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Disc slippage and its relationship to lower back pain in some athletes

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Abstract
Herniated discs, or disc slippage, are a common musculoskeletal issue that often leads to lower back pain, especially in athletes. This condition occurs when the nucleus pulpous of an intervertebral disc pokes out through an insufficiently strong annulus fibrous, putting pressure on nerve roots. Athletes are at higher risk due to prolonged spinal loading, repetitive activities, and poor biomechanics. The study explores biomechanical factors linking disc slippage to lower back pain, including risk factors like previous injuries, poor posture, sport-specific demands, and inadequate core strength. It also discusses current diagnostic methods, evidence-based treatments, and preventative strategies. Understanding this connection can help develop tailored rehabilitation plans and preventive measures for improved spinal health and athletic performance.

Keywords: Disc slippage, lower back pain, athletes, intervertebral disc herniation, biomechanics, rehabilitation strategies

Introduction

Engaging in physical activity is known to enhance muscle strength and flexibility, however, certain sports that require prolonged use of the lower back can lead to severe pain if not properly managed by both athletes and coaches. They must balance this muscle work to achieve optimal muscle function. For example, endure significant lower back pressure during specific movements, while javelin throwers must arch their backs to maximize distance. Low back pain is a common and serious injury, particularly in industrialized nations, with approximately 80% of people in developing countries also affected. Back pain has become a ubiquitous issue in modern life, prompting many to report it as a regular ailment. Countless employees consult doctors daily for backaches, leading to the characterization of these pains as “diseases of civilization”.

The region poses challenges for both athletes and non-athletes due to its structural weaknesses and the stresses it endures. The concentration of heavy loads, natural spinal curves, and increased workload in this area can lead to various problems and injuries during physical activities, certain occupations, and poor posture when using technology. While muscle weakness or loss of tone, along with heightened exertion in the region, primarily causes lower back pain in gymnastics. This imbalance can lead to muscle fiber and tendon tears. Overstretching exercises may result in tendonitis and, at times, synovial effusion due to overuse. Since excessive training provides no benefits, athletes may experience muscle fatigue, leaving them vulnerable to muscle and tendon injuries, as well as joint issues, particularly in the lower back, which supports much of the body's weight during activity. It is important to differentiate between normal muscle fatigue and the more harmful sensation of physical exhaustion. All parts of the body are connected to the spine either directly or indirectly. The back muscles, which are responsible for maintaining an upright posture, are centered around the spine. When the spine is injured, either directly or indirectly, the pain affects movement and consequently the body's systems. The cervical and regions are the most susceptible to injury and stress. Since muscles determine the external shape of the body, it is natural that any weakness affecting the muscles or certain muscle groups associated with any part of the body will ultimately lead to an imbalance in posture.

The muscles connected to the spine have a significant impact on increasing or decreasing the curvature of the spine. If these muscles weaken, the balance is disrupted, and the shape of the natural curvatures changes accordingly. This results in postural deviations. The pelvis is the center of postural alignment, as its rotation affects the natural curves of the spine. Both the vertebral column and the pelvis play a crucial role in maintaining upright posture and spinal health. This flexible, movable column is located in the center of the body and maintains balance.

With age, the outer fibrous layer of the cartilage becomes weaker and stiffer, while the inner part gradually dries out. Until around the age of 50, the nucleus of the cartilage remains mobile and susceptible to prolapse. After age 30, the outer fibers can become weak, allowing the inner core to bulge and protrude. These indicators may suggest a deficiency in the nucleus pulpous of the intervertebral disc, which can lead to the extrusion of the nucleus and subsequent compression of the nerves. This compression often results in numbness and tingling in the upper extremities, including the forearms, hands, and fingers. Other sensory changes, like parenthesis and burning sensations, frequently accompany this compression. Additionally, the individual may experience varying degrees of weakness in the forearm and hand, depending on the condition of the disc and its function in relation to the vertebrae. Consequently, the affected individual may not fully recover to their pre-injury state.

