Observational Study

Medicine

OPEN

Development and validation of an ICF-based new scale—Atılım Kinesiophobia Scale

A methodological study

Naime Uluğ, PT, PhD[a,*], Ayhan Parmaksız, PhD[b], Sena Nur Begen, PT, MSc[c,d], Zehra Can Karahan, PT, PhD[c], Seval Yılmaz, PT, PhD[c], Mehmet Fatih Adalı, PT, MSc[e], Sema Nur Aslan, PT, MSc[c,d], Özgür Selim Uysal, MD, PhD[f], Dudu Melek Er, CDS, PhD[c], Öznur Tunca, PT[d], Erden Kılıç, MD[f]

Abstract

It is important to assess kinesiophobia, which increases the risk of disability by limiting physical activity. In this cross-sectional study, we aimed to develop a scale that assesses kinesiophobia with the multidimensional structure of International Classification of Functioning, Disability and Health (ICF). Atılım Kinesiophobia Scale (AKS) was developed in Turkish by an expert panel using questionnaires replied by 367 subjects. Finally, 38 questions based on the sub-domains of the ICF described by World Health Organization. In the scope of this cross-sectional study content validity and reliability were assessed; construct validity (both convergent and divergent validity) was checked against Tampa Kinesiophobia Scale-17 and Visual Analog Scale. AKS demonstrated good internal consistency and convergent validity, with significant correlations observed with the Tampa Scale for Kinesiophobia-17 ($r = 0.478$, $P < .001$). Divergent validity was supported by insignificant correlations with the Visual Analog Scale ($r = 0.019$, $P = .855$). The Cronbach alpha coefficient of 0.862 indicates a high level of internal consistency for the AKS. Based on these findings, the final version of AKS was refined to include 4 factors and 14 items, demonstrating good internal validity. We developed and validated the AKS to assess kinesophobia in patients with acute and/or chronic musculoskeletal pain. This new ICF-based scale can be used to assess kinesiophobia; however further studies are required to prove its validity and reliability in other languages.

Abbreviations: AKS = Atılım Kinesiophobia Scale, CFA = confirmatory factor analysis, CFI = comparative fit index, EFA = exploratory factor analysis, ICF = International Classification of Functioning, Disability and Health, KMO = Kaiser–Meyer–Olkin, RMSEA = root mean square error of approximation, SRMR = standardized root mean square residual, TSK = Tampa Kinesiophobia Scale, VAS = Visual Analog Scale.

Keywords: fear of movement, ICF, kinesiophobia, pain, scale

1. Introduction

In the last decade, fear has been frequently studied in the explanation, understanding, and treatment of musculoskeletal pain. Kinesiophobia is one of the most widely used conceptual definitions that can describe the pain-related fear.[1] Kinesiophobia, first described by Kori, is a condition in which a person experiences an excessive, irrational, and debilitating fear of movement, reinjury, and physical activity resulting from a sense of sensitivity to painful injuries or their recurrence.[2] Kinesiophobia is also known as fear avoidance of activity and physical movement caused by painful injury and sensitivity to repeated injury.[3,4]

The prevalence of kinesiophobia in chronic pain, especially musculoskeletal pain, has been reported to be between 50% and 70%.[5,6] Pain-induced kinesiophobia negatively affects

Informed consent was obtained from all subjects/patients participated in the study.

The authors have no funding and conflicts of interest to disclose.

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the University's Institutional Review Board.

Clinical Trial Number: NCT06278012.

Supplemental Digital Content is available for this article.

[a] *The Faculty of Health Sciences of Ankara University Prosthetics and Orthotics Department, Ankara, Turkey,* [b] *İstanbul Health and Technology University, İstanbul, Turkey,* [c] *Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Atılım University, Ankara, Turkey,* [d] *Faculty of Physiotherapy and Rehabilitation, Department of Physiotherapy and Rehabilitation, Hacettepe University, Ankara, Turkey,* [e] *Kaman Government Hospital, Kırşehir, Turkey,* [f] *Yüzüncü Yıl Hospital, Ankara, Turkey.*

** Correspondence: Naime Uluğ, The Faculty of Health Sciences Prosthetics and Orthotics Department, Ankara University, Ankara, Turkey (e-mail: ulugnaime@gmail.com).*

How to cite this article: Uluğ N, Parmaksız A, Begen SN, Can Karahan Z, Yılmaz S, Adalı MF, Aslan SN, Uysal ÖS, Er DM, Tunca Ö, Kılıç E. Development and validation of an ICF-based new scale—Atılım Kinesiophobia Scale: A methodological study. Medicine 2025;104:40(e44834).

Received: 16 May 2025 / Received in final form: 29 August 2025 / Accepted: 03 September 2025

http://dx.doi.org/10.1097/MD.0000000000044834

response to treatment and mobility in orthopedic problems. Kinesiophobia can be the main cause of non-recovery in people diagnosed with nontraumatic arm, neck, and shoulder problems.[7,8] For these reasons, kinesiophobia has recently become one of the important issues that have started to receive attention from rehabilitation professionals.[9,10]

To date, 5 different scales that are used in the assessment of pain-related kinesiophobia are defined. These are: Fear of Pain Questionnaire, Pain Anxiety Symptoms Scale, Fear-Avoidance Beliefs Questionnaire, Fear-Avoidance of Pain Scale, and Tampa Scale for Kinesiophobia (TSK).[11] The psychometric properties and validity and reliability of these scales are reported to have some weaknesses. Recently, the TSK-17 is considered to be the most frequently used scale to measure kinesiophobia.[12] However, some studies have identified limitations related to TSK. Weermeijer and Meulders stated that TSK-17 questions are not appropriate for all patients with chronic musculoskeletal pain. Because the questions in the "activity avoidance" factor mainly focus on exercise, they assume that the individual is exercising while overlooking the kinesiophobia experienced by patients in their daily routine activities. Due to similar inadequacies, the TSK-11 is not mentioned in the Australian Clinical Practice Guidelines.[8] Lundberg et al reported 2 deficiencies with the TSK; first one is that the scale cannot detect patients with less fear-avoidance beliefs and second one is that the patients are scoring high on the scale even after successfully participating in treatment, which may reflect a problem with the questionnaire.[11,13] Although TSK-17 is popular, patients and clinicians have reported that the scale has some drawbacks, such as a long completion time or less sensitive.[14]

Chronic musculoskeletal pain is a multidimensional phenomenon characterized by a complex interaction between biological, psychological, and social factors.[15,16] The International Classification of Functioning, Disability and Health (ICF) is a system that comprehensively assesses health status, functionality, disability, and the impact of environmental factors.[17] The ICF addresses individuals' health not only in the context of disease or disorder but also considering functionality and environmental factors. In this context, kinesiophobia relates to different components of the ICF. It is associated with Body Functions and Structures, such as B280 Pain and B152 Emotional Functions (e.g., fear and anxiety).[18] Fear of movement and pain perception can lead to muscle weakness and imbalance.[19] It can also affect Activities and Participation, limiting daily activities like walking or climbing stairs (D450 Walking and D455 Moving Around).[20] Social participation, work, and recreational activities (D920 Recreation and Leisure) may also be restricted.[21] Environmental factors influence kinesiophobia as well. Health services and policies (E580) affect access to rehabilitation, while supportive or discouraging attitudes from family and healthcare professionals (E310 Immediate Family and E355 Health Professionals) can impact the severity of kinesiophobia.[22,23]

Developing a kinesiophobia scale based on the ICF framework would allow a comprehensive assessment that considers emotional, cognitive, functional, and environmental dimensions. This study aimed to develop and validate a new scale of kinesiophobia under the ICF framework.

