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Cross-cultural adaptation and psychometric testing of the Arabic version of the Modified Low Back Pain Disability Questionnaire

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Abstract

Background

The Modified Low Back Pain Disability Questionnaire (MLBPDQ) is used for evaluating the functional disability in patients with low back pain (LBP). However, the measurement characteristics of the MLBPDQ among Arab patients are unknown. In this study, we aimed to translate and cross-culturally adapt the MLBPDQ into Arabic and evaluate its psychometric properties.

Methods

An Arabic version of the MLBPDQ was developed through forward translation, translation synthesis, and backward translation. Sixty-eight patients (55 males and 13 females) with a mean age 37.01 Â 7.57 years were recruited to assess its psychometric properties. Reliability was evaluated using internal consistency (Cronbachâ s Î), test retest reliability (utilizing intraclass correlation coefficient [ICC]), standard error of measurement (SEM), minimal detectable change at 95% confidence level ($MDC_{95\%}$), and 95% limits of agreement (LOA). The construct validity was investigated by correlating the new translation with four other measures of LBP (using Spearmanâ s rho). Finally, receiver operating characteristic curve was constructed to compute the sensitivity, using the area under the curve (AUC), and the minimum important change (MIC). An alpha level of 0.05 was set for statistical tests and all the psychometric values were tested against *a priori* hypotheses.

Results

The culturally aligned MLBPDQ showed good internal consistency (Cronbachâ s Î = 0.85). The ICC, SEM, $MDC_{95\%}$, and LOA between baseline and two days later were 0.98, 1.60, 4.43, and -4.23 to 7.70, respectively, while the values between baseline and 14 days later were 0.94, 2.77, 7.67, and -6.59 to 13.53, respectively. The scale also demonstrated moderate to excellent correlation (rho = 0.54â 0.86) with the other four questionnaires. The AUC value of the Arabic-MLBPDQ was 0.68, and the MIC was 3 points.

study are not publicly available. See the accompanying retraction notice for more information.

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Conclusion

The Arabic version of the MLBPDQ demonstrates adequate psychometric properties and can be used to assess disability level in patients with LBP in Arabic-speaking communities.

Introduction

Among other disabling conditions, low back pain (LBP) has been identified as the highest contributor to disability globally [1]. Though recovery from LBP and return-to-work may occur in a month for as many as 75% [2], return to normalcy in those whose pain persists for 6â 10 weeks after onset may take up to a year [3]. The lost productive time and missed workdays due to LBP may cost employers $19.8 billion per year [4]. Therefore, measures of disability associated with LBP are essential. Such measures would help evaluate and monitor patients in diagnostic and treatment stages, which might assist in reducing painful, costly episodes of LBP.

Self-report measures of LBP associated disability are widely used by clinicians because they are easy to administer and inexpensive [5]. One of the most commonly used self-report disability questionnaires for people with LBP is the Oswestry LBP Disability Questionnaire (ODQ), which was described by Fairbank and colleagues [6]. Following the original English version of the ODQ, many variants of it have been produced in English [7â 12], and there are about 31 adaptations in other languages [13], including Arabic [14â 16].

While the ODQ has been adapted into many cultures, approximately 60% (19 out of 31) of the validation studies have reported missing responses, ranging from 11% to 90%, to the question about how LBP interfered with patientsâ sex life [13,15â 32]. Speculations about why respondents were unable or unwilling to answer this question include that they could be too young [32] or never had sex [15,31,32]. Others might be too embarrassed or find the question unacceptable due to cultural or religious influence [13,15,16,19,23,31,32]. Although a previous study showed that Arab people are willing to discuss their sexual life and how it is affected by LBP [33], it has been reported that up to 69% of respondents did not answer the sex-life questions of the Arabic ODQ [15,16]. An attempt was made to resolve this problem by removing the question and then validating the questionnaire [15].

Fritz and Irrgang [12] published a modified version of the ODQ (MLBPDQ). They replaced the sex-life question with a question about the effect that LBP has on employment and/or homemaking. The MLBPDQ was found to be a valid, reliable, and sensitive tool [12,34,35]. It was also adapted into three different languages [36â 38]. To our knowledge, a validated Arabic version of the MLBPDQ has never been published. Therefore, our aims were to (1) translate and cross-culturally adapt the MLBPDQ into Arabic and establish (2) the reliability, (3) validity, and (4) sensitivity of the Arabic version.

Materials and methods

This study was in two stages. Stage one, translation and cross-cultural adaptation of the MLBPDQ into Arabic, and Stage two, testing the psychometric properties of the Arabic-MLBPDQ. The Research Ethics Committee of the University of Tabuk, Tabuk, Saudi Arabia (SA) approved the study, and all respondents gave their signed written informed consent.