Intervertebral disc herniation is a common and frequently occurring injury in various sports activities. A relative deficiency in spinal movement facilitates it. The percentage of individuals affected by these conditions reaches up to 80% in some industrialized countries, varying in severity, location, and duration from one person to another. Numerous and varied causes, such as disc herniation in the region, contribute to these pains. Many physicians believe that this problem, in addition to medical and physical therapy, requires surgical intervention, but surgery in this case, and the fear it causes in the patient, is considered highly risky, prompting some doctors to try physical therapy and avoid surgery unless the patient's pain reaches an unbearable level.

This study conducted on “Disc Herniation and its Association with Lordosiss and Lower Back Pain” to advance sports medicine and establish a foundation for future research on disc herniation.

Significance of study

This guideline aids healthcare providers in identifying common athletic injuries and differences in their incidence among individuals. This knowledge is crucial for implementing preventive measures and enhancing overall physical performance. However, injuries can negatively impact general health by disrupting daily routines and causing psychological distress, which may impede the attainment of desired outcomes. The researcher believes that anticipating injuries, understanding their causes, and knowing how to prevent them can significantly help individuals avoid injury during both physical activities and daily life.

Objectives of the study

This research aims to investigate the relationship between lordosiss, pelvic tilt angle, and the incidence of herniated discs among athletes. We will address the following sub-objectives to achieve our main goal:

- The aim is to pinpoint the connection between herniated discs and lower back pain in certain athletes.
- The study aims to ascertain the degree of pain alleviation in the region and spine of the participants.

Search Terms

Excessive Lordosiss

This condition involves an abnormal increase in lumbar concavity, causing the abdomen to protrude and leading to elongated, weakened abdominal muscles. The pelvis tilts forward, resulting in a lateral deformity around a transverse axis.

Disc Herniation

This is a common injury in both sports and daily life, occurring when the gel-like nucleus of a spinal disc protrudes and compresses the spinal cord. Most cases involve lateral protrusion, affecting only one leg, varying severity based on injury extent and back muscle condition. Most commonly affected are the fifth, sixth, and seventh cervical vertebrae and the fourth and fifth lumbar vertebrae, while the first sacral vertebra is less frequently involved. A mid-back herniation is rare. This condition arises when the nucleus slips, compromising the surrounding fibres and exerting pressure on the nerves to the thigh and leg, resulting in lower back pain. Due to its various forms and gradual progression, disc herniation is considered a significant modern health issue. Curvature of the Vertebral Column.

According to the anterior-posterior curvatures of the vertebral column can be defined as follows: Cervical curvature is a forward convexity that begins at the first vertebra and ends at the second thoracic vertebra, making it the least pronounced spinal curvature. The thoracic curvature is convex posteriorly, starting with the second thoracic vertebra and extending to the end of the thoracic region. Lumbar curvature is convex anteriorly, starting from the middle of the 12th thoracic vertebra and ending where it meets the sacrum. The coccyx comprises the coccygeal vertebrae at the end of the spinal column.

Yasmin Al-Bahari Susan Salah El-Din (2007) [8], citing Davide, Walter, and others, stated that the natural curvatures of the spine serve as safety and security factors, essential for maintaining balance and absorbing shocks. While Mohamed Bakri Qadri (2000) [1] stated that the region represents points of weakness and movement problems for both athletes and non-athletes. Due to the vital nature of this region, which bears significant loads and weights, and the natural curves and activities that occur in it more than in other parts of the spine, it leads to troubles, problems, and injuries for athletes and non-athletes during physical activities, certain professions, and incorrect sitting postures when writing, reading, or due to the misuse of modern technological devices.

Mechanics of the Spine and Pelvis

Muscles that move the vertebral column

A group of muscles extending from the posterior convexity to the thigh and pelvis impacts spinal alignment, according to Qadri Bakri and Saham Al-Ghamri (2011) [5]. These muscles help maintain upright posture, alleviating pressure on the lower back vertebrae. The contraction of the back extensor muscles aligns the spine over the pelvis; this area has the thickest, strongest muscles and greater mobility, leading to increased stress. The back extensors also stabilize the body during flexion movements. Movements of flexion and extension occur around the transverse axis, lateral flexion around the sagittal axis, and rotation around the vertical axis, allowing spine movement. The iliacus muscle, the largest muscle in the human body, is essential for extending the thigh and maintaining an upright posture, along with the iliopsoas muscle.

