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Psychometric properties of the Arabic version of the International Knee Documentation Committee subjective knee form

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ABSTRACT

Background: The International Knee Documentation Committee (IKDC) subjective knee form is a widely used measure to assess symptoms, functional impairments, and sport activity limitations related to knee conditions.

Objectives: This study aimed to assess the psychometric properties of the Arabic version of the IKDC (IKDC-AR) in patients experiencing knee pain.

Methods: The IKDC-AR was compared to the short form 36 (SF-36) questionnaire, and the visual analog scale (VAS) using Spearman's rank correlation coefficient to evaluate construct validity. Internal consistency was examined using Cronbach's alpha, while test-retest reliability was analyzed using intraclass correlation coefficient ($ICC_{2,1}$). Measurement precision was quantified through the standard error of measurement (SEM) and minimal detectable change (MDC).

Results: Strong correlations were observed between the IKDC-AR and SF-36 subscales reflecting similar constructs, including physical component summary and physical function (r = 0.71 and r =0.74, respectively). A moderate negative correlation with the VAS (r = -0.65) further supported construct validity. Divergent validity was confirmed by weak correlations with SF-36 subscales for the mental component summary and mental health (r =0.17 and r =0.18, respectively). The IKDC-AR demonstrated excellent internal consistency (Cronbach's alpha = 0.92) and high test-retest reliability ($ICC_{2,1}$ = 0.95). Measurement precisions was highlighted with a SEM of 3.95 and MDC of 10.95.

Conclusion: The IKDC-AR is a reliable and valid tool for evaluating knee function and symptoms in Arabic-speaking patients with knee pain. Its strong psychometric properties make it suitable for both clinical and research applications.

Keywords: knee, IKDC, reliability, and validity

INTRODUCTION

The assessment of knee intervention outcomes has progressively focused on utilizing the patient-reported outcome measures (PROMs) over clinician-based measures during the last two decades [1-3]. This shift led to the development of numerous subjective knee assessment tools and rating scales designed to evaluate patient outcomes from their own perspective. Moreover, symptoms such as clicking and instability are often indicative of specific knee disorders, thereby facilitating the use of symptom-related items in outcomes measurement tools [3].

PROMs are self-reported questionnaires utilized as subjective assessment tools. These instruments provide valuable insights into a patient's general health, functional status, and quality of life [4]. Additionally, the use of PROMs has been shown to enhance the understanding of the effects of medical intervention [5]. They are also a valuable method for monitoring patient's progress, determining prognosis, and distinguishing between treatments [6].

Several PROMs have been developed for condition-specific or joint-specific [7]. The American Orthopedic Society for Sports Medicine revised the International Knee Documentation Committee (IKDC) subjective knee form in 1997, creating a knee-specific tool for evaluating symptoms, function, and sports activity [8]. The translation of IKDC into multiple languages has increased its use across diverse cultural contexts. The study by Almalki et al. [9] translated and validated the IKDC Arabic version (IKDC-AR), demonstrating its reliability and validity for among male patients with anterior cruciate ligament reconstruction (ACLR) [9]. However, the IKDC-AR has been validated only for ACLR male patients [9]. Broadening the application of the IKDC-AR to include male and female patients complaining of knee pain might support the generalization of IKDC-AR and encourage clinicians to use the

tool to reflect on the efficiency of an intervention or patient's status. Therefore, this study aimed to examine the psychometric properties of the IKDC-AR among Arabic-speaking patients experiencing knee pain.

METHODS

Participants

A convince sample of 110 patients with knee pain were randomly selected from the physical therapy department at King Abdulaziz Hospital, King Abdullah Medical Complex, and East Jeddah Hospital between March to August 2022. Patients with inflammatory arthritis (e.g., rheumatoid and psoriatic arthritis), had fractures or undergone intra-articular injection or massive lower limb surgery for the past 6 months were excluded from the study.

Informed consent, demographic data including (age, gender, and occupation) and clinical information such as (weight, height, and knee involvement) were acquired from all study participants before starting the study. All participants were instructed to complete the IKDC-AR, the Arabic version of the short form 36 (SF-36), and the visual analog scale (VAS). To evaluate test-retest reliability, each participant was required to complete the IKDC-AR twice, with a 5-to-7-day interval between the initial and retest administrations.

