RESEARCH PAPER

Correlation between Breast Weight, Postural Deviation, Scapular Kinematics in Breastfeeding Postpartum Women

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ABSTRACT

Background
The postpartum period is associated with musculoskeletal adaptations due to hormonal changes, breastfeeding posture, and increased breast weight. These factors may influence spinal alignment and scapular mechanics. Increased breast weight shifts the center of gravity anteriorly, contributing to postural deviations such as increased thoracic kyphosis and altered cervical lordosis. These adaptations may further affect scapular stability and movement. However, limited literature has explored these relationships in breastfeeding postpartum women. This study aimed to determine the correlation between breast weight, postural deviation, and scapular kinematics.

Material and Methodology
A cross-sectional observational study was conducted among 252 breastfeeding postpartum women. Breast weight was measured using a digital hanging weighing machine. Thoracic kyphosis and cervical lordosis were assessed using the flexicurve method. Scapular kinematics were evaluated using the Scapular Dyskinesis Test and the Lateral Scapular Slide Test (LSST).

Result
The mean breast weight was 2.02 ± 0.66 kg. Mean thoracic kyphosis and cervical lordosis were 13.68 ± 2.09° and 27.24 ± 5.42°, respectively. A strong positive correlation was found between breast weight and thoracic kyphosis ($\rho = 0.70$, $p < 0.001$). Breast weight showed a weak, non-significant negative correlation with cervical lordosis ($\rho = -0.10$). Participants with positive LSST demonstrated significantly higher breast weight and thoracic kyphosis compared to those with negative LSST ($p < 0.001$).

Conclusion
Increased breast weight is significantly associated with increased thoracic kyphosis and altered scapular stability in breastfeeding postpartum women. Early identification and physiotherapeutic intervention may help prevent postural dysfunction and musculoskeletal complications.

Keywords: *Breast weight, postural changes, thoracic kyphosis, scapular kinematics, breastfeeding mothers, Postpartum musculoskeletal changes.*
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INTRODUCTION

The postpartum period is characterized by profound physiological, hormonal, and biomechanical changes that influence a woman's musculoskeletal system. During pregnancy and lactation, hormonal influences such as oestrogen and progesterone lead to structural changes in breast tissue, resulting in increased breast size and weight. These adaptations, although essential for infant nourishment, can alter the biomechanics of the spine and upper body, potentially predisposing women to postural deviations and musculoskeletal discomfort during the postpartum phase.[1] The enlargement of breast tissue and the associated anterior shift in body mass contribute to a forward displacement of the centre of gravity. To maintain

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balance, compensatory mechanisms such as increased thoracic kyphosis and cervical lordosis may develop. These postural adaptations, while functional in maintaining stability, can lead to increased mechanical stress on spinal structures, ultimately contributing to discomfort and functional limitations in postpartum women.[2]

Postural alignment plays a crucial role in maintaining musculoskeletal health, particularly in postpartum females. Changes in spinal curvature during pregnancy directly influence scapular positioning and movement. The scapula relies on coordinated muscle activity for stability, and any disruption in spinal alignment can adversely affect scapular kinematics, leading to compromised upper limb function and increased susceptibility to pain and dysfunction.[3] Breastfeeding practices further contribute to postural alterations, as mothers often adopt sustained forward-flexed positions while feeding their infants. Prolonged maintenance of such postures can result in muscle fatigue, weakness of scapular stabilizers, and increased thoracic kyphosis. These biomechanical changes are strongly associated with the development of scapular dyskinesis, which reflects abnormal scapular motion and positioning during shoulder movements.[4]

Scapular dyskinesis is a multifactorial condition influenced by poor posture, muscle imbalance, and altered spinal alignment. During the postpartum period, repeated breastfeeding activities and inadequate ergonomic awareness can contribute to abnormal scapular mechanics. Although some studies report no direct association between breastfeeding positions and scapular dyskinesis, a high prevalence of musculoskeletal discomfort suggests the involvement of additional contributing factors.[5] Pregnancy-induced weight gain and increased breast volume impose additional mechanical loads on the spine, leading to adaptive changes in spinal curvature. The increased anterior load often results in enhanced lumbar lordosis and thoracic kyphosis, thereby altering normal posture. These changes highlight the significant role of body weight and breast mass in influencing spinal alignment and overall musculoskeletal health.[6]