2. Materials and methods

2.1. Scale development procedure

This methodological scale development study was conducted in 3 steps.

Step 1: Item Development Stage
Step 2: Questionnaire Development Stage
Step 3: Scale Development and Evaluation Stage

Atılım Kinesiophobia Scale (AKS) development stages are explained in Figure 1.

2.1.1. Step 1: Item Development Stage. A total of 6 experts in the fields of physiotherapy and kinesiophobia contributed to the development of the scale.

In the first stage of the study, literature related to kinesiophobia was reviewed through the Pubmed, Scopus, Web of Science, and Google Academic. In the studies, patients' statements about kinesiophobia were analyzed. Initially we gathered a panel of experts to contribute to the topics and types of questions for the scale. The panel consisted of 6 experts: a physiotherapist with more than 20 years of experience in musculoskeletal pain and who had conducted a Turkish validation and reliability study of the TSK; an orthopedic surgeon with more than 20 years of experience; another physiotherapist with 8 years of experience in neurological physiotherapy; 2 physiotherapists with 8 years of experience in orthopedic rehabilitation. Additionally, the scale questions were checked for grammar by a Turkish linguist and necessary corrections were made.

The experts were chosen so that the various aspects of our questionnaire (pain, kinesiophobia psychology, and fear avoidance) would all be considered. Prior to the startup meeting, we provided each panel member with information about the different aspects of pain-related kinesiophobia and reinjury. Then we asked them to think about possible items to suggest, based on how they experienced the kinesiophobia in patients and also patients' self-reports. Then the items of the scale were identified through the ICF domains.

The experts revised an initial 38-question scale according to the patient-specific terminology based on the words or sentences that they heard from patients use regularly to reflect their terminology/reality in the items of the scale. The study team discussed the questions and did necessary revisions with several meetings. Then these words and phrases were formed into items, which were essentially the statements on the questionnaire that the expert participants would rate or answer.

2.1.2. Step 2: Scale Development Stage (the content validity and conducting a pilot study). The questionnaire in this study consisted of basic demographic characteristics (gender, age, diagnosis, pain severity). Based on ICF framework and patients' self-reports derived from qualitative studies, a total of 4 preliminary factors and 38 items were constructed to measure kinesiophobia within the AKS.

The content validity of the preliminary items was examined by 10 experienced clinicians who established content validity with Lawshe technique. Lawshe technique requires a 3-point rating to each item, in which experts marked as "essential," "useful but not essential," and "not necessary."[24] With the help of experts' ratings, we removed less valid items from the questionnaire. The AKS questions were also sent to 10 external experts with more than 20 years of clinical experience for rating. The experts were asked to rate each item in terms of how accurately it would measure kinesiophobia in patients with acute, chronic, postoperative conditions, as well as in neurological and geriatric patients.

For the pilot study (content validity) of the AKS, convenient sampling was performed with 40 patients (with acute and chronic pain, postoperative and neurological condition, and geriatric patients) to confirm their understanding of the constructed 38 preliminary items. In the pilot study, while the questionnaires were filled out by the participants, attending physiotherapists took note of the questions that the patients had difficulty in understanding. For the items that they indicated having a low understanding, the sentence structure was modified before the completion of the final questionnaire of the study.

2.1.3. Response format and scoring of the scale. The scoring of the scale should be done as a 5-point Likert scale and should be in the form of Strongly Disagree (1 point), Disagree (2

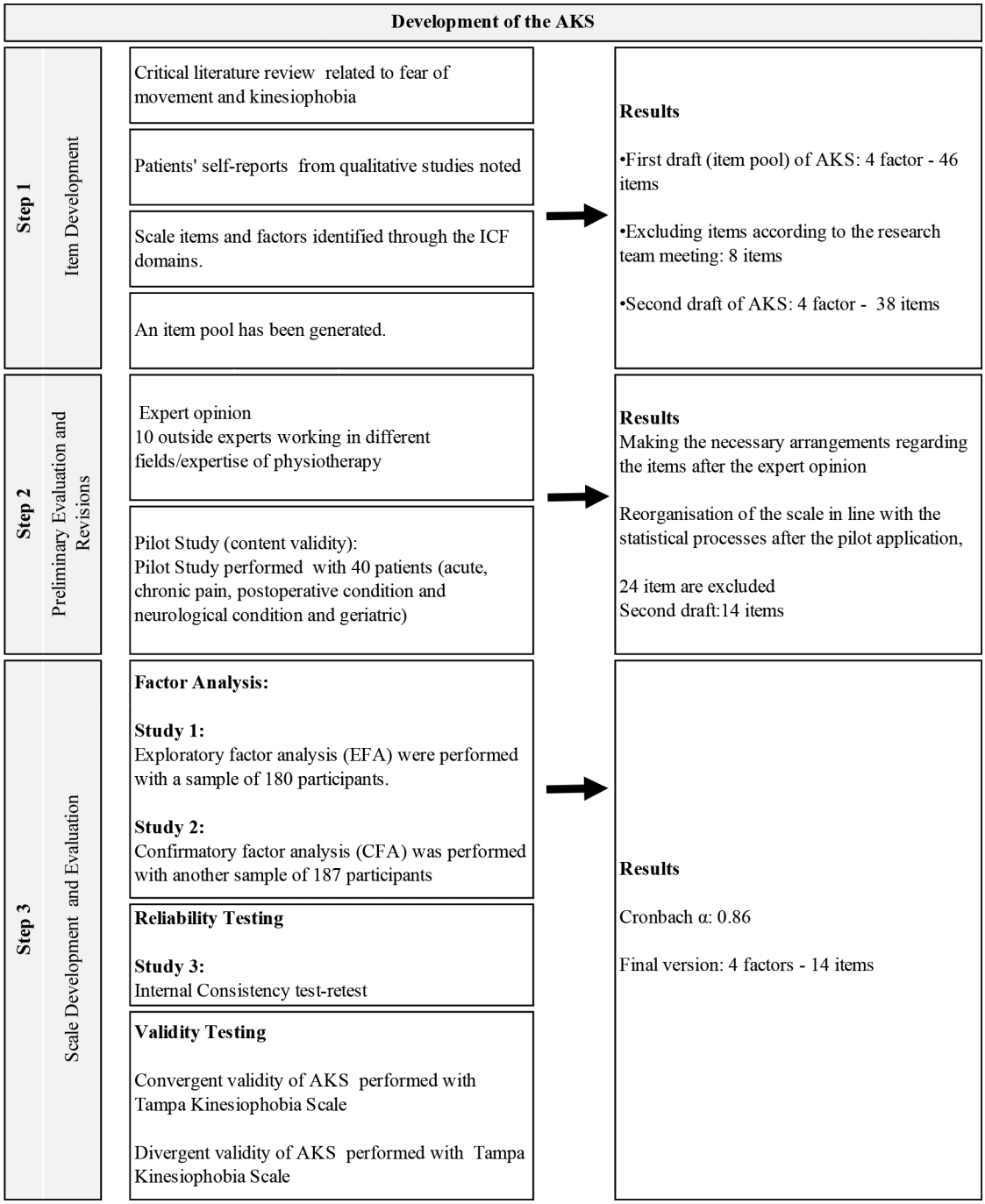

Figure 1. Flowchart of the study procedure. AKS = Atılım Kinesiophobia Scale, ICF = International Classification of Functioning, Disability and Health.

points), Neither Agree nor Disagree (3 points), Agree (4 points), and Strongly Agree (5 points). Scale scoring was made by summing the point values of the answers given to the questions, and higher scores indicate a higher level of kinesiophobia. The questions which had positive meaning reverse scored in the scale (Items 24, 25, and 26).

