JBACHS
Journal of Basic and Clinical Health Sciences

A TURKISH-LANGUAGE VALIDATION AND RELIABILITY STUDY OF THE STORM FEAR QUESTIONNAIRE (SFQ)

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Cite this article as: Parlak-Somuncu B, Dilaver I, Karakullukcu S, Beyhun N E, Topbas M. A Turkish-Language Validation and Reliability Study of the Storm Fear Questionnaire (SFQ)J Basic Clin Health Sci 2024; 8: 474-482.

ABSTRACT

Purpose: The purpose of this study is to determine the validity and reliability of the Turkish-language version of the Storm Fear Questionnaire (SFQ).
Material and Methods: The research was completed with 299 individuals. After obtaining sociodemographic information of the participants, Storm Fear Questionnaire, Eco-Anxiety Scale and Severity Measure for Specific Phobia were administered. Exploratory and confirmatory factor analysis was applied to evaluate the scale's construct validity, while Cronbach's alpha (α) reliability coefficient was used to determine its consistency, and test-retest reliability was employed to determine its stability.
Results: Scores from the SFQ scale ranged from 0 to 56, with a mean score of 13.3 ±11.4. A structure consisting of a single factor with an eigenvalue greater than 1, explaining 59.0% of the total variance emerged from the factor analysis. Factor loadings for the SFQ, the original of which consists of 15 items, ranged between 0.594 and 0.879. One item with a factor loading less than 0.30 was removed from the scale. The Cronbach alpha coefficient of the first test was 0.943.
Conclusion: We think that the 14-item scale obtained in this research can be employed as a valid and reliable tool for evaluating storm fear in adults in Türkiye.

Keywords: Phobias, fear, wind, extreme weather, factor analysis.

INTRODUCTION

Storms are defined as organized system of clouds and thunderstorms that has a closed low-level circulation (1). Approximately 2000 storms occur worldwide at any one time, the total annual number being approximately 16 million. Ten percent of these may be severe (2). An increase in the strength and frequency of storms has been predicted due to the alarming situation resulting from weather events deriving from global climate change evolving into a global climate crisis (3,4). Extreme weather events such as storms, severe rain, floods, and hail have also tended to increase in Türkiye in the last 20 years. Storms represented 21.4% of extreme weather events in the country in 2022 (5). According to Turkish State Meteorological Office data, storms can be seen in almost all regions of Türkiye, with tornadoes even being reported in the Eastern Black Sea and Northeast Anatolia regions, where they had never been observed until the last 10 years (6,7).

Several health-related effects of storms have been reported. For example, they can lead to injuries, the interruption of basic health services, infrastructure problems, material and economic losses, and

mortality, both directly and indirectly (8). Injuries, infections and parasitic diseases, cardiovascular diseases, respiratory diseases, and neuropsychiatric disorders and been shown to capable of being linked to increased mortality, even months after a storm (4). In the light of their potential to affect large numbers of people and multifaceted health impacts, storms and the weather events accompanying them represent an important public health problem (8).

Although various studies have revealed the effect of storms and the global climate crisis on human health, their impacts on human psychology have only recently become the subject of discussion. A report published in 2009 espoused the possibility of an interaction between climate change and mental health and called for greater research into the subject (3,9). This revealed the need for an examination of the effects of storms, expected to increase in line with climate change, on human psychology. Fear of storms was therefore addressed in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (10) and was classified among the natural/environmental type phobias, a specific phobia subtype.

Fear of storms is defined as a continuous and extreme fear of meteorological events such as storms and hurricanes. Individuals with storm phobia often experience a worried expectation of weather events such as storms (10). In addition, this fear can lead to physiological reactions such as tachycardia and sweating, symptoms which may emerge not only at the time of storms, but during their anticipation (11). Natural/environmental type phobias are one of the most overlooked clinical manifestations in terms of clinical studies and scientific publications. They are generally detected incidentally in patients presenting for treatment of other problems. Sufferers frequently do not present to health institutions for treatment, for reasons such as storm fear not being perceived as a disease, its being regarded as a personality trait, failure to report the development of symptoms, and their being able to continue with their lives by means of successful avoidance tactics (12,13). Westefeld (12) performed semi-structured interviews with 81 individuals in America reporting extreme fear of storms of hurricanes. Eighty-six percent of the participants reported anxiety concerning approaching storms, and that such anxiety was accompanied by countless other symptoms (such as constantly monitoring weather forecasts, security anxiety, and difficulty falling asleep). However, only 10% of that

