

## AWARENESS AND KNOWLEDGE OF ANTERIOR CRUCIATE LIGAMENT INJURY AMONG GENERAL POPULATION IN THE NORTHERN REGION, SAUDI ARABIA

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### Abstract

**Background:** Anterior cruciate ligament (ACL) injuries are common yet often under-recognized in the general population, leading to inadequate preventive measures and treatment. This study evaluates awareness and knowledge of ACL injuries among residents in the Northern Region of Saudi Arabia.

**Materials and methods:** A cross-sectional survey was conducted with 417 participants, utilizing a validated questionnaire to assess demographic characteristics, knowledge of ACL injury severity, risk factors, symptoms, treatment perceptions, and personal experiences with ACL injuries.

**Results:** The mean age of participants was 25.4 ± 7.5 years, with a predominance of males (79.6%). While 64.3% recognized ACL injuries as serious, 80.8% exhibited poor overall knowledge regarding the condition. Concerning the participants' perceptions of factors contributing to ACL injuries, unsuitable floor or shoes (45.6%), body collision (38.6%), over-exercising (36.9%), and the combined causes (46%) were identified. Only 3.8% reported prior ACL injuries; among them, 68.8% experienced severe intermittent pain, and 54.9% favored surgery as the best treatment option. The post-surgery satisfaction rate was 55.6%.

**Conclusions:** The study highlights significant gaps in awareness and knowledge of ACL injuries in the Northern Region of Saudi Arabia. Targeted educational interventions are crucial to enhance public understanding, promote preventive strategies, and improve health literacy concerning ACL injury management.

**Key words:** Awareness; ACL injury; risk factors; treatment perceptions; sports injuries

### Resumen

**Antecedentes:** Las lesiones del ligamento cruzado anterior (LCA) son comunes, pero a menudo no se reconocen lo suficiente en la población general, lo que lleva a medidas de prevención y tratamiento inadecuados. Este

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estudio evalúa la conciencia y el conocimiento de las lesiones del LCA entre los residentes de la región norte de Arabia Saudita.

**Materiales y métodos:** Se realizó una encuesta transversal con 417 participantes, utilizando un cuestionario validado para evaluar las características demográficas, el conocimiento de la gravedad de la lesión del LCA, los factores de riesgo, los síntomas, las percepciones del tratamiento y las experiencias personales con las lesiones del LCA.

**Resultados:** La edad media de los participantes fue de 25,4 ± 7,5 años, con predominio de varones (79,6%). Mientras que el 64,3% reconoció las lesiones del LCA como graves, el 80,8% mostró un conocimiento general deficiente sobre la afección. Con respecto a las percepciones de los participantes sobre los factores que contribuyen a las lesiones del LCA, se identificaron el suelo o los zapatos inadecuados (45,6%), la colisión corporal (38,6%), el ejercicio excesivo (36,9%) y las causas combinadas (46%). Solo el 3,8% informó lesiones previas del LCA; entre ellos, el 68,8% experimentó dolor intermitente intenso y el 54,9% favoreció la cirugía como la mejor opción de tratamiento. La tasa de satisfacción posoperatoria fue del 55,6%.

**Conclusiones:** El estudio destaca importantes lagunas en la concienciación y el conocimiento sobre las lesiones del LCA en la región norte de Arabia Saudita. Las intervenciones educativas específicas son cruciales para mejorar la comprensión pública, promover estrategias preventivas y mejorar la alfabetización sanitaria en relación con el tratamiento de las lesiones del LCA.

**Palabras clave:** Concientización; lesión del ligamento cruzado anterior; factores de riesgo; percepciones del tratamiento; lesiones deportivas

Conscientização e conhecimento sobre lesões do ligamento cruzado anterior entre a população em geral na região norte, Arábia Saudita

**Histórico:** Lesões do ligamento cruzado anterior (LCA) são comuns, porém frequentemente subdiagnosticadas na população, resultando em cuidados inadequados. Este estudo investiga a conscientização e o conhecimento sobre lesões do LCA entre residentes da Região Norte da Arábia Saudita.

**Materiais e métodos:** Foi realizada uma pesquisa transversal com 417 participantes, utilizando um questionário validado para avaliar características demográficas, conhecimento sobre a gravidade da lesão, fatores de risco, sintomas, percepções do tratamento e experiências pessoais.

**Resultados:** A média de idade dos participantes foi de 25,4 ± 7,5 anos, com

predominância de homens (79,6%). Embora 64,3% reconhecessem a gravidade das lesões do LCA, 80,8% apresentaram conhecimento geral deficitário. Entre os fatores de risco percebidos, mencionaram-se piso ou calçados inadequados (45,6%) e colisões (38,6%). Somente 3,8% relataram lesões anteriores do LCA; destes, 68,8% sofreram dor intensa e 54,9% preferiram cirurgia como tratamento, com uma taxa de satisfação pós-operatória de 55,6%.

