

Psychological aspects associated with ACL rehabilitation and recurrence in football players: a systematic review

Aspectos psicológicos asociados a la rehabilitación del LCA y las recidivas en futbolistas: una revisión sistemática

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Abstract. Although most football players recover good physical function after anterior cruciate ligament (ACL) surgery, some do not return to their sport or to the same pre-injury level, and there is a risk of recurrence. Therefore, this study aimed to examine research on psychological aspects of ACL rehabilitation and Return to Play (RTP), as well as their influence on possible recurrence in football and futsal players. The search was conducted using the Scopus, PubMed, WoS, CENTRAL databases, and grey literature sources DART-Europe and OpenGrey. A total of nine studies met the inclusion criteria. The results indicated as the most evaluated psychological factor the psychological readiness to RTP through the Anterior Cruciate Ligament Return to Sport After Injury (ACL-RSI). Likewise, psychological interventions in ACL-injured football players have positive effects on mood states, reduces pain perception, and fear reinjury, among others. Risk profiles for recurrence included vulnerability to stress and high psychological readiness to RTP. Therefore, psychological interventions should be incorporated into the rehabilitation process and screening to identify players at risk for poor outcomes or recurrences. Additional research would help to understand the influence of other variables or optimal levels of psychological readiness to RTP.

Keywords: anterior cruciate ligament; RTP; sports injury; psychology; rehabilitation.

Resumen. Aunque la mayoría de los jugadores de fútbol recuperan una buena función física después de la cirugía del ligamento cruzado anterior (LCA), algunos no regresan a su deporte o al mismo nivel previo a la lesión, y existe el riesgo de recidivas. Por tanto, este estudio tuvo como objetivo examinar la investigación sobre los aspectos psicológicos de la rehabilitación del LCA y el retorno al juego (RTP), así como su influencia en las posibles recidivas en jugadores de fútbol y fútbol sala. La búsqueda se realizó utilizando las bases de datos Scopus, PubMed, WoS, CENTRAL y las fuentes de literatura gris DART-Europe y OpenGrey. Un total de nueve estudios cumplieron los criterios de inclusión. Los resultados indicaron como factor psicológico más evaluado la disposición psicológica al RTP a través del Anterior Cruciate Ligament Return to Sport After Injury (ACL-RSI). Asimismo, las intervenciones psicológicas en futbolistas lesionados de LCA tienen efectos positivos sobre los estados de ánimo, reducen la percepción del dolor y el miedo a volver a lesionarse, entre otros. Los perfiles de riesgo para las recidivas incluyeron la vulnerabilidad al estrés y una alta disposición psicológica para el RTP. Por lo tanto, las intervenciones psicológicas deben incorporarse al proceso de rehabilitación y al cribado para identificar a los jugadores con riesgo de peores resultados o recidivas. Investigaciones adicionales ayudarían a comprender la influencia de otras variables o los niveles óptimos de disposición psicológica para el RTP.

Palabras clave: ligamento cruzado anterior; RTP; lesión deportiva; psicología; rehabilitación.

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Introduction

Injury is a significant concern in sports practice and research in the field of physical activity and sports (Johnson & Ivarsson, 2017; Schneider et al., 2006). Sports injuries have a significant impact not only on athletic performance, but also on the personal and social lives of injured athletes (Rubio et al., 2020; Truong et al., 2020). Numerous theoretical models have been proposed in the scientific literature to analyse the relationship between psychological variables and sports injuries (Andersen & Williams, 1988; Brewer, 1994; Heil, 1993). Wiese-Bjornstal et al. (1998) presented a comprehensive model that addressed the psychological response to injury and the rehabilitation process, highlighting the crucial role of stress in this context. For these authors, personal and situational factors are present throughout the process, which is dynamic and circular. Cognitive appraisals can influence emotions, which in turn can impact behaviour. Similarly, emotions affect behaviours and behaviours affect cognitive appraisals, and so on. Finally, psychological consequences are connected to the whole injury experience, around the three components of the model: cognitive

appraisal, emotional response, and behavioural response. Based on this model, it is understood that stress is not only an element of risk in sports injuries but also an obstacle to recovery from these injuries.

One of the five fundamental lines of research on the relationship between psychological factors and sports injuries is the study of athletes' emotional and psychological reactions to injuries (Olmedilla & García-Mas, 2009). A considerable diversity of cognitive reactions, such as intrusive thoughts or reduced self-esteem, as well as emotional responses of sadness, anger or fear, have been observed. In addition, behavioural changes such as eating disorders or alcohol consumption have been identified as a consequence of sports injuries (Brewer, 2017). Following the model proposed by Wiese-Bjornstal et al. (1998), the way in which athletes perceive their injury, rather than the fact that it occurred, plays a fundamental role in understanding the emotional responses of injured athletes (Tracey, 2003). Likewise, this model can explain how athletes' willingness to commit to rehabilitation, as well as the value they place on this process, influences their cognitive, emotional, and behavioural reactions to the rehabilitation of their injury.

According to Olmedilla & García-Mas (2023), some of the psychological variables present in the recovery process are pain, mood, catastrophic thinking, anxiety, depression, perfectionism, and coping resources. Johnston & Carroll (1998) provide an example of how psychological variables affect rehabilitation processes. The authors observed that athletes with fear of re-injury were hesitant, did not try as hard as they could, and were suspicious of injury-provoking situations (e.g., during rehabilitation and in sporting contexts). Likewise, the method of assessing rehabilitation also affected the psychological and behavioural levels. Athletes who perceived their rehabilitation positively reported feeling happiness and relief, which promoted greater adherence. Conversely, those who perceived it negatively reported feeling frustrated, which led to hesitation and caution towards performing the exercises in their rehabilitation program.

