



Review Article

Copyright© Fatima Khurshid

# A Systematic Review of Anterior Cruciate Ligament (ACL) Injuries in Soccer Players

Fatima Khurshid<sup>1\*</sup>, Tayyaba Ghazanfar<sup>2</sup>, Um e Anum Ayesha<sup>3</sup>, Ayesha Khurshid<sup>4</sup> and Ahmed Nawaz Chattha<sup>5</sup>

<sup>1</sup>Medical Doctor, Department of Radiation Oncology, Shifa International Hospital Ltd. Islamabad Pakistan

<sup>2</sup>Mphil pharmacy Hamdard university Islamabad, Pakistan

<sup>3</sup>Medical Doctor, Department of Medicine, DHQ Hospital Mirpur AJK, Pakistan

<sup>4</sup>Medical Student, Departed of Physiotherapy, Mirpur University of science and technology, Mirpur AJK Pakistan

<sup>5</sup>MBBS Student, pak red crescent medical college, Lahore Pakistan

\*Corresponding author: Fatima Khurshid, Medical Doctor, Department of Radiation Oncology, Shifa International Hospital, Ltd. Islamabad, Pakistan.

**To Cite This Article:** Fatima Khurshid\*, Tayyaba Ghazanfar, Um e Anum Ayesha, Ayesha Khurshid and Ahmed Nawaz Chattha, A Systematic Review of Anterior Cruciate Ligament (ACL) Injuries in Soccer Players. *Am J Biomed Sci & Res.* 2024 21(6) AJBSR.MS.ID.002900, DOI: [10.34297/AJBSR.2024.21.002900](https://doi.org/10.34297/AJBSR.2024.21.002900)

**Received:** 📅: March 11, 2024; **Published:** 📅 March 19, 2024

## Abstract

Anterior Cruciate Ligament (ACL) injuries are a major concern in soccer, affecting both players' performance and well-being. This systematic analysis of ACL injuries in soccer players looks at the prevalence, risk factors, and preventative measures. The review found that ACL injuries are more common in older age groups among young male soccer players and are frequently induced by non-contact causes. Gender inequalities were also observed, with females having a higher rate of ACL injuries. Multi-component preventative programs, such as plyometrics and strength workouts, have shown successful in lowering ACL injuries. Further study is required to create targeted therapies and optimise preventative tactics. Understanding the risk factors and effective prevention techniques for ACL injuries in soccer players is critical to improving athlete outcomes and reducing the sport's injury burden.

**Keywords:** Anterior cruciate ligament, Soccer Players, ACL

## Introduction

The anterior Cruciate Ligament (ACL) is a key ligament in the knee that provides stability and regulates excessive mobility. ACL injuries are common in sports that require rapid stops, changes of direction, or jumping. These injuries are common during sports such as soccer, basketball, football, and skiing. ACL injuries can range from minor sprains to severe tears that may necessitate surgical intervention for healing [1]. Soccer has a somewhat high incidence of ACL injuries due to the nature of the game, which includes swift changes of direction, turning, and sudden stops. According to studies, female soccer players are more likely to develop ACL in

juries than their male counterparts. The incidence of ACL injuries in soccer varies according to age, gender, level of play, and playing surface [2].

Understanding the risk variables linked with ACL injuries in soccer is critical for developing effective preventative techniques. Poor neuromuscular control, muscle imbalances, prior injury, anatomical abnormalities, and playing circumstances are some of the most prominent risk factors for ACL injuries. By identifying these risk variables, coaches, athletes, and medical professionals can create tailored prevention programs to reduce ACL injuries. Neuro-



muscular training programs, proper warm-up and cool-down routines, strength training focusing on the lower extremities, balance and proprioception exercises, proper footwear and equipment use, and education of athletes on proper landing and cutting techniques are all potential prevention strategies for ACL injuries in soccer [3-5].

A proposed strategy for preventing ACL injuries recommends conducting biomechanical tests on athletes before and after preventive treatments are implemented. This includes on-the-field inspections while players conduct cutting motions in order to identify potential injury risks and modify prevention strategies appropriately. Despite widespread knowledge of ACL injury concerns in sports, injury prevention strategies for this demographic have been inconsistent due to ambiguous risk variables. To construct more specialized injury prevention measures, additional research is required to refine and develop effective prevention tactics targeted to the athletic group at risk.

### ACL Injury Mechanisms

A non-contact ACL tear occurs when excessive stresses are applied to the knee ligament without any external contact, whereas a contact ACL rupture is caused by a collision. Non-contact injuries are more common and typically occur during deceleration and acceleration motions. According to studies, the ligament elongates during rapid deceleration, which increases strain. Balance training and modified change of direction techniques are effective therapies for reducing strain and injury risk. High-risk maneuvers in soccer include deceleration before sidestepping and landing from jumps. Analyzing kinematics, kinetics, and muscle activation patterns aids in the identification of causes that strain the ACL and guides preventative measures. However, there are inconsistent findings in the literature regarding risk factors and the effectiveness of preventative interventions [3,5-8].

