DOI: 10.4274/npa.5344

Turkish Version of the Depression Anxiety Stress Scale (DASS- 42): Psychometric Properties

Depresyon Anksiyete Stres Ölçeğinin (DASS-42) Türkçeye Uyarlanmış Şeklinin Psikometrik Özellikleri

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ABSTRACT

Objective: This study explores the reliability, the construct and convergent validity of the Turkish version of the DASS-42.

Methods: The Turkish-language version of the DASS-42 was administered to a non-clinical sample, broadly representative of a university student population (N=1102) in terms of demographic variables. Competing models of the latent structure of the DASS were derived from theoretical and empirical sources and evaluated using confirmatory factor analysis. The convergent validity of the scale was examined by correlating it with the previously validated and frequently used Turkish version of the Hospital Anxiety and Depression Scale.

Results: The best fitting model of the latent structure of the DASS consisted of three correlated factors corresponding to the depression, anxiety, and stress scales. The reliability of the DASS was excellent and the measure possessed adequate convergent validity.

Conclusion: The Turkish version of the DASS-42 is a reliable and valid measure of the constructs it was intended to assess. This measure was found useful for evaluating depression, anxiety, and stress in non-clinical population. Further studies are needed to study the utility of this measure in psychiatric patients. *(Archives of Neuropsychiatry 2010; 47: 118-26)*

Key words: Depression, anxiety, stress, DASS-42, normative data, validation, reliability analysis

ÖZET

Amaç: Bu çalışmanın amacı DASS-42 ölçeğinin Türkçeye uyarlanmış şeklinin geçerlilik, güvenilirliğini sınamaktır.

Yöntemler: DASS-42 ölçeğinin Türkçe uyarlaması demografik özellikleri ile üniversite öğrencilerini temsil eden ve 1102 kişiden oluşan, klinik olmayan bir örneğe uygulanmıştır. DASS-42 ölçeğinin yapısal özellikleri ile ilgili modeller kuramsal ve ampirik bilgilerden yararlanılarak oluşturulmuş ve doğrulayıcı faktör analizi (CFA) ile değerlendirilmiştir. Ölçeğin yapısal geçerliliği daha önce Türkçeye uyarlanmış, geçerliliği ve güvenilirliği belirlenmiş olan ve sık kullanılan Hastane Anksiyete Depresyon Ölçeği (HAD) ile sınanmıştır.

Bulgular: DASS-42 ölçeği Türkçe uyarlamasının yapısal geçerliliğinin değerlendirilmesinde birbirleriyle ilişkili depresyon, anksiyete ve stres faktörleri elde edilmiş ve ölçeğin güvenilirliği yüksek olarak bulunmuştur. Yapısal geçerlilik bakımından da uyumlu olduğu gözlenmiştir.

Sonuç: DASS-42 ölçeğinin Türkçe uyarlamasının klinik olgulardan oluşmayan topluluklarda geçerliliği ve güvenilirliği yüksek bir ölçek olarak depresyon, anksiyete ve stresin değerlendirilebilmesi amacıyla kullanılabileceği kanaatine varılmıştır. Ölçeğin klinik olgular üzerinde değerlendirmesi çalışmalarının yapılmasına gereksinim vardır. *(Nöropsikiyatri Arşivi 2010; 47: 118-26)*

Anahtar kelimeler: Depresyon, anksiyete, stres, DASS-42, normatif veri, geçerlilik, güvenilirlik analizi

Introduction

The Depression Anxiety Stress Scale (DASS) is a 42-item, single, self-report measure of anxiety, depression and stress, developed by Lovibond and Lovibond (1). The developers originally intended to create a measure that would maximally discriminate between depression and anxiety. During the scale's development, items not specifically related to depression and anxiety were not included in the measure but were regarded as controls; however, it was revealed that the control items tended to form a third group characterized by chronic nonspecific arousal. More items were added to this group, and the third scale-the stress scale-emerged. Lovibond and Lovibond employed predominantly non-clinical samples for scale development on the basis that depression and anxiety represent dimensional, not categorical, constructs (1). Studies suggested that the DASS does possess adequate convergent and discriminant validity (1). A large student sample (n=717) was administered the Beck Depression Inventory (BDI), the Beck Anxiety Inventory (BAI), and the DASS (2). The BAI and the DASS anxiety scale were

