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Fear of Movement: Validity and Reliability Study of the Turkish Version of the Tampa Scale of Kinesiophobia for Headache in Patients with Migraine

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Abstract

Background While triggering by physical activity is a criterion for the diagnosis of migraine, evaluations regarding fear of movement related to physical activity are lacking in the literature. This study aimed to investigate the validity and reliability of the Turkish version of the Tampa Scale of Kinesiophobia, adapted to headache (TSK-H), in patients with episodic migraine (EM) and chronic migraine (CM). This questionnaire is a newly developed version adapted for headache, based on but different from the original TSK used in low back pain, and has not been previously validated in Turkish for headache.

Methods Patients between the ages of 18–70 were included in the study. Demographic-clinical information was obtained after expert committee evaluation and cross-cultural adaptation of the questionnaire. Numerical Pain Rating Scale (NPRS), Migraine Disability Assessment (MIDAS), Headache Impact Test-6 (HIT-6), Hospital Anxiety and Depression Scale (HADS) and TSK-H were evaluated for structural validity. Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were performed. Intraclass Correlation Coefficient (ICC) and Cronbach's α values were analyzed for reliability.

Results A total of 329 patients ($n=148$ EM, $n=181$ CM) with a mean age of 37.2 ± 10.6 years for EM and 39.8 ± 13.1 years for CM were included in the study. Headache intensity on NPRS was 6.89 ± 1.86 for EM and 7.56 ± 2.10 for CM. Item-total correlations ranged from −0.030 to 0.758. Cronbach's α was 0.925. TSK-H had good test-retest reliability (ICC = 0.866, $n=151$) and high internal consistency (Cronbach's α = 0.928). TSK-H was associated with NPRS, MIDAS, HIT-6 and HADS ($p<0.000$ for each one). EFA identified a four-factor structure explaining 58.64% of the variance. CFA remained within acceptable limits.

Conclusion The Turkish version of the 23-item TSK-H is a valid and reliable tool for assessing kinesiophobia in patients with migraine and is significantly associated with physical, functional and psychosocial factors.

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Keywords Kinesiophobia, Physical activity, Movement, Neck, Body, Migraine

Introduction

Kinesiophobia is defined as the individual's avoidance of movement due to fear of experiencing a similar injury or pain again after an injury [1, 2]. After experiencing pain, individuals may choose to avoid the pain or confront it. Movement avoidance behavior can lead to physical inactivity, limitations in daily activities, decreased quality-of-life (QoL), and psychological problems over time [3]. The perceptual behavioral model is an approach that explains pain, fear of reinjury, and movement avoidance behaviors. According to this model, the individual associates the pain experience with past negative experiences, develops anxiety about reinjury, and this reinforces movement avoidance behavior [4].

Migraine is a primary headache type that is moderate to severe, usually unilateral, pulsatile, and can be triggered by physical activity (PA). Attacks may involve aura, nausea, vomiting, photophobia, phonophobia, and osmophobia [5]. Female sex, young age, family history, high stress, and physical inactivity are among the main risk factors [6]. PA includes all muscle movements performed by skeletal muscles and requiring energy expenditure. Exercise is a subtype of physical activity that involves planned, structured, repetitive movements aimed at maintaining physical fitness. Therefore, every exercise is a physical activity. Movements that are part of daily life, such as planned exercises, going up and down stairs, doing housework, riding a bicycle, going to work, or neck movements, are considered PA [7]. Migraine patients may experience neck pain (NP) before or during an attack, which may be aggravated by neck movements or by staying in the same position for a long time. For this reason, patients may tend to avoid PA that involve neck movements. According to the criteria of the International Classification of Headache Disorders (ICHD-3), worsening of headache with PA is a criterion considered in the migraine diagnosis [5]. In addition, hypocretin deficiency, which is involved in the pathophysiology of migraine, may play a role in the onset of attacks, while increased lactate levels during anaerobic exercise and calcitonin gene-related peptide released due to exercise are also among the attack-triggering mechanisms [8]. Due to these physiological mechanisms, migraine patients may avoid exercise and PA. Even neck or general body movements requiring low effort levels can trigger attacks [9].

In line with this information, there is no valid and reliable assessment tool specifically developed for the Turkish migraine population to assess the level of kinesiophobia. And there is a striking lack of studies in the literature investigating the fear of movement due to PA in migraine. The existing Tampa Scale of Kinesiophobia (TSK) was revised by an expert panel consisting of physiotherapists and neurologists working in the field of migraine, focusing on headache, and some original items were added to develop the "Tampa Scale of Kinesiophobia for Headache (TSK-H)". This questionnaire is a newly developed version adapted for headache, based on but different from the original TSK used in low back pain, and has not been previously validated in Turkish for headache. This study aimed to examine the validity and reliability of the TSK-H for the Turkish population in patients with migraine; and to evaluate the possible relationships between kinesiophobia and variables such as headache intensity, disability, headache impact, anxiety, and depression.

Methods

Study Design and Ethical Approval

This study was designed as a prospective, descriptive and cross-sectional. Ethical approval for the study was received from the Clinical Research Ethics Committee of Yozgat Bozok University Faculty of Medicine on 16.10.2024 with the approval number 2024-GOK AEK-2411_2024.10.16_190. The study was registered at ClinicalTrials.gov with the number NCT06857357 (https://clinicaltrials.gov/study/NCT06857357, Registration Date: 26.02.2025). Informed consent was obtained from all participants, and the study was conducted in accordance with the Declaration of Helsinki.