Scientific research also highlights the importance of certain psychosocial influences, such as fear of re-injury, lifestyle changes, work demands, available social support, loss of motivation, perceived self-efficacy, and psychological readiness to return to play (RTP), appear to play in an athlete's recovery and subsequent decision to return to sports (Baez et al., 2020; Burland et al., 2019; Forsdyke et al., 2022; Podlog & Eklund, 2010). Webster et al. (2018) found that fewer pain symptoms and better self-reported knee function were associated with psychological readiness to RTP. Phelan et al. (2019) compared psychological readiness to RTP between uninjured athletes and those who had undergone ACL surgery. The authors found that nine months after surgery, psychological readiness did not return to the levels observed in the uninjured group. A meta-analysis found that low psychological readiness to RTP was associated with higher odds of graft rupture after ACLR (Cronstrom et al., 2023). Similarly, younger individuals with lower psychological readiness have a higher risk of sustaining a second ACL injury after returning to sports (McPherson et al., 2019a). These findings are important given that athletes who return to sports before feeling psychologically prepared may experience anxiety, fear, and stress, sustaining a second injury and decreasing performance (Gómez-Espejo et al., 2022; Paterno et al., 2018).

ACL tears are among the most common sports-related knee injuries (Majewski et al., 2006). In the case of football, Requejo-Herrero et al. (2023) reported an average of 11 ACL tears per season and 17 recurrent injuries over 10 seasons in La Liga Española. In other countries, such as Germany, a total of 72 injuries have been reported, with an average of 9.6 ACL tears per season (Schiffner et al., 2018), or in the Italian first division with 84 ACL injuries, 25% of which were recurrent (Grassi et al., 2020). In addition, some studies suggest that female players have a two to three times higher risk of ACL injury than their male counterparts (Waldén et al., 2011) and a higher incidence of a second ACL injury (Hong et al., 2023). Serrat et al. (2023) reported 94 ACL injuries over 10 seasons in female first and second division players. In addition, 31.9% of the

footballers had already suffered an ACL injury in the previous seasons. On the other hand, although not many epidemiologic studies on ACL injuries in futsal have been found, some studies seem to indicate that it is one of the sports with the highest incidence of injuries, with the main injured body part being the lower limb, specifically the knees and ankles (Gene-Morales et al., 2021; Ruiz-Pérez et al., 2021), and ACL tears being one of the most frequent and severe (Ruiz-Pérez et al., 2019). Regarding the RTP rate in football players, Zaffagnini et al. (2014) found that 95% of professional football players returned to the same level of activity one year after surgery, and 71% could still play competitive football after four years. More recently, Farinelli et al. (2023) reported an RTP rate of 92.6% in elite UEFA football players. Despite this, many athletes with good knee function do not return to their previous level of sports participation after ACLR, suggesting the existence of other factors that influence RTP (Arden et al., 2016).

Several reviews have found the influence of psychosocial factors after ACLR. Athletes who suffered an ACL injury may suffer from symptoms of depression, especially during the first 6 weeks after ACL reconstruction, being more frequent among professional athletes than among non-professionals (Piuissi, Berghdal et al., 2022). Longo et al. (2023) found that the main reasons for not RTP were concerns about reinjury and pain, whereas self-efficacy, psychological will, and age were associated with better functional outcomes. Other factors that may help predict which athletes are more likely to RTP include motivation to return, lower levels of kinesiophobia, higher levels of self-efficacy, confidence and subjective knee function, risk acceptance and social support (Momaya et al., 2024). In a recent meta-analysis of 3744 patients, Xiao et al. (2023) found no significant differences in the self-reported knee function of athletes who had RTP compared to those who had not after ACL surgery. However, the group that had RTP exhibited a higher psychological readiness, higher self-efficacy, and lower kinesiophobia than the other group. Similarly, Nwachukwu et al. (2019) found that of the 795 patients who did not achieve RTP, 64.7% cited psychological reasons for not returning. Fear of reinjury was the most common reason (76.7%); other psychological factors included lack of confidence in the treated knee (14.8%), depression (5.6%), and lack of interest/motivation (2.5%).

According to Olmedilla & García-Mas (2023), the psychological elements that influence rehabilitation and RTP can be subject to modification through appropriate interventions (Cognitive-Behavioural Therapy, EMDR or Mindfulness), improving the athlete's adherence and increasing self-confidence at the time of RTP. However, these programs do not receive the systematic attention required for traditional postoperative rehabilitation processes. Based on the above, it is crucial to understand the relationship between psychological aspects in ACL injury rehabilitation and subsequent RTP, especially considering that although most patients recover good physical function after surgery, some do not return to their sports or to the same pre-injury

level, in addition to the current risk of recurrence.

Although there are reviews in the literature on this topic (Longo et al., 2023; Momaya et al., 2024; Nwachukwu et al., 2019), they generally include studies with different types of sports, making it difficult to identify football-specific factors. Football is an intense sport where there are quick and sudden changes of direction, jumps and landings with impact and physical contact with other players. The ACL injury data presented above also supports the idea of conducting a systematic review focusing on this sport. In fact, football has a higher incidence of ACL injuries than other team sports like volleyball and basketball (Joseph et al., 2013). Furthermore, to our knowledge, there are no reviews that consider futsal, so the inclusion of studies involving futsal players could potentially lead to the development of new research avenues. Therefore, this study aimed to examine research on psychological aspects of ACL rehabilitation and Return to Play (RTP), as well as their influence on possible recurrence in football and futsal players.