Postpartum anthropometric changes, particularly the persistence of increased breast mass, continue to influence posture even after childbirth. These changes affect the distribution of body mass and may contribute to sustained alterations in spinal curvature and centre of mass. Consequently, postpartum women may experience prolonged postural deviations that impact balance, movement efficiency, and musculoskeletal well-being.[7] Musculoskeletal pain associated with breastfeeding is not limited to local breast discomfort but may originate from underlying postural and biomechanical dysfunctions. Improper alignment of the thoracic spine and prolonged asymmetric postures can lead to referred pain in the breast region. Physiotherapeutic interventions focusing on posture correction have been shown to alleviate such discomfort, emphasizing the importance of biomechanical factors in breastfeeding-related pain.[8]

Breastfeeding positions and practices significantly influence the development of musculoskeletal problems in postpartum mothers. Various feeding positions, if not ergonomically optimized, can lead to neck pain, back pain, and postural abnormalities. Although not all positions show a direct statistical association with pain, the repetitive nature and duration of breastfeeding activities play a crucial role in musculoskeletal strain.[9] The prevalence of musculoskeletal pain among breastfeeding women is notably high, with studies reporting frequent occurrences of neck, thoracic, and lower back pain. Factors such as prolonged feeding duration, inadequate support, and poor posture contribute significantly to these symptoms. These findings highlight the need for improved ergonomic practices and awareness among postpartum women to minimize musculoskeletal complications.[10] Biomechanical adaptations during pregnancy, including increased spinal curvature and altered muscle activation patterns, continue to influence posture in the postpartum period. The increased activity of trunk extensor muscles reflects the body's attempt to counterbalance anterior loads. However, these compensatory mechanisms may lead to muscle fatigue and contribute to persistent postural deviations.[11]

Accurate assessment of spinal posture is essential in understanding postural deviations associated with postpartum changes. Non-invasive tools such as the flexicurve ruler have been widely used to measure thoracic kyphosis due to their reliability and ease of application in clinical settings. Such tools are particularly useful in evaluating postural alterations in postpartum populations without exposing individuals to radiation.[12] Similarly, the assessment of cervical lordosis is crucial in evaluating upper spinal alignment and its relationship with musculoskeletal dysfunction.[13] Postural control during pregnancy and postpartum is influenced by changes in body composition, joint stability, and centre of gravity. These factors can reduce balance and increase the risk of instability, highlighting the importance of maintaining optimal posture. Understanding these biomechanical changes is essential for developing preventive and rehabilitative strategies aimed at improving maternal health outcomes.[14]

MATERIALS AND METHODS

This research utilizes a cross-sectional analytical design to investigate the interrelationships between breast weight, postural deviation, and scapular kinematics in a sample of 252 breastfeeding postpartum women. Participants were recruited through convenience sampling from maternity wards 11,12 at Krishna Vishwa Vidyapeeth, Karad. Sample size was determined using the formula n= [($Z\alpha$+$Z\beta$)/C]^2 + 3 Where, C= 0.5 Ln[(1+r)/(1-r)], $Z\alpha$=1.96, $Z\beta$=0.84, r= 0.176. Inclusion criteria consisted of primigravida women aged 22–35 years who were between 0 days and 1 month postpartum, currently

breastfeeding, and able to follow instructions for physical assessment. Potential participants were excluded if they had a history of breast, thoracic, or shoulder surgery, current breast infections (mastitis), traumatic spinal or shoulder fractures, or cognitive impairments. Ethical approval was secured from the Institutional Ethics Committee, and all participants provided written informed consent prior to data collection. The research utilized several non-invasive instruments: a digital hanging weighing machine with a soft support strap to objectively quantify breast weight, a flexicurve ruler for measuring thoracic kyphosis and cervical lordosis, and standard measuring tapes. For the assessment of scapular kinematics, clinical observation was paired with validated functional tests, specifically the Yes/No Scapular Dyskinesis Test and the Lateral Scapular Slide Test. Measurements were recorded on predesigned forms and subsequently entered into Microsoft Excel for compilation. Statistical analysis was performed using IBM SPSS software, utilizing descriptive statistics (mean, standard deviation, and range) to summarize participant characteristics and inferential statistics (Pearson's or Spearman's correlation tests, depending on data normality) to determine the strength and direction of the linear relationships between breast weight, postural deviations, and scapular movement patterns. All procedures emphasized participant confidentiality and safety, ensuring that the biomechanical assessments did not interfere with maternal comfort or medical care.

