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Adaptation of the Coronavirus Anxiety Scale in Turkish for the Higher Education Context: A Validity and Reliability Study

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Abstract

Since the onset of the coronavirus pandemic, several studies in medical fields have been conducted; however, the impact of the disease on individuals' psychology has not been covered enough. The measures taken to prevent the spread of COVID-19 have brought various restrictions both in social life and in areas such as education, economy and health. Due to the pandemic and subsequent restrictions, students continuing to higher education are likely to experience some psychological problems such as anxiety and depression. Therefore, studies regarding the anxiety levels of students should be carried out. In line with this need, the aim of the study is to adapt the Coronavirus Anxiety Scale (CAS) into Turkish in the context of higher education. The sample consisted of 513 undergraduate and graduate students. The data collection tools were the CAS and the State-Trait Anxiety Inventory (STAI). The results of the confirmatory factor analysis (CFA) supported the factor structure of the original scale and yielded an excellent fit for all the indices. The original factor structure of the CAS was also confirmed, and the scores significantly correlated with gender, state-anxiety and health status of the participants. The scores obtained from the adapted scale were found highly reliable and valid. The increase in the spread of COVID-19, especially after the mutations of the virus have emerged, indicates that its psychological and behavioral consequences and effects might last longer. To this end, the study has valuable implications for higher education policy makers, university administrators and teaching staff.

Keywords: coronavirus anxiety, higher education, scale adaptation, the CAS, the STAI

Koronavirüs Kaygı Ölçeği'nin Yükseköğretim Bağlamında Türkçe'ye Uyarlanması: Geçerlik ve Güvenirlik Çalışması

Öz

Koronavirüs salgınının başlangıcından bu yana, tıp alanında çeşitli çalışmalar yapılmış; ancak, salgının insan psikolojisi üzerindeki etkilerine ilişkin yapılan çalışmaların sayısı nispeten sınırlı kalmıştır. COVID-19'un yayılmasını engellemeye yönelik alınan önlemler hem sosyal hayatta hem de eğitim, ekonomi ve sağlık gibi alanlarda çeşitli kısıtlamaları beraberinde getirmiştir. Salgın ve devamında getirilen kısıtlamalar nedeniyle, yükseköğretime devam eden öğrencilerin de diğer bireyler gibi kaygı ve depresyon gibi bazı psikolojik problemler yaşama olasılığı yüksektir. Dolayısıyla öğrencilerin kaygı düzeylerine ilişkin çalışmalar yapılmalı ve mevcut durumları belirlenmelidir. Bu ihtiyaca paralel olarak, çalışmanın amacı, Koronavirüs Kaygı Ölçeği'nin (KKÖ) yükseköğretim bağlamında Türkçeye uyarlanmasıdır. Araştırmanın örneklemi 513 lisans ve lisansüstü öğrenciden oluşmaktadır. Araştırmada, veriler KKÖ ve Durumluk-Sürekli Kaygı Ölçeği (DSKÖ) kullanılarak toplanmıştır. Doğrulayıcı faktör analizi sonuçları, orijinal ölçeğin faktör yapısını desteklemiş ve uyarlanan ölçekten elde edilen puanları geçerlik ve güvenirlik düzeylerinin yüksek olduğu bulunmuştur. Ayrıca, analiz sonuçları KKÖ'nün orijinal faktör yapısını doğrulamış ve puanların, katılımcıların cinsiyet, durumsal kaygı ve sağlık durumları ile anlamlı bir ilişkiye sahip olduğunu göstermiştir. Özellikle virüsün mutasyonları ortaya çıktıktan sonra COVID-19'un yayılmasındaki artış, psikolojik ve davranışsal sonuçlarının ve etkilerinin daha uzun sürebileceğini işaret etmektedir. Bu doğrultuda, uyarlanan ölçeğin yükseköğretim politika yapıcıları, üniversite yöneticileri ve öğretim personeli için faydalı olacağı vurgulanmaktadır.

Anahtar kelimeler: Koronavirüs kaygısı, yükseköğretim, ölçek uyarlama, KKÖ, DSKÖ

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1 | Introduction

The coronavirus disease 2019, or widely known as COVID-19, is an infectious disease that appeared first in Wuhan, China, in late December 2019 and rapidly spread across the world. Due to the serious increase in the number of cases and causalities observed throughout the world, the World Health Organization (WHO) declared COVID-19 as a pandemic on 11 March 2020. WHO has stated that there are no preventive or curative medicines for COVID-19, but "ongoing clinical trials of both western and traditional medicines" (World Health Organization, 2020, May 4). According to the Strategic Preparedness and Response Plan published by WHO in April 2020, clinical case fatality is roughly "over 3%, increasing with age and rising to approximately 15% or higher in patients over 80 years of age" and "underlying health conditions that affect the cardiovascular, respiratory and immune systems confer an increased risk of severe illness and death" (World Health Organization, 2020, p. 3). To this end, most governments have taken precautionary measures against COVID-19 in order to minimize the social and economic damages of this pandemic.

