LITERATURE REVIEW

Exercise for postnatal low back pain and pelvic pain

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Abstract
Postnatal low back pain (LBP) and pelvic pain can affect up to 82% of women at some point in the year after they have given birth. Sufferers often report pain of varying intensities, resulting in effects ranging from mild annoyance to severe disability. Neither LBP nor pelvic pain in the first year post-partum are clearly understood, but these problems are thought to be caused by a multitude of factors, including a previous history of LBP, back pain in pregnancy, hormonal changes, the postural changes associated with a new baby, tiredness and mood. This systematic review of the available randomized controlled trials (RCTs) that met certain inclusion and exclusion criteria analyses five studies of the effect of exercise on LBP and pelvic pain in the first year post-partum. All of these trials focused on abdominal strengthening. Two RCTs reported that exercise was associated with positive outcomes, but the remaining three studies concluded that it brought no additional benefit. Although the evidence suggests that abdominal exercise in the first year post-partum may provide some relief for women suffering from LBP and pelvic pain, more research of better methodological quality needs to be completed.

Keywords: core stability, exercise, low back pain, pelvic pain, postnatal care.

Introduction

Postnatal low back pain (LBP) and pelvic pain are common problems in the post-partum period, and these conditions can vary in intensity from being a mild annoyance to presenting as a severely disabling condition. The incidence of postnatal LBP has been shown to range from 21% to 82% in the first year post-partum (Östgaard & Andersson 1992; To & Wong 2003). Wu *et al*. (2004) reported that 7% of women suffer from continuing postnatal pelvic girdle pain (PGP) that affects their activities of daily living. These figures are significant when considered with regard to birth rates in England and Wales, which continue to rise, with 723 913 live births being recorded in 2011 (ONS 2012).

Low back pain is described as chronic once it has persisted for 3 months or more. Most back pain is described as non-specific, mechanical LBP, to which no recognizable pathology can be attributed (Duthey 2013). Vleeming *et al*. (2008) described pregnancy-related pelvic pain as pain generally experienced between the posterior iliac crest and the gluteal fold, particularly in the vicinity of the sacroiliac joint.

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Causes

In the first year post-partum, LBP or pelvic pain can occur for a multitude of reasons, often with no single factor being apparent. A previous history of back pain has been identified as a risk factor for ongoing postnatal pain (Östgaard & Andersson 1992). In To & Wong's (2003) study of 326 patients, 77% ($n=250$) were reported to have experienced an episode of back pain during their pregnancy, and a further 48% ($n=120$) had suffered from an episode of back pain before becoming pregnant. The above authors also investigated severe back pain in pregnancy. They found that those participants who had experienced an earlier onset of pain symptoms in their second trimester, as compared to those who only experienced pain in their third trimester, were more likely to report ongoing back or pelvic pain at follow-up 24 months later.

There is a continuing debate about whether epidural and spinal block analgesia has a link with ongoing LBP since many women opt for this form of analgesia for pain relief during

pregnancy. MacArthur *et al.* (1990) suggested that there was a correlation; however, more recent research by Howell *et al.* (2002) involving 369 women found no causal link between back pain and epidural anaesthesia in labour and delivery. In another study (Breen *et al.* 1994), 1042 women were interviewed postnatally about the incidence of post-partum back pain. The frequency of back pain in those participants who received epidural anaesthesia (44%) was equivalent to those who did not (45%).

Relaxin has the greatest effect on collagen, gradually replacing it with a remodelled version that has greater extensibility and pliability. Marnach *et al.* (2003) demonstrated significantly increased joint laxity in pregnancy, although they could not directly relate it to changes in relaxin levels. Calguneri *et al.* (1982) reported that the effects of the joint laxity caused by relaxin could last for 3–5 months post-partum, although there is a significant lack of reliable research on postnatal relaxin levels in human beings. Tregear *et al.* (2000) postulated that relaxin is unlikely to have a significant effect on joint pathology once the placenta has been delivered, and contended that a slow resolution of joint pathology or simply birth trauma are more likely causes of this condition. Stephenson & O'Connor (2000) suggested that a multifoetal pregnancy can increase the amount of relaxin production, thereby increasing the potential risk of joint laxity.