2.1.4. Step 3: Scale Evaluation/Validation Stage (construct validity and internal reliability). For the reliability and validity of this study, item analyses and exploratory factor analysis (EFA) were performed with a sample of 180 participants (Study 1) and confirmatory factor analysis (CFA) was performed with another sample of 187 participants (Study 2). In addition, to evaluate internal reliability the Cronbach alpha coefficient was calculated in Study 1 and to evaluate consistency repeated measures (test-retest) the interclass correlation coefficient was performed in Study 3 with a sample of 100 participants.

Each participant signed a consent form, approved by Institution's Board of Ethics of Atılım University, for their data to be used and was assured that the information acquired would stay confidential. Demographics, including age, gender, and diagnosis were recorded. The Visual Analog Scale (VAS) was used to evaluate the current intensity of pain; AKS and TSK-17 were used to assess kinesiophobia.

2.2. Study design

This study was conducted between March 2022 and March 2024. For the reliability and validity analysis, 2 separate samples were utilized. For the item analysis and EFA, a sample size

approximately 5 times the number of items was targeted. In this context, 180 participants were enrolled for the first study. In the second study, which focused on the CFA, data were collected from 187 participants. Additionally, a test-retest reliability study was conducted with 100 participants selected from the second study's sample. In total, 367 participants (aged 18–75) with acute, subacute, or chronic pain due to various musculoskeletal problems were enrolled in the study. These patients were receiving physiotherapy in 2 private physiotherapy clinics, outpatient care at 2 public hospitals, or inpatient rehabilitation following orthopedic surgery in 2 private hospitals in Ankara, Turkey.

Inclusion criteria for our study were as follows: adults aged 18 to 65 years, with acute, subacute, and chronic pain related to any musculoskeletal problems, and with a sufficient proficiency in the Turkish language to adequately comprehend and respond to the scale items.

Exclusion criteria for our study were as follows: individuals who were unable to read and understand Turkish, and patients diagnosed with malignancies or severe infections.

2.3. Study procedure

Demographic data, including age, gender, and diagnosis, were recorded. Patient's current pain intensity was assessed by VAS. A 100 mm horizontal line with the words "no pain" anchored at the left and "worst imaginable pain" anchored at the right was utilized as the VAS.

The TSK-17 was used to assess kinesiophobia. TSK-17 is a commonly used scale to assess kinesiophobia in people experiencing different kinds of pain conditions. The TSK-17 has already been translated into several languages, and research on a variety of groups has clearly shown the scale's validity and reliability. The Turkish version of TSK, a 17-item scale with a 4-point Likert scale, was completed by all patients. The scale goes from 17 to 68, with a score of 37 or below indicating modest kinesiophobia and a score of more than 37 indicating a strong fear.[25]

2.4. Data analysis

All statistical analyses were conducted using the JASP software (version 0.18.3, University of Amsterdam), a free and open-source R-based statistical platform designed for advanced statistical modeling and analysis. Qualitative data were summarized using frequency and percentage, while quantitative data were summarized by mean, standard deviation, minimum, and maximum statistics.

2.4.1. Content validity. Content validity was assessed using Lawshe method. The item pool created for this study was reviewed by 10 experienced academicians, and content validity ratios for the items and content validity index for the scale were calculated. Initially the scale consisted of 38 items.

2.4.2. Reliability and validity analysis. For the reliability and validity study, item analyses and EFA were performed using a sample of 180 participants (Study 1). CFA was conducted with another sample of 187 participants (Study 2). To evaluate internal reliability, the Cronbach alpha coefficient was calculated in Study 1. For test-retest reliability, the 1-way random effects model (where participants are considered random) was used to calculate the interclass correlation coefficient in Study 3.

2.4.3. Item analysis. In item analysis, item-rest correlations and Cronbach alpha coefficient statistics (with each item deleted) were examined.

2.4.4. Exploratory factor analysis. In the EFA analysis, Bartlett sphericity test was used to evaluate the factorability of the data, and Kaiser–Meyer–Olkin (KMO) statistics were used to evaluate the sampling adequacy. Principal axis factoring was used for factor extraction, and the Promax method was used for rotation method. The number of factors were determined based on the Kaiser criterion (eigenvalues >1) and the parallel analysis method. Variance explained by each factor and the total variance for all factors were reported.

2.4.5. Model fit. For model fit, comparative fit index (CFI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR) statistics were reported. Correlations between factors were also reported.

2.4.6. Confirmatory factor analysis. CFA was conducted using the diagonally weighted least squares method to validate the factor structure derived from the EFA. Model fit was evaluated using several indices, including the chi-square/degree of freedom ratio (χ^2/df), CFI, goodness-of-fit index, and non-normed fit index (also known as the Tucker–Lewis index). Additionally, Bentler–Bonett normed fit index, RMSEA, and SRMR statistics were calculated. Results were presented as coefficient estimates, standard error of the coefficient estimates statistics, coefficient confidence intervals, *P*-values for coefficients, as well as standardized coefficients and R^2 statistics.

2.4.7. Convergent and divergent validity. As additional analyses, the relationships between TSK-17 scores and VAS values and the AKS factors were examined using Pearson and Spearman correlation coefficients to assess convergent and divergent validity.

3. Results

3.1. Characteristics of the participants

Sociodemographic data of the participants included in our study is presented in Table 1. The average age of the study groups was around 42 to 44 and the majority of the participants were women (62.78% in the first study and 56.68% in the second study). In both the first and the second study, we can see that participants had different levels of education. All participants were recruited from the musculoskeletal pain patients group and the majority had chronic diseases (68.33% in Study 1 and 78.08% in Study 2).

3.2. Validity and reliability

3.2.1. Study 1: Item analysis and EFA. In EFA analysis, a 4-factor structure with 14 items was reached and 1 more item was removed from the model after CFA analysis (Fig. 2). The findings related to the model obtained as a result of EFA and CFA analyses are given below in order.

Findings related to item analyses and EFA analysis are given in Table 2. The result of item-rest correlations analysis showed that the lowest correlation coefficient was 0.526 (highest 0.752) and the lowest factor loading was 0.431 (highest 0.913). Cronbach alpha statistics were calculated as 0.862 for Factor 1, 0.794 for Factor 2, 0.780 for Factor 3, 0.765 for Factor 4, and 0.869 for the total scale score. As a result of EFA, the total variance explained was 58.7%. Since Bartlett test of sphericity was statistically significant (χ^2(df = 91) = 1177.71; $P < .001$), the lowest KMO statistic for the items was 0.724 and the overall KMO statistic was 0.845; the factorability and sampling adequacy of the data were provided. Other fit statistics for the model were calculated as RMSEA = 0.069, SRMR = 0.029, and CFI = 0.967.