Participants and Eligibility Criteria

The sample consisted of patients with episodic migraine (EM) and chronic migraine (CM) diagnosed by neurologists specialized in headache disorders at the neurology departmens of Mersin University, Gazi University, Zonguldak Bülent Ecevit University, Kütahya Health Sciences University, Gaziantep City Hospital, Silivri State Hospital, Trakya University, and Elite Research and Surgery Hospital between January 2025 and May 2025. Diagnoses were made following the ICHD-3 [10].

The inclusion criteria were as follows: (1) a confirmed diagnosis of EM-CM based on ICHD-3 criteria; (2) being between 18 and 70 years of age; and (3) having sufficient Turkish language proficiency (reading, writing, speaking, and comprehension) to understand and accurately respond to the questionnaires and scales. The exclusion criteria were: (1) having a diagnosis of any headache disorder other than EM-CM; (2) having a medical history of systemic diseases such as malignancy, inflammatory disorders, acute fractures, surgical conditions, neurological, psychological, or rheumatologic disorders; and (3) lacking literacy or fluency in the Turkish language.

Development of the Tampa Scale of Kinesiophobia for Headache (TSK-H)

Before the development of the new scale, formal permission was obtained from the original developers of the TSK. The development and validation of the TSK-H was conducted using a standardized, widely accepted measurement development methodology comprising three phases [11]: 1.Item generation and domain identification, 2.Cognitive evaluation and pilot testing in a small sample of patients, and 3. Psychometric validation.

The item generation process followed a rigorous, multistep approach [11]:

Comprehensive Literature Review

A systematic search was conducted to identify the relevant biopsychosocial constructs related to fear of movement in patients.

Patient Interviews and Focus Groups

Semi-structured interviews were held with patients to explore their beliefs, fears, and avoidance behaviors related to PA and movement.

Expert Panel Review

A multidisciplinary research team, including physiotherapists and neurologists, reviewed the preliminary item pool to ensure theoretical coherence and clinical applicability.

Item Drafting and Selection

Based on the findings from the previous steps, items were drafted and iteratively refined best to represent the fear-avoidance dimensions specific to headache-related kinesiophobia.

Independent Expert Evaluation

Finally, external experts evaluated the item pool for content relevance, clarity, and comprehensiveness. Revisions were made based on their feedback to finalize the pretest version of the TSK-H.

This structured approach was designed to ensure that the final instrument is psychometrically robust and clinically meaningful for individuals with headache-related movement fear.

Outcome Measures

Demographic and Clinical Assessments

Participants were asked about their sex, age, weight, height, duration of diagnosis, migraine triggers, symptoms during attacks, the number of analgesics taken in the past month, headache days per month, attack frequency, duration of attacks, headache intensity, presence of NP. The form had no scoring system; it was used solely for data collection.

Headache Intensity

The Numeric Pain Rating Scale (NPRS) is an assessment of headache intensity that asks participants to respond to the headache they are experiencing at the time of the evaluation, representing a number between 0 and 10; "no headache = 0" (left) and "worst headache = 10" (right) [12].

Disability Assessment

The Migraine Disability Assessment (MIDAS) questionnaire evaluates migraine-related disability over the past three months. It consists of five self-administered items addressing disability in work/school, household chores, and family, social, or leisure activities [13].

Headache Impact

The Headache Impact Test-6 (HIT-6) is a headache-specific headache impact questionnaire that evaluates vitality, pain, psychological distress, social functioning, role functioning, and cognitive functioning. Each item is scored on a 5-point Likert scale (6 = never, 8 = rarely, 10 = sometimes, 11 = very often, 13 = always). The total score is obtained by summing the scores of the six items, yielding a range between 36 and 78 [14].

Anxiety and Depression Status

The Hospital Anxiety and Depression Scale (HADS) consists of 14 items, with 7 items evaluating anxiety and 7 items evaluating depressive symptoms. Each item is scored on a scale from 0 to 3 (13). The subscale scores are calculated by summing the respective items, resulting in a possible score range of 0 to 21 for both the Anxiety and Depression subscales. A score of 0–7 is considered within the normal range, 8–10 suggests the possible presence of a mood disorder, and a score of 11 or above indicates a probable mood disorder [15].

Kinesiophobia for Headache

Kinesiophobia and avoidance of movement due to fear of injury were assessed using a 17-item questionnaire developed initially by Kori et al. [1]. The Turkish version of the scale was adapted by Tunca-Yılmaz et al. in 2011 for low back pain and NP [4]. It is scored using a 4-point Likert scale (1 = Strongly Disagree, 4 = Strongly Agree). Items 4, 8, 12, and 16 are reverse-scored. The total score ranges from 17 to 68, with higher scores indicating greater levels of kinesiophobia. A total score above 37 is considered indicative of a high level of kinesiophobia. However, since not all items of the original TSK were relevant to individuals with headaches, a modified version was developed specifically for this population. In the revised version, certain items were removed, some were reworded, and new items were added, resulting in a TSK-H consisting of 23 items. As with the original, it used a 4-point Likert

scoring system (1 = Strongly disagree, 2 = Disagree, 3 = Agree, 4 = Strongly agree) and higher scores indicate higher levels of kinesiophobia. Items 2 and 6 were reverse scored (4 = Strongly disagree, 3 = Disagree, 2 = Agree, 1 = Strongly agree) and the total score is between 29 and 86. The scale was retested 7 days later after the initial test. The English version of TSK-H was available in the supplementary material. (Supplement).