A multitude of other causes of LBP and pelvic pain exist, including the postural changes and the new roles that motherhood brings, the age of any existing children, tiredness, mood and previous levels of function. A retrospective cohort study by Gutke (2007) found that post-partum depressive symptoms were three times more prevalent in women who suffered from lumbopelvic pain than in those who did not.

Exercise

There are currently several major guidelines that mention post-partum exercise for LBP and pelvic pain (ACOG 2002; RCOG 2006; NICE 2009). Only the RCOG (2006) guidelines recommend specific types of exercise for women in the post-partum stage. These state that women who have had an uncomplicated delivery may immediately begin a gentle exercise programme involving walking, pelvic floor muscle exercises (PFMEs) and stretching. The American College of Obstetricians and Gynecologists guidelines (ACOG 2002) recommend that exercise should be resumed gradually, but state that there are no published studies to indicate that, in the absence of medical complications, the rapid resumption of activities will result in adverse effects.

None of the above guidelines (ACOG 2002; RCOG 2006; NICE 2009) specifically mention post-partum LBP or PGP. This highlights the often generic and broad nature of formal advice on exercise in the postnatal period. Exercise is frequently prescribed by physiotherapists for LBP and pelvic pain after thorough subjective and objective assessments. Women are often reluctant to make unnecessary journeys to attend appointments during the early postnatal period, and they may turn to a generic programme of exercise in order to ease LBP or pelvic pain. This regimen may include home exercises, group classes or outdoor pursuits.

At the time of writing, no systematic review of studies of exercise for LBP and pelvic pain in the first year post-partum had been completed. Therefore, the work reported in the present paper was considered to be a useful and relevant research project to undertake.

Materials and methods

A systematic review protocol was developed alongside tools for paper selection, data extraction and the assessment of methodological quality.

The key aims of the review were to investigate the following questions:

- Does performing prescribed exercise improve LBP and pelvic pain in the first year post-partum?
- Do particular types of exercise improve LBP and pelvic pain outcomes in the first year post-partum?
- Do particular client groups respond better to different types of exercise; for example, those who have undergone Caesarean section versus those who experienced a vaginal delivery; primiparous versus multiparous women; and younger versus older patients?

Search

The Medical Literature Analysis and Retrieval System Online (January 1990 to August 2013), the Allied and Complementary Medicine Database (1990 to August 2013), PsychINFO (1990 to August 2013), the Cochrane Library (2013) and the Cumulative Index to Nursing and Allied Health Literature (1990 to August 2013) were systematically searched using the terms listed in Table 1.

Table 1. Search themes (Boolean variations were also included in the electronic search)

Theme		
(1) Postnatal	(2) Back and pelvic pain	(3) Postnatal exercise
Post-partum	Back pain	Exercise
Postnatal	Low back pain	Cardiovascular
Birth	Lumbago	Pilates
Mother	Pelvic pain	Yoga
Maternal	Pelvis pain	Core stability
Mum	Sacroiliac pain	Core strengthening
Mom	Postnatal pain	Walking
	Post-partum pain	Running
	Pelvic girdle pain	Jogging
	Symphysis pubis dysfunction	Aquatic exercise
		Water-based exercise
		Tai chi
		Aqua-aerobics

The search themes were grouped into: (1) ''postnatal''; (2) ''back and pelvic pain''; and (3) ''postnatal exercise''. The results were supplemented by hand searching and a grey literature search using the same themes. The present author identified 149 articles of possible relevance that were then screened using the title and abstract to assess whether the studies met the following inclusion and exclusion criteria:

- the participants included women up to 1 year post-partum;
- only participants with LBP and/or pelvic pain were included;
- any form of exercise could be included except PFMEs in isolation;
- the study must be a randomized control trial (RCT); and
- outcome measures for pain and/or function must be included.