Measures to prevent the spread of COVID-19 have resulted in drastic changes in educational, social, economic and sanitary practices. The initial stage started with uncertainties, during which the governments could not take drastic measures about their education systems. After the initial shock wave, decisions about the courses, exams, school days, curricula started to be taken, each time with a clearer understanding of the situation. Governments around the world ordered institutions at all levels to cease face-to-face educational activities and to use online methods for teaching (Daniel, 2020). Most of the institutions had little or no time to get prepared for such a system.

Apart from the serious threats the COVID-19 pandemic posed to individuals' physical health, it has provoked a range of psychological issues such as fear, anxiety and depression (Huang & Zhao, 2020; Qiu et al., 2020). Individuals have often been exposed to information surge regarding the pandemic about the dramatic increase in the number of cases and death rates, as well as ways to protect themselves and prevent the spread of disease (Šrol et al., 2020). Indeed, the studies conducted so far reported that people at all levels (individual, social and international) have been subject to a wide range of psychological impacts (Wang et al., 2020). Previous studies on endemics such as SARS and MERS also revealed that people were prone to psychological problems during emergency states (Chang et al., 2004; Lee et al., 2018; Lu et al., 2006; McAlonan et al., 2007). To this end, we argue that the COVID-19 pandemic, affecting nearly all the countries around the world, has had psychological consequences, one of which is the increase in the level of anxiety.

During the pandemic, it is of vital importance to take precautions regarding the individuals' mental state. Anxiety, one of the most basic and universal emotions, is "an emotion characterized by feelings of tension, worried thoughts and physical changes like increased blood pressure" (American Psychological Association, n.d.). The concept is also described as a state of arousal against a non-objective danger, manifested by bodily, emotional and mental changes, and is also summarized as anxiety or anxious expectations about the future (Lewis & Aiken, 1976). Spielberger (1996) suggested that anxiety is a multidimensional construct and can be explained in two dimensions: state and trait anxiety. State anxiety occurs when a person makes a mental assessment of some types of threats in line with their own perceptions (Spielberger, 1983). State anxiety increases when stressful life events are intense, and it decreases when stressors disappear (Endler & Kocovski, 2001). Trait anxiety, on the other hand, is a relatively permanent individual difference and a permanent personality trait in anxiety tendency and the possibility of future anxiety (Spielberger, 1972). COVID-19 anxiety can be also regarded as a state anxiety, since it is based on a specific stressful event.

The relationship between COVID-19 and some other psychological constructs have been studied in several countries since the start of the pandemic (Duan & Zhu, 2020; Greenberg et al., 2020; Holmes et al., 2020; Tan et al., 2020; Zandifar & Badrfam, 2020). Since the first case due to COVID-19 occurred on 11 March 2020 in Turkey, several studies have been conducted (Aktoz et al., 2020; Erdeve et al., 2020;

Günertem et al., 2020; Yavuz & Ünal, 2020). For instance, fear of COVID-19 was examined by a seven-item scale which was also adapted into Turkish by Haktanir et al. (2020) and Satici et al. (2020). There are still few studies investigating COVID-19 in terms of its psychological effects (e.g., Akdeniz et al., 2020; Bostan et al., 2020; Çetin et al., 2020; Özdin & Bayrak Özdin, 2020; Tutku et al., 2020). In order to offer a reliable and valid scale to measure the psychological effects of COVID-19 on the public in the Turkish context, we aimed at adapting the Coronavirus Anxiety Scale (CAS) developed by Lee (2020).

At parallel time frames, the CAS was adapted into Turkish through two other studies which focused on the general Turkish population (Biçer et al., 2020; Evren et al., 2020). Moreover, the tools used for convergent validity and the expressions used in the translated scales vary among these studies. These differences might add further evidence regarding the proof to the scale scores' validity and contribute to the explanation of the psychological construct that is assessed.

