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Journal Sport Area
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Vol. 10. No. 3. December, (2025)

The relationship between subjective knee function and psychological readiness to return to sport after ACL injury: A cross-sectional study

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Received 25 October 2025; Accepted 15 November 2025; Published 14 December 2025
Ed 2025; *10*(3): 369-376

ABSTRACT

Background: Athletes with anterior cruciate ligament (ACL) injuries often reduce or stop sports participation due to fear of re-injury and low confidence in their injured knee. While most studies emphasize physical recovery, fewer explore how subjective knee function affects psychological readiness to return to sport. **Objectives**: This study aims to determine the contribution of self-reported knee symptoms and function (subjective assessment) to psychological readiness to return to sport after ACL injury with operative and non-operative treatment. **Methods:** This cross-sectional study involved 40 participants who met the inclusion criteria for post-ACL injury, both operative and non-operative. Data were collected using the International Knee Documentation Committee (IKDC 2000) questionnaire for subjective knee function and the Anterior Cruciate Ligament–Return to Sport after Injury (ACL-RSI) scale for psychological readiness. A simple linear regression test was conducted with a 95% confidence interval. **Finding/Results:** The mean IKDC score was 69.80 ± 12.53 and the mean ACL-RSI score was 58.43 ± 19.12. The regression analysis showed a significant positive relationship between subjective knee function and psychological readiness to return to sport ($r = 0.61$, $p < 0.05$), with a coefficient of determination (R^2) of 0.373. **Conclusion:** Subjective knee function significantly influences psychological readiness to return to sport after an ACL injury. Enhancing knee function through targeted rehabilitation programs may improve athletes' confidence and reduce fear of re-injury, facilitating a safer and more effective return to sport.

Keywords: Anterior cruciate ligament injury; knee function; psychological readiness

https://doi.org/10.25299/sportarea.2025.vol10(3).19470

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How to Cite: Yuliana, E., Purba, R. H., Mighra, B. A., Oktafiranda, N. D., & Nurhidayah, D. (2025). The relationship between subjective knee function and psychological readiness to return to sport after ACL injury: A cross-sectional study. *Journal Sport Area*, *10*(3), 369-376. https://doi.org/10.25299/sportarea.2025.vol10(3).19470

Authors' Contribution: a – Study Design; b – Data Collection; c – Statistical Analysis; d – Manuscript Preparation; e – Funds Collection

INTRODUCTION

ACL injuries type of musculoskeletal injury that can have significant impacts, especially for adolescents who are actively involved in competitive sports. This injury not only limits a person's ability to return to previous performance but can also potentially stop sports participation completely. Previous research reported

that only two out of five athletes successfully returned to the same sport as before the injury two years after ACL reconstruction surgery, or approximately 60% (Ardern et al., 2015). Similar results were reported by Lindanger et al. (2019) as many as 83% of patients returned to pivot sports, while 53% managed to return to their previous level of performance after ACL reconstruction surgery. Supported by a recent study comparing physical activity levels between uninjured individuals and individuals after ACL reconstruction, individuals observed 5-8 years post ACL reconstruction surgery have a physical activity is lower than those who have never been injured (Stigert et al., 2023). This condition can have long-term impacts, namely an increased risk of osteoarthritis (OA) and if individuals already have OA, individuals with a history of ACL injury have a seven-fold increased risk of undergoing total knee replacement (TKR) (Khan et al., 2019).

