

The Relationship Of Isometric Quadriceps And Hamstring Muscles Strength Ratio To Lower Back, And Knee Injuries And Their Performance In Combat Sports

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Introduction:-

Athletes suffer a high number of lower back and knee injuries because the hamstring and quadriceps muscles are used more when changing positions, defending, and kicking. Moreover, no previous research has been conducted to link strength to injury and performance. So, if a link can be found between strength to injury and performance, it will be extremely beneficial to both coaches and athletes.

Objectives:- The purpose of this study is to investigate the relationship between isometric strength of the hamstrings and quadriceps muscles and lower back and knee injuries, as well as their performance in combat sports.

Methodology:- On the basis of inclusion and exclusion criteria, a total of 60 subjects were chosen for the study using simple convenient sampling. Hamstring and quadriceps muscle measurements for data analysis, strength was used. A small questionnaire form was filled out by the athlete for a history of injuries and for performance wins/losses ratio of matches was taken.

Results:- It shows the Strong correlation (p value 0.01) between left Q/H strength ratio with low back injury, weak correlation (p value 0.04) between Right Q/H strength ratio with low back pain, and Strong negative correlation (p value -0.018) between low back injury with performance.

Conclusion:- Both male and female athletes who suffered from low back injury had increase left and right quadriceps and hamstring strength ratio, and the athletes who had left knee injury has decreased performance. Male athlete with low back injury has less left knee injuries and increased performance. While female athlete who had more quadriceps hamstring strength ratio has better performance.

Keywords:- Injury of lower back, injury of knee, Performance, Quadriceps to hamstring ratio, Hand held dynamometer, Combat Sports.

INTRODUCTION

Combat sports such as boxing, kickboxing, judo, karate, martial arts, and mixed martial arts are designed for self-defence. Each martial knowledge system has its skills and methods for moving the body for self-persistence. Either philosophical or practical considerations guide these abilities. Because each martial knowledge system uses the body differently for different reasons, the learning objectives of each system will differ. Taekwondo, Karate, Kung Fu, and other Asian martial knowledge systems have spread beyond their respective countries to become global phenomena. While this system offers many similar benefits, these systems frequently compete for students with Western exercise and sports programs. As a result, researchers are comparing martial arts training to traditional forms of physical exercise such as Western sports and dance. (Allen, B. 2013). Combat sports are divided into weight classes to promote fair competition by pairing opponents of equal stature and body mass (also known as "weight" within the sport). Combat sports are typically steeped in their tradition and culture, especially when it comes to weight-making practices. (Langan-Evans. et al, 2011). Athlete performance requires adequate quadriceps and hamstring strength. These two muscles act as functional antagonists; contraction of the quadriceps causes knee extension, while contraction of the hamstrings causes knee flexion. These muscle groups work together to control the shank's accelerations and

decelerations about the thigh, and sufficient strength in both muscle groups is required for running, jumping, landing, and other athletic activities. (Willigenburg, et. al 2014). Poor muscle strength has also been proposed as a factor that predisposes an athlete to injury. (Mjølsnes et al., 2004). Moreover, bilateral strength inequalities between the dominant and non-dominant leg, particularly in the lower body, have been linked to poor body movement control and injury. The quadriceps work as a dynamic stabiliser of the knee joint, whereas the hamstrings primarily protect the anterior cruciate ligament by the action of dynamic protagonists. (Park et al., 2010).

Because combat sports have grown in popularity, it is vital to focus attention on injury risk variables to design effective trauma prevention strategies. Age, gender, weight category, experience, training, and competition were all investigated as potential injury predictors and found to be statistically significant. (Hammami, et. Al 2018). In terms of weight class, the study discovered that middleweight divisions had a higher risk of damage than light and heavyweight categories. (Cierna, D. et. Al 2019). Punches, kicks, blocks, and falling to the ground are common injuries in combat sports because they frequently entail striking, throwing, or immobilizing an opponent. The evolution of sports injuries is intimately linked to each area's legislation, techniques, and athletes' physical condition. (Hammami, et. Al 2018). Destabilization of the knee may be caused by a lack of active neuromuscular control, as indicated by increased knee extension motion, torque, and passive joint stability, as evidenced by increased joint laxity. (Myer. et al, 2009). Patellofemoral discomfort is associated with a loss of quadriceps strength. (Hande Guney. et al, 2016). Quadriceps muscle weakness is linked to an increased risk of injury and can lead to osteoarthritis in the knee joint.

