

# Arabic Version of the Short Anterior Cruciate Ligament–Return to Sport After Injury Scale: Translation, Cross-cultural Adaptation, and Validation

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**Background:** The short version of the Anterior Cruciate Ligament–Return to Sport After Injury (ACL-RSI) scale is a self-reported questionnaire developed to assess the psychological readiness of patients to return to sports after ACL reconstruction (ACLR).

**Purpose:** To translate, cross-culturally adapt, and validate the short version of the ACL-RSI scale into the Arabic language (ACL-RSI-Ar).

**Study Design:** Cohort study (diagnosis); Level of evidence, 2.

**Methods:** The original short version of the ACL-RSI scale was forward and backward translated, cross-culturally adapted, and validated following international standardized guidelines. Sixty patients who participated in sports activities and underwent ACLR completed the ACL-RSI-Ar, the International Knee Documentation Committee (IKDC) Subjective Knee Evaluation Form, and Knee injury and Osteoarthritis Outcome Score (KOOS) scales. To assess test-retest reliability, 34 participants completed the ACL-RSI-Ar scale twice. Statistical tests were conducted to test the internal consistency, reliability, and construct and discriminant validity of the ACL-RSI-Ar scale.

**Results:** The ACL-RSI-Ar showed adequate internal consistency (Cronbach alpha = 0.734) and excellent test-retest reliability (intraclass correlation coefficient, 0.871). The ACL-RSI-Ar was strongly correlated with the IKDC (Spearman  $\rho = 0.515$ ,  $P < .001$ ) and weakly to strongly correlated with all KOOS subscales (Spearman  $\rho = 0.247$ - $0.590$ ,  $P < .05$ ). Patients who returned to sports had significantly higher scores on the ACL-RSI-Ar scale when compared with those who did not return to sports ( $P = .001$ ).

**Conclusion:** The short ACL-RSI-Ar scale, as translated, was internally consistent, reliable, and valid for evaluating psychological readiness to return to sports after ACLR in Arabic-speaking patients.

**Keywords:** ACL reconstruction; ACL-RSI; return to sports; psychological readiness; translation

Anterior cruciate ligament (ACL) rupture is a devastating injury and one of the most common sports-related knee injuries in the United States and Europe.<sup>26,27</sup> In Saudi Arabia, ACL injury is also a common knee injury that affects young individuals, with the most cases occurring during sports.<sup>34</sup> Many athletes who desire to return to their preinjury level of sports participation choose to undergo ACL reconstruction (ACLR).<sup>14</sup> However, the outcomes after ACLR are variable and may not meet patient expectations. For example, a previous meta-analysis<sup>4</sup> of 69 studies found that only 65% of patients had returned to their preinjury level of sports activity and only 55% had returned to

competitive sports participation. In addition, existing literature<sup>29</sup> reported that up to 31% of patients sustained a second ACL injury within 2 to 15 years after ACLR.

Various studies<sup>13,23,39</sup> have investigated the influence of multiple factors on poor outcomes after ACLR. Physical factors, such as muscle strength and neuromuscular function, alone cannot predict the ability of patients to return to sports.<sup>3,20,25</sup> This has promoted an investigation into other factors that may affect return to sports.<sup>3</sup> In recent years, for instance, more attention has been paid to psychological factors post-ACLR.<sup>28</sup> Patients who undergo ACLR often report negative emotions, anxiety, and fear of movement and reinjury.<sup>9,24</sup> These psychological factors can adversely affect the recovery and the ability to return to sports.<sup>9,24</sup> Previous reviews<sup>4,11,13,23,39</sup> demonstrated that the psychological status of athletes may influence their ability to

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successfully return to sports. Therefore, evaluating and addressing psychological readiness of patients to return to sports is an important element that should be incorporated during rehabilitation and included as one of the return-to-sports clearance criteria in patients with ACLR.<sup>11,13</sup>

