RESEARCH ARTICLE

EFFECTIVENESS OF STABILITY BALL EXERCISES COMBINE WITH ERGONOMIC TRAINING IN PREGNANCY RELATED LOW BACK PAIN - A RANDOMIZED CLINICAL TRIAL

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ABSTRACT

Background: Pregnancy related low back pain (PR-LBP) is very common, which affects activities of daily life including work, sleep, physical activity and compromise the quality of life. The prevention PR-LBP through physical therapy is uncommon in Pakistani population. **Objective:** to determine the effectiveness of stability ball exercises (SBE) in combination with ergonomic training (ET) in pregnancy related low back pain (PR-LBP). **Methodology:** A single blinded, randomized clinical trial was conducted at physical therapy department of Haleema Siraj Hospital Rawalpindi Pakistan. A total of n=90, who were coming to the clinic for follow-up, fulfilled the inclusion criteria and were thus recruited through non-probability convenient sampling technique. The study participants were randomly divided in to two groups i.e. SBE (n=45) and combination of SBE with ES (n=45), through lottery method. Quebec disability scale (QDS) was used to determine the functional disability. **Results:** The mean age of study participants was 26.5±4.56723 years. Significant improvement was observed in both groups with larger effect size throughout the treatment duration ($p<0.05$).**Conclusion:** SBE and combination of SBE with ES significantly reduced low back pain and functional disability

Keywords: activities of daily living, disability, ergonomic, posture, pregnancy, pregnancy related low back pain, stability ball exercises.

INTRODUCTION

Low back pain (LBP) is very common during pregnancy either with or without pelvic girdle pain; henceforth referred to as pregnancy related low back pain (PR-LBP).[1] It is very usual musculoskeletal pain which affects activities of daily life including work, sleep, physical activity, and so on, which in result compromise the quality of life. [2]

Different studies reported prevalence of PR-LBP which vary because of diagnostic criteria and different definitions. It is reported that approximately 45-75% women experience low back pain during pregnancy or post-partum. [1] Many studies have shown that 20%-23% women take sick leave from work due to PR-LBP. It is considered as the most common cause of absentees from work place.[3, 4] Although most females recover from PR-LBP after delivery, within a month but 5%-8.5% of females continue to report LBP even after up to 2 years of delivery. [5]

The mechanical factors may contribute to PR-LBP such as postural changes and weight gain. As body's centre of gravity move forward which increases lumbar processes and increased pressure on lower back, consequently leads to LBP during pregnancy.[6,7] Also, hormonal changes during pregnancy also cause LBP. In pregnancy, increase in production of relaxin hormone affects neuromuscular control, ligament relaxation and causes discomfort in sacroiliac joint and low back which leads to pelvic instability and spine dislocation.[6-8]

Conservative management is gold standard to treat or manage LBP. It includes pharmacological treatment, physiotherapy, nerve stimulation, massage, acupuncture, stabilizations belt, yoga, relaxation exercises. While considering the individuality of each female and condition of pregnancy, early identification and treatment leads to best results. [9] A recent study suggests that stability ball exercises is an effective approach which reduces low back pain, improves exercise behaviour and daily life activities.[10] It improves muscular alignment and posture which reduces stress on back and thus reduces pain significantly. [7] Furthermore, PR-LBP can be prevented through proper posture which reduces mechanical stress on lumbar area, and exercises which strengthens and improve flexibility of surrounding structures.[7] Other than that moderate intensity of aerobics prior to

planned pregnancy may prevent LBP. Proper posture and ergonomic trainings also helps to reduce pain intensity of low back. [11] This can be augmented by counsel patient the resting positions for comfort, lying with feet supported, sitting with back supported, standing and stretching exercises relax the tired muscles. Low heeled shoes and footstools maintains a posterior pelvic tilt which also reduces backache.[12]

Literature supports effectiveness of the stability ball exercises and ergonomics training during activities for managing pregnancy related low back pain. But there is paucity in the literature regarding evidence of combination of stability ball exercises with ergonomic training. It was hypothesized that ergonomic training in addition stability ball exercises may further improve pregnancy related low back pain. So the objective of the study was to determine the effectiveness of stability ball exercises (SBE) in combination with ergonomic training (ET) in pregnancy related low back pain (PR-LBP).