Sample Size

Based on the reference study [16], the sample size was determined to be 240 by applying the commonly recommended rule of thumb of recruiting at least ten participants per item of the TSK-H, which consists of 24 items.

Statistical Analysis

The analyses were performed using the Statistical Package for the Social Sciences for Windows (IBM SPSS Statistics 22; SPSS Inc., Chicago, Illinois, USA). Confirmatory Factor Analysis (CFA) was conducted using JASP software (version 0.19.2).

The structural validity was evaluated through Exploratory Factor Analysis (EFA) and CFA. EFA was conducted using principal component analysis (PCA) with varimax rotation on the items of the TSK-H. Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy, Bartlett's test of sphericity (BTS), percentage of explained variance, eigenvalues, and factor loadings were examined. A KMO value of 0.50 or above was considered acceptable for conducting EFA. A significant BTS value ($p < 0.05$) indicates that the correlation matrix is factorable, suggesting the presence of underlying structures [16]. An explained 50% or greater variance was considered acceptable [17]. Factors with eigenvalues greater than one were retained [18]. Factor loadings above 0.40 were considered meaningful and included in the analysis [19]. The following model fit indices and their acceptable thresholds were considered for CFA: chi-square/degrees of freedom ratio (CMIN/DF; acceptable: <5, good: <3), Root Mean Square Error of Approximation (RMSEA; good: <0.08, moderate: 0.08–0.10, poor: >0.10), Goodness-of-Fit Index (GFI: 0.90–0.95), Comparative Fit Index (CFI: 0.80–0.90), Normed Fit Index (NFI: 0.80–0.95), Standardized Root Mean Square Residual (SRMR: 0.05–0.10), Incremental Fit Index (IFI: >0.80), and Parsimony-Adjusted Measures Index (PNFI: >0.50) [20]. Construct validity was assessed by examining the correlations between the TSK-H and the NPRS, MIDAS, HIT-6, and HADS. The strength of the correlation coefficients was interpreted as follows: 0.81–1.00 (excellent), 0.61–0.80 (very good), 0.41–0.60 (good), 0.21–0.40 (moderate), and < 0.20 (poor) [21]. For construct validity, we hypothesized that the instrument would show strong positive correlations with measures (HIT-6, HADS-A) theoretically related to the same construct, and moderate correlations with measures assessing unrelated constructs (NPRS, MIDAS, HADS-B), in accordance with COSMIN recommendations [22]. Content validity was assessed by evaluating participants' perceptions of the scale's relevance and comprehensiveness in capturing headache-related kinesiophobia. Participants provided feedback on whether the purpose of the scale aligned with their condition, whether the items were representative of their experiences, and whether the scale adequately addressed various aspects of their headache-related fears [23]. Face validity was evaluated by conducting preliminary testing with a small group diagnosed with headache disorders to ensure the items were clear, understandable, and appropriate for the target population. Feedback from these participants was used to make minor adjustments to item wording and clarity [24].

To assess the reliability, both test-retest reliability and internal consistency were evaluated. An Intraclass Correlation Coefficient (ICC) greater than 0.75 and a Cronbach's alpha coefficient exceeding 0.80 were considered indicators of good reliability [19]. A Bland–Altman plot was constructed to demonstrate the agreement between measurements. In addition, as components of reliability, the Standard Error of Measurement (SEM) and the Minimal Detectable Change (MDC) were calculated using established formulas [19]:

$$\mathrm{SEM}_{95}:\ \mathrm{SD}\ /\sqrt{(1-\mathrm{ICC})};\ \mathrm{SD}=\ \text{standard deviation}$$

$$\mathrm{MDC}_{95}:\ \mathrm{z}\ *\ \mathrm{SEM}\ *\ \sqrt{2};\ \mathrm{z}=1.96$$

Floor and ceiling effects were evaluated by determining the minimum-maximum scores and calculating the percentage of participants who achieved these scores. If fewer than 15% of participants obtained the lowest or highest possible scores, floor or ceiling effects were considered absent [23]. A significance level of $p < 0.05$ was set for all statistical analyses.

Results

The mean age of participants with EM was 37.25 ± 10.68 years, and the mean age of participants with CM was 39.88 ± 13.15 years. Headache intensities were 6.89 ± 1.86 for EM and 7.56 ± 2.10 for CM. As expected, patients with CM reported more frequent headaches, higher levels of disability and psychological distress, and greater fear of movement ($p < 0.05$). A total of 24.2% stated regular exercise ($n = 80$, Female = 65, Male = 15). Demographic and clinical information is presented in Table 1.