Outcome Measurements

IKDC-AR

The IKDC-AR is a knee-specific PROM that assesses symptoms, function, and physical activity [8]. The IKDC-AR contains 18 items measuring three domains with a scoring system as fallow: items 1, 4, 5, 6, and 7-17 as a five-point Likert scale, items 2, 3, and 18, as a 0-10 rating scale, and item 6 as dichotomous. The final score ranges from 0 to 100, where higher scores reflect better outcomes [8].

Short form-36 Arabic version

The SF-36 is a comprehensive health questionnaire comprising 36 items, designed to assess eight specific domains of health: physical functioning (PF), role-physical (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role-emotional (RE), and mental health (MH). These eight health domains can be further condensed into two principal summary components: the physical component summary (PCS) and the mental component summary (MCS) [10]. The SF-36 was cross-culturally adopted and validated in Arabic language [11].

Visual analog scale

The VAS was employed to measure pain intensity and has demonstrated reliability and validity in evaluating pain levels among patients with various knee disorders [12]. Two descriptive terms, such as "no pain" and "extremely severe pain," were placed on each side of a 100-mm-long horizontal line. Patients were instructed to estimate the average intensity of their knee pain experienced over the preceding week.

Statistical Analysis and Psychometric Measurements

SPSS software (IBM SPSS Statistics, V 29.0) was used for all statistical analyses. To test data normal distribution, the Shapiro-Wilk test was used. Descriptive statistics were obtained for all variables. Internal consistency of the questionnaire was evaluated using Cronbach's alpha, while test-test reliability was assessed with the intraclass correlation coefficient ($ICC_{2,1}$). The convergent and divergent validity of IKDC-AR were analyzed using Spearman's rank correlation coefficient. The p-value for statistical significance was set at < 0.05.

Sample size estimation

The item-to-respondent ratio (1:6) was utilized to estimate the sample size of this study. A literature review indicated that approximately 90% of validation studies included a sample size of 100 or more participants [13]. Therefore, a minimum sample size of 108 was determined to be appropriate for this study.

Reliability

Internal consistency was examined using Cronbach's alpha, with alpha value ranging from 0.70 to 0.95 was used to demonstrate acceptable internal consistency [14]. Test-retest reliability was evaluated using the intraclass correlation coefficient ($ICC_{2,1}$) with a 95% confidence interval, an ICC value of 0.70 or higher indicate a satisfactory degree of reliability [15]. Measurement error was determined by calculating the standard error of measurement (SEM) using the equation: SEM = scores SD* $\sqrt{(1\text{-ICC})}$ and the minimal detectable change (MDC_{95}) using the equation: $MDC_{95} = SEM \times 1.96 \times \sqrt{2}$ [16].

Validity

Construct validity of IKDC-AR was assessed by utilizing the Spearman's rank correlation coefficient to assess its relationship with the short form-36 and VAS. Both convergent and divergent validity were evaluated. Moderate to strong correlations were hypothesized between IKDC-AR and SF-36 subscales reflecting similar constructs (PF and PCS) and VAS to support convergent validity. For divergent validity, low to weak correlations were expected between IKDC-AR and SF-36 subscales representing mental health (MH and MCS).

Floor and ceiling effects

Floor and ceiling effects would be evident if at least 15% of the participants attained the topmost or lowermost scores on the scale [17].

Acceptability

Factors such as reject percentage, completed questionnaires percentage, and missing questions percentage, as well as the time needed to finish the questionnaire, were considered in determining the IKDC-AR acceptability. The IKDC-AR acceptance was also assessed, with the proportion of questions that were difficult to understand, as well as the individuals' desire to complete the questionnaire again [18].

RESULTS

Demographics Characteristics

This study included 110 participants, with an average age of 57.1 ± 8.8 years. The average BMI was 31 ± 4 and the majority of the participants (68.2%) were female. For the education level, 78.2%of the participants had at least a high school or bachelor's degree, and 62.7% were retired. The mean of the initial and retest IKDC-AR scores were 39.8 ± 17.6 and 40.8 ± 16.7, respectively. The mean knee pain score measured by VAS

Table 1. Characteristics of the participants (n = 110)