**Conclusões:** O estudo evidencia a falta de conscientização e conhecimento sobre lesões do LCA na Região Norte da Arábia Saudita, destacando a necessidade de intervenções educativas específicas.

**Palavras-chave:** Conscientização; lesão do LCA; fatores de risco; percepções de tratamento; lesões esportivas

### Introduction

The "anterior cruciate ligament (ACL)" is an essential component of knee joint stability. This robust band of connective tissue originates from the posterior-medial region of the lateral femoral condyle and inserts into the anterior portion of the tibial intercondylar eminence [1]. The ACL's primary function is to restrict excessive displacement of the tibia forward in relation to the femur, thus maintaining proper knee biomechanics [2,3].

ACL injuries are among the most serious sports-related injuries, affecting both professional and recreational athletes. These injuries typically occur during activities that involve sudden changes in direction or abrupt stops, such as in football and basketball [4]. While there is variation between studies and populations, the general trend shows increasing rates of ACL reconstruction surgery over the past two decades in many developed countries, with current annual incidence typically falling in the range of 40-80 per 100,000 population [5-7]

This type of injury is a significant concern in sports medicine. It predominantly impacts young, athletic individuals, particularly those engaged in high-activity sports like football, basketball, and soccer [2]. ACL tears require prompt attention, as failing to address them can lead to further knee damage, including meniscal tears and early-onset osteoarthritis [8]. Over recent decades, there has been a marked increase in ACL injuries attributed to both rising sports participation rates and the inherent risks associated with these activities [9]. Notably, women participating in these sports are two to ten times more likely to sustain an ACL injury compared to their male counterparts [10], highlighting a significant gender disparity in injury risk [11].

While most ACL reconstructions (ACLRs) enhance the mechanical stability of the affected knee, the risk of a second injury upon returning to sports (RTS) remains a significant concern. Despite many athletes resuming normal knee function post-surgery, there is a rising trend of athletes discontinuing their sports participation following ACL reconstruction [12]. This global concern is reflected in the Saudi Arabian context. Two surveys conducted in the Albah and Aseer regions found that while the public possesses a reasonable understanding of ACL injury severity, there are notable gaps in knowledge regarding associated risk factors. This underscores a need for improved health education to enhance public awareness and reduce the occurrence of ACL injuries [13,14]. However, these studies do not provide a comprehensive picture of ACL injury awareness across Saudi Arabia, particularly in the Northern Border Region. Given the potential regional variations in sports participation, healthcare access, and public health education, it is crucial to assess awareness levels in different parts of the country. Therefore, this study aims to assess the awareness and understanding of ACL injuries among the general population in the "Northern Border region of Saudi Arabia," an area where this issue has not been previously explored. The study results will contribute to a more comprehensive understanding of ACL injury awareness in Saudi Arabia and inform targeted public health interventions.

**Material and methods**

**Study Design**

This cross-sectional study utilized an online questionnaire that was shared with participants through various social media platforms (WhatsApp, Twitter, Facebook) and distributed in multiple settings, including malls, university campuses, and community campaigns throughout the Northern Border region of Saudi Arabia.

**Sampling Technique**

The convenience sampling technique was employed in this study to select participants. The simple size was calculated using Epi Info (<https://www.openepi.com/SampleSize/SSCohort.htm>). A margin of error of 5%, an expected proportion of 50%, a confidence interval of 95%, and a population size of 383,051 were used, resulting in a minimum calculated sample size of 384.

In the final analysis, we enrolled 417 participants. This increase in the sample size beyond the minimum requirement was implemented to enhance the robustness and representativeness of the findings, ensuring a more comprehensive understanding of the studied population. By enrolling additional participants, we aimed to mitigate any potential sampling bias and improve the statistical power of our analyses.

**Inclusion and exclusion Criteria**

Eligible participants consisted of males and females aged between 18 and 65 years who consented to participate in the study. Individuals younger than 18 or older than 65 were excluded, as were those who declined to complete the questionnaire. Also, healthcare workers who work in a related field were excluded to avoid the impact of their previous knowledge on the estimation of actual population knowledge.

**Sampling tool**

An adapted version of the questionnaire used by Gharbawi et al., a previous study conducted in regions of Saudi Arabia, was used [15]. It consists of questions related to demographic information (such as age, sex, residence, marital status, occupation, and educational level), anthropometric data (i.e., height and weight), physical activity (sports participation and type of sports), knowledge/awareness of ACL injury, perceived risk factors for ACL injury, symptoms and management of ACL injury, post-injury assessment, post-surgery satisfaction, and physiotherapy follow-up [15].