The EFA of the TSK-H revealed a four-factor structure that accounted for 58.64% of the total variance. Sampling adequacy was confirmed by a high KMO value

Table 1 Demographic information of the participants ($n=329$)

	Episodic migraine ($n=148$) Mean ± SD or Median (IQR)	Chronic migraine ($n=181$) Mean ± SD or Median (IQR)	*p* Value
Age (years)	37.25 ± 10.68	39.88 ± 13.15	$p=0.05$
Weight (kg)	68.86 ± 15.17	69.90 ± 12.90	$p=0.251$
Height (m)	1.66 ± 0.08	1.65 ± 0.09	$p=0.126$
BMI (kg/m^2)	24.97 ± 4.84	25.68 ± 4.47	$p=0.09$
Headache diagnosis period (years)	12.90 ± 12.63	14.15 ± 12.88	$p=0.476$
Number of painkillers taken during an attack	2.10 ± 1.61	2.65 ± 3.85	$p=0.144$
Number of headache days in a month	5.45 ± 3.44	17.05 ± 4.54	$p<0.001$**
Number of headache attacks in a month	4.04 ± 4.10	6.76 ± 6.57	$p<0.001$**
Headache attack duration (hours)	23.67 ± 34.79	31.38 ± 33.29	$p=0.011$*
Headache intensity (NPRS)	6.89 ± 1.86	7.56 ± 2.10	$p=0.003$*
Neck pain intensity (NPRS)	5.86 ± 2.44	6.94 ± 2.34	$p<0.001$**
MIDAS	20 (9–32)	35 (17–75)	$p<0.001$**
HIT-6	60.71 ± 6.85	65.37 ± 6.17	$p<0.001$**
HAD-A	8.56 ± 4.57	10.09 ± 4.57	$p=0.003$*
HAD-D	7.03 ± 4.21	8.6 ± 4.39	$p=0.001$*
TKS-H	55.54 ± 11.26	62.98 ± 11.95	$p<0.001$**

SD Standard deviation, *kg* kilogramme, *m* meter, *TSK-H* Tampa Scale of Kinesiophobia for Headache, *NPRS* Numeric Pain Rating Scale, *MIDAS* Migraine Disability Assessment, *HIT-6* Headache Impact Test-6, *HADS-A* Hospital Anxiety and Depression Scale-Anxiety, *HADS-D*, Hospital Anxiety and Depression Scale-Depression

*$p<0.05$

**$p<0.001$

Table 2 Exploratory factor analysis results for the Turkish version of the TSK-H ($n=329$)

	Factor 1	Factor 2	Factor 3	Factor 4
4a	0.461			
12a	0.577			
13a	0.560			
15	0.765			
16	0.773			
17	0.837			
18a	0.787			
19a	0.784			
19b	0.618			
4b		0.629		
12b		0.825		
13b		0.842		
14		0.786		
18b		0.522		
3			0.654	
5			0.426	
6			0.525	
9			0.613	
10			0.606	
2				0.487
7				−0.651
8				0.639
11				0.461
Percent variance (%)	22.599	40.145	50.266	58.635

TSK-H Tampa Scale of Kinesiophobia for Headache; Kaiser-Meyer-Olkin measure of sampling adequacy: 0.915; Bartlett's Test of Sphericity Approx. Chi-Square: 4415.906 ($p=0.000$) for migraine patients

(0.915), and Bartlett's test of sphericity was significant (χ^2=4415.906, $p<0.001$), indicating suitability for factor analysis. Most items demonstrated meaningful loadings on distinct factors; however, Item 1 did not load significantly on any of the extracted factors and was therefore excluded from the final structure. The resulting four-factor model was both interpretable and psychometrically adequate for assessing headache-related kinesiophobia. After removing item 1, analyses were performed without changing the representative item numbers. Therefore, number 2 in the factor loadings is number 1 in the final version.The English version of TSK-H was available in the supplementary material. (Supplement).

Initially, the EFA yielded a five-factor structure for patients based on the eigenvalue-greater-than-one criterion. However, one of the factors included only a single item, which is considered psychometrically weak due to the inability to assess internal consistency and lack of shared variance with other items. The number of factors was restricted to four to obtain a more reliable and interpretable factor structure. The four-factor solution provided a more coherent distribution of items across factors, with each factor comprising multiple items with acceptable loadings, and was therefore retained as the final model (Table 2; Fig. 1).

The CFA yielded mixed results regarding model fit. The relative chi-square (CMIN/DF = 4.37) was within the acceptable range, and the SRMR value (0.071) indicated a satisfactory fit. However, other indices such as RMSEA (0.101), GFI (0.783), and CFI (0.820) were below optimal