### Kinematics and Kinetics

Kinematic and kinetic values are essential in understanding the movements and forces acting on the body. Motion occurs in three planes: frontal, sagittal, and transverse, represented by adduction/abduction, flexion/extension, and internal/external rotation. Multiplanar analysis is proposed as the most effective way to predict injury risk, with most studies supporting multiplanar conditions as more likely to cause injuries. Mechanisms of injury within each plane should be understood, such as valgus/varus stresses in the frontal plane and limited hip/knee flexion in the sagittal plane. Frontal plane kinematics, specifically valgus alignment, at both initial and peak contact in landing have been identified as significant predictors of injury risk. However, there are differing opinions on the effects of knee abduction on ACL injury, as the medial collateral ligament (MCL) primarily resists valgus moments. Limited hip and knee flexion in the sagittal plane has consistently been associated with injury risk, and studies have found that knee position close to full extension during deceleration maneuvers is a common factor in non-contact ACL injuries. In the transverse plane, internal tibial rotation has been shown to result in higher ACL strain compared

to external rotation, but external rotation also has the potential to damage the ligament, particularly in weight-bearing situations. Further research is needed to fully elucidate these risk factors and their interactions, especially in sport-specific populations and movements [3,9-13].

### Methodology

For this systematic review focusing on Anterior Cruciate Ligament (ACL) injuries in soccer players, a comprehensive search strategy was employed to identify relevant studies. The primary database utilized for this review was PubMed due to its extensive coverage of biomedical literature. The search approach was designed to include keywords relating to ACL injuries, soccer players, risk factors, and prevention techniques. The following search terms were used: "Anterior Cruciate Ligament injury," "ACL injury," "soccer players," "football players," "risk factors," and "prevention strategies," which were combined using Boolean operators to refine the search results.

Specific criteria were used to select publications for inclusion in this review to ensure the research's relevance and quality. The studies selected had to be published in peer-reviewed journals and largely focus on ACL injuries in soccer players, with an emphasis on risk factors and prevention techniques. To ensure uniformity and accessibility, all selected articles had to be written in English. Articles that did not fulfill the given criteria or were not available in full-text format were omitted from consideration throughout the review process. A detailed selection approach was carried out using PubMed, resulting in the discovery of 30 publications that closely related to the research topic. This extensive selection procedure began with screening candidate articles' titles and abstracts, followed by a thorough assessment of the entire texts to determine their eligibility based on the defined inclusion and exclusion criteria. Furthermore, cross-referencing was used to guarantee that the issue was covered thoroughly and to validate the relevance and authenticity of the selected articles.

The systematic extraction of data from the selected papers entailed obtaining critical information such as study characteristics, sample size, methodology, and notable findings on both risk factors and preventative techniques for ACL injuries in soccer players. This methodological methodology intended to synthesis the gathered data in order to provide a comprehensive overview of ACL injuries in this specific group of athletes. The integration of this knowledge, which focuses on common risk factors and evidence-based prevention techniques, will help to provide a full grasp of the issue.

### Results

The systematic analysis of 30 studies on ACL injuries in soccer players gives important insights into the incidence, risk factors, and prevention techniques for these injuries. According to the findings, ACL injuries are more common in older age groups among young male soccer players. This finding underscores the importance of age-appropriate injury prevention interventions in this population. Non-contact injuries were discovered to be widespread among pro-

fessional male soccer players, occurring during activities such as pressing, dribbling, and tackle. These findings highlight the necessity of addressing biomechanical aspects and movement patterns in training and preventative programs. According to the analysis, a high proportion of ACL ruptures in professional soccer players require surgical reconstruction. However, the majority of athletes were able to resume training in a reasonably short period of time and maintained their pre-injury performance levels three years later.

Female soccer players had a higher frequency of ACL injuries than males, indicating that they were more susceptible. This emphasizes the significance of creating gender-specific risk assessment and preventative measures for ACL injuries in soccer. The

analysis highlights the efficacy of multi-component preventative programs, such as plyometrics, strength exercises, and preseason/ in-season training, in minimizing ACL injuries in soccer players. Specific programs, such as FIFA 11+, have shown a considerable reduction in knee injuries, particularly ACL injuries, when administered correctly. Biomechanical study reveals that knee valgus loads and hip/knee flexion angles during landing lead to ACL damage. Training methods that address these aspects, such as pelvic and core strength training, have resulted in improved landing biomechanics and jump height. Soccer players' successful rehabilitation after ACL damage and reconstruction has been linked to positive communication, self-belief, goal-setting, and clear goals. These psychological elements are critical to supporting the rehabilitation process and getting the best possible outcomes (Table 1).

