EFFECT OF THERAPEUTIC EXERCISES ON PREGNANCY-RELATED LOW BACK PAIN AND PELVIC GIRDLE PAIN

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About 76% of pregnant women report low back pain (LBP) at some point during pregnancy (27), 20% of women experience pelvic girdle pain (PGP) during pregnancy (3) and the cause is probably multifactorial. The pain tends to increase with advancing pregnancy and negatively affects quality of life. The purpose of this article is to assess whether application of the specific therapeutic exercises positively affects course and outcome of pregnancy-related LBP and PGP. Comprehensive database search was performed during June, 2012 within PubMed, OvidSP, and PEDro with the purpose of finding RCTs on exercise effects for pregnancy-related LBP and PGP. The number of found studies is relatively small, thirteen, with overall methodological quality not satisfactory and the results should be interpreted with caution. Moreover, the results are inconsistent and the effects recorded rather insignificant. Although type, frequency, intensity, and duration of exercises vary in the studies, authors mostly used stabilising exercises for lumbopelvic area and aquatic exercises. Preliminary results are promising, nevertheless the definitive clinical meaning still cannot be determined with certainty. Adding specific exercises to the usual prenatal care seems to reduce back and pelvic pain, however, higher quality research needs to be conducted to determine optimal plan of exercise intervention.

Keywords: pregnancy, low back pain, pelvic girdle pain, exercises, stabilisation

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Introduction

Low back pain (LBP) and pelvic girdle pain (PGP) is a common problem during pregnancy inducing lower quality of life, work absenteeism and disability. Pregnancy-related LBP and PGP can be defined as lower back and pelvis recurrent or continuous pain for more than 1 week (36). LBP is usually defined by the pain between 12th rib and the gluteal fold and it may radiate down a leg (55). Pelvic pain can be defined as the pain between posterior iliac crest and the gluteal fold, particularly in the vicinity of the sacroiliac joints. It may radiate in a posterior thigh and can occur in conjunction with, or exclusive, pain in the symphysis (55). The diagnosis of PGP can be reached after exclusion of lumbar pathology (55). Lumbopelvic pain is used where there is no distinction between PGP and LBP. Previously, LBP and PGP were considered as one condition, but today it is clear that they are two distinct conditions (34). There is no international agreement on how to differentiate PGP from LBP, but recommendations for classification of PGP exist (55).

Correct treatment is hampered by several factors with the lack of clear definition and pathogenesis being the most important. The lack of precise definition and large variety of study designs caused inconsistent reporting of incidences of lumbopelvic pain which vary between 4% and 76.4% (3, 31, 41, 48). Incidence for PGP is 20.1% (3). PGP can be classified in 5 subgroups with various incidences (3): pelvic girdle syndrome (6%), symphysiolysis

(2.3%), one-sided sacroiliac syndrome (5.5%), double-sided sacroiliac syndrome (6.3%) and miscellaneous pain (1.6%). The risk of PGP relapse in subsequent pregnancies has been reported to be 85% (32). Considering the low back pain prevalence of around 6% among general population of 30 year old women (7) it becomes clear that pregnancy-related LBP and PGP represent important problems.

Pain generally increases as pregnancy advances, having negative effect on daily activities, such as walking, lifting, climbing stairs, lying flat on the back, housework and employment, hobbies and leisure (59). The problem is usually worse at night, especially in the last trimester. The onset of pain is usually by weeks 17-19 and number of incidences peak by weeks 24-36 (41). Twenty to thirty percent of pregnant women describe their pain as severe and disabling (8, 23, 41). Pregnant women with PGP are more disabled than those with LBP, have higher pain scores and are perceived to be more difficult to treat than pregnant women with LBP (6, 18, 43, 49). Also, women being classified with both LBP and PGP in pregnancy have much stronger odds ratio for persistent pain (20). Postpartum depressive symptoms are 3 times more prevalent in women with lumbopelvic pain than in those without (19). Pain location is possibly an important predictor of recovery, namely, less than 10% of pregnant women having pain in two joint regions or less had PGP 2 years after delivery, compared to 21% of those with pain in all three joints (17). 5-27% women have persisting pain 1-3 months after delivery (2, 18, 22) and 7% have remaining pain 6 years after delivery (45). Two years after delivery prevalence equals that of the general population (45). High pain intensity indicates bad prognosis after delivery (44).

