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Original Article / Özgün Makale

Reliability and validity of Turkish version of Migraine-Specific Quality of Life v2.1 questionnaire

Migrene Özgü Yaşam Kalitesi Ölçeği v2.1'in Türkçe versiyonunun güvenirlik ve geçerliği

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ABSTRACT

Background: This study aims to assess whether the Turkish version of the Migraine-Specific Quality of Life Questionnaire v2.1 (MSQ v2.1) is a reliable and valid tool for evaluating the impact of migraine on daily functioning and overall quality of life.

Patients and Methods: This multi-center, descriptive, prospective study included a total of 182 migraine patients between December 2023 and May 2024. All patients were assessed at two visits with a four-week interval. The Turkish MSQ v2.1 was evaluated for comprehensibility, patient-physician reliability, internal consistency, test-retest reliability, and construct validity.

Results: Of a total of 182 patients, 19 were male and 163 were female with a mean age of 40.8±12.2 (range, 18 to 73) years. Item comprehensibility was high, with 94 to 97.8% at Visit 1, and from 98.4 to 100% at Visit 2. A strong correlation was observed between self-administered and physician-administered MSQ v2.1 scores at Visit 1 ($r = 0.916$, $p < 0.001$). Internal consistency was excellent, with Cronbach's alpha values of 0.932 at Visit 1 and 0.912 at Visit 2. Test-retest reliability was moderate ($r = 0.468$, $p < 0.001$). Construct validity was supported by strong correlations with the Headache Impact Test-6 ($r = 0.751$ at Visit 1 and $r = 0.772$ at Visit 2), monthly headache days ($r = 0.453$ and 0.553), and Numeric Rating Scale scores ($r = 0.539$ and 0.564), all with $p < 0.001$.

Conclusion: The Turkish MSQ v2.1 is a reliable and valid tool for assessing health-related quality of life (HRQL) in migraine patients. It demonstrates excellent internal consistency, moderate test-retest reliability, and strong correlations with established measures of HRQL, headache severity, migraine frequency, and supporting its use in clinical practice and research.

Keywords: Clinical scale, Health-Related Quality of Life, migraine, Migraine-Specific Quality of Life Questionnaire, reliability; validity.

ÖZ

Amaç: Bu çalışmada, Migren-Spesifik Yaşam Kalitesi Ölçeği v2.1'in (MSQ v2.1) Türkçe versiyonunun migrenin günlük yaşam ve yaşam kalitesi üzerindeki etkisini değerlendirmede güvenilir ve geçerli bir araç olup olmadığı incelendi.

Hastalar ve Yöntemler: Bu çok merkezli, tanımlayıcı, prospektif çalışmaya Aralık 2023 ile Mayıs 2024 tarihleri arasında toplam 182 migren hastası dahil edildi. Tüm hastalar, dört haftalık arayla iki ziyarette değerlendirildi. Türkçe MSQ v2.1'in anlaşılabilirliği, hasta-hekim uyumu, iç tutarlılığı, test-tekrar test güvenirliği ve yapı geçerliliği incelendi.

Bulgular: Toplam 182 hastanın 19'u erkek ve 163'ü kadın olup, yaş ortalaması 40.8±12.2 (dağılım, 18-73) yıl idi. Madde anlaşılabilirliği yüksek bulunmuş olup, 1. ziyarette %94-97.8, 2. ziyarette ise %98.4-100 arasında saptandı. Birinci ziyarette, hastanın kendi kendine uyguladığı MSQ v2.1 ile hekim tarafından uygulanan MSQ v2.1 skorları arasında güçlü bir korelasyon gözlendi ($r = 0.916$, $p < 0.001$). İç tutarlılık mükemmel olup, Cronbach alfa değerleri 1. ziyarette 0.932 ve 2. ziyarette 0.912 olarak bulundu. Test-tekrar test güvenirliği orta düzeydeydi ($r = 0.468$, $p < 0.001$). Yapı geçerliliği; Baş Ağrısı Etki Testi-6 ile güçlü korelasyonlar (1. ziyarette $r = 0.751$ ve 2. ziyarette $r = 0.772$), aylık baş ağrısı gün sayısı ($r = 0.453$ ve 0.553) ve Sayısal Derecelendirme Ölçeği skorları ($r = 0.539$ ve 0.564) ile desteklenmiş olup, tümü için $p < 0.001$ idi.

Sonuç: Türkçe MSQ v2.1, migren hastalarında sağlıkla ilişkili yaşam kalitesini (HRQL) değerlendirmek için güvenilir ve geçerli bir araçtır. Ölçek, mükemmel iç tutarlılık, orta düzeyde test-tekrar test güvenirliği ve HRQL, baş ağrısı şiddeti ile migren sıklığını değerlendiren yerleşik ölçümlerle güçlü korelasyonlar göstermekte olup, bu bulgular klinik uygulama ve araştırmalarda kullanımını desteklemektedir.

Anahtar sözcükler: Klinik ölçek, Sağlıkla İlişkili Yaşam Kalitesi, migren; Migrene Özgü Yaşam Kalitesi Anketi, güvenirlik; geçerlilik.

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Migraine is a neurological disorder characterized by recurrent and severe headaches which significantly disrupt daily functioning. Patient-reported outcome measures (PROMs) are widely recognized as essential tools for evaluating the impact of diseases on health-related quality of life (HRQL) in clinical practice.[1,2] Disease-specific PROMs, such as the Migraine-Specific Quality of Life Questionnaire version 2.1 (MSQ v2.1), are particularly valuable as they directly address the challenges unique to a given condition, thereby providing a more precise assessment of treatment effects. Such instruments capture treatment-related changes more effectively and are recommended for use in clinical trials for migraine.