Present Study

In the process of the pandemic, the dramatic changes occurred in the lives of both teachers and students, and psychological effects took a back seat. Thus, people have been likely to avoid recognizing the psychological effects of the pandemic. The teachers have been struggling to adapt to a new way of teaching with technologies, while students, along with getting used to online learning, have been trying to understand and decide "what will happen next?". All students have been dragged away from their social lives overnight and some other students have been on the verge of starting a career or making career choices. Most of them, including the ones at higher education institutions, worry about the long-term disadvantages of COVID-19 and feel confused about their future. Previous research revealed that health-related emergencies could have many psychological effects that can be expressed as anxiety and fear on university students (Mei et al., 2011). To this end, we can assert that the concerns and fears about the negative effects of the illness on academic deeds might influence the mental health of students (Immediate Psychological Responses.), and the search for a "normal" could be a cause of such psychological problems as depression and anxiety. The present study aims to adapt the CAS into Turkish to be used in higher education settings. Therefore, the scale can be used for the assessment of dysfunctional anxiety of the university students caused by the COVID-19 pandemic.

2 | Method

Participants

In this study, online survey data from 513 undergraduate and graduate students were collected in the Fall semester of the 2020-2021 academic year. The undergraduate participants were enrolled at a faculty of education, and the graduate participants were studying at the department of educational sciences at a state university in Turkey. In order to obtain similar participants with the original scale development group, the participants were selected from the group of people who had spent at least one hour during the past three weeks thinking about or watching media about COVID-19. The ones who had not spent enough time thinking or getting information about the coronavirus excluded from the data set (n=11). Convenient sampling was utilized, and the study group was composed of 70.3% women and 29.7% men aged between 18 and 54 ($\underline{\bar{x}}$=23.82).

The sample was randomly divided into two groups as Sample 1 and Sample 2 for the analysis. The data of Sample 1 (n= 249) was used to perform the confirmatory factor analysis (CFA). The data obtained from the Sample 2 (n=253) was used for correlational analysis providing evidence for validity and variance analyses.

The participants from different cities were included in the study group to gain maximum possible representation. Most of the participants live in big cities where the population is more than 750.000 (n= 199, 39.6 %), followed by cities (n= 141, 28.1%), provinces (n= 95, 18.9%), villages (n= 58, 11.6%) and towns (n=9, 1.8%). The majority of the participants stated that their health conditions were 'good' (n=292,

58.2%) and very good' (n=184, 36.7%), while 4.6 % (n= 23) of the participants reported that their health was at a moderate level, 0.6% (n=3) reported health problems.

Instruments and Adaptation Procedure

An adapted Turkish version of the Coronavirus Anxiety Scale (CAS) and the State-Trait Anxiety Inventory (STAI) were used for data collection. The data were gathered online via Google forms. In order to collect data, a few measures were conducted. The first measure was background information form. In this form, participants were asked to report their gender, age, current residency, health status and whether they spent at least one hour during the past three weeks thinking about or watching media about the coronavirus.

State-Trait Anxiety Inventory: Spielberger (1983) developed the STAI in order to further investigate state and trait anxiety. It is a self-report scale and consists of two scales, and each scale includes 20 items. In this study, the Turkish version of the STAI adapted by Öner and LeCompte (1983) was used to get evidence for validity proof for the adapted anxiety scale. In many studies, the psychometric qualities of the STAI have been investigated and the studies have shown that the scale has excellent internal consistency and average Cronbach alpha value as 0.89. Also, STAI-Trait has evidenced perfect test-retest reliability with average Cronbach alpha value estimated as 0.88 (Barnes, Harp and Jung, 2002). Despite the general consistency of the STAI, the STAI-State version has been reported as having lower temporal stability due to the nature of the measured construct. Furthermore, there is much evidence that shows the STAI has convergent and discriminant validity (Spielberger, 1983). In this study, the STAI was used to get a validity proof for the adapted anxiety scale. In other words, the STAI and the CAS were developed to measure anxiety and the STAI was preferred here in order to investigate the validity of the adaptive scale due to its high psychometric qualities.

Coronavirus Anxiety Scale: The original scale was developed by Lee (2020). The scale included 20 items, and the researcher composed an item pool by considering the psychology of fear and anxiety literature. All of the items were written as manifestations of this type of anxiety. The dimensions of coronavirus anxiety were determined as follows; cognitive, behavioral, emotional and psychological. The final form of the CAS included five items that were written in a 5-point Likert format reflecting the frequencies of symptoms, ranging from 0 (*not at all*) to 4 (*nearly every day*) over the preceding two weeks. The scaling type was developed in line with the American Psychiatric Association's system of measuring psychiatric symptoms over time and response treatment. In the development study, it was found that the CAS discriminates well between persons with and without dysfunctional anxiety using an optimized cut score of 9 (90% sensitivity and 85% specificity). These results support the CAS as an efficient and valid tool for clinical research and practice (Lee, 2020).