**Table 1:** Overview of Previous Studies on ACL Injuries in Soccer Players

Author	Year	Population	Intervention	Key Findings	References
Diego Costa Astur et al.	2023	17,108 young male soccer players	Evaluation of players over two seasons	336 ACL injuries were identified, with a higher incidence in older age groups.	14
Alberto Grassi et al.	2017	Professional male soccer players	YouTube-based video analysis	Non-contact injuries occurred in 44% of cases, mostly during pressing, dribbling or tackling	15
Markus Waldén	2016	men's professional football in Europe	ACL injuries in men professional football	High match injury (157) rates, ACL reconstruction for most complete ruptures, majority resumed training within 6.6 months, 65% maintained pre-injury performance after 3 years.	16
Markus Waldén	2011	57 clubs with 2,329 players football players	Anterior cruciate ligament injury in elite football	Female elite footballers have doubled ACL injury incidence, younger, and more likely to sustain non-contact injuries, with hamstring grafts more common in Sweden than Europe.	17
Ana Ferri-Caruana	2020	29 female soccer players	Impact of Pelvic and Core Strength Training on ACL Injury Biomechanical Risk Factors	The Pelvic and Core Strength Training (PCST) program improved landing biomechanics and knee flexion angles in female soccer players, reducing knee FPPA and enhancing jump height.	18
Francesco Della Villa	2020	148 Italian male footballers	Systematic video analysis of ACL injuries in professional male football (soccer)	44% non-contact, 44% indirect contact, 12% direct contact ACL injuries in professional male football.	19
				Knee valgus loading was the dominant injury pattern (81%).	
				Injuries peaked in the first half of matches (62%) and at the beginning/end of the season.	
Eduard Alentorn-Geli	2009	males and female soccer players	Preventing Non-Contact ACL Injuries in Soccer Players: Part 2	Soccer has a higher ACL injury risk, but multi-component prevention programs, including plyometrics and strength exercises, combined with pre-season and in-season programs, are effective in reducing injuries with crucial compliance.	20
Eduard Alentorn-Geli	2009	female soccer players	Preventing Non-Contact ACL Injuries in Soccer Players: Part 1	Soccer increases ACL injury risk due to factors like knee laxity, hormonal influences, muscle imbalances, and poor biomechanics, while extrinsic factors like dry weather and artificial surfaces contribute.	21
Urban Johnson	2016	eight female soccer players	Rehabilitation after first-time anterior cruciate ligament injury and reconstruction in female football players	This study examined eight resilient female soccer players who recovered from ACL injuries and underwent reconstructive surgery. Constructive communication, self-belief, goal-setting, and clear plans were key factors in their successful rehabilitation.	22