Method

Once the study context was defined and the objectives were stated, a systematic review of the scientific literature was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocol (PRISMA; Page et al., 2021) through the following stages:

- Selection of eligibility criteria.
- Description of the sources of information and search strategies
- Process of selection, evaluation, extraction of information and elaboration of a flow chart
- Collection and listing of data

Eligibility Criteria

To be included in the systematic review, an article must meet the following inclusion criteria. These criteria are based on the PICO (Participants/Intervention/Comparison/Outcomes) strategy. The study population consisted of football and/or futsal players (both male and female) who sustained ACL injuries. Experimental and observational studies were selected as intervention criteria. Comparison criteria included single-group studies and those that included two groups: injured and uninjured football players. For the outcome criterion, only studies that used validated instruments to measure psychological variables were included. On the other hand, articles were excluded if: (1) access to the full text was not available; (2) they were written in a language other than Spanish or English; (3) they were qualitative research, review articles, letters to the editor, editorial commentaries, etc.; (4) their objective was to validate an instrument; (5) they presented data from football players and other athletes together; (6) they included injuries other than ACL injuries.

Sources of information

The Scopus, PubMed, and Web of Science (WoS; Science

Citation Index Expanded and Social Sciences Citation Index) databases were used for searching, critical reading, and evaluating the articles. The Cochrane Central Register of Controlled Trials (CENTRAL) was also searched for potential randomized and quasi-randomized controlled trials of interest. In addition, DART-Europe and OpenGrey were consulted as sources of grey literature.

Search strategy

A search was performed in the "title, abstract, and keywords" fields of the four databases. The following strategy was used: "return to competition" OR rtc OR "return to sport" OR rts OR "return to play" OR rtp OR rehabilitation OR recovery AND acl OR "anterior cruciate ligament" AND psych* AND football OR soccer OR futsal. No filtering was applied to the search, and publications through October 1, 2023, were included.

For the search in DART-Europe and OpenGrey, the following strategy was used "anterior cruciate ligament" AND psych* and English or Spanish language as a filter.

Study selection process

Zotero v. 6.0.26 was used to pool the results of the searches and eliminate duplicate studies. The extraction process was based on the protocol of Ateef et al. (2022), which was consulted in the International Prospective Register of Ongoing Systematic Reviews (PROSPERO) database. Thus, two reviewers performed the inclusion of trials in a two-stage process. In the first phase, the records were screened by reading the title, abstract, and keywords to identify potentially relevant studies. In the second phase, the selected articles were read in full to ensure that they met the eligibility criteria. Quality control was carried out by two trained reviewers as in similar studies (Caicedo-Parada et al., 2020). Specifically, the reliability of both was calculated using Cohen's kappa statistic with qualitative intervals of poor (< .20), weak (.21–.40), moderate (.41–.60), good (.61–.80), and very good (> .81) for the screening of records and selection of studies, giving very good intraobserver and interobserver agreement values according to Altman (1991). The lowest value corresponded to the interobserver agreement in the screening process, with a value of $k = .885$. Finally, it was adopted a conservative strategy in the screening phase and included all records to be evaluated in the eligibility phase. Figure 1 illustrates the screening process.

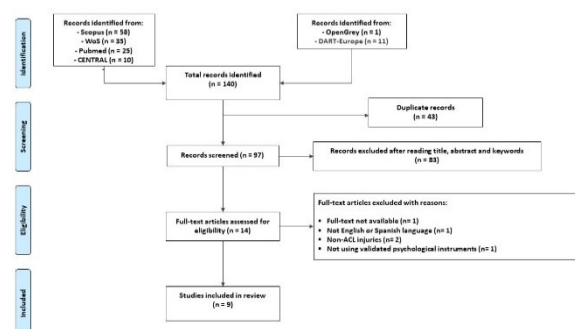


Figure 1. PRISMA flow diagram

Quality appraisal

Methodological rigor was verified using a structured rating system called the PEDro scale (Gómez-Conesa et al., 2015). This system has been used in numerous studies (Guede-Rojas et al., 2023; Kakavas et al., 2023; Liddle et al., 2023; Pastora-Bernal et al., 2021). It is used to quantify the external validity, quality of the methods used, and statistical description in randomized experimental studies. It consists of 11 items with a score ranging from 0 to 10 (item 1 assesses external validity but is not included in the total score). A higher score indicated better methodological quality, although the following classification has been recommended (Cashin & McAuley, 2020): (9-10) excellent; (6-8) good; (4-5) acceptable; and poor (< 4).

Data extraction and synthesis

Outcome data were extracted independently by one reviewer and subsequently verified by the other reviewers. Study variables were coded and grouped into three categories: 1) general study descriptors (citation, objective and study design); 2) study population (group, sample size, sex, mean age and standard deviation); 3) outcomes (psychological assessment instruments and psychologically relevant findings). Data synthesis was performed using an emergent synthesis approach, which according to Schick-Makaroff et al. (2016), provides a systematic approach to synthesising varied literature in a thematic area that includes various types of data.

The results were summarised in narrative and summary expression and in tables, according to the proposed method. Results were structured with subheadings, including demographic characteristics of study participants,

methodology of included studies, psychological assessment instruments and psychologically relevant findings.

Results

Demographic characteristics of study participants

The results of the extraction process are summarized in Table 1. Nine studies that indicated the influence of psychological variables in football players who sustained an ACL injury were included. The years of publication of the articles ranged from 2016 to 2023, with Faltstrom et al. (2016, 2021, 2023) being the author with the most articles. The total number of participants was 1404, of which 55% were male and 45% were female. The mean age of the participants was between 20 and 33 years. All participants were football players, and none were futsal players.