The MSQ v2.1 is a valuable tool for assessing the impact of migraine on patients' quality of life, widely used in both medical research and clinical practice.[3-5] It encompasses three key domains: Role Function-Restrictive (RF-R), Role Function-Preventive (RF-P), and Emotional Function (EF), providing a comprehensive understanding of how migraines affect daily living activities and well-being. Psychometric studies have demonstrated its reliability and validity across diverse populations, with Cronbach's alpha (α) values ranging from 0.70 to 0.85.[6,7] Subsequent validation studies, including those by Bagley et al.[8] and Martin et al.,[9] further confirmed its robustness and applicability in heterogeneous populations. Additionally, the MSQ v2.1 is endorsed by organizations, such as the International Headache Society, for use in clinical trials evaluating preventive migraine treatments.[10] Moreover, the questionnaire has been successfully adapted into various languages, confirming its cross-cultural applicability.[11-15] Its widespread use reflects its well-defined structure and specific focus on migraine-related quality of life, establishing it as a key tool in both research and clinical decision-making.

Despite its global use, the Turkish version of the MSQ v2.1 has not yet been validated. In the present study, we aim to address this gap by evaluating the reliability and cultural applicability of the Turkish adaptation, ensuring that it retains the psychometric strengths of the original version.

PATIENTS AND METHODS

This multi-center, descriptive, prospective study was conducted at Departments of Neurology of five tertiary care centers between December 2023 and May 2024. Initially, patients with a diagnosis of migraine were screened. Migraine diagnoses were established based on the criteria outlined in the third edition of the International Classification of Headache Disorders.[16] Both episodic migraine (EM) and chronic migraine (CM) patients were included. Patients receiving prophylactic treatment were required to have maintained a stable therapeutic regimen for a minimum of three months prior to enrollment. Exclusion criteria comprised major psychiatric disorders that could impair cognitive function, illiteracy, inability to attend follow-up visits, or unwillingness to participate. Out of 207 initially recruited patients, 25 were excluded due to loss to follow-up (n = 11) or withdrawal of consent (n = 14), resulting in a final sample of 182 patients for analysis (Figure 1). Episodic migraine was defined as experiencing up to 14 headache days per month on average over the preceding three months, whereas CM was characterized by at least 15 headache days per month for at least three consecutive months, with a minimum of eight days fulfilling migraine criteria. A written informed consent was obtained from each patient. The study protocol was approved by the Acıbadem University, Faculty of Medicine, Ethics Committee (Date: 30.11.2023, No: 2023-19/656). The study was conducted in accordance with the principles of the Declaration of Helsinki.

Outcome measures

The study was conducted over two consecutive visits: Visit 1 (baseline) and Visit 2 (four weeks later). At baseline, sociodemographic characteristics, headache-related variables, and scores from the Migraine Disability Assessment Scale (MIDAS), and Patient Health Questionnaire-4 (PHQ-4) were obtained. At the second visit, patients returned their completed headache diaries and rated headache severity using the Numeric Rating Scale (NRS).

At both visits, all patients were evaluated using the Headache Impact Test-6 (HIT-6), and self-administered scores were obtained for the Comprehensibility Assessment Form (CAF) and the MSQ v2.1.

Additionally, at Visit 1, a subgroup of patients (Subgroup A, n = 90), randomly selected through 1:1 allocation, underwent physician-administered CAF and MSQ v2.1 evaluations.

The psychometric evaluation of the Turkish MSQ v2.1 included comprehensibility, construct validity, test-retest reliability, agreement between patient- and physician-reported scores, and internal consistency (Figure 2).