A paper selection tool was used as an *aide-mémoire*, and to ensure consistency when assessing the titles and abstracts of all 149 articles to decide whether these should be included in or excluded from the systematic review. If this stage was inconclusive, the present author would then access the full paper in order to make a final decision about inclusion or exclusion.

Quality evaluation and identifying risk of bias

No universal agreement on methodological appraisal exists (Desmeules *et al.* 2012). The present author examined some of the most popular tools for quantitative methodological assessment, and decided that an amalgamation of those of Downs & Black (1998) and Caldwell *et al.* (2005) would highlight any relevant issues in the papers analysed in this systematic review. This modified tool was initially evaluated by the present author's clinical tutor, Jennifer Bromley, and then piloted on 22 August 2013 with another experienced physiotherapist, Shernaz Screwvala. A pilot involving a single study (Stuge *et al.* 2004a) highlighted some wording issues, and a final draft was then created.

Although those papers that were of poor quality (i.e. meeting <50% of the criteria) should have been removed from the systematic review process, the paucity of literature on this subject prompted the present author to retain these and acknowledge this as a significant limitation of the review process. The process of search and selection is illustrated with a flow chart (Fig. 1).

Data extraction tool

To standardize the process of data extraction and improve the validity of the results, a tool was developed to summarize the main findings. This data extraction instrument includes bibliographic details such as the year of publication and where the article was found, along with the aims, interventions and outcomes of the study. Because of the nature of the systematic review question, the tool goes into some detail with regard to intervention and control exercise duration and repetitions. The author used the Cochrane data extraction tool, her clinical knowledge, feedback from her clinical tutor and a pilot study with an experienced external physiotherapist as the basis for the development of the instrument used in the present systematic review.

Results

Five studies met the inclusion and exclusion criteria (Mens *et al.* 2000; Stuge *et al.* 2004a; Oh *et al.* 2007; Gutke *et al.* 2010; Ammar *et al.* 2011), and were deemed appropriate following a methodological quality assessment. The full selection process is summarized in a flow chart (Fig. 1).

Study characteristics

All five trials involved similar types of exercise, and compared participants who were prescribed abdominal stabilization exercises with control groups. Two of the five studies (Stuge *et al.* 2004a; Ammar *et al.* 2011) reported that specific core stabilizing exercises produced statistically positive results for pain and function. Another (Gutke *et al.* 2010) found that core stabilizing exercises improved function at 3 months, but