The Modified Disability Questionnaire

Like the original version, the MLBPDQ includes 10 items covering LBP and assessments of the effects of pain on function. In addition to pain assessment, the functions covered are personal

care, lifting, walking, sitting, standing, sleeping, social life, traveling, and employment/homemaking (replacing the sex life item). Each item consists of six statements that range from 0 (*no disability*) to 5 (*maximal disability*). The patient chooses the statement that most closely represents his/her status. To obtain a disability score, the sum of the scores is divided by the total possible score (i.e., 50). To obtain the percentage of a patientâ s disability, the resulting total is multiplied by 100: 0% (no disability) and 100% (the most severe disability).

Translation and cross-cultural adaptation

The MLBPDQ was translated through a process of forward translation, translation synthesis, and backward translation [39] (Fig 1, removed at the time of retraction). First, two translators proficient in English who were native Arabic speakers translated the English version of the MLBPDQ into Arabic. The first translator was a physician who was aware of the MLBPDQ concept. The second translator, a computer engineer, had no medical background and was unaware of the concept. Second, the translators synthesized the two versions into one. Third, two other translators whose native language was English and who were proficient in Arabic translated the Arabic version of the MLBPDQ back into English. Neither translator had medical background, nor access to the original version of the questionnaire.

After that, a four-member committee of experts produced a prefinal Arabic version of the MLBPDQ for field-testing. The committee consisted of two healthcare professionals, a linguistic professional, and the principal investigator (HSA). One of the healthcare professionals was proficient in methodology, and the principal investigator relayed questions or queries raised in committee meetings to the forward and back translators. The committee reviewed and analyzed any discrepancy or inconsistency in previous stages of the translation process. They also judged the document and made any changes necessary to ensure clarity and suitability for the general Arab public. The reviewers made four main suggestions. The first suggestion was to convert the distance unit from miles to kilometers in Section 4 (walking). The second suggestion was to restructure the last selection in Section 4 to â I am in bed most of the time and cannot go to the toilet without help of othersâ . The third suggestion was to add â to practice social activityâ to selection 4 in Section 8 (Social Life). The fourth suggestion was to add the word â commutingâ to the title of Section 9. The rest of the modifications suggested by the review committee are presented in S1 Table (removed at the time of retraction).

The prefinal version was completed by 30 patients to evaluate the questionnaireâ s comprehensibility and provide final input on its language. Overall, no major difficulties were faced by respondents, and they could read and understand all the 10 sections. Finally, the Arabic-MLBPDQ was produced and ready for psychometric testing (see S1 Appendix, removed at the time of retraction).

Psychometric testing

Using convenience sampling, patients from local hospitals in Tabuk, SA who met the inclusion/exclusion criteria were recruited. The inclusion criteria were patients presenting with acute or chronic LBP, aged 18â 65 years, and fluent in Arabic. Excluded were patients who were pregnant and those with a history of psychiatric disorders, malignancies, or neurological

Image removed at the time of retraction.

Fig 1. Processes for cross-cultural adaptation and validation of the Modified Low Back Pain Disability Questionnaire.

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pathologies. Terwee and colleagues [40] believed 50 participants could be used to adequately measure the floor and ceiling effects, reliability, agreement, minimum important change (MIC), and construct validity of a questionnaire; therefore, considering losses to withdrawal, follow-up, or protocol violation, we set to recruit ₳ 60 patients.

Because most of the change in patientsâ condition was observed immediately following the injury [5], it is vital to perform assessments during the first two weeks of enrollment. Therefore, follow-up assessments occurred two and 14 days after baseline. Fig 1 (removed at the time of retraction) illustrates the three sessions of assessment.

In Session 1, the baseline assessment, respondents completed a demographic survey that indicated whether they met the exclusion/inclusion criteria. Those who qualified completed the following questionnaires in Arabic: the MLBPDQ, the Fear Avoidance Beliefs Questionnaire (FABQ) [41], the Quebec Back Pain Disability Scale (Quebec) [42], the Roland-Morris Disability Questionnaire (RM) [43], and the Visual Analog Scale (VAS) [44]. Table 1 summarizes the psychometric properties of the questionnaires.

In Session 2, which occurred 48 hours later, respondents answered a 7-level global change scale to detect any big alterations in LBP characteristics or symptoms since baseline. The scale asked respondents to rate the extent that their LBP had changed over the past two days. The scale had seven response options: *completely gone*, *much better*, *better*, *a little better*, *about the same*, *a little worse*, and *much worse*. Respondents who answered â about the sameâ or â a little betterâ or â a little worseâ were classified as stable [45] and completed the Arabic-MLBPDQ again.

In Session 3, held 14 days following the baseline assessment, respondents completed the Arabic-MLBPDQ for a third time and completed the four other scales in addition to the global change scale.

Data analyses

Data analyses included the assessment of the Arabic-MLBPDQ for floor and ceiling effects, reliability, construct validity, and sensitivity. All the obtained psychometric values were tested against *a priori* hypotheses. IBM SPSS Statistics for Windows version 25.0 (Armonk, NY) was utilized to perform the statistical tests with alpha level at 0.05.

