Research Article

The effect of exercise on back pain and lordosis in the second trimester of pregnancy

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ABSTRACT

Introduction: Low back pain increases during pregnancy. However, due to rapid weight gain and displacement of the body's center gravity, low back pain, and lumbar lordosis are more common in the second trimester of pregnancy. This study aimed to investigate the effect of stretching exercises on low back pain and lordosis is in the second trimester of pregnancy. **Methods:** This clinical trial study was done on 60 pregnant women at 16–24 weeks of pregnancy who referred to health centers of Mashhad in 2014. The intervention group received stretching and strengthening exercises 3 days a week (morning and evening each time for 15 min), and the control group received usual care for back pain. Quebec back pain questionnaire and flexible ruler were used. Two-way analysis of variance with repeated measures, ANOVA and paired *t*-test were used to analyze data. **Results:** The results showed that significant changes in terms of back pain at different times in both groups ($P < 0.001$). Back pain was significantly decreased after 3rd week in the intervention group ($P < 0.001$); however, it was significantly increased from the 4th week in the control group ($P = 0.025$). **Conclusion:** The results show that exercise therapy significant effect on reducing low back pain and lumbar lordosis in the second trimester of pregnancy. Therefore, the use of exercise therapy is highly recommended to prevent and treat this common and costly problem.

KEY WORDS: Back pain, Exercise, Lumbar lordosis, Pregnancy

INTRODUCTION

Low back pain is one of the major problems of modern societies,[1] which highly related to absences from work, disability, and frequent use of health services.[2,3] Today, back pain come in the form of a modern international epidemic, which is the second reason of referring physicians also cause of hospitalization and costly medical problems in every country.[4-6] It seems that more women are more at the risk back pain than men.[7,8] Approximately 70% of women have experienced back pain once in their lives.[6-9] One of the conditions that make women more prone to low back pain in pregnancy.[9]

Goli *et al*. study (2014) that was conducted in Isfahan showed that the most common type of pain is lower back pain (51.3%).[10] Pregnant woman's body undergoes certain changes in physiology and anatomy, which occurs gradually in the later stages of pregnancy, the changes including hormonal changes, structural, and postural deviations.[1,11] In addition to physiological changes, the greatest cause of back pain in pregnancy is associated with poor body position.[4,12] One of the behaviors associated with the disease predicting its successful treatment and curtailing the negative side effects and severity of the disease involves medication adherence among patients.[13] Everyone's body is important in his life. Spine as the support structure of the upper body plays a major role in carrying out functions of the body and movements. Spine with several conditions changes the body and ultimately affect the individual performance.[14,15] Clearly, if such an important part of the body exposed to excessive pressure or inactivity leave negative impact and imbalance activity on the process of moving. The backbone structure includes mechanisms that help the adjustment of pressure on the spine, cervical, thoracic, and lumbar. Lumbar

Access this article online

Website: jprsolutions.info | ISSN: 0975-7619

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Received on: 17-03-2019; Revised on: 21-05-2019; Accepted on: 26-05-2019