The Physiology of Muscles Acting on the Spine: Zainab Al-Alam and Nahed Abdel Raheem (2005) describe the spine as a flexible column providing a primary axis for the body, maintaining balance, and connecting to the lower limbs, significantly influencing associated organs**.** In addition, Byrne TN and Benzel EC (2013) state that muscle cells are the fundamental units of muscles, with a medium-sized muscle containing about 10 million muscle fibres. A connective tissue sheath envelops each group of fibers, forming a motor unit, the functional component of the muscle. Muscles connect to tendons, resilient connective tissues that handle considerable stress.

Muscles generate and store energy, enabling prolonged function without relying only on immediate reserves. They can contract and relax to varying degrees and restore muscle tone, a partial contraction essential for posture and readiness. Muscle tone involves alternating contractions of individual fibres, ensuring the body remains poised and responsive to stimuli, crucial for maintaining proper mechanical alignment and enhancing muscle efficiency.

Determining the pelvic angle in the body

Muhammad Fathi Hindi (1993) notes that the pelvis typically tilts forward and downward at an angle of 55 to 60 degrees when standing. We measure this pelvic tilt angle by drawing a line from the junction of the vertebrae and sacral vertebrae to the point where the pubic bones intersect a horizontal line. Variations in this angle can increase anterior concavity in the region a decrease results in a reduced normal curve and a flattened back. The rounded heads of the femurs, situated within the acetabulum, form ball-and-socket joints that balance the pelvis on a transverse axis, allowing for rotational movement. Pelvic rotation affects the sacral angle and alters normal spinal curves. Maintaining an upright posture requires significant muscular effort from specific muscle groups.

Abdul Rahman Zaher (2013) highlights that physicians use various procedures to diagnose and treat lower back pain. This process necessitates a deep understanding of spinal anatomy and physiology, enabling the differentiation of structural, functional, and congenital injuries, as well as pathological conditions. Additionally, other factors contributing to lower back pain and reduced functional capacity should be considered. A physician's effectiveness in treating back pain relies on their ability to identify changes in spinal structure and function that may lead to pain, along with assessing social, psychological, and other influencing factors.

Impaired body mechanics and its relationship to lower back pain

Norjin Campello noted in 1996 that a primary cause of lower back pain is dysfunction in the body's mechanics or peripheral ligaments. Normal posture is upright, so bending requires joint and vertebrae movement. The lower back vertebrae, being highly mobile, endure significant pressure from bending, lifting heavy objects, and twisting, which can lead to pain, narrow the spinal canal, and compress the spinal cord or nerves. Muscle strain also adds stress to the ligaments, contributing to lower back pain. Improper daily activities can create chronic strain on the lower back, leading to muscle spasms and pain. Examples include improper lifting, twisting during movement, and prolonged sitting without breaks to realign the vertebrae. Sudden movements in poor posture or falls can directly injure the back's ligaments and muscles.

How to use Magnetic Resonance Imaging (MRI)

Magnetic Resonance Imaging (MRI) is the primary method for diagnosing conditions affecting the brain and spinal cord. People commonly use it to evaluate specific symptoms and health issues.

MRI utilizes a magnetic field and radio waves to create images of the body's organs and tissues.

Typically, large MRI machines have a bed that slides into a narrow tunnel to capture images of different body parts. The strength of the magnetic resonance waves, which produce three-dimensional images viewable from multiple angles, determines the quality of these images.

Previous Studies

The 2015 study by Marlyn Fakry Shenouda developed a training program to enhance physical attributes and prevent lower limb injuries in rhythmic gymnasts. The study employed an experimental design, gathering data through an expert opinion questionnaire and a form that recorded player data and injuries before and after the program. The research employed various physical tests and measurement devices. The study involved a purposively selected sample of 16 rhythmic gymnasts from Baghdad Sports Club, divided into an experimental group of 8 and a control group of 8, all under 14 years of age. The findings indicated that the training program effectively improved muscle strength, flexibility, and overall skill performance while successfully reducing lower limb injuries in the experimental group.