sample reported seeking treatment for those symptoms. In addition, that study reported that affected by severe weather events through experience or media were probable factors causing of storm phobia. Two percent of the total populations of the USA and Canada are thought to experience fear of storms at least once in their lives (2). However, the prevalence of fear of storms in Türkiye is unknown since no studies have been performed on the subject. The only validated scale measuring fear of storms in the literature is the Storm Fear Questionnaire (SFQ). This self reported questionnaire consists of 15-item with five point Likert type response format and measures the severity of storm fear by investigating its behavioral and cognitive characteristics. Nelson et al. (14) concluded that the SFQ exhibits powerful psychometric properties and is reliable and valid in English. That study also reported a difference in scale scores between individuals reporting high and low fear following exposure to a virtual storm. There is no personal tool measuring fear of storms in Turkish. A clinical interview performed by a specialist within the scope of DSM-5 criteria is required for disease evaluation. The development of a measurement tool based on self-reports will facilitate diagnosis and provide an opportunity to treat such patients. It will also contribute to the objective determination of the prevalence of storm fear in society by providing resources for research into such fear in adults.

The purpose of this research is to determine the validity and reliability of the Turkish-language version of the SFQ.

MATERIAL AND METHODS
Design
This research was conducted in a metadological design. The requisite permissions for the SFQ adaptation study were obtained from its developer, Martin M. Anthony. This study was approved by Scientific Research Ethics Committee of Karadeniz Technical University (Decision Date: 13.07.2023, Number: 24237859-442). All participants were explained the details of the study prior to enrolment, and verbal consent was obtained.

Participants
The research was performed among adults in the Turkish provinces of Trabzon, Gümüşhane, and Erzincan. When calculating the sample size in validity and reliability studies, it is recommended to reach participants 10 times the number of items in the scale

(15). Since the SFQ consists of 15 items, we planned to include at least 270 individuals in the research, 15 for each variable, with a 20% margin of error. The research was eventually completed with 299 individuals. In the second part of the research, a repeat test containing the SFQ was administered to 80 of the participants taking part in the first stage. The research data were collected by the authors using the face-to-face survey method. The inclusion criteria were age 18 or over, and the absence of any condition that might hinder the establishment of communication, answering the questions in the survey, or taking part in the research.

Application Stages
The English to Turkish translation was done by two translators independent of the research team with a good knowledge of both languages. The translated scale was then evaluated by three public health specialists, each item being compared with the original version. The scale finally assumed its final form in the light of the suggestions received. A pre-test was applied with 10 individuals to assess the scale's comprehensibility and clarity. Following the pre-test, the scale was once again examined by the specialist group, and any requisite amendments were made. It was then translated back into English by a Turkish-English translator. The version translated back into English was then sent to the developer of the scale, Martin M. Anthony, and feedback was received. At the end of the final corrections, the scale was translated back into Turkish by an English-Turkish translator. This final version was applied to the individuals agreeing to take part. For the purpose to test the test-retest reliability of the scale, a retest was administered to 80 participants 14 days after the survey. The final version of the scale is presented in the Appendix.

Data Collection Tools
The first part of the data collection form employed in the first stage of the research and prepared by the authors investigated sociodemographic and personal characteristics. The second part contained the Eco-Anxiety Scale (EAS) and the Severity Measure for Specific Phobia (SMSP) in addition to the SFQ. The EAS, which measures the anxiety that individuals experience when thinking about climate change and other global climate conditions, was employed since storms are a climate change event, and the SMSP since storm phobia is included under the heading of