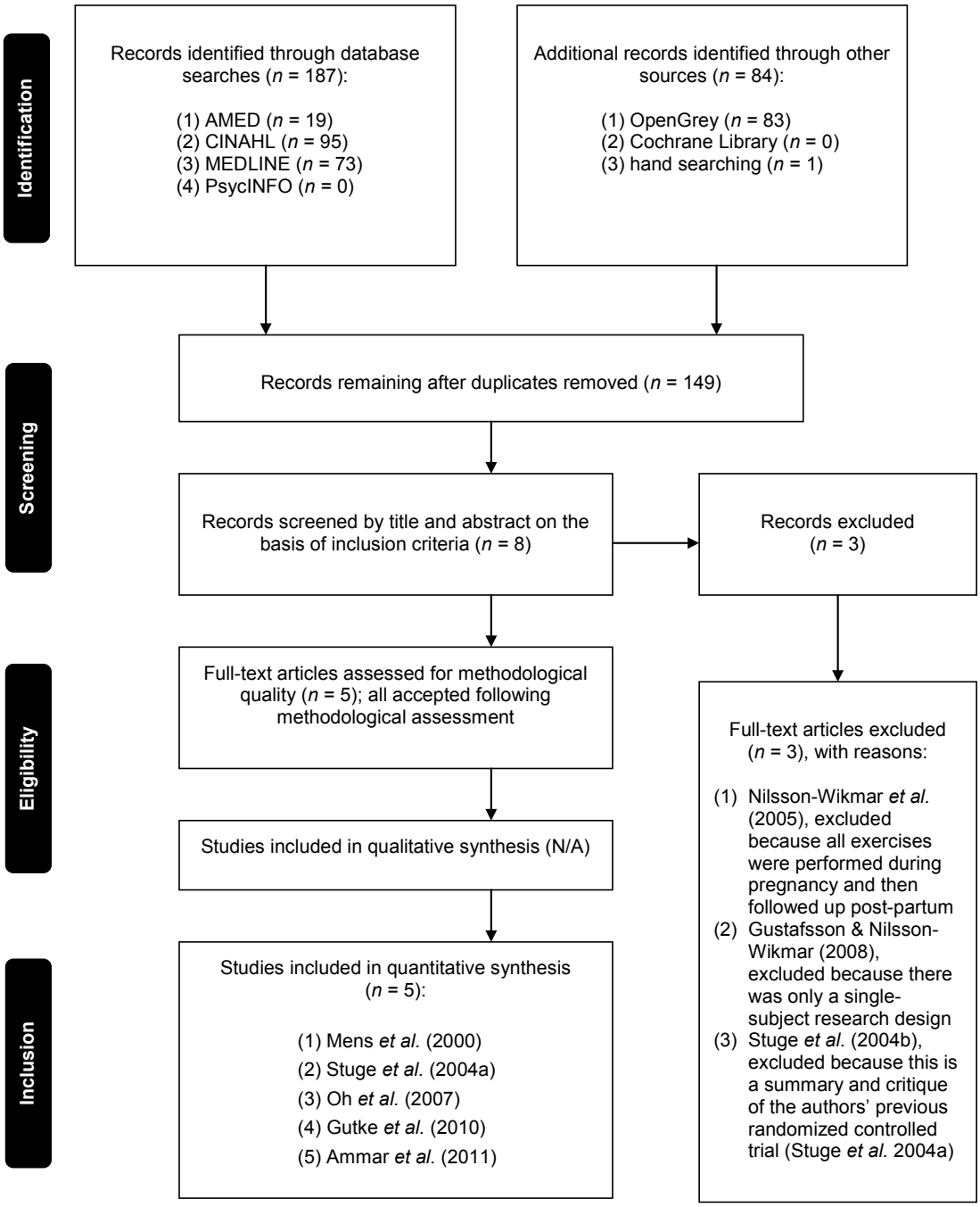

Figure 1. Summary of the search and selection process: (AMED) Allied and Complementary Medicine Database; (CINAHL) Cumulative Index to Nursing and Allied Health Literature; (MEDLINE) Medical Literature Analysis and Retrieval System Online; and (N/A) not applicable.

that there was no statistically significant difference between the intervention and control groups at 6 or 12 months. Table 2 summarizes all five papers.

Similar outcome measures were used that focused mainly on pain and function. Three of the five studies (Stuge *et al.* 2004a; Gutke *et al.* 2010; Ammar *et al.* 2011) used the Oswestry Disability Index (ODI) and a visual analogue scale as outcome measures.

Stuge *et al.*'s (2004a) RCT of stretching and movement versus specific stabilizing exercises met 13 of the 19 quality criteria in the methodological assessment, giving it the highest score (68%) of all five studies. These stabilizing exercises were found to be significantly associated with a positive improvement in pain, with effect size scores of 1.49 and 0.98, and 1.49 being recorded for morning and evening pain, and the ODI, respectively.

However, in the study by Mens *et al.* (2000), a dropout rate of 25% ($n=4$) was reported for the participants in the stabilizing diagonal trunk muscle control group as a result of an increase in

Table 2. Summary of the five studies included in the systematic review: (PGP) pelvic girdle pain; (LBP) low back pain; (LPP) lumbopelvic pain; and (HEP) home exercise programme