Floor and ceiling effects. Floor and/or ceiling effects exist if more than 15% of respondents obtained the maximum or minimum possible score [40]. Floor and ceiling effects were

Table 1. Psychometric properties of Arabic questionnaires included in the study.

Questionnaire	FABQ	Quebec	RM
Study	Alanazi et al. 2017 [41]	Alnahhal and May 2012 [42]	Maki et al. 2014 [43]
Internal consistency	-	Î± = 0.92	Î± = 0.729
Test-retest reliability	ICC = 0.76	Îº = 0.86â 0.98	ICC = 0.90
Construct validity	r = 0.234â 0.283[a]	r = 0.69[a]	r = 0.259[c]
	r = -0.115â 0.12[b]	r = 0.66[d]	
	r = 0.092â 0.208[c]		
Sensitivity	ES = 0.25	-	-

FABQ, Fear-Avoidance Beliefs Questionnaire; Quebec, Quebec Back Pain Disability Scale; RM, Roland-Morris Disability Questionnaire; Î±, Cronbachâ s alpha; ICC, intraclass correlation coefficient; Îº, weighted kappa; r, Spearman correlation coefficient; ES, effect size.

[a]Correlated with the Modified Low Back Pain Disability Questionnaire.

[b]Correlated with the Quebec Back Pain Disability Scale.

[c]Correlated with the Visual Analog Scale.

[d]Correlated with the Numeric Pain Rating Scale.

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defined by computing the number of respondents who scored the lowest status (90â 100) or the highest status (0â 10), respectively, on the Arabic-MLBPDQ [13].

Reliability. Internal consistency of the Arabic-MLBPDQ was evaluated by calculating Cronbachâ s Î± at baseline. Test-retest reliability was determined by testing and then retesting and calculating the intraclass correlation coefficients (ICC) in a one-way random effects model with multiple measures. Cronbachâ s Î± and ICC values were interpreted as follows: < 0.50, poor; 0.50â 0.75, moderate; 0.75â 0.90, good; and > 0.90, excellent [46,47]. Furthermore, measurement error was examined by calculating the standard error of measurement (SEM). The minimal true change in score for one person beyond measurement error was estimated by calculating the minimal detectable change at 95% confidence level ($MDC_{95\%}$) [40]. The following formulas were used to calculate the SEM and $MDC_{95\%}$, respectively: $SEM = SD\sqrt{1 \quad \ddot{A}_{\hat{a}} \quad ICC}$ (where SD is the standard deviation) [48]; $MDC_{95\%} = 1.96\ x\ \sqrt{2}\ x\ SEM$ [46]. Finally, the 95% limits of agreement (LOA) between the scores of the Arabic-MLBPDQ on baseline and the following administrations were visually assessed by constructing a Bland-Altman plot [49]. The records of only those patients classified as stable in Sessions 2 and 3 were used to evaluate the reliability. Our hypotheses regarding the values of Cronbachâ s Î±, ICC, SEM, $MDC_{95\%}$, and LOA for the Arabic-MLBPDQ are stated in Table 2.

Validity. Construct validity was evaluated by correlating the Arabic-MLBPDQ with the Arabic versions of the FABQ, the Quebec, the RM, and the VAS and calculating a Spearman rank correlation coefficient (Spearmanâ s rho). Spearmanâ s rho values were interpreted as follows: < 0.25, little or no relationship; 0.25â 0.50, fair; 0.50â 0.75, moderate; and ãŸ 0.75, excellent [48]. Table 2 presents *a priori* hypotheses to test the construct validity of the Arabic-MLBPDQ. The hypotheses were formulated based on the findings of previous validation studies of the ODQ and MLBPDQ. According to Terwee et al. [40], 75% or more of the hypotheses need to be confirmed to support the construct validity of the instrument being assessed.

Sensitivity. Sensitivity to change, or responsiveness, of the Arabic-MLBPDQ was examined by constructing a receiver operating characteristic (ROC) curve from the change scores between the two-week follow-up and the baseline. The area under the curve (AUC) was used to quantify the ability of the Arabic-MLBPDQ to segregate patients who were improved from those who remained stable based on the 7-level global change scale. AUC values range from 0.5, indicating no diagnostic accuracy, to 1, indicating perfect diagnostic accuracy [65]. We hypothesized that an AUC value of 0.70 or more [40] would be obtained for the Arabic-MLBPDQ (Table 2). The MIC of the Arabic-MLBPDQ was then estimated using the ROC curve. The MIC was determined by locating the point on the curve nearest to the left-hand corner of the graph. This point is associated with the maximum sensitivity and specificity of the questionnaire and represents a cutoff value to separate patients who have experienced improvements in their condition from those who have not [66]. Our predefined hypothesis regarding the MIC value is stated in Table 2, which was formulated based on previous MIC values obtained for the ODQ and MLBPDQ among patients with nonspecific LBP utilizing the same approach described above.