The Anterior Cruciate Ligament–Return to Sport After Injury (ACL-RSI) scale is a self-reported questionnaire developed to assess the psychological readiness of patients to return to sports after ACLR.<sup>37,40</sup> The long version of this scale consists of 12 items that evaluate emotions, confidence in performance, and risk appraisal of patients who are willing to return to sports after ACLR.<sup>40</sup> The ACL-RSI scale has shown good reliability and validity.<sup>40</sup> In recent years, several studies<sup>4,19,25</sup> have found that a poor score on the ACL-RSI scale is associated with a decreased rate to return to sports after ACLR. In addition, poor psychological readiness has been shown to predict the risk of a second ACL injury.<sup>21,22</sup> Collectively, these findings highlight the importance of using the ACL-RSI scale for the assessment of psychological readiness when making clinical decisions for return to sports.

The long version of the ACL-RSI scale was developed in 2008 and is frequently used in both research and clinical settings in English-speaking countries.<sup>40</sup> This scale has been translated, cross-culturally adapted, and validated into many languages, such as Swedish,<sup>18</sup> French,<sup>7</sup> Turkish,<sup>16</sup> simplified Chinese,<sup>8</sup> and Spanish.<sup>31</sup> With a busy clinical environment, the same authors<sup>40</sup> who developed this scale recently developed a short version of the ACL-RSI scale, which has shown good reliability and validity.<sup>38</sup> Furthermore, they concluded that the short version of the ACL-RSI scale has psychometric properties equal to those of the full version.

We believe that translation of this short version of the ACL-RSI scale into the Arabic language will help clinicians in Arabic-speaking countries to use the scale in clinical decision-making as well as to facilitate multinational and multicultural research projects. Therefore, this study aimed to translate, cross-culturally adapt, and validate the short version of the ACL-RSI scale into Arabic (ACL-RSI-Ar).

## METHODS

### Translation and Cross-cultural Adaptation

Translation and cross-cultural adaptation of the short version of the ACL-RSI scale was performed according to the Guidelines for the Process of Cross-Cultural Adaptation of

Self-Report Measures.<sup>5</sup> The scale was translated into Arabic by 2 physical therapists (M.A., Y.A.) who are native Arabic speakers with excellent knowledge of the English language. The original short version and the 2 translations were reviewed and discussed with a third bilingual physical therapist (H.A.) to correct any conceptual errors or discrepancies and to establish 1 Arabic version of the scale. The physical therapists involved in the translation process are faculty members and researchers working in the orthopaedic research field. During a consensus meeting, an initial version of the ACL-RSI-Ar scale was confirmed. The scale was then back-translated to English by 2 native English speakers with a good knowledge of the Arabic language who were not aware of the original version of the scale or the purpose of the study. A consensus meeting was then held by the translators to finalize the final Arabic version of the scale. In the final stage, a pilot study was conducted on 5 patients who underwent ACLR at least 3 months postsurgically. These patients were asked to complete the ACL-RSI-Ar scale and comment on the content of the questions and on how to revise them if necessary.

### Participants

The sample size was determined based on previous recommendations, which indicate at least 10 participants for each question in a questionnaire.<sup>6</sup> The short version of the ACL-RSI scale consists of 6 questions. Therefore, a minimum of 60 patients with ACLR would be required to conduct this study. The inclusion criteria for this study were participants who (1) were aged 16 years or older, (2) underwent primary ACLR with or without associated meniscal injury, (3) were a minimum of 3 months postsurgery at the time of participation in the study, (4) participated in at least recreational activity before the ACL injury ( $\geq 5$  on the Tegner Activity Level Scale), and (5) were able to read and write in Arabic. Patients were excluded if they had a history of knee injuries before the current ACL injury; had bilateral ACL injuries, multiligament reconstruction, and/or articular cartilage repair; or were not planning to return to sports. This study was approved by the research ethics committee of Majmaah University. The procedures of this study were explained to potential participants, and informed consent was obtained before participation in the study. Then, participants were asked to complete an online questionnaire (Google Forms). For test-retest reliability, participants were asked to complete the same questionnaires again

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Ethical approval for this study was obtained from Majmaah University (reference No. HA-01-R-088).

within a month of the first attempt. Participants were enrolled into the study between April and December 2019.

