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Original Article

FREQUENCY OF LEG LENGTH DISCREPANCY SECONDARY TO UP-SLIP SACRO-ILIAC JOINT AMONG ASYMPTOMATIC FAST BOWLERS

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A B S T R A C T

ABSTRACT

***Background**: Low back pain and other musculoskeletal problems are becoming more common in cricketers, particularly fast bowlers. Fast bowlers have been shown to suffer from LBP, which affects daily activities and leads to poor performance. The repetitive spinal and pelvic motions required in fast bowling are the sources of these musculoskeletal issues. A tilted pelvis can lead to functional LLD due to an up-slip SIJ. LLD is a condition in which one leg appears to be longer than the other. Early detection of LLD can prevent fast bowlers from LBP and other musculoskeletal problems. Pakistan has several cricket academies and one of the most professional teams. Still, there is not enough study on health, fitness, and body mechanics to help assess various elements that influence a player's performance. Knowledge about LLD will benefit the players regarding their health, comfort, and performance. Therefore, we conducted this research to look at the incidence of LLD among young fast bowlers secondary to up-slip SIJ.*

***Subject and methods**: This study aims to determine the frequency of LLD among young fast bowlers. A cross-sectional survey was conducted among asymptomatic young fast bowlers of Karachi. We approached our target population by visiting some cricket academies in Karachi. A screening proforma was provided, and two physical tests were performed on each participant to examine LLD*

***Results**: The sample size of this study was 350. The age of the participants was between 9 and 19. Out of 350 participants, 329 were males, and 21 were females. 146 (41%) of the participants had LLD greater than 1 cm, and 204 (58.3%) didn't have LLD or had LLD less than 1 cm. Years of practice and training hours were observed to be associated factors.*

***Conclusion**: Ruling out LLD in asymptomatic young fast bowlers is important to protect them from future musculoskeletal problems because it can affect their performance. We noticed the relation between LLD and other factors. For young players, more practice is required to balance their fitness and work performance. In the future, we hope this research will help examine LLD not only in fast bowlers but also in other players.*

1. Introduction

Leg length discrepancy (LLD), also termed leg-length inequality or an-isomelia, is a morbidity in which one leg appears to be longer than the other. Some individuals are born with this condition, having an unequal tibial or femoral length (Anatomical LLD or congenital LLD). In contrast, others develop it due to changes in the mechanics of the lower limb, i.e., joint contractures, malalignment of the static or dynamic mechanical axis, ligamentous laxity, muscular imbalance, or pelvic torsion (Functional LLD). [1] In other words, the anatomical difference is due to actual measured differences in the length of both legs caused by natural growth retardation, and functional leg length results when some other body structure affects leg length, e.g., scoliosis, muscle imbalance, infection, flat feet, trauma, or up-slip SI joint. [32] Irregular mobility of the hip, knee, ankle, or foot can cause functional LLD. It's estimated that about 40–70% of people have some degree of leg length discrepancy. The difference is often so slight that it may not cause a problem. [1]

The biomechanical causes of functional LLD are simple to

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understand if one knows the anatomy of the pelvis. The sacroiliac joint connects the pelvis to the spine. The lower edge of the sacroiliac joint has a slight bone promontory. This acts as a ledge to help support the upper body's weight across the SI joint. [2] If one side of the pelvis moves forward, it will ride up this ledge. Conversely, if it twists backward, it will fall off this ledge and become lower; this is referred to as an up-slip. [3] An up-slip occurs when a specific type of microtrauma occurs. It happens when a person accidentally steps off a height and jams their pelvis straight up with a straight knee and a relaxed hip. Anything that resembles that motion (dropping a step while carrying a laundry basket, slipping out of a truck without a running board, strolling on uneven ground and inadvertently stepping into a depression) can create one. Falling on one side of your buttock might also cause them. [29] Up-slip of the SIJ is assumed to have a close and crucial relationship with LLD. The general belief is that SIJ up-slip leads to functional LLD, in which the legs appear unequal in length despite being anatomically similar. [4]

Figure 1: Anatomy of Sacroiliac Joint

LLD may be symptomatic, or it may be asymptomatic; if it remains untreated, LLD can lead to different musculoskeletal disorders such as low back pain, hip pain, stress fractures, degenerative conditions, and functional scoliosis. [5]