Results

Sixty-eight men and women with LBP were enrolled to assess the psychometric properties of the translated questionnaire. The reliability was assessed in respondents who were classified as stable (61 respondents at two days and 53 respondents at 14 days), while the answers of all 68 respondents at baseline and 14-day later were used to calculate validity and sensitivity (Fig 1, removed at the time of retraction). Thus, all groups met the 50-participant requirement prescribed by Terwee and colleagues [40].

Table 2. *A Priori* hypotheses for testing the psychometric properties of the Arabic-Modified Lower Back Pain Disability Questionnaire.

Reliability		
Internal consistency	Cronbachâ s Î± = 0.70â 0.95 [40]	
Test-retest	ICC > 0.70 [40]	
SEM	â¤ 2.15â 6.5 [12,20â 22,27,32,34,50]	
$MDC_{95\%}$	â¤ 6â 13.67 [12,13,20â 22,27,32,34,36,50â 52]	
95% LOA	â 12.7 to 13.7 [16,30,32]	
Construct validity		
Instrument	**Construct measured**	**Direction and magnitude of the relationships**
FABQ	Fear-avoidance beliefs	Little or no correlation (r = 0.19) [13]
Quebec	Functional disability	Moderate to excellent positive relationship (r = 0.79â 0.90) [14,15,29]
RM	Functional disability	Moderate to excellent positive relationship (r = 0.50â 0.84) [14,23,25,27,29,30,32,36,50,53â 59]
VAS	Pain intensity	Fair to excellent positive relationship (r = 0.33â 0.84) [13,14,16,19â 23,25,27,28,31,32,50,51,53â 56,58â 60]
Sensitivity to change		
AUC	> 0.70 [40]	
MIC	4â 11 [12,34,52,61â 64]	

ICC, intraclass correlation coefficient; SEM, standard error of measurement; $MDC_{95\%}$, minimal detectable change at 95% confidence level; LOA, limits of agreement; FABQ, Fear-Avoidance Beliefs Questionnaire; r, Pearson correlation coefficient; Quebec, Quebec Back Pain Disability Scale; RM, Roland-Morris Disability Questionnaire; VAS, Visual Analog Scale; AUC, area under the curve; MIC, minimum important change.

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Respondentsâ demographic characteristics are presented in Table 3. Categorical variables are provided in frequencies and percentages. Continuous variables are summarized by group using means and standard deviations. Table 4 illustrates the test values at baseline and retest values after two daysâ and after two weeksâ follow-up for the Arabic-MLBPDQ and the four other questionnaires.

Floor and ceiling effects

No floor or ceiling effects were detected. Two respondents obtained the highest status scores of 8% and 6% at two days and 14 days, respectively. No respondents obtained the lowest status score.

Table 3. Demographic characteristics of the respondents (N = 68).

Characteristic		**N**	**%**
Sex	Male	55	80.9
	Female	13	19.1
Marital status	Single	10	14.7
	Married	57	83.8
	Divorced	1	1.5
Education level	High school	16	23.5
	Diploma	12	17.6
	University	40	58.9
Employment status	Employed	59	86.8
	Unemployed	5	7.4
	Student	4	5.8
Duration of low back pain	3 weeks to 3 months	37	54.4
	>3 months	31	45.6
Age mean Â± SD (years)	37.01 Â± 7.57		
Weight mean Â± SD (kg)	74.7 Â± 9.72		
Height mean Â± SD (cm)	169.58 Â± 7.94		

SD, standard deviation.

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Table 4. Test values at baseline and retest values after 2 and 14 days for Arabic questionnaires.

Questionnaire	Baseline (N = 68)			At 2 days (N = 61)			At 14 days (N = 68)		
	Minâ Max	Mean	SD	Minâ Max	Mean	SD	Minâ Max	Mean	SD
MLBPDQ	12â 56	31.8	11.3	8â 58	31.0	11.7	6â 54	27.9	11.4
FABQ	13â 41	25.5	7.2	-	-	-	9â 34	22.7	6.7
Quebec	15â 52	31.8	11.1	-	-	-	5â 48	27.5	10.4
RM	3â 14	7.3	3.1	-	-	-	1â 13	6.2	2.6
VAS	2â 8	4.8	1.6	-	-	-	2â 6	3.5	1.5

All questionnaires were in Arabic.

Min, minimum; Max, maximum; SD, standard deviation; MLBPDQ, Modified Low Back Pain Disability Questionnaire; FABQ, Fear-Avoidance Beliefs Questionnaire; Quebec, Quebec Back Pain Disability Scale; RM, Roland-Morris Disability Questionnaire; VAS, Visual Analog Scale.