Variable	Reference				
	Mens *et al.* (2000)	Stuge *et al.* (2004a)	Oh *et al.* (2007)	Gutke *et al.* (2010)	Ammar *et al.* (2011)
Pain area	Pelvis (PGP)	Pelvis (PGP)	Lower back (LBP)	Lumbopelvic region (LPP)	Lower back (LBP)
Pain area confirmed on objective assessment	Yes	Yes	Not stated	Yes	Not stated
Postnatal stage at commencement of trial	Between 6 weeks and 6 months post-partum	6–16 weeks post-partum	Immediately post-partum	8–12 weeks post-partum	4–28 weeks post-partum
Exercise intervention	(1) Diagonal or (2) longitudinal trunk muscle activation	Physiotherapy and specific stabilization exercises	Strengthening and stretching programme for the lumbar spine	Specific stabilization exercises	Specific stabilization exercises
Intervention group:					
method of exercise provision	Videotape for use at home	HEP with physiotherapy appointment progression	One class and then home videotape	HEP with individual guidance every other week	One physiotherapy session and then HEP
completed trial (*n*)	Group: (1) 16 (2) 14	40	27	33	17
intensity	30 min, three times a week	30–60 min, 3 days a week	20 min, three times a day, 3–5 days a week	10 repetitions of each exercise twice a day	45 min, three times a week
duration (weeks)	8	18–20	8	26 (6-month follow-up)	4
drop-out rate (*n*)	Group: (1) 4 (25%) (2) 1 (14%)	0	10	Not stated	2
mean age (years)	Group: (1) 30.7 (2) 32.3	32.4	28.3	32	Not stated
mean parity (*n*)	Group: (1) 2.0 (2) 1.1	1.8	Primiparous: 16 Multiparous: 11	2	Not stated
Control group:					
control intervention	Standard advice, resumption of activities of daily living and avoidance of exercise	Physiotherapy and stretching	No input	Information on PGP and resumption of normal activities	Stretching and general strengthening
completed trial (*n*)	14	41	25	53	17
duration (weeks)	8	18–20	8	Not stated	4
drop-out rate (*n*)	0	0	7	Not stated	3
mean age (years)	32.1	32.3	27.3	30.0	26.4
mean parity (*n*)	1.8	1.6	Primiparous: 12 Multiparous: 13	2	Not stated

pain. This was the only paper to describe an increase in pain after exercise. Along with Ammar *et al.* (2011), Mens *et al.* (2000) scored joint lowest for methodological quality, with both trials only meeting nine of the 19 methodological criteria (47%).

Data varied considerably between the five papers, with differing outcome measures, baseline characteristics, lengths of follow-up and statistical testing being reported in each. Therefore, although the feasibility of a meta-analysis was discussed with a statistician (Andrew Scally, University of Bradford, Bradford, UK), this was deemed inappropriate because of the lack of homogeneity between the studies.

Discussion

The aim of the present systematic review was to investigate whether prescribed exercise improves LBP and pelvic pain in the first year post-partum. The durations of the trials ranged from 4 to 20 weeks, and a variety of repetitions were recommended. The studies took place over 4 weeks (Ammar *et al.* 2011); 8 weeks (Mens *et al.* 2000; Oh *et al.* 2007); an implied length of 12 weeks, although this was unclear (Gutke *et al.* 2010); and 20 weeks (Stuge *et al.* 2004a). There was also a variation in the number of repetitions recommended throughout the week, ranging from two or three times a day (Mens *et al.* 2000; Gutke *et al.* 2010) to three times a week (Stuge *et al.* 2004a; Oh *et al.* 2007; Ammar *et al.* 2011). No overall conclusions could be drawn with regard to exercise duration, intensity and repetition because of this wide variation. Three of the five studies had study durations of no more than 8 weeks (Mens *et al.* 2000; Oh *et al.* 2007; Ammar *et al.* 2011). This is a relatively short period of time in which to achieve muscle strengthening and improved stability. National Health Service (NHS) Choices (2011) reported that exercise programmes are most effective if performed regularly over prolonged periods, and the NICE (2009) guidance on chronic LBP recommends gradually increasing the length of exercise sessions over several weeks until these amount to 150 min a week. This may be one reason why Stuge *et al.* (2004a), whose study took place over the longest period, achieved positive outcomes. However, prolonging the duration of exercise may also allow more time for the normalization of hormone levels to occur, as well as a reduction in other confounding variables such as tiredness and mood.