Characteristics	M ± SD or n (%)
Age (years)	57.1 ± 8.8
Body mass index ((kg/m2)	31 ± 4
Gender	
Male	35 (32)
Female	75 (68)
Education level	
Elementary school	18 (16)
Intermediate school	6 (5)
High school	39 (36)
Bachelor or more	47 (43)
Occupation	
Employed	41 (37)
Retired	69 (63)
Involved knee	
Right	23 (21)
Left	22 (20)
Bilateral	65 (59)
Patient-reported outcome measures	
IKDC-AR 1st time	39.8 ± 17.7
IKDC-AR 2nd time	40.9 ± 16.7
VAS	6 ± 2.1
SF-36	
Physical functioning	49.5 ± 22.7
Mental health	69.1 ± 20.4
Physical component summary	36.3 ± 9.3
Mental component summary	49.7 ± 12.7

Note. M: Mean & SD: Standard deviation

was 6 ± 2.1. The mean scores of the SF-36 subscales are presented in **Table 1**. The IKDC-AR scores did not show a normal distribution (p = 0.02). Out of the 110 participants, 90 completed the IKDC-AR for the retest session and were included in test-retest reliability analysis.

Reliability

The IKDC-AR demonstrated a strong internal consistency level (Cronbach's alpha = 0.92) and high test-retest reliability ($ICC_{2,1}$ = 0.95). The SEM and MDC_{95} were 3.95 and 10.95, respectively (**Table 2**).

Validity

Construct validity was confirmed through significant positive correlations between IKDC-AR and SF-36 subscales of PCS and PF (r = 0.71, p ≤ .001; r = 0.74, p ≤ .001) and a moderate negative correlation with VAS (r = -0.65, p ≤ .001). Divergent validity was demonstrated by weak positive correlations between IKDC-AR and SF-36 subscales of MCS and MH (r = 0.17, p ≤ .05; r = 0.18, p ≤ .05) (**Table 3**).

Floor or Ceiling Effects

No floor and ceiling effects were detected.

Acceptability

IKDC-AR exhibited high acceptability among participants, with a 0% rejection rate, 100% completion rate, and with no missing items. The average time to complete the questionnaire was 5.18 minutes, and all items were reported as easy to understand.

Table 3. Construct validity assessment of the IKDC-AR

Outcome measures	IKDC-AR
SF-36 PCS	.713**
SF-36 PF	.745**
SF-36 MCS	.175*
SF-36 MH	.178 *
VAS	-.658**

Note. *Correlation is significant at the 0.05 level & **Correlation is significant at the 0.01 level

DISCUSSION

The primary purpose of this study was to examine the reliability, validity, and acceptability of the IKDC-AR in Arabic-speaking patients experiencing knee pain. The findings indicated that IKDC-AR exhibits satisfactory psychometric properties implied that the IKDC-AR is reliable, valid, and acceptable outcome measure for evaluating Arabic-speaking patients with knee pain.

The internal consistency of the IKDC-AR was high, with Cronbach's alpha of 0.92, comparable to the original IKDC version and the other translated versions as well (**Table 4**). The IKDC-AR showed high test-retest reliability, with an ICC value of 0.95, consistent with the original IKDC version (ICC= 0.95) and the other translated versions, which reported ICC values ranging from 0.91 to 0.99 [8, 9, 13, 19-29]. Similarly, the test-retest reliability observed in this study aligns with the findings from ACLR patients population where the IKDC-AR was used (ICC = 0.95) [9]. This high ICC value confirms that the IKDC-AR is a reliable assessment tool to be used with knee pain patients. Regarding the IKDC-AR measurement precision, the SEM was 3.95, suggesting that individual test score might fluctuate by 3.95 points due to measurement error. The MDC_{95} was calculated to be 10.95 points signifying that change in the IKDC-AR scores exceeding 10.95 points can be confidently interpreted as meaningful change and not attributable to measurement error. By understanding SEM and MDC_{95} for the IKDC-AR, clinicians and researchers can make more accurate interpretation of the patients outcomes and treatment effectiveness.

The convergent validity of the IKDC-AR was evaluated using the PF and PCS subscales of the SF-36 and VAS. Strong positive correlations were observed between the IKDC-AR and the PF and PCS subscales, demonstrating its validity as a measure of knee joint function. These findings align with previous studies [9, 20, 22, 27, 28], were the correlation coefficient between IKDC and PF subscale of the SF-36 ranged from 0.70 to 0.80 across various translations, including the Turkish, Brazilian, Portuguese, Dutch, Swedish, Thai, and Arabic version [9, 20, 22, 27, 28]. On the other hand, slightly lower correlations (0.63-0.67) were reported for the English, Italian, Korean, and Chinese versions [8, 19, 25, 26]. Moreover, IKDC-AR revealed a moderate negative correlation with the VAS, consistent with the results from the Arabic and Turkish IKDC versions [9, 27].