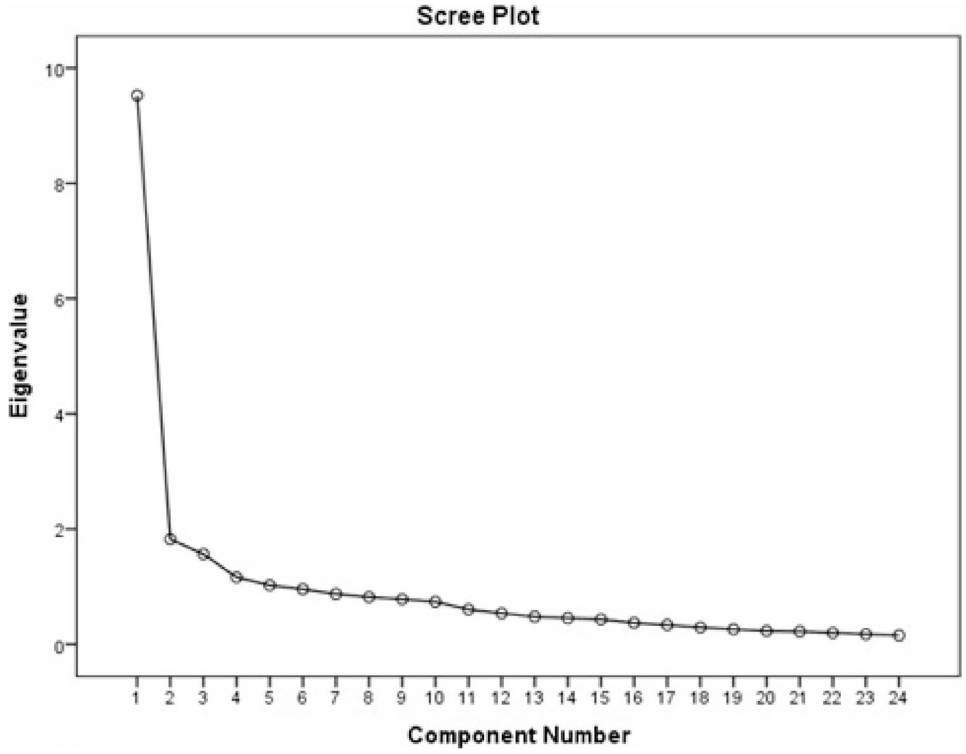


Fig. 1 Scree plot of the Turkish version of the TSK-H ($n = 329$)

Table 3 Fit indices as a result of the TSK-H confirmatory factor analysis ($n = 329$)

	Acceptable value range	The value obtained
CMIN/DF (x^2/df)	Good 3 > and 5 > acceptable	(973.911/223) 4.37
RMSEA	Good 0.08 >, medium 0.1 – 0.08 and poor 0.1 <	0.101
GFI	0.90 ≤ GFI < 0.95	0.783
CFI	0.80 ≤ CFI ≤ 0.90	0.820
NFI	0.80 ≤ NFI ≤ 0.95	0.780
SRMR	0.05 < SRMR ≤ 0.10	0.071
IFI	0.80 < IFI	0.821
PNFI	0.90 < PNFI	0.687

CMIN/df Relative Chi-square, *RMSEA* Root Mean Square Error of Approximation, *GFI* Goodness of Fit Index, *CFI* Comparative Fit Index, *NFI* Normed Fit Index, *SRMR* Standardized Root Mean Square Residual, *IFI* Incremental Fit Index, *PNFI* Parsimonious Normed Fit Index

thresholds, suggesting that while the model demonstrates some structural validity (Table 3; Fig. 2).

Item-level analysis of the TSK-H demonstrated satisfactory psychometric properties. Corrected item-total correlations ranged from – 0.030 to 0.762. Item 7 showed a negative correlation. The overall internal consistency of the scale was excellent, with a Cronbach's alpha of 0.925, suggesting high reliability (Table 4).

The TSK-H demonstrated strong test–retest reliability, with an ICC of 0.866 (95% CI: 0.820–0.901). The SEM was 4.34, and the MDC was 12.03. The internal consistency remained high (Cronbach's $\alpha = 0.928$), confirming the temporal stability and reliability of the scale in repeated measurements (Table 5).

The TSK-H showed significant positive correlations with all related clinical measures. The strongest association was observed with the HIT-6 ($r = 0.512$, $p < 0.001$), followed by anxiety ($r = 0.432$), depression ($r = 0.387$), migraine-related disability ($r = 0.336$), and headache intensity ($r = 0.280$). These findings support the convergent validity of the TSK-H and its relevance in assessing fear of movement concerning headache impact, emotional distress, and headache (Table 6). These findings were consistent with our predefined hypotheses regarding the expected magnitude and direction of the correlations, supporting the construct validity of the instrument.

Face and content validity were confirmed by expert panel review. No floor or ceiling effects were observed, as 0% of participants achieved the lowest or highest possible scores.

Discussion

In this study, the validity and reliability of the Turkish version of the TSK-H were investigated in patients with migraine. The findings support that the scale is a valid and reliable tool. The TSK-H is consistent over time and is a valid repeated measurement scale for clinical and research purposes. In addition, our study showed that

