Prevalence of Leg Asymmetry and Assessment of Lower Limb Strength Post Hamstring Rehabilitation in Cricket Players

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Abstract: A hamstring injury is strain or pulls of hamstring muscles commonly observed in sport related activities including cricket, soccer, basketball, football, and tennis due to sprinting with sudden stops and starts. This injury typically causes a sudden, sharp pain in the back of your thigh. Swelling, tenderness, bruising or discoloration along the back of leg, as well as muscle weakness or an inability to put weight on injured leg is appeared within the hour.

Objective: The aim of study was to find out the prevalence of changes in lower limb strength and leg asymmetry among cricketers with prior hamstring rehabilitation.

Material and Method: A cross sectional study was carried out following nonprobability convenient sampling technique. Data was collected from different cricket local cricket academies and clubs of Lahore. A total sample size of 79 cricketers was selected according to inclusion criteria of this study in which age group 16-26 years and had history of hamstring injury for 12 months. Demographic data including age, gender, height, weight. FASH (functional assessment scale for hamstring injury), single leg hop test and Asymmetry Index were used for assessing strength of hamstring muscles along with bilateral asymmetry in legs. The data was analyzed using SPSS software version 25 by using Correlation and Chi-square test.

Results: A total sample size of 79 cricketers was selected according to inclusion criteria of this study in which age group 16-26 years and had history of hamstring injury for 12 months. According to results from FASH questionnaire assessment of hamstring injury was done in which more than 90% were healthy and rest 10% were at risk for injury. While performing single leg hop test average jump distance was 53.48inches for unaffected leg and 39inches for affected leg.

***Conclusion*:** From this study, it is concluded that leg asymmetry is found prevalent in cricket players with prior hamstring rehabilitation. It is also concluded that lower limb strength of cricket players is significant. Leg asymmetry affects their functional and athletic abilities, caused pain during daily professional training, and affects their sports participation and performance.

***Index Terms*:** Cricket Players**,** Leg Asymmetry, Lower Limb Strength, Post Hamstring Rehabilitation,

I. Introduction:

Cricket is played in 105 countries that are members of the International Cricket Council and has a long history of popularity in commonwealth countries. For almost 400 years, people of all sexes, nationalities, and skill levels have flocked to cricket stadiums to see unique of the world's most widespread spectator sports. Cricket is an endurance test that calls on skill, strategy, and a bat and ball. Cricket is played by two teams of eleven players each on a rectangular pitch in the center of an oval field. Each team consists of a wicketkeeper, four bowlers, three fielders, and two batsmen. A hard ball struck with an extended round arm action 22 yards (20 meters) in the direction of the stumps is required after a run-up [(1)].

Ever since 2006, hamstring injuries have become increasingly common in cricket. Starting around 2006, the Twenty20 format's star began to rise. Historically, cricket matches have lasted multiple days and consisted of two "innings" for each team. "First Class" cricket refers to the highest level of the sport, where the games are played over the course of multiple days. A team's innings in First Class cricket will continue until all 10 batsmen have been dismissed, regardless of the number of overs bowled. Because bowlers must keep bowling until the opposition is out of the game, their workloads may increase [(2)].

Injuries to the hamstrings are typically the result of a rapid strain or pull on the muscles in that area. The hamstrings, or posterior thigh muscles, consist of the Semitendinosus, Semimembranosus, and Biceps femoris. Hamstring injuries occur between 1.2 and 4.0 times per 1000 athlete exposures across several

different sports. It is believed that 22% of football players suffer a hamstring injury every season, and that number rises to between 17 and 21% when considering sports in general and Gaelic football specifically. Hamstring injuries cause significant financial and time losses for athletes and organizations [3]. A hamstring strain was one of several frequent problems in the highest level of cricket prior to the last decade. Presently, this is the most shared injury in the proficient cricket league. As a result of the popularity of Twenty20 cricket, this is probably the case. Injuries occur at similar rates in both domestic and international matches, regardless of format, but are more common among international players since they play for a bigger portion of the year without a true off-season [4].

