

Relationship between Hip Internal Rotators and Back Extensor Endurance in Mechanical Low Back Pain

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Abstract

Background & Objective: Low back pain is a prevalent musculoskeletal disorder that often leads to mechanical alterations during various activities. A reduced range of hip rotation and decreased endurance of the paraspinal muscles are considered contributing factors to biomechanical low back pain. This study aims to examine the relationship between hip internal rotator flexibility and back extensor endurance in females aged 18-30 years experiencing biomechanical low back pain.

Methodology: The study included 120 females aged 18-30 years, selected based on specific inclusion and exclusion criteria. Hip internal rotation range was assessed using a goniometer, while trunk extensor endurance was evaluated using the Biering-Sorensen test.

Results: The results of Spearman's rank correlation coefficient test that there is a weak positive correlation between hip internal rotation (right) $r = 0.101$ and left ($r = 0.063$) with back extensor endurance and are not statistically significant ($p > 0.05$).

Conclusion: This study demonstrated that there is no significant relationship between hip internal rotation and back extensor endurance in individuals with mechanical low back pain.

Keywords: Mechanical low back ache, External and internal hip rotation range of motion, Trunk extensor endurance, Lumbar instability

Introduction

Low Back Pain (LBP) is characterised as discomfort or pain commonly seen in the region between the coastal margin and the inferior gluteal fold.^{1,2} LBP has emerged as a significant global health concern with life time prevalence of approximately 70-85%

of the population leading to disability and work absenteeism, resulting in financial burden which indirectly leads to deficit in productivity.³ As reported by Ferguson et al. neck and back pain are second major contributors for disability after iron deficiency anaemia in India.^{4,5} Various factors contribute for LBP, with mechanical LBP being the most common

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form of chronic pain. Mechanical low back pain is characterised as nociceptive pain which commonly originates intrinsically from the spine, intervertebral discs, or surrounding soft tissues.^{6,7,8}

Low back pain (LBP) is more common in women, who also experience chronic musculoskeletal pain more frequently than men. Sex differences in pain are influenced by biological, psychological, and sociocultural factors, with heightened pain sensitivity contributing to women's higher pain reports.⁹

The biomechanical interplay within the hip, pelvis and the spine including the involvement of shared muscles such as psoas, quadratus lumborum, erector spinae, gluteus maximus, etc. makes the hip joint to be a major contributor in LBP.^{10,11} The association between LBP and hip rotation ROMs is significant as the hypothesis states that there will be a compensation in the motion of the lumbopelvic region when there is limited hip ROM. These compensatory movements lead to the development of LBP symptoms due to an increase in the loads and stress in the joint tissues of the lumbopelvic region.^{10,12,13}

The trunk extensors, including the erector spinae and multifidus, play a crucial role in maintaining spine stability and posture, making them essential for preventing low back pain (LBP).¹⁴ Trunk extensor endurance refers to the ability of the back and core muscles, especially the erector spinae group, to sustain contractions over time without fatigue or loss of strength. These muscles are crucial for maintaining an upright posture, stabilizing the spine, and facilitating movement. Weak trunk extensor muscles can contribute to low back pain, as they are responsible for maintaining proper spinal alignment and stability.¹⁵ This can put a strain on the hip joint and limit the range of motion, including internal rotation. On the other hand, limited hip internal rotation can also affect trunk extensor endurance by altering the alignment and mechanics of the spine.¹⁶

There is a basic belief among manual and physical therapists that structural imbalances and asymmetry in the body can result in painful musculoskeletal conditions. In this model, the imbalances and asymmetries increase the abnormal mechanical/physical stress imposed on the musculoskeletal

system. The need of the study was to find out the relationship between hip internal rotation and back extensor endurance in mechanical low back pain of the age group between 18-30 years old.

Methodology

An observational study was carried out at the Tejasvini Hospital Group of Institutions, involving 120 female participants aged between 18 and 30 years. The study focused on specific predictor variables, including age (in years), weight (in kilograms), height (in centimetres), and BMI, which were recorded for each participant following a brief explanation of the study's purpose. Hip internal rotation was assessed using a goniometer, while back extensor endurance was evaluated using the Biering-Sorensen Test.

The inclusion criteria comprised females aged 18-30 years experiencing mild to moderate low back pain. Exclusion criteria included pregnancy, a history of lumbar spine surgery within six months prior to testing, psychological illnesses, neurological conditions, rheumatic diseases, congenital deformities, or unwillingness to participate in the study.

Outcome Measures

- (a) A universal goniometer was used to evaluate hip rotation range of motion. The patient was seated at the edge of the table, with their legs hanging off of it and their knees pressed against the table. The patella served as the fulcrum, and the goniometer was positioned along the tibia's shaft. After that, the patient was instructed to actively rotate the hip medially while staying within their pain threshold. One therapist measured the internal rotation of an average of three recordings. For both groups, all measurements were recorded bilaterally. As reported, the goniometer's reliability for hip range of motion is very high, with Cronbach α values of 0.90.¹⁷
- (b) Biering - Sorensen Test was used to assess Back extensor endurance strength. The patient was positioned in prone on a table with ASIS placed at the end of the table, for safety a chair was placed in front of the patient so that the

patient so that the patient could hold on to the chair when fatigued. With arms bent across the chest, and hips fully extended, the subject was asked to perform a concentric contraction to place the spine in horizontally. This was visually assessed by the clinician. The test was terminated when the subject was unable to maintain the position or becomes too fatigued to continue, or experience any kind of pain. An intra-rater reliability of the Biering-Sorensen test was reported as (ICC = 93.2%).¹⁸

- (c) A visual analogue scale (VAS) was used to measure the pain intensity with NPRS ICC = 0.991.¹⁹ VAS is usually a horizontal line, 100 mm in length, with the amount of pain that a patient feels ranges across a continuum from no pain to severe pain. The patient was asked to mark the point on the line representing the perception of their current state.

