Evaluation of the efficacy of an exercise program for pregnant women with low back and pelvic pain: a prospective randomized controlled trial

Serpil Ozdemir, Hatice Bebis, Tulay Ortabag & Cengizhan Acikel

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Abstract

Aim. To evaluate the effect of exercise programs on pregnant women with pregnancy-related low back and pelvic pain.

Background. Low back and pelvic pain during pregnancy is a major health problem due to its frequent occurrence and such pain can limit pregnant women in many of their daily activities.

Design. A randomized trial with a control group \( n = 48 \) and an intervention group \( n = 48 \). Trial registration number NCT02189356.

Methods. Department of Obstetrics and Gynecology, between December 2011–May 2012, an Education and Research Hospital in Turkey. Based on the intention-to-treat principle, all pregnant women were analysed according to the group they were assigned to, regardless of whether they received the intervention or not. Participants in the intervention group received health counselling and exercised regarding low back and pelvic pain for four weeks. The pregnant women in the control group received usual care, comprised of routine clinical practice for pregnancy-related low back and pelvic pain.

Results. According to Mann–Whitney U test analysis results, there was a statistically significant difference between the control and intervention groups' Visual Analogue Scale during relaxation scores and Visual Analogue Scale during activity scores at the end of the study. According to Mann–Whitney U test analysis results, the change in the mean Oswestry Disability Index score for the intervention group and the difference in the mean scores between the two groups was statistically significant.

Conclusions. A four-week exercise program including individualized health counselling to relieve low back and pelvic pain improved the functional status in pregnant women.

Keywords: pregnancy-related low back and pelvic pain, exercise program, nurse
Why is this research or review needed?
• Previous studies have reported that one quarter of women with low back and pelvic pain during pregnancy had severe pain.
• In previous studies, 8-36% of women with low back and pelvic pain during pregnancy had various degrees of functional impairment.
• Although some studies have reported that exercise programs are effective for pregnancy-related low back and pelvic pain, there were also studies with conflicting findings.

What are the key findings?
• Although this study was conducted in a small sample, regular exercises during pregnancy may substantially relieve or resolve pregnancy-related low back and pelvic pain.
• Regular exercises during pregnancy may promote improved functional status.

How should the findings be used to influence policy/practice/research/education?
• Pregnant women could always be asked about low back and pelvic pain at prenatal clinic visits.
• Services that include preventive approaches to low back and pelvic pain could be provided to pregnant women with pregnancy-related low back and/or pelvic pain and regular exercise programs should be implemented.

Introduction

Every woman has the right to a healthy pregnancy (Taşkin 2007). Some health problems that arise due to the natural course of pregnancy may negatively affect maternal and foetal health (Mogren 2000, Pennick & Young 2007, Pennick & Liddle 2013). Low back and pelvic pain (LBPP) is one of the most frequently reported disorders in pregnancy all over the world (Mogren 2000, Pennick & Young 2007, Elden et al. 2008, Chang et al. 2011, Pennick & Liddle 2013), beginning during pregnancy and continuing until the postpartum period. Also LBPP is not necessarily an unhealthy symptom— it is a symptom that is common in healthy pregnancies (Taşkin 2007, Verstraete et al. 2013). LBPP may recur during subsequent pregnancies and have lifelong effects (Damen et al. 2001, Röst et al. 2006, Chang et al. 2011, 2012). Previous studies have reported that between 20% and 90% of women experience LBPP during pregnancy (Perkins et al. 1998, To & Wong 2003, Albert et al. 2006, Mazicioglu et al. 2006, Robinson et al. 2006, Kalus et al. 2008, Ji & Ha 2010, Vermani et al. 2010, Bjelland et al. 2011), making LBPP in pregnancy a major women’s health and public health issue (Wang et al. 2004, Bastiaansen et al. 2005a,b, Mogren & Pohjanen 2005).


Prevention, early diagnosis and treatment of pregnancy-related LBPP may protect, maintain and improve the health of pregnant women, positively affecting both the health of individuals and public health.

Background

Although pregnancy-related LBPP is a major women’s health problem, options for pain management remain limited due to the potential harm to the foetus (Perkins et al. 1998, Kanakaris et al. 2011, Saccomanni 2011). Further obstacles to the proper prevention, diagnosis and treatment of LBPP include a lack of knowledge of current treatment options and the assumption that pain is ‘a natural consequence of pregnancy’ by both pregnant women and clinicians (Vermani et al. 2010, Kanakaris et al. 2011). It has been reported that only 32% of the pregnant women with LBPP mentioned their pain to a healthcare professional and that 75% of healthcare professionals did not use any treatment method to manage the pain (Wang et al. 2004). However, there is evidence that pregnant women desire information from healthcare professionals regarding the prevention and reduction in LBPP during the prenatal clinic visits.
visits (Greenwood & Stainton 2001). Nurses who provide basic health care during prenatal clinic visits play an important role in the prevention and treatment of LBPP and in meeting the expectations of their patients (Shima et al. 2007).