### Self-Reported Questionnaires

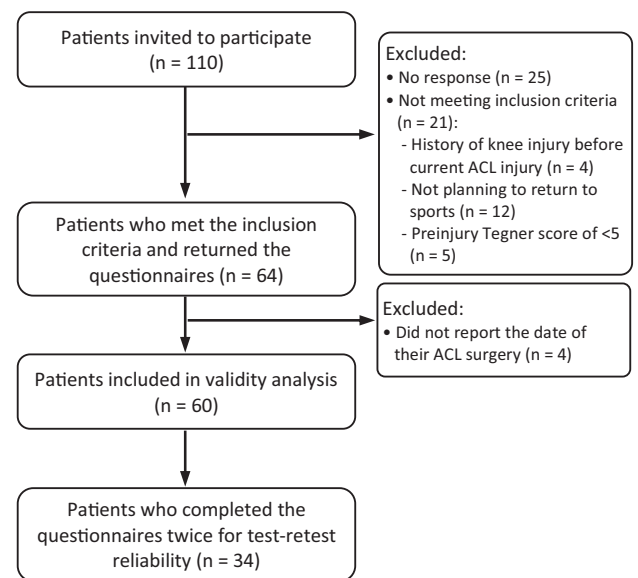
The short version of the ACL-RSI scale was developed to assess 3 domains of return to sports: emotions, confidence in one's performance, and risk evaluation.<sup>38</sup> The ACL-RSI score ranges from 0 to 100, with higher scores representing a greater psychological readiness to return to sports.<sup>38</sup> This scale has been shown to be valid and reliable.<sup>38</sup>

The construct validity of the ACL-RSI-Ar scale was assessed against the Arabic versions of the International Knee Documentation Committee (IKDC) Subjective Knee Form<sup>2</sup> and the Knee injury and Osteoarthritis Outcome Score (KOOS).<sup>1</sup> The Arabic versions of these reference questionnaires have been validated. The IKDC scale is an 18-item self-reported questionnaire and is used to assess symptoms, sports activity, and function in patients with knee injuries. The IKDC score ranges from 0 to 100, with a score of 100 indicating no limitation with activities of daily living or sports activity and the absence of symptoms. The KOOS scale contains 42 items to evaluate knee function in 5 subscales: symptoms (7 items), pain (9 items), activities of daily living (17 items), sports and recreation function (5 items), and knee-related quality of life (QoL) (4 items). The score on each subscale ranges from 0 to 100, with 100 representing no knee problems.

### Statistical Analysis

Descriptive analyses were presented as means, standard deviations (SDs), and percentages. We analyzed the ACL-RSI-Ar score distribution to determine the presence of floor and ceiling effects. These effects correspond to the percentage of participants with the lowest (0) or highest (100) scores. To rule out any compromise on the reliability and validity of the scale, the percentage of participants with the lowest and highest scores should not exceed 15%.<sup>35</sup> The internal consistency between the items on the ACL-RSI-Ar scale was assessed using the Cronbach alpha test.<sup>35</sup> A Cronbach alpha value between 0.70 and 0.95 indicates adequate internal consistency.<sup>35</sup> The test-retest reliability of the ACL-RSI-Ar scale was evaluated by 2-way random intraclass correlation coefficients (ICCs) for absolute agreement with corresponding 95% confidence intervals (95% CIs).<sup>35</sup> The reliability was considered excellent if  $ICC \geq 0.75$ ; good if  $0.40 \leq ICC < 0.75$ , and poor if  $ICC < 0.40$ . The absolute measurement error of the scale was expressed by the standard error of measurement [ $SEM = SD_{\text{pooled standard deviation}} \times \sqrt{1 - ICC}$ ]. The smallest detectable change for the individual score ( $SDC_{\text{individual}} = 1.96 \times \sqrt{2} \times SEM$ ). Then, the smallest detectable change for the group score ( $SDC_{\text{group}} = SDC_{\text{individual}}/\sqrt{n}$ ).<sup>35</sup>