Methodology of included studies

The total PEDro scale scores assigned to the articles included in this review are presented in Table 1. The most common design was cross-sectional, with three articles (Bortone et al., 2021; Correa et al., 2023; Faltstrom et al., 2016) of good methodological quality. There were two randomized clinical trials by Almuhaaya et al. (2023) and D'Isanto et al. (2022) with excellent and good methodological quality, respectively. Two prospective cohort studies (Faltstrom et al., 2021, 2023) have also achieved excellent quality. Manara et al. (2022) conducted a case series study of good methodological quality. Finally, the single case study by Palmi et al. (2018) was not analysed using the PEDro scale because of the risk of bias inherent in this type of design.

Table 1.
Analysis of the studies included in the systematic review.

Article	Participants	Objective	Design	Psychological Assessment instruments	Psychologically relevant findings
Almuhaaya et al. (2023)	EG = 18 male players (26.5 ± 6.65 years)	To examine the feasibility and acceptability of adding a structured educational session to the rehabilitation program for football players following ACL injury.	RCT	- TSK - ACL-RSI	At follow-up, the intervention group showed improvement in kinesiophobia and fear of another injury, as well as psychological readiness for the RTP, compared to the control group who did not receive the educational session.
PEDro Scale: 10	CG = 17 male players (26.1 ± 5.33 years)				
Correa et al. (2023)	15 male players ready for RTP (23 ± 5.89 years)	To investigate whether there are differences in kinesiophobia and performance on field tests and exercises related to the injured knee after medical discharge between players who perceive themselves to be psychologically ready for RTP and those who do not.	Cross-sectional	- TSK-11 - ACL-RSI	Football players who did not consider themselves psychologically ready for RTP had worse field test performance and greater dynamic knee valgus during the squat test compared to those who did perceive themselves to be ready. Additionally, they reported greater fear of movement-related pain and lower knee function.
PEDro Scale: 8	20 male players not ready for RTP (21 ± 3.78 years).				
Fältström et al. (2023)	112 female players (20 ± 2 years).	To explore whether the association between various risk factors and ACL injury in female football players would be affected by different follow-up times and statistical approaches.	Cohort study	- ACL-QoL - ACL-RSI - SSP - SMPS	At 12-month follow-up, female players with higher psychological readiness scores for RTP, lower impulsivity scores, higher stress vulnerability scores, and better knee functionality had an eightfold increased risk of sustaining a second ACL injury.
Manara et al. (2022)	666 male players and 196 female players with an average of 30 years.	To determine the rate of subsequent ACL injuries and RTP rate in football players, as well as to evaluate predictors of RTP and ACL injury recurrence.	Case series	- ACL-RSI	Younger age and better psychological readiness were found to be predictors of return to play (RTP). Those who had returned to football and had not experienced an additional ACL injury had higher overall ACL-RSI scores and were less fearful of another injury.
PEDro Scale: 8					
D'Isanto	EG = 15 female	To examine the effect of Mirror	RCT	- VAS	The Mirror Therapy group reported a greater perception of

et al. (2022)	players (33 ± 1.8 years) y	Therapy added to conventional rehabilitation on psychological readiness and pain perception in ACL injured female football players.		- ACL-RSI	psychological readiness compared to the conventional physical therapy group. On the other hand, both groups experienced a reduction in pain perception after rehabilitation.
PEDro Scale: 7	CG = 15 female players (32 ± 1.6 years)				
Bortone et al. (2021)	30 male players (26.9 ± 5.7 years).	To assess the clinical, psychological and biomechanical condition of football players who had the RTP at 2 years after ACLR.	Cross-sectional	- TSK - ACL-RSI	Older football players exhibited a greater fear of re-injury and lower motivation to RTP. Recreational football players reported significantly higher levels of fear of re-injury compared to those returning to the competitive level. Higher levels of kinesiophobia were significantly associated with more complaints of ACL injury and lower psychological readiness for RTP. Football players with lower fear of re-injury demonstrated better performance in terms of balance and strength with fewer asymmetries. Although most participants reported being psychologically ready to RTP at the time of assessment, those with lower scores experienced greater limitations in daily activities and took longer to perform the agility test, particularly on the injured leg. Additionally, injury to the dominant leg was associated with lower fear of re-injury and lower psychological readiness for RTP.
PEDro Scale: 8					
Fältström et al. (2021)	117 female players (20 ± 2 years)	To investigate the combinations of various clinical risk factors by CART analysis that are associated with secondary ACL injury in female football players after primary unilateral ACLR.	Cohort study	- ACL-QoL - ACL-RSI - SSP - SMPS	Players who are at a higher risk of suffering a second ACL injury are those who had low performance in the jumping test, greater vulnerability to stress, were unadventurous, estimated high psychological readiness for RTP, and performed well in jumping with camber. This risk profile was three times more likely to result in a second ACL injury.
PEDro Scale: 9					
Palmi et al. (2018)	1 male player aged 28 years	To evaluate the effectiveness of Mindfulness in the rehabilitation of an injured professional football player.	Single case design (n=1)	- POMS - PANAS - SE - Sport injury questionnaire	The analysis of the psychological moment on the day of the injury indicates a high degree of motivation and self-demand, as well as perceived demand from the coach. Differences were observed between negative and positive emotions, with the former scoring higher. Regarding mood states, the dimensions of tension, depression, anger, fatigue, and confusion decreased progressively throughout the weeks of psychological work, while the vigour dimension increased. The average evaluation of the sessions was positive, with particular emphasis on learning relaxation and thought management techniques.
PEDro Scale: N/A					
Fältström et al. (2016)	94 current female players (20.1 ± 2.3 years)	To determine whether demographic factors, psychological factors, and ACL injury characteristics were associated with RTP. Second, to make comparisons of current knee function, readiness for RTP, and knee-related quality of life between players who returned to football and those who did not.	Cross-sectional	- Questionnaire on factors related to the return to football - ACL-QoL - ACL-RSI - SSP - SMPS	The most common reasons for non-RTP were lack of confidence in the knee and fear of re-injury. Current players had higher motivation for RTP, higher scores on the personality trait "adventure seeking" and "personal standards" of perfectionism compared to players who did not return to football. A one-point increase in motivation was associated with 1.5 times greater likelihood of returning to football. Likewise, current players had higher scores on psychological readiness for RTP and better quality of life related to ACL injury.
PEDro Scale: 8	88 female players had not returned (20.8 ± 3 years)				