Research suggests that psychological components are associated with individuals' restrictions on returning to exercise after an ACL injury, as various emotional and cognitive reactions can arise after an ACL injury, like afraid of getting injured again (76.7%), deficiency of confidence in the abilities of the injured knee (14.8%), depression (5.6%), and decreased interest or motivation after the injury (2.5%) (Nwachukwu et al., 2019). Meanwhile, psychological readiness is closely related and significantly influences an individual's return to physical activity as previous the ACL injury, so that the psychological readiness score is a predictor of success or failure in returning to exercise after an ACL injury (Beischer et al., 2023; Vutescu et al., 2021; Webster & Feller, 2019). Patients who successfully return to the same physical activities after ACL reconstruction surgery are generally characterized by a higher level of psychological readiness (Beischer et al., 2023). Supported by other studies, higher psychological readiness scores are associated with a return to pre-injury performance (Vutescu et al., 2021; Webster & Feller, 2019). Conversely, those with lower physical activity levels compared to before the ACL injury showed lower psychological readiness scores (Yuliana & Kushartanti, 2020). Therefore, low psychological readiness scores are an indicator of failure to return to post ACL sport (Faleide et al., 2021; Schilaty et al., 2023).

Many factors can influence psychological readiness to return to sport after an ACL injury, including physical condition (Faleide et al., 2021), gender, age, time between injury and surgery, pre-injury sports participation, and knee function (Webster et al., 2018). Research findings indicate that subjective knee symptoms and function are closely related to psychological readiness to return to sport after ACL surgery. (Webster et al., 2018). Subjective knee symptoms and function are self-reported assessments by patients through administered questionnaires. Strengthened by a biopsychosocial approach, self-reported knee function and psychological readiness to return to sport are biopsychosocial variables that influence return to sport after sports injury (Bae, 2024). The biopsychosocial approach is how biological, psychological and social factors influence the occurrence of sports injuries and the results of sports injury rehabilitation (Bae, 2024). However, limited research in Indonesia has examined how subjective knee function relates to psychological readiness after ACL injury. Therefore, this study aims to examine the relationship between these two factors among post-ACL athletes.

METHOD

Research Design

This study used a cross-sectional survey design, and has been declared to meet the requirements or be ethically feasible with the number KEP/II/2024/X/M290524EY-PMNT.

Research Subject

This study sample involved 40 individuals with ACL injuries treated either operatively or non-operatively. The sample met the criteria established in this study. Inclusion criteria included experiencing an ACL injury due to sports activities, and a time interval of more than six months from the ACL injury or ACL reconstruction surgery. This time period is a common measure used to assess knee function after ACL surgery (Kay et al., 2023; Nawasreh et al., 2018). Furthermore, participants were willing to participate in the study by signing a consent agreement to be included in the study. Meanwhile, exclusion criteria aimed to avoid influencing the reported knee function assessment results and causing bias in the relationship to psychological readiness, including experiencing other injuries besides the ACL injury after or before the ACL injury, ongoing signs of

inflammation in the knee joint, and range of motion still below 50% compared to the normal side. Furthermore, participants had health problems or conditions that interfered with giving consent to be included in the study, such as problems with the neuromuscular system or psychological problems, thus not representing the target population. Of course, the determination of research sample criteria is adjusted based on the research objectives so that the selected sample will be able to provide relevant and accurate information to answer the research questions.

Research Procedure

This study was conducted in July 2024, at the Faculty of Sport Science, Jakarta State University. Subjective knee symptoms and function were assessed using the IKDC 2000 subjective knee joint assessment form, and psychological readiness was assessed using the ACL-RSI questionnaire, translated into Indonesian using the Cross-Cultural Adaptation method (Yuliana & Kushartanti, 2020). The IKDC 2000 instrument consists of 18 questions, scored between 0 and 100, with higher scores indicating lower levels of symptoms and functional impairment and higher levels of sports activity (Kanakamedala et al., 2016). Meanwhile, the ACL-RSI questionnaire consists of 12 questions and was developed based on three components related to returning to sport (emotion, performance confidence, and risk assessment) and scored between 0 and 100, with higher scores indicating a more positive psychological state (Sadeqi et al., 2018). The research sample was asked to answer the IKDC 2000 questionnaire according to the symptoms and knee function currently felt, and to answer the ACL-RSI questionnaire according to their current psychological condition.