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Reliability

Table 5 summarizes the reliability properties of the Arabic-MLBPDQ. A Cronbachâ s Î± of 0.85 was obtained indicating good internal consistency. Removal of item 5 or 6 slightly increased the Cronbachâ s Î± to 0.86. Regarding test-retest reliability, with 61 respondents, the Arabic-MLBPDQ showed excellent reliability (ICC = 0.98; 95% CI: 0.97â 0.99) between baseline (M = 32.8 Â± 11.3) and two days later (M = 31.0 Â± 11.7). Similarly, after 14 days, with 53 respondents, the questionnaire continued to show excellent reliability between the baseline (M = 33.3 Â± 11.4) and 14 days later (M = 29.8 Â± 11.7; ICC = 0.94; 95% CI: 0.91â 0.97). The SEM and $MDC_{95\%}$ were 1.60 and 4.43, respectively, for two days, and 2.77 and 7.67, respectively, for 14 days. Furthermore, the Bland-Altman plot for two and 14 days test-retest showed a good distribution of scores with no systematic bias. The mean difference and 95% LOA were calculated as 1.74 (-4.23 to 7.70) after two days, and 3.47 (-6.59 to 13.53) after 14 days (Figs 2 and 3, removed

Table 5. Psychometric properties of the Arabic Modified Low Back Pain Disability Questionnaire.

Psychometric property		Baseline (N = 68)	At 2 days (N = 61)	At 14 days (N = 68)
Reliability	Internal consistency	Cronbachâ s Î± = 0.85	-	-
	Test-retest	-	ICC = 0.98 (95% CI = 0.97â 0.99)	ICC = 0.94 (95% CI: 0.91â 0.97)[a]
	SEM	-	1.60	2.77[a]
	$MDC_{95\%}$	-	4.43	7.67[a]
	Mean difference (95% LOA)	-	1.74 (-4.23 to 7.70)	3.47 (-6.59 to 13.53)[a]
Construct validity	FABQ	rho = 0.60*	-	rho = 0.70*
	Quebec	rho = 0.77*	-	rho = 0.86*
	RM	rho = 0.54*	-	rho = 0.63*
	VAS	rho = 0.62*	-	rho = 0.62*
Sensitivity	AUC	-	-	0.68** (95% CI = 0.52â 0.84)
	MIC	-	-	3 (73.3% sensitivityâ 50.0% specificity)

All questionnaires were in Arabic.

ICC, intraclass correlation coefficient; CI, confidence interval; SEM, standard error of measurement; $MDC_{95\%}$, minimal detectable change at 95% confidence level; LOA, limits of agreement; FABQ, Fear-Avoidance Beliefs Questionnaire; Quebec, Quebec Back Pain Disability Scale; RM, Roland-Morris Disability Questionnaire; VAS, Visual Analog Scale; rho, Spearman rank correlation coefficient; AUC, area under the curve; MIC, minimum important change.

[a]Assessed in respondents classified as stable (N = 59).

*Two-tailed correlation is significant at Î± = 0.01.

**Significant at Î± = 0.05.

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Image removed at the time of retraction.

Fig 2. The 95% limits of agreement of the Arabic MLBPDQ scores between baseline and two days. MLBPDQ: Modified Low Back Pain Disability Questionnaire; SD: standard deviation.

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Image removed at the time of retraction.

Fig 3. The 95% limits of agreement of the Arabic MLBPDQ scores between baseline and 14 days. MLBPDQ: Modified Low Back Pain Disability Questionnaire; SD: standard deviation.

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at the time of retraction). These reliability values of the Arabic-MLBPDQ confirm our predefined hypotheses presented in Table 2.

Validity

As shown in Table 5, the construct validity testing using Spearmanâ s rho at baseline and after 14 days showed significant moderate correlations between the Arabic-MLBPDQ and the FABQ, the RM, and the VAS, and excellent positive correlation with the Quebec. These results confirm our predefined hypotheses, except for the FABQ (i.e., confirming 75% of the hypotheses).

Sensitivity

The sensitivity of the Arabic-MLBPDQ was tested with 68 patients. An AUC value of 0.68 (standard error 0.08; 95% CI, 0.52â 0.84) was obtained after constructing the ROC cure (Fig 4).

