Original Article

Risk Factors Associated with Low Back Pain among Pregnant Women in Pakistan

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Abstract

Background: Low back pain is a common musculoskeletal condition characterized by axial or parasagittal pain in the lower lumbar region that can occur during pregnancy. **Objective:** The objective of the study was to assess the risk factors related to low backache among women during pregnancy. **Methods:** This cross-sectional study included 148 pregnant women. A questionnaire used to gather demographic information, patients' characteristics, standard of living and incidence was designed for the study. Visual analogue scale was used to measure the severity of pain while the Roland Morris disability questionnaire was used to determine the effects of low back pain on activities of daily life in pregnant women. **Results:** Low back pain in previous pregnancies has a strong association with the onset of low back pain (p=0.001). Women who experienced backache during menstruation was least expected to have low back pain. (p<0.001). Women who were younger at age were more prone to have low backache (p=0.001). According to the Roland-Morris disability questionnaire 60% of pregnant women with LBP experienced mild disability, 30% of pregnant women with low back pain experienced moderate disability and only 10% of them experienced severe disability. **Conclusion:** Factors that have great impact on occurrence of backache during pregnancy are lack of physical activity, back pain during menstruation, younger age, and occurrence of low back pain in previous pregnancies. Most women with low back pain experienced mild to moderate disability during pregnancy.

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Citation: Amjad F., M. Awais. 2021. Risk factors associated with low back pain among pregnant women in Pakistan. *The healer Journal of Physiotherapy and Rehabilitation Sciences*, 1(2):51-59.

Keywords: low back pain; pregnancy; Roland Morris disability questionnaire; visual analogue scale

Introduction

Pregnancy has profound effects on a woman's body and low back pain (LBP) is common musculoskeletal condition characterized by axial or parasagittal pain in the lower lumbar region occurs during pregnancy.[1] Back pain or discomfort in pregnancy seem unnoticed and forgotten in antenatal care. The incidence of LBP is 50% in pregnant women complaining of back pain during pregnancy or during childbirth. Thirty percent of those with high pain scores

reported severe discomfort with activities of daily living (ADLs). This pain begins in early pregnancy and gradually progresses over time and affects young women more than older ones. LBP that occurs during pregnancy can be an unusual problem and may occur due to different reasons. This can be caused by the combination of mechanical, hormonal, circulatory, and psychological factors. It can cause unemployment, disability and can be the leading cause of economic and social issues.[2] Woman's body undergo vigorous changes throughout the pregnancy. Gender-related weight gain reflects these changes, which includes increases in fetal fat mass and fat-free mass as well as the placenta and amniotic fluid.[3] Increased weight raises the force exerted to joints which may transfer the patient's center of gravity and causes anterior pelvic tilt which then increase the amount of force applied to the lumbar region.

Evidence suggests that anterior shift is related to the problems with pubic symphysis. In addition, postural changes may be used to measure pre-existing changes, causing lordosis and an increase in the naturally occurring arch of the spine which increases the pressure on lower back.[4] Women will shift the head and upper body backward above the pelvis as a result of anterior center of gravity displacement, resulting in hyper-lordosis of the lumbar spine. As a result, the ligaments, intervertebral discs and joints are put under more strain which can contribute to joint derangement. Furthermore, the muscles of the abdomen are strained and debilitated and the lumbosacral plexus might be compressed by the additional weight. To accommodate enlarged uterus, the muscles of the abdomen stretch as well.

These muscles get fatigued and lose their capability to retain regular posture of body as they extend, affecting the lower back to bear the brunt of torso's increased weight.[4,5] Considerably gestational weight gain (GWG) is the major risk identified in a study. Pregnant women with greater GWG (about 20kg) had a higher prevalence of LBP than women with lower (<15 kg).6 The incidence of LBP increases both with age & height. It was difficult to distinguish the related contributions of the two factors. No evidence was found to suggest a link between back pain during pregnancy and height, weight, 'obesity indicator', or infant weight. Analysis of the amplifying and liberating factors shows some differences in LBP between pregnant and non-pregnant women. It has been reported that there is absence of low back pain in patients attending prenatal physiotherapy classes but statistics do not provide clear evidence of any protective effect of this presence.[7] LBP is also associated with sedentary lifestyle as inactivity raises the risk of back pain as compared to active women. However, patients with activities that are described as 'overworked' and 'actively demanding' also have greater risk of causing back pain in pregnancy which suggests that overwork is probably not appropriate.[4]