Abdul-Wahab Al-Ashari's 2014 study examined the effects of excessive pelvic rotation during the split position in rhythmic gymnasts, focusing on its relationship with lower back pain and muscle electrical activity. The research aimed to identify differences in pelvic variables (width, anterior tilt angle, and rotation angle) and hip joint flexibility between gymnasts with and without excessive pelvic rotation. We purposively selected a sample of 34 rhythmic gymnasts aged 14 to 16 from Sporting Club and Smouha Club in Alexandria.

The findings highlighted a connection between excessive pelvic rotation and lower back pain, as well as differences in muscle electrical activity. Notably, electrical activity was consistent across muscle groups that controlled anterior and posterior pelvic tilt. The rectus abdominals, external oblique, biceps femoris, semitendinosus, and semimembranosus muscles all showed higher activity**.**The study suggests that individuals with average height, weight, and muscular build, alongside a long spine relative to their body length, may be less prone to disc herniation.

The study by Park *et al.* (2012) investigates how various factors influence shoulder and hip coordination during axial trunk rotation in individuals with chronic low back pain. It aimed to compare the maximum shoulder and hip rotation angles in the horizontal plane between those with chronic low back pain and healthy individuals. A descriptive methodology categorized 38 participants aged 50–60 into two groups: 19 with chronic low back pain and 19 healthy controls. We measured shoulder and hip rotation angles from an upright standing position. Results showed significant differences in hip rotation angles in the transverse plane, favoring the healthy group, while shoulder rotation angles did not differ significantly between the groups. Additionally, age and body mass index influenced both shoulder and hip rotation angles.

Montgomery T, *et al.* (2011) [5]. The Effect of Spinal Posture and Pelvic Fixation on the Range of Motion of Trunk

Rotation. This study investigated how spinal posture and pelvic fixation affect trunk rotation range of motion (ROM). The researchers used a descriptive method to look at twenty male participants and used an optoelectronic motion analysis system to track the participants' trunk movement during maximum rotation in different spinal postures around the vertical axis. The researchers repeated the tests and ensured reliability through correlation coefficients and standard deviations. Key findings showed a 25.5% increase in trunk rotation. Fixing the pelvis during a 45-degree forward trunk lean resulted in a 5% decrease in trunk rotation compared to its natural position. Interestingly, fixing the pelvis increased trunk rotation by up to 9%. The researcher utilized a descriptive approach to effectively meet the research objectives.

Scope of Research

- **Time Frame:** Data collection for the research sample lasted from October 15, 2023, to January 25, 2024, totaling three months and ten days.
- **Geographic Scope:** We conducted medical examinations and radiological imaging at Baquba Hospital and a certified physical therapy clinic, administering tests and measurements to the samples.
- **Population:** The study involved a sample of athletes from sports clubs in the Baghdad Governorate.

Research Sample

The sample included individuals diagnosed with disc herniation, initially comprising 9 athletes from Baghdad sports clubs. After confirming diagnoses, we narrowed it down to 6 participants. Additionally, we included 3 local athletes with the same condition as a pilot sample, who underwent post-research testing procedures.

Sample Selection Criteria

Participants must have a diagnosis of a herniated disc with spinal curvature. A specialist will conduct an initial assessment to evaluate the severity and location of the injury based on clinical signs, including pain from spinal movements, functional tests, and diagnostic imaging. These tests will help in assessing the patient's condition.

Table 1: Statistically describe the research sample data in terms of the fundamental primary variables

M	Sample	No.	Percentage
1	Basic sample	6	66.67%
2	Exploration sample	3	33.33%
3	total	9	100.00%

Table 2: Demonstrates that the research sample data is homogeneous in its basic measurements

Variables		Statistical indications of description	
	Average	Speeded deviation	Torsion
Age year	18.93	4.77	0.04
The length is cm	173.55	3.26	0.42
Satin weight	70.93	4.77	-0.11

The skewers coefficients range from -0.41 to 0.12, indicating that the measurements are nearly normal, as normative skewers values typically fall between ±3 and close to zero. The flattening coefficients, ranging from -1.64 to -0.43, suggest that the normative curve's fluctuations are acceptable and show no significant upward or downward trend on average. This indicates that the members of the research group are consistent across the variables.