Note. N/A: Not applicable; EG: Experimental group; CG: Control group; ACL: Anterior cruciate ligament; RCT: Randomized Controlled Trial; TSK/TSK-11: Tampa Scale of Kinesiophobia; ACL-RSI: Anterior Cruciate Ligament Return to Sport After Injury; RTP: Return To Play; ACL-QoL: Anterior Cruciate Ligament - Quality of Life; SSP: Swedish Universities Scales of Personality; SMPS: Sport Multidimensional Perfectionism Scale; VAS: Visual Analogue Scale; ACLR: Anterior Cruciate Ligament Reconstruction; POMS: Profile of Mood States; PANAS: Positive and Negative Affect Schedule; SE: Session Evaluation.

Psychological assessment instruments

The most used psychological assessment instrument (n = 8; 88.9%) was the Anterior Cruciate Ligament Return to Sport After Injury (ACL-RSI), which was present in all included studies, except Palmi et al. (2018). This was followed by the Anterior Cruciate Ligament Quality of Life (ACL-QoL) (n = 3; 33.3%), the Swedish Universities Scales

of Personality (SSP) (n = 3; 33.3%), and the Sport Multidimensional Perfectionism Scale (SMPS) (n = 3; 33.3%). The Tampa Scale of Kinesiophobia (TSK) was present in two studies (22.2%) and its short version (TSK-11) in one study (11.1%). The remaining instruments were used in only one study. Table 2 lists the instruments used and the variables assessed for each instrument.

Table 2. Psychological evaluation instruments and assessed variables.

Questionnaire	Author	Variable assessed
Anterior Cruciate Ligament Return to Sport After Injury (ACL-RSI)	Webster et al. (2008)	Psychological readiness for the athlete's return to sport after an ACL injury. It has 3 domains: emotions, risk appraisal and confidence in knee function and performance.
Anterior Cruciate Ligament- Quality of Life (ACL-QoL)	Mohtadi (1998)	Impact of ACL injury on patients' lives. It has 5 domains: symptoms, physical complaints, work-related concerns, physical activity and sport participation and lifestyle and social concerns.
Tampa Scale of Kinesiophobia (TSK)/TSK-11*	Miller et al. (1991)/ Woby et al. (2005)	Fear of movement and re-injury.
Swedish Universities Scales of Personality (SSP)	Gustavsson et al. (2000)	13 stable personality traits: somatic anxiety, psychic anxiety, stress susceptibility, lack of assertiveness, impulsiveness, adventure seeking, detachment, social desirability, embitterment, trait irritability, mistrust, verbal trait aggression,

		physical traits and aggression.
Sport Multidimensional Perfectionism Scale (SMPS)	Dunn et al. (2002)	Perfectionism in sport. It has 4 dimensions: personal standards, concern about mistakes, perceived parental pressure and perceived coach pressure.
Profile of Mood States (POMS)	Balaguer et al. (1993)	Mood states. It has 6 dimensions: tension, depression, anger, vigour, fatigue and confusion.
Positive and Negative Affect Schedule (PANAS)	Sandín et al. (1999)	Affections considered positive and negative.
Visual Analogue Scale (VAS)	Hayes & Patterson (1921)	Subjective perception of pain.

Note. * This is a shortened version of the original TSK with 11 items.

In addition to these standardized instruments, some articles use interviews and ad hoc questionnaires, such as the Sports Injury Questionnaire by Palmi et al. (2018), which assesses personal data, sport, and injury history. Similarly, information on daily stressors, anxiety levels, coach demands, motivation, attention, and psychological resources on the day of injury was collected. Another instrument presented in this study is the Session Evaluation (SE), in which the football player evaluated the criteria of learning, interest, and intra-session comfort and answered two open-ended questions about what he liked the most and what was the most difficult.

Another example of an ad hoc instrument is the study by Faltstrom et al. (2016), in which players answered a questionnaire about factors related to returning to football and the reasons they did not return to competition. Possible reasons included "poor knee function," "don't trust my knee," "fear of reinjury," "had a new injury," "team or training changed," "family situation," "work situation," "don't enjoy playing anymore," or "other reasons." The authors also assessed behavioural factors, including motivation to RTP, reasons for playing football before the injury, and risk-taking behaviours while playing football before the injury.