G. S. Roi	2006	professional soccer players competing in the 2002-2003 Italian Serie A Championship	Prevalence of anterior cruciate ligament reconstructions in professional soccer players	Top-level professional soccer players undergo 10.4% ACL surgical reconstructions, with younger age increasing the risk of injury, with contact injuries more common in official games and non-contact injuries in training or nonofficial games.	23
Holly J Silvers-Granelli	2017	In the study, 1,535 male soccer players from 61 Division I and II NCAA teams participated	FIFA 11+ Program and ACL Injury Prevention in Male Soccer Players	FIFA 11+ injury prevention program reduced knee injuries in male soccer players, ACL injury likelihood, and overall knee injuries by 4.25-fold, resulting in a 42% reduction.	24
Bing Yu	2007	female soccer players	Mechanisms of non-contact ACL injuries	Non-contact ACL injuries in female soccer players are common due to loading mechanisms like small knee flexion angle and great quadriceps muscle force.	25
P Forkel	2014	33 patients	Anterior Cruciate Ligament Reconstruction with Quadriceps Tendon: Primary and Revision Surgery.	The study analyzed 33 patients with revision ACL surgery, showing 70% improvement in anterior-posterior translation after 2 years, with 6% displaying a sliding pivot shift phenomenon.	26
Kay M Crossley	2020	11 773 female football (soccer) players	Making football safer for women	In women's football, there is low-level evidence that multicomponent, exercise-based programs reduce overall and ACL injuries by 27% and 45%, respectively.	27
Anne Fältström	2021	117 female soccer players	Second ACL Injury Risk in Female Soccer Players After Reconstruction: Clinical Profile	A study reveals 24% of female soccer players with previous ACL reconstructions sustained a second injury, with a CART analysis identifying high-risk players with 89% accuracy.	28
Paula Requejo-Herrero	2023	male soccer players	Anterior cruciate ligament ruptures in Spanish soccer first division	Between 2010-2011 and 2019-2020, 110 ACL ruptures were reported among Spanish male first-division soccer players, with 15.45% being re-ruptures, with non-contact injury being the predominant cause.	29
Bartłomiej Kacprzak	2023	12 male professional soccer players	Rehabilitation of Soccer Players' Knee Injuries	A study on 12 male soccer players aged 18-30 showed that knee cartilage surgery and primary ACL reconstruction improved pain, symptoms, and quality of life post-injury.	30
Felipe Silva dos Santos	2023	Male soccer players	Prevention of ACL injuries in professional soccer athletes	Soccer's high injury incidence is due to high-intensity movements and physical contact, with sports physiotherapists playing a crucial role in providing comfort and injury prevention.	31
Manuel Magaña-Ramírez	2024	14820 male soccer players	ACL Injury Prevention in Football Players: Optimal Exercise Program	A meta-analysis of 11 RCTs involving 14,820 participants evaluated exercise-based prevention programs for ACL injuries in football players, assessing their effectiveness and providing recommendations for practice.	32
Maheshwer Bhargavi	2023	482 high school athletes	ACL Tears in Adolescent Athletes	High school athletes, female soccer players, and those with hamstring autografts are at a higher risk of ACL recurrence, with a 5.2% rate in patients with at least 2 years of follow-up.	33
Luca Farinelli	2023	27 male elite professional soccer players	ACL Rupture in Elite Soccer Players: Return to Play and Injury Patterns	Elite soccer players' return to play after anterior cruciate ligament reconstruction is 92.6%, with a median time of 256 days, with 7.4% experiencing graft failure and 7.4% moving to lower leagues.	34
Ian S. Hong	2023	3,112 male and female soccer players	ACL Reconstruction in Soccer Players	Soccer players' graft failure/reoperation rates after anterior cruciate ligament reconstruction ranged from 3.0% to 24.8%, with females having a higher incidence of secondary ACL injury.	35
Husam Nawas	2023	soccer players, including both professional and collegiate athletes.	Preventing and Returning from ACL Injuries in Soccer Players	Soccer ACL tears, primarily in females, can be prevented through musculoskeletal control and hip abductor strength, with return to play rates ranging from 95% to 62%.	36

Dalvandpour Nazanin	2023	42 male soccer players	Attention Focus Impact on Jump-Landing Kinematics in Soccer Players During ACL Prevention Exercises	The study reveals that the focus of attention during injury prevention exercises significantly affects jump-landing kinematics in soccer players, with External Focus of attention (EF) demonstrating better hip and knee angles.	37
Georgios Kakavas	2023	male soccer players	Impact of Subtalar Kinematics on Knee Laxity Following ACL Injury in Soccer Players.	Soccer players with a history of ACL injury showed higher foot pronation and ACL laxity values, suggesting an increased risk of ACL injury, particularly in the ACL group.	38
Vanessa Bernardes Marques	2023	67 soccer players, 36 male and 31 females	Field-Based Tests for ACL Injury Risk Screening in Soccer Players: A Gender Comparison	The study found no significant difference in total scores between male and female soccer players, but female players had higher errors in knee medialization and trunk-flexion displacement.	39
Abdullah Almuahaya	2023	both professional and amateur players	Enhancing ACL Rehabilitation in Soccer Players: A Feasibility Study of Educational Sessions.	The study suggests structured educational sessions for soccer players post-ACL reconstruction are feasible and acceptable, with high participant retention rates, but recommends larger studies with longer follow-up periods.	40
Abdulrahman Mukhlif Mousa	2023	Soccer Players	Enhancing Quadriceps Recovery in Soccer Players Post ACL Surgery Using Innovative Device	The study demonstrated that an innovative device in soccer players' rehabilitation after anterior cruciate ligament surgery enhanced muscle strength, range of motion, and functional efficiency.	41
Onur Celika	2023	Turkish professional athletes	Knowledge and awareness of anterior cruciate ligament injury among Turkish professional athletes	The study reveals insufficient awareness among professional team sport athletes about ACL injuries, injury prevention programs, and return to sports, with male and soccer players showing higher participation rates.	42
Niondina M. Nyström	2023	114 Female soccer players	ACL Injuries and Athletic Identity Impact on Eating Disorders in Female Soccer Players	ACL tear and athletic identity do not predict disordered eating behaviors among female soccer players; future research should explore weight gain anxiety, exercise identity, and body dissatisfaction.	43

These findings underline the importance of ACL injuries in soccer and the necessity for comprehensive preventative efforts that take into account age, gender, biomechanical parameters, and psychological elements of recovery. By implementing evidence-based preventative programs and customizing them to soccer players' unique requirements, the incidence and impact of ACL injuries can be reduced, eventually improving athletes' long-term results.