Pathogenesis and etiology of pregnancy-related lumbopelvic pain is unclear and probably multifactorial. High incidence of lumbopelvic pain is probably caused by several factors, such as altered posture with increased lumbar lordosis, and ligamentous laxity caused by relaxin and fluid retention within connective tissues (28). Possible mechanism for pain and disability in pregnant women with PGP may be abnormal motor control patterns since positive changes in motor control are associated with reductions in pain and disability (40, 52, 53). During the last months of pregnancy and the first 3 weeks after delivery, motion of the pelvic girdle joints is 32-68% higher in patients with lumbopelvic pain than in healthy controls (35). This finding supports the idea that heightened motion is one of the factors that causes pain and justifies a treatment with measures to reduce this motion (35).

Physically and psychosocially demanding working conditions like physically strenuous work, rotating shifts, night shifts and high job strain are associated with an increased reporting of pelvic pain in pregnancy (25). Additionally, parity, previous trauma to the pelvis, previous LBP and PGP, abnormal BMI, history of hypermobility and amenorrhea are factors influencing the risk of developing lumbopelvic pain (36, 55). ASLR test and belief in improvement are strong predictors of clinical significance in women with PGP postpartum (56). Predictors of having persistent PGP or combined PGP and LBP pain after delivery are, to name a few, low endurance of back flexors, older age, combined pain in early pregnancy, and work dissatisfaction (20). For every 10 seconds lost in endurance, the risk of PGP or combined pain postpartum increased by a factor of 1.18 and for every year older the risk increased by a factor of 1.20 (20). Low endurance of back flexors may be a covariant factor that partly explains previous LBP (20). Epidural or spinal anaesthesia is not associated with long term risk of persistent LBP, but elective caesarean section is significantly associated with an increased risk of persistent LBP after pregnancy compared to emergency caesarean section (37).

Non-pharmacological interventions for LBP and PGP treatment consist of exercise therapy, aquatic therapy, acupuncture, ergonomic advice, use of pelvic belt, and other physiotherapy modalities. The purpose of this article is to assess whether application of specific therapeutic exercises positively affects course and outcomes of pregnancy-related LBP and PGP. A review was undertaken to update knowledge of the available evidence for exercise therapy interventions in pregnancy-related LBP and PGP compared with other treatments or no treatment. The secondary objective is to consider necessary elements for clinical implementation of exercises and future research.

Methods

A comprehensive database search was performed during June, 2012 within PubMed, OvidSP and PEDro with the purpose of finding RCTs on exercise effects for pregnancy-related LBP and PGP. The databases were searched chronologically from inception until June 29th, 2012. Keywords and their combinations were: «pregnancy», «low back pain», «pelvic pain», «exercise», «aquatic therapy», «physiotherapy», and «hydrotherapy». Inclusion criteria were defined using PICO model (population, intervention, control/comparison and outcome):

- Population: women during pregnancy
- Intervention: all types of exercise therapy on land and aquatic exercise therapy
- Control/comparison: RCTs
- Outcomes: disability and pain questionnaires, VAS, days of sick leave

Results

Thirteen articles met the inclusion criteria for this review (table 1) and included 3229 participants. The number of found studies is relatively small, with overall methodological quality not satisfactory and the results should be interpreted with caution. Moreover, the results are inconsistent and the effects recorded rather insignificant. Most commonly assessed outcomes were pain and disability, but outcomes, methods of outcome measurement, time and number of measurements varied through articles. A meta-analysis could not be performed and effect size could not be calculated because of the heterogeneity of participants and the outcome measurements. Also, definition of LBP and PGP varied through studies, and some of the articles did not differentiate between LBP and PGP.