nature-environment type phobias, a specific phobia subtype. In the second stage of the research, only the SFQ was applied to participants due to be retested.
Storm Fear Questionnaire (SFQ); This 15-item self-report scale was developed by Nelson et al. (14) in 2014. Participants are asked to indicate how much each statement describes them on a five-point Likert-type scale (0 = not at all true and 4 = almost always true). The scale score is calculated by summing the scores obtained from all items in the scale. The score that can be obtained from the scale varies between 0 and 60, higher scores indicating greater storm fear. Nelson et al. (14) showed that the scale exhibited a one-dimensional factor structure, with a Cronbach α value of 0.95.
Eco-Anxiety Scale (EAS); This scale was developed by Hogg et al. (16) for the purpose of measuring anxiety in the light of experience of anxiety associated with environmental crisis and the severity thereof. The EAS consists of 13 items, four measuring emotional symptoms, three measuring rumination, three measuring behavioral symptoms, and three measuring personal effect anxiety. The participants were asked how frequently they experienced each eco-anxiety characteristics when reflecting on climate change and other environmental climate conditions (0 = never, 1 = sometimes, 2 = frequently, 3 = almost always). No items on the scale are reverse-scored, and higher scale scores indicate greater anxiety. The Turkish language validation and reliability study were done by Uzun et al. (17) in 2022. The scale structure preserved that of the original version. Reported Cronbach α values were 0.91 for the total scale, 0.83 for emotional symptoms, 0.86 for behavioral symptoms, and 0.84 for rumination and personal effect anxiety.
The Severity Measure for Specific Phobia (SMSP); This scale was developed for DSM-5 by the American Psychiatric Association (10) for measuring the severity of specific phobia in individuals aged 18 or over. It consists of 10 items. Each item asks the respondent to indicate the severity of specific phobia symptoms in the previous seven days using a five-point scale (0= Never; 1= Sometimes; 2= Half the week, 3= Most of the week, and 4= All the week). The scale score is calculated by adding the scores for the individual items. Possible scores range between 0 and 40. The internal consistency of the scale in Öztekin et al. (18) study was 0.79, with item-total score correlation coefficients ranging between 0.33

Table 1. The participants' sociodemographic characteristics of (n=299)

Characteristics		
	Mean ± SD	Median (Min – Max)
Age	37.7 ± 12.1	35 (18 – 70)
	Frequency (n)	Percentage (%)
Marital Status		
Single	85	28.4
Married	214	71.6
Education Status		
Primary school graduate	13	4.3
Secondary school graduate	9	3.0
High school graduate	67	22.4
University graduate	210	70.3
In Income-Generating Employment		
Yes	229	76.6
No	70	23.4
Presence of Chronic Disease Diagnosed		
Yes	78	26.1
No	221	73.9

and 0.78, showing that the Turkish-language version is also valid and reliable.

Statistical Analysis

IBM SPSS 23.0 software was used for statistical analyses. AMOS version 24.0 software was employed for confirmatory factor analysis. Descriptive statistics were presented as number and percentage for qualitative variables and as mean±standard deviation and median, minimum-maximum values for quantitative variables. Statistical alpha significance level was accepted as p <0.05.

Validity Studies

In order for a scale to be standardized and subsequently yield accurate information, it must possess two features known as 'validity' and 'reliability.' Validity refers to the degree to which a measurement tool is capable of accurately measuring the feature it is intended to measure, without confusing it with any other characteristic (19). Construct validity and convergent-divergent validity were analyzed in the present study.

Exploratory and confirmatory factor analysis was applied to assess the structural validity of the scale. Principal component analysis (PCA) was used to perform exploratory factor analysis (EFA). To determine whether the sampling adequacy for factor analysis Kaiser-Meyer-Olkin (KMO) test and Bartlett's Test of Sphericity (BTS) were used. Root Mean Square Error of Approximation (RMSEA), Root Mean

Square Residual (RMR), Chi-square ($\chi2$), degrees of freedom (df), comparative fit index (CFI), goodness of fit index (GFI), normed fit index (NFI) and Tucker-Lewis Index (TLI) were used to assess the model fit in confirmatory factor analysis.

The Turkish versions of the Eco-Anxiety and The Severity Measure for Specific Phobia were used to analyze the convergent-divergent validity of the Turkish-language version of the SFQ, and the relationship between the scales was determined using Spearman correlation analysis.

Reliability Studies

Reliability refers to the consistency with which a measurement tool measures the desired variable, or the degree to which the measurement results are free from error (19). In the present research, stability and internal consistency tests were used to determine the reliability of the SFQ.