Statistic Analysis

This research analyzes data using Statistical Package for the Social Sciences (SPSS) Version 20 software. Descriptive statistics were used to analyze the baseline characteristics of the study sample. Data included the mean, maximum, minimum, and standard deviation, with 95% confidence intervals (CI). Data normality was tested using the Shapiro–Wilk test. A linearity test was performed to test the linear regression assumption. Furthermore, a simple linear regression test was used to determine the correlation coefficient and coefficient of determination of subjective knee symptoms and function, as well as psychological readiness, with a significance level of 0.05. Interpretation criteria for correlation strength r > 0.6 = strong.

RESULTS AND DISCUSSION

A total of 40 research samples participated and met the criteria set in this study. Consisting of 31 male samples (77.5%) and 9 female samples (22.5%). The research sample with operative treatment consisted of 26 samples (65%) and non-operative treatment consisted of 14 samples (35%). Characteristics data of the research sample are in **Table 1**.

Table 1. Research Subject Characteristics Data

No	Characteristics	Mean	Standard Deviation
1	Age	22.4	2.76
2	Time Between Surgery and Test (operative treatment)*	31.25	20.52
3	Time Between Injury and Test (non-operative treatment)*	28.77	18.06

Note: *units using months

The research sample of 40 with operative or non-operative treatment had an average IKDC score was 69.80 ± 12.53 (95% CI 65.79 to 73.81), and the average ACL-RSI was 58.43 ± 19.12 (95% CI 52.31 to 64.54). The assessment results are presented in **Table 2**.

Table 2. IKDC 2000 Score and ACL-RSI Score Results

No	Description	Mean	Maximum	Minimum	Standard Deviation	95% Confidence Interval of the Difference	
						Lower	Upper
1	IKDC 2000	69.80	95.40	19.5	12.53	65.79	73.82
2	ACL-RSI	58.43	97	21	19.12	52.31	64.54

A significant positive correlation was found between IKDC scores and ACL-RSI ($r = 0.611$, $p < 0.05$). Furthermore, to determine the extent of influence of subjective knee symptoms and function on psychological readiness to return to exercise post an ACL injury, a coefficient of determination test was conducted. The results showed an R Square value (coefficient of determination) of 0.373. This means that subjective knee symptoms and function have an influence or contribution to psychological readiness to return to exercise post an ACL injury of 37.3%. In addition, a correlation coefficient analysis was also conducted between scores IKDC 2000 and scores ACL-RSI. The results showed a figure of 0.61, which means that subjective knee symptoms and function have a positive and strong relationship with psychological readiness to return to exercise after an ACL injury. The results of the data analysis are presented in **Table 3**.

Table 3. Simple Linear Regression Test Results

Independent Variables	R (Correlation Coefficient)	R Squere (Determination Coefficient)	P-Value
IKDC 2000 Score (Subjective Knee Symptoms and Function)	0.611	0.373	0.000

Psychological readiness, although not the primary focus in ACL injury rehabilitation, has a significant impact on recovery outcomes after an ACL injury (Nedder et al., 2025). Nearly two-thirds (60% of athletes) are not psychologically prepared to return to sport after injury, and only 40% are ready to return to sport after an ACL injury (Juggath & Naidoo, 2024). Psychological readiness is defined as feelings of confidence and the absence of fear (Dluzniewski et al., 2024). The purpose of this study was to examine the relationship between subjective knee function with psychological readiness to return to sport after an ACL injury.

The Relationship between Knee Function and Psychology

A significant relationship was found between subjective knee symptoms and function as assessed by the IKDC 2000 and psychological readiness to return to sport after an ACL injury as evaluated by the ACL-RSI. Consistent with previous research, Psychological readiness that is highly correlated with returning to sport after ACL surgery is self-reported symptoms and function (Schilaty et al., 2023; Webster et al., 2018). Furthermore, subjective knee symptoms and function contributed 37.3% to psychological readiness to return to sport after an ACL injury. This supports previous research findings, where quadriceps and hamstring rate of torque development (RTD) have been identified as determinants of psychological readiness to return to sport after an ACL injury (Lee et al., 2023). Conversely, patients with lower functional assessment results, such as hamstring strength, jumping performance, and subjective knee function, had higher kinesiophobia (Norte et al., 2019).