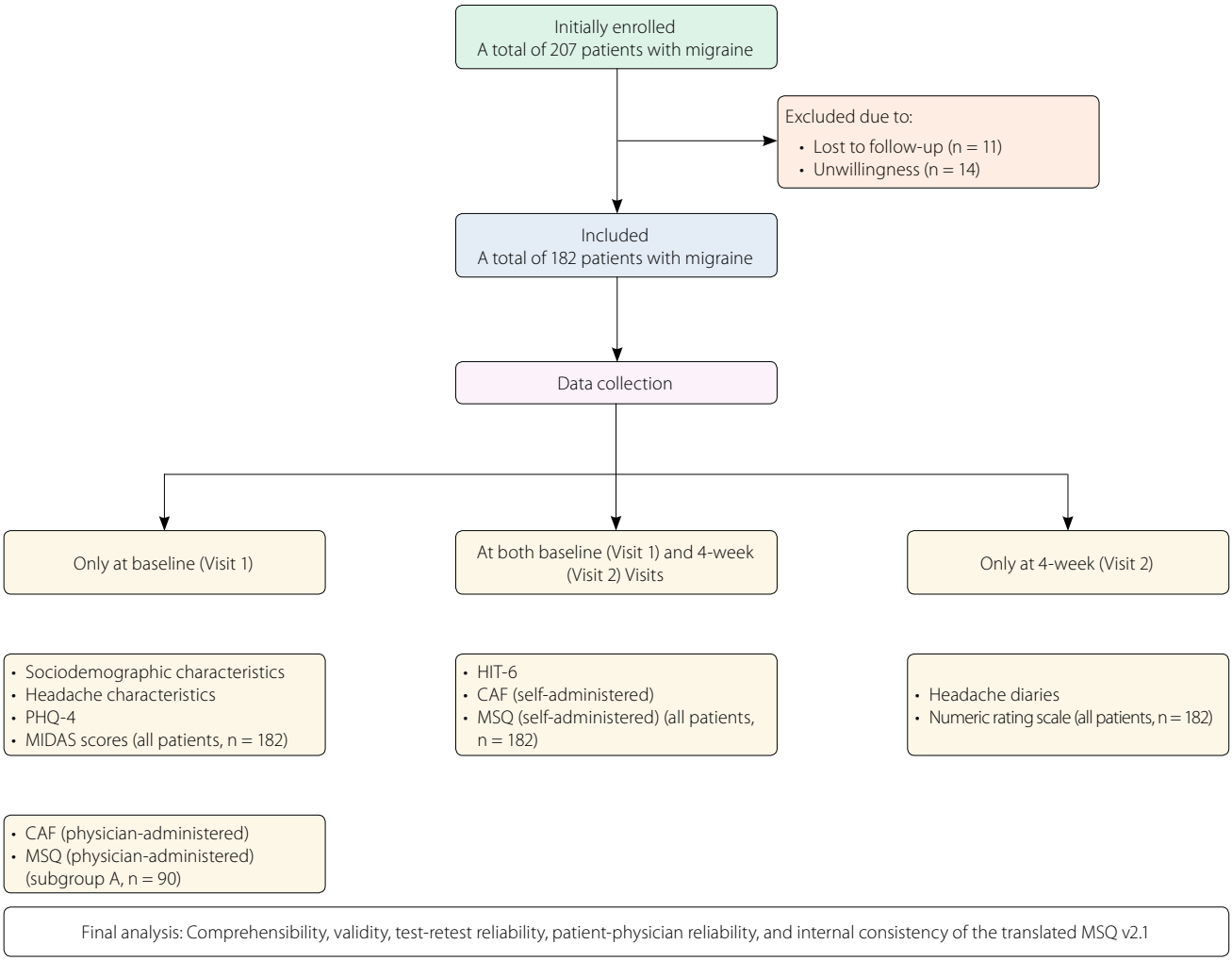

Figure 1. Flowchart of the study.

PHQ-4, Patient Health Questionnaire-4; MIDAS, Migraine Disability Assessment test; HIT-6, Headache Impact test-6; CAF, comprehensibility assessment form; MSQ, Migraine Specific Quality of Life.

Severity, frequency, and intensity of headache

At Visit 1, patients were asked about the number of monthly headache days (MHDs), monthly migraine days (MMDs), and the quantity of medications taken for pain relief during the previous month. Headache frequency was monitored through diaries at the follow-up visit, while intensity was assessed using the MIDAS-B score at baseline and the NRS at Visit 2.

Headache impact test

The HIT-6 is designed to measure the impact of headaches on various aspects of daily life, including social interactions, role performance, cognitive capacity, vitality, and emotional well-being.[17,18] It comprises six items rated on a five-point Likert scale: 6 (never), 8 (rarely), 10 (sometimes), 11 (very often), and 13 (always). The total score ranges from 36 to 78 and is categorized into four levels: ≤ 49 (no or minimal impact), 50-55 (mild), 56-59 (moderate), and ≥ 60 (severe impact).

Migraine disability assessment scale

The MIDAS evaluates migraine-related disability over the previous three months by assessing productivity losses in three domains: work or school, household responsibilities, and family/social or leisure activities. It includes five questions that determine the number of days affected by migraine.[19,20] Disability severity is classified as follows: –5 days (minimal or none), 6-10 days (mild), 11-20 days (moderate), and > 21 days (severe).

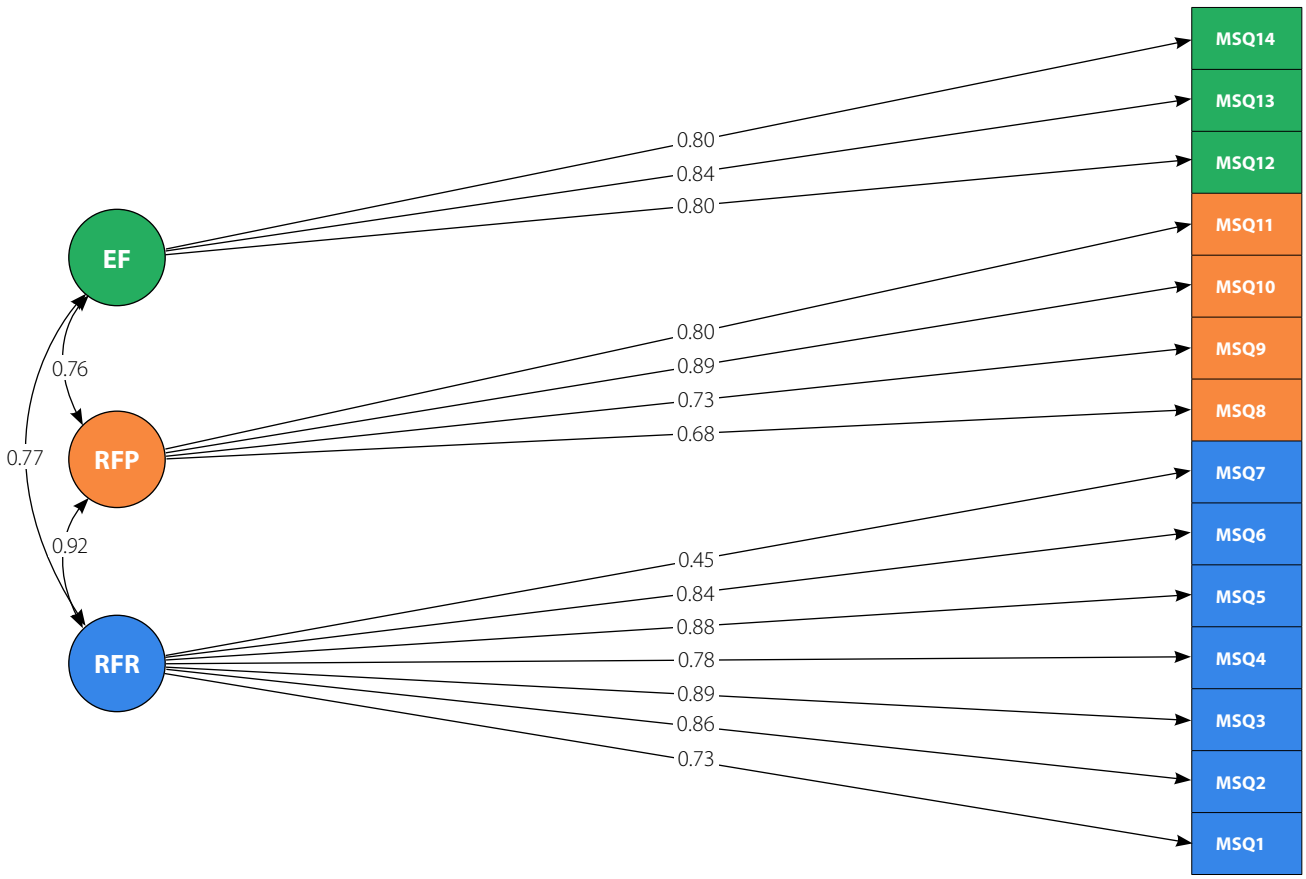

Figure 2. Factor analysis of MSQ v.2.1.