METHODOLOGY

A single blinded, randomized clinical trial was conducted at physical therapy department of Haleema Siraj Hospital (HSH) Rawalpindi Pakistan for a time period of 1 year. The study was initiated after taking approval from the medical director of HSH and advanced study & research committee (ASRC) of Isra institute of rehabilitation sciences, Isra University Islamabad. The informed consent was taken from all participants and assured them about confidentiality of the data according to the Deceleration of Helsinki.

The participants were included who had a pregnancy of up to 32 weeks with previous history of low back pain and with the age of 18-35 years. However pregnant females who had any deformity, complications or co-morbidity such as hypertension and diabetes, suspicion of preterm labor were excluded from the study. A total of n=90, who were coming to the clinic for follow-up, fulfilled the inclusion criteria and were thus recruited through non-probability convenient sampling technique as shown in figure 1.

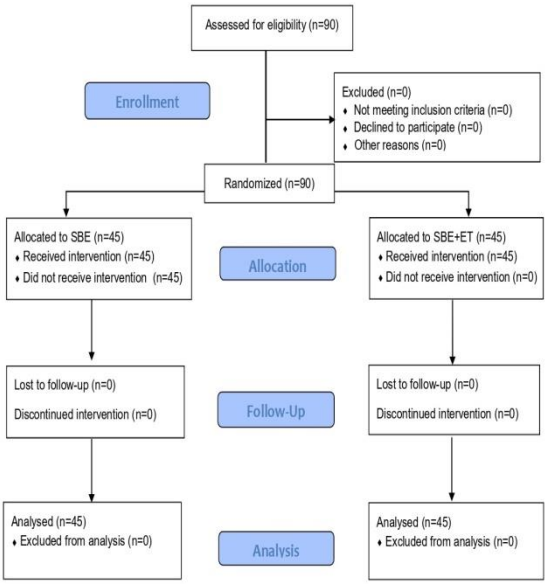

Figure 1: CONSORT diagram

The participants were randomly allocated in to two group; stability ball exercises (SBE) n=45, and combination of stability ball exercises (SBE) with ergonomic training (ET) group n=45, through lottery method. The duration of intervention was one month and five sessions a week. The intervention of both groups is shown in table 1.

Table 1: Intervention of study participants

Group I SBE group	Group II (SBE+ES)
Ball wall squats Stand up straight with a fitness ball behind back and against the wall, the feet about shoulder-width apart. Slide down the wall until knees reach a 90-degree angle then return to starting position, for 10 repetitions in 3 sets with 3 minutes rest between the sets. **Gym ball balancing** : Sit on the gym ball with back straight and legs should be open slightly to balance, move hips in circular movements clockwise and anti-clock wise for 10 repetition on each side.	
-	Proper posture training and restore biomechanics during activities i.e. sitting lying, carrying etc

The pre interventional data was collected before first day of intervention and participants were reassessed after every 2 weeks till the end of intervention i.e. 4th week. The general demographics of study participants in terms of age, occupation, medication, and pre-existing medical conditions were obtained at baseline. Quebec Pain disability scale (QDS) was used to determine the functional disability of patients, which has established validity and reliability.[13] As the data was normally distributed so the within group changes

RM-ANOVA was applied in both groups, while between the group One Way ANOVA was applied to determine the differences with significance value and effect size. The SPSS version 20 was used to analyse the data and level of significance was set at p<0.05.

RESULTS

The mean age of the study participants was 26.5000±4.56723 years. Mostly females n=70 were housewife, n=8 were teachers, n=9 were health care professionals and n=3 were government employees. The median numbers of pregnancies were 2(2) and duration of pregnancy was 25.7667±5.19734 weeks. Quebec Pain Disability Questionnaire showed significant improvement in stability ball exercise group {(*F(df)*= 103.398(1.74,76.92), *ηp2*=0.701) and combination of ES and SBE group {(*F(df)*= 86.506(1.4, 61.78), *ηp2*=0.663) with large effect size. Pair wise comparison also showed significant improvement from 0 week to 2nd week (p<0.001, Cohen's d=1.25)} and 2nd week to 4th week (p<0.001, Cohen's d=1.137)} as shown in table 2.

Furthermore, between the groups analysis showed no significant difference (p<0.001) between both groups throughout the treatment duration as shown in table 3.