lordosis is the most vulnerable and has multiple risk factors due to the high weight-bearing. In addition, muscle weakness effects the formation and changes.[14] The only way to strengthen the sector and strengthen the body is to have enough mobility through exercise and physical activity and maintain optimal body condition. Otherwise leads to an extreme excess of natural lumbar concavity that is entitled round back or lordosis, which changes to 45 degrees from normal lumbar lordosis which is 30 degrees.[15] With the progress of pregnancy caused by a heavy abdominal cavity, the center of gravity is displaced toward the front and lower. Unprepared muscles and muscle weakness in such situations lead to soreness and local spasms, which causes low back pain and lumbar lordosis.[9,16,17] Prevention and treatment of low back pain associated with pregnancy can have devastating implications for pregnant women and society in terms of quality of life, public health costs, and productivity.[7,17] The usual treatment for back pain in health centers is as follows: Rest wearing lower-heeled shoes, Squat (standing down) rather than bend when picking up objects from the ground, back support pillow when sitting, belt use for pregnancy, and hot showers sleeping on a firm mattress.[18] However, the high prevalence of back pain and disability caused by, there are many challenges in choosing the appropriate treatment way. Despite extensive research and multiple treatments such as resting, correct posture, exercise therapy, physiotherapy, stabilization exercise, massage therapy, pain medication, acupuncture, yoga, electrotherapy, and heat treatment, but still, there is no general agreement on the treatment of low back pain.[1,19-41] Exercise during pregnancy is increasingly taken into consideration. One of the goals of exercise during pregnancy is to restore optimum biomechanics of the body.[1,7] Exercise stimulates the production of natural pain inhibitor hormones, and with the increase in pain, threshold plays a role in preventing or reducing the incidence of low back pain. Exercise not only helps to reduce lower back pain but also helps in a more rapid recovery, prevent injury, and reduce the risk of disability from back pain.[9,20-22] Society of Obstetrics and Gynecology of Canada and the Canadian Society of Exercise Physiology recommended all pregnant women who have not any limit in the physical activity must be encouraged to take part in stretching exercises as part of a healthy lifestyle during pregnancy.[23] American College of Sports Medicine recommended women moderate-intensity physical activity, preferably the whole week for about 30 min.[24] Exercise remains incomplete without a good stretching. Most of the aerobic and strength training caused muscle cramps. To alleviate cramps, the stretching exercise program should be done.[25] The benefits of stretching exercises are as follows: Increase flexibility, increase range of motion, increase blood flow, reduce stress, and reduce sports injuries. Exercises aimed at stretching muscles of the spine, stretching hamstring muscle stretching adductor, stretch the muscles of the vertebral spine, strengthen the extensor muscles of the hip, in the fours, strengthen muscles, trans versus abdominis, and in the four-leg and abdominal muscles.[26]

Practice pelvic movements also play an important role in correcting posture. The pelvic tilt will determine the status of lumbar lordosis. Rotating the pelvis forward increases lumbar, while the rotation of the hips back will result in the flattening and lower lumbar area.[27]

METHODS

This clinical trial study was done on 60 pregnant women at 16–24 weeks of pregnancy who referred to health centers of Mashhad in 2014. Sample size was estimated 15 using the sample size formula, taking into account $\alpha = 0.05$ and $\beta = 0.2$ and the results Shojaedin and Yousefpour[28] study reported that the ability to function in both sports and taping 25/5 ± 7/28 and 42/66 ± 9/14, respectively. Thirty patients in each group were considered taking into account the loss factor of a sample size. Names of the two best health centers were written and placed in a lottery wheel. After picking out the names, the first one was assigned as the intervention group, and the other one was the control group. The reason for choosing these centers was: They are homogenous in terms of demographic characteristics of patients, higher number of visitors, and officials cooperation. Initially, 60 cases were included, which ultimately 51 samples (26 in the intervention group and 25 in the control group) were remained in the study. Nine patients were excluded from the study, four patients due to unwillingness to continue the study, four no presence for taking part in exercises, and one due to bleeding and threatened of abortion.

Inclusion Criteria

16–22 weeks gestational age, maternal height 150 cm or more, body mass index (BMI) 26–8/19, pain intensity score between 10 and 50 based on Quebec Back Pain questionnaire, and certificate of having a healthy heart and lungs were included in the study.

Exclusion Criteria

Medical conditions, high-risk pregnancy, pre-pregnancy history of back pain, spinal disorders, pregnancy after assisted reproductive techniques, surgery in the lumbar, systolic blood pressure 140 or more, and diastolic 90 were excluded from the study.