Hamstring injuries are caused by the triggering mechanism of fast running. There is still some debate in the scientific literature on when hamstring injuries most commonly occur: at the early stance phase versus the late swing phase of the sprinting cycle. Hamstring injuries are a frequent outcome of sprinting because the hamstring muscle absorbs such a large portion of the high ground response forces produced during the early stance phase. It has been demonstrated in vivo that the Achilles tendon is subjected to greater forces during the concentric stance phase of running, jumping, and hopping than the eccentric swing phase; this may also apply to the hamstrings. Additionally, studies indicate that the late swing phase is when hamstring injuries are most likely to occur [5].

Two types of acute hamstring strains have been documented, each resulting from a different mechanism of injury. High-velocity jogging is the leading cause of type I acute hamstring strains. Injuries to the hamstring tend to occur at the end of a runner's swing when they stretch their hamstrings eccentrically to slow down their swinging leg and get ready for foot impact. The long head of the biceps femoris is often involved in type I hamstring strains, which occur most frequently at or near the proximal muscle-tendon junction. When the hamstrings are stretched beyond their normal range of motion, they suffer from a type II strain. [6] Dance, slide tackling, and high kicking are just a few examples of activities that frequently involve flexing the hips and extending the knees, both of which can lead to a hamstring strain. The proximal free tendon of the Semimembranosus is commonly involved in Type II hamstring strains, which typically occur near the ischial tuberosity. Compared to type I hamstring strains; type II hamstring strains have a longer healing time [7].

High velocity running requires robust eccentric strength, which develops when the hamstring muscles are fully extended. Hip flexion and lower leg extension cause the hamstring to grow because the muscle is stretched across both joints it acts on. In turn, this allows the muscle to exert its impact over a larger area. Athletes who have suffered a hamstring strain have been shown to be weaker when using the muscle in a stretched position. The hamstrings are completely lengthened in this position. Whenever the hamstring is injured, the discomfort is usually immediate and intense, and the swelling and pain set in within a few hours. Common signs of a hamstring injury are swelling, bruising, muscle weakness, and/or an inability to bear weight on the injured leg [8]

A hamstring strain used to be just one of many frequent ailments, but in the last decade it has become the most common injury at the professional and Olympic levels. The introduction of Twenty20 cricket is probably to blame for this. At a rate of 8.7 per 100 players per season, the vast majority of these strains are either mild or moderate. Hamstring issues are sometimes linked to excessive bowling the week prior. Other controllable factors include a lack of a proper warm-up, being tired while playing, being inflexible, experiencing low back pain, and having a strength imbalance between the hamstrings and quadriceps (hamstring strength being 60% of quadriceps strength)[9]

It's more likely that you'll pull a hamstring if you do any of the following: Taking part in sports. The risk of hamstring injury is elevated in activities like dancing and sprinting that require a lot of running and stretching. A history of hamstring injury If the patient resumes the same level of exercise before completing rehabilitation, the hamstring injury is likely to recur. inability to change A lack of hamstring flexibility increases the risk of injury during high-intensity or high-force activities. Inadequate muscle mass. There is some medical consensus that a lack of muscle strength is a factor in hamstring injuries, although other experts have proposed alternative explanations. When the quadriceps, which are located in the anterior compartment, are stronger and more developed than the hamstrings, the latter are at greater risk of injury [10].

The aim of the study was to determine the prevalence of hamstring injuries among cricket players as In Pakistan the most popular and most common sport which we saw in every road and ground here is cricket Mostly authors have done their work with footballer and soccer players studying with similar injuries. With

the best of researcher's knowledge there is insufficient data available on this topic in Pakistan. There are not so many authors are journals written on cricket and cricket related injury like Hamstring Injury, ACL, Side Strain Injury. The fitness and physical health of our cricket players playing around is one of important topic needs to be addressed and to guide and train them towards safe and Injury free sports activities. New researcher should work on athletic and functional training and conditioning of players.