Hip flexors and extensors, quadriceps, and hamstrings all play important roles in developing an optimal lumbopelvic rhythm. The involvement of strong and weak muscles at the same time, or the manifestation of a muscular imbalance, may impair the lumbopelvic mechanism, resulting in increased local and general spine stresses, and thus irritation and possibly inflammation. (Koutedakis. et al, 1997). Higher quadriceps femoris strength demonstrated a balance between the quadriceps femoris and the hamstring, as well as a higher hamstring muscle strength rate. The hamstring muscle strength rate is thought to be higher because it improves knee joint stability, allowing for faster short-distance speed and precise foot techniques. (Jeon, K., Chun, S., & Seo, B. 2016). The present study was done to find the relationship between hamstrings and quadriceps strength to lower back and knee injuries and their performance in combat sports.

Methodology

A sample of 60 athletes was selected using simple random sampling based on inclusion and exclusion criteria. The subjects of this study were the residents in Delhi NCR, who volunteered for the study. Informed written consent was obtained from all subjects and their parents. After the informed consent was obtained, demographic data and history of injuries of lower back, knee and total win and lose matches were recorded. Isometric strength of the quadriceps and hamstring were recorded during the evaluation of each athlete's visit for their prospective screening. Included within the consent form was a detailed medical history and previous sports participation questionnaire. Both male and female athletes of the age group 18 to 40 years, who played professional fights were included. The athlete who had another injury like RTA or another accidental injury (not related to the game) was excluded.

Isometric Quadriceps and hamstring strength were assessed using the Baseline hydraulic Hand-held dynamometer (Jamar). Assessment: All measurements were performed with the subject in a sitting position on a quadriceps chair with the thigh horizontal and the knee at the edge of the table with the hip knee at 90° angle. The examiner was seated in front of the subject. The hand-held dynamometer was held perpendicular to the limb surface and turned so that the examiner couldn't see the scale during testing. The readings were noted by another assessor. Before testing, subjects were given a practice trial of one submaximal contraction to familiarize the subjects with the testing procedure. After 2 mins. of rest, testing was done. For Quadriceps testing: The knee was positioned at 90° and maintained in the position using a standard goniometer, the HHD was held on the anterior part of the lower leg, above the talo-tibial joint line. Patients were asked to do a maximal isometric contraction, held for 5 seconds. For Hamstring testing: At 90° of knee flexion, the HHD was held on the posterior aspect 1-2 cm above the lateral malleolus. After a rest period of 10 mins. the readings were obtained from the other leg. From each leg, 3 readings were recorded for both quadriceps and hamstrings with 1 minute rest after each contraction. The mean of the isometric strength values was recorded in "kg" and the ratio was obtained by dividing the mean quadriceps by to mean hamstring strength. The obtained data of the Q: H ratio was then correlated with a history of injury and performance (win and lose ratio).



Figure 1.1



Figure 1.2

Figure 1.1 & 1.2. Isometric Strength Testing of Hamstring: The patient was made to sit on a high quadriceps, with back straight and hands unsupported, hip and knee at 90°- 90°. A hand-held dynamometer is placed over the posterior aspect of the tibia, above the medial malleolus.



Figure 2.1



Figure 2.2

Figure 2.1 & 2.2. Isometric Strength Testing of Quadriceps: The patient was made to sit on a high quadriceps chair, with back straight and hand unsupported, hip and knee at 90°- 90°. Hand-held dynamometer placed over the anterior aspect of the tibia, above the talo-tibial joint line.

Results

A total of 60 athletes (46 male and 14 female) were recruited for the study from the different combat sports. The mean of their age was 25.31. Out of 60 athletes, 26 were judo players, 14 were Boxers, 8 were MMA fighters, 8 were Kickboxers, and 4 were karate athletes. The result shows that there is a strong correlation (p-value 0.01) between the left Q/H strength ratio with low back injury, a weak correlation (p-value 0.04) between the Right Q/H strength ratio with low back pain, and a strong negative correlation (p-value -0.018) between low back injury with performance.