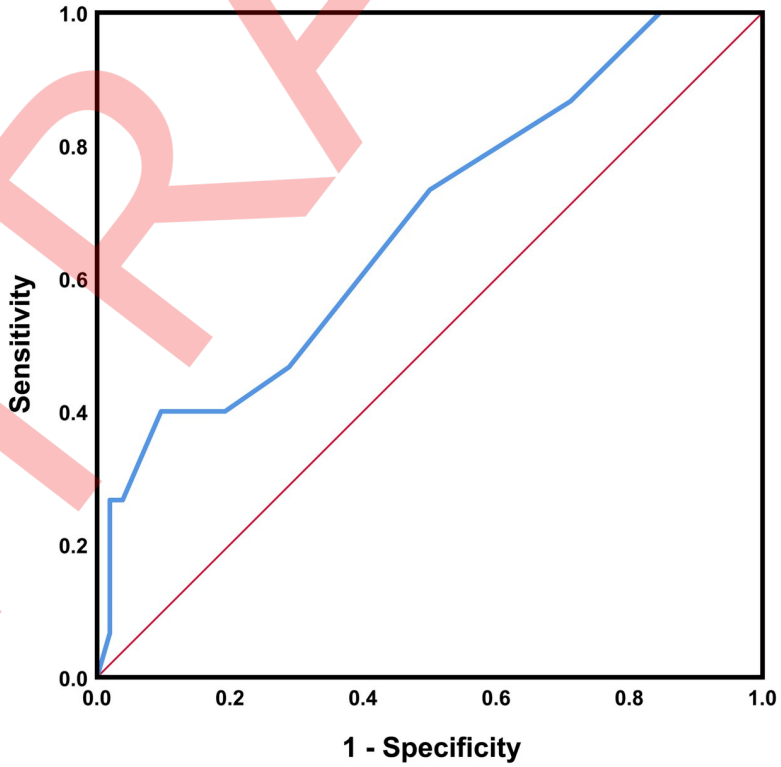

Fig 4. Receiver operating characteristic curve for the Arabic Modified Low Back Pain Disability Questionnaire.

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This value was less than we hypothesized, but significant at 0.05 alpha level. The MIC identified form the ROC curve was 3 points, corresponding to 73.3% sensitivity and 50.0% specificity. This MIC is less than the value stated in our predefined hypothesis.

Discussion

In this study, we evaluated the reliability, validity, and sensitivity of the MLBPDQ after translation and cross-cultural adaptation to Arabic. The results showed that this version has excellent reliability, moderate-to-excellent validity, and adequate sensitivity. Because improving patientsâ health and healthcare provision are the overriding goals of creating culturally aligned, accurately translated, and rigorously validated health assessments, the Arabic-MLBPDQ can be expected to aid assessment of LBP and associated disability by clinicians in Arabic-speaking communities.

Chang and colleagues [67] cautioned against adapting a direct translated instrument because of language differences, especially those highlighted by idiomatic expressions and colloquial phrases. When adapting an instrument, therefore, the overall goal should be making the instrument widely accepted in the target culture and not including questions that would be outside the respondentsâ experiences. In this study, in addition to some grammatical corrections and sentence restructuring, the expert committee recommended four noteworthy modifications.

First, the reviewers unanimously suggested converting the distance unit from miles to kilometers (Section 4 (walking); options 2, 3, and 4). This is because Arabic countries typically use metric units rather than imperial units to measure distance. Although the English MLBPDQ is annotated with conversion of miles to kilometers for selection 2, the annotation does not convert all the options in that section. This might make it difficult for some patients to comprehend those selections. Moreover, the converted distance in the three options was rounded to 1.5, 1, and 0.5 km, respectively, to make it easier for patients to understand. The word â approximatelyâ was also added at the end of each option.

Second, the reviewers suggested changing â I am in bed most of the time and have to crawl to the toiletâ to â I am in bed most of the time and cannot go to the toilet without the help of others.â This is because it is very uncommon in Arab cultures for a patient to be in this stage of disability without a relative or caregiver around to help them with their daily living activities. Concurrently, the intended meaning of being bedbound and unable to walk to the toilet independently was retained.

Third, in selection 4 of Section 8 (Social Life), the reviewers suggested adding â to practice social activityâ at the end of the sentence. This was to approximate the meaning of â going outâ in the English MLBPDQ. Fourth, the reviewers agreed upon adding the word â commutingâ to the title of Section 9 to be read as â traveling/commuting.â The reason was that the word â travelingâ in Arabic literally means traveling from one city/country to another, which could confuse patients. We believe that these modifications made the Arabic-MLBPDQ more aligned to Arab cultures.

No floor or ceiling effects were detected for the Arabic-MLBPDQ at the three assessment sessions. This indicates a good distribution of scores for the Arabic-MLBPDQ, good content validity, and another indication of adequate reliability [40]. Homogeneity of items is an important feature of a questionnaire, especially if all items are measuring the same construct [40]. In the present study, the obtained internal consistency value of 0.85 indicates good homogeneity of all the 10 items of the adapted questionnaire. It was not too low (i.e., lack of association between the items), nor too high (i.e., redundancy of some items) [40]. In comparison with previous reports, the internal consistency value of the Arabic-MLBPDQ is higher than the

Table 6. Psychometric properties of the published Modified Low Back Pain Disability Questionnaire and Arabic Oswestry Disability Questionnaire.