Table 3: Statistical descriptions of the research sample data in physical variables

Average	Torsion	Speeded deviation	Average	Variables	Abdomen		
0.46	1.64	9.75	No	Sit-up from lying position			
0.84	1.72	29.42	Degree	Dynamometer	Back	**Muscle Strength**	**1**
0.68	2.22	15.97	Space	Standing back bend (arching the trunk backward)		Spine Flexibility	2
0.47	2.17	8.74	Space	Forward trunk flexion from a sitting position			
23.11	0.36	2.05	23.11	Standing trunk flexion to the right			
20.82	0.41	2.23	20.82	(Repeated term) Standing trunk flexion to the right			
0.70	1.06	8.81	Right	Time		Balance Test of One-leg	3
0.42	0.84	8.82	Left				

Table 3 shows the homogeneity of the research sample's pain intensity measurements, with skewers coefficients ranging from -0.894 to 0.354. These values suggest that the measurements approach normality, as normal skewers coefficients fall within ±3 and are close to zero. The kurtosis coefficients ranged from -1.447 to -0.653, indicating that the normal curve remains stable, confirming the homogeneity of the research group in these variables.

Study Objectives: The study aimed to:

- Obtain consent from participants and their affiliated clubs for research involvement.
- Develop and implement a data recording form for specific measurements.
- Verify the nature of injuries, associated complications, and the suitability of measurement tools.
- Ensure the validity of all measurement devices and tools.
- Explain the research objectives and measurement procedures to assistants.
- Calculate how long it will take to collect data from tests and measurements while maintaining the imaging device's safety.
- Schedule imaging appointments at specialized medical centers.

Baseline Study: From March 15 to May 10, 2024, eight athletes with disc herniation underwent baseline measurements.

Statistical Analysis: We applied the following methods in our statistical analysis of the data using SPSS.

- Mean
- Standard deviation-
- Skewers coefficient

Table 4: The morphological variables assessed

T-Value	Higher value	Lower Value	Standard Deviation	Median	Average	Variables	
3.04	171.00	153.00	6.71	162.80	162.38	Herniated disc angle	
13.83	159.00	152.00	2.81	155.80	155.13	(Kyphotic angle	
19.33	19.33	12.00	11.50	0.49	11.20	11.12	Herniated disc
13.71	13.71	12.10	11.30	0.58	11.15	11.05	
28.65	9.00	7.00	1.13	7.30	7.13	Pain severity	

The mean scores were 162.083 for lordosiss and 154.883 for kyphosis, with t-values ranging from 2.592 to 28.354, indicating that the sample exhibited lordosiss, pelvic tilt, kyphosis, and disc herniation. These differences were statistically significant at the 0.05 level among the players. The spine is the body's central axis, especially for athletes, and even minor issues can severely impact performance, particularly when back muscles weaken. Increased strain on the spine often leads to chronic lower back pain and injuries like disc herniation, which is on the rise.