MSQ: Migraine Specific Quality of Life; MSQ v2.1, Migraine-Specific Quality of Life Questionnaire v2.1; RFP: Role function-preventive; RFR: Role function-restrictive.

Patient Health Questionnaire-4

The PHQ-4, developed by Kroenke et al.,[21] is an ultra-brief screening instrument for symptoms of depression and anxiety. The scale consists of four items, each rated on a four-point Likert scale ranging from 0 (0 = "Not at all" to 3 = "Nearly every day"), yielding a total score between 0 and 12. Higher scores indicate greater psychological distress. Subscale scores for depression and anxiety are obtained by summing the relevant items. Its brevity enables rapid screening in both clinical practice and research contexts.[22]

Migraine-Specific Quality of Life Questionnaire version 2.1

The MSQ v2.1 is a self-administered questionnaire comprising of 14 items designed to evaluate the impact of migraines on three quality-of-life over the preceding four weeks: (a) Role Restrictive (RR): seven items evaluating limitations in daily work and social activities; (b) Role Preventive (RP): four items assessing the extent to which migraines interrupt social and occupational functioning; and (c) Emotional Function (EF): three items addressing emotional effects, such as frustration and despair.

The scoring of the MSQ v2.1 involves transforming raw scores into a 0-100 scale to facilitate interpretation. Each of the 14 items is rated on a six-point Likert scale (1 = "None of the time" to 6 = "All of the time"), yielding a minimum possible total score of 14 and a maximum of 84. The transformed score is calculated using the formula:

$$\text{Transformed score} = \frac{(\text{Raw score} - \text{Minimum score})}{(\text{Maximum score} - \text{Minimum score})} \times 100$$

Higher scores of the MSQ v2.1 indicate better health-related quality of life.[9] To illustrate, a raw score of 45 corresponds to a transformed score of approximately 44.3. The same procedure is applied both for the overall score and for each domain separately, using the respective minimum and

maximum values based on the number of items in that domain.

Forward and Back Translations of MSQ v2.1

The Turkish adaptation of the MSQ v2.1 was carried out through a standardized forward and back-translation process. Initially, a bilingual native Turkish speaker translated the original English version of MSQ v2.1 into Turkish. Subsequently, a native English blinded to the original questionnaire, back-translated it into English. Two authors meticulously reviewed the back-translated English version, comparing it with the original MSQ v2.1 to ensure semantic and conceptual equivalence. The Turkish version was only finalized as the official Turkish adaptation of MSQ v2.1 after confirming its consistency with the original version. This process preserved both the intent and psychometric integrity of the original instrument while ensuring cultural appropriateness for Turkish patients (Appendix).

Comprehensibility assessment

The comprehensibility of the MSQ v2.1 was assessed using the CAF. Patients completed self-administered CAF at both visits, while physicians also completed the CAF for subgroup A patients at Visit 1. Comparisons between Visit 1 and Visit 2 allowed assessment of changes in comprehension over time. The CAF evaluated how well patients understood each item of the MSQ v2.1 using a four-point scale: 1 (well-understood), 2 (partly understood), 3 (hardly understood), and 4 (not understood).

Patient-physician reliability

Patient-physician reliability was examined in Subgroup A by comparing self-administered and physician-administered MSQ v2.1 scores at Visit 1. This analysis was conducted to evaluate the level of agreement and consistency between different modes of administration.

Reliability assessment

Reliability was explored using two different methods in terms of reproducibility and internal consistency. Test–retest reliability was determined by correlating MSQ v2.1 scores from Visit 1 and Visit 2 within the same patients. Internal consistency was assessed using Cronbach's α for Visit 1 and Visit 2 scores across all participants, as well as for self-administered and physician-administered scores in Subgroup A. The correlation between the internal consistency of Visit 1 self-administered and physician-administered scores was also analyzed. The four-week interval between visits was chosen to be long enough to minimize recall bias, while still short enough to avoid major clinical changes in disease severity.

Validity of MSQ v.2.1.

Validity was assessed through multiple approaches. At visit 1, MSQ v2.1 scores were correlated with migraine characteristics and clinical measures, including duration of migraine, MHDs, MMDs, migraine frequency, PHQ-4, HIT-6, and MIDAS scores (total, MIDAS-A, and MIDAS-B). Similarly, at Visit 2, correlations were examined between MSQ v2.1 scores and MHDs, MMDs, HIT-6, and NRS scores. In addition, construct validity was evaluated by performing a Confirmatory Factor Analysis (CFA). Together, these analyses provided a comprehensive assessment of the questionnaire's ability to capture migraine-specific quality of life across different domains and time points.

Statistical analysis

Statistical analysis was performed using the STATISTICA version 13.5 software (TIBCO Software Inc. CA, USA).[23] Descriptive data were presented in mean±standard deviation (SD), median (min-max) or number and frequency, where applicable. The Shapiro-Wilk test was applied to assess normality for MSQ v2.1, HIT-6, MIDAS, MIDAS-A, MIDAS-B, PHQ-4, and NRS scores. Differences in MSQ v2.1 item comprehensibility between Visit 1 and Visit 2 were examined with the Wilcoxon signed-rank test. Internal consistency was measured using Cronbach's α, with α ≥0.70 indicating adequacy. Test-retest reliability was evaluated using the Spearman correlation. Convergent validity was analyzed by correlating MSQ v2.1 scores with MIDAS, HIT-6, PHQ-4, MHDs, MMDs, and NRS, with coefficients ≥ 0.30 regarded as moderate and ≥ 0.50 as strong.[24,25] For structural validity, CFA was conducted in JASP. The predefined three-factor model (RF-R, RF-P, EF) was tested with fit indices: CFI, TLI (≥ 0.95), and RMSEA (< 0.06).[26] Standardized factor loadings were used to evaluate item-factor relationships. A p value of < 0.05 was considered statistically significant.