Reports from the literature characterize pregnancy-related LBPP as a preventable and treatable health problem (Reeder et al. 1997, Pillitteri 2007). Professional nurses may protect women’s health during pregnancy by effectively managing LBPP using evidence-based practices (Shima et al. 2007). Methods for the management of LBPP include regular exercise programs, health education, acupuncture, rest, pharmacological options, Transcutaneous Electrical Nerve Stimulation (TENS), the use of specially shaped pillows, sacroiliac belts and pregnancy corsets, the application of heat and/or cold and various complementary medicine options (Stuge et al. 2003, Mens et al. 2006, Pennick & Young 2007, Pennick & Liddle 2013).

There is evidence that the use of exercise programs before and during pregnancy can provide effective pain management for women with LBPP, although some studies reported conflicting findings (Ostgaard et al. 1994, Nilsson-Wikmar et al. 2005, Shima et al. 2007, Gutke et al. 2008, Dumas et al. 2010). Past systematic reviews of randomized controlled trials examining this issue have cited many limitations to the available research, including the types of research, the methods, the sample sizes and the significant potential for bias (Stuge et al. 2003, Pennick & Young 2007, Mens et al. 2009, Vermani et al. 2010, Kanakaris et al. 2011, Pennick & Liddle 2013).

Therefore, we determined a need for a well-designed, prospective randomized trial with a control group (standard care group) and an intervention group, using a repeated measures design, trial registration number NCT02189356. 48 pregnant participants with pregnancy-related LBPP were included in the control group and 48 pregnant participants with pregnancy-related LBPP were included in the intervention (exercise) group.

**Participants**

This research was performed between December 2011–May 2012 at the Department of Obstetrics and Gynecology, Gulhane Military Medical Education and Research Hospital in Ankara, Turkey. Approximately 3000 births occur annually at this clinic. Participants were pregnant women who presented to the obstetrics department for routine pregnancy examinations, had pregnancy-related LBPP and fulfilled the eligibility criteria. 209 pregnant women were evaluated between the indicated dates. Forty three women did not meet eligibility criteria, 54 pregnant women refused to participate in the study and 16 pregnant women were excluded from the study because of other reasons such as moving to another city, not completing the forms regularly. Ninety-six pregnant women who met the eligibility criteria accepted to participate in the study and were randomized (Figure 1 Flow chart). Eligibility criteria of the research were determined following a literature review (Stuge et al. 2003, Sabino & Grauner 2008, Mens et al. 2009, Robinson et al. 2010, Chang et al. 2012). The eligibility criteria were:

- Age over 18 years old
- Ability to read and write in Turkish,
- Volunteering to participate in the study,
- Being between 20-35 weeks of gestation,
- Having no complications for any reason during the study,
- No diagnosis of low back and/or pelvic disease prior to pregnancy,
- Not performing exercise for half an hour at least 3 days a week during pregnancy,
- Not using analgesics for low back and pelvic pain,
- Not using other methods for the treatment low back and pelvic pain.

**Interventions**

Participants diagnosed with pregnancy-related LBPP by a doctor and with no medical obstacles to participation in the study were directed to nurse. The nurse invited the

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Collecting dates about the characteristics of the pregnant woman
- Assessment of low back and pelvic pain
- Determination of functional level

Assessed for eligibility (N = 209)

Pregnant women with pregnancy-related LBPP (N = 96)
- First meeting

Randomized (N = 96)

Control Group (n = 48)
- Usual care
- Explanation of how to fill the pain follow-up forms weekly and distribution of the forms

Allocation

Intervention Group (n = 48)
- Usual Care
- Applying information training of low back and pelvic pain and giving education booklets
- Applying protection methods education of low back and pelvic pain and giving education booklets
- Applying exercise training, giving exercise diary and education booklet
- Explanation of how to fill the pain follow-up forms weekly and distribution of the forms

Excluded (n = 113)
- Declined to participate (n = 54)
- Not meeting eligibility criteria (n = 43)
- Other reasons (no time or no interest) (n = 16)

