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ORIGINAL ARTICLE

Relationship between Anterior Cruciate Ligament Injury and Flat-Foot among Volleyball Players of Lahore, Pakistan

SANA TAUQEER[1], MUHAMMAD ADNAN[2], AMMARAH IKRAM[3], AYESHA ASLAM SAPRA[4], UMER RAFIQUE[5], ASSRA NOOR JAVED[6], HAMMAD SHAKEEL[7]
[1]*Senior Lecturer, The University of Lahore, Pakistan.*
[2]*DPT, The University of Lahore, Pakistan*
[3]*Physiotherapist, University of West Scotland.*
[4]*MS The University of Lahore, Lahore Pakistan.*
[5]*The University of Lahore, Lahore Pakistan.*
[6]*Physiotherapist, Iffat Anwar Medical Complex*
[7]*Physiotherapist, University of West Scotland.*
Correspondence to: SanaTauqeer, Email: sana.tauqeer@uipt.uol.edu.pk

ABSTRACT

Background: A person with flat feet experiences a decrease in their medial arch when they bear weight. Players of volleyball are more vulnerable to ACL problems. Playing volley-ball increases the risk of ACL damage because of the repeated jumping and falling on the ground.
Aim: To find relationship between anterior cruciate ligament injury and flat-feet among volleyball players of Lahore, Pakistan
Methodology: This cross-sectional study included volley-ball players and was conducted on 158players. Participants were selected by non-probability sampling. Their age was in range between20 to30 years and only males were included. For collection of data KUJALA score (anterior knee pain scale) was used to assess anterior cruciate ligament injury and Clarke's angle was used to measure flat-foot. Data was collected from training academies in Lahore. Written consent was taken from the participants and the significance of the study were explained before filling the questionnaires.
Results: In present study the mean age was 23.14. The mean of KUJALA score and Clarke's angle for right knee and flat foot was 77.78 and 9.57 respectively. The mean of KUJALA score and Clarke's angle for left knee and flat foot was 71.90 and 9.09 respectively. The Pearson's correlation showed negative correlation between KUJALA score and Clarke's angle.
Practical Implications: This research will be very beneficial to society it will help to make a correct and beneficial rehabilitation plan for flat foot patients having ligamentous injury. It will also help athletes to decrease pain management for patients having ACL injury in flat foot patients.
Conclusion: The present study concluded that there is negative correlation between anterior cruciate ligament injury and flat foot which means reduction in medial longitudinal arch can increase knee pain followed by anterior cruciate ligament injury.
Keywords: Anterior cruciate ligament, Athletes, Flat foot, Volleyball players

INTRODUCTION

The transverse, medial, and lateral longitudinal arches of the foot are formed by the 26 bones that make up the structure of the foot. The foot consists of three primary parts: the midfoot, the hindfoot, and the front foot. Contributions to the structural creation of the foot are made by the phalanx, metatarsals, and tarsals. Angle of medial, lateral and transverse arches of foot is in range of fifteen to eighteen millimeters, three to five millimeters and twenty-five-degree angle from ground. When the arches of the foot are angled more than they should be, deformities of the feet result. Arches of foot supported by palmer fascia of foot, palmer ligaments and also with spring ligament[1].

Palmer fascia extends from the heal bone to the head of the metatarsals on the planter surface of the foot. Palmer fascia continues with the fascia of the foot's external surface and forms septa with the muscles of the plantar surface. All meta-tarsals save the first are connected to the heel bone by the long Planter ligament. The cuboid and heel bone are connected by the short palmer ligament. From the heel bone to the navicular bone, the spring ligament[2].

Anatomically, flat feet occur when the longitudinal soles or medial arches collapse. This is due to the fact that during weight-bearing activities, the foot soles' whole surface makes contact with the ground. An adipose cushion under the medial longitudinal arch causes humans to have flatfeet from birth; this condition will improve between the ages of two and five other sources attribute muscular imbalance, ligament weakening, and mal function of the posterior tibial tendon to the cause of flatfeet[3].

The creation of falling arches and the q-angle have a crucial link that can be disrupted, perhaps leading to abnormalities in gait pattern. In Australia, 44% of cases of flexible flat foot are caused by pes-planus. Furthermore, fewer than 1% of people have pathological flat feet. The percentage of cases with pes-planus decreases as one ages[4]. Three-year-olds have a forty percent chance of experiencing collapsed arches, while six-year-olds still have a twenty-four percent chance. Chances of occurrences of flat-feet are larger in boys rather than girls. Flatfoot developed as a result of an increase in body mass index[5].

Anterior cruciate ligament (ACL) injuries have been more common in young athletes who play sports, especially in female athletes. The prevalence of these injuries was most recently estimated to be about 400 tears per 100,000 person-years in teenagers. ACL injuries were almost 1.4 times more common in girls than in boys. This difference in incidence is probably due to the several risk factors for ACL injuries in female athletes, which include smaller notch width, genuvalgum, more anterior tibial laxity, and lower hamstring strength[6].