The adaptation process was designed in accordance with the related literature (Hambleton & Patsula, 1999). First, the existing scales about COVID-19 were investigated with regard to their psychometric qualities and convenience for the context of the current study before starting the adaptation process. The CAS was chosen for the present study as it was an easily applicable, time-efficient and effective tool with its high psychometric qualities. In addition, the CAS has been adapted into different languages such as Bangla and Polish, which proved that the scale could be used in different cultures as well (Ahmed et al., 2020; Skalski et al., 2021). In the second step of the adaptation process, official permission from the scale developer was obtained through an email. After this, to ensure language validity, the translation and back-translation method was utilized with well-qualified academics who had a high level of proficiency in English language. The initial translated version was asked to be reviewed by two experts in Turkish language and psychology. After the revisions were completed upon expert views, the Turkish form of the scale was sent for back-translation. The original scale and the translated one were compared, and the final version for the pilot study was developed. In the third step, content and face validity of the scale was investigated by calculating Lawshe's Content Validity Index (Lawshe, 1975) and statements in the scale were analyzed

whether they could actually measure the proposed latent structure. Also, for face validity, expert views were taken into account, and expert judgment was analyzed based on Miles and Huberman inter-coder reliability. The inter-coder reliability of the two experts was calculated as 0.86, and it was concluded that the experts were consistent with the translation of the statements into Turkish (Miles & Huberman, 1994).

In the fourth step, a pilot study was conducted with a small group consisting of 72 adults to perform some basic statistics. In the light of the feedback and analysis, the final form of the scale for the study (Appendix I) was produced and administered to the target group. Then, the CFA was utilized in order to get evidence proof for the construct validity of the scale scores. In the sixth step of the adaptation process, psychometric qualities, item characteristics and reliability of the scale scores were calculated for data accuracy.

Data Analysis

Descriptive statistics were calculated at the scale and item level. In addition, the CFA was conducted to investigate the factorial structure of the scale. In the CFA, the Maximum Likelihood Estimation (MLE) was used since the normality assumption of the total score was met. We also reported several goodness of fit statistics. The Relative Chi-Square Test, Root Mean Square Error of Approximation (RMSEA), Root Mean Square Residual (RMR), Normed Fit Index (NFI), Non-Normed Fit Index (NNFI), Relative Fit Index (CFI), Relative Fit Index (RFI), Goodness of Fit Index (GFI) and Adjusted Goodness of Fit Index (AGFI) were used. For the relative chi-square test, X2/df ratio, several lower bound values were proposed in the literature, and the values below 3 indicate the perfect fit; the ones between 3 and 5 indicate the moderate fit (Kline, 2015). According to Brown (2015)'s suggestions, the values ≤ 0.08 are considered good for RMSEA, RMR and SRMR (Standardized Root Mean Square Residual). For the fit indices such as NFI, NNFI, CFI, IFI (Incremental Fit Index), RFI, GFI, AGFI, the recommended thresholds for acceptable values are above 0.90 (Brown, 2015).

The dimensionality of the CAS was investigated in terms of Mokken Scale Analysis (MSA) included in Nonparametric Item Response Theory (Mokken, 2011). In particular, the dimensionality of the scale is analyzed with the Automated Item Selection Procedure (AISP) in MSA. The AISP uses the coefficient of homogeneities (H_{ij} index) to assess the dimensionality of the data. In this study, for H_i and H values, the lower bound was accepted as .3, and for H_{ij} indexes, non-negativity was taken as a criterion (Sijtsma & Molenaar, 2002). The MSA analyses were performed on the R 4.0 program with the "*mokken*" package.

In order to get evidence regarding the criterion validity of the scores obtained from the adapted scale, the total scores of the CAS and the STAI were compared through Pearson Correlation Coefficients. Finally, in order to investigate the reliability of the measures, several statistics were performed. In social sciences, Cronbach's alpha coefficient is generally preferred to investigate the reliability of the scales, but in the current research, McDonald's omega coefficient, which is a more robust index, was also estimated due to the theory-based scale (Dunn et al., 2014; McDonald, 2013; Peters, 2014). Hence, Cronbach's alpha, McDonald's Omega and Grate Lower Bound (GLB) coefficients were estimated. Item analyses, correlations and reliability investigations were carried out by SPSS 22.0 and JASP, while the CFA was performed via Lisrel 8.1.

Research ethics

The present study received ethical approval from the research ethics board of a public university in Turkey (2020-3/18). Before starting the survey, the participants were informed through a consent form which involved the confidentiality of given responses, the objectives and aim of the study, risks and so on. The participants included in the study signed informed consent statements by choosing "I agree to participate". Anonymity and data confidentiality was guaranteed by the researchers.