Declined to participate

Usual care

First week: one telephone call (n = 48)
- Following up the pain weekly

Second week: one telephone call (n = 48)
- Following up the pain weekly

Third week: one telephone call (n = 48)
- Following up the pain weekly

Fourth week: one telephone call (n = 48)
- Following up the pain weekly

- Application of the exercise program
- Keeping a diary of exercise
- Following up the pain weekly

Second week: three telephone calls (n = 48)
- Application of the exercise program
- Keeping a diary of exercise
- Following up the pain weekly

Third week: three telephone calls (n = 48)
- Application of the exercise program
- Keeping a diary of exercise
- Following up the pain weekly

Fourth week: three telephone calls (n = 48)
- Application of the exercise program
- Keeping a diary of exercise
- Following up the pain weekly

Face to face interview at the end of the fourth week (n = 96)
- Collecting dates about the characteristics of the pregnant woman
- Assessment of low back and pelvic pain
- Determination of functional level
- Analysis of the data obtained and the assessment of results

Analyses

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Pregnant women to the research room for a discussion on low back and pelvic pain. After the eligibility criteria of the pregnant women were reviewed, initial assessments were completed and the participants were subsequently randomized (Figure 1).

The nurse gave health counselling to the participants in the intervention group about the prevention of pregnancy-related LBPP and initiated an exercise program that included exercise training. The health counselling and exercise training booklets provided were prepared based on the literature (Wang et al. 2004, Pillitteri 2007, Akbayrak & Kaya 2008, Vermani et al. 2010). Each counselling session lasted an average of 45 minutes. Sessions were completed in a positive education atmosphere and were face-to-face as consistent with the principles of adult education (Sullivan et al. 1999). The structure and function of the vertebrae, physical changes occurring during pregnancy, causes of pregnancy-related LBPP, the problems that the pain causes, methods of pain management, correct posture development, body mechanics during activities of daily life and ergonomics were explained to the pregnant women using illustrated booklets during the trainings. During the counselling, the nurse received information from the participants about their daily activities and educated the participants about the behaviors that might damage the low back and pelvic regions. Participants were given practical demonstrations of how to move and how to protect the low back and pelvic regions during daily life. For example, the nurse demonstrated how to retrieve an object from the ground, how to reach shelves, how to sit and stand up and how to lie down, guiding the participants through these activities as well. The participants’ questions were answered and they were given educational booklets. Following the health consultation, exercise education was given. The participants were given illustrated booklets explaining the effects of pregnancy exercises on maternal and foetal health, situations that need attention before starting and during exercises, signs of danger, what should be done in potentially dangerous situations, how to breathe during exercise and the method, frequency and amount of the exercise. The exercises given to the intervention group were based on the guidelines from ‘Exercise in Pregnancy’ by the Royal College of Obstetricians and Gynaecologists (RCOG) and the guidelines from ‘Pregnancy and Exercise’ by Hacettepe University in Turkey (Reeder et al. 1997, Pillitteri 2007, Akbayrak & Kaya 2008). It was emphasized that pregnant women should complete their exercises as shown at least 3 days a week for 30 minutes (Reeder et al. 1997, Pillitteri 2007, Akbayrak & Kaya 2008). The duration of the exercise program was 4 weeks. Participants were offered a choice of two types of exercise according to the weather conditions. The first option comprised exercises performed on a mattress, including stretching, tightening and loosening movements that targeted large muscle groups from the neck to the vertebrae. The nurse explained that the mattress exercises would start with a 5 minute warm up, continue for at least 15-20 minutes at mid-tempo and end with a 5 minute cool down. The second option was a walking exercise. The participants were expected to warm up for 5 minutes, increase their speed for 5 minutes, continue at mid-tempo for 15 minutes and complete a 5 minute cool down. It was emphasized that the pulse rate should be between 120-160/min when the participants reached mid-tempo. In this exercise program, we assumed that both the walking exercise and the mattress exercises had equal effects on the low back and pelvic pain. Pregnant women were able to choose the type of exercise according to their wishes and requirements and could use either or both of the exercise options. The nurse determined the exercise plan with the pregnant women, creating an individual exercise program according to the patient’s personal characteristics. The participants were asked to record the type and the duration of the completed exercises during the program on the data collection form and were asked to note if they encountered any problems during the program. The nurse taught the participants how to complete the forms and answered any questions about the programs. The nurse spoke with the pregnant women on the phone three times a week and gave counselling according to their needs. During interviews, pregnant women were reminded to complete the data collection forms. After 4 weeks, the researchers made a final assessment of the pregnant women and collected the forms during a face-to-face interview. The exercise programs were terminated at this point, though (Figure 1) the pregnant women were able to continue the counselling if they wished. At the end of the study, pregnant women in the intervention group were asked to note if they meet any side effects of the exercise. There was not any negative feed-back about the exercise program.