As the pregnancy proceeded, a small number of patients felt pain due to certain movements or ADLs which require additional work or energy. All movements especially sitting, standing, and throwing were assumed to be associated with LBP. In addition, standing-up and throwing were closely linked to LBP during pregnancy.[8] Symptoms that are associated with it include rigidity, restricted movement in the legs & back and faulty bladder control.[4] Pain and related symptoms may be normal or occur only in certain areas or after prolonged activity. Some patients report increasing pain as the daytime progresses while others report that the discomfort intensifies at night and frequently affects sleep.[4]

Some women says that it has hindered them from working and many says that it affects their ADLs including household chores and work.[4] The discomfort normally starts around the fifth or sixth month of pregnancy, and it gets worse in the evening. Pain usually begins around eighteenth week and increases amid the twenty-fourth and thirty-sixth week of pregnancy. The backache may go away after three months, but

7-8 percent of individuals suffer from chronic pain. It can, however, begin as early as the 1st trimester or as late as three weeks after delivery.[9,10,11] Approximately 67 percent of women have night-time pain. Reasons that increase the pain include walking, sitting, coughing, standing, sneezing and during a bowel movement. However, pain in the lumbar pelvic area is usually described as mild to moderate, with the exception of a small percentage (20%) of pregnant women who perceive the pain as severe.[12] During pregnancy, pain intensity measurements range from moderate (50 or 60 mm) to the visual analogue scale (VAS) of 100 mm (severe). Thus, the reported pain may be slight or tolerable in 50% of the cases and be severe in other.[10] Around 7% of women have major complications after pregnancy. Low back pain is more common in pregnant women who have had lumbar difficulties previously or chronic LBP, with discomfort happening twice as often as in those who have never had back pain. They are also more prone to suffer from severe and long-term pain.

In a similar way, women who have pain during one pregnancy have more risk of experiencing pain during the next.[4] LBP is strongly associated with a previous history of these symptoms and LBP in previous pregnancies.[2] In severe cases, pregnant woman seek treatment for cure. Intensive treatment for LBP is chosen during pregnancy for evident reasons, although there is no much success with these treatments. Treatments include physiotherapy, acupuncture, transcutaneous nerve stimulation, chiropractic treatment, stabilization belts and medication. Good posture is necessary for relieving low back pain, belts or braces are sometimes used to ensure proper posture.[4]

Exercise or active lifestyle before and after pregnancy can improve the strengthening of the abdominal muscles, back and pelvis which improve posture and allow for weight bearing capability. Low intensity exercises can also relieve pain once it starts. While exercise in the 2nd half of pregnancy lessen the pain that follows the 12-week cycle three times. In relieving lumbar pain, pelvic tilt is very effective, knee pulling, SLR and kegel exercises are also effective in alleviating LBP in women during pregnancy.[4] Exercise during the 2nd half of pregnancy had a significant impact on spinal flexibility.[13]

G. Jimoh *et al.*, conducted a study aimed to determine the incidence of LBP and its effects on physical disability and function during pregnancy. Two hundred women appearing in prenatal care clinics at three health centers in Pakistan had proforma consisted of 29 questions compiled for them. The changes associated with LBP found include the occurrence, extent and severity of pain, lack of physical activity that occur in traumatic event, the consequence of functional activity and the management options required for the relief of LBP. The rate of pregnant women with LBP is slightly more than the women without pain during pregnancy. Backache is most common in both obese and elderly group and is often associated with the improper positioning of body and associated workload. Many women during pregnancy suffering from this pain seek treatment from gynecologists rather than orthopedics or physiotherapist. Low back pain is more common in pregnancy that often results in low activity rate, poor performance.[14] The purpose of this study was to assess the risk factors related to low backache among women during pregnancy.