RESULT

Table 1:

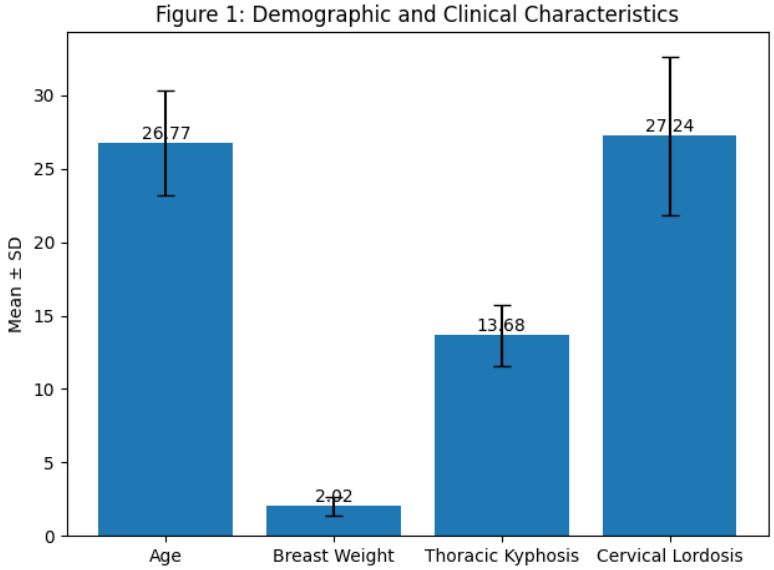
Variable	N	Mean	SD
Age (years)	252	26.77	3.58
Breast Weight (kg)	252	2.02	0.66
Thoracic Kyphosis (deg)	252	13.68	2.09
Cervical Lordosis (deg)	252	27.24	5.42

Note: SD = Standard Deviation.

This table presents the baseline characteristics of all 252 participants. The mean age was 26.77 ± 3.58 years. The average breast weight was 2.02 ± 0.66 kg. The mean thoracic kyphosis was 13.68 ± 2.09 degrees, while the mean cervical lordosis was 27.24 ± 5.42 degrees. These values describe the overall sample distribution in terms of age, breast weight, and spinal curvature.

GRAPH 1:

Figure 1: Demographic and Clinical Characteristics



The mean breast weight among participants was 2.02 ± 0.66 kg, while the mean thoracic kyphosis and cervical lordosis were 13.68 ± 2.09° and 27.24 ± 5.42°, respectively. The mean age was 26.77 ± 3.58 years.

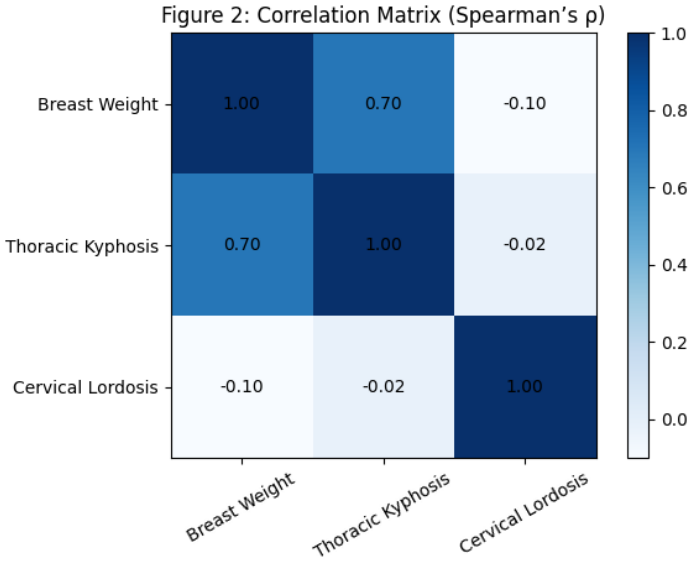
Table 2:

Variable	Breast Weight	Thoracic Kyphosis	Cervical Lordosis
Breast Weight	1.00	0.70*	-0.10
Thoracic Kyphosis	0.70*	1.00	-0.02
Cervical Lordosis	-0.10	-0.02	1.00

*Statistically significant ($p < 0.001$).

This table shows the Spearman's rho correlation between breast weight and spinal curvatures. There is a strong positive correlation between breast weight and thoracic kyphosis ($\rho = 0.70$, $p < 0.001$), indicating that higher breast weight is associated with increased kyphosis. There is a weak negative correlation between breast weight and cervical lordosis ($\rho = -0.10$) and a negligible negative correlation between thoracic kyphosis and cervical lordosis ($\rho = -0.02$), both of which are not statistically significant.

