

Original Article

Effects of Core Stability Training on Lumbar Flexibility in Postpartum Females with Hyperlordosis: A Quasi-Experimental Study

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Abstract

Background: Lordosis is the natural curve of lumbar spine which is essential for proper posture and spinal alignment. When this angle increases then that is hyperlordosis & when it decreases called hypolordosis. Many postpartum women experience an increase in lumbar lordosis, which can cause discomfort, pain, and postural imbalances, potentially leading to long-term musculature issues. Core stability exercises effectively strengthen the abdominal and spinal muscles, addressing these postural problems and enhancing overall stability, which is crucial for recovery and preventing future complications.

Objective: The current study was designed to assess the effect of core stability training on lumbar flexibility in hyperlordotic postpartum females.

Methods: In this Quasi Experimental study, a Non-Probability-Convenience sampling technique was used to collect the data. The total duration of treatment was 12 weeks. Pre-treatment Modified-Modified Schober Test (MMST) value was measured before and after the treatment of twelve weeks to check the efficiency of the core stability exercises in hyperlordotic postpartum females. Data was analyzed on SPSS 25.

Results: In this study, core stability training significantly decreased lumbar lordosis (p value = 0.000) with mean values of 8.21 ± 0.22 and 7.68 ± 0.37 for Pre-Exercise MMST (Mean \pm SD) and Post-Exercise MMST (Mean \pm SD) respectively.

Conclusion: Core stability training is a good approach for correcting lumbar lordosis and back pain after childbirth. This means core stability exercises played an important role in correcting hyperlordosis and in gaining the spine's normal curvature hence alleviating symptoms.

Keywords: Postpartum, Core Stability, Lumbar Flexibility, Hyperlordotic

Introduction

Pregnancy triggers various physiological adaptations, driven primarily by hormonal shifts, increased

weight, and expanded blood volume.¹ These changes often lead to alterations in the spine's curvature, especially in the thoracic and lumbar regions, as well as discomfort in the lower back and pelvic areas. They also affect balance and gait patterns.^{2,3} Postpartum, addressing hyperlordosis can benefit from enhanced lumbar flexibility and strengthened core stability, both essential in restoring alignment and alleviating discomfort. Low back pain related to pregnancy is a frequent issue, affecting around 50.9% of pregnant women. Additionally,

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49% report experiencing pelvic pain for more than three months during pregnancy, while 10% continue to have pelvic pain throughout the entire pregnancy. In the first year postpartum, 72% of women suffer from pain in the lumbar and pelvic areas, with some continuing to experience this discomfort for up to three years after giving birth.⁴ Some of the musculoskeletal changes in pregnancy include the forward neck flexion, hyperlordosis of the lower back, and laxity of ligaments & joints, increasing the movement of the pubic symphysis and sacroiliac joint.⁵ The hormone released in pregnancy softens the ligaments & tendons, leading to the hypermobility of the joints and preparing the body for the delivery phase.⁶ Backache is one of the common problems in pregnant females, pain can be of the facet joint and pelvic girdle or combined, 76% of the pain is mainly in the lower back. Even the increased lordotic curvature during pregnancy remains the same after delivery to some extent. Abdominal muscles start separating in later stages of pregnancy which affects the stability of the lower back spine, this, in turn, tightens the hip flexors & lower back muscles to stabilize the spine. Because of all musculoskeletal changes the normal gait pattern of pregnant females gets disturbed and mostly adapts to the waddling gait. These musculature and postural changes cause many musculoskeletal symptoms & pains.⁷

Lumbar Flexibility pertains to the range of motion and ability to move the lower back (lumbar spine) through various motions such as bending forward, backward, and side-to-side. The pelvic floor muscles, diaphragm, and transverse abdominis, as well as superficial muscles like the rectus abdominis, obliques, and erector spinae are among the structures that provide lumbar flexibility and mechanical stability of the spine. Core stability refers to the strength, endurance, and control of these muscles. Postural changes during pregnancy, such as the shortening of the para-spinal muscles, increase in pelvic tilt, and overstretching of the abdominal muscles together with reduced muscle stamina, compromise the strength and stability of the lumbopelvic region.⁸ An anterior pelvic tilt increases lumbar lordosis and compensatory thoracic kyphosis, with lumbar hyperlordosis being the most prevalent postural change.

Pregnancy-related lumbar and pelvic girdle pain is a prevalent issue, impacting many women both during pregnancy and postpartum, often leading to functional impairment and reduced quality of life. Studies indicate that stabilizing exercises can enhance physical function

and reduce disability in this population, highlighting the potential value of targeted motor control and stability exercises.^{9,10} Specific exercises for motor control and stability have been recommended for lumbar and pelvic postpartum pain.^{11,12} The level of evidence is, however, limited, as few randomized controlled trials have been performed. Despite limited evidence of effect, core stabilization exercises have grown in popularity and different core stabilization approaches are practiced because of increasing awareness of postpartum issues as well as recommendations by healthcare providers. Investigating the effectiveness of these exercises is essential to establish evidence-based practices for managing postpartum lumbar and pelvic pain, supporting better recovery and long-term well-being for affected women.