Cronbach's alpha (α) reliability coefficient was employed to determine the internal consistency of the SFQ. Item-total correlations were evaluated. A cut-off value of 0.7 was employed when evaluating the Cronbach alpha test results (19).

Test-retest reliability was used to determine the stability of the scale. For test-retest reliability, the scale was re-applied to 80 individuals 14 days after the first test, and the Intraclass Correlation Coefficient (ICC) test was performed between the two applications.

RESULTS

The study was completed with 299 individuals with a mean age 37.7 ± 12.1 years (min=18; max=70). The sociodemographic and descriptive characteristics of the participants are shown in Table 1.

Scores from the SFQ ranged from 0 to 56, with a mean score of 13.3 ±11.4. A summary of correlations means and standard deviations of 14 items according to the first test is shown in Table 2. A moderate and significant correlation was observed between the responses given to 14 items.

As a result of the analysis, the KMO value was 0.954 and the p value was <0.001 in Bartlett's test. In line with these data, it was decided that the sample was suitable for factor analysis. (Chi-square value = 2887.13, df = 91).

Factor analysis revealed a structure consisting of a single factor with an eigenvalue exceeding 1, explaining 59.0 of the total variance.

The model fit of the scale was determined by evaluating chi- square, degrees of freedom and Root Mean Square Error of Approximation. In terms of goodness of fit indices, RMSEA value below 0.08 is considered a good fit indicator. In this research, the mean RMSEA value was found to be 0.077. An χ^2 / df ratio of 2.76 was determined (acceptable value <5). The Comparative Fit Index (CFI) value was 0.954, the Normed Fit Index (NFI) value was 0.930, and the Goodness of Fit Index (GFI) was 0.905 (Table 3).

In Table 4, the explanatory and confirmatory factor analysis results are shown. Factor loadings for the SFQ, which originally consisted of 15 items, ranged
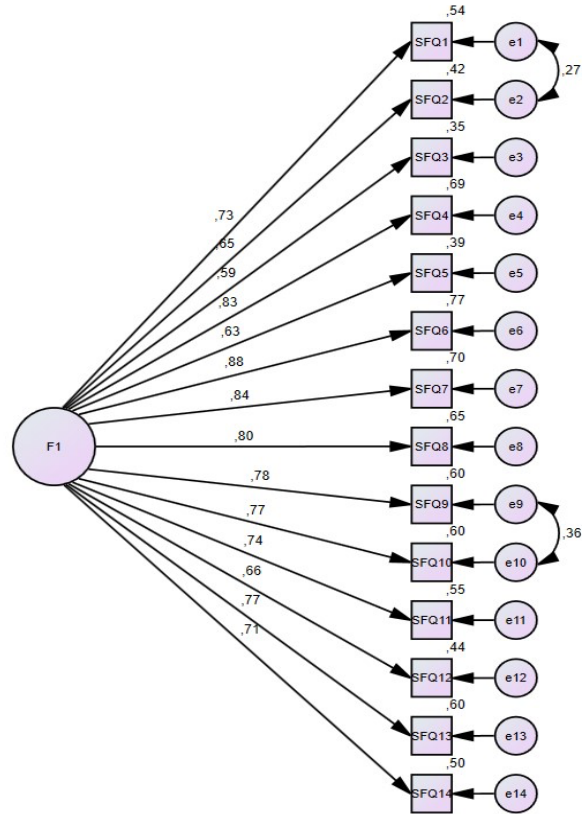

Figure 1. Standardized factor loadings in confirmatory factor analysis

Table 2. Correlations, means and standard deviations of 14 items according to the first test (n=299)