The lumbar lordosis was measured using a flexible ruler by the investigator after training and receiving a confirmation from a specialist in both groups. In this technique, mothers were asked to stand quite comfortable and natural, open legs shoulder-width

apart and look forward. The researcher then stands hinter the subject to find reference points. These areas include the upper posterior iliac spines that their assessment was done by two dents in the lower back. These points are marked by markers then were connected with a straight line in a way that the midpoint was the second sacral vertebral thorn appendage (S2). The iliac crest subjects were pressed with fingers in the entrails to find the iliac crest. Two thumbs were meet parallel to the horizon at the back of the mothers, which fourth lumbar vertebra is at the same level. Then brushed with counting beads up, the growth of thorns and marked the first lumbar vertebra. The researcher placed the flexible ruler on the marked spots (L1, S2) and pressed along the ruler in a way that there was no space between the ruler and the skin. The ruler took the shape of lumbar lordosis. Then, draw the shape of the on paper without changing. It is important to care to draw a curvy line from the part it was tangential to the skin. The following equation was used to calculate the angles of lordosis research unit.

$$\theta = 4\text{Arc tan } 2H/L$$

Length curve (L) represents the distance between the first sacral vertebra and the second lumbar vertebra. The height (H) represents the vertical line which has maximum distance from the line (L).

Intervention group participate in practice by the doctor at the center of stretching and strengthening back, according to the Ministry of Health by researchers after receiving the certificate health of heart and lungs. Participants were trained in the clinic and face-to-face. Completing the form of daily exercise was also explained. They also were asked to do the exercises in front of the researcher verification exercise; educational pamphlets training was provided to subjects. For further investigation of the samples, follow-up phone call was done once a week and meetings were held once every 2 weeks.

Exercise was as follows:

1. Posterior pelvic tilt (located in the fours, hands across shoulders, and knees are shoulder-width apart, body weight given to the hips. abdominal muscles contract slightly)
2. Practice in the supine position (lying on his back, legs apart and feet on the floor, inhale, and then lift up with expiratory muscles of the buttocks. With the support of hand below the hips, loose the hips and back softly to the ground)
3. Stretch the upper back (squeezing the buttocks and the soles of the prostrate with outstretched hands forward along with normal breathing)
4. Stretch the hamstring muscles (legs stretched out and your body to the foot pull a few seconds in the hold mode. Bend body from the hips and try to drag chest to foot. Your body in hold mode and feel the tension in the back of your thighs).

These exercises were performed at home for 3 days a week, twice a day (morning and evening) each time for 15 min, for 6 weeks.

The control group received routine prenatal education. Quebec Back Pain questionnaire was completed by both groups once a week. The questionnaire included 20-item with six options questions scoring pain in daily activities among 0–100. The first option zero indicates "without pain" and option 6 indicates severe pain (hospitalization). Overall, zero showed healthy person, mild pain (1–25), moderate pain (26–50), severe pain (51–75), and not bearable (hospitalization) (76–100). This questionnaire was completed at the beginning of the research and then every week after.

Paired *t*-test, ANOVA test was used to investigate the effect of the independent variable on the dependent variables. After verifying normal distribution of data by Kolmogorov–Smirnov test and to compare pairs of time, Bonferroni was used. $P < 0.05$ was considered significant.

This is a clinical trial registration code: IRCT - ID: IRCT2015070223021N1.

RESULTS

To compare mean quantitative factors related to individual characteristics between the two groups, one-way analysis of variance was used. The mean values and standard deviation of age and the age of the spouse were specified separately in the two groups at Table 1. Independent *t*-test results showed no significant difference between the two groups in age ($P = 0.897$), age of spouse ($P = 0.278$), height ($P = 0.060$), and weight ($P = 0.550$). BMI between the two groups was not significantly different ($P < 0.788$).

Kolmogorov–Smirnov was used to profile of midwifery normal distribution. To compare mean quantitative factors related to the characteristics of Midwifery between the two groups, independent *t*-tests (for variables with normal gestational age, number of children) and Mann–Whitney test (for variables several abnormal pregnancy, parity, and number of abortions) were used. The mean values and standard deviations of obstetric variables in the two groups are listed at Table 2. Test results were showed no significant differences between the two groups in terms of gestational age ($P = 0.268$), number of pregnancy ($P = 0.641$), parity ($P = 0.426$), number of children ($P = 0.348$), and abortion ($P = 0.549$).