The pregnant women in the control group received usual care, comprised of routine clinical practice for pregnancy-related LBPP. Usual care is comprised of movement without straining herself in daily life, often forcing herself to rest, taking paracetamol pills and consultation physical therapy clinic for LBPP. In the study, the doctor did not find it necessary for the control group participants to be consulted to physical therapy clinic. None of the pregnant women in the control group used paracetamol pills because they were afraid of side effects on their baby. Nurse did not tell the control group participants about not to exercise. If they
wanted to exercise they would do, there were no obstacle for doing exercise.

The nurse spoke with the women in the control group on the phone once a week and asked them to assess their LBPP and complete the data collection form. The final assessments of the participants were made during a face-to-face interview 4 weeks later (Figure 1). In the last assessment, nurse asked to the control group participants ‘do you exercise three times a week at least half an hour regularly’ and ‘do you know anything about exercises for LBPP’. At the end of the study, the control group participants said that they did not exercise and they did not know the exercise for LBPP. Willing pregnant women in the control group were advised on pain management strategies such as exercise program after completion of the 4 weeks of the study.

Sample size and statistical power considerations

The sample size was calculated using the PS Software: Power and Sample Size program (http://biostat.mc.vanderbilt.edu/wiki/Main/PowerSampleSize). Using the literature, we calculated that a sample size of 48 pregnant women in both the exercise group and the control group (total 96 pregnant women) could allow for detection of a difference in VAS score of 10 mm between the intervention and control group, given a SD of 15 mm with accompanying 0.95% confidence intervals (CI) and a power of 0.90 (Kalus et al. 2008). Ten mm difference in VAS score between the intervention and control group was accepted as meaningful based on Kalus et al.’s (2008) study and our clinic obstetrician experience.

Randomization

According to the CONSORT requirements, the participants were randomly allocated to either the intervention group \((n = 48)\) or the control group \((n = 48)\) using opaque, sealed envelopes and a simple randomization method. The clinic nurse who was independent from the study, at the clinic randomly drew the envelopes and broke the seal in the nursing room (Kanik et al. 2011). After the randomisation, the research nurse explained the study’s purpose and procedures to the pregnant women in the control and intervention groups. The same procedure was repeated for all the pregnant women. Blinding of participants was not feasible due to the study design.

Primary outcomes

The primary outcomes of this study were the change in pain intensity at the end of 4 weeks compared with the baseline and the changes in functional status at the end of weeks first and fourth.

Data collection

The nurse collected the data by meeting with the pregnant women at the beginning and end of the study for a total of two interviews. The data collection form included the sociodemographic characteristics of the pregnant women, their pregnancy history and questions about any history of pain. In these meetings the nurse measured the severity of the LBPP and determined the functional status of the pregnant women. The participants measured the severity of LBPP at the end of each week for a total of 4 measurements and recorded their pain on a ‘Weekly Pain Follow-up Form’. Additionally, participants in the intervention group recorded their exercises on a ‘Daily Exercise Form’. The forms were collected for evaluation by the nurse at the completion of the study.

Measures

Validity and reliability of pain intensity

We used the Visual Analogue Scale (VAS) to measure the intensity of the participants’ pain. The VAS is a reliable and valid scale that widely used all over the world for the assessment of pain intensity (Wewers & Lowe 1990, Lindseth & Vari 2005, Kalus et al. 2008, Murphy et al. 2009, Potter et al. 2013). Pregnant women noted the severity of the low back and pelvic pain that they perceived on a 100 mm VAS (Figure 2). The nurse determined the intensity

![Figure 2: Visual analog scale.](image-url)
of pain by measuring the point the pregnant woman had marked with a ruler. We examined the intensity of two types of pain; perceived pain intensity at rest as VASrelaxation and perceived pain intensity during activity as VASactivity.