Psychologically relevant findings

Three studies investigated the effect of different interventions on psychological variables during ACL rehabilitation (Almuhaya et al., 2023; D'Isanto et al., 2022; Palmi et al., 2018). Results showed improvements in kinesiophobia, fear of re-injury, psychological readiness for RTP (Almuhaya et al., 2023) and reduced pain perception (D'Isanto et al., 2022). In addition, improvements in mood states were observed throughout the psychological treatment (Palmi et al., 2018).

Four studies investigated the influence of psychological aspects associated with RTP (Bortone et al., 2021; Correa et al., 2023; Fältström et al., 2016; Manara et al., 2022). Fältström et al. (2016) reported that the most common reasons for not RTP were lack of confidence in the knee and fear of re-injury. Active players had higher motivation for RTP, higher scores on the personality trait 'adventure seeking' and 'personal standards' of perfectionism, compared to players who did not return to football. Similarly, active players had higher scores on psychological readiness for RTP and better quality of life related to ACL injury. Poorer performance on physical tests and greater kinesiophobia have also been observed in football players who did not feel psychologically prepared for the RTP (Bortone et al., 2021; Correa et al., 2023), experienced more complaints of ACL

injury and greater limitations in daily activities (Bortone et al., 2021), with psychological readiness being a predictor for the RTP (Manara et al., 2022).

Two studies identified risk profiles for a second ACL injury (Fältström et al., 2021, 2023). According to Fältström et al. (2021), players at highest risk were those with low performance in the jumping test, higher vulnerability to stress, were unadventurous, estimated high psychological readiness for the RTP and good performance in the jump rope test. This risk profile was three times more likely to suffer a second ACL injury. Recently, Fältström et al. (2023) reported an eightfold increased risk for those players with higher RTP psychological readiness scores, lower impulsivity scores, higher stress vulnerability scores and better knee functionality. In contrast, Manara et al. (2022) reported higher overall ACL-RSI scores and lower fear of re-injury in those players who had returned to football and had not suffered an additional ACL injury.

Discussion

Considering football as an intense contact sport, its particular characteristics and the previously presented data on ACL injuries, it is necessary to conduct a review that specifically focuses on this sport. This study aimed to identify the psychological aspects of ACL rehabilitation, as well as RTP, and its influence on possible recurrences in football and futsal players. After the review, nine studies were found that met the inclusion criteria. The first aspect to highlight is that no research was found in the field of futsal. Although it is true that it is a sport with less impact than football, the need to study futsal as a separate specialty seems justified, since differences have been found in psychological characteristics related to performance between football and futsal (Mirzaei et al., 2016), and the data on lower extremity injuries, such as ACL rupture, suggest an interesting field in which to develop research (Gene-Morales et al., 2021; Ruiz-Pérez et al., 2019, 2021).

Based on the objectives and results of the studies included in this review, they can be divided into two groups. The first group included articles that aimed to investigate the effects of some treatments on the rehabilitation of football players with ACL injuries (Almuhaya et al., 2023; D'Isanto et al., 2022; Palmi et al., 2018). The treatments included Mindfulness, Mirror Therapy, and incorporation of a structured educational session into the conventional rehabilitation program. The results showed benefits in mood states, a positive evaluation of the sessions in learning psychological techniques, improvement in the perception of psychological readiness for RTP, reduced pain perception,

and reduced kinesiophobia and fear of reinjury.

As can be seen, many psychological factors are present in ACL rehabilitation. Some authors also highlight social support, motivation and goal setting, self-efficacy, athlete expectations regarding the time and effort required for this process, kinesiophobia, and fear of re-injury (Johnson et al., 2016; Walker et al., 2022). Piussi, Berghdal et al. (2022) conducted a systematic review and found that athletes who suffer an ACL injury may experience symptoms of depression, particularly during the first 6 weeks after ACLR. As Burland et al. (2019) point out, all psychological responses play a role in the outcome or success of recovery after injury. For example, football players who exhibit lower levels of self-confidence and less optimism (cognition) show greater fear of re-injury (emotion), which may lead to lower adherence to rehabilitation (behaviour) and influence whether the football player achieves successful RTP (outcome). In this sense, research such as that of Candel et al. (2023) shows the role of catastrophic thinking on mood states in football players with severe and very severe injuries, where the greater the catastrophism (rumination, helplessness, and magnification), the greater the negative mood state (tension, depression, anger, and fatigue), and the lower the positive mood state (vigour). Similarly, fear of new exercises during rehabilitation can manifest as anger or frustration (Kvist et al., 2023).

There is consensus on the importance of good psychological readiness for RTP times and outcomes, as it is a good predictor of return to pre-injury level and recurrences in football players (Figueroa et al., 2022). Kunnen et al. (2020) found that football players manifested psychological readiness for RTP based on confidence in four areas: in the rehabilitation process, in their physical abilities, in medical professionals, and in not fear of reinjury. These results are of particular importance since work such as that of Gómez-Espejo, Olmedilla, et al. (2022) shows that correct psychological readiness is related to good mental health during RTP. Moreover, as readiness increased over time, levels of stress, anxiety, and depression tended to improve.

Other studies have demonstrated the benefits of psychological interventions for knee rehabilitation (Cupal & Brewer, 2001; Maddison et al., 2006, 2012). Brewer et al. (2022) implemented an interactive multimedia program using a cognitive behavioural approach in athletes and non-athletes with ACL injuries. Those who completed the program demonstrated greater preoperative confidence in their ability to cope than those who received standard care. They also experienced lower levels of postoperative pain and kinesiophobia as well as greater use and perceived usefulness of patient education materials. Therefore, even the addition of a few psychoeducational sessions to conventional rehabilitation programs may be an economical and effective means of addressing the psychological problems or needs of football players at the time of injury and during their ACL recovery process (Gómez-Espejo, García-Mas, et al., 2022).