Check back pain changes between the two groups before and during the first 6 weeks was tested by

two-way ANOVA with repeated measures (comparison between the seven-time with effect group). Comparison of pain at different times using one-way ANOVA with repeated measures (independently and without effect group) were studied. Pain between the two groups was compared using t-test in each of the seven-level individually. The results showed that in both groups and back pain have significant changes at different times (P <0.001). To determine the difference between groups, the Bonferroni method was used as one of the subsequent analyses. Bonferroni method was determined that back pain was significantly reduced in exercise group from the 3rd week (P <0.001) and in the control group from the 4th week was significantly increased (P = 0.025). Two groups were compared separately in terms of back pain. The results showed that before intervention until the 1st week there were no significant differences between the two groups in terms of back pain (P > 0.05), however, was significantly different from the 2nd week (P < 0.01). Two-way analysis of variance with repeated measures showed significant difference interaction of group × time (P < 0.001), and the intervention was effective on pain of change. The effect of time (P < 0.001) and group (P < 0.001) independently on back pain changes has been effective. The results of this test with back pain are specified in Table 3.

Lordosis changes between the two groups before the intervention and after 6th week were tested using two-way ANOVA with repeated measures (comparison between the 2 times with effect group). In addition, lordosis was evaluated by paired *t*-test in the 6th week and before the intervention. Before the intervention, lordosis between the two groups was compared using *t*-test. The comparison was performed separately for the 6th week. The results showed that lordosis was calculated more before the intervention in comparison to the

Table 1: The mean and SD of quantitative variables related to individual characteristics and comparison test between the two groups

Items investigated	Groups				*P*-value
	Control		Intervention		
	SD	Average	SD	Average	
Age	5.39	27.72	4.14	27.54	0.897
Age of spouse	5.69	30.8	3.89	32.33	0.278
Height	5.11	162.81	6.32	162.77	0.06
Weight	3.18	70.88	4.32	70.23	0.55
BMI	0.56	26.51	0.47	26.47	0.788

Comparisons between groups using the independent *t*-test. SD: Standard deviation, BMI: Body mass index

Table 2: The mean and SD of quantitative variables related to obstetric variables and comparison test between the two groups

Items investigated	Groups				*P*-value
	Control		Intervention		
	SD	Average	SD	Average	
Gestational age (week)	5.44	20.64	4.78	18.95	0.268(1)
Number of pregnancy	0.87	1.80	0.59	1.46	0.147(2)
Parity	0.79	1.21	0.74	1.00	0.298(2)
Number of children	0.73	1.23	0.51	0.92	0.203(2)
Number of abortion	0.53	0.50	0.52	0.60	0.661(2)

(1)Compared between groups using independent *t*-test. (2)Compared between groups using the Mann–Whitney test. SD: Standard deviation

Table 3: Check back pain changes between the two groups at baseline and every week

Review times	Groups				*P*-value(2)
	Control		Intervention		
	SD	Average	SD	Average	
Before	11.98	26.96	11.01	22.82	0.283
Intervention	10.47	28.58	9.82	24.14	0.188
1st week	9.30	29.46	8.23	21.64	0.036
2nd week	9.37	31.54	8.53	19.36	<0.001
3th week	9.47	34.29	7.47	14.95	<0.001
4th week	9.38	35.46	7.25	12.36	<0.001
5th week	9.06	36.21	6.78	8.14	<0.001
P-value(1)	<0.001		<0.001		

(1)Comparison between the different stages (before intervention and each week) using one-way repeated measures ANOVA. (2)Comparison between the two groups using the independent *t*-test. The significant effect of time: P<0.001. The significant effect of group: P<0.001. The significant effect of time×group: P<0.001. SD: Standard deviation

6th week, and this is a significant difference ($P < 0.002$), in the exercise group. Lordosis difference ($P = 0.586$) was not significant before the intervention and in the 6th weeks in the control group. Two groups of lordosis before the intervention ($P = 0.949$) and in 6 weeks ($P = 0.568$) showed no significant difference. Repeated measures ANOVA showed a significant interaction of group × time ($P < 0.041$) and intervention on lordosis changes have been effective. It was also found the effect of time ($P = 0.266$) and the effect of group ($P = 0.749$) independently on lordosis was not effective. The results of this test with lordosis are specified in Table 4.