Validity and reliability of functional level
The Oswestry Disability Index (ODI) was used to determine the participants’ functional status. The ODI was developed in 1976 by O’Brien (Fairbank & Pynsent 2000) and is a condition-specific outcome measure used in the management of spinal disorders. The ODI has been broadly tested and was found to have good psychometric properties and to be useful in a wide variety of settings (Fairbank & Pynsent 2000). The ODI is the ‘gold standard’ for low back functional outcome instruments (Fairbank & Pynsent 2000), is self-administered and consists of a 10-item questionnaire. The first section evaluates the intensity of pain and the others describe its disabling effects on typical daily activities including personal care activities (washing, dressing), lifting, walking, sitting, standing, sleeping, social life and travelling. Each item is scored from 0-5, with higher values demonstrating greater disability (Fairbank & Pynsent 2000). The ODI’s validity and reliability in the Turkish population was examined by Yakut et al. (2004) and the Cronbach $\alpha$ value was reported as 0.91 (Yakut et al. 2004).

Exercise level
Exercise diaries are easy, cost-effective and frequently used methods to measure physical activity (Lindseth & Vari 2005). In this study, exercise diaries were used to determine the exercise levels of participants in the intervention group. Exercise for 30 minutes at least 3 days a week was considered sufficient.

Ethical considerations
An Academy Ethical Committee approved the study design, protocols and informed consent procedure with number 1491-348-11/1539-227. Participants were informed about the study before inclusion and could decline to participate at any time. The participants read and signed the informed consent form with the help of the nurse at the beginning of the study.

Data analysis
Based on the intention-to-treat principle, all pregnant women were analysed according to the group they were assigned to, regardless of whether they received the intervention or not. To investigate the differences between the groups, the Student’s $t$-test was used for values with a normal distribution and the Mann–Whitney $U$-test was used for values without a normal distribution. To investigate the differences within the groups, the paired samples $t$-test was used for values with a normal distribution and the Wilcoxon test was used for values without a normal distribution. Repeated measurement results that did not have a normal distribution were analysed using the Friedman Test. The error level for all analysis was set at $P = 0.05$. The results were analysed using SPSS, version 15.0 (SPSS Inc., Chicago, IL, USA). A nurse who was independent from the study evaluated and calculated VAS and ODI scores. All statistical analysis was done with accompaniment of an epidemiology expert.

Results

Study sample
We invited 209 women to participate, of whom 54 women could not participate or declined to participate and 59 women were excluded for various reasons. A total of 96 women were available for the baseline measurement and were randomized. The flow of participants through the study is shown in Figure 1.

The characteristics of participants analysed on an intention-to-treat basis ($n = 96$) are shown in Table 1 (Montori & Guyatt 2001). At the beginning of the study, there was no statistically significant difference between the two groups with regards to any of the possible confounding variables (To & Wong 2003, Wang et al. 2004, Wu et al. 2004, Albert et al. 2006, Bjelland et al. 2011, Chang et al. 2012). The characteristics of the participants in the two groups were similar at the beginning of the study. No baseline differences in Visual Analogue Scale during relaxation-VASrelaxation-1 score ($z = 1.355; P = 0.176$), Visual Analogue Scale during activity-VASactivity-1 score ($z = 0.018; P = 0.985$) and Oswestry Disability Index-ODI1 score ($t = 0.641; P = 0.523$) were observed between the intervention group and the control group initially (Table 1).

The effects of the exercise program on pain intensity and functional status
For the control group, the Visual Analogue Scale during relaxation (VASrelaxation-1) was $42.77$ (26.57) at baseline and increased to $49.02$ (24.89) VASrelaxation-2 at the final ($z = 1.271, P = 0.204$) and the baseline Visual Analogue Scale during activity (VASactivity-1) was $59.81$ (22.60) and
Table 1 Characteristics of the study sample (n = 96).