II. Materials and Methods:

A total of 79 cricket players (mean ± standard deviation [SD], age 21.62 ± 2.186 years, body weight 56.1kg ± 2.62, volunteered to participate in this study. 79 national-level Pakistani cricket players competing in the Pakistan domestic cricket system Players with current or recent injuries that may have impeded their ability to perform the testing protocol were excluded based on team physiotherapists' advice. This study was approved by the University's human research ethics committee, and all players provided written informed consent prior to data collection.
Data were collected from each player in a single testing session. Players were asked to complete an FASH questionnaire, detailing their history of hamstring strain and any other major lower limb injuries over the prior 12 months. Age, years of sports participation, stature, mass, and dominant leg were also recorded for all players.

Hip Abductor strength: Hip abductor strength were measured using Manual Muscle Testing (MMT) protocol. Players were positioned supine with straight legs. Players completed three maximal voluntary contractions of unilateral hip abduction by resisting the external resistant force. Players were first given a demonstration from investigators and performed 1e2 warm-up/practice repetitions. Each contraction was held for approximately 5s, with players alternating between right and left limbs after 5-10s of rest. Excellent reliability and validity [(11)] have been previously reported hip abductor strength assessments.

Hip Extensor Strength: Hip Extensor strength were measured using Manual Muscle Testing (MMT) protocol. Players were positioned prone with straight legs. Players completed three maximal voluntary contractions of unilateral hip extension by resisting the external resistant force. Players were first given a demonstration from investigators and performed 1e2 warm-up/practice repetitions. Each contraction was held for approximately 5s, with players alternating between right and left limbs after 5-10s of rest. Excellent reliability and validity [(11)] have been previously reported hip extensor strength assessments.
Knee flexor strength : knee flexor strength was measured by using Manual Muscle Testing Protocol (MMT). Players were positioned prone with straight legs. Players completed three maximal voluntary contractions of unilateral knee flexion by resisting the external resistant force. Players were first given a demonstration from investigators and performed 1e2 warm-up/practice repetitions. Each contraction was held for approximately 5s, with players alternating between right and left limbs after 5-10s of rest. Excellent reliability and validity [(11)] have been previously reported knee flexor strength assessments.

Statistical analysis: Data was analyzed using SPSS version 25.0 quantitative variables were represented using mean, standard deviation, and histogram. Categorical variables were presented as frequencies, percentages, bar chart and computed variable for prevalence. Chi square test was used to find association. Strength and jump/ landing kinetics were compared between limbs with and without an injury history and between legs using Mean± S.D and frequency/ percentage. Between leg asymmetry for each was assessed using a one-sample two-tailed test, with a null hypothesis of 0% asymmetry.

Table I: Statistical Analysis of the Demographics of Participates:

Variables	Results
Age	21.62 ± 2.186 (12-26yrs)
Weight	56.1kg ± 2.62 (50kg-61kg)
Height	5ft- 5.4ft = 7(8.9%)
	5.5ft- 5.8ft =55(69.6%)
	5.9ft- 6 ft = 17(21.5%)
Mode Of Playing	Batting = 64 (81%)
	Bowling = 15 (19%)
Time Of Hamstring Injury	3 months = 33 (41.8%)
	6 months = 30 (37.97%)
	12 months = 16(20.25%)
Time Of Rehabilitation Program	3 months = 15 (19%)
	6 months = 36 (45.56%)
	9 months = 28(35.44%)

Single leg hop test: unaffected leg	53.48 ± 1.44
Single leg hop test: affected leg	39.75 ± 1.79

Table II: Statistical Analysis of the Manual Muscle Testing (MMT) of Lower Limb:

Movements Grading		**Frequency (%)**
Knee Flexion	Grade III: Normal	7 (8.9%)
	Grade IV: minimal resistance	54 (68.4%)
	Grade V: maximal resistance	18 (22.8%
Hip Abduction	Grade III: Normal	11 (13.9%)
	Grade IV: minimal resistance	55 (69.6%)
	Grade V: maximal resistance	13 (16.5%)
Hip Extension	Grade III: Normal	25 (31.6%)
	Grade IV: minimal resistance	46 (58.2%
	Grade V: maximal resistance	8 (10.1%)