The Role of Muscle Strength

To explain the relationship between knee symptoms and function and psychological readiness, as demonstrated in the results of this research and supported by several previous studies, when an ACL injury or post-ACL reconstruction occurs, common problems found are atrophy and deficits in quadriceps muscle strength and endurance (Csapo et al., 2019; Pamukoff et al., 2017). Furthermore, ACL injury causes deficits in hamstring muscle strength (Bouzekraoui Alaoui et al., 2025). Hamstring muscle strength that fails to recover can increase the risk of re-injury, possibly due to the inability to support and stabilize the knee joint during changes in frontal and transverse planes of movement (Buckthorpe et al., 2021). Deficits in hamstring and quadriceps muscle strength can also lead to the perception of joint instability during sports participation (Lee et al., 2023), and movement becomes impaired, thus affecting the athlete's movement quality (Buckthorpe, 2019). This is likely to be perceived negatively by athletes, thus altering ACL-RSI scores (Lee et al., 2023). This is in line with the statement that functional decline, such as knee instability after an ACL injury, can trigger negative psychological responses (Christino et al., 2016). When negative psychological responses arise, they can become a barrier to successful motor and functional recovery after ACL surgery (Du et al., 2022). Therefore, psychological readiness scores can be used as predictors of a person's safe return to sport post injury (Dluzniewski et al., 2024).

Implications for Rehabilitation

The return of knee function to its original state and the return of physical activity or sports as before the injury are signs of successful ACL injury treatment, both with operative and non-operative treatment. Therefore, understanding interventions or rehabilitation programs that can improve knee function is necessary to minimize the fear of ACL re-injury and increase psychological readiness to return to sport after an ACL injury. Rehabilitation programs have been shown to not only improve function but also improve athlete psychology (Meierbachtol et al., 2018). A recent study reported that patients who underwent symmetrical muscle function restoration 12 months after ACL reconstructionhad higher self-efficacy compared to patients who did not undergo knee function recovery (Nedder et al., 2025). Athletes who participated in advanced recovery training after ACL reconstruction surgery not only experienced improved knee function but also improved athlete psychology (Meierbachtol et al., 2018). Similarly, a more stable knee can provide a feeling of greater confidence and support better recovery outcomes (Christino et al., 2016). These data support the relationship between physical ability or performance and cognitive and emotional responses, such as be afraid and confidence, then contribute to athletes' perceptions of skill or success in sport participation (Ardern et al., 2013). Therefore, in ACL injury rehabilitation interventions, physical and psychological recovery are inseparable and are part of the achievement indicators, in order to optimize the results of the ACL injury rehabilitation program and increase the chances of a safe return to sport. Furthermore, knee symptoms and function, as well as psychological readiness, are crucial factors that can play a part in athletes' decisions to return to sport.

Our study has limitations, including the fact that the data analysis did not differentiate between operative and non-operative treatment groups. Future research could analyze these groups by operative and non-operative treatment, which would provide broader context for the findings. Another limitation is that this study only highlights the relationship between self-reported knee symptoms and function and psychological readiness to return to sport after ACL injury. Future research may identify factors such as quadriceps-hamstrings strength, biomechanics, neuromuscular control, and joint stability on psychological readiness to return to sport post-ACL injury.

CONCLUSION

Subjective knee function significantly influences psychological readiness to return to sport following ACL injury. Rehabilitation programs that enhance knee function may consequently improve athletes' confidence and reduce fear of re-injury.

ACKNOWLEDGEMENTS

The researchers would like to thank the student athletes from the Faculty of Sport Science, Jakarta State University, who agreed to be research subjects. They also thank the Faculty of Sport Science, Jakarta State University, for their contribution to this research, which provided a 2024 research grant to the researchers, making this research possible.

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