3 | Findings

Preliminary analysis

Before conducting the CFA, the data were reviewed regarding the assumptions of the analyses. Extreme values, normality of the variables, multicollinearity and singularity were investigated, and it was found that the data did not have issues pertaining to these assumptions. For missing values, the Missing Completely at Random (MCAR) test was performed, and the results yielded a non-significant chi-square value which suggested that missing values occurred randomly. Only three answer patterns were detected as having missing values; hence these patterns were excluded from the data set.

Confirmatory Factor Analysis

The CFA was carried out on Sample 1 (n= 249) to test whether or not the original unidimensional structure of the scale was confirmed in the adapted scale. The results supported the one-dimensional factor structure of the original scale. It was found that the one-dimensional structure of the original CAS was preserved in the Turkish form. The single factor model yielded an excellent fit for all indices. The following results were obtained for the Turkish version of CAS; [$X^2(5)=5.64$, p=.34; X^2/df= 1.128; RMSEA=.026 (.00, .045; 90% CI); CFI=1.00; RFI=.98; NFI=.99; NNFI=1.00; GFI=.99; AGFI=.97; SRMR=.021].

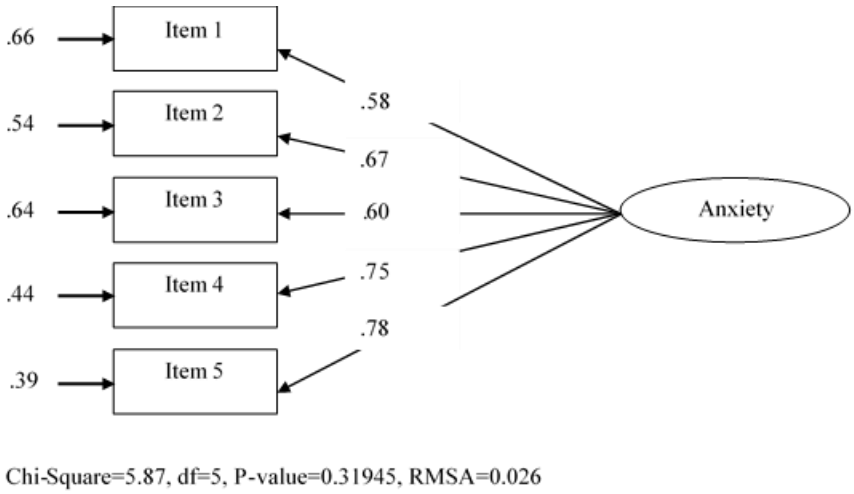

Figure 1. *Single Factor CFA Model*

The factorial structure proposed by the CFA and the standardized coefficients are presented in Figure 1. The standardized coefficients were estimated as ranging from .58 to .78, higher than the critical value .40, and all of these coefficients were found significant at the .01 level. Hence it can be concluded that these items were significant indicators of the latent variable, anxiety. In addition to standardized coefficients, the whole model was found significant in the assessment of Coronavirus anxiety (p<.05).

The CFA was repeated for different gender groups in order to examine if the Turkish version of the CAS measured the same way across the gender. The results demonstrated that in the assessment of the coronavirus anxiety construct, there was no significant difference across gender. Excellent model-data fit indices were estimated for both genders [$X^2(10)=13.55$, p=.52; X^2/df= 1.135; RMSEA=.031 (.00, .038; 90% CI); CFI=.99; RFI=.96; NFI=.98; NNFI=.99; GFI=.97; AGFI=.95; SRMR=.025]. In addition, the X^2 differences were not found significant, and this indicated that there was not any significant model change between the genders. These findings demonstrated that the Turkish version of the CAS was valid for adults and both genders

The Results of the AISP

The AISP was performed in order to investigate the factor structure of the CAS. The first finding of the analysis was that all of the *Hij* indexes were estimated positive; hence the estimation of item and scale level coefficients were conducted, and the results of the analyses are given in Table 1.