RESULTS

Of a total of 182 patients, 19 were male and 163 were female with a mean age of 40.8±12.2 (range, 18 to 73) years. Most participants were classified as having EM (90.1%), and 67.6% were receiving preventive treatment at baseline (Table 1).

The clinical characteristics of the patients at both visits are summarized in Table 1. At Visit 1, patients

Table 1. Demographic and clinical features of the participants (n = 182)

Variables	n	%	Mean±SD
Sex			
Female	163	89.6	
Positive family history of migraine	124	68.1	
Episodic migraine	164	90.1	
Chronic migraine	18	9.9	
Visit 1			
MHDs in the previous month			11.5±8.8
MMDs in the previous month			7.5±6.2
Number of migraine attacks medications (previous month)			8.3±10.6
Total MIDAS			37.7±41.4
MIDAS-A			28.6±23.4
MIDAS-B			7.5±1.6
HIT-6			62.8±8.0
PHQ-4			5.3±3.2
Visit 2			
MHDs			8.4±6.3
MMDs			5.6±4.9
Number of migraine attacks medications			7.1±4.9
HIT-6			58.7±10.1
NRS			6.2±1.9

SD, standard deviation; MHDs, Monthly headache days; MMDs, Monthly migraine days; MIDAS, Migraine Disability Assessment test; MIDAS-A, number of days with headache in the last 3 months; MIDAS-B, average headache severity over the last 3 months on a 0-10 scale; HIT-6, Headache Impact test-6; PHQ-4, Patient Health Questionnaire-4; NRS: numeric rating scale.

reported a mean of 11.5±8.8 MHDs and 7.5±6.2 MMDs. The mean MIDAS total score of 37.7±41.4 indicated severe disability. The MIDAS grades were distributed as follows: Grade 1 (n = 30, 16.5%), Grade 2 (n = 24, 13.2%), Grade 3 (n = 24, 13.2%), and Grade 4 (n = 104, 57.1%). The mean PHQ-4 score at Visit 1 was 5.3±3.2. At Visit 2, headache frequency decreased, with mean values of 8.4±6.3 MHDs and 5.6±4.9 MMDs. The mean NRS score was 6.2±1.9. In addition, HIT-6 scores significantly decrease between Visit 1 and Visit 2 (62.8±8.0 *vs.* 58.7±10.1; $p < 0.001$), indicating an improvement in headache impact on daily life.

Comprehensibility

At Visit 1, 94.0 to 97.8% of patients rated MSQ v2.1 items as "well understood", increasing to 98.4 to 100% at Visit 2 (Table 2). A statistically significant difference in comprehensibility was found between Visit 1 and Visit 2 for Items 1, 3, 4, 6, 7, and 12.

In Subgroup A, physician-based evaluation at Visit 1 confirmed similarly high rates, with "well-understood" items ranging from 95.6 to 100%. In addition, physician-reported assessments also demonstrated very high comprehension rates (97.8 to 100%) (Table 3).

Correlations between patient and physician rating were calculated for Items 1, 6, 8, 10, 12, and 14. Agreement was significant for several of these items, with correlation coefficients ranging from r = −0.016 to 0.703 and p values from 0.881 to < 0.001. For other items, comprehension was higher when evaluated by physicians.

Patient-physician reliability

At Visit 1, no significant difference was found between self-administered (mean: 31.62±15.37) and physician-administered (mean: 31.28±15.97) MSQ v2.1 scores ($p = 0.482$). Moreover, a strong positive correlation was observed between the two methods (r = 0.916, $p < 0.001$) (Table 4).

Test-Re-Rest Reliability

MSQ v2.1 scores significantly decreased from 29.18±15.25 at Visit 1 to 22.34±15.48 at Visit 2 ($p < 0.001$). Despite this change, test-retest analysis

Table 2. Comprehensibility of MSQ v2.1. items at Visit 1 compared to Visit 2 (n = 182)

	Self-administered scores of MSQ v.2.1													
	Item 1		Item 2		Item 3		Item 4		Item 5		Item 6		Item 7	
	Visit 1	Visit 2	Visit 1	Visit 2	Visit 1	Visit 2	Visit 1	Visit 2	Visit 1	Visit 2	Visit 1	Visit 2	Visit 1	Visit 2
Comprehensibility	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
0	174 (95.6)	180 (98.9)	179 (98.4)	181 (99.5)	177 (97.3)	182 (100.0)	171 (94)	180 (98.9)	177 (97.3)	181 (99.5)	176 (96.7)	181 (99.5)	174 (95.6)	179 (98.4)
1	2 (1.1)	2 (1.1)	-	1 (0.5)	2 (1.1)	-	6 (3.3)	2 (1.1)	1 (0.5)	1 (0.5)	1 (0.5)	1 (0.5)	4 (2.2)	3 (1.6)
2	4 (2.2)	-	3 (1.6)	-	3 (1.6)	-	4 (2.2)	-	3 (1.6)	-	3 (1.6)	-	4 (2.2)	-
3	2 (1.1)	-	-	-	-	-	1 (0.5)	-	1 (0.5)	-	2 (1.1)	-	-	-
p value	0.020*		0.131		0.038*		0.007*		0.056		0.033*		0.037*	

	Item 8		Item 9		Item 10		Item 11		Item 12		Item 13		Item 14	
	Visit 1	Visit 2	Visit 1	Visit 2	Visit 1	Visit 2	Visit 1	Visit 2	Visit 1	Visit 2	Visit 1	Visit 2	Visit 1	Visit 2
Comprehensibility	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
0	177 (97.3)	180 (99.4)	178 (97.8)	182 (100.0)	178 (97.8)	182 (100.0)	178 (97.8)	181 (99.5)	175 (96.2)	180 (99.4)	178 (97.8)	182 (100.0)	177 (97.3)	181 (99.5)
1	2 (1.1)	1 (0.6)	1 (0.5)	-	1 (0.5)	-	1 (0.5)	1 (0.5)	5 (2.7)	1 (0.6)	1 (0.5)	-	3 (1.6)	-
2	2 (1.1)	-	2 (1.1)	-	2 (1.1)	-	2 (1.1)	-	2 (1.1)	-	2 (1.1)	-	2 (1.1)	-
3	1 (0.5)	-	1 (0.5)	-	1 (0.5)	-	1 (0.5)	-	-	-	1 (0.5)	-	-	1 (0.5)
p value	0.071		0.066		0.066		0.102		0.011*		0.066		0.339	