Table 1.1: Correlation of left and right quadriceps and hamstring ratio with injuries and performance in total athletes.			
	<i>Left Q/H Ratio</i>	<i>Right Q/H Ratio</i>	<i>Left Knee Injury</i>
<i>Lower Back Injuries</i>	0.010024088	0.041859681	
<i>P</i>			-0.018572547

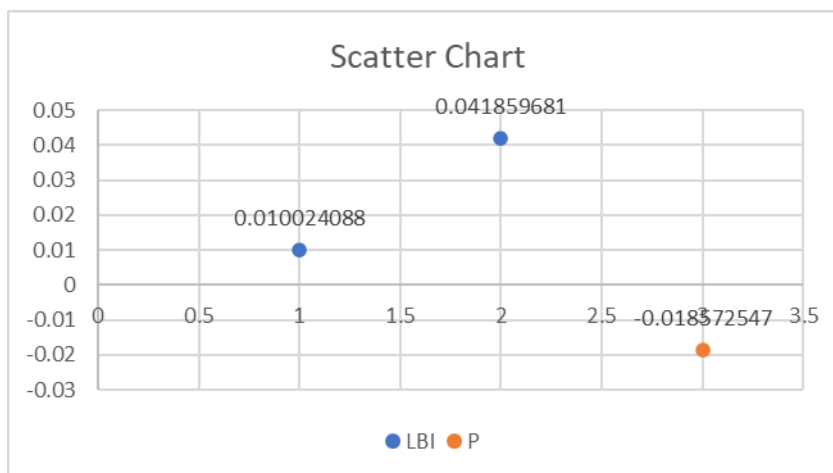


Figure 3: Scatter Chart (Total Athlete)

Discussion

In the present study, the Quadriceps to hamstring strength ratio correlates with a history of knee injuries, low back injury and performance who played in the at-list state level. The study concluded that there was a moderate association between strength, injury and performance in total athletes, male athletes and Female athletes. The result of the current study shows that there is a strong correlation (p-value 0.01) between the left Q/H strength ratio with a low back injury, indicating that if the left quadriceps and hamstring ratio increase the low back injury also increases. A weak correlation (p-value 0.04) between the right Q/H strength ratio with low back pain, indicates if the right quadriceps hamstring ratio increases the lower back injury also increases. Which is supported by **Biering-Sørensen, F.I.N. (1984)**. That means the quadriceps muscle strength is too high than hamstring muscle strength, creating a muscular imbalance in athletes who have a history of low back injury. The correlation between knee injury and performance shows a strong negative correlation, indicating that if left knee injury increases performance decreases. This is supported by a study conducted by **Iijima, H et al in (2018)** and **Huang, K.H., Hsieh, R.L. and Lee, W.C. in 2015**. They suggest because of knee pain physical activity or functions are restricted. A weak negative correlation (p-value -0.04) between low back injury and left knee injury, indicates if low back injury increases left knee injury decreases. The correlation between knee injury and performance shows a moderate negative correlation (p-value -0.03) between left knee injury with performance, indicating that if left knee injury increases performance decreases. This is supported by a study conducted by **Iijima, H et al in (2018)** and **Huang, K.H., Hsieh, R.L. and Lee, W.C. in 2015**. They suggest because of knee pain physical activity or functions are restricted.

A positive correlation between the right Q/H ratio and Performance indicates if the right quadriceps and hamstring ratio increase performance is increase. That means the higher quadriceps strength of the right knee increases the performance of the female athlete. This is supported by a study conducted by **Sundby, Ø.H. and Gorelick, M.L., 2014** says athletic performance requires adequate quadriceps and hamstring strength. The quadriceps and hamstrings are functional antagonists; contraction of the quadriceps causes knee extension, whereas contraction of the hamstrings causes knee flexion. These two muscle groups work together to govern the shank's accelerations and decelerations about the thigh, and sufficient strength in both is essential for running, jumping landing, and other athletic activities. This study increased the knowledge of physiotherapists and contributed towards evidence-based practice. This study will also help in determining the best and most effective physiotherapy intervention on Strength condition after the injury to achieve the best performance.

Limitations of the study

Not much literature is available regarding Quadriceps and Hamstring strength and its relation to Injury and performance. The strength of the quadriceps and hamstring was measured by a hand-held dynamometer because the better option for strength measurement was not available. Measures were used for measuring muscle strength challenges the results obtained. Cause and effect relationships cannot be established with such a small sample size. Future research should be directed at better understanding the relationship between muscle strength injuries and performance. Further research can be done using objective measures for measuring muscle strength. e.g. Isokinetic, Micro fet2 or Push-pull dynamometer.

Conclusion

According to the findings of this study, the total number of male and female athletes who suffered from low back injuries had good left and right quadriceps and hamstring strength ratio (low hamstring strength) and those who had left knee injuries had decreased performance. Male athlete with lower back injuries has fewer left knee injuries and those who have left knee injuries has decreased performance. And female athletes who had good quadriceps hamstring strength ratio had more performance.

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