Around the world, over 23% of the general population has an LLD of more than 1 cm. [6] According to Anderson, a gap of ¾–1½ inches requires foot correction or a heel lift, while a difference of less than ¾ inch does not require correction. [7] Abnormal gait patterns can result from an LLD of 2 cm or more. Individuals who spend most of their days on their feet or participate in sports appear to be more susceptible to LLD than those who play less. [1] LLD can be found in over ninety percent of athletes, depending upon what sport they are playing and the level of activity of the team. For example, fast bowlers tend to have a large number of LLD cases because of the repetitive nature of running and landing on one foot. [3]

Fast bowlers' spines are subjected to recurrent sagittal plane and rotatory movements over a long period of time, increasing their risk of back injury. [28] Asymmetry of the spine can cause LBP; reestablishment of symmetric posture can be achieved by applying a foot lift. It has been seen to give significant relief from LBP. [30] A difference in the length of the legs can alter the alignment of the spine and make it more prone to the shock forces caused by running. A leg length discrepancy isn't painful itself, but it can cause other problems and injuries that can cause pain. If someone suffers regular bouts of iliotibial band syndrome or has sciatica-like pain radiating from the buttocks down into the legs, a leg length discrepancy may be positive. [31]

During running, forces of up to 3 times body weight are transmitted through the feet and the lower limb; when performing sports that involve leaping and jumping, these forces can reach 7 or 8 times body weight. [32]

Running biomechanics differ from walking biomechanics, as does the impact of LLD. The vertical oscillations are higher in running, and because there is no double support, weight is not distributed evenly between the legs. The stance phase is longer in walking (60%) compared to running (30%). This causes three times the load on the lower extremity compared to walking. Increased LLD can result in higher loads and peak stresses at contact surfaces of the SI joint. This may cause LBP and other musculoskeletal disorders. [1]

The study aims to screen early LLD and prevent young asymptomatic fast bowlers from performance decline due to low back pain and other injuries in the future, to provide benefit to the physiotherapy community to assess LLD among asymptomatic athletes, to spread awareness among athletes that repetitive bowling and incorrect bowling action can lead to LLD, which is an important cause of low back pain, and to enable cricket academies to screen LLD among cricketers from the grassroots level. Knowledge about these factors will reduce premature retirement and improve performance. This study will bridge the gap area and lay the foundation for further studies related to the health and fitness of cricketers to be conducted in Pakistan.

Leg length discrepancy, which refers to the appearance of one leg being shorter, is either structural or functional. Mostly, LLD is associated with sacroiliac joint dysfunction. LLD remains asymptomatic in most populations but can lead to various musculoskeletal problems, primarily low back pain. According to Anderson, a 0.75-inch LLD is bearable, but more than this range needs to be corrected. There is limited data available worldwide—especially in Pakistan—about awareness of athletes' different musculoskeletal disorders associated with LLD. Athletes remain undiagnosed and untreated, which leads to poor performance and causes an undue medical burden.

2. Materials and Method

This cross-sectional study evaluated frequency of LLD among young fast bowlers, all aged under 19 years, from approachable cricket academies located in different areas of Karachi. These academies included UBL Sports Complex, PIA Cricket Academy and Jauhar Sports Complex. Data collection was carried out from January 2022 to March 2022. The technique used for sampling was the non-probability purposive sampling technique. The study covered a final sample of 350 young asymptomatic fast bowlers calculated through open EPI with a hypothesized frequency of 65% (the participants having asymptomatic sacroiliac joint dysfunction). The confidence level is 95%, the margin of error up to 5%, and the design effect is 1%.

Fast bowlers of age under 19, both male and female, were included in the study. Whereas off- season players, obese athletes, individuals with any history of any trauma or fracture, individuals with anatomical shortening of the leg, individuals with any trunk or lower limb deformity, individuals with comorbidities and individuals with musculoskeletal or neurological impairment were excluded from the study.

The consent letter was emailed to all the cricket academies

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before the researchers personally visited the academies. A screening proforma was administered in the academies, and the therapist performed two physical tests on each participant after taking consent. These tests were:

Supine to long sitting test: This test was performed to check the contribution of SIJ to an apparent LLD. The test was performed in the supine position. The researcher grasped the participant's legs above the ankles and fully flexed them, and then extended them. The researcher then compared the two medial malleoli to see if a difference in position was present. Had the participant sit up while keeping the legs extended. Compared the position of the medial malleoli one more time to check if there was a change. [27]

Direct tape measurement: This test was performed to rule out the presence of LLD. This test was performed in the supine position. The researcher checked the leg length of each participant with the help of measurement tape by measuring the distance between the anterior superior iliac spine (ASIS) and the medial malleolus of each leg, and a difference of 1cm or more was considered positive. The data of every participant was kept private. [26]

After checking for normality, descriptive characteristics of the sample were calculated. The frequency of the positive supine to long sitting test was calculated through the frequency test. To study the association between LLD (outcome variable) and training hours and years of practice (exposure variables), we conducted the Chi-square test. Correspondence between different variables and LLD was also calculated. All statistical analyses were performed using the Statistical Package for Social Sciences (IBM SPSS Statistics for Windows, version 22.0) with the significance level set at $p < 0.05$.