* $p < 0.05$, *p*, Wilcoxon Signed Rank test (Visit 1 *vs.* 2)

- For Item 1. There was a significant difference in comprehensibility between Visit 1 and Visit 2 ($p = 0.020$).
- For Item 3. There was a significant difference in comprehensibility between Visit 1 and Visit 2 ($p = 0.038$).
- For Item 4. There was a significant difference in comprehensibility between Visit 1 and Visit 2 ($p = 0.007$).
- For Item 6. There was a significant difference in comprehensibility between Visit 1 and Visit 2 ($p = 0.033$).
- For Item 7. There was a significant difference in comprehensibility between Visit 1 and Visit 2 ($p = 0.037$).
- For Item 12. There was a significant difference in comprehensibility between Visit 1 and Visit 2 ($p = 0.011$).

Table 3. Comprehensibility of MSQ v2.1 items in Group A at Visit 1 compared to Visit 2 (n = 90)

	Self- and physician-administered MSQ v.2.1 scores at Visit 1													
	Item 1		Item 2		Item 3		Item 4		Item 5		Item 6		Item 7	
	Self-reported	Physician-reported	Self-reported	Physician-reported	Self-reported	Physician-reported	Self-reported	Physician-reported	Self-reported	Physician-reported	Self-reported	Physician-reported	Self-reported	Physician-reported
Comprehensibility	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
0	88 (97.8)	89 (98.9)	90 (100)	90 (100)	87 (96.7)	90 (100)	86 (95.6)	90 (100)	88 (97.8)	90 (100)	88 (97.8)	89 (98.9)	86 (95.6)	90 (100)
1	2 (2.2)	-	-	-	2 (2.2)	-	3 (3.3)	-	-	-	1 (1.1)	1 (1.1)	2 (2.2)	-
2	-	-	-	-	1 (1.1)	-	1 (1.1)	-	1 (1.1)	-	-	-	2 (2.2)	-
3	-	1 (1.1)	-	-	-	-	-	-	1 (1.1)	-	1 (1.1)	-	-	-
*p**	1.000		1.000		0.102		0.059		0.180		0.414		0.063	
Correlation														
r	–0.016		-		-		-		-		–0.016		-	
p[b]	0.881		-		-		-		-		0.881		-	

	Item 8		Item 9		Item 10		Item 11		Item 12		Item 13		Item 14	
	Self-reported	Physician-reported	Self-reported	Physician-reported	Self-reported	Physician-reported	Self-reported	Physician-reported	Self-reported	Physician-reported	Self-reported	Physician-reported	Self-reported	Physician-reported
Comprehensibility	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
0	88 (97.8)	89 (98.9)	89 (98.9)	90 (100)	89 (98.9)	89 (98.9)	89 (98.9)	90 (100)	86 (95.6)	88 (97.8)	89 (98.9)	90 (100)	89 (98.9)	88 (97.8)
1	1 (1.1)	1 (1.1)	1 (1.1)	-	1 (1.1)	1 (1.1)	-	-	3 (3.3)	2 (2.2)	-	-	-	2 (2.2)
2	-	-	-	-	-	-	1 (1.1)	-	1 (1.1)	-	-	-	1 (1.1)	-
3	1 (1.1)	-	-	-	-	-	-	-	-	-	1 (1.1)	-	-	-
p[a]	0.414		0.317		1.000		0.317		0.180		0.317		1.000	
Correlation														
r	–0.016		-		1.000		-		0.345		-		0.703	
p[b]	0.881		-		-		-		0.001*		-		< 0.001*	

MSQ v2.1, Migraine-Specific Quality of Life Questionnaire v2.1; r: Spearman Rank Correlation; *, $p < 0.05$; [a], Wilcoxon Signed Rank; [b], Spearman Rank Correlation.

Table 4. Test-retest reliability and internal consistency of MSQ v2.1

	MSQ v.2.1. scores	Visit 1 *vs.* Visit 2	Test-retest reliability Correlation between scores		Reliability (internal consistency)
Self-administered scores	Mean±SD	p^a	r	p^b	Cronbach-alpha coefficient
All patients (n = 182)					
Visit 1	29.18±15.25	< 0.001*	0.468	< 0.001*	0.932
Visit 2	22.34±15.48				0.912
Group A (n = 90)					
Visit 1	31.62±15.37	< 0.001*	0.508	< 0.001*	0.953
Visit 2	25.60±17.48				0.887
Group B (n = 92)					
Visit 1	26.79±14.83	< 0.001*	0.390	< 0.001*	0.908
Visit 2	19.15±12.53				0.949

	Patient-physician reliability Correlation between scores				
	MSQ v.2.1. scores	Visit 1 *vs.* Visit 2	Test-retest reliability Correlation between scores		Reliability (internal consistency)
Self- *vs.* physician-administered scores	Mean±SD	p^a	r	p^b	Cronbach-alpha coefficient
Group A (n = 90)					
Visit 1-self administered	31.62±15.37	0.482	0.916	< 0.001*	0.953
Visit 1-physician administered	31.28±15.97				0.958

MSQ v2.1, Migraine-Specific Quality of Life Questionnaire v2.1; SD, standard deviation; r, Spearman Correlation Rank; * $p < 0.05$; [a], Wilcoxon Signed Rank; [b], Spearman Correlation Rank.