Table 1. The Scalability Coefficients and AISP Results

	Hi	Se	AISP
Item 1	0.47	0.05	1
Item 2	0.55	0.05	1
Item 3	0.53	0.06	1
Item 4	0.57	0.05	1
Item 5	0.63	0.04	1
H value	0.55	0.04	

The H_i values were found higher than the lower bound value c=.3. The values between 0.3 and 0.4 indicate weak scaling, .4< H_i <.5 indicate moderate scaling, and the ones higher than 0.5 indicate the high power of scaling (Mokken, 2011). When the H_i *and H* values were examined, according to these boundaries, it can be concluded that three items had a high level of scalability, one item had a moderate level of scalability and item 5 had perfect scalability. Also, the standard errors of the coefficients were low which indicates high reliability. Based on the high H_i values, the H value was found as 0.55, which shows the high power of scaling and unidimensionality. In the third column of Table 1, the results obtained from the AISP are presented, and the value 1 one indicates that these items were grouped in the same dimension. When the results were analyzed, it can be seen that all items were clustered under one dimension, which revealed that scale items compose a unidimensional scale. In summary, considering the results provided by the AISP, the adapted version of the CAS had a strong unidimensional feature, which had also been confirmed by the CFA. The results of the AISP provided another evidence proof for the construct validity of the CAS scores.

Analysis of variance and correlation analyses

The descriptive statistics regarding the total scores of the CAS and the STAI were calculated and these statistics are presented in Table 2

Table 2. Descriptive Statistics of the CAS and the STAI

	N	Min.	Max.	Mean	Mode	Median	Sd	Skewness	(se)	Kurtosis	(se)
CAS	253	.00	13.00	2.16	.00	1.00	2.46	1.592	.153	3.238	.305
STAI-State	253	20	76.00	41.04	38	40	8.93	.825	.153	1.458	.305
STAI-Trait	253	24	67.00	44.96	45	44	7.01	.610	.153	.612	.305

The results showed that the participants' coronavirus anxiety level was at a very low level. The distributions of the CAS and the STAI-State total scores did not fit the normal distribution. In order to decide the distribution features of the total scores accurately, normality tests (Kolmogorov-Smirnov) were performed, and the results confirmed that none of the total scores were normally distributed.

After the estimation of the descriptive statistics, the differences in the CAS scores of the participants according to the health status, gender, age and place of residence were analyzed. Due to the non-normal distribution of the total scores, Mann-Whitney U test was performed. The results indicated that the CAS scores of the female participants were significantly higher than the males' scores. The mean rank was estimated as 272.62 for the women and 201.46 for the men (p=.00).

As for the investigations of age groups about the CAS scores, the participants were grouped into three categories (18-25, 26-40 and above 40). The results revealed that there were no significant differences in

the CAS scores based on age and among the age groups. Hence it can be concluded that the age variable did not make any difference in the level of coronavirus-related anxiety.

In order to find out the influence of the participants' health status on the CAS scores, the independent samples of Kruskal Wallis test were used. When the findings were analyzed, it was found that there were significant differences between the group that stated their health status as very good and the ones whose health status was good or moderate. The results of this analysis were given in Table 3.

Table 3. The Results of Kruskal-Wallis Test

Health Status Sample 1 - Sample 2	Test Statistic	Std. Error	Std. Test. Statistic	Adj. Sig.
Very good - Bad	38.69	82.51	.47	1.00
Very good - Good	51.75	13.34	3.87	.001**
Very good - Moderate	95.13	31.35	3.03	.014**
Bad - Good	-13.06	82.27	-.16	1.00
Bad - Moderate	-52.46	87.02	-.65	1.00
Good -Moderate	43.37	30.70	1.41	.95

In Table 3, it can be seen that the CAS scores of the participants varied among the groups, but these differences were found significant in the two groups only. The participants reporting that their health status was very good had lower levels of Coronavirus anxiety than the ones who stated that their health status was good or moderate. These findings were also confirmed with the mean scores of the groups. The means of the health group status groups are given in Table 4.

Table 4. The Mean Scores of Health Status Groups

Groups	N	Mean
Bad	1	2.00
Moderate	13	4.08
Good	147	2.66
Very good	88	1.70
Total	249	2.38

The results in Table 5 show the differences in the CAS scores among the groups. The ones who stated that their health status was very good had lower levels of Coronavirus anxiety than other groups. However, the number of the participants within the groups was not equal; hence interpretation of the total scores may be misleading. Based on the significant differences, it can be claimed that the participants with very good health had lower levels of Coronavirus anxiety than the other groups.

Another demographic variable was the place of residence, which was investigated through the Independent Samples Kruskal-Wallis Test. The results showed that the anxiety levels did not differ significantly with regard to the place of residence.

Correlation analyses were conducted in order to get the validity evidence for proof for the CAS scores and to examine the relationship between CAS scores and the anxiety levels of the participants and its relationship with people's anxiety. The results yielded that the total scores of the Turkish version of CAS were correlated with the total scores of the STAI. In addition to the STAI, the CAS and age, place of residence and health status differences were investigated in Sample 2 (n=253). The results were given in Table 5.