Most of the studies compared some type of exercise to standard care (10, 11, 16, 26, 24, 30, 38, 39, 50, 51, 54), and two studies compared exercise therapy to acupuncture and exercise therapy vs. acupuncture vs. standard care (58, 12). Duration of interventions was from 1 week to 20 weeks, but most of the interventions were conducted for 8-12 weeks. Sample size varied from 60 to 761 pregnant women. Gestational ages varied across three trimesters having majority of the interventions in the second half of the pregnancy. Types of interventions included stabilisation exercises (10, 11, 12, 24, 39), water gymnastics (26), combination of land and aquatic exercises and other physiotherapy modalities (58), exercises for global muscle activity and stretching (30), combination of pelvic floor, aerobic and additional exercises (16, 38, 50, 51) and pelvic tilt exercise (54). Two studies included aquatic exercise, as a part of the multimodal physiotherapy program (58) or as the main intervention (26). Most of the studies found positive effect of exercise therapy on pain and disability (10, 12, 16, 26, 30, 38, 50, 54), but some did not find significant difference to standard care (11, 24, 39, 51, 58).

Acupuncture, compared to multimodal physiotherapy program (58) and stabilizing exercises (12) showed superior results. Wedenberg et al (58) conducted randomised controlled trial to compare 10 sessions of acupuncture to 10 sessions of multimodal physiotherapy program which included education, posture correction, pelvic belt, soft tissue mobilisation and exercises on land and in water 1 to 2 times/week within 6-8 weeks. Research included 60 pregnant women prior to the 32nd week of gestation. Measured outcomes were disability (Disability Rating Index) and pain (VAS). Mean VAS values were lower after acupuncture than after physiotherapy both in the morning (3.4 to 0.9, 3.7 to 2.3 respectively, $p = 0.02$), as well as in the evening (7.4 to 1.7, 6.6 to 4.5 respectively, $p<0.01$). Mean DRI values had decreased significantly in the acupuncture group than in the physiotherapy group where no significant changes had occurred. However, 12 participants from the exercise group dropped out of study so it is difficult to determine clinical significance. Elden et al (12) had similar results on much larger sample (386 pregnant women in 12-31 week of gestation). They had two experimental groups, where the first group had acupuncture for 6 weeks, advice, home exercise program and pelvic belt, while the second group had 6 hours of specific individual stabilisation exercises, advice, home exercise program and pelvic belt for 6 weeks. Controls received standard care plus advice, pelvic belt and home exercise program. Specific individual stabilisation exercises started by emphasising activation and control of local deep lumbopelvic muscles. Training of more superficial muscles in dynamic exercises to improve mobility, strength and endurance capacity was gradually introduced. After the treatment, the stabilising exercise group had less pain in the morning ($p=0.03$; difference in medians: 9; 95% CI 1.7 – 12.8; $p=0.312$) and in the evening ($p=0.02$; difference of medians: 13; 95% CI 2.7-17.5; $p=0.0245$) than the standard group. The acupuncture group had less pain in the evening than the stabilising exercise group ($p=0.01$; difference of medians: -14; 95% CI -18 to -3.3, $p=0.0130$). There were no significant differences in positive pain drawings between the groups: 93% of those receiving usual care, 85% of those receiving acupuncture and 87% of those receiving physiotherapy reported pain.