In this study, core stability training was used to maintain lumbar extensibility to correct the lumbar curve from lordosis in hyperlordotic postpartum females. The objective was to assess the effect of core stability training on lumbar flexibility in hyperlordotic postpartum females.

Methods

This was a quasi-experimental study, conducted in Jinnah Hospital, Lahore, and was completed within the time duration of six months (July 2021-January 2022). There was only one study group in which core stability exercises were performed. Non-Probability-Convenience sampling technique was used to collect the data as it allows easier recruitment of participants, as the access to postpartum groups is limited in our settings.

After approval from the ethical review board (NO. REC/RCR/AHS/21/0520), informed written consent was collected from all the participants. The sample size was 17, calculated by the online EPITOOL sample size calculator.¹³ The sample included postpartum females of 3 months to 6 months, with history of single-ton pregnancy regardless of their delivery history i.e. both females with a history of normal delivery (11) & c-section delivery (6) were included. Age of these females were between 18 to 35years and all participants had a measured Modified-Modified Schober's test (MMST) reading more than 6.85 ± 1.18 cm. The participants were matched for BMI and physical activity level. Those with pre-existing musculoskeletal conditions were excluded. Pregnant females or those with a history of complications after or during delivery e.g. infection, accident, or trauma were excluded from this study.

The Modified-Modified Schober Test (MMST) was the tool used to assess the range of motion for the lumbar spine. In MMST, the patient should be in a standing position, the examiner marks both posterior superior iliac spine (PSIS) and then draws a horizontal line at the center of both marks. The second line was marked 5 cm below the first line. The third line was marked 10 cm above the first Line. The patient was then instructed to flex forward as if attempting to touch his/her toes, The examiner measured the distance between the top and bottom line again. If the measurement was less than 5cm, it was hypo lordosis while the normal flexion value was 6.85±1.18cm for the age group of 18 – 35 years, which was in our inclusion criteria.¹⁴

During the 1st visit of the patients, history was taken along with complete physical examination and Modified-Modified Schober Reading was measured, and treatment was given to the participants. The core stability exercises that were suggested to the patients were toe-tapping, back isometrics, and superman exercises. In this study, three sessions per week were given for twelve weeks. In all sessions, core stability training was performed for all patients. Post-treatment MMST values were measured after the treatment of twelve weeks to check the efficiency of the core stability exercises in hyperlordotic postpartum females. The total treatment was for a period of 12 weeks. All participants followed the same regimen i.e. Toe tapping, Back Isometrics and Superman, the duration of each session same three sets of each 10 repetitions. Data was analyzed on SPSS 25. Comparison between the pre-exercise and post exercise MMST score was done by paired t test as the data was normally distributed (checked by Shapiro wilk test) and a p value < 0.05 was considered significant.

Results

The study involved 17 postpartum females, aged 18 to 35, who underwent 12 weeks of core stability training. The demographic information of the study participants along with pre- and post-intervention MMST score is given in table I. The results showed a reduction in hyperlordosis as shown by pre- and post-treatment MMST

scores, with 14 out of 17 participants experiencing improvement. The paired t test confirmed the intervention's effectiveness, with a highly significant p-value of 0.000, indicating a clear impact of the training on post-partum hyperlordosis as shown in Table II. The partici-

Table I: Demographic information of the study participants

n = 17	17
	Mean ± SD
Age	25.00 ± 2.34
BMI	23.8 ± 1.6
Pre. Treatment MMST Score	8.211 8±. 21
Post. MMST Score	7.6829 ± .36

n = number of study participants, mean ± SD: Mean ± standard deviation, MMST Value (cm): Modified - Modified Schober's test

Table III: Comparison of Pre- and Post-Core Stability Exercises MMST score between normal delivery and C section group

Group	n	C section	Normal delivery	p value
Pre-Exercise MMST	6	8.01 ± 0.12	8.33 ± 0.15	0.12
Mean ± SD				
Post-Exercise MMST	11	7.66 ± 0.17	7.71 ± 0.23	0.18
Mean ± SD				

n = sample size, MMST Value (cm): Modified - Modified Schober's test, mean ± SD: Mean ± standard deviation, p-value calculated by Independent samples t test. p value < 0.05 was considered statistically significant.

pants with improved scores had decreased pain as well as improved mobility as described by the participants. The comparison between C-section and normal delivery groups, as shown in Table III, did not yield statistically significant differences. This lack of difference is noteworthy as it suggests that the mode of delivery may not substantially impact the specific outcomes measured in this study.