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highly correlated (r= 0.81), as were the BDI and the DASS depression scale (r=0.74) (2). Similar values were obtained from clinical populations (3,4). To assess the DASS's psychometric properties, Lovibond and Lovibond administered the measure to a large non-clinical sample (n=2914). Reliability was assessed by using Cronbach's alpha and was acceptable for the depression, anxiety and stress scales (0.91, 0.84, and 0.90, respectively) (1). These values were similar to those obtained from the clinical populations (3,4).

Several studies have directly tested the construct validity of the DASS (1,3-8). All of these studies have consistently supported the validity of a three-factor structure corresponding to the dimensions of depression, anxiety, and stress; however, some studies suggest a slight degree of misspecification (3-5,8). The assumption on which the development of the DASS was based, and which was confirmed by research data, is that the differences between the depression, anxiety, and stress experienced by normal subjects and the clinically disturbed, are essentially differences of degree (1,3-9). The DASS, therefore, has no direct implications for the allocation of patients to discrete diagnostic categories postulated in classificatory systems such as the DSM (Diagnostic and Statistical Manual of Mental Disorders) and the ICD (International Statistical Classification of Diseases and Related Health Problems). However, the DASS Manual gives recommended cut-offs for conventional severity labels (normal, moderate, severe) (1).

Psychiatry itself is an agent of globalization. Efforts to develop an international nosology and standardized approaches to diagnosis and treatment remain highly biased toward Euro-American constructs developed over the preceding century (10). While the World Health Organization and World Psychiatric Association have tried to broker international consensus on diagnostic nosology and best practices in clinical intervention and prevention, the non-Western database remains very limited (10,11). Although the research strongly suggests the universal nature of phenomena such as depression and anxiety, nonetheless, evidence exists that symptoms may be expressed differently in different cultures (12-21). Some empirical methods are available to indicate whether phenomena such as depression, anxiety, and stress are universal across cultures. If these syndromes have a universal aspect to them, it would be expected that the factor structure of the data gathered from a set of items in one language would be similar to the factor structure of the data gathered from the same set of items in the other language. If the original items had the highest loadings, this would indicate strong universality of the syndrome (22,23).

There are several scales in Turkish for measuring depression, anxiety, and stress. All of them were translated and adapted into Turkish from the original English version and validated for the Turkish population. They include Zung Self-Rating Depression Scale (24), the Beck Depression Inventory (25), the Hospital Anxiety and Depression (HAD) Scale (26), the Beck Anxiety Inventory (27), the Hamilton Depression Rating Scale (28), and the Beck Depression Inventory II (29). The Hamilton Depression Scale has a practical value in the evaluation of the results of therapy, rather than for screening purposes in a non-clinical population. The Zung Self Rating Depression Scale is too simple and is not used frequently anymore. The Beck Depression Inventory, Beck Anxiety Inventory and Beck Depression Inventory II are also self-report instruments and valid for the Turkish population, but they are not measuring stress. The HAD scale is developed for non-psychiatric clinical patients, but also has been used widely for measuring depression and anxiety in population studies. All of the above mentioned scales have some limitations in their use in non-clinical populations. We wanted to adapt a reliable, valid, practical and newly developed instrument, which can measure depression and anxiety together with stress in non-clinical populations, and should be an easy and quick measure for screening. We found the DASS-42 suitable for this purpose. Therefore, in the present study we aim to assess: (a) the reliability and validity of the Turkish version of the DASS-42 and (b) the suitability of the cut-off scores originally reported by Lovibond and Lovibond.