Sixty minutes of group exercise, once a week, during 12 weeks including pelvic floor muscle contractions twice a day and education is effective in reducing the prevalence of lumbopelvic pain in pregnancy ($p=0.01$) compared to controls which received only information (38). The program consisted of daily pelvic floor muscle training at home and weekly group training including aerobic exercises, pelvic floor muscle and additional exercises, and information related to pregnancy. The program prevented lumbopelvic pain in 1 in 8 women. However, intensity of pain was not measured. There was no difference in sick leave during pregnancy, however women in the training group had significantly ($p=0.01$) higher scores on functional status. Research included 301 healthy pregnant women in 20th week of gestation. Measured outcome was disability (Disability Rating Index), but reported clinical relevance was less than 10%. Martins & Pinto e Silva (30) found similar results in their study on much smaller sample of 69 pregnant women after 12th week of gestation. Intervention consisted of exercises in groups for global muscle activity and stretching, whereas controls received standard care only. 61% of women from the experimental group reported no pain at lumbar or posterior pelvic area, compared to only 11% of women from the control group ($p=0.01$). Sedaghati et al (50) conducted research to assess effect of exercise program on 90 healthy pregnant women. Intervention started between 20th and 22nd week. It consisted of three exercise sessions per week for 8 weeks. Measured outcome was pain (Quebec Low Back Pain Questionnaire). Low back pain was increased slightly in the exercise group. The control group showed significant increase in the sensitivity of low back pain ($p < 0.0001$). Authors did not measure disability or other outcomes. Garshasbi & Faghih Zadeh (16) conducted randomised controlled research to investigate the effect of exercise during pregnancy on the intensity of low back pain and kinematics of spine. 107 women participated in an exercise program three times a week for 60 minutes during second half of pregnancy for 12 weeks. Intervention consisted of 15 exercises for abdominal and hamstring muscles and for increasing flexibility of iliopsoas and paravertebral muscles. 105 controls received standard care. At the end of the program low back pain intensity was increased in the control group and the exercise group showed significant reduction in the intensity of low back pain after exercise ($p<0.0001$). Flexibility of spine decreased more in the exercise group ($p<0.0001$).

Nillson-Wikmar et al (39) came to a different conclusion. Their study included 118 pregnant women with PGP before 35th week of pregnancy. Clinic exercise group received information, sacroiliac belt and participated in a training program comprised of 4 different strengthening and stabilisation exercises twice a week. Exercises were performed until gestation week 39 and the time between inclusion and week 38 was 16 weeks (range 4-27 weeks). Women in the clinic exercise group exercised on average 16 times. Home exercise group received information, sacroiliac belt and home exercise program consisting of 3 exercises aiming to stabilise pelvis. The number of exercise occasions in the home exercise group was not recorded. Information group received only information and sacroiliac belt. There were no significant differences between 3 groups during pregnancy or at follow-ups postpartum regarding pain and activity. Authors concluded that home or clinic exercises had not had any additional value compared to the information and sacroiliac belt. Haugland et al (24) obtained similar results. They assessed whether a group intervention program for pregnant women with pelvic girdle pain in second half of pregnancy had any effect on pain and daily function postpartum. Intervention group (n=275) participated in an education program that consisted of information, ergonomics and exercises once a week for 4 weeks. Controls (n=285) were not offered any treatment, however, 60% of the control group searched for an alternative treatment. There were no statistically significant differences between groups regarding pain, but self-evaluated utility of the intervention group was high in the intervention group. Intervention was organised in small groups of maximum five women and the groups had one session for 2h once a week for 4 consecutive weeks.

The two most recent studies also could not confirm positive effects of group exercise in pregnancy (11, 51). Eggen et al (11) conducted randomised controlled trial about effects of exercise on prevalence of LBP and PGP in pregnancy. They included 257 healthy pregnant women. Experimental group was included in a guided exercise program and received ergonomic and home exercise advice. Guided exercises were conducted once a week for 60 minutes, from gestational week 16 to gestational week 36. The purpose of the exercises was to achieve efficient motor control and ability to dynamically control and stabilise the lumbopelvic region during daily activities. The exercises focused on activity of pelvic floor muscles and transversely oriented abdominal muscles with coordinated activity of global muscles. There was no effect on prevalence of LBP (OR 0.77; 95% CI 0.50-1.19) or PGP (OR 1.03; 95% CI 0.66-1.59). Additionally, there were no significant differences in pain intensity and disability between groups. Stafne et al. (51) studied lumbopelvic pain in 765 women randomised to a regular exercise program during pregnancy in comparison to women receiving standard antenatal care. The intervention included aerobic and strengthening exercises conducted between 20 and 36 weeks of pregnancy. Exercises were led by physiotherapists once a week, while twice a week women were encouraged to exercise at home. There were no significant differences between groups of women reporting pain at 36 weeks (74 vs. 75%, $p=0.76$). Proportion of sick leave was lower in the intervention group (22 vs. 31%, $p=0.01$).