In summary, there is a 4-factor structure in which all statistics are at a sufficient level. This structure was further tested with another sample (participant group/Study 2) by CFA analysis. In addition, when the correlations between the factors were analyzed, there was a moderate positive relationship between Factors 1, 2, and 3 (r = 0.527–0.606), while Factor 4 had a weak

Table 1

Sociodemographic characteristics of patients.

	Study 1: EFA (n = 180)		Study 2: CFA (n = 187)	
	$\bar{X}$ (SD)	*M* (Min–Max)	$\bar{X}$ (SD)	*M* (Min–Max)
Age	43.66 (13.45)	44 (33.75–54)	42.09 (13.73)	43 (29.5–53)
	n	%	n	%
Gender				
Male	67	37	81	43
Female	113	62	106	56
Education				
Primary school	42	23	36	19
Secondary school	12	6	7	3
High school	45	25	56	29
University	75	41	79	42
Master or more	6	3	9	4
Diagnose				
Musculoskeletal pain	180	98	187	96
Pain duration				
Acute	34	18	20	10
Subacute	22	12	21	11
Chronic	123	68	146	78
Missing	1			

CFA = confirmatory factor analysis, EFA = exploratory factor analysis, *M* = median, Max = maximum, Min = minimum, n = number of participants, SD = standard deviation, $\bar{X}$ = mean.

relationship with Factors 2 and 3 ($r = 0.268$ and $r = 0.276$) (Table 3).

3.2.2. Study 2: Confirmatory factor analysis. In the second study, the second level confirmatory factor model was tested with 187 participants. The findings are shown in Table 4 and Figure 3. In the model, modification suggestions were evaluated and covariance was defined between Item-24 and Item-25. Statistically significant relationships were found between these items (standardized coefficient estimation was calculated as 0.493). All path (regression) coefficients obtained as a result of CFA were statistically significant (Table 4). When the statistics related to the fit of the model are examined, it is seen that χ^2/df (1.447) statistic is <2, goodness-of-fit index (0.975), CFI (0.970), Tucker–Lewis index (0.963) statistics are >95%, and RMSEA (0.049) and SRMR (0.080) statistics are <8%. The smallest R^2 statistic was calculated as 10.8% (Table 4). According to all indices, it can be inferred that the data fit the model or that the data confirms the model. Additionally, the study was conducted with larger than the sample size required for the CFA model at a significance level of 5%, with Holter critical sample size being 166. Descriptive statistics of the scales applied in all study phases are given in Table 5.

3.2.3. Convergent and divergent validity. When the relationships between TSK-17 and scale score obtained in our studies were analyzed, a statistically significant positive moderate relationship was found between TSK-17 and Factor 2, Factor 3, and total score, and a statistically significant weak-moderate positive relationship was found between TSK-17 and Factor 1 and Factor 4 (Table 6). Scatter plots of TSK-17 and the AKS total score of the scale are presented in Figure 4. When the relationships between VAS scores and AKS scores obtained in the test-retest study were analyzed, no statistically significant relationship was found between VAS scores and TSK-17 and AKS scores (Table 6). Scatter plots of VAS scores and TSK-17 and AKS total scores are given in Figure 5.

4. Discussion

This study aimed to develop and validate the AKS to assess kinesiophobia in patients with musculoskeletal pain. As a result, a scale consisting of 4 factors and 14 items was constructed. The factors included: pain and pain-related fear avoidance (3 items), emotional factors (3 items), attitude toward movement and physical activity (3 items), and activity and participation (5 items); all alignment with ICF framework. Additionally, the AKS demonstrated strong internal consistency was shown by a high Cronbach alpha coefficient of 0.86. In terms of internal consistency, the Cronbach alpha coefficient reflects the degree to which items are interrelated and supports the reliability of the scale.[26]

Several studies on kinesiophobia are predominantly focused on patients with chronic musculoskeletal pain, such as chronic low back and neck pain.[27–29] In these studies, the TSK-17 was frequently used to assess kinesiophobia. However, limitations of the TSK-17 have been identified in previous studies.[14] These limitations are difficulties in understanding the questions, and feedback of the patients that the questions are not relevant to the patient's condition. Additionally, physiotherapists involved in this study observed that patients had some difficulties while answering the questions of TSK-17. Therefore those limitations inspired the research team to develop a new scale with simple narrative questions suitable for different patient conditions that can be easily understood and replied.[30] Therefore, in this study, the reliability and validity of our newly developed AKS was analyzed with EFA and CFA analyses and compared with TSK. In the EFA analysis, a 15-item 4-factor AKS structure was formed. However, because of CFA analysis, 1 item was extracted from the model and a final scale with 14 items and 4 factors was constructed.

To our knowledge, scales related to kinesiophobia have not previously been designed or described according to the framework of ICF. In the AKS scale, 4 sub-factors were created in accordance with the ICF structure different from the TSK. These factors are F1: Activity and participation; F2: Body structure function/Fear avoidance related to pain; F3: Attitude towards movement and physical activity; F4: Personal factors/emotional factors. When we examine the subdimensions of TSK, items 1, 11, 14, 15, and 16 assess attitude, items 5, 8, 6, 2, 3, 4, 12, 13, 14, 15, and 16 assess activity, and items 7, 9, 10, 12, and 17 assess psychological state.

When the sociodemographic characteristics of the participants included in our study were analyzed, the age and gender

ATILIM KINESIOPHOBIA SCALE (AKS)

Instructions: Using the scale below, please indicate the degree of fear of movement in relation to the feelings and thoughts because of your pain/condition/illness/injury/.

Rating	**1**	**2**	**3**	**4**	**5**
Meaning	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

Pain and Fear-Avoidance Related to Pain.	
Item Number	
I-10	I'm afraid of getting reinjured when I move.
I-11	I avoid moving because of my pain
I-17	If I move, I am afraid of falling and getting injured afterwards.
Personal Factors	
Emotional Factors	
I-24*	My doctor/physiotherapist's recommendation to exercise/movement encourages me.
I-25*	I am generally willing to move and exercise.
I-26*	I exercise even if I have pain.
Attitude Towards Movement and Physical Activity	
I-27	I avoid exercising because of my pain.
I-28	I have no courage to move and exercise.
I-29	Even the slightest pain in my body makes me very anxious.
Activity and Participation	
I-20	I am afraid to move without assistive devices (cane, walker, e.g., AFO, etc.).
I-32	I am afraid to move inside the house (due to reasons such as stairs, narrow spaces, poor lighting).
I-35	I can't do my daily shopping and outdoor tasks because of my fear of movement.
I-36	I can't go outside because of my pain.
I-38	I am afraid to go outside because of my fear of falling (due to reasons such as crowded enviroment, slopes, stairs).

Reverse scored questions

Figure 2. Atılım Kinesiophobia Scale.

distributions of the study groups were similar. Therefore, the scale items are applicable to different patient groups including both genders. Consistent with the literature, the sample age range of our study is compatible with the average age of the participants in the validity and reliability studies on kinesiophobia.[31–33]

In EFA, CFA, and test-retest studies, patients with different levels of education participated. These results suggest that the AKS can be a suitable, comprehensible, and applicable scale for participants at all levels of education group.