## Discussion

The findings of this systematic study shed light on Anterior Cruciate Ligament (ACL) injuries in soccer players, identifying key risk variables and efficient prevention techniques. ACL injuries were observed to be more common in later age groups among young male soccer players, stressing the importance of age-appropriate preventative strategies. Non-contact injuries were found to be common in professional male players during activities such as pressing, dribbling, and tackling, highlighting the necessity of addressing biomechanics and movement patterns in training and preventative programs.

A systematic assessment of ACL injuries in soccer players found numerous important risk variables for these injuries. Older age groups had a higher rate of ACL injuries among young male soccer players, emphasizing the necessity of age-appropriate preventative approaches. Non-contact injuries during activities like as pressing,

dribbling, and tackling were widespread among elite male athletes, highlighting the importance of addressing biomechanical components and movement patterns in training and preventative programs. Gender differences were found, with females having a higher incidence of ACL injuries. Multi-component preventative programs, such as plyometrics and strength exercises, were found to be beneficial in decreasing ACL tears. Improving preventive outcomes requires tailoring prevention techniques to individual criteria such as age, anatomical anomalies, and previous injuries. Overall, identifying these risk variables is critical for developing evidence-based and personalised prevention programmes to lower the frequency of ACL injuries in soccer players [2,5-7].

ACL injuries are managed in a variety of ways, including nonoperative management, ACL repair, reconstruction with various graft types, anatomic reconstruction, tunnel drilling techniques, fixation methods, and the potential use of internal bracing, ALL reconstruction, and biologic agents. Pre and postoperative rehabilitation are critical components of the management process, and the timing of return to play must be carefully considered and assessed on an individual basis. Treatment options are determined by patient characteristics, tear pattern, and surgeon expertise, and continued research is necessary to develop and optimize management procedures for ACL injuries.

Nonoperative management of ACL tears is crucial to prevent recurrent instability and additional knee injuries. Structured rehabilitation programs are used to strengthen surrounding muscles and improve knee stability. ACL repair involves re-approximating the torn ends of the native ACL using sutures or suture anchors, aiming to preserve the native ligament and promote healing. ACL reconstruction involves creating a new ligament using grafts such as Hamstring Tendon (HT), Bone-Patellar Tendon-Bone (BPTB), or Quadriceps Tendon (QT). Anatomic reconstruction aims to restore the native ACL footprint on both the tibial and femoral sides of the knee, taking into account the individual anatomy of the patient. Tunnel drilling techniques for ACL reconstruction have evolved, with a shift away from transtibial drilling towards outside-in techniques or using guides placed through the anteromedial portal. Fixation methods and graft types are not clear, and patient selection is critical. Anterolateral Ligament (ALL) reconstruction may be considered in conjunction with ACL repair or reconstruction. Biologic agents like Platelet-Rich Plasma (PRP) and stem cells are being investigated in ACL repair and reconstruction [44-51].

The study discovered that the cost burden of (ACL) reconstructions for amateur football players in Australia is significant, estimated Anterior Cruciate Ligament at \$A69,623,211 year. The average overall cost of an ACL reconstruction is \$A34,079, with indirect expenditures accounting for the bulk. The mean indirect expenses are 19.8% greater than the mean direct expenditures, but lower among female and junior players. ACL expenditures are three to four times higher than osteoarthritis costs. However, according to the report, emphasizing injury prevention programs might result in large cost savings, with an estimated \$A9,460,224 saved for every 10% increase in adherence to such programs. These findings emphasize the importance of injury prevention and its potential impact on lowering the financial burden of ACL repairs in amateur football players [52].

Soccer players can reduce ACL injuries through multi-component preventative programs like plyometrics, strength exercises, and preseason/in-season training. The FIFA 11+ program has shown promising results in minimizing knee injuries. Training strategies targeting knee valgus loads and hip/knee flexion angles improve landing biomechanics and jump height. Positive communication, self-belief, goal-setting, and defined goals facilitate successful rehabilitation. Neuromuscular training can modify risk factors in female athletes, but studies are inconsistent. Targeting high-risk athletes may improve prevention efficiency [53,54].

However, it is vital to recognize several limitations in the present corpus of literature. There is a need for further high-quality research into ACL injury risk factors and prevention measures in soccer players, particularly women. The variety in study designs, sample sizes, and outcome measures across the included studies makes it difficult to make direct comparisons and draw firm conclusions. Future study should try to address these limitations while also refining and optimizing preventative techniques for ACL injuries among soccer players.

Overall, this systematic review emphasizes the importance of ACL injuries in soccer and the necessity for comprehensive prevention measures that take into account age, gender, biomechanical parameters, and psychological elements of rehabilitation. The incidence and severity of ACL injuries can be lowered by implementing evidence-based preventative programs customized to the specific needs of soccer players, resulting in better long-term outcomes for athletes.