First Author, Yr.	Adapted To	Internal consistency	Reliability					Construct Validity		Sensitivity		
		Cronbachâ s Î±	Days	ICC	SEM	MDC	LOA	Measure	r	Days	AUC	MIC
Modified Low Back Pain Disability Questionnaire												
Current Study	Arabic (SA)	0.85	2	0.98	1.60	4.43	-4.23 to 7.70	VAS	0.62	14	0.68	3
			14	0.94	2.77	7.67	-6.59 to 13.53	Quebec	0.77â 0.86			
								RM	0.54â 0.63			
								FABQ	0.60â 0.70			
Fritz, 2001 [12]	Original	-	28	0.90	5.40	12.68	-	-	-	28	0.94	6
Denteneer, 2018 [36]	Dutch	-	63	0.89	3.19	8.80	-	RM	0.69	63	0.64	-
								SF-36	-0.59 to -0.29			
Sakulsriprasert, 2006 [37]	Thai	-	20â 30 min	0.98	-	-	-	-	-	-	-	-
Baradaran, 2016 [38]	Persian (Iran)	0.69	Not reported	0.68	-	-	-	SF-36	-0.55 to -0.18	-	-	-
Arabic Oswestry Disability Questionnaire												
Algarni, 2014 [14]	Arabic (SA)	0.89	2	0.99	-	-	-	VAS	0.71	-	-	-
								Quebec	0.79			
								RM	0.66			
Guermazi, 2004 [15]	Arabic (Tunisia)	0.76 (items 3, 4, 6, 7 & 8). 0.70 (items 1, 2 & 5).	3	0.98	-	-	-	VAS-pain	0.58	-	-	-
								VAS-handicap	0.70			
								Waddel Index	0.73			
								Quebec	0.87			
Ramzy, 2008 [16]	Arabic (UAE)	0.99	2	0.99	-	-	-2.40 to 3.76	VAS	0.81â 0.90	-	-	-
								Squat test	-0.77 to -0.70			

ICC, intraclass correlation coefficient; SEM, standard error of measurement; MDC, minimal detectable change; LOA, 95% limits of agreement; r, correlation coefficient; AUC, area under the curve; MIC, minimum important change; SA, Saudi Arabia; VAS, Visual Analog Scale; Quebec, Quebec Back Pain Disability Scale; RM, Roland-Morris Disability Questionnaire; FABQ, Fear-Avoidance Beliefs Questionnaire; SF-36, short form health survey questionnaire; UAE, United Arab Emirates.

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value of the Persian-MLBPDQ [38] (see Table 6), and comparable with the values of some validation studies of the ODQ (0.83â 0.87) [13,17,19,20,23â 25,55,57,59].

The test-retest reliability of the Arabic-MLBPDQ was excellent. The noted ICC values were close to previously reported reliability coefficients of the MLBPDQ. For example, the English MLBPDQ showed an excellent ICC value of 0.90 at four-weeksâ follow-up [12]. The reliability of the Dutch MLBPDQ, although with a longer follow-up period (nine weeks), was also excellent (0.89) [36]. The Thai version demonstrated a total ICC value of 0.98, but with 20 to 30 minutes of inter-administration time [37]. Regarding the original ODQ, the Arabic-SA [14] and the Arabic-Tunisian [15] versions had excellent reliability, with ICC values of 0.999 and 0.98, respectively (two to four daysâ follow-up). These values are comparable with the reliability coefficients reported in the current study (Table 6).

It is important to note that ICC value alone does not provide enough information about measurement error of an instrument [68]. Therefore, we calculated the SEM for the Arabic-MLBPDQ, which is an estimate of measurement error. The less SEM, the more reliability of that instrument [48]. The SEM is also used to calculate the MDC, which reflects the smallest change in score for one person beyond measurement error [40,48]. For instance, the $MDC_{95\%}$

value of 7.67 calculated for 14 days indicates that, for a specific patient, a change of more than 8 points is most likely due to true change in the functional disability status of that patient rather than measurement error. This threshold is relativity less than the values reported in most of the previous validation studies of the ODQ (ranging from 9 to 13) [13,21,22,27,32,50,51], and the MLBPDQ (8.8) [36]. The SEM and $MDC_{95\%}$ of the Arabic-MLBPDQ reported in this study suggest the absolute reliability of the questionnaire.

Another measure of reliability assessed in this study are the LOA, which represent the degree of agreement of scores obtained on two different occasions [48]. The 14-day LOA analysis of the Arabic-MLBPDQ indicates that a deterioration more than 14 points and improvement more than seven points is considered a true change in a patientâ s disability status at a 95% confidence level [30]. When comparing the LOA of the Arabic-MLBPDQ with other versions validated previously, the upper limit is extremely similar to the values calculated for the Chinese (13.7) [32] and the Danish (12.4â 13.6) [30] versions of the ODQ; however, the lower limit is less (-12.5 and -9.2 to -12.7 for the Chinese and the Danish, respectively). The Arabic ODQ-United Arab Emirates (UAE) [16] showed narrower limits of agreement of -2.4 to 3.76 at 95% confidence level for two days retest (Table 6).