Table 5. Correlations between the STAI scores and the CAS

		CAS	STAI-State	STAI-Trait
Spearman's rho	CAS	1.000		
	STAI-State	.411**	1.000	
	STAI-Trait	.292**	.408**	1.000

In Table 5, the estimated Spearman's Rho coefficients are presented, and all of the correlation coefficients were found significant. The correlation coefficient between the CAS and the STAI-State scores indicated a moderate correlation (r=.411, p<.01). On the other hand, the correlation between the STAI-Trait and CAS was calculated as .292 indicating a low correlation.

Reliability

The reliability of the adapted scale was investigated through Cronbach Alpha, McDonald's Omega and GLB coefficients. The estimated coefficients are given in Table 6.

Table 6. Reliability coefficients

Reliability Coefficients	McDonald's ω	Cronbach's α	GLB
Scale	0.82	0.81	0.85

The coefficients given in Table 6 indicate the internal consistency level of the adapted version of CAS. The Cronbach Alpha coefficient of the scale was estimated as 0.81, which is higher than the cut-off value, 0.70 (Crocker and Algina, 1986). The Omega coefficient was found similar to the Cronbach Alpha value, which indicates the more realistic boundary of the Cronbach alpha. The GLB was found higher than the other, and all of the coefficients demonstrated that the scale had a high level of internal consistency.

In order to analyze the relationships among the items, item statistics were also calculated, and the findings are given in Table 7.

Table 7. Item-total statistics

Items	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
1	5.29	.506	.802
2	4.62	.623	.769
3	5.18	.601	.775
4	4.62	.650	.759
5	5.18	.633	.767

Item-total statistics and items' contribution levels to the internal consistency of the scale are given in Table 8. When the item-total correlations were analyzed, all of the coefficients were found positive and higher than 0.506. The lower-bound commonly accepted for correlation coefficients is 0.42, and the items having higher correlation with the total score than the lower bound are classified as highly discriminative (Crocker & Algina, 1986). Hence, the results obtained for the CAS items showed that all of the items were very good at measuring the latent trait. Also, it can be concluded from the Cronbach alpha if item deleted values that all of the items contributed to the internal consistency of the scale positively. The findings supported that the scale items measure the same latent trait, Coronavirus anxiety, and all of the items were highly correlated with the total score.

4 | Discussion

The CAS can be used by healthcare professionals and researchers easily to identify possible cases of anxiety associated with coronavirus. In this study, we aimed to adapt and validate this useful scale to be utilized by higher education institutions in order to screen coronavirus-related anxiety among their students.

The CAS uses five items to reveal a unidimensional factor of COVID-19 related anxiety and demonstrates good internal reliability and moderate to high inter-item correlations, which shows that each item measures a meaningfully distinctive aspect of anxiety. In order to examine the convergent validity of the CAS, the STAI was used, and the results indicated low and moderate correlations. This is an expected

finding because the coronavirus is a current phenomenon, and the STAI-State measures the anxiety of the state rather than the general anxiety level of individuals.

The construct validity of the CAS was analyzed through CFA, and a single factor structure of the scale with 5 items was confirmed with perfect model fit indices in the adapted version of the scale. High scores obtained from the scale mean that the individual has high level of anxiety. The proposed model was also confirmed based on gender variable since there was no significant difference across gender. These findings demonstrated that the Turkish version of the CAS was valid for university students and both genders as it is found in the original study.

The analysis regarding the internal consistency supported that the scale items measure the same latent trait, Coronavirus anxiety, and all of the items were highly correlated with the total score. When compared to the original study, the reliability coefficients were found relatively low, which might be related to the homogeneity of the sample in the current study.

The results also showed that the participants' coronavirus anxiety level was at a very low level. This may be because the coronavirus is less fatal to the young population. However, in the studies conducted with a more heterogeneous sample in a variety of countries where the transmission and mortality rates are much higher, including the USA, where the scale was developed (Lee, 2020), the participants were found to have a high level of COVID-19 related anxiety (Huang & Zhao, 2020; Qiu et al., 2020; Roy et al., 2020; Shevlin et al., 2020; Wang et al., 2020). The reason for this might be that in Turkey, when compared to other countries affected by the pandemic, its transmission and death rates have remained lower because of the measures taken since the first case diagnosed on 11 March 2020.

The results indicated that the CAS and the STAI-Trait scores of the women participants were significantly higher than the men's. Other studies investigating general anxiety in the past (Guo et al., 2016; Sareen et al., 2013) or COVID-19 related anxiety also revealed similar findings (Gao et al., 2020; Qiu et al., 2020; Shevlin et al., 2020; Wang et al., 2020). In line with this finding, we can say that anxiety and COVID-19 related anxiety do not differ with regard to gender variables among cultures.