The Spearman  $\rho$  correlation was used to evaluate the construct validity between the ACL-RSI-Ar and IKDC scales, KOOS subscales, and KOOS total scores. The correlation was classified as strong ( $\rho \geq 0.5$ ), medium



**Figure 1.** Flowchart illustrating participants' enrollment. ACL, anterior cruciate ligament.

( $0.3 \leq \rho < 0.5$ ), or weak ( $\rho < 0.3$ ).<sup>10</sup> An independent-sample *t* test was performed to test the discriminant validity between participants who had returned to sports participation (Tegner  $\geq 5$ ) and those who had not returned to sports (Tegner  $< 5$ ). All analyses were performed using SPSS software (Version 26.0; IBM).

## RESULTS

### Cross-cultural Adaptation

Translation of the short version of the ACL-RSI scale into Arabic and the subsequent back-translation were conducted without any major linguistic or grammatical problems. The questions were clear and easy to understand, and no specific cultural adaptations were recommended during the translation process.

### Study Participants

A total of 110 patients with ACLR were invited to participate in the study. Of these patients, 25 did not respond, and another 21 patients did not meet the inclusion criteria. The remaining patients ( $n = 64$ ) met the inclusion criteria and completed the questionnaires. Four of 64 patients did not report the date of their ACL surgery; therefore, their data were excluded from the analysis. The final number of participants included in the analysis was 60 (Figure 1).

All participants were men, with the majority ( $n = 56$ ) playing soccer before the ACL injury. The average time from surgery to the time of participating in the study was  $11.22 \pm 3.84$  months (range, 4-20 months). The demographic and clinical characteristics of the participants are presented in Table 1.

TABLE 1  
Demographic and Clinical Characteristics of the  
Participants (N = 60)<sup>a</sup>

Variable	Value
Age, y	31.38 ± 7.23
Male sex	60
Height, cm	171.14 ± 14.08
Weight, kg	85.33 ± 23.20
Time since surgery, mo	11.22 ± 3.84
Type of activity	
Soccer	56
Volleyball	1
Martial arts	1
Running	1
Cycling	1
ACL-RSI-Ar scale, %	52.28 ± 21.58
IKDC scale, %	72.18 ± 18.01
KOOS Symptoms, %	84.41 ± 13.18
KOOS Pain, %	87.63 ± 13.30
KOOS ADL, %	91.21 ± 12.34
KOOS Sport, %	72.67 ± 25.08
KOOS QoL, %	53.85 ± 22.73
Total KOOS, %	77.95 ± 14.92

<sup>a</sup>Data are presented as mean ± SD or No. ACLR, anterior cruciate ligament reconstruction; ACL-RSI-Ar, Arabic version of the Anterior Cruciate Ligament–Return to Sport After Injury scale; ADL, activities of daily living; IKDC, International Knee Documentation Committee scale; KOOS, Knee injury and Osteoarthritis Outcome Score; QoL, quality of life.

### Floor and Ceiling Effects

Floor and ceiling effects were assessed using data from 60 participants with ACLR. The average total score on the ACL-RSI-Ar scale was 52.28 ± 21.58 (range, 0-90). Only 5% (n = 3) of the participants presented with a score lower than 10 on the ACL-RSI-Ar scale, and none of the participants scored higher than 90.

### Internal Consistency

The internal consistency of the ACL-RSI-Ar scale based on the strength of the correlation among the 6 items was adequate, with a Cronbach alpha of 0.734.

### Reliability

The test-retest reliability of the ACL-RSI-Ar scale was excellent, with an ICC of 0.871 (95% CI, 0.743-0.935;  $P < 0.001$ ). The SEM was 7.24, the SDC<sub>individual</sub> was 20.08, and the SDC<sub>group</sub> was 3.44. Reliability was assessed in 34 patients who completed the questionnaire twice, with an average of 9.38 ± 6.35 days between tests. The average scores of the ACL-RSI-Ar scale were 49.80 ± 20.02 at the first test and 52.01 ± 20.32 at the second test (Table 2).