## Conclusion

This systematic review explores the prevalence, risk factors, and prevention strategies for ACL injuries in soccer players. It emphasizes the need for age-appropriate and gender-specific interventions, as well as multi-component prevention programs incorporating plyometrics and strength exercises. The review also highlights the influence of psychological factors on rehabilitation and long-term athlete outcomes. Further research is needed to refine prevention strategies and tailor interventions to individual needs. Evidence-based prevention programs can help minimize ACL injuries and improve overall well-being and performance.

## Acknowledgement

None.

## Conflict of Interest

None.

## References

- Maniar N, Cole MH, Bryant AL, Opar, DA (2022) Muscle force contributions to anterior cruciate ligament loading. *Sports Med* 52(8): 1737-1750.
- Saxby DJ, Catelli DS, Lloyd DG, Sawacha Z (2023) The role of biomechanics in anterior cruciate ligament injuries prevention. *Front Sports Act Living* 5: 1134969.
- Mancini SL, Dickin C, Hankemeier DA, Rolston L, Wang H (2024) Risk of Anterior Cruciate Ligament Injury in Female Soccer Athletes: A Review.
- Montalvo AM, Schneider DK, Webster KE, Yut L, Galloway MT, et al. (2019) Anterior cruciate ligament injury risk in sport: a systematic review and meta-analysis of injury incidence by sex and sport classification. *J Athl Train* 54(5): 472-482.
- Yu B, Garrett WE (2007) Mechanisms of non-contact ACL injuries. *Br J Sports Med* 41(suppl 1): i47-i51.
- Shimokochi Y, Shultz SJ (2008) Mechanisms of noncontact anterior cruciate ligament injury. *J Athl Train* 43(4): 396-408.
- Cerulli G, Benoit DL, Lamontagne M, Caraffa A, Liti A (2003) In vivo anterior cruciate ligament strain behaviour during a rapid deceleration movement: case report. *Knee Surg Sports Traumatol Arthrosc* 11(5): 307-311.
- Dos Santos T, Thomas C, Comfort P, Jones PA (2019) The effect of training interventions on change of direction biomechanics associated with increased anterior cruciate ligament loading: a scoping review. *Sports Med* 49(12): 1837-1859.
- Fox AS, Bonacci J, McLean SG, Spittle M, Saunders N (2014) What is normal? Female lower limb kinematic profiles during athletic tasks used to examine anterior cruciate ligament injury risk: a systematic review. *Sports Med* 44(6): 815-832.