**Ethical considerations**

This study had the ethical clearance of the "Local Committee of Bioethics (HAP-09-A-043) of the Northern Border University, Arar, Saudi Arabia" (approval # 35/24/H) dated 25/03/2024. After discussing the aim and objectives of the research, consent was obtained from all participants before taking part. Data confidentiality and participant anonymity were strictly maintained throughout the study. All collected data were anonymized and stored securely, ensuring that no identifiable information could be linked to individual participants. Access to the data was limited to authorized research personnel only, and all findings are presented in aggregate form to protect participant privacy further.

**Statistical analysis**

The collected data were analyzed using SPSS version 20. The Shapiro-Wilk test was employed to assess the normality of numerical data. The categorical data were presented as numbers and percentages. To analyze the relationships between pairs of variables (poor versus good knowledge), we utilized "Pearson's Chi-Square" test or "Fisher's exact" test where appropriate.

Statistical significance was established at a *p*-value less than 0.05.

**Results**

**Study participant characteristics**

A total of 417 participants with a mean age of 25.4 ±7.5 (17-62 years) were included in this study. They have a mean body mass index (BMI) of 23.7±3.9. The demographic characteristics of the study population are presented in **Table 1**. The majority of participants (67.1%) were under 25 years old, with males constituting 79.6% of the participants, indicating a predominantly young and male study population. Most participants (68.1%) were from Arar (the capital of the Northern Border area), single (72.4%), and students accounting for 52.8% of the participants (Table 1).

**Participant's physical activity**

The majority of participants (89.4%) reported engaging in sports activities, while only 10.6% did not participate in any sports (Table 2). Among those who practiced sports (n=373), the most popular activities were walking (83.9%) and jogging (66.0%).

Knowledge about anterior cruciate ligament injury seriousness

Regarding the perceived seriousness of ACL injuries among the 417 participants, the findings reveal that the majority of respondents (64.3%) recognized ACL injury as a serious condition. At the same time, more than a quarter of the participants (28.1%) were uncertain about the seriousness of ACL injuries, responding, "I don't know," highlighting the presence of a significant knowledge gap.

**Table 1.** Study participant's characteristics.

Study participant's characteristics (n=417)		Frequency (n)	Percent (%)
Age	< 25 years	280	67.1
	26 - 45 years	122	29.3
	> 45 years	15	3.6
Sex	Male	332	79.6
	Female	85	20.4
Residence	Arar	284	68.1
	Rafha	87	20.9
	Tarif	45	10.8
	Al-Owaigila	1	0.2
Marital status	Single	302	72.4
	Married	106	25.4
	Divorced	9	2.2
Occupation	Student	220	52.8
	Teacher	53	12.7
	Military	52	12.5
	Engineer	21	5
	Physician	11	2.6
	Retired	13	3.1
	I don't work	27	6.5
	Others	20	4.8

**Table 2.** Practice of sports activity among study participants (n=417).

	No (n, %)	Yes (n, %)
	44 (10.6%)	373 (89.4%)
<b>Which sports do you practice? (n=373)</b>		
Walking	60 (16.1%)	313 (83.9%)
Jogging	127 (34.0%)	246 (66.0%)
Running	205 (55.0%)	168 (45.0%)
Jumping	347 (93.0%)	26 (7.0%)
Swimming	326 (87.4%)	47 (12.6%)
Football	263 (70.5%)	110 (29.5%)
Volleyball	337 (90.6%)	35 (9.4%)
Weightlifting	277 (74.5%)	95 (25.5%)
Fitness exercise	225 (60.3%)	148 (39.7%)
Basketball	350 (93.8%)	23 (6.2%)

Data are presented as frequencies (n) and proportion (%).

**Knowledge about risk factors that cause anterior cruciate ligament injury and the related risk**

Concerning the participants' perceptions of factors contributing to ACL injuries and activities that may increase the risk of such injuries, participants most frequently identified unsuitable floor or shoes (45.6%), body collision (38.6%), over-exercising (36.9%), and the combined causes constitute about 46%. Interestingly, lack of knowledge about protective methods (35.0%), lack of preparation (27.6%), and lack of physical fitness (23.5%) were less frequently recognized as potential causes.

Regarding activities that may increase the risk of ACL injury, playing football (57.8%), old age (43.9%), and playing basketball (43.6%), were the most specified risk-related activities (Table 3).

**Knowledge about symptoms of anterior cruciate ligament injury**

Participants were asked about symptoms they associate with ACL injuries (Table 4). The most commonly recognized symptom was pain at night in the knee (53.7%). Other symptoms were identified by approximately one-third of participants, including instability (34.5%), crackles (34.1%), locking (33.3%), and swelling (31.4%). Fewer participants associated ACL injuries with stiffness (30.5%) or leg weakness (26.4%).