### Construct Validity

The results showed that the ACL-RSI-Ar scale had a significant positive correlation with the IKDC scale ( $\rho = 0.515$ ,

TABLE 2  
Test-Retest Reliability of the ACL-RSI-Ar Scale  
(n = 34 Participants)<sup>a</sup>

Variable	Value
ACL-RSI-Ar, mean ± SD	
First test	49.80 ± 20.02
Second test	52.01 ± 20.32
Mean difference	2.21
ICC (95% CI)	0.871 (0.743-0.935)
SEM	7.24
SDC <sub>individual</sub>	20.08
SDC <sub>group</sub>	3.44

<sup>a</sup>ACL-RSI-Ar, Arabic version of the Anterior Cruciate Ligament–Return to Sport After Injury scale; ICC, intraclass correlation coefficient; SDC, smallest detectable change; SEM, standard error of measurement.

TABLE 3  
Correlation Between the Short Version of the ACL-RSI-Ar  
and Other Outcome Measures (N = 60 Participants)<sup>a</sup>

ACL-RSI-Ar Versus	Spearman $\rho$	<i>P</i>
IKDC	0.515	<b>&lt;.001</b>
KOOS Symptoms	0.247	<b>.029</b>
KOOS Pain	0.284	<b>.014</b>
KOOS ADL	0.4	<b>.001</b>
KOOS Sport	0.494	<b>&lt;.001</b>
KOOS QoL	0.59	<b>&lt;.001</b>
KOOS total	0.542	<b>&lt;.001</b>

<sup>a</sup>Bolded *P* values indicate statistical significance ( $P < .05$ ). ACL-RSI-Ar, Arabic version of the Anterior Cruciate Ligament–Return to Sport After Injury scale; ADL, activities of daily living; IKDC, International Knee Documentation Committee scale; KOOS, Knee injury and Osteoarthritis Outcome Score; QoL, quality of life.

$P < .001$ ), all KOOS subscales ( $\rho = 0.247-0.590$ ,  $P < .05$ ), and KOOS total score ( $\rho = 0.542$ ,  $P < .001$ ). The results of the correlation analyses are summarized in Table 3.

### Discriminant Validity

Participants who returned to sports had a significantly higher score on the ACL-RSI-Ar scale when compared with those who did not return to sports ( $P = .001$ ). The average score on the ACL-RSI-Ar scale was 59.90 ± 19.61 for participants who returned to sports participation (n = 34), compared with 42.31 ± 20.24 for those who did not return to sports (n = 26).

## DISCUSSION

The current study demonstrated that the short version of the ACL-RSI-Ar scale was an internally consistent, reliable, and valid scale for Arabic-speaking patients who had undergone ACLR. These findings indicate that the Arabic

version of the scale has satisfactory psychometric properties similar to those of the original English version and the adaptation of the scale to other languages.<sup>11</sup>

The ACL-RSI-Ar scale showed excellent test-retest reliability and adequate internal consistency. The test-retest reliability of the ACL-RSI-Ar scale was 0.871, corresponding to the test-retest reliability obtained in previous studies of the French (ICC, 0.90), Turkish (ICC, 0.92), and Spanish (ICC, 0.90) versions of the scale.<sup>7,16,31</sup> Likewise, the internal consistency of the ACL-RSI-Ar scale was adequate (Cronbach alpha, 0.734). Compared with our findings, the other language versions, for example, the Brazilian (0.87), Turkish (0.88), and Spanish (0.90), had higher Cronbach alphas than ours.<sup>7,16,33</sup> Although a Cronbach alpha between 0.70 and 0.95 is indicative of adequate internal consistency,<sup>35</sup> we believe that the lower alpha value of the ACL-RSI-Ar scale in the current study could be due to the fact that we translated and cross-culturally adapted the short version of the ACL-RSI scale. The authors of the short version of the ACL-RSI scale explained that they developed this version because the long version, which consists of 12 items, has item redundancy.<sup>38</sup> The existence of item redundancy and a large number of items in a scale has been found to increase Cronbach alpha values.<sup>35</sup> Therefore, it is likely that item redundancy in the long version of the ACL-RSI scale might have contributed to the high Cronbach alpha values reported in previous studies.

