Reliability, validity and responsiveness of the Kurdish version of the questionnaire Disability of the Arm, Shoulder and Hand in patients with carpal tunnel syndrome

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ABSTRACT

Introduction: The Disabilities of Arm, Shoulder and Hand (DASH) questionnaire predicts the amount of the patient's inabilities and symptoms to evaluate the impacts of upper limb conditions in the patient's daily-life activities. This study aims to test the psychometric properties of DASH in Kurdish patients with carpal tunnel syndrome.

Materials and Methods: 93 patients with diagnosed carpal tunnel syndrome subjected to complete the self-report DASH-KU and patient rated wrist\hand evaluation PRWHE-KU questionnaire during two consecutive assessments with a 24-hour interval before any intervention.

Results: DASH-KU questionnaire had excellent internal consistency (Cronbach's alpha = 0.99) and test-retest reliability (intra-class correlation coefficient =0.99). A strong correlation between the DASH-KU score and the PRWHE tool (r=0.792) demonstrated acceptable construct validity of DASH-KU. Bland–Altman plot showed good agreement between the two assessments of DASH-KU, and no floor (3%) nor ceiling effects (0%) were observed. Factor analysis showed that the DASH-KU scale had a high acceptable adequacy (adequacy index = 0.700) and a significant sphericity (p<0.001). The analysis showed a major factor that accounted for 40% of the observed variance with an eigenvalue of 13.14. In addition, five items model also explained 81.23% of the DASH-KU scale variance. However, the responsiveness of DASH-KU was suboptimum, which can be linked to the short 24-hour interval between measurements.

Conclusion: The DASH-KU scale is a reliable, valid, and responsive instrument for assessing disabilities in patients with carpal tunnel syndrome.

INTRODUCTION
Carpal tunnel syndrome (CTS), the most common entrapment neuropathy, is caused by median nerve compression at the wrists.[1] Patient-oriented outcome measures provide a better understanding of the patient's overall functional outcomes following musculoskeletal conditions. Therefore, various subjective, patient-rated assessment tools were developed in the evaluation of the upper extremity, including the patient-rated wrist/hand evaluation (PRWHE) and the disabilities of arm, shoulder, and hand (DASH) questionnaires.[2-4] The DASH questionnaire was originally developed by the American Academy of Orthopedic Surgeons (AAOS) in collaboration with the Institute for Work and Health (IWH). This 30-item scale addresses the patient's disabilities and symptoms in the preceding week to evaluate the extent and impact of injuries on the patient's daily-life activities. DASH has previously shown great clinometric quality and correlation with the international classification of functioning, disability, and health (ICF) assessment.[5,6] The cross-cultural adaptation of DASH has made it available in many regions.[7-9] In this regard, Kc et al. demonstrated that considerable changes during the cross-cultural adaptation of the Nepali version of DASH led to an excellent intraclass correlation (ICC) and test-re-test reliability.[10] Lee et al.,[11] introduced the Korean version of DASH and reported an ICC of 0.91 and a high internal consistency.

In addition, the reliability and validity of this scoring tool were also approved in the Greek cross-cultural adaptation.[12] In continuation with the previous studies, we aimed to test for validity, reliability, and responsiveness of adapted Kurdish DASH[13] questionnaire in patients with carpal tunnel syndrome.

MATERIALS AND METHODS
Participants
Patients with diagnosed carpal tunnel syndrome were recruited in this cross-sectional study. 93 subjects were consecutively and available recruited from the Shahid Saifaddin consultation clinic in Sulaymaniyah, Iraq, between

Aprils to October 2022. Inclusion criteria were adult patients (age>18 years old) with diagnosed carpal tunnel syndrome having at least primary school education. Patients with any cognitive, linguistic, or vision impairment were excluded from our study.

Outcome Measures
Participants completed the self-report DASH-KU questionnaire two consecutive times within 24 hours.

Statistics
A sample size of 60 patients was calculated to be enough for this study according to the test-retest reliability of 0.90, reported in a previous study,10 and considering a 20% dropout rate (alpha of 5% and beta of 10%).