GRAPH 2:



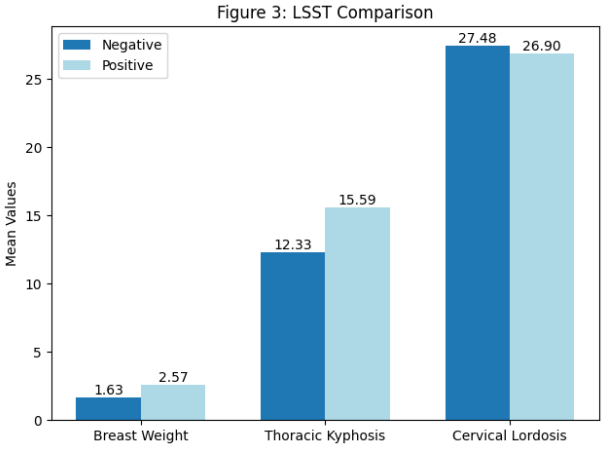
Correlation analysis demonstrated a strong positive correlation between breast weight and thoracic kyphosis ($\rho = 0.70$, $p < 0.001$). However, breast weight showed a weak negative and non-significant correlation with cervical lordosis ($\rho = -0.10$).

Table 3: Participants were grouped based on the results of the Lateral Scapular Slide Test (Negative vs. Positive).

Variable	Negative (n=148) Mean (SD)	Positive (n=104) Mean (SD)	p-value
Breast Weight (kg)	1.63 (0.48)	2.57 (0.46)	< 0.001*
Thoracic Kyphosis (deg)	12.33 (1.18)	15.59 (1.55)	< 0.001*
Cervical Lordosis (deg)	27.48 (5.65)	26.90 (5.08)	0.290

This table compares participants with negative (n = 148) and positive (n = 104) Lateral Scapular Slide Test results. The positive group showed significantly higher breast weight (2.57 ± 0.46 kg vs. 1.63 ± 0.48 kg) and thoracic kyphosis (15.59 ± 1.55° vs. 12.33 ± 1.18°) with $p < 0.001$, indicating strong statistical significance. However, cervical lordosis was similar between groups (26.90 ± 5.08° vs. 27.48 ± 5.65°) with a non-significant p-value (0.290).

GRAPH 3:



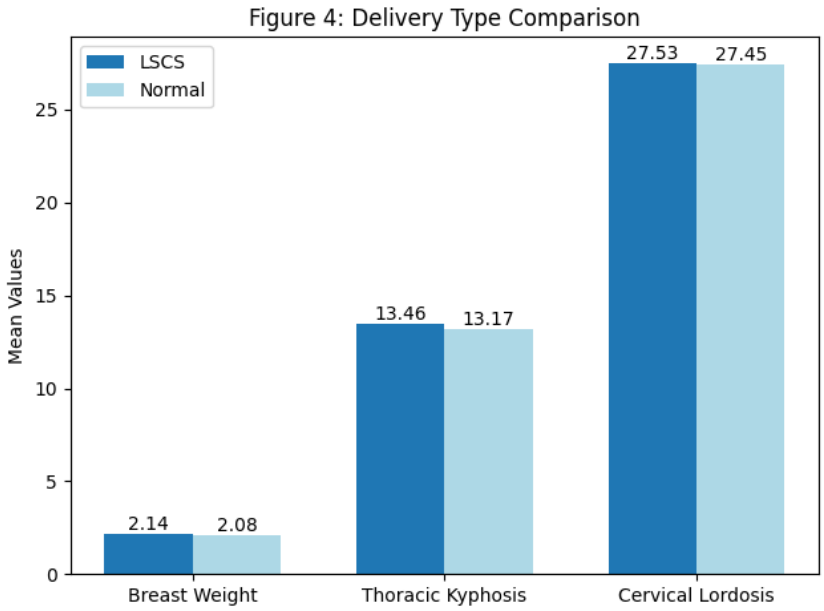
Participants with a positive LSST exhibited significantly higher breast weight (2.57 ± 0.46 kg) and thoracic kyphosis (15.59 ± 1.55°) compared with those with a negative LSST (1.63 ± 0.48 kg and 12.33 ± 1.18°, respectively) ($p < 0.001$). No statistically significant difference was observed in cervical lordosis ($p = 0.290$).

Table 4: Analysis was conducted on the subset (n=252) to determine if the mode of delivery (LSCS vs. Normal) influenced parameters.

Variable	LSCS Mean (SD)	Normal Mean (SD)	p-value
Breast Weight (kg)	2.14 (0.60)	2.08 (0.68)	0.671
Thoracic Kyphosis (deg)	13.46 (2.01)	13.17 (1.78)	0.585
Cervical Lordosis (deg)	27.53 (6.17)	27.45 (5.04)	0.964

There were no statistically significant differences between the two groups for breast weight ($p = 0.671$), thoracic kyphosis ($p = 0.585$), or cervical lordosis ($p = 0.964$). Mean values were comparable across both groups, indicating that mode of delivery does not significantly influence these variables.