Two of the five studies (Mens *et al.* 2000; Oh *et al.* 2007) used videotape to deliver the exercises to the intervention and control groups. The reasons cited for this were that travel time would have been extensive for the participants, and that bias might be introduced if different physiotherapists instructed the classes. Oh *et al.* (2007) reported that the lack of an intervention effect in their study might have been influenced by the delivery of instructions via videotape, and acknowledged that this was a limitation. Personal guidance and supervision play important parts in the progression and compliance process of exercise prescription. Stuge *et al.* (2004a) reported that they chose personal instruction in order to improve quality of performance and increase motivation by guiding patients in their choice, dosage and optimal execution of exercise. Receiving guidance under instruction may also improve posture and position when performing exercise. Urquhart *et al.* (2005) stressed the importance of body position when performing exercises for LBP in order to ensure correct initiation of the appropriate muscle groups, something that may not be controlled when exercises are performed independently at home.

Two of the five trials in the present systematic review (Stuge *et al.* 2004a; Gutke *et al.* 2010) used additional physiotherapy along with exercise prescription. Both of these confounding variables present issues when trying to compare the studies. Moffett & McLean (2006) reported that, if pain is worsened during exercise, then pain can be minimized in most cases by appropriate use of passive physiotherapy treatments, which may help to alleviate pain sufficiently for patients to continue their active exercise regimen. Dries Hettinga, quoted by NHS Choices (2011), suggested combining a programme of exercise with a course of manual therapy, especially when the pain is persistent. This may be useful for groups whose back and pelvic pain is initially severe.

The secondary aims of the present systematic review included establishing whether patient demographics, mode of delivery, parity and age may influence the outcome of postnatal exercises, but these proved difficult to determine. Oh *et al.* (2007) specified that they excluded patients who had experienced surgical ''complications'' during labour or post-partum, but included those who had undergone Caesarean section, reporting rates of 22.2% ($n=6$) and 40% ($n=10$) in the intervention and control groups, respectively ($P=0.17$). Mens *et al.* (2000), Stuge *et al.*

(2004a), Gutke *et al*. (2010) and Ammar *et al*. (2011) made no mention of mode of delivery within their inclusion and exclusion criteria, and therefore, it has to be presumed that women who had undergone a surgical delivery would have been included in these studies. The baseline characteristics reported in Gutke *et al*. (2010) indicate that, respectively, 18% ($n=5$) and 17% ($n=7$) of the women included in treatment and control groups gave birth via Caesarean section. Mens *et al*. (2000), Stuge *et al*. (2004a) and Ammar *et al*. (2011) made no mention of delivery mode or how this could affect outcomes in either the baseline characteristics that they reported or anywhere else in their research. The paper by Oh *et al*. (2007) was the only one to document whether anaesthesia was used during delivery. The low incidence of reporting the use of anaesthesia in these papers may partly be a result of the low risk of epidural or spinal anaesthesia during delivery causing persistent post-partum back pain in the long term (Mogren 2007).

The present systematic review of five RCTs suggests that abdominal strengthening exercises appear to have either no influence or a positive effect on postnatal LBP and/or pelvic pain. No reliable conclusions can be made regarding other modes of exercise, exercise duration, the number of repetitions, the inclusion of manual therapy, and using an individual, group or videotape format to provide exercises.

Limitations

Although every effort was made to systematically obtain all the available literature, limitations are always likely and should be acknowledged. The paucity of studies meant that the present author included studies of poorer methodological quality than desired. Only Gutke *et al*. (2010) recorded the mean change from baseline by combining baseline statistics for the outcome measures for the control and experimental groups when analysing their data. The other four studies (Mens *et al*. 2000; Stuge *et al*. 2004a; Oh *et al*. 2007; Ammar *et al*. 2011) used mean pre- and post-trial outcome measure data, and considering the small group sizes, this could have affected the outcomes recorded and conclusions drawn.