10. Levine JW, Kiapour AM, Quatman CE, Wordeman SC, Goel VK, et al. (2013) Clinically relevant injury patterns after an anterior cruciate ligament injury provide insight into injury mechanisms. *Am J Sports Med* 41(2): 385-395.
11. Kim SY, Spritzer CE, Utturkar GM, Toth AP, Garrett WE, et al. (2015) Knee kinematics during noncontact anterior cruciate ligament injury as determined from bone bruise location. *A J Sports Med* 43(10): 2515-2521.
12. Norcross MF, Lewek MD, Padua DA, Shultz SJ, Weinhold PS, et al. (2013) Lower extremity energy absorption and biomechanics during landing, part I: sagittal-plane energy absorption analyses. *J Athl Train* 48(6): 748-756.
13. Rachmat HH, Janssen D, Verkerke GJ, Diercks RL, Verdonshot N (2016) In-situ mechanical behavior and slackness of the anterior cruciate ligament at multiple knee flexion angles. *Med Eng Phys* 38(3): 209-215.
14. Astur DC, Margato GF, Zobiolo A, Pires D, Funchal LFZ, et al. (2023). The incidence of anterior cruciate ligament injury in youth and male soccer athletes: an evaluation of 17,108 players over two consecutive seasons with an age-based sub-analysis. *Knee Surg Sports Traumatol Arthrosc* 31(7): 2556-2562.
15. Grassi A, Smiley SP, Roberti di Sarsina T, Signorelli C, Marcheggiani Muccioli GM, et al. (2017) Mechanisms and situations of anterior cruciate ligament injuries in professional male soccer players: a YouTube-based video analysis. *Eur J Orthop Surg Traumatol* 27(7): 967-981.
16. Waldén M, Häggglund M, Magnusson H, Ekstrand J (2016) ACL injuries in men's professional football: a 15-year prospective study on time trends and return-to-play rates reveals only 65% of players still play at the top level 3 years after ACL rupture. *Br J Sports Med* 50(12): 744-750.
17. Waldén M, Häggglund M, Magnusson H, Ekstrand J (2011) Anterior cruciate ligament injury in elite football: a prospective three-cohort study. *Knee Surg Sports Traumatol Arthrosc* 19(1): 11-19.
18. Ferri Caruana A, Prades Insa B, Serra Ano P (2020) Effects of pelvic and core strength training on biomechanical risk factors for anterior cruciate ligament injuries. *J Sports Med Phys Fitness* 60(8): 1128-1136.
19. Francesco Della Villa, Matthew Buckthorpe, Alberto Grassi, Alberto Nabuzzi, Filippo Tosarelli (2020) Systematic video analysis of ACL injuries in professional male football (soccer): injury mechanisms, situational patterns and biomechanics study on 134 consecutive cases. *Br J Sports Med* 54(23):1423-1432.
20. Alentorn Geli E, Myer GD, Silvers HJ, Samitier G, Romero D, et al. (2009) Prevention of non-contact anterior cruciate ligament injuries in soccer players. Part 2: a review of prevention programs aimed to modify risk factors and to reduce injury rates. *Knee Surgery Sports Traumatol Arthrosc* 17: 859-879.
21. Alentorn Geli E, Myer GD, Silvers HJ, Samitier G, Romero D, et al., (2009) Prevention of non-contact anterior cruciate ligament injuries in soccer players. Part 1: Mechanisms of injury and underlying risk factors. *Knee surgery* 17: 705-729.
22. Johnson U, Ivarsson A, Karlsson J, Häggglund M, Waldén M, et al., (2016) Rehabilitation after first-time anterior cruciate ligament injury and reconstruction in female football players: a study of resilience factors. *BMC Sports Sci Med Rehabil* 8: 20.
23. Roi GS, Nanni G, Tavana R, Tencone F (2006) Prevalence of anterior cruciate ligament reconstructions in professional soccer players. *Sport sciences for health* 1: 118-121.
24. Silvers Granelli HJ, Bizzini M, Arundale A, Mandelbaum BR, Snyder Mackler L (2017) Does the FIFA 11+ injury prevention program reduce the incidence of ACL injury in male soccer players?. *Clin Orthop Relat Res* 475(10): 2447-2455.
25. Yu B, Garrett WE (2007) Mechanisms of non-contact ACL injuries. *British journal of sports medicine* 41(suppl 1): i47-i51.
26. Forkel P, Petersen W (2014) Anatomic reconstruction of the anterior cruciate ligament with the autologous quadriceps tendon: Primary and revision surgery. *Operative Orthopädie und Traumatologie*, 26(1): 30-42.
27. Crossley KM, Patterson BE, Culvenor AG, Bruder AM, Mosler AB (2020) Making football safer for women: a systematic review and meta-analysis of injury prevention programmes in 11 773 female football (soccer) players. *British journal of sports medicine*, 54(18): 1089-1098.
28. Fältström A, Kvist J, Bittencourt NF, Mendonça LD, Häggglund M (2021) Clinical risk profile for a second anterior cruciate ligament injury in female soccer players after anterior cruciate ligament reconstruction. *Am J Sports Med* 49(6): 1421-1430.
29. Requejo Herrero P, Pineda Galan C, Medina Porqueres I (2023) Anterior cruciate ligament ruptures in Spanish soccer first division: An epidemiological retrospective study. *Knee* 41: 48-57.
30. Kacprzak B, Rosińska K (2023) Rehabilitation of soccer players' knee injuries: cartilage reconstruction, anterior cruciate ligament surgery, and intensive recovery—a pilot study. *J Clin Med*12(21): 6893.
31. Dos Santos FS, De Oliveira Aguiar EC, Da Costa BLS (2023) Prevention of ACL injuries in professional soccer athletes: a systematic review. *Revista Intercontinental de Gestão Desportiva-RIGD (Intercontinental Journal of Sport Management) ISSN 2237-3373* 13(3): e110066.
32. Magaña Ramírez M, Gallardo Gómez D, Álvarez Barbosa F, Corral Pernía JA (2024) What exercise programme is the most appropriate to mitigate anterior cruciate ligament injury risk in football (soccer) players? A systematic review and network meta-analysis. *J Sci Med Sport* S1440-2440(24): 00049-00055.
33. Maheshwer B, Paliobeis A, Halkiadakis P, Konda S, Calcei JG, et al. (2023) Anterior cruciate ligament tears in the adolescent population: injury demographics and risk of reinjury among high school athletes. *J Pediatr Orthop* 43(10): 591-597.
34. Farinelli L, Abermann E, Meena A, Ueblacker P, Hahne J, et al. (2023) Return to play and pattern of injury after ACL rupture in a consecutive series of elite UEFA soccer players. *Orthop J Sports Med* 11(3): 23259671231153629.
35. Hong IS, Pierpoint LA, Hellwinkel JE, Berk AN, Salandra JM, et al. (2023) Clinical outcomes after ACL reconstruction in soccer (football, futbol) players: A systematic review and meta-analysis. *Sports Health*, 15(6): 788-804.
36. Nawas H, Fleming H, Purcell S (2023) ACL injuries in soccer players: prevention and return to play considerations. *Mo med* 120(6): 446-450.
37. Dalvandpour N, Zareei M, Abbasi H, Abdoli B, Mohammadian MA, et al. (2023) Focus of attention during ACL injury prevention exercises affects improvements in jump-landing kinematics in soccer players: A randomized controlled trial. *J Strength Cond Res* 37(2): 337-342.
38. Kakavas G, Malliaropoulos NG, Forelli F, Mazeas J, Skarpas G, et al. (2023) How Subtalar Kinematics Affects Knee Laxity in Soccer Players After Anterior Cruciate Ligament Injury? *Cureus* 15(10): e47850.
39. Marques VB, Oliveira DF, De Borba Capaverde V, Michel RC, Ribeiro Alvares, et al. (2023) Performance of male and female soccer players in field-based tests for screening the anterior cruciate ligament injury risk. *Sport Sci Health* 19(1): 131-137.
40. Almuhaya A, Albarrati A, Alhowimel A, Alodaibi F (2023) Adding a structured educational session to the rehabilitation program of soccer players following anterior cruciate ligament reconstruction: a feasibility study. *Int J Sports Phys Ther* 18(1): 81-91.
41. Mousa AM, Kadhim MJ (2023) Nmusing an Innovative Device to Improve the Efficiency of The Anterior Quadriceps Muscle of The Injured Knee Joint After Surgical Intervention of The Anterior Cruciate Ligament in Advanced Soccer Players. *Semiconductor Optoelectronics* 42(1): 1504-1511.
42. Celik O, Celik GE, Kilinc BE, Harput G (2023) Knowledge and awareness of anterior cruciate ligament injury among Turkish professional athletes: an online survey. *Res Sports Med* 1-17.