**Treatment perceptions for anterior cruciate ligament injury**

Participants were asked about methods to relieve symptoms and the best treatment options for ACL injuries (Table 5). The majority of participants identified prescribed medications as the most effective means of symptom relief (48.7%). Other options included rest (16.8%), ice application (11.8%),

**Table 3.** Perceived risk factors related to anterior cruciate ligament injury and its increased risk.

Which of the following factors do you believe can cause anterior cruciate ligaments? (n=417)	No (n, %)	Yes (n, %)
	Lack of knowledge about the protective methods	271 (65.0%)
Lack of preparation	302 (72.4%)	115 (27.6%)
Lack of physical fitness	319 (76.5%)	98 (23.5%)
Over-Exercising	263 (63.1%)	154 (36.9%)
Body collision	256 (61.4%)	161 (38.6%)
Unsuitable floor or shoes	227 (54.4%)	190 (45.6%)
Combined causes	225 (54.0%)	192 (46.0%)
Which of the following can increase the risk of anterior cruciate ligament injury? (n=417)		
Long walking	347 (83.2%)	70 (16.8%)
Long-standing	367 (88.0%)	50 (12.0%)
Long sitting	365 (87.5%)	52 (12.5%)
Going up and down stairs	331 (79.4%)	86 (20.6%)
Moving from sitting to standing position	343 (82.3%)	74 (17.7%)
Kneeling or squatting	377 (90.4%)	40 (9.6%)
Running	321 (77.0%)	96 (23.0%)
Playing football	176 (42.2%)	241 (57.8%)
Playing basketball	235 (56.4%)	182 (43.6%)
Playing paddle/tennis	276 (66.2%)	141 (33.8%)
Old age	234 (56.1%)	183 (43.9%)

Data are presented as frequencies (n) and proportion (%).

**Table 4.** Perceived symptoms of anterior cruciate ligament injury by study participants.

Which of the following symptoms do you believe a person with anterior cruciate ligament injury will have? (n=417)	No (n, %)	Yes (n, %)
Weakness of Leg	307 (73.6%)	110 (26.4%)
Swelling of knee	286 (68.6%)	131 (31.4%)
Instability of knee	273 (65.5%)	144 (34.5%)
Stiffness of Knee	290 (69.5%)	127 (30.5%)
Crackles in Knee	275 (65.9%)	142 (34.1%)
Locking of knee	278 (66.7%)	139 (33.3%)
Pain at night in the knee	193 (46.3%)	224 (53.7%)

Data are presented as frequencies (n) and proportion (%).

**Table 5.** Knowledge about relieving the symptoms of anterior cruciate ligament injury and its treatment, including physiotherapy.

Which of the following can relieve the symptoms of anterior cruciate ligament injury? (n=417)	Frequency (n)	Percent (%)
Rest	70	16.8
Put ice at the site of the injury	49	11.8
Put a hot compress at the site of the injury	35	8.4
Herbs and alternative medicine	18	4.3
Over-the-counter medications	42	10.1
Prescribed medications	203	48.7
Which of the following is the best treatment for Anterior Cruciate Ligament injuries? (n=417)		
Herbal and Alternative Medicine	26	6.2
Physiotherapy	104	24.9
Medication	58	13.9
Surgery	229	54.9
Do you think that physiotherapy is important after Anterior Cruciate Ligament surgery? (n=417)		
very important	232	55.6
Important	110	26.4
Less Important	60	14.4
Not Important	15	3.6

Data are presented as frequencies (n) and proportion (%).

**Table 6.** Description of pain among Participant's complained of Anterior Cruciate Ligament injury.

Description of pain among Participants complained of Anterior Cruciate Ligament injury (n=16)	Frequency (n)	Percent (%)
How many times have you complained of an anterior cruciate ligament injury?	once	9 (56.3)
	More than once	7 (43.8)
How would you describe the pain?	Mild Intermittent pain	3 (18.8)
	Mild Constant pain	2 (12.5)
	Severe Intermittent pain	11 (68.8)
Where is the location of pain?	Front of knee	5 (31.3)
	Inside the knee	10 (62.5)
	Behind of the knee	1 (6.3)
How would you describe your level of activity after the Anterior Cruciate Ligament injury?	Not affected	2 (12.5)
	Partially affected	12 (75)
	Severely affected	2 (12.5)
Did you undergo surgery to treat your Anterior Cruciate Ligament injury?	Yes	9 (56.3)
	No	7 (43.8)

Data are presented as frequencies (n) and proportion (%).

and over-the-counter medications (10.1%). Notably, only a small percentage considered hot compresses (8.4%) or alternative medicine (4.3%) effective. When asked about the best treatment for ACL injuries, surgery was favored by 54.9%, followed by physiotherapy (24.9%) and medication (13.9%). Herbal and alternative medicine received the least support (6.2%).