Reliability
The reliability of the DASH-KU questionnaire was evaluated by assessing Cronbach's alpha, ICC, and kappa statistics. Cronbach's alpha determines the internal consistency of the questionnaire, and scores of 0.70-0.79, 0.80-0.89, and >90 were defined as acceptable, good, and excellent, respectively. ICC was used to evaluate test-retest reliability between the first and second assessments of DASH-KU. An ICC of more than 0.75 was considered excellent. Kappa coefficients were also assessed to indicate the extent of agreement between participants' answers in two instances. Kappa coefficients of more than 0.90 were considered excellent.

Validity
The DASH-KU questionnaire's validity was measured by assessing the Pearson correlation coefficient of the DASH-KU and PRWHE scores. Criterion validity was evaluated by calculating the concordance correlation coefficient (CCC). In addition, ceiling and floor effects were reported. Ceiling and floor effects were considered as scores higher than the 90th percentile and lower than the 10th percentile of the total possible score, respectively. Moreover, we performed a factor analysis and rested the Kaiser-Meyer-Olkin sample adequacy index. A value greater than 0.60 was considered acceptable.[14] Sphericity was assessed by Bartlett's test. Finally, we conducted a principal component analysis and designed a Cattell's scree plot.

Responsiveness
Effect size, standardised response means (SRM), standard error in measurement (SEM), minimal detectable change (MDC) with a confidence interval of 95% (MDC95) and 90% (MDC90) were measured to assess responsiveness. The effect size and SRM were used to determine the ability of DASH-KU to detect improvement rates following the treatments. SEM, MDC95, and MDC90 were calculated to assess the ability of DASH-KU to distinguish true changes in the clinical status of a patient from an error in measurements during the follow-up period. All analysis were performed in MedCalc statistical software version 20.2.

Ethics Approval and Informed Consent
The ethics committee of Sulaymaniyah University has approved this study (Ethical code: 7/29-4758 on April 18th, 2022). Informed written consent was obtained from all participants.

RESULTS
Descriptive Statistics
Ninety-three patients were included in our study. The mean age of the participants was 51.23±9.15 years old. The majority of the included patients were females (77.4%), urban residents (66.7%), non-smokers (83.9%), and without an academic-level education degree (80.6%). The mean duration of symptoms was 15.69±7.10 weeks. The right upper limb was more prevalently involved (57% compared to 43%) (Table I). The mean total score of DASH was 31.40±12.31 in the first and 31.40 ± 12.30 in the second assessment. The mean difference in the time required to complete the form was 0.38±0.84 (Table II).

Psychometric Properties of the DASH-KU Questionnaire
Reliability
The analysis showed excellent internal consistency among the first and second assessments of the DASH-KU questionnaire. The Cronbach's alpha of the questionnaire was calculated as 0.9995. ICC of DASH-KU was 0.9995 (95% CI: 0.9994 to 0.9996), representing excellent test-retest reliability. In addition, kappa statistics of the score was 0.993 (95% CI: 0.987 to 0.999), demonstrating the questionnaire's excellent reliability.

Validity
Construct validity of the DASH-KU questionnaire was assessed by evaluating the correlation of DASH-KU with the PRWHE questionnaire. Results showed a strong correlation between the DASH-KU score and PRWHE (r=0.7921; *p*<0.0001). In addition, the CCC of DASH-KU (0.9990, 95% CI: 0.9987 to 0.9992) demonstrated strong correlation and validity. Bland–Altman plot showed good agreement between the two assessments of DASH-KU (Figure 1). No floor (3%) nor ceiling effects (0%) were observed (Table III).

Factor analysis showed that the DASH-KU scale had a high acceptable adequacy (adequacy index = 0.700) and a significant Sphericity (*p*<0.001) (Table IV and Figure 2). The analysis showed a major factor that accounted for 40% of the observed variance with an eigenvalue of 13.14. In addition, five items also explained 81.23% of the DASH-KU scale variance (Table IV).

Responsiveness
The effect size and SRM of DASH-KU were -0.00005 (95% CI: -0.012 to 0.003) and 0.001 (95% CI: -0.122 to -0.220), respectively. Since the follow-up period was 24 hours, a large effect size and SRM were not expected. The ability to detect changes was assessed by estimating SEM, MDC90, and MDC95. The DASH-KU scale's SEM, MDC90, and MDC95 were 0.275, 0.640, and 1.255, respectively (Table III).