GRAPH 4:



No statistically significant difference was observed between LSCS and normal delivery groups for breast weight (2.14 ± 0.60 vs 2.08 ± 0.68 kg; $p = 0.671$), thoracic kyphosis (13.46 ± 2.01 vs 13.17 ± 1.78°; $p = 0.585$), or cervical lordosis (27.53 ± 6.17 vs 27.45 ± 5.04°; $p = 0.964$).

DISCUSSION

The findings of this study underscore a significant biomechanical relationship between increased breast weight during the postpartum period and alterations in upper quadrant posture and scapular stability. A primary result was the strong positive correlation (p= 0.70) between breast weight and thoracic kyphosis, which aligns with previous research suggesting that mammary hypertrophy during lactation shifts the body's center of gravity anteriorly. This forward shift necessitates compensatory spinal adjustments, specifically an increase in the kyphotic curve, to maintain postural balance. Interestingly, while thoracic alignment was significantly impacted, cervical lordosis did not show a corresponding correlation, suggesting that the initial biomechanical stress of increased breast load is primarily localized to the mid-back region.

The relationship between breast weight and scapular kinematics further highlights the functional impact of these physical changes. Participants who tested positive for altered scapular kinematics via the Lateral Scapular Slide Test (LSST) had significantly higher mean breast weights compared to those with stable scapular positioning. This suggests that the weight of the breasts, potentially combined with poor ergonomic practices during breastfeeding, leads to the weakening of key stabilizer muscles like the serratus anterior and lower trapezius. Prolonged hunching while feeding often results in a "slouched" posture, which has been shown to decrease the overall muscle forces required for effective scapular dynamics, eventually manifesting as scapular dyskinesis.

Furthermore, our data indicated that the mode of delivery (LSCS vs. Normal) had no statistically significant effect on the variables measured, reinforcing the idea that these musculoskeletal adaptations are a result of the physiological demands of lactation rather than the surgical or natural process of childbirth itself. Similar findings in recent studies have noted that while breastfeeding is vital for infant development, the lack of ergonomic awareness often leads to preventable kyphotic deformities and shoulder dysfunction. Therefore, early intervention focusing on postural education and adequate breast support is essential for postpartum physical health.

STRENGTH OF THE STUDY:

- **Substantial Sample Size:** The inclusion of 252 participants provides high statistical power to the findings compared to smaller observational studies in this field.
- **Objective Measurement Tools:** Utilizing digital weighing for breast mass and the flexicurve method for spinal tracing adds objective reliability to the data.
- **Clear Inclusion Criteria:** Focusing specifically on primigravida women in the immediate postpartum period (0-1 month) allowed for a controlled evaluation of early-stage musculoskeletal changes.

FUTURE RECOMMENDATIONS

- **Longitudinal Tracking**: Future research should monitor mothers from late pregnancy through six months postpartum to better understand the progression of spinal and scapular changes.
- **Comparative Studies**: Researchers should compare primigravida and multigravida women to see if postural deviations worsen with subsequent pregnancies.
- **Intervention Testing**: Studies should evaluate the effectiveness of specific corrective exercises and ergonomic breastfeeding supports in reducing thoracic kyphosis.

LIMITATIONS OF THE STUDY

- **Time-Specific Data**: The study uses a cross-sectional design, capturing postural changes at only one point in time rather than tracking them throughout the entire postpartum year.
- **Fluctuating Measurements**: Breast weight was measured at a single instance, which may not account for daily weight fluctuations occurring before and after breastfeeding sessions.
- **Specific Population**: The research focused exclusively on primigravida women (first-time mothers), meaning the results may not apply to women who have had multiple pregnancies.
- **Geographic Constraint**: Data collection was limited to a single hospital in Karad, which may affect the generalizability of the results to women in other regions.
- **Potential for Bias**: The use of convenience sampling may lead to self-selection bias among the participants.

CONCLUSION

This study concludes that increased breast weight in postpartum breastfeeding women is significantly associated with greater thoracic kyphosis and altered scapular kinematics. The strong correlation between breast load and spinal curvature indicates that mammary changes during lactation are a major driver of postural deviation. Because these biomechanical changes occur regardless of delivery mode, there is a critical need for integrated postnatal care that includes ergonomic education and musculoskeletal screening to prevent chronic upper back and shoulder dysfunction.

Ethics Statement

The study received approval from the Institutional Ethical Committee, Karad (Protocol Number 354/2025-2026).

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Conflict of interest

The authors declare that they have no conflicts of interest related to this article.

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