Methods

This cross-sectional study was performed at the University of Lahore Teaching hospital, from April 2020 to October 2020, after the approval of study from the Institutional review board committee of the University of Lahore. The data was collected from 148 pregnant females, age ranged between 21-40 years, though a questionnaire with patients' consent. The proforma included questions about the age of the patient, education, occupation category, average pre-pregnancy and during pregnancy weight, history of previous childbirth type, gestational

age and number of pregnancies. Pain-related questions were also included in the questionnaire such as the onset of LBP before pregnancy and analogue scale (VAS) which is a 10 cm line with anchor statements on the left (no pain) and on the right (severe pain) upon which a patient with his finger indicates pain intensity. The quality of life of a pregnant women affected by LBP was assessed by Roland Morris disability questionnaire (RMDQ) which consists of 24 questions describing limitations to the ADLs. Total score ranges from zero representing no disability to 24 representing the highest degree of disability. Patients were divided into 4 groups according to their scores: 0–3 points represents no disability 4–10 points represents mild disability, 11–17 points represents moderate and 18-24 with severe disability. Data was entered and analyzed by using IMB SPSS V21.0. Mean and standard deviation was calculated for quantitative variables. Correlation was calculated to find the association using chi-square test.

Results

Among 148 pregnant women, 80 (54%) presented with LBP and 68 (46%) without LB. About 36.5% of participants reported back pain, with a rise in the proportion to 54% during pregnancy. The factors which intensify the pain in a pregnant with low back pain were positions basically lying/sleeping (25%), sitting (18.75%), and walking (16.25%) followed by bending (13.75%), standing (10%), lifting heavy objects (8.75%), and physical activity (7.5%). The onset of pain is usually gradual (75.8%), but in 24.2% pregnant women it was very tough to conclude the cause of low back pain, whereas an abrupt onset of pain was observed in a small proportion of women.

Table-I demonstrates the participant's characteristics. No differences were seen significantly between the group of pregnant women with LBP and group of pregnant women without pain with reference to height, weight and age. Table-II shows the frequency and percentage of mode of delivery in previous childbirth with more percentage of normal previous pregnancy if any, and the onset of LBP during the menstrual cycle. The intensity of pain was measured through the scale known as visual vaginal delivery. The mean intensity of pain score in pregnant women with low back pain was measured at 5.52 ± 1.73 on the visual analogue scale, and the. onset of pain was determined to be occurred at an average age of gestation 25.8 ±7.5 weeks.

According to RMDQ calculations, the effect of low back pain had on the ADLS of the pregnant woman was 8.1±4.44 and 60% of pregnant women with LBP experienced mild disability while 30% of pregnant women with low back pain experienced moderate disability and only 10% of them experienced severe disability. Low back pain in previous pregnancies has a strong association with the onset of low back pain (p=0.001). Women who experienced backache during menstruation was least expected to have LBP. (p<0.001). Women who were younger at age were more prone to have low backache (p=0.001).

Table-I: Participants baseline characteristics (n=148)

Variables	Mean ± S.D
Age (years)	27.5± 5.3
Height (cm)	165±6.9
Pre-gestational weight (kg)	61±1.1
Gestational weight (kg)	71±1.15
Number of pregnancies	2.1±0.79
Week of pregnancy	37.3±5.4

Table-II: Mode of delivery in previous childbirth

	Frequency	Percent
Normal vaginal delivery	83	56%
Caesarean section	65	44%
Total	148	100%

Table-III: Association of low back pain with physical activity in pregnant women using chi-square test

		Pregnant women		Total
		With low back pain	Without low back pain	
Physical activity before pregnancy	Yes	20 (37.0%)	56 (59.6%)	76 (51.4%)
	No	34 (63.0%)	38 (40.4%)	72 (48.6%)
Total		54 (100.0%)	94 (100.0%)	148 (100.0%)
Physical activity during pregnancy	Yes	22 (40.7%)	57 (60.6%)	79 (53.4%)
	No	32 (59.3%)	37 (39.4%)	69 (46.6%)
Total		55 (100.0%)	94 (100.0%)	148 (100.0%)

Table-IV: Pearson correlation of low back pain with physical activity before and during pregnancy

	Value	Df	Sig. (2-sided)	Value	Df	Sig. (2-sided)
	Physical activity before pregnancy			Physical activity during pregnancy		
Pearson Chi-Square	6.973[a]	1	.008	5.456[a]	1	.019
Continuity Correction[b]	6.100	1	.014	4.686	1	.030
Likelihood Ratio	7.031	1	.008	5.474	1	.019
Fisher's Exact Test	--	.010	.007	--	.026	.015
Linear-by-Linear Association	6.926	1	.008	5.420	1	.020

This may be related with lower levels of education, which is also the cause of low back pain. Previous pregnancy childbirth type did not have a significant influence on the occurrence of LBP (p=0.350). Physical activity before and during pregnancy was found to correlate significantly with a lower occurrence of LBP complaints among pregnant women (p<0.001).