Table 2: With-in Group changes

		Stability Ball Exercises					Combination of ES and SBE				
		Mean	*SD*	*MD/ F(df)*	*p-value*	*d/ ηp²*	*Mean*	*SD*	*MD/ F(df)*	*p-value*	*d/ ηp²*
Quebec Pain Disability	Zero week	58.38	18.47	14.42	0.000***	1.09[a]	59.93	17.48	15.48	0.000***	1.256[a]
	2nd week	43.96	17.60	14.37	0.000***	1.28[b]	44.44	16.99	15.64	0.000***	1.137[b]
	4th week	29.58	16.79	103.39(1.74,76.92)	0.000***	0.70[c]	28.80	16.40	86.50(1.4, 61.78)	0.000***	0.663[c]

[a] zero to 2nd week, [b] 2nd week to 4th week and [c]zero to 4th week.
Significance Level: p<0.05, p<0.01**, p<0.001***.*

Table 3: Between group comparison *(QDS)*

		Stability Ball Exercises		Combination of ET and SBE				
		Mean	*SD*	*Mean*	*SD*	*F(df)*	*P-value*	*ηp²*
Quebec Pain Disability	Zero week	58.38	18.479	59.93	17.483	.168(1,88)	0.683	.002
	2nd week	43.96	17.609	44.44	16.993	0.018(1,88)	0.894	.000
	4th week	29.58	16.799	28.80	16.402	0.049(1,88)	0.825	.001

Significance Level: p<0.05, p<0.01**, p<0.001****

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DISCUSSION

The objective of the study was to determine the effectiveness of stability ball exercises (SBE) combined with ergonomic training (ET) on Quebec pain disability (QDS) scale in women with pregnancy related low back pain (PR-LBP). It was hypothesized that combination group is more effective as compared to the group with stability ball exercises (SBE). However, the results suggested that the study participants in both groups showed equally significant improvement throughout the intervention duration. A previous study conducted by Izhar et al suggested that SBE and ET, both significantly improve pain and disability related to PR-LBP. [7]

According to results of the study, stability ball exercise showed significant improvement in functional disability of women with PR-LBP. A study conducted by Chiu-Fang Yan et al. determined stability ball exercises not only reduces the low back pain in pregnant women but also improve the daily life functions.[10] Similarly, a study reported improvement in functional disability, pain and spinal mobility measured on Quebec Disability in patients performing stability ball exercises.[14] The possible reasons of improvement in functional disability is improved posture, muscular alignment and centre of gravity.[15] Exercises on stability ball mobilize the lumbosacral fulcrum and sacroiliac coxofemoral articulation and maintain the muscle tone of transverse and oblique abdominal muscles.[16] Therefore these studies correspond to the recent study which emphasized the use of stability ball exercise to reduce functional disability.

Moreover, significant improvement was observed in combination of stability ball exercises and ergonomic training group, which also correlates with the previous literature in which ergonomic

training[17, 18] and stability ball exercises significantly improve LBP.[10] During sitting, the lumbar spine is in kyphotic posture (flexed) which displaces the nucleus pulposis posteriorly and increases the stress on intervertebral disc. The reduced motion in lumbar spine compromise the nutrition of intervertebral disc because prolonged contractions causes muscle fatigue because of the reduced resting period. [19] Therefore, proper posture during activities reduces mechanical load on spine and thus decreases LBP.[7]

In pregnancy, the enlarging gravid uterus shifts centre of gravity forward that increases the natural inward curvature of spine and hence increases mechanical load on spine and stress on intervertebral disc which leads to compression due to decreased height. And proper posture training balance the anterior shift.[9, 20, 21] Similar to the results of current study ergonomic training and maintaining posture reduces LBP and improve the daily functions.[22, 23] Furthermore, forward shifting requires good core muscle strength to stabilize the lumbar spine and pelvic girdle.[24] And exercises on stability ball improves the sense of balance, muscle flexibility and endurance and strengthens the core muscles which stabilize the lumbar spine and thus reduces the occurrence of back injury and functional disability.[25, 26]

The one of the limitation in the study was the sample was not specific to one of the three trimesters, as the fetus grow it affects biomechanically affect differently in each trimester.

CONCLUSION

The combination of stability ball exercises with ergonomic trainings equally effective with stability ball exercises alone in pregnancy related low back pain. So stability ball exercises alone can be prescribe for alleviate the low back pain in pregnancy. But it is recommended to consider the trimester specific low back in future study, to make the results generalized to specific population.

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