<table>
<thead>
<tr>
<th></th>
<th>Control (n = 48)</th>
<th>Intervention (n = 48)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>X (sd)</td>
<td>min–max</td>
</tr>
<tr>
<td>Age</td>
<td>30.10 (4.26)</td>
<td>21–38</td>
</tr>
<tr>
<td>BMI1 (kg/m²)</td>
<td>24.05 (3.79)</td>
<td>15.67–31.56</td>
</tr>
<tr>
<td>BMI2 (kg/m²)</td>
<td>27.49 (3.96)</td>
<td>17.96–34.01</td>
</tr>
<tr>
<td>Parity (n)</td>
<td>0.98 (0.81)</td>
<td>0–2</td>
</tr>
<tr>
<td>Gestation (week)</td>
<td>27.27 (5.26)</td>
<td>20–35</td>
</tr>
<tr>
<td>Gestational age that pains started in</td>
<td>20.23 (6.48)</td>
<td>4–32</td>
</tr>
<tr>
<td>VASrelaxation-1 (mm)</td>
<td>42.77 (26.57)</td>
<td>0–100</td>
</tr>
<tr>
<td>VASactivity-1 (mm)</td>
<td>59.81 (22.60)</td>
<td>10–100</td>
</tr>
<tr>
<td>ODI1</td>
<td>31.29 (7.04)</td>
<td>15–46</td>
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| Parity                               |                 |                       |                 |       |            |       |
|                                      | n               | %                     | n               | %     | X†         | P     |
| Nullipar                             | 16              | 33.3                  | 23              | 47.9  | 2.787      | 0.248 |
| Primipar                             | 17              | 35.4                  | 16              | 33.3  |            |       |
| Multipar                             | 15              | 31.3                  | 9               | 18.8  |            |       |
| Family structure                     |                 |                       |                 |       |            |       |
| Nuclear                              | 46              | 95.8                  | 44              | 91.7  | 0.711      | 0.390 |
| Large                                | 2               | 4.2                   | 4               | 8.3   |            |       |
| Education                            |                 |                       |                 |       |            |       |
| ≤8 years                             | 11              | 22.9                  | 5               | 10.4  | 2.70       | 0.100 |
| 8 years<                             | 37              | 77.1                  | 43              | 89.6  |            |       |
| Work situation                       |                 |                       |                 |       |            |       |
| Worker                               | 8               | 16.7                  | 10              | 20.8  | 0.274      | 0.601 |
| Non-worker                           | 40              | 83.3                  | 38              | 79.2  |            |       |
| Perceived of economic situation      |                 |                       |                 |       |            |       |
| Inadequate                           | 8               | 16.7                  | 9               | 18.8  | 0.071      | 0.789 |
| Adequate                             | 40              | 83.3                  | 39              | 81.2  |            |       |
| Smoking                              |                 |                       |                 |       |            |       |
| Non-smoker                           | 34              | 70.8                  | 32              | 66.6  | 0.196      | 0.906 |
| Quit smoking in pregnancy            | 8               | 16.7                  | 9               | 18.8  |            |       |
| Smoker                               | 6               | 12.5                  | 7               | 14.6  |            |       |
| Previous low back and pelvic pain story during pregnancy | control n = 32, exercise n = 25 | | | | |
| Yes                                  | 13              | 40.6                  | 12              | 48.0  | 0.310      | 0.578 |
| No                                   | 19              | 59.4                  | 13              | 52.0  |            |       |
| Definition of low back and pelvic pain |               |                       |                 |       |            |       |
| Burning                              | 5               | 10.4                  | 3               | 6.2   | 0.874      | 0.832 |
| Sharp                                | 21              | 43.8                  | 21              | 43.8  |            |       |
| Blunt                                | 4               | 8.3                   | 3               | 6.2   |            |       |
| Tingling                             | 18              | 37.5                  | 21              | 43.8  |            |       |
| The time period that low back and pelvic pain was the most severe | | | | | | |
| Morning                              | 2               | 4.2                   | 4               | 8.4   | 4.433      | 0.218 |
| Midday                               | 11              | 22.9                  | 11              | 22.9  |            |       |
| End of day                           | 11              | 22.9                  | 18              | 37.5  |            |       |
| Night                                | 24              | 50.0                  | 15              | 31.3  |            |       |
Table 1 (Continued).

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<th>Control (n = 48)</th>
<th>Intervention (n = 48)</th>
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<tr>
<td></td>
<td>n (%)</td>
<td>X²†</td>
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<tr>
<td>The frequency of low back and pelvic pain</td>
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<td>Continued</td>
<td>8 (16.7)</td>
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<tr>
<td>Often</td>
<td>11 (22.9)</td>
<td></td>
</tr>
<tr>
<td>Sometimes</td>
<td>25 (52.1)</td>
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<tr>
<td>Rarely</td>
<td>4 (8.3)</td>
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*Student t-test.
†Mann–Whitney U-test
‡Women who have previously at least one live birth were included in.

BMI₁, body mass index at the beginning of pregnancy; BMI₂, body mass index at the beginning of the study; VASrelaxation₁, the average pain score during relaxation at the beginning of the study; VASactivity₁, the average pain score during activity at the beginning of the study; ODI₁, the average ODI score at the beginning of the study; X², Pearson chi-square test.

at the end of the study VASactivity₂ was 62.50 (21.31) (z = 1.132, P = 0.258) (Table 2).

For the intervention group, there was a statistically significant difference in both the Visual Analogue Scale during relaxation (VASrelaxation) scores (z = 4.347, P = 0.001) and Visual Analogue Scale during activity (VASactivity) (z = 4.829, P = 0.001) scores when compared with the baseline scores (Table 2).