Discussion

Lumbosacral pain is a common complaint in a pregnant woman but it is not fully understood complaint.[4,10,15] Since fifty percent of pregnant women suffering from varying intensity of back pain during pregnancy so it is known to be pregnancy-related pain.[16,17] According to the observations of researchers, twenty percent to ninety percent of women during pregnancy complaints of LBP.[18,19,15] In addition, many factors that intensify pain, subjective evaluation and a range of components of (rate of onset of pain, intensity and limitations to functions) affect the pain assessment and

discrepancies between the outcomes of numerous studies.[20,21] Some complaints of pain resolve instinctively,

while some complaints of pain may progress into chronic pain.[22] This study proved that lying position (sleeping) (25%), sitting (18.75%), and walking (16.25%) can contribute to low back pain. It was also noted that women who did not engage in physical activity often experienced low back pain. Factors that have great impact on occurrence of backache during pregnancy are lack of physical activity, back pain during menstruation, younger age, and occurrence of low back pain in previous pregnancies.

Most women with low back pain experienced mild to moderate disability during pregnancy. In this study the researchers observed that during pregnancy and childbirth, backache extending down from leg to the knee is a sign of LBP in women during pregnancy. The authors claimed that it occurs due to changes occurring in the pelvis region while sciatica can also occur.[4] This study reported that LBP usually occurs between twenty to twenty eight weeks during pregnancy.[23] According to a study low backache usually occurred approximately at 7.6 to 2.8 weeks and it is measured with VAS with the measurement approximately 1.72 to 5.59.

Another study claimed that onset of pain normally occurred at twenty-seven weeks in which pain arises by twenty to twenty-eight weeks. While the other study claimed that the pain occurs in twenty-two weeks.[19] It is indicated by body mass scores that LBP during pregnancy is influenced by it. The most important changes, affecting the musculoskeletal system during pregnancy are weight gain. Recent study shows that average body mass index was less (22.7) in women with low back pain before pregnancy which then increased to 27.9 in pregnancy. Some studies also identify the importance of BMI and its increase is a major cause associated with backache in pregnancy.[19]

While, many scholars do not find any relation between the body mass index and backache in a pregnant woman.[23] Many studies showed that if women had backache in their first pregnancy then there is higher chance that they me experience the LBP in succeeding pregnancies.[10,24] It is observed in a study that fifty-three percent from the group of women with LBP in pregnancy stated similar complaints as they had in their earlier pregnancies.[25] It is stated in a study that both vigorous activity and LBP before pregnancy are major causes related with pelvic girdle pain and back pain. According to it, tissue damage is caused by these two factors, which are predisposing factors to develop symptoms in a patient.[10] While some scholars claimed no association between the occurrence of LBP and number of pregnancies.[26]

Though, women who are young and have low education level are more expected to develop low back pain. In the first few weeks of postpartum, betterment occurs instinctively and lower back pain subsides. For example, in a randomized controlled trial, pain was resolved without treatment within the first twelve weeks after birth in ninety-nine percent of women.[16] Women who are regularly involved in a physical activity before pregnancy are less likely to have pain, while vigorous activity will intensify this pain in pregnancy.[20,27,28]

The risk of back pain decreases with physical activity in pregnancy.[13,29] The effect of exercise is advantageous for women with low back pain. Performing stabilizing exercises are beneficial for women in pregnancy suffering from back pain and pelvic pain. In addition, recurrent episodes of backache and pelvic girdle pain maybe prevented with physical activity to occur during pregnancy.[30] Evidence suggests that exercise performed in pregnancy may decrease the pregnancy related LBP and that functional disability may be recover by

any kind of exercise (either water-based or land-based exercise). In some studies it is suggested that pregnancy related pelvic girdle pain may be improve with the acupuncture therapy or CST.[31]

The intensity and duration of the exercise should be designed according to the woman's capacity and condition of health, as well as the dedication. There are some kinds of exercises which are not popular but they are simple, consider safer for women during pregnancy and recommended in pregnancy i.e. aqua-fit exercise and yoga. Performing breathing exercises, relaxing techniques and various fitness exercises are advantageous for both fetus and mother. Some studies showed that uterus functions better and labor is shorter in mothers who are physically active.