Several previous validity-reliability studies have focused on kinesiophobia among patients with chronic musculoskeletal pain patients using the TSK-17. Similarly, studies have also examined kinesiophobia in patients with acute and subacute musculoskeletal pain. Likewise, all the participants in our study were from the patient group with musculoskeletal pain and the majority (68.33% in Study 1 and 78.08% in Study 2) had chronic pain. It has been reported that the incidence of kinesiophobia in patients with musculoskeletal pain is high (50%–70%).[6] Therefore, the participants in our study were patients with musculoskeletal pain or injury.

In this study, as a result of the EFA analysis of the AKS scale, a 14-item 4-factor structure was obtained from the items with factor loadings above 0.40. When the AKS was compared with the TSK-17, similar factor structures were found. The lower number of questions in the AKS may provide convenience for clinicians and patients in clinical use and reduce the loss of time.[34]

The correlation analysis between TSK-17 and AKS dimensions revealed a relationship between TSK-17 total score and

Table 2

Item analysis and results of exploratory factor analysis (n = 180).

	Item analysis				EFA*	
	$\bar{X}$	SD	Item-rest correlation	If item dropped, Cronbach α	Factor loadings	KMO
F1: Activity and participation						
Item-35	1.828	1.425	0.731	0.819	0.913	0.872
Item-36	1.833	1.420	0.746	0.815	0.749	0.899
Item-38	1.828	1.456	0.752	0.814	0.696	0.876
Item-20	1.522	1.184	0.526	0.867	0.642	0.882
Item-32	1.800	1.408	0.649	0.841	0.498	0.892
F1 total	**8.811**	**5.545**		**CA = 0.862**	**EV = 0.201**	
F2: Body structure function/fear avoidance related to pain						
Item-10	2.372	1.718	0.679	0.681	0.811	0.863
Item-17	2.550	1.770	0.674	0.686	0.714	0.886
Item-11	2.900	1.698	0.570	0.794	0.641	0.886
F2 total	**7.822**	**4.373**		**CA = 0.797**	**EV = 0.135**	
F3: Attitude towards movement and physical activity						
Item-27	2.433	1.572	0.608	0.712	0.788	0.815
Item-28	1.817	1.356	0.695	0.633	0.719	0.799
Item-29	2.439	1.618	0.564	0.766	0.431	0.887
F3 total	**6.689**	**3.797**		**CA = 0.78**	**EV = 0.132**	
F4: Personal factors/emotional factors						
Item-25	1.506	1.038	0.665	0.627	0.863	0.616
Item-24	1.572	1.083	0.553	0.734	0.645	0.724
Item-26	2.000	1.382	0.612	0.693	0.641	0.735
F4 total	**5.078**	**2.915**		**CA = 0.765**	**EV = 0.119**	
AKS total	**28.400**	**12.396**		**CA = 0.869**	**EV = 0.587**	**0.845**

CA = Cronbach alpha, CFI = comparative fit index, df = degrees of freedom, EFA = exploratory factor analysis, EV = proportion of explained variance, KMO = Keiser–Meyer–Olkin, RMSEA = root mean square error of approximation, SD = standard deviation, SRMR = standardized root mean square residual, $\bar{X}$ = mean.

*Factoring method: principal axis factoring; rotation method: Promax; Bartlett test: $\chi^2(df = 91) = 1177.71$; $P < .001$; fit indices: RMSEA = 0.069; SRMR = 0.026; CFI = 0.967.

Table 3

Correlation coefficients between factors.

	Factor 1	Factor 2	Factor 3	Factor 4
Factor 1	1	0.553	0.527	-0.090
Factor 2	0.553	1	0.606	0.268
Factor 3	0.527	0.606	1	0.276
Factor 4	-0.090	0.268	0.276	1

Values are Pearson correlation coefficients.

Table 4

Confirmatory factor analysis results (n = 187).

						95% CI			
Factor	Item	Estimate	SE	*z*	*P*	Lower	Upper	Std. est.	R^2
F1	I-32	0.632	0.071	8.842	<.001	0.492	0.772	0.65	0.422
	I-20	0.256	0.051	5.006	<.001	0.156	0.356	0.284	0.081
	I-35	0.691	0.072	9.607	<.001	0.55	0.832	0.728	0.531
	I-36	0.807	0.082	9.845	<.001	0.646	0.967	0.759	0.577
	I-38	0.775	0.081	9.573	<.001	0.616	0.934	0.754	0.569
F2	I-10	0.526	0.144	3.641	<.001	0.243	0.809	0.646	0.417
	I-11	0.587	0.164	3.581	<.001	0.266	0.908	0.751	0.564
	I-17	0.537	0.148	3.642	<.001	0.248	0.827	0.659	0.434
F3	I-27	0.534	0.153	3.496	<.001	0.235	0.834	0.695	0.484
	I-28	0.552	0.159	3.468	<.001	0.24	0.864	0.785	0.616
	I-29	0.367	0.105	3.486	<.001	0.161	0.574	0.442	0.196
F4	I-24	0.239	0.051	4.72	<.001	0.14	0.339	0.329	0.108
	I-25	0.576	0.073	7.861	<.001	0.432	0.719	0.635	0.403
	I-26	1.132	0.149	7.597	<.001	0.84	1.424	0.936	0.877
S-O	F1	0.675	0.077	8.767	<.001	0.524	0.826	0.559	0.313
	F2	1.812	0.576	3.145	.002	0.683	2.941	0.876	0.767
	F3	1.707	0.553	3.089	.002	0.624	2.791	0.863	0.745
	F4	0.668	0.099	6.721	<.001	0.473	0.863	0.555	0.308

Estimation Method: DWLS; fit indices: $\chi^2 = 104.20$, df = 72, $\chi^2/df = 1.447$, GFI = 0.975, CFI = 0.970, TLI = 0.963, NNFI = 0.963, RMSEA = 0.049, SRMR = 0.080, Holter critical N (α = .05) = 166.67. CFI = comparative fit index, CI = confidence interval, DWLS = diagonally weighted least squares, GFI = goodness-of-fit index, NNFI = non-normed fit index, RMSEA = root mean square error of approximation, SE = standard error, S-O = second order, SRMR = standardized root mean square residual, Std. est. = standardized estimate, TLI = Tucker–Lewis index.

