment effects were generally significant, but Foster *et al*.'s (2016) confidence intervals were imprecise because this was a feasibility study and pilot randomized trial. No confidence intervals were reported for the treatment effects of either K-tape or PMR.

Outcome measures

On the whole, the RCTs used validated outcome measures for QoL and VAS to measure the effect of treatment. Backhausen *et al*. (2017) measured sick days taken off work, as well as RMDQ and VAS, which added clinical and socioeconomic significance to their results. The other studies could potentially have benefitted from this approach.

The outcome measures used by Haakstad & Bø (2015) were not validated because they used self-reported LBP and PGP to measure the effect of treatment. This technique is probably inaccurate since there is a degree of subjectivity, and this may undermine the validity of these results. Furthermore, no QoL outcome measure was used in their study. Group exercise may not have had an impact on pain; however, it could have had an effect on QoL or function. These measures would be of significance for clinical practice. Therefore, the results showing that group exercise does not improve LBP in pregnancy should be interpreted with caution when being used in practice.

Impact

Within the pilot arm of their feasibility study, Foster *et al.* (2016) demonstrated that the results tend to favour the addition of acupuncture to standard care for pregnancy-related back pain with no major adverse events. It will be interesting to observe the results of a future, appropriately powered RCT if and when these authors carry one out. There were 10 cases of minor side effects, including nausea, vomiting, drowsiness, headaches pain and fainting.

No adverse events were reported for supervised exercise (Sklempe Kokic *et al*. 2017), unsupervised water-based exercise (Backhausen *et al*. 2017) or PMR (Akmeşe & Oran 2014). Notably, statistically significant reductions of lumbopelvic pain in pregnant women were demonstrated using a VAS.

Kaplan *et al*. (2016) reported that two patients experienced allergic reactions to the K-tape, but significant short-term beneficial effects were observed on a VAS. Haakstad & Bø (2015) described no adverse events during group exercise, but there was no decrease in VAS scores in the population studied.

It should be noted that interventions including group exercise, supervised exercise, unsupervised

water-based exercise and PMR cost the healthcare system very little and promote self-management. Group-based exercise is a low-cost intervention that can be encouraged independently, but only one RCT showed no statistically significant improvement in pain scores (Sklempe Kokic *et al*. 2017).

K-tape and acupuncture may be less cost-effective because of the short follow-up times in the RCTs. Kaplan *et al*.'s (2016) intervention group were followed up after only 5 days. A longer-term study is necessary in order to be able to make recommendations for clinical practice. Foster *et al*. (2016) conducted their follow-up at 8 weeks, but a longer-term one would be beneficial. Arguably, both of the above-mentioned interventions could be less cost-effective because these do not encourage self-management.

Summary

When considering treatment options for pregnant women with LBP or lumbopelvic pain, it can be concluded that there is only low-quality evidence to support the use of K-tape and PMR. Notably, there is moderate-quality evidence for unsupervised water-based exercise and therapeutic exercise improving pain intensity and QoL in pregnant women with LBP, and good-quality evidence for acupuncture doing the same.

Limitations

The present study is limited in that there were only two authors, and therefore, the interpretation of the results was subjective. Only one author (A.B.) conducted the search and undertook the CASP review, which added to this subjectivity.

Conclusions

Unsupervised water-based exercise, supervised therapeutic exercise and acupuncture all appear to be effective physiotherapy modalities for the treatment of LBP in pregnancy. Recent data have questioned the influence of group exercise on pain in pregnant women with LBP. The present paper did not study function or QoL, which would be of relevance if significant. It should be noted that previous evidence suggests that group exercise has possible benefits. Individualized pelvic floor muscle (PFM) training alone is the first-line treatment option for women with UI (Abrams *et al.* 2017; Dumoulin *et al.* 2018; NICE 2019), and there are indications that integrating the synergistic muscles of the abdominal cylinder may be of additional benefit in PFM rehabilitation. This needs to be investigated further with trials employing homogenous intervention protocols.

Further research is indicated to investigate the impact of K-tape and PMR, both of which may be beneficial.

There is currently no existing literature on the physiotherapy treatment of patients within the high-risk pregnancy group.

This clear review should help to: increase the MSK physiotherapist's confidence when treating pregnant women with LBP; assess new evidence for use in clinical practice; and clarify current best practice for the low-risk population of pregnant women with lumbopelvic pain.

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Amy Banning is a specialist MSK physiotherapist. She worked at Guy's and St Thomas' NHS Foundation Trust (GSTNHST) in London for 2 years before moving to Chelsea and Westminster Hospital in January. Pelvic health formed part of Amy's specialist MSK rotations at GSTNHST.

Colette Pollard is a pelvic health physiotherapist. She spent over 4 years at GSTNHST, where she specialized in both women's and men's health. She recently moved to Imperial College Healthcare NHS Trust, where she now works as a clinical specialist pelvic health physiotherapist.