Volleyball players are more susceptible to ACL injuries than players in other sports who areprofessionals.ACL injuries are more likely to occur as a result of repeated jumps and landings on the ground during volley-ball injuries. In order to minimize strain on the anterior cruciate ligament and to lower the maximum extension and abduction moments of the knee, volleyball players commonly employ knee braces as preventative and therapeutic measures[7]. Thirty percent of volley-ball players' knee injuries usually affect their lower extremities. A higher percentage of knee-related injuries—about 69%—affect athletes[8].

A research study was conducted by Arif et al conducted a study in 2023 Prevalence and characteristics of sports injuries in athlete with flat foot) to explore the chances of the most common injuries occurring in volleyball players who had flat feet. In this investigation[9]. They Concluded that volleyball players with flat feet have a higher risk of ligamentous injuries to the knee and injuries connected to the ankle[10].

Timothy A. conducted a study in 2023 the frequency and

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nature of injuries incurred during a girls' high school volleyball season should be estimated[9]. The findings showed that while over a third of the injuries suffered by teen age girls' volleyball players were not related to time loss, the majority of injuries did. The characteristics of TL and NTL injuries varied greatly[11].

Our main objective is to find relationship between ACL injuries and flat feet among volley ballplayers. This research aims to inquire relationship between ACL related injuries and flat feet among volley ball players in Lahore. My research as physiotherapy student intends to contributetomedicalfieldbybringingawarenessaboutthissport-relatedinjury.Understandingthisrelationship can aid in rehabilitation plan and care. We are addressing this essential information gap and perhaps improving rehabilitation program of ACL injuries.

METHODOLOGY

This cross-sectional study was completed within 6 months after the approval of synopsis. Ethical Letter was taken from Ethical Review Committee (REC-UOL-209-02-2024) The University of Lahore. Data was collected from The University of Lahore Sports Club and the physiotherapy department of The University of Lahore Teaching Hospital. Non probability convenient sampling technique was used. Sample size of 158 was calculated by using Epitool Sample Size Online Calculator. Where assumed population standard deviation is 12.81, confidence interval 95%, acceptable error is 2. In this research the Players of volley ball team only male (aged 20-30 years) were included[12]. The participants having flat-foot, ACL Injury from last 6 months or last one year were included in this study. Those players who could actively perform knee flexion and extension, leg raises, and squats were included in this study. The passive knee movement of included players was assessed by researcher by gently moving the knee joint through its full range of motion. Those who were participating in any rehabilitation plan regarding anterior cruciate ligament injury were exclude. Participants who had ACL reconstruction was excluded (Tarantino, 2022). All international level players were excluded and those who suffer with ankle fracture was also excluded. For collection of data KUJALA score (anterior knee pain scale) was used to assess anterior cruciate ligament injury and Clarke's angle was used to measure flat-foot. To measure Clarke's angle picture of foot was taken on blank page using ink than trace the outline of foot to make it clear and visible. Measure the distance from the highest point of the arch to the ground using a ruler. This measurement represents Clarke's angle for flatfoot. Written consent was taken from the participants and the significance of the study were explained before filling the questionnaires. The analysis of data was done through SPSS 24.0. Categorical variables were described as absolute frequencies (n) and relative frequencies (%); continuous variables were described as mean ±standard deviation (parametric distributions). Descriptive measured for each variable was calculated. The Pearson's correlation was used to assess the relationship between anterior cruciate ligament injury and flat-foot.

RESULTS

Table 1 showed among 158 volleyball players The 102(64.5%) participants had symptoms of knee pain form last six years and 56(35.4%) had symptoms from last year.

Table 2 showed among 158 volleyball players showed the mean of KUJALA score and Clarke's angle for right knee and flatfoot was 77.78 and 9.57 respectively. The mean of KUJALA score and Clarke's angle for left knee and flatfoot was 71.90 and 9.09 respectively.

Table 3 showed among 158 volleyball players Pearson's correlation indicates the negative correlation between KUJALA score and Clarke's angle. Thervalue-.100 indicates low degree of relation between two variables.