DISCUSSION
This psychometric testing of DASH in the Kurdish language showed that DASH-KU has excellent reliability, validity, and acceptable responsiveness in identifying upper limb disorders. Our results demonstrated similar properties for DASH-KU to the English original version.[4]

Table I: Demographic and clinical characteristics of the included subjects

Variables	Value (n=93)
Age (year)	
Mean±SD	51.23±9.157
Gender (%)	
Male	21 (22.6)
Female	72 (77.4)
Educational status (n, %)	
Non-academic	75 (80.6)
Academic	18 (19.4)
Occupation (n, %)	
Employed	52 (55.9)
Un-employed	41 (44.1)
Residency status (n, %)	
Urban	62 (66.7)
Rural	31 (33.3)
Smoking status (n, %)	
Smoker	15 (16.1)
Non-smoker	78 (83.9)
Involved Region side (n, %)	
Right	53 (57.0)
Left	40 (43.0)
Duration of presence of symptoms (mean±SD; weeks)	15.69±7.10

SD: Standard deviation

Table II: Total score of DASH scale in the first and second assessment

	First assessment	Second assessment	Mean difference
DASH			
Total score	31.40±12.31	31.40±12.30	-0.001±0.55
Time needed to complete (min)	7.35±0.87	6.97±1.03	0.38±0.84
PRWHE			
Total score	43.16±15.09	43.12±15.07	0.04±0.24
Time needed to complete (min)	3.62±0.81	3.37±0.68	0.25±0.68

DASH: Disabilities of the Arm, Shoulder, and Hand
PRWE: Patient-Rated Wrist Evaluation

Table III: Psychometric properties of the Kurdish version of DASH

Properties	Value (95% CI)
Reliability	
Cronbach alpha	0.9995
ICC	0.9995 (0.9994 to 0.9996)
Kappa	0.993 (0.987 to 0.999)
Validity	
Pearson Rho	0.7921
Ceiling effect	0%
Floor effect	3.0%
CCC	0.9990 (0.9987 to 0.9992)
Responsiveness	
Effect size	-0.00005 (-0.012 to 0.003)
SRM	0.001 (-0.122 to -0.220)
Ability to detect changes	
SEM	0.275
MDC 90	0.640
MDC95	1.255

CCC: Concordance correlation coefficient
MDC: Minimal detectable change
SEM: Standard error in measurement
SRM: Standardized response means

The reliability of DASH-KU in the present study was excellent. Both internal consistency and test-retest reliability of the DASH-KU was higher than 0.99. In line with the present study, Lee et al., (2004) by examining 161 patients, showed that the ICC of the Korean version of DASH was 0.91 and its Cronbach's alpha was 0.94.15 Also, Themistocleous et al. (2006)12 reported a Cronbach's alpha equal to 0.96 for the Greek version of DASH.[12] Kc and colleagues demonstrated that the reliability of the Nepali translation of DASH was at an excellent level (ICC=0.97 and alpha=0.92).

Table IV: Results of factor analysis

Component	Eigenvalues	% Variance	Cumulative %
1	13.143	43.81	43.81
2	4.155	13.85	57.66
3	3.241	10.802	68.462
4	2.198	7.326	75.788
5	1.632	5.441	81.229
6	1.145	3.818	85.046
7	0.893	2.975	88.022
8	0.712	2.374	90.395
9	0.558	1.86	92.256
10	0.487	1.624	93.88
11	0.437	1.46	95.339
12	0.26	0.866	96.205
13	0.223	0.744	96.95
14	0.197	0.657	97.607
15	0.141	0.475	98.082
16	0.121	0.402	98.484
17	0.108	0.359	98.843
18	0.089	0.296	99.139
19	0.064	0.214	99.352
20	0.057	0.19	99.542
21	0.036	0.121	99.663
22	0.028	0.092	99.756
23	0.025	0.082	99.838
24	0.014	0.047	99.886
25	0.012	0.041	99.927
26	0.008	0.03	99.957
27	0.007	0.022	99.979
28	0.003	0.009	99.988
29	0.002	0.007	99.995
30	0.001	0.005	100