Home exercises three times a day for one week improved functional outcome measured by Roland Morris Questionnaire and Patient Specific Functional Scale (10). Research included 90 pregnant women in three groups. First group only exercised, second group exercised and used rigid pelvic belt and third group exercised and used non rigid pelvic belt. Mean number of exercise sessions in the first group was 17. There was significant reduction in the Roland Morris Questionnaire score, Patient Specific Functional Score and pain scores in all groups. There were no significant differences between groups, with the exception of average pain score. The worst pain scores decreased by 22.6%, 12.7%, and 10.8% for the exercise-only group, the group receiving exercise plus a nonrigid belt, and the group receiving exercise plus a rigid belt, respectively. In the first group, Rolland Morris Questionnaire score decreased by 27.7% with a five point difference (31.25%). Patient-Specific Functional Scale reduced by 38.6% for the exercise-only group with a two point difference (20%). Pelvic belt did not add any benefit.

Kihlstrand et al (26) compared aquatic exercise, once a week for 1 hour during 20 weeks with standard care. Study was conducted on 258 pregnant women before 19th week of gestation. Measured outcomes were pain, sick leave and adverse effects. Experimental group significantly reduced intensity of pain, sick leave and there were no adverse effects. Pelvic tilt exercise 5 times a week for 8 weeks in third trimester also reduced pain intensity without any adverse effects on neonatus (54). The mean VAS of back pain in the experimental group was significantly lower at day 56 than at day 0 and lower than the control group at day 56 ($p < 0.05$) by unpaired t-test.

Generally, pregnant women who participated in exercise programs additional to their standard antenatal care reported less pain and disability which is in accordance with previous systematic review (48) but not all studies give evidence for this positive effect. Methodological quality of most studies was rather poor and carries a high potential for biased results. Some authors did not use adequate methods of allocation of participants and some did not report if the main assessor was blinded. Participants were not blinded due to the nature of the interventions. Regardless, overall results are promising and show reduction in pain intensity, increase in the ability to perform daily activities and a decrease in number of sick days. There were no adverse effects on pregnancy and fetus/neonatus.

Discussion

Pregnant women without contraindications should engage in regular, moderate-intensity physical activity during pregnancy (5). On the other hand, pregnant women reduce their physical activity and those with lumbopelvic pain are less likely to exercise regularly (47). Observational studies have demonstrated that physical activity before pregnancy may reduce risk of developing lumbopelvic pain (36, 43). However, sedentary coping strategies are more frequent than exercising in women with lumbopelvic pain (9). Thus, inactivity leads to deconditioning and there is association between reduced muscle function and lumbopelvic pain in pregnancy (20). Moreover, lack of physical activity is associated with a large number of possible complications during pregnancy and childbirth. Supervised exercise program is recommended as a first-line treatment for patients with nonspecific chronic low back pain (1). Manual therapy, specific training of the local muscles and education are also effective in increasing functional capacity and reducing the symptoms. Also, there is evidence that therapeutic aquatic exercise is beneficial for non specific low back pain (57). Specific stabilisation exercise is an effective treatment option for many forms of spinal pain and related disability (14).

Knowledge concerning primary and secondary prevention and treatment of LBP and PGP in pregnancy is limited. Exercise before pregnancy might reduce the risk for LBP during pregnancy, but there is limited benefit for women with PGP (36, 43). On the other hand, no study has reported adverse effect of stabilising exercises on the pregnancy and fetal outcomes (13) and prospective epidemiology study of 92 671 pregnant women has reported no association between exercise performed after 18 weeks of gestation and risk of miscarriage (29). Individual exercises, led by physiotherapists and group exercises improve functional outcomes. Specific stabilisation exercises for transversely oriented abdominal muscles which also include both local and global muscles showed most benefit for LBP and PGP. Various parameters for training (duration, intensity, timing, frequency etc.) are not researched enough and evidence is very limited. Role of specific exercises in early pregnancy is virtually unknown. Variability of treatment, different timing and measurement instruments make it impossible to calculate overall estimate of the effect. Overall, it seems that pregnant women included in exercise therapy, regardless of timing and type of exercise therapy, have less intensive pain and disability than those who receive only standard care. However, it is impossible to exclude possible placebo effect.