3. Result

This cross-sectional study comprised 350 fast bowlers. All of the participants were between the ages of 9 and 19. Out of the total number of fast bowlers who participated in the study, 329 (94%) were males, and the remaining 21 (6%) were females, with a female to male ratio of 1:15, respectively.

The assessment of 350 fast bowlers under 19 years showed that LLD was seen with a rate of approximately 41.7%, which means that 146 out of 350 young fast bowlers had LLD greater than 1 centimeter. Among them, 19.5% of fast bowlers had LLD of 1 centimeter, and about 12.9% of participants had LLD of 2 centimeters. About 0.6% of participants had an LLD of 5 centimeters. The remaining 58.3% of fast bowlers did not have LLD, or they had LLD of less than 1 centimeter, which is negligible.

The chi-square analysis identified a significant relationship between years of practice and incidence of LLD (P=0.00). The rate of LLD slightly but not significantly increases with age ($p>0.05$). However, gender was not observed to be an associated factor ($p>0.05$). Regularly exercising and training emerged as an important associated factor in LLD. Statistical analysis revealed a significant correlation between the training hours and LLD (P = 0.000). Fast bowlers who attend the training sessions for less than 10 hours a week tend to have a higher incidence of LLD than those who train for more than 10 hours a week.

The binary logistic regression with supine to long sitting test as the outcome variable and gender, age, years of practice, and training hours as exposure variables showed that factors independently associated with LLD were years of practice (p = 0.001) and training hours (p = 0.00) but not the age and gender ($p > 0.05$).

4- Discussion

This research was conducted to examine the frequency and prevalence of Leg Length Discrepancy among Asymptomatic fast bowlers. In the presented study survey total of 350 fast bowlers, 329 males and 21 females, actively participated in LLD diagnosis. Presented study results showed 41.7% of fast bowlers of age under 19 had LLD greater than 1cm remaining 58.3% of fast bowlers had LLD of less than 1cm. Other studies reported the prevalence of LLD among runners, i.e., Elicia Pollard & Eddie Traylor 2013 examined LLD by using the Tape Measure Method at Langston University and concluded that about 47% of Runners were unaware of the presence of LLD. [8]

The percentages vary due to divergent study designs, Methodology, Sample age, Gender, Sample size and strategy of gathering and extracting data. Noticing the prevalence of LLD is not enough; it is also important to note the triad relation between training hours and years of practice with LLD, but no research in the past has considered it. Presented study results showed notable relation between years of practice and the prevalence of LLD. Fast bowlers who played for more than 4 years were presented with more LLD than those whose years of practice were less than 4 years.

Limitations in training hours to a higher risk of Leg Length Discrepancy and it later in life might cause Running Related Injuries, Low Back Pain, Musculoskeletal Problems and many more leading injuries. Mitchell J. Rauh conducted a study in 2018 to monitor the incidence of LLD and Low Back Running Related Injury, and the results showed that males whose LLD is more than 1.5cm are at an increased risk of sustaining Lower Leg Running Related Injuries. [5]

Our study showed differences between age groups, and the percentage of participants reporting LLD increased with age. However, those differences were not enough to be significant ($p<0.05$). In the same way, no significant differences were found between males and females and the incidence of LLD. Probably the limited number of female participants could explain it because the majority of research showed significant differences in gender; for example, a study with 103 young adult Nigerians, both male and female, reported that LLD was higher in males than females. [27]

Ariella Applebaum. et al. Published an article to examine the overview and spinal implications of LLD; as a result, she came to know that many people do not know about LLD, and it is unrecognized in states. LLD less than 1cm is Asymptomatic and may not require treatment, and LLD greater than 2cm requires treatment as it can affect gait patterns, posture, balance problems and LLD can lead to Musculoskeletal Problems and, we couldn't agree more. The motive of our research was the same as above, to rule out LLD more than 2cm and to treat it to limit the problems such as balancing problems, Musculoskeletal problems, Low Back Pain that will later affect Asymptomatic fast bowlers' performance and daily challenges. [21]Jussi timgren MD in 2018 investigated the role of pelvic asymmetry that leads to leg length shortening [20]. He assessed the position of the iliac crest and inferior scapular angles of patients with a palpation meter tool for accurate results. He concluded that 89% of patients with LBP might have mechanical SI joint dysfunction that causes leg length discrepancy. The presented Research also highlighted the relation between SI joint Dysfunction and Leg Length Discrepancy, and we agree to this point that LBP can be a symptom of future abnormality such as Pelvic mal-alignment that will later result in Leg length Discrepancy/ Inequality. Ranson. et al. in 2008 examined the lumbar Paraspinal