When the CAS and the STAI scores based on the age and among the age groups were analyzed, the results demonstrated that there were no significant differences. Along with Lee (2020) in the development process of the CAS, some other researchers studying anxiety based on STAI results also found that age is not a significant factor in the determination of anxiety level (Ahorsu et al., 2020; Andreoletti et al., 2006; Brenes, 2006; Fuentes & Cox, 2000). Especially in the pandemic process, the fact that young adults have had anxiety as much as the older ones may not have caused a significant difference in terms of anxiety level. Due to being a newly introduced issue, the number of research studies on this subject is very rare; therefore, additional research in this area is required.

Another finding of the study to be discussed was the significant difference among the participants between the CAS scores and health status groups. As confirmed by other studies on anxiety in general and coronavirus related anxiety (Potvin et al., 2011; Wang et al., 2020), the participants reporting that their subjective health status was very good had a lower level of coronavirus related anxiety than the ones who stated that their subjective health status was good or moderate.

Finally, the results showed that the anxiety levels did not differ significantly with regard to the participants' place of residence. These results differ from some published studies which pointed out that the level of anxiety could be associated with place of residence. For example, Cao et al. (2020) found that living in urban areas, in contrast to rural areas, could result in lower levels of anxiety among college students. The authors described this result by highlighting possible differences between urban and rural areas in terms of economic, cultural and educational resources. We believe that further studies focusing on this kind of variable should be carried out to make more conclusive comments.

5 | Conclusion

In conclusion, the Turkish version of the CAS presented in this study has high internal consistency, as well as convergent and construct validity. The results suggest that the CAS is a reliable and valid scale measuring coronavirus-related anxiety. The findings also supported that the level of COVID-19 anxiety measured by the CAS is not affected by language and culture. In order to generalize the findings, further studies with other translations and samples can be carried out.

The study has essential implications for higher education policymakers, university administrators and teaching staff. The increase in the spread of COVID-19, especially after the mutations of the virus have emerged, indicates that its psychological and behavioral consequences and effects might last longer. Both policymakers and university boards should regularly screen students' level of anxiety caused by COVID-19 to minimize the risks related to the psychological results of the pandemic in educational settings. For instance, Columbia University (USA) requires a similar self-check to be completed by all students and staff members before they visit the university facilities. The CAS also offers an invaluable and effective tool for such purposes.

The study has a few limitations with regard to sampling, data collection and data analysis. The first one is the non-normal distribution; despite the large sample size, the participants in this study were mostly female young adults aged between 18-25. The second limitation is the sampling method. We can say that the sampling was not a true probability, which could be normal considering the current situation, and only the individuals with internet access could participate. Further studies with a balanced distribution in terms of gender, education level and age would yield more representative results for the target population. The third one is the data collection method which was limited to self-report tools since qualitative data collection methods such as interviews or observation were prohibited during the pandemic. The last limitation of the study is related to the analyses. All the analyses were based solely on a cross-sectional design which hindered causal inferences.

Statements of publication ethics

We hereby declare that the study has not unethical issues and that research and publication ethics have been observed carefully.

Researchers' contribution rate

The study was conducted and reported with equal collaboration of the researchers.

Conflict of interest

There is no conflict of interest to disclose.

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Appendix I. Turkish Version of the CAS

Son 2 hafta boyunca aşağıdaki durumları ne sıklıkta yaşadınız?		Hiçbir zaman	Nadiren, 1-2 günden az	Birçok gün	7 günden fazla	Neredeyse her gün
1	Koronavirüs ile ilgili haberleri okuduğumda ya da dinlediğimde, başım döndü, kendimi sersemlemiş veya halsiz hissettim.	0	1	2	3	4
2	Koronavirüs hakkında düşündüğüm için uykuya dalmakta veya deliksiz uyumakta sorun yaşadım.	0	1	2	3	4
3	Koronavirüs hakkında düşündüğümde ya da bu virüsle ilgili bir bilgiyle karşılaştığımda donakalmış ya da felç geçirmiş gibi hissettim.	0	1	2	3	4
4	Koronavirüs hakkında düşündüğümde ya da bu virüsle ilgili bir bilgiyle karşılaştığımda iştahım kesildi.	0	1	2	3	4
5	Koronavirüs hakkında düşündüğümde ya da bu virüsle ilgili bir bilgiyle karşılaştığımda midem bulandı veya mide problemleri yaşadım.	0	1	2	3	4
	Sütunların toplamı:					