For the control group, the baseline mean ODI₁ score was 31.29 (7.04) and the final ODI₂ score was 31.96 (7.12) (t = 0.608, P = 0.546). For the intervention group, the baseline mean ODI₁ score was 32.25 (7.59) and the final ODI₂ score was 26.40 (8.03), with a statistically significant difference between these two results (t = 4.970, P = 0.001) (Table 2).

At the end of the study, there was a statistically significant difference between the control and intervention groups with regards to the Visual Analogue Scale during relaxation (VASrelaxation₂) (z = 3.598, P = 0.001) scores and the Visual Analogue Scale during activity (VASactivity₂) (z = 5.090, P = 0.001) scores (Table 3). The final mean ODI₂ scores for the control group were significantly higher than the mean ODI₂ scores for the intervention group (t = 3.588, P = 0.001) (Table 3).

The weekly changes in pain intensity for control and intervention groups are shown in Table 4. We found a statistically significant increase from the first mean the Visual Analogue Scale during relaxation (VASrelaxation) score to the last mean VASrelaxation score in the control group (F₁ = 20.461, P = 0.001). We also found a statistically significant decrease in the mean VASrelaxation score for the intervention group over the study duration (F₁ = 58.456, P = 0.001) (Figure 3). The mean Visual Analogue Scale during activity (VASactivity) scores for the control group remained at a similar level through the study duration (F₁ = 4.803, P = 0.440). We found a statistically significant decrease in the mean Visual Analogue Scale during activity (VASactivity) scores for the intervention group over the study duration (F₁ = 72.507, P = 0.001) (Figure 4).
Table 3 The comparison according to the characteristics of groups at the end of the study (I) (n = 96).

<table>
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<td></td>
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<td>min–max</td>
</tr>
<tr>
<td><strong>VAS_relaxation–2 (mm)</strong></td>
<td>49.02 (24.89)</td>
<td>0–100</td>
</tr>
<tr>
<td><strong>VAS_activity–2 (mm)</strong></td>
<td>62.50 (21.31)</td>
<td>0–99</td>
</tr>
<tr>
<td><strong>ODI2</strong></td>
<td>31.96 (7.128)</td>
<td>21–47</td>
</tr>
</tbody>
</table>

*P < 0.05.
†Mann–Whitney U-test.

VAS_relaxation–2, the average of pain score during rest at the end of the study; VAS_activity–2, the average of pain score during activity at the end of the study; ODI2, the average of ODI score at the end of the study.

Table 4 The comparison of the groups’ measurements of VAS_relaxation and VAS_activity according to weeks at the end of study (n = 96).

<table>
<thead>
<tr>
<th></th>
<th>VAS_relaxation (mm)</th>
<th>VAS_activity (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X (s.d)</td>
<td>min–max</td>
</tr>
<tr>
<td><strong>Control (n = 48)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First assessment</td>
<td>42.77 (26.57)</td>
<td>0–100</td>
</tr>
<tr>
<td>1st week</td>
<td>35.44 (21.31)</td>
<td>0–100</td>
</tr>
<tr>
<td>2nd week</td>
<td>40.79 (24.29)</td>
<td>0–100</td>
</tr>
<tr>
<td>3rd week</td>
<td>41.73 (26.00)</td>
<td>0–100</td>
</tr>
<tr>
<td>4th week</td>
<td>41.50 (27.58)</td>
<td>0–100</td>
</tr>
<tr>
<td>Last assessment</td>
<td>49.02 (24.89)</td>
<td>0–100</td>
</tr>
<tr>
<td><strong>Intervention (n = 48)</strong></td>
<td>50.44 (26.92)</td>
<td>0–100</td>
</tr>
<tr>
<td>1st week</td>
<td>50.83 (21.49)</td>
<td>0–100</td>
</tr>
<tr>
<td>2nd week</td>
<td>44.58 (23.53)</td>
<td>0–100</td>
</tr>
<tr>
<td>3rd week</td>
<td>37.65 (23.55)</td>
<td>0–100</td>
</tr>
<tr>
<td>4th week</td>
<td>35.67 (25.71)</td>
<td>0–100</td>
</tr>
<tr>
<td>Last assessment</td>
<td>29.75 (23.84)</td>
<td>0–100</td>
</tr>
<tr>
<td><strong>F</strong></td>
<td>20.461</td>
<td>58.456</td>
</tr>
<tr>
<td><strong>P</strong></td>
<td>0.001*</td>
<td>0.001*</td>
</tr>
</tbody>
</table>

*P < 0.05.