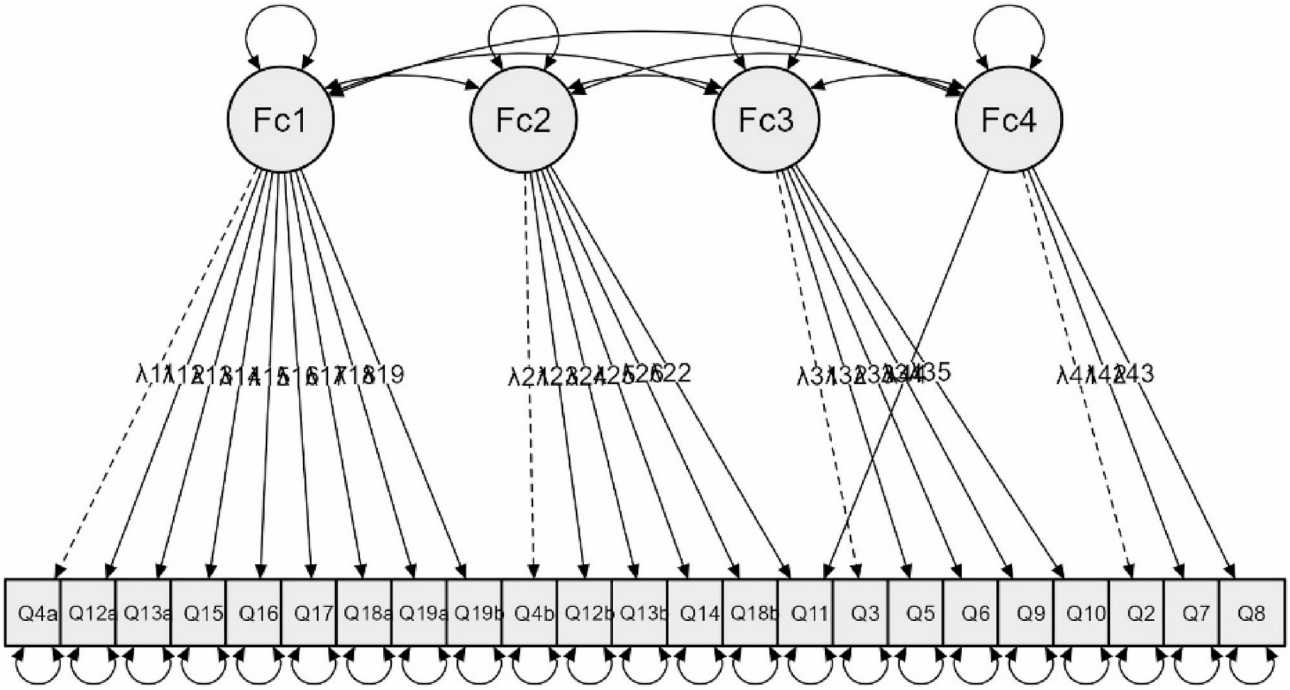


Fig. 2 The diagram of the CFA of the Turkish version of the TSK-H ($n = 329$)

Table 4 Mean scores, corrected item-total correlations and cronbach's α if item deleted results for the TSK-H ($n = 151$)

Item	Mean	SD	Corrected-item total correlation	Cronbach's α if item deleted
2	2.10	0.73	0.498	0.924
3	2.16	0.77	0.238	0.928
4a	2.36	0.90	0.678	0.920
4b	2.73	0.90	0.613	0.922
5	2.76	0.84	0.484	0.924
6	1.97	0.82	0.543	0.923
7	2.54	0.81	−0.030	0.932
8	2.47	0.74	0.366	0.926
9	2.11	0.83	0.683	0.920
10	2.41	0.92	0.629	0.921
11	2.79	0.75	0.320	0.926
12a	2.20	0.83	0.757	0.919
12b	2.68	0.81	0.615	0.922
13a	2.42	0.91	0.758	0.919
13b	2.84	0.83	0.540	0.923
14	2.74	0.82	0.600	0.922
15	1.95	0.81	0.744	0.919
16	2.09	0.82	0.762	0.919
17	2.01	0.77	0.743	0.919
18a	1.99	0.77	0.707	0.920
18b	2.50	0.84	0.538	0.923
19a	2.10	0.82	0.681	0.920
19b	2.42	0.84	0.605	0.922
Cronbach's α				0.925

TSK-H Tampa Scale of Kinesiophobia for Headache, *SD* Standard deviation

kinesiophobia in patients with migraine has a physical, functional and emotional dimension.

As a result of the explanatory factor analysis, there was a four-factor structure explaining 58.64% of the variance, and the factor loadings were generally high. A four-factor structure for neck version was also found in the study conducted in the Brazilian population [25]. Among the items of the four-factor structure in our study, Factor 1 can be interpreted as fear of triggering headaches with movement, Factor 2 as fear that existing headaches will increase with movement, Factor 3 as negative beliefs about movement, and Factor 4 as distrust towards movement. Interestingly, although item 19b (new 18b) was included in factor 1, similar items were loaded on factor 2. This may indicate that individuals may have perceived this item as triggered due to its content. The KMO value was relatively high at 0.915 and the sample adequacy was excellent. When all item results were analyzed, a five-factor structure emerged, but since one of these structures contained only one item and was found to be psychometrically weak, the scale was limited to four factors.

CFA yielded mixed results in terms of model fit. While the relative chi-square ($\chi^2/df = 4.37$) and SRMR (0.071) values were within acceptable limits, other important indices such as RMSEA (0.101), GFI (0.783), and CFI (0.820) remained below the desired thresholds. These results suggest that, although the scale exhibits acceptable structural validity, the current four-factor model may benefit from further refinement. In particular, conceptual overlap among certain items, the presence of

Table 5 Test–retest reliability and internal consistency of the TSK-H ($n = 151$)

	Baseline Mean ± SD	Retest Mean ± SD	*p*	Test-retest (ICC and 95% CI)	SEM	MDC	Internal consistency (Cronbach's α)
TSK-H	54.32 ± 11.64	57.70 ± 12.60	0.050	0.866 (0.820–0.901)	4.34	12.03	0.928