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Table1: Descriptive statistics of Duration of symptoms

	Frequency	Percentage
Last six months	102	64.6
Last year	56	35.4

Table 2: Descriptive Statistics of KUJALA score and Clarke's angle

	Mean	St. Deviation
Khaula Score		
Right	77.78	1.064
Left	71.90	1.453
Clarke's Angle		
Right	9.57	0.74
Left	9.09	.058

Table 3: Correlations between right knee and flatfoot

	Kujala Score	Clarke's angle
KUJALA score right knee		
Pearson Correlation	1	-.100
Sig(2-tailed)		.211
N	158	158
Clarke's angle right knee		
Pearson Correlation	-.100	1
Sig(2-tailed)	.211	
N	158	158

Table 4: Correlations between left knee and flatfoot

	Kujala Score	Clarke's angle
KUJALA score left knee		
Pearson Correlation	1	-.091
Sig(2-tailed)		.256
N	158	158
Clarke's angle left knee		
Pearson Correlation	-.091	1
Sig(2-tailed)	.256	
N	158	158

DISCUSSION

The present cross-sectional study was conducted on volley ball players to analyses the relation between anterior cruciate ligament injury and flat foot. The total 158 male participants with age ranging in 20-30 years were included in this study. The age of majority players was 23years.The 27.8% participants had pain in right knee and 72.2% had pain in left knee. The study conducted by Gaudotin 200 8suggested that it is common for individuals to have slight differences in strength, flexibility, or function between right and left knee. It could be influenced by factors such as previous injuries, anatomical variations or difference in muscle activation patterns[13].

The individuals in present study had anterior cruciate ligament injury with symptoms of sudden knee pain, swelling, instability or a felling of giving way in the knee. The 64.6% players had duration of ACL symptoms from last six months and 35.4% had symptoms of ACL from last year. The studies conducted by Shen L. in 2018 suggested that ACL injury can occur in various sports like soccer, basketball, volleyball and football. It causes due to sudden stops or changes indirection while running or jumping, direct impact or collision to the knee, landing awkwardly from jump and pivoting with a planted foot[14].

In present study the KUJALA score questionnaire was used to assess the functional ability of knee it also asses the anterior cruciate ligament injury. It consists of various items related to pain, symptoms and function. The functions were assessed by limping, support, walking, climbing of stairs, squatting, running, jumping and prolonged sitting with the knees flexed. The data of present study showed that 55.7% participants had no limping of knee and 72.8% players had full support of knee without any pain. Some players can walk unlimited without any pain with regular rest intervals but majority of the players can walk for 1-2 Km without

any pain or discomfort[15].

In addition to sports ACL injury also disturbs the daily activities of athletes as the data of current study showed that 42.2% players had slight pain when descending stairs and 35.4% player's complaint of pain during repeated squatting. The 26.6% participants had pain in running after more than 2 Km and 29.7% had slight difficulty in jumping. It was also supported by past literature conducted by Georgoulis AD in 2003 that ACL control knee stability during activities like running, jumping and changing direction its injury can leads to instability and difficulty in performing these movements[16].

The mean of KUJALA score in present study was approximately 77 which indicates a moderate level of knee function and health following an anterior cruciate ligament injury. KUJALA score is a subjective measure used to assess the functional outcome and quality of life after ACL injury and treatment. A score of 71 suggests that there may be some limitations in knee function, but it's not severe. This result was also supported by study conducted by Mindia Patelin 2021 in which mean of KUJAL A score was 78[17].

Flat foot is a relatively common condition in flat foot the medial longitudinal arch is generally decreased or flattened compared to a normal arch. The reduction of arch height alters the weight bearing of the foot, resulting to pain irritation, or discomfort in the foot and other lower limb joints due to the synchronization in their biomechanics. The biomechanics and functionality of proximal joints can therefore be impacted by unexpected or sustained stress on the foot, which typically manifests as discomfort in the knee, hip, pelvic, and lower back. In present study flatfoot was assessed by Clarke's angle. Clarke's Angle < 30° could be said that person is havingflatfoot[18].

The focus of present study was on relationship between anterior cruciate ligament injury and flat foot which was calculated by Pearson's correlation. The r value -0.100 and 0.091 showed a negative correlation between anterior cruciate ligament and flat foot of volleyball players. The p value showed insignificant relation between these two variables. It shows that reduction in medial longitudinal arch can increase knee pain following the ACL injury. According to a study by Chidiebele and Gross et al., there may be a correlation between knee pain and foot changes if the postural changes that go along with flatfoot morphology led to a tendency for the femur to follow the tibia in internal rotation[19].

CONCLUSION

The present study concluded that there is negative correlation between anterior cruciate ligament injury and flat foot which means reduction in medial longitudinal arch can increase knee pain followed by anterior cruciate ligament injury.

Limitations and recommendations: In this study only male participants were included with small sample size.

1. In present study age was limited and only young players were included
2. The study included only volleyball players
3. Infuturemorestudiesshouldbeconductedtoanalysesfemalepla yerswithlargesamplesizeonlargescale Moreover In addition to flatfoot more studies should be conducted to asses flatfoot in football and basketball player.

Authorship and contribution declaration: Each author of this article fulfilled following Criteria of Authorship:

1. Conception and design of or acquisition of data or analysis and interpretation of data.
2. Drafting the manuscript or revising it critically for important intellectual content.
3. Final approval of the version for publication.

All authors agree to be responsible for all aspects of their research work.

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