It has been recommended that *a priori* hypotheses need to be stated when evaluating the construct validity of an instrument [40]. This is to avoid potential risk of bias when interpreting the correlations with other instruments. In this study, the construct validity of the Arabic-MLBPDQ was supported by confirming three out of four (75%) of the predefined hypotheses. The Arabic-MLBPDQ showed significant excellent correlation with the Arabic Quebec, which is similar to the reported correlation between the Arabic-SA ODQ (r = 0.792) [14] and the Arabic-Tunisian ODQ (r = 0.86) [15] with the Arabic Quebec. Furthermore, the moderate correlation values calculated in this report with the RM were comparable with the correlations reported between the two questionnaires in Dutch (r = 0.69) [36], and the Arabic-SA ODQ with the Arabic RM (r = 0.656) [14] (Table 6), but slightly less than the values calculated in previous validation studies of the ODQ in other languages [25,27,29,53,55,56,59]. Similarly, a moderate degree of association was detected between the Arabic-MLBPDQ and VAS. This value is similar to the values obtained in other reports [13,32,50,54,55], and slightly higher than the one obtained between the Arabic-UAE ODQ and VAS [16]. In term of association between the Arabic-MLBPDQ and FABQ, it was stronger than the values reported for the Hausa version of the ODQ (r = 0.19) [13]. This association value provides further information about the direct proportionality of fear-avoidance beliefs with self-reported disability due to LBP [69â 75].

The sensitivity to change of the Arabic-MLBPDQ as indicated by the AUC value is similar to the sensitivity of the Dutch version (AUC = 0.64) [36]. However, the English version of the MLBPDQ achieved excellent sensitivity of AUC = 0.94 [12] (Table 6). A possible explanation for the higher sensitivity value of the English version of the MLBPDQ is that re-administration time was after four weeks. On the other hand, the Arabic-MLBPDQ was re-administered two weeks after baseline. This might have slightly decreased the likelihood of detecting changes in patientsâ condition; however, we believe that the sensitivity value described in this study highlights the usefulness of the Arabic-MLBPDQ.

Another measure of responsiveness evaluated in this study is the MIC. The MIC, also called the minimal clinically important difference and the minimal clinically important change [48], is interpreted as the smallest change in score in the construct measured that is considered useful by the patient. Consequently, this change would lead to an adjustment of the patientâ s management in the absence of excessive side effects and extra costs [76]. It is suggested that the MIC should be greater than the MDC for an instrument be able to differentiate minimum important change from measurement error [40]. The obtained MIC of 3 points for the Arabic-MLBPDQ is less than

the MDC of 7.67 points. Similar relationship between the MIC and MDC was also calculated for the English version of the MLBPDQ in three previous studies (6 vs. 12.6) [12], (9 vs. 12.8) [34], and (5 vs. 13.1) [35]. This was also the case in several responsiveness studies of the ODQ [52,62,77]. Some studies attributed that to the anchor used for calculation, the global change scale, which could be very subjective and influenced by recall bias [62,77]. Therefore, and since the MDC value of the Arabic-MLBPDQ exceeds the MIC, and it is relatively well above the SEM, we suggest considering a change of more than 8 points (i.e., the $MDC_{95\%}$) after two-week of treatment as a true change in patient status [35], as described earlier in the discussion.

A potential limitation of this study is that the patient sample group was drawn from a single Arab country, Saudi Arabia. However, we believe this will have a minimal effect on the generalizability of the results, because the translation and adaptation of the MLBPDQ was completed using Modern Standard Arabic, the language used in books, newspapers, magazines, media, formal speech, and communications and the most common form of Arabic taught in primary education in all Arab countries [78,79]. Further, the Arabic-MLBPDQ was tested among literate patients only. We recommend evaluating the psychometric properties among nonliterates as well, similar to the work done by Adamu and colleagues [13]. Another limitation of our study was not including the forward and backward translators on the expert committee. The principle investigator was a part of the committee and could deliver any questions or queries raised by the members, and the committee raised no questions to the translators during the meeting, but we believe that the translatorsâ presence could have made the discussion more productive. An additional limitation was our using a two-day interval to measure the test-retest reliability of the Arabic-MLBPDQ. Although a two-day interval is not uncommon in the previous validation studies of the ODQ [14,16,19,22,27,29,32,51,53,54,58,59], and the reliability coefficients obtained after two days and after 14 days are comparable, the risk of memory effect cannot be excluded with such a short interval. Finally, the MIC value computed in this study for the Arabic-MLBPDQ should be interpreted with caution because it is within the MDC. We recommend further research to be conducted in this area.

In conclusion, our study showed that the Arabic-MLBPDQ is a psychometrically valid, reliable, and, to some degree, sensitive tool to assess disability level in patients with LBP. We suggest that clinicians and researchers utilize this Arabic version of the MLBPDQ in their practice to monitor Arabic-speaking patients with LBP.

Supporting information

S1 Data. Dataset.
(XLSX)

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