**Pain profiles and treatment experiences among participants with a history of ACL Injury**

A small proportion of the study respondents had experienced ACL injuries, with only 3.8% (n=16) reporting that they had complained of such an injury. Among these participants, 43.8% reported experiencing injury more than once, 68.8% described their pain as severe and intermittent, and about two-thirds of them located this pain inside the knee (Table 6). In terms of activity level following their ACL injury, 75.0% indicated that they were partially affected, while 12.5% reported being not affected at all. Furthermore, over half of the participants (56.3%) underwent surgery to address their ACL injury, whereas 43.8% (n=7) did not require surgical intervention (Table 6). The most significant reason for avoiding surgery in the latter subgroup (n=7) was the belief that it was unnecessary (57.1%), followed by concerns about surgery-associated

complications (28.6%) and the high cost of surgery for just one participant (14.3%).

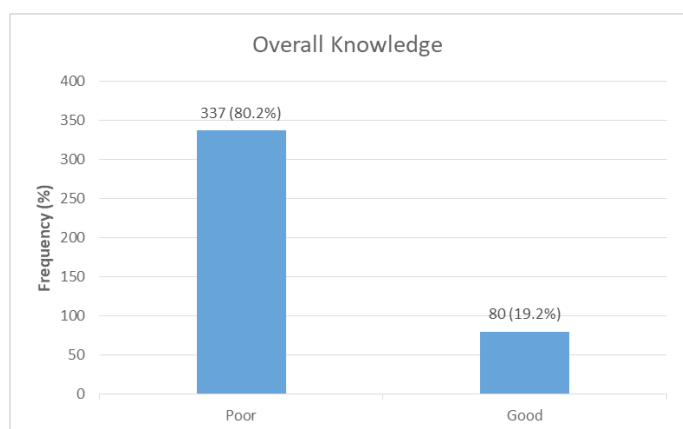
Among the nine participants who underwent surgery for their ACL injury, the level of satisfaction with the surgical outcomes was notably positive. About 55.6% reported being completely satisfied with the surgery results, while 44.4% (n=4) indicated that they were mostly satisfied. In terms of following a post-surgery physiotherapy program, 66.7% confirmed that they adhered to the program, whereas 33.3% reported following the program only partially.

**Overall knowledge regarding anterior cruciate ligament injury among study participants**

An assessment of respondents' overall knowledge regarding ACL injury reveals that most of the participants (80.8%; n=337) have poor knowledge and only 19.2% (n=80) demonstrated a good level of knowledge (Figure 1).

**Association of demographic data with overall knowledge of ACL injury**

The analysis of the demographic data in relation to overall knowledge of ACL injury revealed that although knowledge levels varied among age groups, particularly with 65.9% of participants under 25 having poor knowledge, this difference did not show statistical significance (p = 0.130). A significant gender disparity was identified, as males exhibited better knowledge (p = 0.000).



**Figure 1.** Distribution of overall knowledge related to anterior cruciate ligament injury among study participants.

**Table 7.** Association of demographic data with overall knowledge.

Demographic data	The overall participants' Knowledge					p-value
		Poor		Good		
		n	%	n	%	
Age	< 25 years	222	65.90%	58	72.50%	0.13
	26 - 45 years	100	29.70%	22	27.50%	
	> 45 years	15	4.50%	0	0.00%	
Gender	Male	255	75.70%	77	96.20%	0.000*
	Female	82	24.30%	3	3.80%	
Residence	Arar	230	68.20%	54	67.50%	0.796
	Rafha	68	20.20%	19	23.80%	
	Tarif	38	11.30%	7	8.80%	
	Al-Owaigila	1	0.30%	0	0.00%	
Marital status	Single	242	71.80%	60	75.00%	0.749
	Married	87	25.80%	19	23.80%	
	Divorced	8	2.40%	1	1.20%	
Occupation	Student	175	51.90%	45	56.20%	0.109
	Teacher	46	13.60%	7	8.80%	
	Military	42	12.50%	10	12.50%	
	Engineer	15	4.50%	6	7.50%	
	Physician	7	2.10%	4	5.00%	
	Retired	13	3.90%	0	0.00%	
	I don't work	25	7.40%	2	2.50%	
	Others	14	4.20%	6	7.50%	

Data are presented as frequencies (n) and proportion (%). Pearson's Chi-Square test or "Fisher's exact" test was applied appropriately. The level of significance was set at p-value < 0.05.