Exercise programs can be applied also during postpartum period, but the results are equally incoherent and evidence is scarce. Postpartum use of specific stabilising exercises for women with residual pelvic girdle pain showed statistically and clinically significant lower pain intensity, lower disability and higher quality of life compared with control group which received physical therapy without specific stabilising exercises (52, 53). Stuge et al (52, 53) used specific training of transversely oriented abdominal muscles with coactivation and training of other local muscles. Focus was initially on transversely oriented abdominal muscles and loading was progressively increased, including both local and global muscles. Significant differences between groups persisted with continued low levels of pain and disability in the specific stabilising exercise group 2 years after delivery. Previous study conducted by Mens et al (33) showed no beneficial effect of the exercise program for diagonal trunk muscles compared with placebo exercises and no exercises at all. They did not include exercises for transversely oriented abdominal muscles. Neither has the study conducted by Gutke et al (21) showed significant differences between groups regarding disability, health related quality of life and reducing pain after specific stabilising exercises targeting the local trunk muscles for postpartum PGP. Treatment with home-training concept of specific stabilising exercises focused on the transversely oriented abdominal muscles, lumbar multifidi and pelvic floor muscles for persistent postpartum pelvic girdle pain was not more effective than natural course. Global muscles were not included in the study, while Stuge et al (52, 53) included both local and global muscles.

Therapeutic aquatic exercise is potentially beneficial for pregnancy-related low back pain but there is further need for high quality trials to substantiate the finding in a clinical setting (57). Aquatic therapy decreases axial loading of the spine and is theoretically ideal and safe medium for pregnant women to exercise (57). A study by Kihlstrand et al (26) indicated that 98% of pregnant women would recommend aquatic therapy to other pregnant women and would also participate in aquatic exercise during their subsequent pregnancy.

Group exercises might not be optimal solution in prevention and treatment of lumbopelvic pain. The European guidelines for PGP (55) recommend individualised exercises in pregnancy. Supervision of exercises is very important for maintaining quality of exercise performance and there is strong correlation between quality of exercise performance and decrease of pain (15). Group exercises during pregnancy might be more suitable in reducing LBP than PGP.

Methodological quality of conducted studies is very variable. Heterogeneity of participants and interventions is the main limitation of this review and does not allow precise comparison and calculation of the effect size. There are large differences among gestational age, sample size, type of intervention, mode of intervention, duration, timing and frequency of intervention and measured outcomes. Also, definition of LBP and PGP is not universal among studies. Different gestational age of participants is especially large problem because pain tends to increase as pregnancy advances. There are several variables which affects pregnancy-related back pain including the time of day, trimester of pregnancy, mental health status, work place factors, previous experience of back pain, hypermobility and maternal age (4, 19, 25, 27, 36, 41, 42, 46). Most of the trials do not provide information about these variables. Also, there is no consensus in literature regarding most valid and reliable outcome measures for pregnancy-related LBP and PGP. Use of different methods for outcome measurement affects the possibility to interpret effect of different interventions for the same pathology and it is impossible to distinguish whether the difference is the result of a different outcome measurement or the intervention.

Conclusion

Level of evidence for therapeutic exercise intervention is still limited as a result of small number of RCTs of various methodological qualities. Quality of evidence is moderate to strong with heterogeneity of participants, instruments of outcome measurement and blinding of assessors. Still, exercise seems to be more effective than the standard antenatal care. There is need for adequate, reliable and valid instruments for outcome measurements, clinical tests, and better consensus on precise definition of LBP and PGP. Research design should include variables like the time of day, trimester of pregnancy, work conditions, stress level, BMI, hypermobility and previous experience with LBP and PGP. Exercise programs added to the standard antenatal care seem to reduce intensity of pain in lumbopelvic area and disability. It is not known to what extent the dosage and type of exercises affect LBP and PGP. More high quality research is needed to identify the most effective elements of training, especially with high rate of reported incidence of pregnancy-related LBP and PGP. Further research should also focus on specific training parameters, timing of intervention, possible preventive role of exercise in early pregnancy and better understanding of etiology and pathophysiology of pregnancy-related LBP and PGP.