The second group of studies aimed to investigate factors

related to RTP and new ACL injuries (Bortone et al., 2021; Correa et al., 2023; Faltstrom et al., 2016, 2021, 2023; Manara et al., 2022). Thus, the factors associated with RTP are higher motivation for RTP, better injury-related quality of life, "adventure seeking" and "personal standards" as personality traits and perfectionism. Conversely, the most common reasons for not returning were lack of confidence in the knee and fear of reinjury. These factors are comparable to those identified in other reviews (Longo et al., 2023; Momaya et al., 2024; Nwachukwu et al., 2019). For example, Nwachukwu et al. (2019) reported the most common reasons were fear of reinjury, lack of confidence in the knee, depression, and lack of interest or motivation. Momaya et al. (2024) identified motivation to return, lower levels of kinesiophobia, higher levels of self-efficacy, confidence and subjective knee function, risk acceptance and social support as factors that might predict athletes more likely to RTP. In contrast to previous reviews, personality factors as "adventure seeking" and "personal standards" related to RTP were found in this study. Accordingly, it would be interesting to investigate other variables that may play protective or facilitating roles in RTP.

These findings are also consistent with other studies. Webster et al. (2018) found that fewer pain symptoms and better self-reported knee function were associated with psychological readiness to RTP. Even in athletes with ACL injuries without surgical treatment, a relationship between good knee function and good psychological readiness for RTP prior to injury has been observed (Slater et al., 2023). In this respect, social support also plays an important role at RTP. For example, Forsdyke et al. (2022) found that reinjury anxiety mediates the relationship between social support and psychological readiness for RTP in football players. This suggests that increasing positive perceptions of social support will decrease reinjury anxiety during rehabilitation, which may help football players to be more psychologically prepared for RTP.

Other studies discussed in this review demonstrated the effect of psychological readiness for RTP and kinesiophobia or fear of injury on physical test performance (Bortone et al., 2021; Correa et al., 2023). Bortone et al. (2021) assessed players two years after ACLR and found that higher levels of kinesiophobia were significantly associated with higher ACL injury complaints and poorer psychological readiness for RTP. In addition, those with less fear of reinjury showed better performance in terms of balance and strength with less asymmetry, while those with lower psychological readiness scores reported greater limitations in daily activities and longer times to perform the agility test, especially in the injured leg. Correa et al. (2023) investigated whether there were differences in kinesiophobia and performance on field tests and exercises related to the injured knee after medical discharge between players who perceived themselves as psychologically prepared for RTP and those who did not. The authors found that players who did not perceive themselves to be psychologically prepared for RTP had worse field test performance and greater

dynamic knee valgus during the squat test compared to those who perceived themselves to be prepared. Additionally, these players had greater kinesiphobia and lower self-reported knee function. In this regard, there is no doubt that fear of re-injury and motivation play critical roles during rehabilitation and subsequent RTP. Kvist et al. (2023) explored the influence of fear after ACLR on rehabilitation and RTP. However, research by Kunnen et al. (2020) with football players showed that the motives for returning to competition were the happiness that football gave them, the sense of belonging, and the love of their sport, which were stronger than the fear of re-injury. Sonesson et al. (2017), on the other hand, reported that greater motivation during rehabilitation was associated with a return to pre-injury sports activity and greater satisfaction with the level of knee activity and function. Johnston & Carroll (1998) observed that athletes with fear of re-injury were hesitant, did not work as hard as they could, and were wary of injury-provoking situations. Athletes who perceived their rehabilitation as positive reported feelings of happiness and relief, which promoted greater adherence. In contrast, those who perceived it negatively reported feeling frustrated, which led to hesitation and caution in performing exercises in their rehabilitation program.

Finally, two articles included in the review presented risk profiles for a second ACL injury. Faltstrom et al. (2021) found that one of the highest risk profiles was those players who had low performance in the jump test, greater susceptibility to stress, were unadventurous, estimated high psychological readiness for RTP, and obtained good results in the jumping jack. These players were three times more likely to suffer a second ACL injury. The second study was published by Faltstrom et al. (2023). They found a risk profile in which players with higher psychological readiness scores for RTP, lower impulsivity scores, higher stress vulnerability scores, and higher knee functionality had an eight-fold increased risk of sustaining a second ACL injury at the 12-month follow-up. In contrast, Manara et al. (2022) found that players who had returned to competition and had not suffered a second ACL injury had a better psychological disposition and a greater lack of fear of re-injury. First, these results support the proposed models of Andersen & Williams (1988) or Wiese-Bjornstal et al. (1998), and the role of stress. Based on the revised model of Williams & Andersen (1998), it is possible that football players at higher risk of injury are more concerned with protecting themselves from re-injury, which could increase their stress levels, reduce their attentional focus, and lead to errors in decision-making and sport performance. If increased muscle tension is included as a response to stress, it would increase the likelihood of injury, which would not occur in those with less susceptibility to stress and less fear of re-injury.