Discussion

The increased curvature of the lumbar spine observed during pregnancy tends to partially revert after delivery. However, some females experience hyperlordosis post-

Table II: Comparison of Pre- and Post-Core Stability Exercises MMST score

n = 17	Pre-Exercise MMST (Mean ± SD)	Post-Exercise MMST (Mean ± SD)	Mean Difference	t-value	p-Value	95% CI
MMST Value (cm)	8.21 ± 0.22	7.68 ± 0.37	0.52 ± 0 .44	4.90	0.000*	(0.30-0.75)

*n = number of study participants, MMST Value (cm): Modified - Modified Schober's test, mean ± SD: Mean ± standard deviation, 95% CI: 95% Confidence Interval, *statistically significant p-value < 0.05 calculated by paired t test.*

partum, which disrupts the anatomical structure of the body and may worsen with subsequent pregnancies. This progression can lead to various musculoskeletal issues and exacerbate symptoms such as pain. Hyperlordosis is primarily driven by the weakening of abdominal muscles and the tightening of lower back muscles and hip flexors.¹⁵ In this study, core stability training was employed to enhance lumbar extensibility and correct the lumbar curve associated with lordosis.¹⁵ The intervention demonstrated statistically significant improvement in MMST scores, underscoring its effectiveness in managing post-pregnancy lordosis. These findings align with evidence suggesting that therapeutic exercises, such as static back, pelvic bridging, crunches, planks, and single-leg pelvic bridging, contribute to core strengthening and help address hyperlordosis.¹⁶ Supporting the results of current study are the findings of Olsson et al. (2019), they compared the effects of physical therapy techniques, including pelvic floor muscle exercises and core stability exercises, on postpartum females suffering from back pain. Their study concluded that core stability exercises yielded more favorable outcomes in reducing lumbar pain and improving abdominal muscle endurance in postpartum females.¹⁷ By synthesizing the findings from this study and prior research, it is evident that core stability exercises play a critical role in managing postpartum hyperlordosis, mitigating associated musculoskeletal issues, and improving overall physical well-being.

The abdominal musculature of the female body weakens in pregnancy because of the continuous stretch & hormonal change. The results obtained through literature show the effects of core muscle training on the trunk muscles' endurance, disability, lower backache, and pain in postpartum.¹⁸ Because of various musculoskeletal changes in pregnancy, the musculature of pregnant females needs to be corrected, and strengthening the lumbar portion is necessary to decrease all these symptoms. The Musculature of pregnant females is under the high influence of hormones during pregnancy and because of the continuous increase in the fetus size, the musculoskeletal of pregnant females disturbs and changes the tone and structure resulting in abnormal curvature of the body.¹⁹ Another study reported that the effect of core stability exercises on the sacroiliac joint were amazing, and these exercises can be used as a treatment of the sacroiliac joint in females in the postpartum. Hormonal changes and fetus size affects the sacroiliac joint and leads to disturbance, raising various symptoms

& discomfort. Authors have also discussed that the flexibility and range of the lumbar spine can also be increased with the help of core stability exercises, and it improves the movement & position of the joints.²⁰ The results of the current study are further supported by findings from a randomized controlled trial conducted by Thabet and Alshehri (2019), which examined the effects of a core training program on 40 postpartum women with diastasis recti. Their study demonstrated that core stability exercises were effective not only in reducing the size of diastasis recti but also in alleviating low back pain and improving the quality of life. These findings are particularly relevant to the current study's focus on hyperlordosis and lumbar flexibility, as diastasis recti and postpartum hyperlordosis share common contributing factors, including weakened core muscles and altered spinal alignment. Strengthening the deep core muscles through targeted exercises, as highlighted in both studies, is crucial for restoring anatomical balance, reducing lumbar strain, and improving overall musculoskeletal health in postpartum women. By initiating core stability exercises in the early postpartum stages, as suggested by Thabet and Alshehri, women may not only address diastasis recti but also mitigate the progression of hyperlordosis, thereby enhancing lumbar extensibility and reducing associated symptoms like low back pain. This integration underscores the broader applicability of core training interventions in addressing postpartum musculoskeletal issues.²¹ The effects of core strengthening are evident in this study as well, suggesting that every postpartum female should be advised to engage in core stability training to help restore musculature after pregnancy. In support of the current study are the results of Smrcina Z et al., 2022, who performed a systematic review and suggested core stabilization exercises as an effective intervention to improve low back pain.²² The study has the limitation of a small sample size plus prior activity levels of the participants might influence outcomes. Future studies with larger sample size and taking into consideration the prior activity level could explore the long-term effects of core stability training on lumbar flexibility and functionality.

Conclusion

The effects of core stability training on lumbar flexibility were evident in hyperlordotic postpartum females. Significant improvements were observed in this study, highlighting the important role core stability exercises play in managing hyperlordosis and aiding in the resto-

ration of normal or near-normal spinal curvature.

Conflict of Interest: None

Funding Disclosure: None

Ethical Consideration: Informed written consent was recorded after approval from the ethical review board, No: REC/RCR/AHS/21/0520. Confidentiality of the participants was maintained.

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Authors Contribution: All the authors contributed equally in accordance with ICMJE guidelines and are accountable for the integrity of the study.

SR: Study design and concept, Acquisition and analysis of data and final approval

SA: Study design, interpretation of data and analysis, revision

EA: Study design and concept, Acquisition and analysis of data and final approval

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