Kaiser-Meyer-Olkin index = 0.700
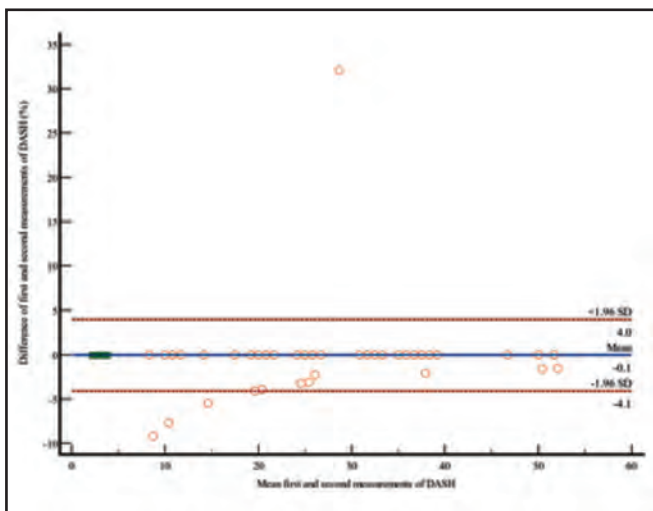Bartlett's Test of Sphericity = 9302.143; p <0.0001

Fig. 1: Agreement between first and second measurements of DASH
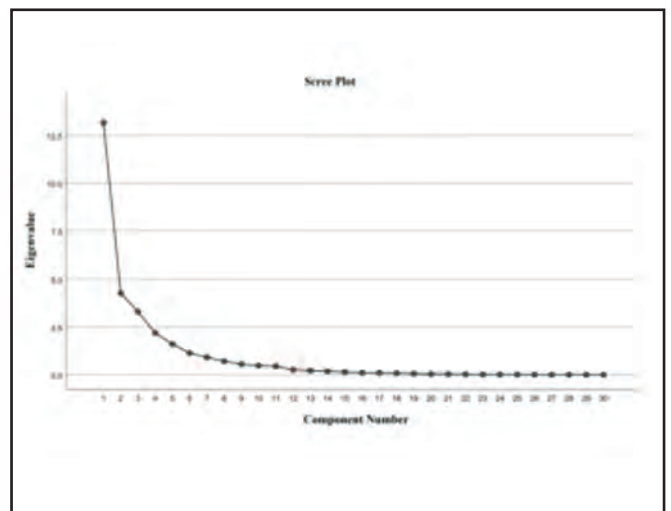

Fig. 2: The screen plot of DASH score

The construct validity of DASH-KU was compared with PRWHE. A strong correlation between DASH-KU and PRWHE was observed in the present study (r=0.79). Other studies have reported the construct validities of the translated versions of DASH ranging from 0.52 to 0.91.[10-12,15-18] Lee et al. (2008) showed a moderate to high relationship between Korean DASH and other tools.[11] Also, Themistocleous et al. (2006)[12] stated that there is a moderate relationship between the

Greek DASH and the SF-36 questionnaire. In addition, Fayad et al. (2008)[19] have reported that the correlation coefficient of the French version of DASH with other tools such as visual analogue score, ADL score, strength score, and range of motion score varied between 0.52 and 0.78. The ability of a questionnaire to detect clinically important changes among the studied patients is evaluated by its responsiveness. Two main values of effect size and SRM are reported as the main

parameters for assessing responsiveness. Our results showed a small effect size and SRM since patients were followed for only 24 hours, which is a short time interval to observe any recoveries in patients. Thus, a large effect size was not to be expected in this study for the responsivity of the questionnaire. However, many studies have shown that the translated versions of DASH accurately detect clinically important changes.[15-25] For example, Lee et al. reported acceptable responsiveness for Nepali DASH,[15] and Farzad et al. (2022)[26] concluded that the tool is highly responsive in hand conditions (effect size=1.65). Therefore, the 24-hour time interval in our study to re-test each participant limited the evaluation of responsiveness.

Identification of the condition and outcome of the treatment has yet to be investigated in cross-cultural adoption studies. Although, responsiveness is examined in some studies, statistical indicators such as sensitivity, specificity, and the area under the curve provide more informative data. It is worth mentioning that psychometric properties are not representative of the diagnostic performance of the utilised tool, and tools with acceptable psychometric properties do not necessarily have high sensitivity and specificity. For example, Moraes et al. (2022)[27] reported that the DASH score has 80% sensitivity and 60.3% specificity in identifying cases. Therefore, assessing the diagnostic accuracy of tools in cross-cultural adaptations is suggested.

CONCLUSION
Our results demonstrate that DASH-KU has excellent reliability, validity, and acceptable responsiveness regarding measuring outcomes in patients with carpal tunnel syndrome, and the psychometric properties of DASH-KU were similar to its original version.

CONFLICT OF INTEREST
No conflicts of interest.

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