43. Nyström NM (2023) Exploring Anterior Cruciate Ligament Tears and Athletic Identity as Predictors of Disordered Eating Behaviors in Female Collegiate Soccer Players.
44. Di Matteo B, Filardo G, Kon E, Marcacci M (2015) Platelet-rich plasma: evidence for the treatment of patellar and Achilles tendinopathy—a systematic review. *Musculoskelet surg* 99(1): 1-9.
45. Achtnich A, Herbst E, Forkel P, Metzloff S, Sprenger F, et al. (2016) Acute proximal anterior cruciate ligament tears: outcomes after arthroscopic suture anchor repair versus anatomic single-bundle reconstruction. *Arthroscopy: Arthroscopy* 32(12): 2562-2569.
46. Van der List JP, DiFelice GS (2017) Primary repair of the anterior cruciate ligament: a paradigm shift. *Surgeon* 15(3): 161-168.
47. DiFelice GS, Villegas C, Taylor S (2015) Anterior cruciate ligament preservation: early results of a novel arthroscopic technique for suture anchor primary anterior cruciate ligament repair. *Arthroscopy: Arthroscopy* 31(11): 2162-2171.
48. Fischer F, Fink C, Herbst E, Hoser C, Hepperger C, et al. (2018) Higher hamstring-to-quadriceps isokinetic strength ratio during the first post-operative months in patients with quadriceps tendon compared to hamstring tendon graft following ACL reconstruction. *Knee Surg Sports Traumatol Arthrosc* 26(2): 418-425.
49. Mulford JS, Hutchinson SE, Hang JR (2013) Outcomes for primary anterior cruciate reconstruction with the quadriceps autograft: a systematic review. *Knee Surg Sports Traumatol Arthrosc* 21(8): 1882-1888.
50. Liu A, Sun M, Ma C, Chen Y, Xue X, et al. (2017) Clinical outcomes of transtibial versus anteromedial drilling techniques to prepare the femoral tunnel during anterior cruciate ligament reconstruction. *Knee Surg Sports Traumatol Arthrosc* 25(9): 2751-2759.
51. Raines BT, Naclerio E, & Sherman SL (2017) Management of anterior cruciate ligament injury: what's in and what's out?. *Indian J Orthop* 51(5): 563-575.
52. Ross AG, Agresta B, McKay M, Pappas E, Cheng T, et al. (2023) Financial burden of anterior cruciate ligament reconstructions in football (soccer) players: an Australian cost of injury study. *Inj Prev* 29(6): 474-481.
53. Tanaka MJ, Jones LC, Forman JM (2020) Awareness of anterior cruciate ligament injury-preventive training programs among female collegiate athletes. *J Athl* 55(4): 359-364.
54. Sugimoto D, Myer GD, McKeon JM, Hewett TE (2012) Evaluation of the effectiveness of neuromuscular training to reduce anterior cruciate ligament injury in female athletes: a critical review of relative risk reduction and numbers-needed-to-treat analyses. *Br J Sports Med* 46(14): 979-988.