Statistical Analysis

Statistical package SPSS 14.0 was used to analyse the data. All the quantitative descriptive data were expressed in mean and standard deviation and categorical data in percentage. The relationship between hip internal rotation and back extensor endurance was evaluated in Spearman's rank correlation test. P value ($p > 0.05$) was considered significant.

Results

The mean and Standard deviation of demographic characteristics of the participants data representing the age (in years), height (in cm), weight (in kg), BMI (in kg/m^2), hip internal rotation (in degree), and back extensor endurance of the study participants are presented in Table 1.

Table 1. Demographic Characteristics of the Study

Variables	Mean \pm SD
Age (years)	19.75 \pm 1.6
Height (cm)	154.9 \pm 7.9
Weight (kg)	51.3 \pm 11.9
BMI (kg/m^2)	21.3 \pm 4.5

Table 2 represents the variables analysed using Spearman's rank correlation coefficient test.

Spearman's rank correlation coefficient test found a weak positive correlation between hip internal rotation (right) with back extensor endurance and no significant relationship between hip internal rotation (left) with back extensor endurance.

Table 2. Variables analyzed using Spearman's rank correlation coefficient test.

VARIABLES	TRUNK EXTENSOR ENDURANCE r value (p-value)
HIP INTERNAL ROTATION (right)	0.101 (0.273)
HIP INTERNAL ROTATION (left)	0.063 (0.409)

Discussions

This study provides valuable insights into the relationship between hip internal rotation and back extensor endurance in individuals with mechanical low back pain (LBP), specifically female participants. The findings indicate a weak positive correlation between right-side hip internal rotation and back extensor endurance, while no significant relationship was observed for the left side. These results highlight the complexity of hip-lumbar interactions and suggest that hip mobility restrictions may play a role in endurance capacity, although they are not the sole determinant.

The partial alignment with previous research reinforces the role of hip mobility in lumbar stability and endurance. Van Dillen et al. (2008) demonstrated the contribution of altered hip rotation in individuals engaged in rotational sports, suggesting compensatory movement patterns associated with LBP.¹⁴ Similarly, Krishna et al. (2020) reported significant differences in hip rotation range of motion (ROM) between individuals with chronic LBP and healthy controls, reinforcing the premise that hip mobility deficits may influence spinal loading and endurance.²⁰

Despite these similarities, the weak correlation observed in this study suggests that additional factors influence back extensor endurance beyond hip mobility. Roach et al. (2015) found that

individuals with chronic LBP exhibited reduced passive hip ROM, supporting the idea that mobility constraints may be prevalent.²¹ However, the lack of significant association with left-side hip internal rotation indicates potential asymmetries in hip function, warranting further investigation into movement compensations.

The biomechanical interplay between lumbar stability and hip mobility remains complex. Prior research has highlighted the effectiveness of hip-targeted interventions for improving lumbar stability (Handrakis et al., 2012; Lee & Kim, 2015).^{22,23} The absence of a strong correlation in this study may indicate that hip rotational restrictions affect spinal endurance through neuromuscular mechanisms rather than direct linear interactions. Gender-based factors may also contribute, as studies like Bento et al. (2020) have reported sex-specific differences in LBP presentations, with females potentially experiencing unique biomechanical adaptations due to pelvic morphology and hormonal influences.²⁴

This study was limited by its sample size, which may have influenced statistical power. Additionally, the focus on female participants restricts generalizability to male populations, requiring future research to explore gender comparisons. Investigations into bilateral hip mobility patterns, muscle recruitment strategies, and the neuromuscular interactions between hip function and lumbar endurance could further clarify the mechanisms at play. Longitudinal studies assessing structured rehabilitation programs may provide additional insights into the dynamic relationship between hip rotation and endurance.

Understanding the nuanced relationship between hip mobility and back extensor endurance can assist clinicians in developing targeted rehabilitation programs. Hip-focused interventions, particularly for individuals with restricted internal rotation, may enhance lumbar endurance and reduce pain-related dysfunction. Given the gender specificity of this study, rehabilitation strategies should incorporate individualized assessments to determine how hip mobility limitations influence spinal endurance in female patients.

Conclusion

This study explored the association between hip internal rotators and back extensor endurance in females aged 18-30 years with mechanical low back pain (LBP). The primary objective was to determine whether hip internal rotators and back extensor endurance contribute to mechanical LBP. The findings indicated a weak positive correlation between right-side hip internal rotation and back extensor endurance, while no significant relationship was observed between left-side hip internal rotation and back extensor endurance. These results underscore the complex interplay between hip mobility and lumbar endurance in mechanical LBP, offering valuable insights for rehabilitation approaches that emphasize hip mobility and spinal endurance in female populations.

Future research should consider longitudinal designs with larger, diverse cohorts and incorporate additional variables such as pelvic alignment, lower limb strength ratios, and movement compensations. Investigating the effects of targeted intervention on both hip rotator strength and lumbar endurance may also help refine rehabilitation protocols for improved clinical outcomes.

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