Nevertheless, these results reflect the complexity of risk factor analysis, as a certain contradiction was found regarding high psychological readiness for RTP and the possibility of recurrence. On the one hand, studies such as McPherson

et al. (2019a) show that young athletes with lower psychological readiness for RTP have a higher risk of a second ACL injury. McPherson et al. (2019b) found that those who sustained a second ACL injury did not significantly improve in psychological readiness for RTP from the pre-intervention assessment to one year after ACLR, and improved less compared to those who were not injured. Additionally, the injured group reported being more nervous about participating in sports, more frustrated and less confident about participating in sports without worrying about the knee, and more fearful of reinjuring while participating in sports. In a meta-analysis by Cronstrom et al. (2023), low psychological readiness for RTP was associated with a higher likelihood of graft rupture after ACLR. In contrast, Piussi, Beischer et al. (2022) compared the psychological characteristics of athletes who had suffered a second ACL injury with those who did not. The authors found that those who suffered a new ACL tear had better psychological readiness, that is, greater confidence in performance, fewer negative emotions, and a lower risk assessment of returning to sports, as well as greater knee-related self-efficacy.

According to Piussi, Beischer et al. (2022), athletes who progress rapidly in rehabilitation and reach the RTP criteria develop a stronger psychological profile, that is, higher RTP disposition and higher knee-related self-efficacy. This would mean that both athletes and health professionals could suggest that RTP is possible, but at the cost of ignoring biological healing and important phases of rehabilitation. Thus, higher self-reported psychological readiness for RTP and higher knee-related self-efficacy may lead to earlier and riskier exposure to sports participation, and thus, a greater risk of ACL reinjury. In fact, Loose et al. (2018) found that most football players wanted to make their own decisions about returning to sport and often decided to return to sport after injury against the recommendation of their physician. Coaches often return injured players to play sooner against the physician's decision, although in most cases, they believe that the physician plays the main role in the decision to RTP. In addition, approximately 30% of players and 70% of coaches reported a new injury after not following the doctor's advice not to RTP after a serious injury. This discrepancy also reflects the current reality of RTP processes in elite football.

A complementary explanation would be that proposed by Webster (2022) based on the Yerkes-Dodson law (Yerkes & Dodson, 1908). According to this law, performance increases with physiological or mental arousal but only up to a certain point, after which performance decreases when arousal levels become too high. For Webster (2022), the same inverted "U" pattern may also explain the relationship between psychological responses and the risk of further ACL injury, i.e., too much or too little would not be optimal. Finally, the results may vary depending on the relationships between variables. It is likely that susceptibility to stress plays a moderating role between psychological readiness and a second ACL injury. Other psychological variables, such as certain personality traits, may also

influence possible relationships. For example, Olmedilla et al. (2022) found that adaptive perfectionism, including "personal standards," played a protective role against symptoms of anxiety, stress, and depression. In addition, because these mental health indicators are related to injury, the likelihood of injury was lower. Conversely, maladaptive perfectionism was associated with worse mental health symptoms and a higher risk of injury.

Limitations, future lines of research and practical implications

Although the present review was conducted according to PRISMA recommendations (Page et al., 2021), it has some limitations. The quality of the review is limited to the data available in the included studies. In this sense, according to the scores obtained on the PEDro scale, the studies would have good or excellent methodological quality, except for the study by Palmi et al. (2018), owing to its single-case design. Based on the expected paucity of studies, we did not include limitations regarding year of publication and design, therefore the included articles are heterogeneous. As a result, the conclusions and findings should be interpreted with caution. Another limitation is that the level of the football players was not considered, so the total sample of the review included from amateur to elite level. It would be interesting to conduct research that makes comparisons at the competitive level, as well as to analyse the possible age and gender differences that some studies have found regarding ACL injury and subsequent RTP. Similarly, based on the suggestion of Olmedilla & García-Mas (2023), further research could be carried out with the aim of studying the characteristics that differentiate football players who have not suffered ACL injuries or recurrences from those who have. The results obtained could be used to implement prevention protocols as a "vaccine" in football and futsal teams.

In view of the results obtained, it is necessary to consider the psychological aspects of rehabilitation and their influence on RTP. A simple screening regarding motivation and fear of re-injury can help to identify those players who may have a lower adherence to rehabilitation and thus, a higher risk of worse evolution and subsequent RTP. Additionally, the implementation of psychological interventions such as Cognitive Behavioural Therapy, EMDR or Mindfulness, as well as specific strategies such as motor imagery, relaxation or goal setting (Lope & Solís, 2020; Olmedilla & García-Mas, 2023; Pastora-Bernal et al, 2021), would complement conventional rehabilitation protocols, which generally focus on physical and functional recovery of the knee. Such interventions could help football players to reduce pain perception and kinesiophobia, while improving their mood, perception of social support and optimal psychological readiness for RTP.

Conclusion

Although some football players meet the clinical criteria for RTP, some do not return to their pre-injury levels or

do not return to RTP. This systematic review provides evidence on the psychological factors present in the rehabilitation of ACL injuries and their influence on RTP and possible recurrences. On the other hand, the main factors associated with RTP are higher motivation for RTP, better injury-related quality of life, and adventure seeking and personal standards as personality traits and perfectionism. Conversely, the most common reasons for not returning were lack of confidence in the knee and fear of re-injury. Fear of reinjury and poorer psychological readiness were also associated with poorer performance on physical tests. In terms of risk profiles, the results suggest that susceptibility to stress and high psychological readiness, in combination with other variables, may increase the risk of sustaining a second ACL injury. Therefore, further studies are needed to explore the optimal level of psychological readiness and possible intervention of other factors such as age or gender, including psychological variables such as perfectionism. Finally, the included studies also suggest positive effects of psychological interventions on mood states, improved perceptions of psychological readiness for RTP, reduced pain perception, and reduced kinesiophobia and fear of reinjury. Based on these findings, screening is recommended to identify players at risk of both poor rehabilitation and recurrence. Likewise, future research could focus on the characteristics of football players without ACL injuries and develop prevention protocols as a "vaccine" to be implemented in football and futsal teams.

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