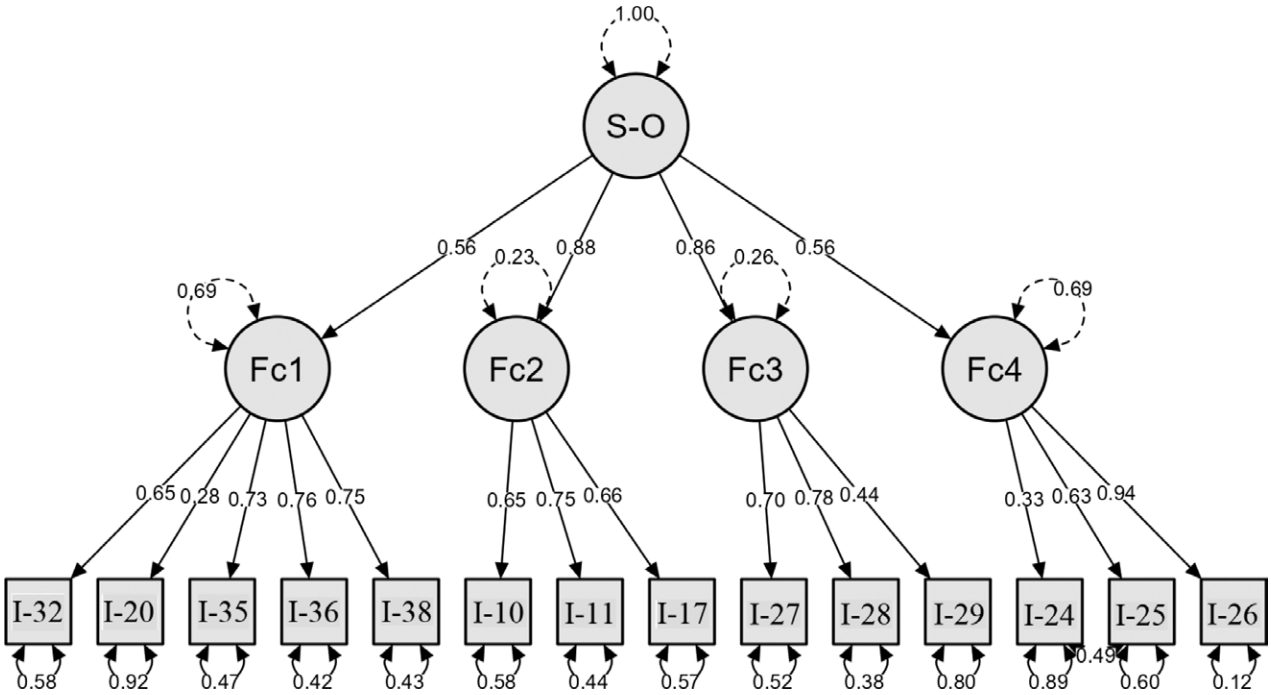

Figure 3. Second order confirmatory factor analysis model.

Table 5

Descriptive statistics of scale scores.

	EFA (n = 180)		CFA (n = 187)		Retest (n = 100)	
	$\bar{X}$ (SD)	*M* (Min–Max)	$\bar{X}$ (SD)	*M* (Min–Max)	$\bar{X}$ (SD)	*M* (Min–Max)
VAS	–	–	–	–	5.22 (1.68)	5 (4–6)
TSK-17	39.68 (7.12)	40 (36–43.25)	38.73 (6.58)	39 (35–43)	–	–
F1	8.81 (5.55)	6 (5–11)	7.82 (4.25)	5 (5–9)	6.97 (3.59)	5 (5–7.25)
F2	7.82 (4.37)	7 (3–11)	8.43 (4.02)	8 (5–12)	8.24 (3.97)	7.5 (5–12)
F3	6.69 (3.8)	6 (3–9.25)	7.1 (3.51)	6 (4–9)	7.42 (3.38)	7 (5–9.25)
F4	5.08 (2.92)	4 (3–7)	5.58 (2.81)	5 (3–7)	5.72 (2.44)	5 (4–7)
AKS total	28.4 (12.4)	25.5 (18–35)	28.91 (10.65)	27 (21–37)	28.35 (10.34)	26 (20–35)

AKS = Atılım Kinesiophobia Scale, CFA = confirmatory factor analysis, EFA = exploratory factor analysis, *M* = Median, Max = maximum, Min = minimum, SD = standard deviation, TSK = Tampa Kinesiophobia Scale, VAS = Visual Analog Scale, $\bar{X}$ = mean.

the 2nd and 3rd factors of AKS. The 2nd factor (pain-related items) and 3rd factor (attitude toward movement and physical activity) questions of the AKS consisted of questions related to kinesiophobia. These factors seem to be consistent with the items about the pain-related factors and activity/exercise related to kinesiophobia in the TSK-17. Based on these data, we can infer that AKS is compatible with and similar to TSK.

Another important finding is the weak correlation between the TSK-17 total score and the 1st factor of the AKS. This can be explained by the fact that there are items questioning the presence of kinesiophobia in the F1 activity-participation dimension according to ICF in the AKS. Unlike the TSK-17 model, this factor or dimension consist of important items, which question kinesiophobia during movement in activities of daily living.[8] We consider that the evaluation of kinesiophobia in the activity-participation dimension may be important, especially for patients with postoperative conditions or acute injury, neurologic problems, and geriatric patients. This factor shows that the AKS has an important dimension which is not present in the TSK-17 model.

Another result of our study revealed a weak correlation between AKS F4 and TSK-17 total score. The fact that the presence of questions related to motivation and courage, which questioned the absence of kinesiophobia related to emotional factors in F4 in AKS model, may explain this weak relationship (a positive response to these questions indicates the absence or low level of kinesiophobia).

In the test-retest analysis, no correlation was found between the VAS pain intensity and the AKS or TSK-17 scores. This finding suggests that kinesiophobia may not always correlate directly with pain intensity. The AKS focuses on kinesiophobia rather than pain itself, which could explain the lack of correlation with VAS.[35–37]

Patient-reported outcomes are critical to clinical decision making and rehabilitation assessment. Feedback from clinicians and patients during the scale development process indicates that the AKS is user-friendly, easy to understand, and can be administered in a short time compared to previous scales. We believe that the use of patient-specific terminology has made the AKS more accessible to the Turkish population.

In conclusion, the AKS demonstrated good content validity, internal consistency, and test-retest reliability for the assessment of kinesiophobia in patients with musculoskeletal pain. The AKS is expected to be useful for assessing kinesiophobia in various patient populations, including those with acute or chronic pain, postoperative conditions, neurological disorders, and geriatric populations.

Table 6

Correlations between TSK-17, VAS, and AKS.

Correlations between TSK-17 and AKS

	EFA (n = 180)				CFA (n = 187)			
	Pearson		Spearman		Pearson		Spearman	
	r	*P*	rho	*P*	*r*	*P*	rho	*P*
F1	0.314	<.001*	0.356	<.001*	0.383	<.001*	0.415	<.001*
F2	0.421	<.001*	0.506	<.001*	0.445	<.001*	0.434	<.001*
F3	0.437	<.001*	0.508	<.001*	0.462	<.001*	0.446	<.001*
F4	0.231	.002*	0.230	.002*	0.213	.004*	0.217	.003*
AKS total	0.478	<.001*	0.566	<.001*	0.531	<.001*	0.532	<.001*

Correlations between VAS and AKS (n = 100)

	Pearson		Spearman	
	r	*P*	rho	*P*
F1	0.049	.627*	0.079	.434*
F2	–0.014	.892*	0.022	.831*
F3	0.042	.680*	0.078	.438*
F4	–0.024	.815*	<0.001	.997*
AKS total	0.019	.855*	0.049	.629*
TSK	–0.099	.328*	-0.062	.540*

AKS = Atılım Kinesiophobia Scale, CFA = confirmatory factor analysis, EFA = exploratory factor analysis, *r* = Pearson correlation coefficient, rho = Spearman correlation coefficient,TSK-17 = Tampa Scale of Kinesiophobia, VAS = Visual Analog Scale.

*$P < .05$ indicates statistical significance.