Geographically, knowledge levels did not significantly differ among participants from various regions (p = 0.796), with the majority from Arar displaying poor knowledge (68.2%). Marital status likewise showed no significant relation to knowledge levels (p = 0.749), and most single participants (71.8%) reported poor knowledge. Occupationally, students represented a considerable segment, with 51.9% having poor knowledge, although no notable differences among other professions were observed (p = 0.109) (Table 7).

**Discussion**

The current study aimed to evaluate the awareness/knowledge of anterior cruciate ligament injury among the general population in the Northern Region of Saudi Arabia. Our findings revealed that a significant majority of participants displayed poor knowledge regarding ACL injuries, with 80.8% categorized as having inadequate understanding. This substantial gap in knowledge is concerning, particularly given the increasing incidence of ACL injuries in sports and physical activities. Previous studies have shown that increased awareness and education about such injuries can lead to improved preventive practices and better health outcomes [16-18].

Demographic analysis indicated a significant association between gender and overall knowledge, with males exhibiting higher levels of knowledge compared to females. This finding aligns with previous research that noted gender differences in health-related knowledge and attitudes. However, it's important to realize that gender differences in health knowledge can vary depending on the specific health topic and cultural context [19]. The predominance of male participants in our study (79.6%) could indeed influence the overall results. This underscores the need for balanced gender representation in health research and targeted educational initiatives for both genders [20].

Participant awareness of the mechanisms that could lead to ACL injuries further underscores the knowledge gap. Although a majority recognized factors such as unsuitable flooring and body collisions, less attention was paid to protective measures and physical fitness, suggesting a lack of comprehensive education on prevention. Studies have demonstrated that enhancing knowledge about injury prevention strategies can significantly reduce the risk of ACL injuries, particularly in high-risk sports activities [21-23].

Pain profiles among participants with a history of ACL injury revealed that a majority described their pain as severe and intermittent, emphasizing the debilitating nature of the injury. Despite this, only a small percentage of respondents (3.8%) reported a prior ACL injury. This finding aligns with previous studies that indicated the risk of ACL injuries is relatively low in the general population compared to athletes [15,24,25]. Moreover, the decision against surgical intervention was predominantly due to the belief that surgery was unnecessary, along with concerns about potential complications and financial implications. These findings reflect the need for better communication and counseling from healthcare providers regarding the management of ACL injuries [26].

Satisfaction levels following surgical interventions were reported positively, with 55.6% of participants completely satisfied with their surgical outcomes. These results indicate that when surgical options are pursued, they can lead to satisfactory recovery and improvements in quality of life, reinforcing the value of timely and appropriate treatment options [27]. However, adherence to post-operative physiotherapy was not universal, with one-third of participants reporting partial compliance. This finding raises concerns about the importance of reinforcing adherence to rehabilitation protocols to maximize recovery outcomes, as previous research indicates that compliance is key to successful rehabilitation after ACL surgery [28-31].

The findings of this study underscore the pressing need for education and awareness campaigns aimed at enhancing the general public's knowledge of ACL injuries, risk factors, and effective management strategies [32]. By addressing these gaps, healthcare providers can contribute to improved awareness, prevention, and overall health outcomes related to ACL injuries in the Northern Region of Saudi Arabia. Future studies should explore the effectiveness of targeted interventions and educational programs to increase knowledge and encourage injury prevention strategies within this population.

**Conclusions and future perspectives**

This study reveals significant gaps in awareness and understanding of anterior cruciate ligament injuries among the general population in the Northern Region of Saudi Arabia. The findings indicate that while some recognize the seriousness of ACL injuries, a large portion of respondents needed to demonstrate better knowledge regarding the injury's risk factors, symptoms, and effective treatment options. Given the prevalence of sports activities in this population, targeted educational initiatives are essential to enhance public knowledge about ACL injuries and their implications. These initiatives should aim to inform individuals about the significance of preventive measures, appropriate treatment pathways, and the importance of rehabilitation following injuries. By fostering a better understanding of ACL injuries,

healthcare providers can significantly contribute to the reduction of injury incidence and improve overall health outcomes within the community. Future research should explore the effectiveness of educational programs in raising awareness and knowledge of ACL injuries and assess the long-term impacts of enhanced awareness on injury prevention behaviors.