TSK-H Tampa Scale of Kinesiophobia for Headache, *SD* Standard deviation, *ICC* Intraclass Correlation Coefficient, *CI* Confidence Interval, *SEM* Standar Error Measurement, *MDC* Minimal Detectable Change

Table 6 Correlations between TSK-H and other questionnaires ($n = 329$)

	NPRS$^{\beta}$	MIDAS§	HIT-6$^{\beta}$	HADS-A$^{\beta}$	HADS-D$^{\beta}$
r	0.280	0.336	0.512	0.432	0.387
p	0.000	0.000	0.000	0.000	0.000

TSK-H Tampa Scale of Kinesiophobia for Headache, *NPRS* Numeric Pain Rating Scale, *MIDAS* Migraine Disability Assessment, *HIT-6* Headache Impact Test-6, *HADS-A* Hospital Anxiety and Depression Scale-Anxiety, *HADS-D* Hospital Anxiety and Depression Scale-Depression

§: Spearman correlation analysis; $^{\beta}$: Pearson correlation analysis

reverse-worded items, and the overall length of the scale may have contributed to the suboptimal fit indices. Similar findings in other cultural adaptations of the TSK suggest that item performance may vary based on linguistic and clinical context. Therefore, restructuring the factor model or simplifying the item set—for example, through item reduction or model respecification—should be considered in subsequent validation efforts. Future studies could also examine whether a shorter form of the TSK-H could improve structural validity while maintaining conceptual integrity. The higher kinesiophobia scores observed in patients with CM compared to episodic migraine patients are consistent with the fear-avoidance model, in which greater attack frequency and disability are associated with increased fear of movement [1–4]. The fact that TSK-H shows positive correlations with all these parameters suggests that headache effect, disability, headache severity, anxiety, and depression may be both the cause and the result of kinesiophobia. These results have revealed that the evaluations regarding kinesiophobia in migraine patients should be addressed at the pain, function, and psychosocial levels. The correlations found with headache intensity [25, 26], catastrophizing [25, 27], anxiety-depression [26, 27], QoL [26, 27], and disability [26] in the neck versions also emphasize the psychosocial and functional features of the scale. Similar correlations were also shown in the temporomandibular joint disorder (TMD) versions [28–30].

The internal consistency of the scale was found to be relatively high (Cronbach's α = 0.925) and this value was consistent with or higher than the results of previous Persian, Brazilian Portuguese, English versions of the NP [25–27], and Brazilian Portuguese, Chinese, and Dutch versions of TMD versions [28–30]. However, despite being reverse-coded, item 7 (new item 6) ("If I were physically active, despite my headache, my condition would be better.") showed a negative item-total correlation (r = – 0.030) and reflects a belief in the positive effect of PA. In this respect, although it differs from other statements focused on fear, avoidance, and adverse effects, it enriches the content by reflecting the cognitive dimension of the kinesiophobia structure. In addition, the Cronbach's α coefficient of the scale increased slightly when this item was removed, it did not change the overall value. Although these findings make the item statistically weak, item 7 (new item 6) was not removed from the final scale for contextual and theoretical reasons. In our study, items 3, 7, and 11 demonstrated relatively low item–total correlations. Nevertheless, their removal did not meaningfully improve internal consistency, and they were retained to preserve the content validity and conceptual integrity of the instrument. The less than optimal fit indices (RMSEA, GFI, and CFI) may partly be related to these items. However, such findings are not uncommon in cross-cultural validation studies, and the overall structural validity of the instrument remains acceptable. This issue should be considered a limitation of the present study.

It is well known that fear of movement varies according to cultural environments in patients experiencing pain. Therefore, reasonable interpretations and evaluations by experts from that culture are needed [27, 31, 32]. We asked a group of physiotherapists and neurologists working in the field of migraine to adapt the original TSK to headache and make their evaluations. In this adaptation, if PA is considered as a whole body activity, we asked the patients which movements or situations triggered or disturbed them such as neck-general body movements, movements in the car, coughing, and straining. The final 24-item scale included psychometric statements related to neck movements, general body movements, driving, and PA. In the analyses, we saw that the first item was not working because it was distributed as a separate factor in the factor loadings (I worry that my headache will increase if I exercise). We renewed the analyses by removing the item. The word "exercise" in this item may have represented a general expression for the patients, so the responses may not have yielded consistent results. The responses to other items in the scale were clearer, such as walking, running, going up and down stairs, and neck movements. Patients may have found the word "exercise" ambiguous in general. Specific movements may have been perceived more clearly. Martins et al. stated that activities such as bending forward, shaking, and head and neck movements should be asked to patients to differentiate headache attacks [9]. The word "exercise" is

also included in item 11 (new item 10) (No one should have to exercise when they have a headache). However, the consistent results in this item may not have been confused because they caused them to avoid an activity such as exercise when they already had a headache. Therefore, clinicians and researchers should provide more specific explanations when asking patients about PA, which may allow patients to give correct answers and thus provide a better understanding of the problem. Patient-reported outcome measures (PROMs) include questionnaires and scales that are valid and reliable in populations. It is important to adapt PROMs to populations in order to use a universal language in clinics and research [33]. The fact that PA is in the differential diagnosis for migraine and that there is no tool in the literature that evaluates migraine-specific fear of movement makes the results of our study valuable. Our results will help clinicians and researchers in the evaluation of fear of movement in migraine patients.