Methods

Study Participants

University students from four different faculties of a single university in Turkey with large undergraduate classes voluntarily participated in the study. Approval for the study was given by the institutional review committee. The aim of the study was explained, and written permission for study participation was collected from those who agreed to participate. Printed study instruments and a questionnaire to collect the demographic data were distributed to the participants. All of the printed materials were filled out by the participants anonymously, and after a short period they were collected. A total of 1300 questionnaires were distributed to the participants; 1245 questionnaires were returned. After data checking, 143 questionnaires with missing data were excluded from the analysis.

Instruments

The DASS-42, translated into Turkish by Uncu et al. (30), is a 42-item instrument measuring current (within the past week) symptoms of depression, anxiety, and stress. Each of the three scales consists of 14 items answered by using a 0-3 scale, where 0=did not apply to me at all, and 3=applied to me very much or most of the time (range of possible scores for each scale is 0–42). Scores considered in the normal range are 0-9 for depression, 0-7 for anxiety, and 0-14 for stress. Scores above these ranges indicate the degree of the problem from mild to extreme. The first studies using the original DASS-42 were performed by its developers on 3540 volunteer Australian university students, and a good convergent validity with other scales was found (31).

The HAD scale was used to assess the convergent validity of the DASS-42. The HAD scale was translated and validated by Aydemir et al. (26). The Turkish version of the scale showed a good convergent validity and has been used in many population-based studies. The HAD scale is a self-report rating scale similar to the DASS-42 and is designed to measure both anxiety and depression. It consists of two subscales, each containing seven items evaluated on a four-point Likert scale (ranging from 0-3). The HAD is scored by summing the ratings for the 14 items to yield a total score and by summing the ratings for the seven items of each subscale to yield separate scores for anxiety and depression.

Questions regarding demographic characteristics were as follows: gender, age, and year in school (freshman, sophomore, junior, or senior).

Analysis

Descriptive statistics and independent samples t-tests were used for summary statistics. Internal reliability of the DASS-42 Turkish version was assessed by means of Cronbach's α scores and item-total correlations. Convergent validity was examined by Pearson's correlation with the HAD Scale. The factorial validity was examined by implementation of exploratory and confirmatory factor analysis and structural equation modeling (SEM). For exploratory factor analysis, a principal component analysis (varimax with Kaiser normalization) was performed to test the validity of the original subscales. Evaluation of model fit was done by using confirmatory factor analysis (CFA). To perform the CFA, AMOS 16.0 was used, and the model parameters were estimated by using maximum likelihood (32). In this study, adequacy of the model was assessed by: (a) root mean square error of approximation (RMSEA), which should be below 0.05 for a good fit; (b) the absolute fit, χ^2/df measure that χ^2 minimum fit function test depends on sample size (33, 34) was used and should be between 2 and 5 for a good fit; (c) Goodness-of-fit index (GFI), which shows the amount of variances and covariance explained by the model and should be greater than 0.90 for an adequate fit of the model; and (d) comparative fit index (CFI), which should also be greater than 0.90 for adequate fit.

Finally, a receiver operating characteristics (ROC) analysis was performed to decide the most appropriate cut-off scores of the Turkish version of the DASS-42 instrument for a non-clinical adult student population. A ROC graph is a technique for visualizing, organizing, and selecting classifiers based on their performance (35). The total area under the ROC curve is a measure of the performance of the diagnostic test since it reflects the test performance at all possible cut-off points. The area lies in the interval (0.5, 1), and the larger the area, the better performance. In other words, ROC analysis yields an effect size called "Area Under the Curve" (AUC). The AUC reflects the probability that a randomly chosen person scores positive on the dependent measures (36). In this study, SPSS for Windows version 16.0, AMOS 16.0, and MedCalc statistical software were used for statistical analyses.

Results

Participant Characteristics

Our study group consisted of 1102 participants, of which 58.3% were female. The mean age was 20.04±1.45 (mean±SD) years. Table 1 shows the distribution of the participants by demographic characteristics.