Figure 1 shows changes in back pain between the two groups at baseline and every week. The interaction between the control and intervention groups (sports) can be seen as the intersection of the lines. Low back pain is also observed increased in the intervention group and decreased in the control group.

DISCUSSION

The present study aimed to compare the effect of exercise on back pain and lumbar lordosis in the second trimester of pregnancy. Significant improvement in back pain and lumbar lordosis in the exercise group was observed compared to the control group.

The results showed that the severity of the pain in the exercise group had a significant decrease compared to the previous intervention ($P < 0.001$) and in the control group had a significant increase compared to pre-intervention ($P < 0.001$).

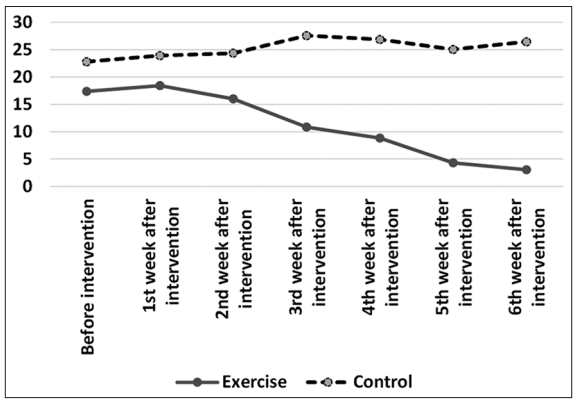

Figure 1: Changes in back pain between the two groups at baseline and every week

In the 2nd week, there was no significant difference in back pain between the two groups. However, over time, back pain was reduced significantly in the exercise group from the 4th week compared to pre-intervention ($P = 0.16$); however, it was increased significantly in the control group ($P = 0.025$).

Yan *et al*. (2014) in Taiwan showed that exercise 3 times a week for 12 weeks decrease significantly back pain during pregnancy.[29] Garshasbi and Zadeh (2005) in Tehran showed that exercise improves back pain in pregnant women ($P < 0.001$) which is consistent with this study.[7]

Positive effects of exercise also expressed in most studies. The studies of Gjestland *et al*. (2012), Nascimento *et al*. (2012), and Granath *et al*. (2006) also confirmed it.[4,30,31]

Stafne *et al*. (2012) in his study which is done on pregnant women at 20–36 weeks and with an exercise program at home 2 times a week for 12 weeks, including balance training, stretching, and aerobic by with a session by physiotherapist, reported that there was no statistically significant pain intensity in week 36 ($P = 76/0$).[32] This result does not match our study. It seems not consistent with the results of this study could be due to differences in the type of exercise and equipment which were used. The researchers showed that different variables have been studied in relation to the effects of exercise during pregnancy; such can be to variables such as type of exercise, intensity of exercise, length of the exercise, and repeated mention.[33-35] Hence, it can be concluded that exercise during pregnancy is effective in reducing pain. Garshasbi and Zadeh (2005) mentioned the enhance of muscle performance of iliopsoas and paravertebral, strengthen abdominal muscles and hamstrings and better condition of body.[7] To explain the physiology, it might be said that exercise increases capillary blood flow, and thus proper oxygen send to the tissues and the exchange of appropriate gas proper causes nutrition of tissues the accumulation of lactic acid was prevented and by increasing the flow capillary blood, normal muscle power will maintain, in fact, vicious cycle of inactivity inhibit joint laxity and screw.[36] Results showed that lordosis was more before the intervention compared to the 6th week in