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Table 1. Details of all included randomised trials

Authors	Sample (n of pregnant women)	Intervention	Duration of intervention (in weeks)	Outcome measures	Results	Positive effect of therapeutic exercises
Kihlstrand et al, 1999	258; ≤ 19 week of gestation	EG (n=129): 1-hour weekly water gymnastics, 20x CG (n=129): no treatment	20	VAS, sick leave, adverse effects	Reduced intensity of pain, reduced sick leave	+
Wedenberg et al, 2000	60 ; ≤ 32. week of gestation	EG (n=30): acupuncture, 10x CG (n=30, 12 dropped out): multimodal PT (including exercises), 1-2 weekly, 10x	6-8	Disability Rating Index, VAS	Reduced intensity of pain compared to CG, but not acupuncture group	+/-
Suputtitada et al, 2002	67, 3rd trimester	EG (n=32): sitting pelvic tilt exercise, twice a day, 5 days/week CG (n=35): standard care	8	VAS at day 0 and day 56 in both groups, neonatal parameters	Reduced intensity of pain	+
Martins & Pinto e Silva, 2005	69; > 12 weeks of gestation	EG (n=33): exercises in groups for «global activity and stretching» CG (n=36): routine medical recommendations	12	VAS, provocation tests	Reduced intensity of pain	+
Depledge et al, 2005	90; different gestational age	EG1 (n=30): exercises, advice, rigid pelvic belt EG2 (n=30): exercises, advice, non rigid pelvic belt CG (n=30): exercises, advice	1	Rolland Morris Questionnaire, Patient-Specific Functional Scale, NRS-101	Reduction of disability and pain in all groups; best pain reduction in exercise-only group	+
Elden et al, 2005	386	EG1 (n=125): acupuncture, advice, home exercise, pelvic belt EG2 (n=131): specific individual stabilization exercise, advice, home exercise, pelvic belt CG (n=130): standard care, advice, home exercise, pelvic belt	6	VAS, examiner assessment	Reduced intensity of pain compared to CG, but not acupuncture group,	+/-
Garshasbi & Faghih Zadeh, 2005	212; 2nd half of pregnancy	EG (n=107): 15 exercises, 60 min, 3x weekly CG (n=105): standard care	12	KEBEK questionnaire; degree of lordosis and flexibility of the spine	Reduction in the intensity of LBP, more spine flexibility	+
Nilsson-Wikmar et al, 2005	118; before week 35, PGP	EG1 (n=37): information, nonelastic sacroiliac belt, in clinic exercise EG2 (n=41): information, nonelastic sacroiliac belt and home exercise program CG (n=40): information, nonelastic sacroiliac belt	16	VAS, Disability Rating Index	No significant difference regarding pain and activity	-
Haugland et al, 2006	560; 18-32 weeks of gestation, PGP	EG (n=275): information, ergonomics/body posture, exercises CG (n=285): no treatment	4	VAS, self-evaluated utility	No significant differences	-
Mørkved et al, 2007	301; from week 20	EG (n=148): daily pelvic floor muscle training at home and weekly group training CG (n=153): standard care	12	Self-reported symptoms, sick leave and functional status - DRI	Significantly less lumbopelvic pain and better functional scores. No difference in sick leave.	+
Sedaghati et al, 2007	90; 20-22 weeks of gestation	EG (n=40): exercise program, 3 sessions a week CG (n=50): standard care	8	Quebec Low Back Pain Questionnaire	Reduced intensity of low back pain	+
Eggen et al, 2012	257; before 20 weeks of gestation	EG (n=129): supervised weekly exercises, local + global muscles, advice, home exercise CG (n=128): standard care	20	Self-reported LPB and PGP, pain intensity, SF-8, MCS	No significant difference on pain or disability	-
Stafne et al, 2012.	761; between weeks 20-36	EG (n=396): exercise program 1x weekly, 2x weekly home exercises	12	Self reports of pain and sick leave Reduced	No significant differences on pain, less sick leave	+/-

		CG (n=365): standard care		intensity of pain compared to CG, but not acupuncture group,		

EG = experimental group; CG=control group