Table 5. Validity of MSQ v2.1

	Correlation of MSQ v.2.1	
	r	*p*
Visit 1		
Duration of migraine	0.051	0.497
MHDs in the previous month	0.453	< 0.001*
MHDs in the previous month	0.441	< 0.001*
PHQ-4	0.415	< 0.001*
HIT-6	0.751	< 0.001*
MIDAS	0.576	< 0.001*
MIDAS A	0.411	< 0.001*
MIDAS B	0.539	< 0.001*
Visit 2		
MHDs	0.553	< 0.001*
MMDs	0.585	< 0.001*
HIT-6	0.772	< 0.001*
NRS	0.564	< 0.001*

MSQ v2.1, Migraine-Specific Quality of Life Questionnaire v2.1; MHDs, monthly headache days, PHQ-4, Patient Health Questionnaire-4; HIT-6, Headache Impact test-6; MIDAS, Migraine Disability Assessment test; MIDAS-A, Number of days with headache in the last 3 months; MIDAS-B, Average headache severity over the last 3 months on a 0-10 scale; MMDs, monthly migraine days; NRS, Numeric Rating Scale; r, Spearman Correlation Rank; *, $p < 0.05$.

showed a moderate correlation between the two time points (r = 0.468, $p < 0.001$) (Table 4).

Internal consistency

The Cronbach's α demonstrated excellent internal consistency of the MSQ v2.1, with values of 0.932 at Visit 1 and 0.912 at Visit 2 (Table 4). These results indicate a high level of reliability across both assessments.

Convergent validity

The MSQ v2.1 demonstrated strong convergent validity through significant positive correlations with various established measures of migraine impact and severity. At Visit 1, MSQ v2.1 scores showed positive correlations with HIT-6 (r = 0.751, $p < 0.001$), MIDAS total (r = 0.576, $p < 0.001$), MIDAS-B (r = 0.539, $p < 0.001$), MHDs (r = 0.453, $p < 0.001$), MMDs (r = 0.441, $p < 0.001$), and PHQ-4 (r = 0.415, $p < 0.001$). Similarly, at Visit 2, MSQ v2.1 scores positively correlated with HIT-6 (r = 0.772, $p < 0.001$), MHDs (r = 0.585, $p < 0.001$), NRS (r = 0.564, $p < 0.001$), and MMDs (r = 0.553, $p < 0.001$). These findings, summarized in Table 5,

Table 6. Factor loadings of MSQ v2.1 scale items and their significances

Factor	Indicator	Factor loadings	SE	Standardized factor loadings	*p*
Role function-restrictive	MSQ1	0.961	0.064	0.734	< 0.001
	MSQ2	1.109	0.053	0.855	< 0.001
	MSQ3	1.024	0.045	0.887	< 0.001
	MSQ4	0.934	0.055	0.783	< 0.001
	MSQ5	0.963	0.044	0.879	< 0.001
	MSQ6	1.028	0.051	0.844	< 0.001
	MSQ7	0.981	0.130	0.447	< 0.001
Role function-preventive	MSQ8	0.929	0.065	0.677	< 0.001
	MSQ9	0.907	0.056	0.731	< 0.001
	MSQ10	1.079	0.047	0.893	< 0.001
	MSQ11	1.085	0.055	0.804	< 0.001
Emotional function	MSQ12	0.931	0.058	0.801	< 0.001
	MSQ13	1.015	0.049	0.837	< 0.001
	MSQ14	1.054	0.052	0.798	< 0.001

MSQ v2.1, Migraine-Specific Quality of Life Questionnaire v2.1; SE, Standard error, *, $p < 0.05$.

provide strong evidence for the convergent validity of the MSQ v2.1, confirming its ability to effectively measure migraine-related quality of life in alignment with other validated instruments.

Confirmatory factor analysis

The three-factor model of the MSQ v2.1, comprising RF-R, RF-P, and EF, demonstrated excellent fit to the data as evidenced by the fit indices (CFI = 0.967, TLI = 0.960, RMSEA = 0.066, $p = 0.070$). All items significantly loaded onto their respective factors ($p < 0.001$), as shown in Table 6. The standardized factor loadings and correlations between items and factors revealed moderate to high correlations for all items and factors, except for MSQ7. These relationships were visually represented in a path diagram (Figure 2), which also highlighted the strong inter-factor correlations (0.92, 0.77, 0.76). These findings provided robust evidence for the construct validity of the MSQ v2.1 and confirmed the adequacy of its three-factor structure in measuring migraine-specific quality of life.

DISCUSSION

In this study, we evaluated the psychometric properties of the Turkish version of the MSQ v2.1 in adults with migraine. Our study findings confirm that the Turkish MSQ v2.1 is a reliable and valid instrument for assessing HRQL in this population. The questionnaire demonstrated excellent internal consistency, with Cronbach's α values ranging from 0.932 to 0.912, and moderate test-retest reliability (r = 0.468). The validity of the MSQ v2.1 was substantiated by strong correlations with other established HRQL measures, including the HIT-6 and the MIDAS. Furthermore, the MSQ v2.1 exhibited significant associations with headache severity metrics (NRS and MIDAS-B) and migraine frequency (MHDs and MMDs) at both Visit 1 and Visit 2 in our Turkish patient cohort. These results collectively support the robust psychometric properties of the Turkish MSQ v2.1 and its utility in assessing migraine-specific quality of life in clinical and research settings.

The Turkish adaptation of the MSQ v2.1 demonstrated excellent comprehensibility, with patients rated the items as "well-understood," with comprehension rates ranging from 94 to 100% across two visits. Notably, several items showed significant improvement in comprehension at the second visit, suggesting increased familiarity with the questionnaire over time. Physician-based evaluations in Subgroup A corroborated these findings, with high comprehension rates (95.6 to 100%) reported. The patient-physician reliability analysis revealed

varying levels of agreement across specific items, with correlations ranging from r = −0.016 to r = 0.703 (p values ranging from 0.881 to < 0.001). While some items showed strong agreement between patients and physicians, others were better understood with physician input, highlighting the importance of clinician involvement in questionnaire administration and interpretation. Taken together, these results provide robust evidence for the psychometric soundness of the Turkish MSQ v2.1, supporting its use as a reliable and valid tool for evaluating migraine-specific quality of life in both clinical practice and research among Turkish-speaking populations.