F, Friedman test.

Figure 3 Change in average pain intensity during rest.

Additionally, low back and pelvic pain analysed separately in terms of functional level or pain intensity but there were not any statistical differences between them.

Figure 4 Change in average pain intensity during activity.

(P > 0.05). At the end of the study we found that there were not any statistical differences between exercise type in terms of pain intensity or functional status (P > 0.05).
Discussion

We determined that the exercise program with individualized health counselling used in this study to relieve and resolve the severity of LBPP over 4 weeks relieved the participants’ pain intensity and promoted their functional status, confirming our research hypothesis. The literature contains studies with both concordant and discordant findings.

Kluge et al. (2011) reported that pregnant women in the exercise group had decreased pain intensity and increased functional capacity when compared with the control group at the end of the exercise program used in their study. We obtained similar results using a continuous health education and individualized exercise program. We determined that the counselling and exercise programs used in our study could be more easily used by all pregnant women with LBPP. Shima et al. (2007) showed that their exercise program relieved the intensity of low back and pelvic pain for pregnant women but did not affect their functional status (Shima et al. 2007), while Morkved et al. (2007) determined that their exercise program prevented the intensity of low back and pelvic pain and improved the functional status in one of eight pregnant women at 36 weeks of gestation. Garshasbia and Zadeh (2005) reported that exercise relieved the severity of pregnancy-induced low back and pelvic pain, while Depledge et al. (2005) reported that exercise and health education programs would increase long-term muscle support and might be more effective than external supports in reducing pain. Our study demonstrated that effective health counselling and an exercise program easily initiated by a professional nurse showed rapid effects by motivating pregnant women to exercise, a significant finding of our study.

In contrast to our findings, Dumas et al. (2010) reported that an exercise program did not relieve the severity of pregnancy-induced low back and pelvic pain and did not affect functional status. Similarly, Nilsson-Wikmar et al. (2005) reported that pelvic stabilization exercises during pregnancy and the postpartum period did not relieve the severity of low back and pelvic pain and did not shorten the postpartum healing process. Ostgaard et al. (1994) reported that while individualized education, ergonomics and exercise programs lessened the pregnant women’s need for rest due to low back and pelvic pain, these interventions did not relieve the pain. The difference between our findings and the literature was thought to result from the methodological design of the studies (Perkins et al. 1998, Hammer et al. 2000, Sneag & Bendo 2007, Sabino & Grauner 2008, Nacir et al. 2009, Vermani et al. 2010). Consequently, our study could provide data that could lead to improvements in nursing practice.

Limitations

In this study, the data about exercise level of pregnant women were based on their written and verbal statements. Pregnant women were not observed during the exercise and this condition was considered a limitation of the study. LBPP was diagnosed according to oral patient history by doctor.

Conclusion

As pregnancy-related LBPP is a preventable consequence of pregnancy, pregnant women should not have to accept living with this pain (Greenwood & Stainton 2001). Our study demonstrated that pregnancy-related LBPP could be relieved and functional status could be improved by regular nurse counselling and the implementation of an individualized exercise program for 4 weeks.

To relieve pregnancy-related LBPP and maintain functional status, an exercise program should be effectively performed, pregnant women’s exercise-related concerns should be addressed and pregnant women should be motivated to exercise. These interventions can be provided by correctly identifying goals and proper nursing interventions. (Shima et al. 2007, Evenson & Bradley 2010). Pregnancy-related LBPP contains characteristic differences from low back pain in the normal population. Therefore, it was hypothesized that exercise programs for LBPP specific to pregnant women would more effectively manage their pain. Exercise programs used by pregnant women with LBPP can provide significant benefits, reducing the intensity of pain by increasing muscle strength, improving functional status and increasing quality of life (Arıkan Beyaz & Özcan 2005, Gutke et al. 2008, Vleeming et al. 2008, Gutke et al. 2010a,b, Ji & Ha 2010).

Additionally, women who are working and have less time to fill paper-work, digital programs may be created for follow-up the exercise program. And future studies should pay attention to pain levels which are in average level in both groups in this study.

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Conflict of interest

No conflict of interest has been declared by the authors.

Author contributions

All authors meet at least one of the following criteria (suggested by the ICMJE: from http://www.icmje.org/ethical_1author.html):

- substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data;
- drafting the article or revising it critically for important intellectual content and final approval of the version to be published.

Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher’s web-site.

References

Kluge J., Hall D., Louw Q., Theron G. & Grové D. (2011) Specific exercises to treat pregnancy-related low back pain in a South


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