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Muscles Morphometry of Fast Bowlers in cricket [11]. They used MRI of the Lumbar Paraspinal Muscle functional cross-sectional area and concluded that the Fast Bowler group had a greater incidence of lumbar Muscle Asymmetry. The Presented Research Results showed that participants who had LLD could lead to further dysfunction, and Lumbar Paraspinal Muscle Asymmetry can be one of them. LPMA can also develop due to the trunk positions adopted in Fast Bowling Techniques. To overcome these issues, we should highlight the dysfunctions/abnormalities from an initial level that will protect the Fast Bowler and their future career.

5- Acknowledgement

We acknowledge all the participants that were involved in our study, without them the study couldn't be completed. Also, all the authors were acknowledged for their contributions.

LIMITATIONS:

There are some limitations in the presented work as we had limited time to gather data. The presented research used validated physical tests to determine LLD, but the exclusion criteria were based on subjective assessment of the participants. Therefore, the results should be interpreted with caution because of their cross-sectional design. Secondly, in our survey, we faced difficulty finding women's Fast Bowler teams on a large scale. Many women fast bowlers were not willing to participate due to their privacy issues, and as a result, we didn't get a large sample size of women fast bowlers. We came across some weaknesses of our survey research which are time management and limited access to Cricket academies. We also noticed that not all academies were fully taking an interest in research because of their lack of knowledge due to, which we had a little difficulty in collecting huge data.

CONCLUSION:

Ruling out Leg length discrepancy in Asymptomatic Young Fast Bowlers is imperative to protect them from future Musculoskeletal Problems, Low Back Pain or any other problem that will affect their performance. The increase in interest of young children in cricket, particularly in fast bowling, needs to be examined at the right time to prevent future problems. Assessment of Asymptomatic Fast Bowlers was done by using two tests that are Supine to Long sitting test and the direct Tape measurement. Our research survey concluded that 41.7% of fast bowlers under 19 were presented with LLD greater than 1cm, and the remaining 58.3% of fast bowlers had LLD of less than 1cm. We noticed the relation between Leg length discrepancy and training hours, too; the more the participants workout, the less they had LLD. For all Young players, more practice is required to balance their fitness and work performance. Years of practice played the major role in LLD assessment. Asymptomatic fast bowlers who played for more than 4 years were in greater quantity presented with LLD than those who played less than 4 years.

In the future, we hope this research will help examine LLD in not only fast bowlers but also in other players with some further addition as required. More research and innovation are needed to maintain this healthy topic to rule out or treat LLD in the Players and Generalized population.

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Table 1 Characteristics of the sample

Characteristic	Category	Frequency	Percent
Gender	Male	329	94%
	Female	21	6%
Age (years)	9	7	2%
	11	17	4.90%
	12	15	4.30%
	13	48	13.70%
	14	53	15.10%
	15	59	16.90%
	16	68	19.40%
	17	51	14.60%
	18	12	3.40%
	19	20	5.70%
Height (feet)	4.1 - 5.0	62	17.70%
	5.1 - 6.0	287	81.90%
	6.2	1	0.30%
Weight (kg)	29 - 50	151	43.10%
	51 - 98	199	56.80%
Years of Practice	1 - 5	276	78.80%
	6 - 14	74	21.20%
Training Hours/Week	<10 hours	144	41.10%
	>10 hours	206	58.90%

Table 2 Direct tape measurement of LLD

LLD (cm)	Frequency	Percent
0	204	58.30%
1	69	19.70%
1.5	18	5.10%
2	45	12.90%
2.5	1	0.30%
3	11	3.10%
5	2	0.60%