Summary Statistics and Normative Data

Table 2 shows mean scores, standard deviations (SD), and percent distributions of the participants according to categories for depression, anxiety, and stress on the Turkish version of the DASS-42.

Independent samples t-tests revealed that females obtained significantly higher scores than males on the anxiety scale ($\bar{X}$=9.95, SD=6.68 [females];$\bar{X}$=8.98, SD=6.13 [males]; t=–2.45, p<0.05), and stress scales ($\bar{X}$=16.63, SD=7.54 [females];$\bar{X}$=14.99, SD=7.38 [males]; t=-3.58, p<0.001). The difference between males and females on the depression scale did not achieve statistical significance ($\bar{X}$=10.2, SD=7.94 [females];$\bar{X}$=9.97, SD=7.61 [males]; t=–0.493, p>0.05).

Reliability and Validity

Cronbach's α values were calculated to assess the internal consistency of the scale, and they were 0.92, 0.86, and 0.88 for

Table 1. Demographics of the participants

	N	%
Age Groups		
17-19	437	39.7
20-22	595	54.0
23-25	70	6.4
Gender		
Male	460	41.7
Female	642	58.3
Grade		
Freshmen	494	44.8
Sophomore	368	33.4
Junior	151	13.7
Senior	89	8.1

Table 2. Mean scores, standard deviations (SD) and distributions of participants according to categories on the DASS-42 scale

DASS-42	Categories	n	Mean	SD	25th Percentile	50th Percentile	75th Percentile
DASS-Depression	Normal	601	4.39	2.70	2	4	6
	Mild	190	11.55	1.16	10.75	12	13
	Moderate	176	16.28	1.74	15	16	17
	Severe	100	23.11	1.82	22	23	24
	Ext. severe	35	32.40	4.12	29	31	35
DASS-Anxiety	Normal	489	4.08	2.08	2	4	6
	Mild	142	8.45	.50	8	8	9
	Moderate	249	11.87	1.43	11	12	13
	Severe	132	16.75	1.44	15	17	18
	Ext. severe	90	24.03	3.88	21	23	26
DASS-Stress	Normal	506	9.53	3.42	7	10	12
	Mild	230	16.46	1.14	15	16	17.25
	Moderate	244	21.75	2.02	20	21	24
	Severe	100	28.46	2.11	27	28	30
	Ext. severe	22	36.82	2.50	34.75	36.50	39

depression, anxiety, and stress, respectively. These values revealed high internal consistency of the Turkish version of the DASS-42. Construct validity measured by item-scale correlations ranged from 0.48 to 0.70 for depression, from 0.33 to 0.59 for anxiety, and from 0.43 to 0.70 for stress. Table 3 shows item-scale correlations.

Pearson's correlation coefficients were calculated for the Turkish version of the DASS-42 and the Turkish version of the HAD scale to measure the convergent validity of the Turkish version of the DASS-42. Table 4 shows significant positive correlation between the two scales. With respect to convergent validity, the DASS depression scale correlated highly with HAD depression (r=0.64; p<0.01), whereas the correlation between DASS anxiety and HAD anxiety was substantial and highly significant (r=0.58; p<0.01). Correlations between the DASS stress scale and the HAD scales were moderately high (r=0.45; p<0.01 and r=0.59; p<0.01). This pattern of correlation confirms the hypothesis of good convergent validity.

