

Assessment of Balance in Pregnant Women Suffering from Mechanical Low Back Pain

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Abstract: The aim of this study was to assess the effects of mechanical LBP on balance during second and third trimester of pregnancy. In this study, the stability indices during the second and third trimester of pregnancy were measured using Biodex Balance System. The overall (OA), anterior-posterior (AP) and medial-lateral (ML) stability index measured at stability level 7. The study population consisted of 30 pregnant women in second trimester, their age ranged from 20 to 28 years and BMI < 30 Kg/m², they were two Groups, group 1 (n=15) complain from mechanical LBP and group 2 (n=15) control group without back pain and another 30 pregnant women in third trimester with same age and BMI < 35 Kg/m², they were two group, group 3 (n=15) with back pain and group 4 (n=15) without back pain. The four groups either pregnant women suffering from LBP or pregnant women without LBP have disturbance of balance during the second and third trimester of pregnancy. On the other hand, group 1 & 3 showed significantly higher values of stability indices than group 2 & 4 (P<.05). In addition, group 3 showed more disequilibrium than group 1 (P<.05). Pregnant women suffering from LBP have very poor postural equilibrium during second and third trimester of pregnancy as compared with pregnant women without LBP and also the study proved that there are more disequilibrium and balance disturbance in pregnant women suffering from LBP during third trimester of pregnancy as compared with pregnant women suffering from LBP during second trimester of pregnancy.

Key words: Balance • Low Back Pain • Second Trimester • Third Trimester • Pregnancy

INTRODUCTION

Pregnancy is characterized by different alterations which occur in every woman [1], hormonal, anatomical and cardiovascular changes, along with edema and weight gain, which may affect musculoskeletal postural equilibrium [2, 3].

The hormonal and hemodynamic alterations, coupled with the accumulation of fluid, fat and mechanical distress of pregnancy, cause mechanical disturbances in ligaments and joints of conjunctive tissue [4], which could contribute to increasing joint mobility and increasing risk of ligament injury [3].

The increasing size and weight of the baby will cause an exaggerated forward pelvic tilt. This is the cause of the lower back pain that many women suffer from during pregnancy. Dorsal and lumbar spine curvature change [1], pain in lower back and pelvis increase [2] and finally stability and gait pattern change [5].

The increase in weight and disequilibrium of joint system caused by increasing body mass which leads to shifting center of mass (COM) and increasing oscillation of center of force (COF), resulting in disequilibrium and influencing biomechanics of posture. This alteration can increase risk of falling, which occurs in 25% of pregnant women [6].

Due to the posture alterations which are evident during the gestational period and the expected changes in balance, musculoskeletal discomfort in the thorax and lower limbs is common [2, 3] and can cause incorrect positioning of feet, back and lower limb pain [7], changes in walking pattern [1]. Therefore, the repercussions of pregnancy on musculoskeletal system result in great adjustments in static and dynamic posture for women.

Low back pain affects 50.9% of pregnant women [8, 9] and 10% of pregnant women complain of pelvic pain during pregnancy [10]. After labor by one year 72% of women suffering from lumbo-pelvic pain and continuous for up to 3 years after labor [11]. Few studies were done during second and third trimester of pregnancy to assess relationship between equilibrium and pregnancy. So the present study evaluated the effects of mechanical LBP on body balance by comparing stability indices between pregnant women suffering from LBP and pregnant women without LBP during second and third trimester of pregnancy with aim of proving basic data for health care in pregnant women.

MATERIALS AND METHODS

This cross sectional study was conducted at the balance lab in Faculty of Physical therapy, Delta University from November 2018 to January 2019. The study protocol was explained in details for each women before the assessment and all women signed an institutionally approved informed consent form which was approved by the Ethics Committee of the Faculty of Physical Therapy, Cairo University No:P.T.REC/012/002253.

Participants: Pregnant women at second and third trimester of pregnancy were initially screened and eligible to share in the study if they had age ranged from 20 - 28 years, body mass index not exceed (30 Kg/m^2 for the female in the second trimester and 35 Kg/m^2 for females in the third trimester) and all were primiparus. They were excluded if they had neuromuscular or musculoskeletal disorders or visual disturbance.

The study population consisted of 60 pregnant women: 30 pregnant women in second trimester (age ranged from 20 to 28 years and $\text{BMI} < 30 \text{ Kg/m}^2$, they were two groups, group (1) ($n=15$) that consisted of females complaining from mechanical LBP and group 2 ($n=15$) control group that consisted of females without

back pain. And another 30 pregnant women in third trimester with same age and $\text{BMI} < 35 \text{ Kg/m}^2$, they were two groups, group 3($n=15$) that consisted of females complaining from mechanical LBP and group 4 ($n=15$) control group that consisted of females without back pain.

Assessment: In this study, the stability indices were measured for participants at the 28 th weeks of gestation in group 1&2 in second trimester and at the 36th weeks of gestation for group 3& 4 in third trimester using Biodex Balance System. The overall (OA), anterior-posterior (AP) and medial-lateral (ML) stability index measured at stability level 7 according to pilot study. Biodex balance system is stability assessment and training tool. It consists of movable balance platform, which provides up to 20 degrees of surface tilt in 360° range. The stability levels available in the system ranged from complete firm surface (Stability level-8) to very unstable surface (Stability level-1)[12].

Biodex balance assessment protocol was used in standing position. The pregnant women in four groups during the second and third trimester of pregnancy were barefoot and instructed to focus on visual feedback screen direct in front of them and attempt to maintain cursor in the center of screen while standing on the unstable platform at stability level 7.