Clinical and research implications

The papers identified in the literature search were of mixed methodological quality. Only five RCTs were identified, and these all focused on abdominal strengthening exercises. Considering the number of women who seek help for postnatal LBP and/or pelvic pain, as well as the many others who may not, better-quality research into a broader range of exercise should be completed.

Conclusions

Despite the apparently high prevalence of LBP and pelvic pain in the first year post-partum, the use of exercise to alleviate these problems has not been extensively researched. Only five RCTs could be found, and all focused on abdominal strengthening programmes. Although this form of exercise does not appear to exacerbate LBP and pelvic pain, there is currently limited evidence to suggest that any additional benefit is associated with it.

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References

American College of Obstetricians and Gynecologists (ACOG) (2002) *Exercise During Pregnancy and the Postpartum Period*. [WWW document.] URL http://www.acog.org/Resources%20And%20Publications/Committee%20Opinions/Committee%20on%20Obstetric%20Practice/Exercise%20During%20Pregnancy%20and%20the%20Postpartum%20Period.aspx

Ammar T. A., Mitchell K. & Saleh A. (2011) Stabilization exercises in postnatal low back pain. *Indian Journal of Physiotherapy and Occupational Therapy* **5** (1), 122–124.

Breen T. W., Ransil B. J., Groves P. A. & Oriol N. E. (1994) Factors associated with back pain after childbirth. *Anesthesiology* **81** (1), 29–34.

Caldwell D. M., Ades A. E. & Higgins J. P. T. (2005) Simultaneous comparison of multiple treatments: combining direct and indirect evidence. *BMJ* **331** (7521), 879–900.

Calguneri M., Bird H. A. & Wright V. (1982) Changes in joint laxity occurring during pregnancy. *Annals of the Rheumatic Diseases* **41** (2), 126–128.

Desmeules F., Roy J.-S., MacDermid J. C., *et al*. (2012) Advanced practice physiotherapy in patients with musculoskeletal disorders: a systematic review. *BMC Musculoskeletal Disorders* **13**: 107. DOI: 10.1186/1471-2474-13-107.

Downs S. H. & Black N. (1998) The feasibility of creating a checklist for the assessment of the methodological quality both of randomised and non-randomised studies of health care interventions. *Journal of Epidemiology and Community Health* **52** (6), 377–384.

Duthey B. (2013) *Update on 2004 Background Paper, 6.24 Low Back Pain*. [WWW document.] URL http://www.who.int/medicines/areas/priority_medicines/BP6_24LBP.pdf

Gustafsson J. & Nilsson-Wikmar L. (2008) Influence of specific muscle training on pain, activity limitation and kinesiophobia in women with back pain post-partum – a "single-subject research design". *Physiotherapy Research International* **13** (1), 18–30.

Gutke A. (2007) *Pelvic Girdle Pain and Lumbar Pain in Relation to Pregnancy*. Medical Dissertation, Department of Health and Society, Division of Physiotherapy, Faculty of Health Sciences, Linköping University, Linköping.

Gutke A., Sjödahl J. & Öberg B. (2010) Specific muscle stabilizing as home exercises for persistent pelvic girdle pain after pregnancy: a randomized, controlled clinical trial. *Journal of Rehabilitation Medicine* **42** (10), 929–935.

Howell C. J., Dean T., Lucking L., *et al*. (2002) Randomised study of long term outcome after epidural versus non-epidural analgesia during labour. *BMJ* **325** (7360), 357.

MacArthur C., Lewis W., Knox E. G. & Crawford J. S. (1990) Epidural anesthesia and long-term backache after childbirth. *BMJ* **301** (6742), 9–12.

Marnach M. L., Ramin K. D., Ramsey P. S., *et al*. (2003) Characterization of the relationship between joint laxity and maternal hormones in pregnancy. *Obstetrics and Gynecology* **101** (2), 331–335.