We used 2 questionnaires, the Arabic IKDC and KOOS scales, to cross-culturally validate the ACL-RSI-Ar scale. The construct validity of the ACL-RSI-Ar scale was examined by correlating the results with the IKDC and KOOS questionnaires. Our results showed that the ACL-RSI-Ar scale was positively and strongly correlated with the IKDC scale. In addition, the ACL-RSI-Ar scale was positively correlated with all KOOS subscales, with the strongest correlation found between the ACL-RSI-Ar and KOOS QoL scales (Spearman's  $\rho = 0.590$ ). These findings are consistent with the results of previous adaptation studies<sup>7,8,15,16,36</sup> of the scale to other languages. Together, these findings indicate that a more positive psychological response is associated with better knee function in patients with ACLR. Furthermore, previous studies<sup>4,11,13,21-23,39</sup> have suggested that the psychological status of athletes may influence their ability to successfully return to sports and/or the risk of a second ACL injury. Therefore, evaluating and addressing psychological readiness to return to sports is an important element that should be incorporated during rehabilitation and included as one of the clearance criteria of return to sports in patients with ACLR.<sup>11,13</sup>

The strong correlation between the ACL-RSI-Ar and KOOS QoL scales is another important finding of this study. The KOOS QoL subscale assesses psychological aspects related to patients' awareness of their knee problems, lifestyle modifications to avoid potential activities that could damage their knee, lack of confidence in the

injured knee, and the overall difficulty that faces these patients with the injured knee.<sup>30</sup> Similarly, the ACL-RSI scale assesses psychological aspects related to emotions, confidence in performance, and risk appraisal of patients in relation to their ability to return to sports after ACLR.<sup>38</sup> Therefore, the strong correlation between the ACL-RSI-Ar and KOOS QoL might be due to the fact that both scales were assessing the psychological status of patients after ACLR. This finding confirms the results of previous studies<sup>7,8,12,16,18,31,36</sup> that found a strong correlation between the ACL-RSI and KOOS QoL scales, with correlation values ranging from 0.580 to 0.718.<sup>7,8,12,16,18,31,36</sup>

Although the short version of the ACL-RSI scale is half the length of the long version, it has been shown to be as robust as the long version in discriminating between patients with ACLR who returned to sports participation and those who did not return to sports.<sup>38</sup> This result is consistent with the result of the short version of the ACL-RSI-Ar scale, which has been shown to have good discriminant validity. Patients who returned to sports participation had significantly higher scores on the ACL-RSI-Ar scale than those who did not return to sports. Our finding is in agreement with the findings of previous adaptation studies of the scale into simplified Chinese,<sup>8</sup> Turkish,<sup>16</sup> and Italian.<sup>36</sup> Therefore, the ACL-RSI-Ar scale can be a helpful scale for Arabic-speaking clinicians to decide whether the athlete is psychologically ready to return to sports participation or might benefit from psychological intervention.

## Limitations

One limitation of this study is that all participants were men. Therefore, the results may not be representative of women. However, the current study is the first to translate and validate the short version of the ACL-RSI scale to Arabic, and it is valuable as it can identify the psychological aspects that might influence the patient's readiness to return to sports. Another limitation is that only participants who had undergone primary ACLR were included in this study. A future study is recommended to examine the generalizability of the ACL-RSI-Ar scale in patients with recurrent ACL injury or patients with ACL deficiency.

## CONCLUSION

The short version of the ACL-RSI-Ar scale as translated was found to be internally consistent, reliable, and valid in patients after ACLR. The ACL-RSI-Ar scale is an excellent measure that can be used to evaluate psychological readiness to return to sports in patients who have undergone ACLR.

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<sup>11</sup>References 7, 8, 12, 15-18, 31, 32, 36, 38.

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