Items	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1														
2	0.615*													
3	0.406*	0.419*												
4	0.621*	0.580*	0.554*											
5	0.383*	0.475*	0.523*	0.565*										
6	0.682*	0.579*	0.519*	0.756*	0.529*									
7	0.610*	0.536*	0.474*	0.689*	0.537*	0.759*								
8	0.635*	0.520*	0.413*	0.657*	0.527*	0.687*	0.694*							
9	0.574*	0.497*	0.380*	0.616*	0.450*	0.689*	0.679*	0.650*						
10	0.550*	0.462*	0.416*	0.639*	0.420*	0.674*	0.652*	0.580*	0.742*					
11	0.549*	0.476*	0.450*	0.600*	0.491*	0.617*	0.537*	0.621*	0.594*	0.602*				
12	0.418*	0.388*	0.469*	0.536*	0.443*	0.567*	0.533*	0.526*	0.532*	0.546*	0.504*			
13	0.559*	0.447*	0.433*	0.626*	0.361*	0.697*	0.663*	0.599*	0.603*	0.687*	0.594*	0.507*		
14	0.491*	0.478*	0.446*	0.546*	0.493*	0.567*	0.587*	0.600*	0.534*	0.542*	0.639*	0.529*	0.564*	
M	0.95	1.07	1.25	0.82	1.50	0.73	0.62	0.98	0.78	0.70	1.20	0.82	0.58	1.30
SD	1.05	1.01	1.26	1.03	1.21	1.04	0.93	1.02	0.98	1.04	1.16	1.06	0.97	1.20

*p<0.001; M=mean; SD=standard deviation

Table 3. Fit index results of confirmatory factor analysis (22,23,27–31)

Sample			N>250		Calculated values
Number of observed variables		**I≤12**	**12<I<30**	**I≥30**	
χ2		Non-significant *P*-value	Significant *P*-value even if the fit is good	Significant *P*-value	<0.001
χ2/df			**χ²/ df<5**		2.76
RMR		<0.08	<0.08	<0.08	0.048
RMSEA		<0.08	<0.08	<0.08	0.077
GFI		>0.90	>0.90	>0.90	0.905
CFI		>0.95	>0.92	>0.90	0.954
NFI-TLI		>0.95	>0.90	>0.80	0.930-0.944

Table 4. The scale's exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) results

	EFA		CFA				
I	PCA	ML	SFL	SE	T values	R²	CA
1	0.758	0.741	0.734	0.044	11.446	0.504	0.940
2	0.692	0.658	0.650	0.050	11.721	0.597	0.941
3	0.631	0.588	0.594	0.086	11.860	0.436	0.944
4	0.841	0.830	0.833	0.030	10.760	0.547	0.937
5	0.661	0.620	0.626	0.075	11.798	0.596	0.942
6	0.875	0.877	0.879	0.024	10.024	0.604	0.936
7	0.841	0.836	0.838	0.024	10.701	0.645	0.937
8	0.817	0.801	0.803	0.033	11.045	0.702	0.938
9	0.803	0.792	0.777	0.034	11.199	0.773	0.938
10	0.799	0.786	0.772	0.039	11.230	0.391	0.938
11	0.772	0.740	0.739	0.053	11.438	0.694	0.939
12	0.694	0.659	0.661	0.054	11.714	0.353	0.941
13	0.783	0.773	0.772	0.034	11.263	0.423	0.939
14	0.745	0.708	0.710	0.062	11.559	0.539	0.940

I=Items, PCA= principal component analysis, ML= maximum likelihood, SFL=standardized factor loadings,
CA=Cronbach Alpha's if item deleted

Table 5. Correlations between the SFQ with EAS and SMSP

Scales (min-max values that can be obtained from the scales)		1	2	Mean±SD	Median	Min-Max
1.Storm Fear Questionnaire (0-56)	r	1		13.3 ± 11.4	11	0-56
	p					
2. Eco-Anxiety Scale (0-39)	r	0.568	1	8.0 ± 7.1	7	0-39
	p	<0.001				
3.The Severity Measure for Specific Phobia (0-28)	r	0.486	0.485	6.6 ± 6.3	6	0-28
	p	<0.001	<0.001			

between 0.594 and 0.879 (Figure 1). One item with a factor loading lower than 0.30 was removed from the scale. Factor loadings were divided by the corresponding standard errors and t values were calculated for each factor. All calculated T values were greater than 1.96 (basic distribution limit). According to the modification indices, a covariance structure was suggested between e1 and e2 and

between e9 and e10. The Cronbach alpha coefficient of the first test was 0.943, and 0.913 in the final test. In the retest the intraclass coefficient value was 0.800 (p<0.001), and in Spearman correlation analysis r=0.729 (p<0.001).
The correlation coefficients between the SFQ in this study and the Eco-Anxiety Scale and the Severity Measure for Specific Phobia are shown in Table 5. A correlation was found between the SFQ with Eco-Anxiety Scale (r=0.568, p<0.001) and the The Severity Measure for Specific Phobia (r=0.486, p<0.001).