Short and long timing balances should be adjusted well when evaluating test-retest reliability. When applied in short periods, patients may remember the questions and give biased answers, but since their clinical conditions will not change much, patients are evaluated in good clinical conditions. In long periods, there may be situations such as changes in the clinical condition of the patients and difficulties in remembering the clinical condition. 2–7 day time intervals were specified for patients with neck pain and TMD [26, 28]. In our study, we applied the retest after 7 days. In our results, the test-retest reliability of TSK-H was found to be high (ICC = 0.866), which supported the scale's consistency over time. This value was consistent with or higher than the Persian, Brazilian Portuguese, English versions previously performed for neck pain [25–27], and Brazilian Portuguese, Chinese, and Dutch versions for TMD [28–30]. Although the results of individuals with NP and TMD pain cannot be directly interpreted with individuals with migraine, because we generally want to address areas close to the headache, and although the number and content of scale items differ, TSK-H is consistent in its assessment over time. It provides reference results for versions of kinesiophobia to be conducted in other cultures in future studies. While comparisons with the NP and TMD versions of the TSK are valuable, the lack of contrast with other psychosocial or behavioral assessment tools specifically used in migraine populations is a limitation. In future studies, it may be beneficial to evaluate the convergent or discriminant validity of the TSK-H by comparing it with other established scales used in migraine populations, such as those assessing pain catastrophizing, pain avoidance, or behavioral coping (e.g., Pain Catastrophizing Scale, Avoidance-Endurance Questionnaire). Such comparisons would provide a broader understanding of how fear of movement relates to other psychological constructs relevant to migraine and help position TSK-H within the spectrum of behavioral assessment tools.

In this study, the TSK-H was used as a measure of kinesiophobia, a fear of movement in patients with headache due to beliefs that it will exacerbate pain or cause harm. Although the items are phrased in terms of movement-related beliefs, the construct is interpreted within the broader fear-avoidance model, reflecting maladaptive headache-related beliefs and avoidance behaviors.

The study has some limitations. Initially starting with 24 items and later reducing to 23 items due to the ineffectiveness of item 1 resulted in a 4-factor structure. Twenty-three items may be considered long for clinical use in patients with headache, especially in migraine patients who experience cognitive fatigue, attentional limitations, or time constraints during attacks. However, our items should be questioned because they were assessed before and during attacks. Another limitation is that there was no other scale with migraine-specific validity-reliability study that could be compared with fear avoidance or fear of movement, so we could not use it for correlation. Also, we did not assess the patients' physical activity levels with a measurement tool. Finally, psychometric analyses were conducted on the overall sample, rather than separately for episodic and chronic migraine groups.

We recommend that a shorter version of the TSK-H (possibly 10 to 15 core items) be developed in future studies using psychometric item reduction techniques, and note that such a short form would require separate validation. A short-form version may increase applicability for clinical and large-scale research while maintaining conceptual integrity. Cultural adaptations be made to assess fear of movement in migraine, and even examined in other headaches, and discussed comparatively in future studies. Perhaps the reverse worded items could be simplified and arranged to form two/or one factor structures. Future studies with larger samples and by separate diagnoses could investigate whether the psychometric properties of the TSK-H differ across these clinically relevant subgroups.

Conclusion

The Turkish version of TSK-H seems to be a valid and reliable tool for assessing kinesiophobia in patients with EM and CM before and during attacks. Our results may provide first-step results for future version studies, as it is currently the first tool to assess kinesiophobia in different movement activities supporting the ICHD-3 diagnostic criteria in patients with migraine. However, adjustments to the items of the scale may make the scale easier to respond to by patients. TSK-H can be an effective PROMs for use in both clinical and research settings.

Supplementary Information

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Supplementary Material 1.

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Informed consent
Informed consent was obtained from all participants before their inclusion in the study. The study was conducted in accordance with the principles outlined in the Declaration of Helsinki, ensuring the protection of participants' rights, safety, and well-being throughout the research process.

Authors' contributions
"Conceptualization, D.O. and H.A.; methodology, D.O. and H.A.; software, D.O. and H.A.; validation, D.O. and H.A.; formal analysis, D.O. and H.A.; investigation, D.O. and H.A.; resources, D.O. and H.A.; data curation, D.O., H.A., D.V., M.C.A., A.B.P., E.Y., A.İ.C., C.U., P.Y.Y., B.K.S., İ.Y., P.G., E.A.D., and A.Ö; writing—original draft prep-aration, D.O. and H.A; writing—review and editing, D.O., H.A, E.E., and A.Ö.; visualization, D.O, H.A, E.E., and A.Ö.;,; supervision, E.E., and A.Ö.; project administration, D.O.; funding acquisition, D.O. All authors have read and agreed to the published version of the manuscript."

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Data availability
No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate
Ethical approval was obtained from the Clinical Research Ethics Committee of Yozgat Bozok University Faculty of Medicine on 16.10.2024 with the approval number 2024-GOKAEK-2411_2024.10.16_190. The study was registered at ClinicalTrials.gov with the number NCT06857357 (https://clinicaltrials.gov/study/NCT06857357, Registration Date: 26.02.2025).

Consent for publication
This section is included as it is not applicable to our study.

Competing interests
The authors declare no competing interests.

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