The MSQ v2.1 is a well-validated tool for assessing the impact of migraines on HRQL. Initially developed through expert review and validated in a cohort of 458 EM patients, it has shown strong psychometric properties across different populations and translations.[6] Martin et al.[9] reported excellent internal consistency (Cronbach's α = 0.93) and good test-retest reliability (intraclass correlation coefficient [ICC] = 0.80). Subsequent validations confirmed these findings, including the Greek version (α = 0.952, ω = 0.951)[15] and the Chinese version (α ≥ 0.81, ICC ≥ 0.69).[13] Our results are in line with these observations. The Turkish MSQ v2.1 demonstrated excellent internal consistency (α = 0.932 at Visit 1, 0.912 at Visit 2), strong patient-physician reliability (r = 0.916), and moderate test-retest reliability (r = 0.468). Comparable results have also been reported in the Italian validation, which showed high internal consistency (α = 0.85-0.92), strong item-total correlations (≥ 0.70), and balanced inter-item correlations (0.63-0.65). These consistent results across languages highlight the MSQ v2.1's robustness and reliability in assessing migraine-related quality of life across diverse populations.[12-15]

Our study confirmed the strong validity of the Turkish MSQ v2.1, demonstrating significant correlations with established migraine-related measures. At Visit 1, MSQ v2.1 scores showed a strong correlation with HIT-6 (r = 0.751) and moderate correlations with total MIDAS (r = 0.576), MIDAS-B (r = 0.539), MHDs (r = 0.453), MMDs (r = 0.441), and PHQ-4 (r = 0.415). At Visit 2, the strong correlation with HIT-6 (r = 0.772) persisted, alongside moderate correlations with MHDs (r = 0.585), NRS (r = 0.564), and MMDs (r = 0.553). These results align with previous validations, such as Martin et al.,[9] who reported strong convergent validity with MIDAS (−0.71), satisfactory discriminant validity Short Form-36 SF-36 (0.54), and criterion validity with headache frequency (−0.40). The Greek version showed correlations with SF-12 (0.1−0.4) and moderate negative correlations with MIDAS,[15] while the Korean version correlated well with MIDAS, HIT-6, MSQoL, PHQ-9, and GAD-7.[14] Bagley et al.[8] found moderate to high correlations with PHQ-4 (−0.21 to −0.42), MIDAS (−0.38 to −0.39), and HIT-6 (−0.60 to −0.71). These findings reinforce the MSQ v2.1's robustness in assessing migraine-related quality of life across different populations.

Furthermore, CFA of the Turkish version of the MSQ v2.1 validated the three-factor structure (RF-R, RF-P, EF) consistent with the original scale. Strong inter-factor correlations (0.92, 0.77, 0.76) and moderate-to-high standardized factor loadings for all items, except MSQ7, confirmed the coherence of the construct. These findings align with validations in other languages. For instance, the Greek version of the MSQ v2.1 reported factor loadings above 0.70 for all items except item 12, providing adequate support for the three-factor model as recommended by the original tool's authors. Similarly, the Chinese version of the MSQ v2.1 demonstrated robust item factor loadings ranging from 0.71 to 0.96, well above the acceptable threshold of 0.5. The Italian validation study of the MSQ v2.1 was specifically conducted on CM patients with medication overuse headache, a particularly challenging subgroup of migraine sufferers.[12] In this population, the psychometric properties of the MSQ v2.1 demonstrated robust results. The three-factor structure of the questionnaire was essentially confirmed, providing support for its construct validity in this specific patient group. More importantly, known-group analysis revealed that MSQ scores consistently decreased with increasing disease severity, providing evidence for the questionnaire's ability to discriminate between different levels of migraine impact in this complex patient population. These consistent results across different cultural adaptations underscore the structural stability and cross-cultural validity of the MSQ v2.1, reinforcing its utility as a reliable measure of migraine-specific quality of life across diverse populations.

Nonetheless, several limitations to this study should be acknowledged. First, the assessment of headache frequency relied on patient recall using MIDAS item A over the previous three months, which may have introduced recall bias. Moreover, the PROMs applied in this analysis differed in their recall periods, and the potential impact of these inconsistencies remains unclear. It is also important

to note that our patient cohort was recruited from a hospital-based headache center, with 67.6% of participants using preventive treatments, which could influence our results. This cohort, consisting of treatment-seeking patients with significant migraine-related disabilities, may not fully represent the general migraine population, thus limiting the generalizability of our findings. The relatively lower proportion of CM patients compared to EM patients in our study may have impacted the correlation analysis between MIDAS and HIT-6 scores, as well as the MSQ v2.1's ability to differentiate between migraine subtypes. Further studies are needed to assess the reliability and validity of the MSQ in CM patients. These limitations highlight the need for additional research with more diverse patient populations and longitudinal designs to better understand the psychometric properties of the MSQ v2.1 across different migraine subtypes and treatment scenarios. Despite these limitations, our study provides valuable insights into the psychometric properties of the Turkish version of the MSQ v2.1. Our findings support the Turkish version's ability to effectively determine migraine-specific quality of life in patients seeking headache-specialty care.

In conclusion, the Turkish version of the MSQ v2.1 demonstrates internal consistency equivalent to the original English scale, along with moderate test-retest reliability and validity through its correlated with HIT-6, MIDAS, NRS, MHDs, and MMDs. Notably, it proves equally reliable whether completed as a PROM or applied by physicians to assess headache-related quality of life. These results underscore the robustness of the Turkish MSQ v2.1 across different administration methods. Nonetheless, further research is warranted to confirm its psychometric performance in patients with CM, thereby enhancing its applicability across the full spectrum of migraine populations.

Author Contributions

P.Y.D.: Idea/concept, design, control/supervision, literature revie, writing the article, references and fundings, materials; P.Y.D., A.Ş., E.I.A., T.E.S., A.Ö., R.K., B.P., T.C.Ş.: Data collection and/or processing; P.Y.D., B.T., D.H.S.: Analysis and/or interpretation; P.Y.D., B.T.: Critical review.

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The data that support the findings of this study are available from the corresponding author upon reasonable request.

AI Disclosure

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