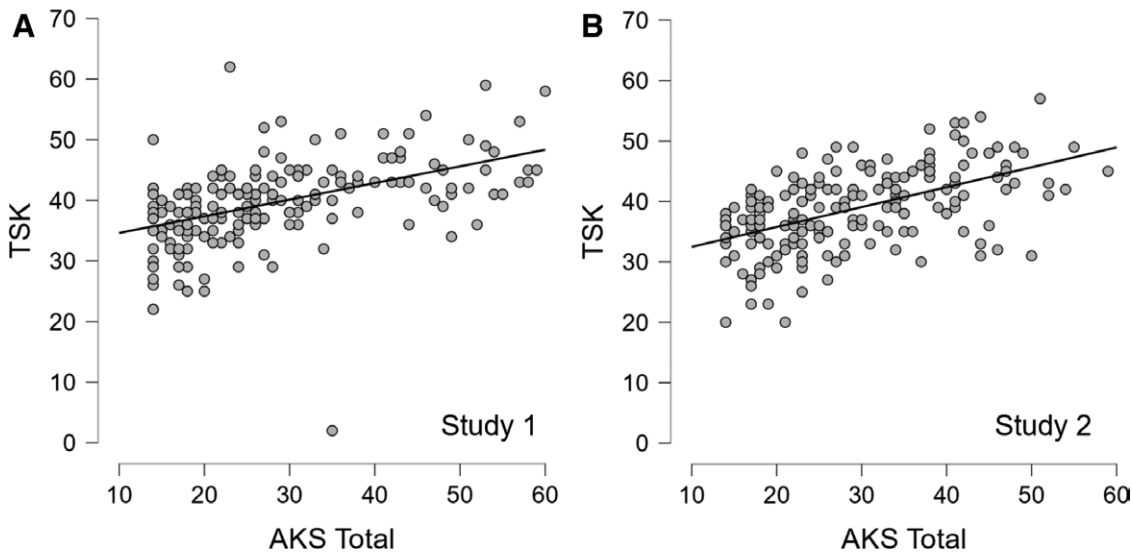

Figure 4. Scatter plot for TSK and AKS total in Study 1 (A) and Study 2 (B). AKS = Atılım Kinesiophobia Scale, TSK = Tampa Kinesiophobia Scale.

4.1. Limitation

The main limitation of this study is that although the scale is intended for use in different patient populations, its validity and reliability were only tested in patients with musculoskeletal pain. Future studies should focus on validating the scale in populations with different patient populations. In addition, the cutoff values for the AKS have not yet been established in large samples.

4.2. Conclusion

We developed and validated the AKS to assess pain-related movement fear in patients with acute and chronic musculoskeletal pain in accordance with ICF domains. The results of this study suggest that the AKS is a reliable and valid tool for measuring kinesiophobia with biological, psychological, and social factors according to the ICF model.

This ICF-based scale could be utilized by healthcare professionals, particularly physiotherapists, to assess kinesiophobia and address potential barriers to rehabilitation, ultimately improving recovery and quality of life. Although our study shows strong reliability and validity in identifying kinesiophobia, further studies are needed to verify the AKS's validity and reliability across different health conditions and cultures.

Acknowledgments

The authors would like to offer their special thanks to all patients, physiotherapists, and research assistants of Department of Physiotherapy and Rehabilitation, Atılım University.

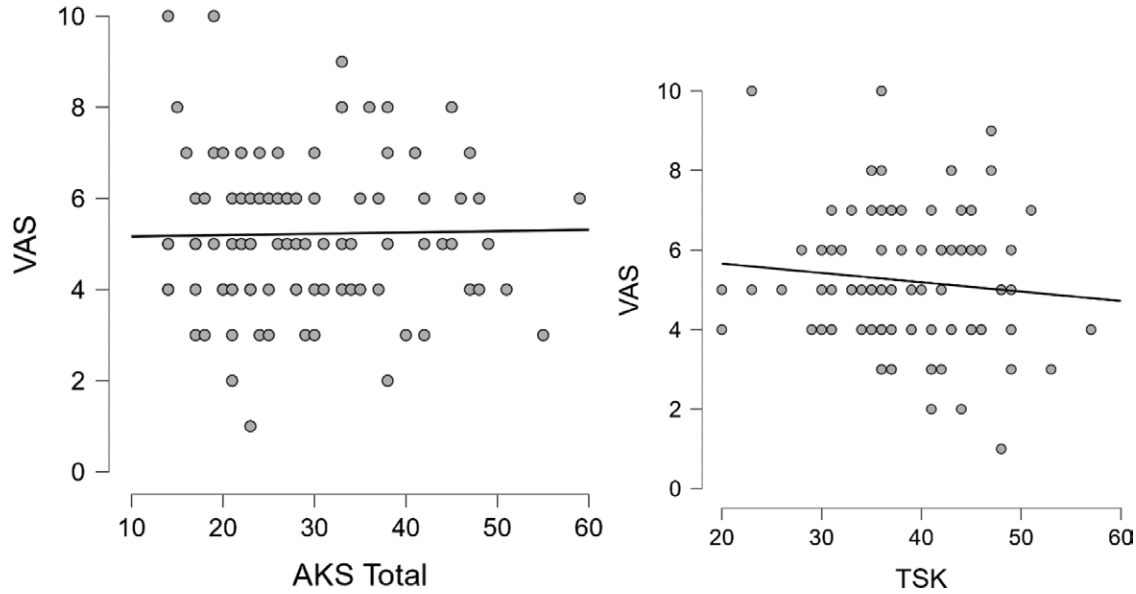

Figure 5. Scatter plot between VAS and AKS total and between VAS and TSK. AKS = Atılım Kinesiophobia Scale, TSK = Tampa Kinesiophobia Scale, VAS = Visual Analog Scale.

Author contributions

Conceptualization: Naime Uluğ, Ayhan Parmaksız, Sena Nur Begen, Öznur Tunca, Erden Kılıç.
Formal analysis: Ayhan Parmaksız.
Investigation: Zehra Can Karahan, Seval Yılmaz.
Project administration: Naime Uluğ, Özgür Selim Uysal, Dudu Melek Er, Öznur Tunca, Erden Kılıç.
Resources: Sena Nur Begen, Zehra Can Karahan, Mehmet Fatih Adalı, Sema Nur Aslan.
Supervision: Naime Uluğ, Seval Yılmaz, Dudu Melek Er, Öznur Tunca, Erden Kılıç.
Visualization: Naime Uluğ, Ayhan Parmaksız, Sema Nur Aslan, Özgür Selim Uysal.
Writing – original draft: Naime Uluğ, Ayhan Parmaksız, Sena Nur Begen.
Writing – review & editing: Zehra Can Karahan, Erden Kılıç.
The original Turkish version of AKS (second draft 38 item, final version 14 item) that could be used in future validation studies is provided in Data Files S1 and S2, Supplemental Digital Content, https://links.lww.com/MD/Q128.