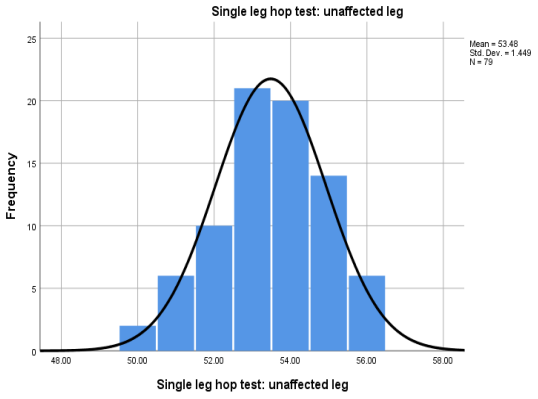

Figure I: Bar chart of Single leg hop test of unaffected leg:

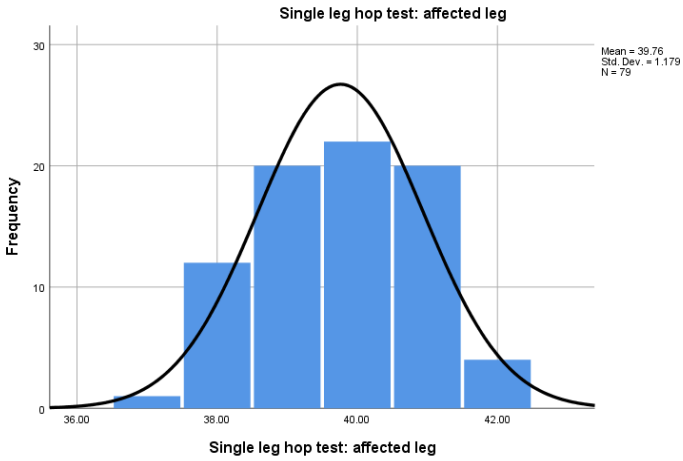

Figure II: Bar chart of Single leg hop test of affected leg

III. Result:

The Results of the statistical analysis were described through the graphs and tables. The demographic analysis of the variables was described in the ***Table I.*** According to ***Table I,*** ages of cricket players were between 16-26 years with the mean age was 21.62 ± 2.186. The heights of participated players are mentioned in which (69.6%) players had height between 5.5ft to 5.8ft and their frequency was 55(69.6%) out of 79. 07(8.9%) out of 79 had height between 5ft to 5.4ft. 17(21.5%) players had height of 5.9 ft to 6ft. Similarly, ***Table I,*** weight of participated players was between 50kg to 61 kg and their mean weight was 56.1kg ± 2.62. ***Table I*** also described the mode of playing as 81% participated players were bowlers because hamstring injury is more common among bowlers while 15 (19%) were batters.

The analysis described the time of hamstring injury among the crickets as 33 (41.8%) said they had 3 months ago injury which was most recent, 30 (37.97%) out of 79 said they had 6 months ago history of injury while 16(20.25%) said they had 1 year ago injury which was most old injury group. The ***Table I*** described the time period for rehabilitation program since injury in which 15 (19%) said they had 3months of rehabilitation program, 36 (45.56%) out of 79 said they had 6 months ago rehabilitation program while 28(35.44%) said they 12 months ago rehabilitation program for hamstring injury.

The ***Table I*** and ***Figure I***, described the results of special test of single leg hop test of unaffected leg are mentioned. The players were asked to jump from one point to another point while on single leg and their distance was measured. In this their mean jump was

53.48 ± 1.44 inches and their median were 54.00 inches.