For the convergent validity, the IKDC-AR was assessed against the MCS and MH subscales of SF-36. Weak positive correlations were observed between the IKDC-AR and the MH

Table 2. Psychometric properties of the IKDC-AR

	Cronbach's alpha	Test (n = 110): M ± SD	Re-test (n= 90): M ± SD	ICC (95% CI)	SEM	MDC_{95}	% ceiling effect	% floor effect
IKDC-AR	0.92	39.8 ± 17.6	40.8 ± 16.7	0.95 (0.92-0.96)	3.95	10.95	0	0.91

Note. M: Mean; SD: Standard deviation; & CI: Confidence interval

Table 4. Psychometric properties of the different language versions of the IKDC

IKDC versions	Test-retest reliability ICC	Cronbach's alpha
English (original) [8]	0.95	0.92
Arabic [10]	0.95	0.91
Italian [19]	0.90	0.91
Dutch [20]	0.96	0.92
English [21]	0.95	0.77
Thai [22]	0.92	0.92
English [23]	0.91	0.93
Brazilian Portuguese [24]	0.99	0.92
Chinese [25]	0.87	0.97
Korean [26]	0.94	0.91
Turkish [27]	0.91	0.89
Swedish [28]	0.92	0.90
Romanian [29]	0.61	0.61
Arabic (present study)	0.95	0.92

Table 5. Convergent and divergent validity between IKDC and SF-36 subscales

IKDC versions	SF-36 subscales			
	PCS	PF	MCS	MH
English (original) [8]	0.66	0.63	0.16	0.25
Arabic [10]	–	0.80	–	0.46
Italian [19]	0.60	0.67	0.40	0.65
Dutch [20]	–	0.71	–	0.21
Thai [22]	0.63	0.75	0.37	0.27
Brazilian Portuguese [24]	0.79	0.75	0.51	0.40
Chinese [25]	–	0.64	–	0.41
Korean [26]	–	0.66	–	0.15
Turkish [27]	0.70	0.69	0.05	013
Swedish [28]	0.73	–	0.32	–
Arabic (present study)	0.71	0.74	0.17	0.18

Note. The dash sign (–) denotes that there is no available values in the literature for those subscales

and the MCS subscales. These findings are consistent with the original IKDC and other translated versions [8, 9, 20, 21, 24-26, 30-32,], supporting the hypothesis that the IKDC-AR and the MH domains of the SF-36 measure distinct constructs. Moreover, no floor or ceiling effects were detected, ensuring the tool's effectiveness across varying levels of knee function (**Table 5**).

There are no established guidelines for assessing the acceptability of PROMs, including factors such as the proportion of rejected participation, completed questionnaires, missing items, or the questionnaire completion time. Furthermore, neither the original IKDC nor its other translated versions have evaluated the IKDC acceptability metrics, with the exception for IKDC-AR, which revealed good acceptability among ACLR patients [9]. Therefore, to assess acceptability in this study, comparisons were made to the IKDC-AR reported in ACLR patients. The results of the current study revealed a comparable degree of acceptability, with a rejection rate of 0%, a 100% completion rate, and no missing responses. Additionally, participants did not report any questions as difficult to understand. The relatively short time required to complete the questionnaire further supports its feasibility and suitability for routine clinical use. These findings indicate that the IKDC-AR is a highly practical and efficient outcome measure for evaluating knee pain and function in Arabic-speaking patients.

This study has some limitations, the disproportionate representation of female participants compared to male participants, potentially limiting the generalizability of the findings [33]. Additionally, the absence of Saudi-specific norms of the SF-36 necessitated reliance on global norms to measure the PCS and MCS [34]. The study did not examine the responsiveness of the IKDC-AR [35].

CONCLUSION

The IKDC-AR is a reliable and valid outcome measure that can be utilized as a PROM for assessing knee pain and function in Arabic-speaking patients. Therefore, this study recommends the utilization of IKDC-AR for clinical settings and research fields as a tool for evaluating knee joint function and symptoms. Future research should evaluate the responsiveness of the IKDC-AR version to further enhance its applicability in detecting changes over time that are clinically important.

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Declaration of interest: No conflict of interest is declared by the authors.

Data sharing statement: Data supporting the findings and conclusions are available upon request from the corresponding author.

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