References

[1] Linton SJ, Shaw WS. Impact of psychological factors in the experience of pain. Phys Ther. 2011;91:700–11.
[2] Knapik A, Saulicz E, Gnat R. Kinesiophobia - introducing a new diagnostic tool. J Hum Kinet. 2011;28:25–31.
[3] Duport A, Pelletier R, Martel M, Léonard G. The influence of kinesiophobia and pain catastrophizing on pain-induced corticomotor modulation in healthy participants: a cross sectional study. Neurophysiol Clin. 2022;52:375–83.
[4] Lethem J, Slade P, Troup J, Bentley G. Outline of a fear-avoidance model of exaggerated pain perception—I. Behav Res Ther. 1983;21:401–8.
[5] Crombez G, Eccleston C, Van Damme S, Vlaeyen JW, Karoly P. Fear-avoidance model of chronic pain: the next generation. Clin J Pain. 2012;28:475–83.
[6] Lundberg M, Larsson M, Ostlund H, Styf J. Kinesiophobia among patients with musculoskeletal pain in primary healthcare. J Rehabil Med. 2006;38:37–43.
[7] Keijsers E, Feleus A, Miedema HS, Koes BW, Bierma-Zeinstra SM. Psychosocial factors predicted nonrecovery in both specific and nonspecific diagnoses at arm, neck, and shoulder. J Clin Epidemiol. 2010;63:1370–9.
[8] Weermeijer JD, Meulders A. Clinimetrics: Tampa scale for kinesiophobia. J Physiother. 2018;64:126.
[9] Comachio J, Magalhaes MO, Campos Carvalho E, Silva APM, Marques AP. A cross-sectional study of associations between kinesiophobia, pain, disability, and quality of life in patients with chronic low back pain. Adv Rheumatol. 2018;58:8.
[10] Çayır M, Durutürk NA, Tekindal MA. Kinezyofobi Nedenleri Ölçeği'nin Türkçe uyarlamasının geçerlik ve güvenirliği. J Exer Ther Rehabil. 2020;7:64–73.
[11] Lundberg M, Grimby-Ekman A, Verbunt J, Simmonds M. Pain-related fear: a critical review of the related measures. Pain Res Treat. 2011;2011:494196.
[12] Waddell G, Newton M, Henderson I, Somerville D, Main CJ. A Fear-Avoidance Beliefs Questionnaire (FABQ) and the role of fear-avoidance beliefs in chronic low back pain and disability. Pain. 1993;52:157–68.
[13] Lundberg M, Styf J, Jansson B. On what patients does the Tampa scale for kinesiophobia fit? Physiother Theory Pract. 2009;25:495–506.
[14] Pincus T, Smeets RJ, Simmonds MJ, Sullivan MJ. The fear avoidance model disentangled: improving the clinical utility of the fear avoidance model. Clin J Pain. 2010;26:739–46.
[15] Gatchel RJ, Peng YB, Peters ML, Fuchs PN, Turk DC. The biopsychosocial approach to chronic pain: scientific advances and future directions. Psychol Bull. 2007;133:581–624.
[16] Leeuw M, Goossens ME, Linton SJ, Crombez G, Boersma K, Vlaeyen JW. The fear-avoidance model of musculoskeletal pain: current state of scientific evidence. J Behav Med. 2007;30:77–94.
[17] World Health Organization. International Classification of Functioning, Disability and Health: Children & Youth Version: ICF-CY. World Health Organization; 2007.
[18] Vlaeyen JWS, Linton SJ. Fear-avoidance and its consequences in chronic musculoskeletal pain: a state of the art. Pain. 2000;85:317–32.
[19] Luque-Suarez A, Martinez-Calderon J, Falla D. Role of kinesiophobia on pain, disability and quality of life in people suffering from chronic musculoskeletal pain: a systematic review. Br J Sports Med. 2019;53:554–9.
[20] Crombez G, Vlaeyen JW, Heuts PH, Lysens R. Pain-related fear is more disabling than pain itself: evidence on the role of pain-related fear in chronic back pain disability. Pain. 1999;80:329–39.
[21] Häkkinen A, Pakarinen A, Hannonen P, et al. Effects of prolonged combined strength and endurance training on physical fitness, body composition and serum hormones in women with rheumatoid arthritis and in healthy controls. Clin Exp Rheumatol. 2005;23:505–12.
[22] Meulders A, Vansteenwegen D, Vlaeyen JWS. The acquisition of fear of movement-related pain and associative learning: a novel pain-relevant human fear conditioning paradigm. Pain. 2011;152:2460–9.
[23] Boersma K, Linton SJ. Psychological processes underlying the development of a chronic pain problem: a prospective study of the relationship

between profiles of psychological variables in the fear-avoidance model and disability. Clin J Pain. 2006;22:160–6.
[24] Lawshe CH. A quantitative approach to content validity. Pers Psychol. 1975;28:563–75.
[25] Yilmaz OT, Yakut Y, Uygur F, Ulug N. Turkish version of the Tampa Scale for Kinesiophobia and its test-retest reliability. Turk J Physiother Rehabil - Fizyoterapi Rehabilitasyon. 2011;22:44–9.
[26] Tavakol M, Dennick R. Making sense of Cronbach's alpha. Int J Med Educ. 2011;2:53–5.
[27] Van Bogaert W, Coppieters I, Kregel J, et al. Influence of baseline kinesiophobia levels on treatment outcome in people with chronic spinal pain. Phys Ther. 2021;101:pzab076.
[28] Dupuis F, Cherif A, Batcho C, Massé-Alarie H, Roy J-S. The Tampa scale of kinesiophobia: a systematic review of its psychometric properties in people with musculoskeletal pain. Clin J Pain. 2023;39:236–47.
[29] Lin LH, Lin TY, Chang KV, Wu WT, Oezcakar L. Pain neuroscience education for reducing pain and kinesiophobia in patients with chronic neck pain: a systematic review and meta-analysis of randomized controlled trials. Eur J Pain. 2024;28:231–43.
[30] Uluğ N, Yakut Y, Alemdaroğlu I, Yılmaz O. Comparison of pain, kinesiophobia and quality of life in patients with low back and neck pain. J Phys Ther Sci. 2016;28:665–70.
[31] Le Carré J, Luthi F, Burrus C, et al. Development and validation of short forms of the pain catastrophizing scale (F-PCS-5) and Tampa scale for kinesiophobia (F-TSK-6) in musculoskeletal chronic pain patients. J Pain Res. 2023;16:153–67.
[32] Mendes LP, Fidelis-de-Paula-Gomes CA, Pontes-Silva A, et al. Tampa scale for kinesiophobia in chronic neck pain patients (TSK-neck): structural and construct validity and reliability in a Brazilian population. BMC Musculoskelet Disord. 2024;25:151.
[33] Monticone M, Giorgi I, Baiardi P, Barbieri M, Rocca B, Bonezzi C. Development of the Italian version of the Tampa scale of kinesiophobia (TSK-I): cross-cultural adaptation, factor analysis, reliability, and validity. Spine. 2010;35:1241–6.
[34] Boateng GO, Neilands TB, Frongillo EA, Melgar-Quiñonez HR, Young SL. Best practices for developing and validating scales for health, social, and behavioral research: a primer. Front Public Health. 2018;6:149.
[35] Ishak NA, Zahari Z, Justine M. Kinesiophobia, pain, muscle functions, and functional performances among older persons with low back pain. Pain Res Treat. 2017;2017:3489617.
[36] Marshall PW, Schabrun S, Knox MF. Physical activity and the mediating effect of fear, depression, anxiety, and catastrophizing on pain related disability in people with chronic low back pain. PLoS One. 2017;12:e0180788.
[37] Costa LCM, Maher CG, McAuley JH, Hancock MJ, Smeets RJ. Self-efficacy is more important than fear of movement in mediating the relationship between pain and disability in chronic low back pain. Eur J Pain. 2011;15:213–9.