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#### References

- Abulhasan, J.F.; Grey, M.J. Anatomy and physiology of knee stability. *Journal of Functional Morphology and kinesiology* 2017, 2, 34.
- Lam, M.H.; Fong, D.T.; Yung, P.; Ho, E.P.; Chan, W.Y.; Chan, K.M. Knee stability assessment on anterior cruciate ligament injury: Clinical and biomechanical approaches. *Sports medicine, arthroscopy, rehabilitation, therapy & technology: SMARTT* 2009, 1, 20, doi:10.1186/1758-2555-1-20.
- Carlson, V.R.; Sheehan, F.T.; Boden, B.P. Video Analysis of Anterior Cruciate Ligament (ACL) Injuries: A Systematic Review. *JBS reviews* 2016, 4, e5, doi: 10.2106/jbjs.rvw.15.00116.
- Gans, I.; Retzky, J.S.; Jones, L.C.; Tanaka, M.J. Epidemiology of Recurrent Anterior Cruciate Ligament Injuries in National Collegiate Athletic Association Sports: The Injury Surveillance Program, 2004-2014. *Orthopaedic journal of sports medicine* 2018, 6, 2325967118777823, doi:10.1177/2325967118777823.
- Herzog, M.M.; Marshall, S.W.; Lund, J.L.; Pate, V.; Mack, C.D.; Spang, J.T. Trends in Incidence of ACL Reconstruction and Concomitant Procedures Among Commercially Insured Individuals in the United States, 2002-2014. *Sports health* 2018, 10, 523-531, doi:10.1177/1941738118803616.
- Zbrojkiewicz, D.; Vertullo, C.; Grayson, J.E. Increasing rates of anterior cruciate ligament reconstruction in young Australians, 2000-2015. *Medical Journal of Australia* 2018, 208, 354-358, doi:10.5694/mja17.00974.
- Paudel, Y.R.; Sommerfeldt, M.; Voaklander, D. Increasing incidence of anterior cruciate ligament reconstruction: a 17-year population-based study. *Knee Surgery, Sports Traumatology, Arthroscopy* 2023, 31, 248-255, doi:10.1007/s00167-022-07093-1.
- Levine, J.W.; Kiapour, A.M.; Quatman, C.E.; Wordeman, S.C.; Goel, V.K.; Hewett, T.E.; Demetropoulos, C.K. Clinically relevant injury patterns after an anterior cruciate ligament injury provide insight into injury mechanisms. *The American journal of sports medicine* 2013, 41, 385-395, doi:10.1177/0363546512465167.
- Pfeifer, C.E.; Beattie, P.F.; Sacko, R.S.; Hand, A. RISK FACTORS ASSOCIATED WITH NON-CONTACT ANTERIOR CRUCIATE LIGAMENT INJURY: A SYSTEMATIC REVIEW. *International journal of sports physical therapy* 2018, 13, 575-587.
- The female ACL: ¿Why is it more prone to injury? *Journal of orthopaedics* 2016, 13, A1-4, doi:10.1016/s0972-978x(16)00023-4.
- Lin, C.Y.; Casey, E.; Herman, D.C.; Katz, N.; Tenforde, A.S. Sex Differences in Common Sports Injuries. *PM & R: the journal of injury, function, and rehabilitation* 2018, 10, 1073-1082, doi: 10.1016/j.pmrj.2018.03.008.
- Grimm, N.L.; Jacobs, J.C., Jr.; Kim, J.; Denney, B.S.; Shea, K.G. Anterior Cruciate Ligament and Knee Injury Prevention Programs for Soccer Players: A Systematic Review and Meta-analysis. *The American journal of sports medicine* 2015, 43, 2049-2056, doi:10.1177/0363546514556737.
- Alzahrani, F.A.M.; Alzahrani, R.A.M.; Alghamdi, A.A.; Alghamdi, A.H.A.; Alghamdi, S.Y.S.; Alghamdi, M.M.H.; Alamri, A.M.A. Awareness about Cruciate Ligament Injury among General Population of Albaha City. *The Egyptian Journal of Hospital Medicine* 2017, 69, 1614-1623, doi:10.12816/0040109.
- Shaker, A.; Alshehri, M.S.M.; Alshehri, F.S.; Alshahrani, M.M.; Alshahrani, M.S.; Alamri, O.M. Knowledge and awareness toward anterior cruciate ligament (ACL) injury among population of Aseer region, Saudi Arabia. *Journal of family medicine and primary care* 2019, 8, 812-817, doi: 10.4103/jfmpc.jfmpc\_27\_19.
- Gharbawi, E.S.; Al-Mubaddil, M.S.; Al-Moaibed, G.F.; Al-Shammri, S.O. Awareness and knowledge about anterior cruciate ligament injury among the general adult population of Saudi Arabia. *Journal of family medicine and primary care* 2020, 9, 379-384, doi: 10.4103/jfmpc.jfmpc\_877\_19.
- Franklin, R.C.; Sleet, D.A. Injury prevention and health promotion: A global perspective. *Health promotion journal of Australia: official journal of Australian Association of Health Promotion Professionals* 2018, 29, 113-116, doi:10.1002/hpja.191.