The risk of childbirth with surgery decreases, blood loss during expulsion of placenta reduces, complications with breastfeeding also minimizes and the time for full recovery after childbirth is shorter. Mother who is involved in a physical activity have plenty of benefits such as decreased birth complications and better rate of oxygen during delivery. Regular exercise is beneficial for pregnancy, childbirth as well as for the reduction of birth defects.[32,33,34] A researcher observed that almost one-third of women during pregnancy in the study suffered from low backache which worsens as the day progressed, while other one-third suffered from pain which intensify at night, which also disturbs their sleep.

Pain occurs during sitting, bending, walking, lifting and standing positions. It is analyzed by a researcher that ADLS are inducing backache; movements which were thought to be related with LBP were mainly standing up from a chair, and turning and standing.[8] It is mainly very problematic because there are no treatment options prescribed for women with low back pain during pregnancy which shows that many of the pregnant women with pain are left untreated. Another consequence is that it progresses to chronic pain after childbirth.

Women should involve in some type of physical activity and may look for the types of jobs that are most appropriate for them. There are many aspects that disturb the condition of a women during pregnancy and so it is essential to select the most suitable treatment that are related to diet and proper body function.

The main limitation of the study was time constraint and females were reluctant to give information and they were least interested in doing every physical activity in this condition. It is necessary to provide educational campaigns and awareness about possible treatments for low back pain to pregnant females.

Conclusion

Low back pain is a prevalent musculoskeletal problem affecting females and it was observed that a large number of women during pregnancy complains of having pain on daily basis, while it is rare before pregnancy. Some women complained of having day time pain while other complained of nocturnal pain which also interferes with their sleep. Factors that have great impact on occurrence of LBP during pregnancy are lack of physical activity, back pain during menstruation, young age, and occurrence of pain in earlier pregnancies. Most women with low back pain during pregnancy experienced mild to moderate disability.

Declarations

Consent to participate: Written consent had been taken from patients. All methods were performed following the relevant guidelines and regulations.

Availability of data and materials: Data will be available on request. The corresponding author will submit all dataset files.

Competing interests: None

Funding: No funding agency was involved.

Authors' contributions: All authors read and approved the final manuscript.

References

1. Bryndal A, Majchrzycki M, Grochulska A, Glowinski S, Seremak-Mrozikiewicz A. Risk Factors Associated with Low Back Pain among A Group of 1510 Pregnant Women. Journal of personalized medicine 2020; 10(2): 51.
2. Mohseni-Bandpei MA, Fakhri M, Ahmad-Shirvani M, et al. Low back pain in 1,100 Iranian pregnant women: prevalence and risk factors. The spine journal 2009; 9(10): 795-801.
3. Widen E, Gallagher D. Body composition changes in pregnancy: measurement, predictors and outcomes. European journal of clinical nutrition 2014; 68(6): 643-52.
4. Sabino J, Grauer JN. Pregnancy and low back pain. Current reviews in musculoskeletal medicine 2008; 1(2): 137-41.
5. Katonis P, Kampouroglou A, Aggelopoulos A, et al. Pregnancy-related low back pain. Hippokratia 2011; 15(3): 205.
6. Matsuda N, Kitagaki K, Perrein E, et al. Association Between Excessive Weight Gain During Pregnancy and Persistent Low Back and Pelvic Pain After Delivery. Spine 2020; 45(5): 319-24.
7. Mantle M, Greenwood R, Currey H. Backache in pregnancy. Rheumatology 1977; 16(2): 95-101.
8. Morino S, Ishihara M, Umezaki F, et al. Low back pain and causative movements in pregnancy: a prospective cohort study. BMC Musculoskeletal Disorders 2017; 18(1): 1-8.
9. Verstraete E, Vanderstraeten G, Parewijck W. Pelvic Girdle Pain during or after Pregnancy: a review of recent evidence and a clinical care path proposal. Facts, views & vision in ObGyn 2013; 5(1): 33.
10. Wu W-H, Meijer OG, Uegaki K, et al. Pregnancy-related pelvic girdle pain (PPP), I: Terminology, clinical presentation, and prevalence. European Spine Journal 2004; 13(7): 575-89.
11. Gutke A, Östgaard HC, Öberg B. Pelvic girdle pain and lumbar pain in pregnancy: a cohort study of the consequences in terms of health and functioning. Spine 2006; 31(5): E149-E55.
12. Mens JM, Huis YH, Pool-Goudzwaard A. Severity of signs and symptoms in lumbopelvic pain during pregnancy. Manual therapy 2012; 17(2): 175-9.
13. Garshasbi A, Zadeh SF. The effect of exercise on the intensity of low back pain in pregnant women. International Journal of Gynecology & Obstetrics 2005; 88(3): 271-5.
14. Jimoh A, Omokanye L, Salaudeen A, et al. Prevalence of low back pain among pregnant women in Ilorin, Nigeria. Medical Practice and Reviews 2013; 4(4): 23-6.
15. Smith MW, Marcus PS, Wurtz LD. Orthopedic issues in pregnancy. Obstetrical & gynecological survey 2008; 63(2): 103-11.
16. Gutke A, Östgaard HC, Öberg B. Predicting persistent pregnancy-related low back pain. Spine 2008; 33(12): E386-E93.
17. Carlson HL, Carlson NL, Pasternak BA, Balderston KD. Understanding and managing the back pain of pregnancy. Current women's health reports 2003; 3(1): 65-71.
18. Norén L, Östgaard S, Johansson G, Östgaard HC. Lumbar back and posterior pelvic pain during pregnancy: a 3-year follow-up. European spine journal 2002; 11(3): 267-71.
19. Mogren IM, Pohjanen AI. Low back pain and pelvic pain during pregnancy: prevalence and risk factors. Spine 2005; 30(8): 983-91.
20. Ostgaard HC, Zetherström G, Roos-Hansson E, Svanberg B. Reduction of back and posterior pelvic pain in pregnancy. Spine 1994; 19(8): 894-900.
21. Stuge B, Hilde G, Vøllestad N. Physical therapy for pregnancy-related low back and pelvic pain: a systematic review. Acta obstetricia et gynecologica Scandinavica 2003; 82(11): 983-90.
22. Vadivelu R, Green T, Bhatt R. An uncommon cause of back pain in pregnancy.