Data Analysis: SPSS for windows, version 23 (SPSS, Inc., Chicago, IL) was used to conduct the statistical analysis. Before the final analysis, data were screened for extreme values and tested, using Shapiro-Wilk test, for normality. Screening for normality showed that all dependent variables were normally distributed and not violates the parametric assumption. unpaired sample t-test was used. The alpha level was set at 0.05.

RESULTS

Statistical analysis revealed that there was significant reduction in OA index, AP index and ML index in group 2 in compared to group 1 ($p\text{-value} < 0.05$) (Table 1).

Statistical analysis revealed that there was significant reduction in OA index, AP index and ML index in group 4 in compared to group 3 ($p\text{-value} < 0.05$) (Table 2).

Statistical analysis revealed that there was significant reduction in OA index, AP index and ML index in group 1 in compared to group 3 ($p\text{-value} < 0.05$) (Table 3).

Table 1: The stability indices of group (1) pregnant women with LBP versus group (2) pregnant women without LBP during second trimester of pregnancy at stability level 7:

| Stability indices (SI) Level 7 | $\bar{x} \pm SD$ | | Sign. |
|--------------------------------|------------------|-----------|--------|
| | Group 1 | Group 2 | |
| OA index | 5.34 ± 1.22 | 3.37±0.32 | P<0.05 |
| AP index | 4.11 ± 1.29 | 2.96±0.27 | P<0.05 |
| ML index | 4.26 ± 1.26 | 2.42±0.49 | P<0.05 |

Data are expressed as mean ± SD. S= < 0.05= Significant.

Table 2: The stability indices of group (3) pregnant women with LBP versus group (4) pregnant women without LBP during third trimester of pregnancy at stability level 7:

| Stability indices (SI) Level 7 | $\bar{x} \pm SD$ | | Sign. |
|--------------------------------|------------------|-----------|--------|
| | Group 3 | Group 4 | |
| OA index | 8.22 ± 1.44 | 3.57±0.41 | P<0.05 |
| AP index | 6.63 ± 1.67 | 2.57±0.31 | P<0.05 |
| ML index | 6.38 ± 1.57 | 2.76±0.51 | P<0.05 |

Data are expressed as mean ± SD. S= < 0.05= Significant.

Table 3: The stability indices of group (3) pregnant women with LBP during third trimester of pregnancy versus group (1) pregnant women with LBP during second trimester of pregnancy at stability level 7:

| Stability indices (SI) Level 7 | $\bar{x} \pm SD$ | | Sign. |
|--------------------------------|------------------|-------------|--------|
| | Group 3 | Group 1 | |
| OA index | 8.22 ± 1.44 | 5.34 ± 1.22 | P<0.05 |
| AP index | 6.63 ± 1.67 | 4.11 ± 1.29 | P<0.05 |
| ML index | 6.38 ± 1.57 | 4.26 ± 1.26 | P<0.05 |

Data are expressed as mean ± SD. S= < 0.05= Significant

DISCUSSION

This study examined the effects of mechanical LBP on body balance by comparing stability indices between pregnant women suffering from LBP (group 1) and pregnant women without LBP (group 2) during second trimester of pregnancy and also by comparing stability indices between pregnant women suffering from LBP (group 3) and pregnant women without LBP (group 4) during third trimester of pregnancy.

The results of our study proved that, the participant in 4 groups suffered from disturbance of balance and equilibrium during 2nd and 3rd trimester of pregnancy. On the other hand pregnant women suffering from LBP (study group) showed significantly higher values of stability indices including (OA, AP and ML) in 3rd followed by 2nd trimester than pregnant women without LBP (control group) which indicated that more disequilibrium and balance disturbance (P <.05).

According to the results of this research, we can concluded that pregnant women suffering from LBP have very poor postural equilibrium during 3rd trimester of pregnancy more than during 2nd trimester as compared with control group. On the other hand these results can be explained by the fact that, the increase in weight as well as disequilibrium on articulation system caused by increase body mass , body size and LBP can shift centre of gravity (COG), resulting in unstable postural balance which affect biomechanics of stability and good posture control [8].

During pregnancy, secretion of relaxin hormone increases more than ten times produce relaxation of ligaments around sacroiliac joint, which causes instability and dysfunction of lumbosacral, pelvic pain and LBP [13, 14].

In addition, the spinal curvature according to growth of fetus and the increase in weight load applied to the joints due to the change in the center of gravity may increase the pain in the lumbo-pelvic region [6]. Approximately 50 % of weight gain concentrated in abdominal region anterior to line of gravity (LOG), transferring centre of gravity, which may promote postural instability [15].

Sihvonen *et al.* [16] reported that LBP in pregnant women begins in the 18th week of pregnancy, reaching maximum between 24 and 36 weeks, which considering another cause of unstable postural balance .

Butler *et al.* [17] said that postural stability gradual decreases during pregnancy and remains reduced up to 6 - 8 weeks after childbirth. Another study done by Jang *et al.* [18] who found that greater anterior–posterior sway, no change in medial–lateral sway and wider stance breadth in pregnant women during stance in comparison to non-pregnant women.

In agreement with the findings of Hyunju *et al.* [15], who study the changes in spinal curvature, degree of pain, balance ability and gait ability according to pregnancy period in pregnant and no pregnant women and found that the gait speed during pregnancy showed significant decrease in pregnant women compared with none pregnant women in addition to balance of pregnant women showed significant decrease compare with non pregnant women on unstable surfaces .

CONCLUSION

Pregnant women suffering from LBP have very poor postural equilibrium during second and third trimester of

pregnancy as compared with pregnant women without LBP and also the study proved that there are more disequilibrium and balance disturbance in pregnant women suffering from LBP during third trimester of pregnancy as compared with pregnant women suffering from LBP during second trimester of pregnancy.

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