- Padua, D.A.; DiStefano, L.J.; Hewett, T.E.; Garrett, W.E.; Marshall, S.W.; Golden, G.M.; Shultz, S.J.; Sigward, S.M. National Athletic Trainers' Association Position Statement: Prevention of Anterior Cruciate Ligament Injury. *Journal of athletic training* 2018, 53, 5-19, doi:10.4085/1062-6050-99-16.
- Bradsell, H.; Frank, R.M. Anterior cruciate ligament injury prevention. *Annals of joint* 2022, 7.
- Ek, S. Gender differences in health information behaviour: a Finnish population-based survey. *Health Promotion International* 2013, 30, 736-745, doi:10.1093/heapro/dat063.
- Anaam, M.S.; Alsahali, S. Gender Differences in Knowledge, Attitudes, and Practices toward COVID-19 in Saudi Arabia: A Cross-Sectional Study. *Diseases (Basel, Switzerland)* 2023, 11, doi:10.3390/diseases11020063.
- Sadoghi, P.; von Keudell, A.; Vavken, P. Effectiveness of anterior cruciate ligament injury prevention training programs. *The Journal of bone and joint surgery. American volume* 2012, 94, 769-776, doi:10.2106/jbjs.k.00467.
- Monajati, A.; Larumbe-Zabala, E.; Goss-Sampson, M.; Naclerio, F. The Effectiveness of Injury Prevention Programs to Modify Risk Factors for Non-Contact Anterior Cruciate Ligament and Hamstring Injuries in Uninjured Team Sports Athletes: A Systematic Review. *PLoS One* 2016, 11, e0155272, doi: 10.1371/journal.pone.0155272.
- Bradsell, H.; Frank, R.M. Anterior cruciate ligament injury prevention. *Annals of Joint* 2021, 7.
- Waldén, M.; Häggglund, M.; Werner, J.; Ekstrand, J. The epidemiology of anterior cruciate ligament injury in football (soccer): a review of the literature from a gender-related perspective. *Knee surgery, sports traumatology, arthroscopy: official journal of the ESSKA* 2011, 19, 3-10, doi:10.1007/s00167-010-1172-7.
- Alghamdi, W.; Alzahrani, A.; Alsawaydi, A.; Alzahrani, A.; Albaqqar, O.; Fatani, M.; Alaidarous, H. Prevalence of cruciate ligaments injury among physical education students of Umm Al-Qura university and the relation between the dominant body side and ligament injury side in non-contact injury type. *Am J Med Med Sci* 2017, 7, 14-19.
- Filbay, S.R.; Grindem, H. Evidence-based recommendations for the management of anterior cruciate ligament (ACL) rupture. *Best practice & research. Clinical rheumatology* 2019, 33, 33-47, doi: 10.1016/j.berh.2019.01.018.
- Kronzer, V.L.; Jerry, M.R.; Ben Abdallah, A.; Wildes, T.S.; McKinnon, S.L.; Sharma, A.; Avidan, M.S. Changes in quality of life after elective surgery: an observational study comparing two measures. *Quality of life research: an international journal of quality of life aspects of treatment, care and rehabilitation* 2017, 26, 2093-2102, doi:10.1007/s11136-017-1560-2.
- Brewer, B.W.; Cornelius, A.E.; Van Raalte, J.L.; Tennen, H.; Armeli, S. Predictors of adherence to home rehabilitation exercises following anterior cruciate ligament reconstruction. *Rehabilitation psychology* 2013, 58, 64-72, doi:10.1037/a0031297.
- Alfonso Mantilla, J.I. Sport readaptation and return to play in high performance. From laboratory to the field: A systematic review. *Revista Iberoamericana de Ciencias de la Actividad Física y el Deporte* 2022, 11, 66-84, doi:10.24310/riccafd.2022.v11i3.15381.
- Kotsifaki, R.; Korakakis, V.; King, E.; Barbosa, O.; Maree, D.; Pantouveris, M.; Bjerregaard, A.; Luomajoki, J.; Wilhelmsen, J.; Whiteley, R. Aspetar clinical practice guideline on rehabilitation after anterior cruciate ligament reconstruction. *British Journal of Sports Medicine* 2023, 57, 500, doi:10.1136/bjsports-2022-106158.
- Gharbawi, M.R.; Pundkar, A.; Dhanwani, Y.; Chandanwale, R.; Jaiswal, A.M. Navigating Post-operative Challenges: A Comprehensive Review of Complications Following Anterior Cruciate Ligament (ACL) Tear Surgery. *Cureus* 2024, 16, e67768, doi:10.7759/cureus.67768.
- San Martín Peña, J.; Picabea Arburu, J.M. Work proposals for injuries reduction in lower limbs in basketball. *Systematic review: Systematic review. Revista Iberoamericana de Ciencias de la Actividad Física y el Deporte* 2022, 11, 141-153, doi:10.24310/riccafd.2022.v11i1.13559.