DISCUSSION
The aim of this research was to establish the validity and reliability of the Turkish-language version of the SFQ. The factor structure, internal consistency, and convergent validity were therefore evaluated, and test-repeat test analysis was performed. There are no previous validity and reliability studies for the SFQ developed in English by Nelson et al. (14) in any other language. This discussion is therefore limited to the data from the present research.
In order for data to be appropriate for factor analysis, the KMO sampling adequacy must exceed 0.5, and the Bartlett sphericity test result must be significant. KMO values between 0.80-1.00 indicate that the sample is adequate. KMO values between 0.70-0.79 is considered moderate, between 0.60-0.69 is considered mediocre and below 0.50 is considered unacceptable (20). The KMO value in this research was 0.954, showing that the sampling was adequate. The Bartlett's test result was also statistically significant (p<0.001). These findings show that the data were suitable for factor analysis.
Construct validity was assessed using principal component analysis. Factor loadings in factor analysis must be at least 0.30 (21). The factor loading of the 15th item showed that this item was insufficient, and it was therefore decided to remove it from the scale. The 15th item contained the statement 'I use medications, alcohol, or drugs to help me cope during a storm.' The loading of this item may have been low because participants were reluctant to admit it since alcohol and drug use can result in stigmatization in Türkiye.
Exploratory factor analysis revealed a single-factor structure with an eigenvalue exceeding 1, explaining 59.0% of the total variance. Similarly to the original study, a one-dimensional factor structure was obtained (14). A moderate correlation was determined among the 14 items.

Using confirmatory factor analysis (maximum likelihood estimation), it was determined whether the SFQ could be validated in the Turkish sample. Fit indices evaluation revealed RMSEA= 0.077, X^2/df=2.76, CFI=0.954, NFI=0.930, and GFI=0.905. These results showed that the scale has adequate fit indices.
T value greater than 1.96 indicates significance at the 0.05 level and T value greater than 2.58 indicates significance at the 0.01 level (22,23). The value in this research was significant at the 0.05 level. This finding shows that the sample was sufficient for CFA and that no other item needed to be removed from the scale.
The reliability of the SFQ was assessed using internal consistency coefficient (Cronbach Alpha) and test-repeat test methods. The Cronbach alpha coefficient is used as a determinant of internal consistency, the closer the coefficient is to 1, the more consistent with one another the statements in the scale. Alpha coefficients of 0.00 ≤ α < 0.40 are considered as meaning that 'the scale is not reliable,' values of 0.40 ≤ α < 0.60 as meaning that 'the scale exhibits low reliability,' values of 0.60 ≤ α < 0.80 as meaning that 'the scale is quite reliable,' and values of 0.80 ≤ α < 1.00 as meaning that 'the scale is highly reliable' (24). This value needs to be at least 70 in studies evaluating psychological concepts (25). The Cronbach alpha coefficient in the present research was 0.943. This high value, similar to that of 0.95 obtained in the original study by Nelson et al. also indicated that the Turkish-language version of the form is highly reliable.
In order to evaluate the scale's test-repeat test reliability, the Turkish-language form obtained was re-applied to 80 individuals after 14 days, and a correlation coefficient of 0.800 (p<0.001) was determined between the two applications. At a 95% confidence interval, ICC reference values < 0.5, 0,50 to < 0.75, 0.75 to < 0.90, and > 0.90 are classified as weak, moderate, good, and perfect (26). This finding shows that the SFQ possesses good test-retest reliability and that the reliability obtained does not change over time.
The Eco-Anxiety and the Severity Measure for Specific Phobia scales were employed for similar scale validity. The SFQ was found to be moderately positively correlated with both scales.

CONCLUSION
In conclusion, in this study of the adaptation of the SFQ developed by Nelson et al. Into Turkish, the

validity and reliability findings supported those from the original study. In contrast to the original study, however, the 15th item was deleted, and a single factor structure consisting of 14 items emerged. We therefore think that the resulting 14-item scale can be used as a valid and reliable tool for evaluating storm fear in adults in Türkiye.

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