Postgraduate medical journal 2005; 81(951): 65-7.
23. Wang S-M, Dezinno P, Maranets I, Berman MR, Caldwell-Andrews AA, Kain ZN. Low back pain during pregnancy: prevalence, risk factors, and outcomes. Obstetrics & Gynecology 2004; 104(1): 65-70.
24. Mens JM, Vleeming A, Snijders CJ, Ronchetti I, Ginai AZ, Stam HJ. Responsiveness of outcome measurements in rehabilitation of patients with posterior pelvic pain since pregnancy. Spine 2002; 27(10): 1110-5.
25. Mota MJ, Cardoso M, Carvalho A, Marques A, Sá-Couto P, Demain S. Women's experiences of low back pain during pregnancy. Journal of back and musculoskeletal rehabilitation 2015; 28(2): 351-7.
26. Orvieto R, Achiron A, Ben-Rafael Z, Gelernter I, Achiron R. Low-back pain of pregnancy. Acta obstetricia et gynecologica Scandinavica 1994; 73(3): 209-14.
27. Mogren I. Perceived health, sick leave, psychosocial situation, and sexual life in women with low-back pain and pelvic pain during pregnancy. Acta obstetricia et gynecologica Scandinavica 2006; 85(6): 647-56.
28. Mogren IM. BMI, pain and hyper-mobility are determinants of long-term outcome for women with low back pain and pelvic pain during pregnancy. European spine journal 2006; 15(7): 1093-102.
29. Shiri R, Coggon D, Falah-Hassani K. Exercise for the prevention of low back and pelvic girdle pain in pregnancy: A meta-analysis of randomized controlled trials. European Journal of Pain 2018; 22(1): 19-27.
30. Bogaert J, Stack M, Partington S, Marceca J, Tremback-Ball A. The effects of stabilization exercise on low back pain and pelvic girdle pain in pregnant women. Annals of Physical and Rehabilitation Medicine 2018; 61: e157-e8.
31. Liddle SD, Pennick V. Interventions for preventing and treating low-back and pelvic pain during pregnancy. Cochrane Database of Systematic Reviews 2015; (9).
32. Miranda M, Navío C. Benefits of exercise for pregnant women. Journal of sport and health research 2013; 5(2): 229-32.
33. Melzer K, Schutz Y, Boulvain M, Kayser B. Physical activity and pregnancy. Sports Medicine 2010; 40(6): 493-507.
34. Weir Z, Bush J, Robson SC, McParlin C, Rankin J, Bell R. Physical activity in pregnancy: a qualitative study of the beliefs of overweight and obese pregnant women. BMC pregnancy and childbirth 2010; 10(1): 1-7.