Table 4: Check lordosis changes between the two groups at baseline and after 6 weeks

Review times	Groups				*P*-value(2)
	Control		Intervention		
	SD	Average	SD	Average	
Before intervention	4.25	40.63	4.23	40.56	0.949
6th week	4.25	40.78	4.18	40.08	0.568
P-value(1)	0.586		0.002		

(1)Comparison between before intervention and 6th week using paired *t*-test. (2)Independent *t*-test between the two groups. The significant effect of time: $P=0.266$. The significant effect of group: $P=0.749$. The significant effect of time×group: $P=0.041$. SD: Standard deviation

the exercise group, which is a significant difference ($P < 0.002$). Lordosis difference was not significant before the intervention compared to the 6th week in the control group ($P = 0.586$). The study findings of Farahani (2006), Foruzan (1998), and Kashanian (2010) have shown consistent with the results of this study in terms of the impact of exercise on lumbar lordosis. The researchers based their findings contend that increased lumbar lordosis can be found in the biomechanics of the body disruption and the underlying pressure abnormal lumbar region. Hence, exercise has a positive influence on lordosis, which is also can prevent complications, correction of lordosis, and keep it natural and effective.[27,37,38] Garshasbi and Zadeh (2005, Tehran) in a study titled "the effect of exercise on the intensity of low back pain in pregnant women" showed that exercise improves back pain in pregnant women, however, has no impact on the lumbar lordosis.[7] The results do not match with the present study. It could be because of the type of sport and the type of study population (nulliparous women).

In general, factors affecting the lumbar change can be divided into two categories: Natural changes in the body, weakness, and muscle tightness of spinal stabilization.[16] It should be noted that the weakness of muscles and also tightness of the muscles causes abnormalities. The mechanism of action is different in each. Muscle weakness is the cause of the abnormality.[8,42] However, tightness is itself abnormality. Hence, anomaly proved not only the result of muscle weakness but also unless there has been a failure to in being stronger. To correct deformities, shortened muscles need to stretch and restore normal length. Then strengthen the weakened muscles, while maintaining the power balance between opposing muscle groups to achieve a normal position.[7,41] Sistan and Balouchestan Province has specific cultural-ethnographical conditions such as tendency to have more children and masculine baby which affect general health of women.[43] This was recognized several centuries ago, but physical activities that might be harmful to fetal health are still not properly known.[44] Success or failure in education is one of the major concerns of every educational system. Educational success and progress in every society represent the success of the educational system regarding targeting and paying attention to meeting individual needs.[45] The role of the nurse in drug administration, training drug calculations are an important educational need for nursing students which is not correctly taken into account in the curriculum. Thus, it is suggested that nursing faculty members regularly control this skill during apprenticeships and internships in the field of nursing students in clinical environments, and if necessary, it should be trained systematically, and these skills should be practiced under the supervision of a trainer.[46] This sensitive and important process can be seen well during stretching and pelvic tilt, which should be noted. According to research findings, stretching and posterior pelvic tilt work on the hip flexor muscle strain and lumbar. Furthermore, by focusing on the center of the body, strengthen abdominal muscles and gluteal.[39,40] One of the main concerns of higher education institutions is quality. One way to the monitoring, development, and improvement of quality takes place within the organization is internal evaluation.[47]

CONCLUSION

Exercise therapy reduces back pain and lumbar lordosis in pregnant women and also improves various everyday activities. The exercises can be used to reduce back pain and lumbar lordosis in women who suffer from back pain during pregnancy and not willing to use aggressive treatments and chemical pain relief drugs. One way to the monitoring, development, and improvement of quality takes place within the organization is internal evaluation.

ACKNOWLEDGMENTS

This study has been approved by MUMS vice presidency for research. Special thanks to the research committee of Mashhad University of Medical Sciences, respected staff of health care centers and samples.

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Source of support: Nil; Conflict of interest: None Declared