The body's structure subjects the vertebrae to compressive forces, with lumbar vertebrae experiencing the highest stress due to greater loads than thoracic vertebrae, making them more prone to injury. Disc herniation often occurs with sudden movements or heavy lifting, exacerbating lordosiss and pelvic tilt and causing the disc's nucleus to protrude and compress the spinal cord. The severity of herniation varies based on the injury's extent and back muscle strength, typically occurring between the third and fourth, or fourth and fifth, vertebrae. Lifting weights or heavy objects frequently leads to this injury. The researcher posits that weak abdominal muscles may play a role in some instances of disc herniation. Weak abs fail to maintain pelvic position, affecting lower spine alignment and potentially worsening lordosiss and pelvic tilt, which narrows the spinal canal and increases the risk of herniation. Abdul Azim Al-Oudli (2004) supports this, noting that the back muscles essential for movement and daily activities are highly prone to injury, especially in the mobile lumbar region, regardless of whether the movements are positive or negative and pain levels among athletes, with correlation coefficients ranging from 0.598 to 0.976, all significant at the 0.05 level. This indicates a meaningful relationship between disc herniation and pain levels. Researchers Amal Abdul Wahab (2014), reported similar findings, noting that pelvic variables, such as pelvic width and tilt angles, balance muscle activity during movement. Additionally, Mohamed Taher Mahmoud (2007) found that lower trunk physical fitness, particularly flexibility and strength, heightens the risk of disc herniation. Conversely, improving trunk and spine flexibility can alleviate pain and enhance muscle efficiency*.* Table 5 also reveals the model's significance, with an F-value of 59.903 at the 0.01 level. An R-value of 0.978 confirms the positive correlation between spinal kyphosis, disc herniation, and lower back pain.

Table 5: Strong positive correlation between back curvature, disc herniation

Pain severity	Herniated disc		Back pain	Lumbar Lordosiss	Variables	
	MRI	XR				
0.769	0.943	0.853	0.952	1	Lumbar vertebra angle	
0.815	0.978	0.847	1	0.952	Degree of thoracic kyphosis	
0.589	0.589	0.908	1	0.847	0.853	Herniated disc
0.817	0.817	1	0.908	0.978	0.943	
1	0.817	0.589	0.815	0.769		Pain

Table 6: Show indicates that the hip joint angle contributes 76% to the variance in disc herniation injuries

Participant percentage	Beta Coefficient	Regression Coefficient	T-Value	F-Value	R^2	R	Dependent Variable	Independent Variable
85.69%	0.762	0.058	6.859	60.036	0.953	0.976	Herniated disc	Lumbar vertebra angle
93.06%	0.089	0.003	5.266					
95.26%		-3.524	5.426					Thoracic kyphosis degree

Table 7: Factors such as heightened disc herniation, excessive lordosiss, and lower back pain contribute to these symptoms

Participant percentage	Beta Coefficient	Regression Coefficient	T-Value	F-Value	R^2	R	Dependent Variable	Independent Variable	
3.895	35%	1.95	0.379	3.895	0.824	-0.908	Herniated disc	Abdomen	Muscle Strength
4.332	58.2%	-0.185	-0.095	4.332				Back	
66.9%	0.501	0.089	3.952	3.822				Spinal Flexibility	
3.822	75.36%	-1.225	-0.215	3.218				left	Kinetic Balance
3.218	78.5%	-0.263	-0.351					right	
81.26%		10.336	3.365					Variables Combination	

Table 6 indicates that the hip joint angle contributes 76% to the variance in disc herniation injuries, followed by lordosiss at 85.36% and spinal kyphosis at 92.63%. Collectively, these factors account for 94.16% of disc herniation injuries. The influence of spinal curvature and kyphosis on disc herniation reaches approximately 95.7%, as indicated by an R^2 of 0.957.

The researcher concludes that an increased lordosiss angle is a potential indicator of impending disc herniation, highlighting the importance of identifying these signs for effective prevention. Disc herniation is common, impacting movement and daily activities, with varying severity, location, and duration of pain among athletes. Factors such as heightened disc herniation, excessive lordosiss, and lower back pain contribute to these symptoms.

The F-value of 47.182, significant at the 0.01 level, indicates that the model is significant. A strong negative correlation exists between physical variables and disc herniation, as evidenced by an R-value of -0.900. Among the factors contributing to disc herniation in athletes, abdominal muscle weakness is the most significant, accounting for 36%. Back muscle weakness follows as the second factor, raising the contribution to 57.9%. Poor spinal flexibility is the third factor, increasing the contribution to 66.8%. Poor dynamic balance on the left side is the fourth, contributing to 74.6%, followed by poor right-side dynamic balance as the fifth factor, which brings the total to 78.4%. Collectively, all physical variables account for 80.9% of the incidence of disc herniation in athletes.

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