Mens J. M. A., Snijders C. J. & Stam H. J. (2000) Diagonal trunk muscle exercises in peripartum pelvic pain: a randomized clinical trial. *Physical Therapy* **80** (12), 1164–1173.

Moffett J. & McLean S. (2006) The role of physiotherapy in the management of non-specific back pain and neck pain. *Rheumatology* **45** (4), 371–378.

Mogren I. M. (2007) Does caesarean section negatively influence the post-partum prognosis of low back pain and pelvic pain during pregnancy? *European Spine Journal* **16** (1), 115–121.

National Health Service (NHS) Choices (2011) *Exercises for Back Pain*. [WWW document.] URL http://www.nhs.uk/Livewell/Backpain/Pages/Backexercises.aspx

National Institute for Health and Clinical Excellence (NICE) (2009) *Low Back Pain: Early Management of Persistent Non-specific Low Back Pain*. NICE Clinical Guideline 88. National Institute for Health and Clinical Excellence, London.

Nilsson-Wikmar L., Holm K., Öijerstedt R. & Harms-Ringdahl K. (2005) Effect of three different physical therapy treatments on pain and activity in pregnant women with pelvic girdle pain: a randomized clinical trial With 3, 6, and 12 months follow-up postpartum. *Spine* **30** (8), 850–856.

Office for National Statistics (ONS) (2012) *Births and Deaths in England and Wales, 2011 (Final)*. [WWW document.] URL http://www.ons.gov.uk/ons/dcp171778_279934.pdf

Oh H.-E., Lee Y.-S., Shim M.-J. & Kim J.-S. (2007) Effects of a postpartum back pain relief program for Korean women. *Journal of Korean Academy of Nursing* **37** (2), 163–170.

Östgaard H. C. & Andersson G. B. J. (1992) Postpartum low-back pain. *Spine* **17** (1), 53–55.

Royal College of Obstetricians and Gynaecologists (RCOG) (2006) *Exercise in Pregnancy (RCOG Statement 4)*. [WWW document.] URL http://www.rcog.org.uk/womens-health/clinical-guidance/exercise-pregnancy

Stephenson R. G. & O'Connor L. J. (2000) *Obstetric and Gynaecologic Care in Physical Therapy*, 2nd edn. SLACK Incorporated, Thorofare, NJ.

Stuge B., Lærum E., Kirkesola P. & Vællestad N. (2004a) The efficacy of a treatment program focusing on specific stabilizing exercises for pelvic girdle pain after pregnancy: a randomized controlled trial. *Spine* **29** (4), 351–359.

Stuge B., Veieræd M. B., Lærum E. & Vællestad N. (2004b) The efficacy of a treatment program focusing on specific stabilizing exercises for pelvic girdle pain after pregnancy: a two-year follow-up of a randomized clinical trial. *Spine* **29** (10), E197–E203.

To W. W. K. & Wong M. W. N. (2003) Factors associated with back pain symptoms in pregnancy and the persistence of pain 2 years after pregnancy. *Acta Obstetricia et Gynecologica Scandinavica* **82** (12), 1086–1091.

Tregear G. W., Ivell R., Bathgate R. A. & Wade J. D. (eds) (2000) *Relaxin 2000: Proceedings of the Third International Conference on Relaxin & Related Peptides 22–27 October 2000, Broome, Australia*. Kluwer Academic Publishers, Dordrecht.

Urquhart D. M., Hodges P. W., Allen T. J. & Story I. H. (2005) Abdominal muscle recruitment during a range of voluntary exercises. *Manual Therapy* **10** (2), 144–153.

Vleeming A., Albert H. B., Östgaard H. C., Sturesson B. & Stuge B. (2008) European guidelines for the diagnosis and treatment of pelvic girdle pain. *European Spine Journal* **17** (6), 794–819.

Wu W. H., Meijer O. G., Uegaki K., *et al*. (2004) Pregnancy-related pelvic girdle pain (PPP), 1: Terminology, clinical presentation, and prevalence. *European Spine Journal* **13** (7), 575–589.

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