Similarly; the ***Figure II*** showed results of special test of single leg hop test of unaffected leg are mentioned. The players were asked to jump from one point to another point while on single leg and their distance was measured. In this their mean jump was 39.75 ± 1.79 inches and their median were 54.00 inches. ***Table II*** provide the statistical analysis about the strength of the post-rehabilitated affected limb that was assessed by using Manual Muscle Testing (MMT). The outcomes of knee flexion which is caused hamstring and biceps femoris muscles is mentioned. After assessing more than 68% with frequency of 54 had grade IV, 7 out of 79 had grade III muscles while 18 (22.8%) had grade V muscles. Grade IV and V had minimum and maximum resistance respectively. Similarly, of hip extension movement performed by gluteus maximus and hamstring muscles is stated in which 25(31.64%) out of 79 had grade III muscles, 46 (58.2%) had grade IV muscles and 8 (10.1%) had grade V muscles while assessing strength. hip abduction caused by gluteus minimus, gluteus medius and tensor fascia latae are mentioned in which. By grading 11 (13.9%) had grade III muscles, 55 (69.6%) had grade IV muscles and 13 had grade IV muscles after assessing lower limb strength.

IV. Discussion

The aim of this study was to first compare and identify any differences in the running biomechanics of the previously injured and uninjured limbs of athletes with a previous unilateral hamstring injury. Injuries to the hamstring seem to be rather common, especially among athletes. There is a dearth of evidence demonstrating the success of current rehabilitation programs. Unfortunately, no data comparing an intervention to doing nothing was found. Most of the suggested techniques were also unsupported by evidence when compared to one another or to more standard treatments like stretching and strengthening exercises and heat or cold. [(12)] Two weeks and a year after returning to full athletic activity, the re-injury rate was much lower in athletes who had participated in a progressive agility and trunk stabilizing program. Results from the current study's FASH questionnaire assessment of hamstring injury suggest that, when compared to previous research, over 90% are healthy and the remaining 10% are at risk for injury. The average hop distance during the single leg hop test was 53.48 inches for the healthy limb and 39 inches for the injured one [(13)].

This study demonstrated that field-based measures of lower limb strength and CMJ kinetics in cricket players differ between those with and without prior hamstring strain injuries. Players with a history of prior hamstring strain exhibited between-leg asymmetries in eccentric knee flexor strength, isometric hip abduction strength, and peak landing forces, that distinguished previously injured from uninjured player. [(14)] Players with a recent hamstring strain did not display deficits in eccentric knee flexor strength, hip adductor or abductor strength, or jump/landing kinetics compared to uninjured players. These findings suggest the possibility that conventional hamstring rehabilitation strategies in cricket players may not adequately restore deficits in lower limb strength and CMJ kinetics, which may persist for months to years following a return to high-level sport. Future work should seek to determine whether redressing these deficits leads to a reduction in injury recurrence. [(15)]

Given the fact that several investigators identified a relation between strength asymmetries and injuries, In that respect, for example, Poulmedis, 1988 suggested that muscle asymmetries and imbalances in the thigh can lead to muscle injuries and increased knee laxity. In addition, significant etiological factors for hamstring injury includes strength deficits in knee extensors and knee joint instability, muscle imbalances between extensors and flexors of the knee and large eccentric strength asymmetry (≥ 15%) between the lower extremities. The present study provides a thorough myodynamic profile of a large sample of professional cricket players and can constitute the basis for a more systematic investigation of its connection to injury along with a partial explanation of certain injury predisposing factors in cricket. [(16)]

Limitations: Following are limitations which were faced:

- This study was confined to only 1 city.
- Only few players were agreed to take part in this study due to academy rules.
- Sample size was limited to 79 participants due to financial constraints.
- Study didn't specifically find prevalence in cricket batters or bowlers.
- Study was conducted with using only 1 variant of hop test.

Ethical approval : This study was approved by the University's human research ethics and all players provided written informed consent prior to data collection. This study was conducted in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki).

Conflict of Interest:
There is no conflicts of interest exist between the authors.

Funding:

The study was not funded

V. Conclusions:

From this study, it is concluded that leg asymmetry is found prevalent in cricket players with prior hamstring rehabilitation. It is also concluded that lower limb strength of cricket players is significant. Leg asymmetry affects their functional and athletic abilities and caused pain during daily professional training and affects their sports participation and performance.

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