Table 3 Supine to Long sitting test

Result	Frequency	Percent
Positive	146	41.70%
Negative	206	58.30%

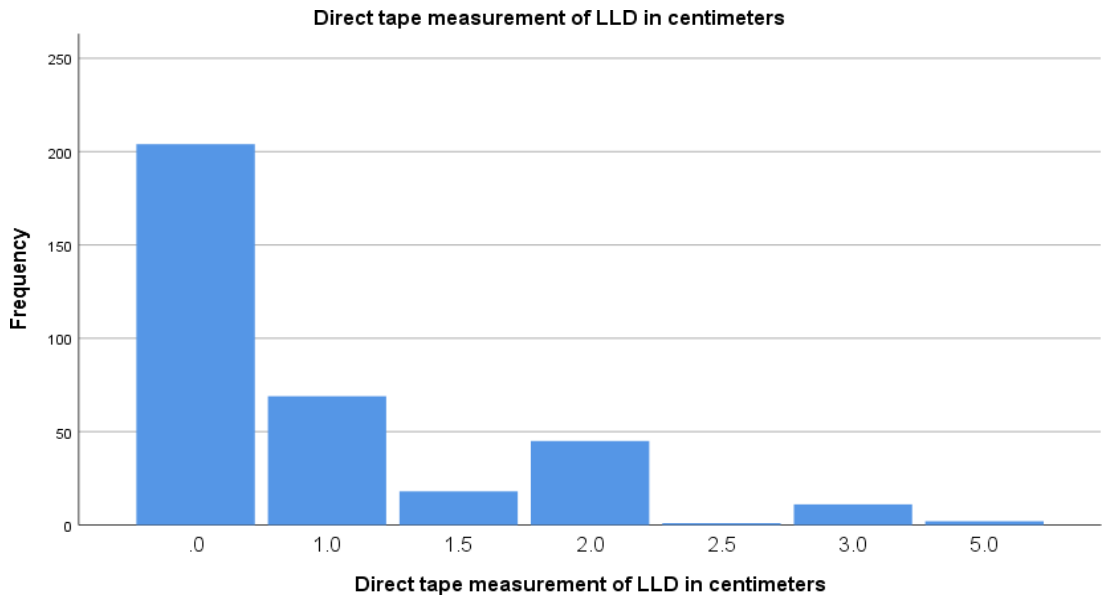

Figure 3 Association between years of practice and LLD

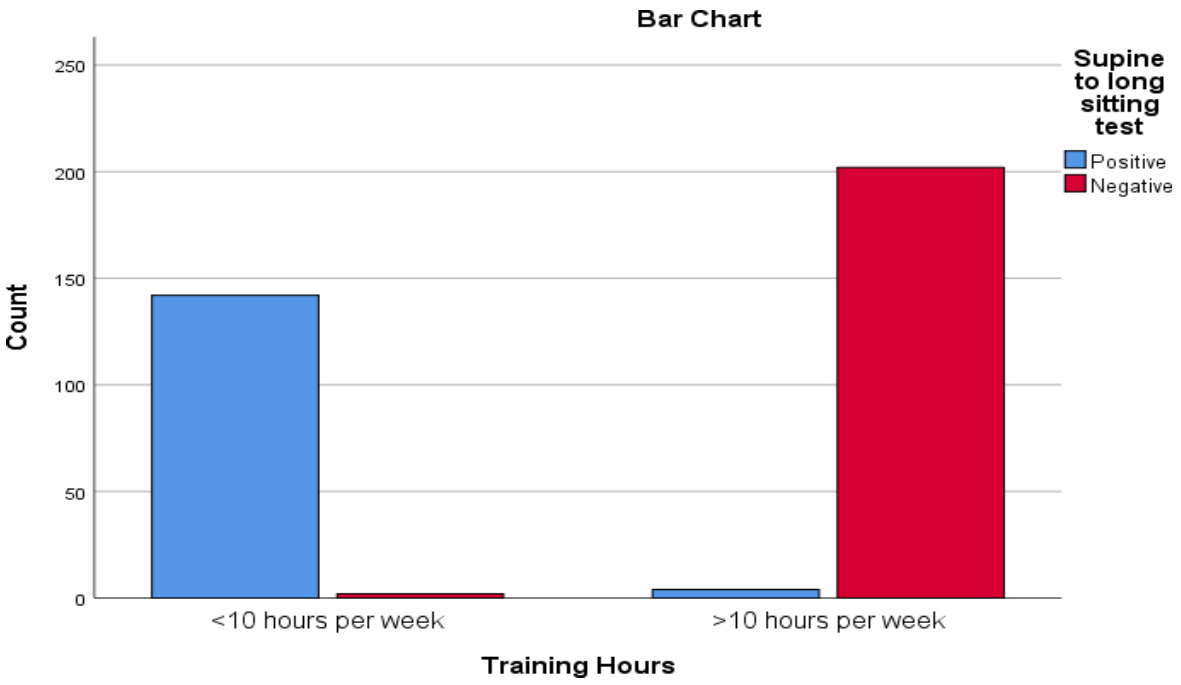

Figure 4 Association between training hours and LLD