Factor Structure

Exploratory Factor Analysis

A principal component analysis (varimax with Kaiser normalization) was performed to test the validity of the original subscales. The three-factor solution accounted for 44% of the total variance, with eigenvalues of 14.1, 2.9, and 1.8. Table 5 shows factor loadings for the 42 items. The first factor that emerged consisted of all items from the depression scale plus two items-one from the anxiety scale (item 30, "feared that would be thrown") and one from the stress scale (item 22, "hard to wind down"). The range of factor loadings was 0.43-0.75. The second factor that emerged consisted of 12 items from the anxiety scale plus two items from the stress scale (item 8, "difficult to relax", and item 39, "agitated"). The final factor was the stress factor, which consisted of all items from the stress scale, except item 39 (agitated), which loaded highest on the anxiety factor. One item (item 28, "felt close to panic") from the anxiety scale loaded higher on the stress factor than on the anxiety factor (0.50 versus 0.38, respectively). To test the stability of the factor structure, the sample was randomly divided into two similar subgroups with 551 subjects in each. In sample I, item 22 (hard to wind down) and item 39 (agitated) were loading on the right factor, which is on the stress scale. In sample II, the results were the same as the results for the total sample. In both of the samples, item 28 (felt close to panic) and item 8 (difficult to relax) were loading on the anxiety scale. All other items were loading on the same factors.

Confirmatory Factor Analysis (CFA)

We built three models for confirmatory factor analyses. The first model accepted anxiety and depression as independent factors, whereas the second model conceived them as correlated factors. The most widely accepted premise in classical measurement theory is that indicators positively associated with the same concept should be positively correlated with one another. This internal consistency perspective is dominant in psychology, sociology, and the other social sciences. This belief of the need for positive correlations among indicators of the same concept explains the common practice of screening correlation matrices for items that cluster together and discarding items that have near zero or negative correlations with other measures of the same construct (37). Our third model

Table 3. Item-scale correlations for the Turkish version of DASS-42

DASS-Depression Items	Item-scale correlations	DASS-Anxiety Items	Item-scale correlations	DASS-Stress Items	Item-scale correlations
DASS 3 no positive feeling	.55	DASS 2 dryness of mouth	.40	DASS 1 upset	.44
DASS 5 not seem to get going	.57	DASS 4 breathing difficulty	.52	DASS 6 over-react	.58
DASS 10 to look forward to	.63	DASS 7 feeling of shakiness	.57	DASS 8 difficult to relax	.52
DASS 13 sad& depressed	.63	DASS 9 anxious	.33	DASS 11 getting upset easily	.59
DASS 16 lost interest about everything	.70	DASS 15 feeling of faintness	.49	DASS 12 using nervous energy	.65
DASS 17 wasn't worth as a person	.69	DASS 19 perspired	.46	DASS 14 getting impatient	.45
DASS 21 wasn't worthwhile	.67	DASS 20 scared	.55	DASS 18 feeling touchy	.51
DASS 24 couldn't seem enjoyment	.66	DASS 23 difficulty in swallowing	.58	DASS 22 hard to wind down	.59
DASS 26 down hearted & blue	.68	DASS 25 awareness of heart action	.58	DASS 27 irritable	.69
DASS 31 unable to be enthusiastic	.60	DASS 28 panic	.59	DASS 29 hard to calm down	.62
DASS 34 worthless	.69	DASS 30 fear of being thrown	.50	DASS 32 difficult to tolerate	.45
DASS 37 nothing to be hopeful	.70	DASS 36 terrified	.57	DASS 33 state of nervous tension	.70
DASS 38 life was meaningless	.69	DASS 40 worried	.52	DASS 35 intolerant	.44
DASS 42 difficult to work	.48	DASS 41 trembling	.55	DASS 39 agitated	.43

Table 4. Means (M), Standard Deviations (SD), Correlations for DAS Scale and HAD Scale and Cronbach α values (N=1102)

Variables	Item	M	SD	Range	DASS-D	DASS-A	DASS-S	HAD-A	HAD-D
DASS-D	14	10.11	7.80	0-42	.92				
DASS-A	14	9.55	6.47	0-42	.70**	.86			
DASS-S	14	15.94	7.51	0-42	.68**	.73**	.88		
HAD-A	7	8.84	3.62	0-21	.57**	.58**	.59**	.81	
HAD-D	7	6.43	3.41	0-21	.64**	.47**	.45**	.50**	.79

The Cronbach α of each subscale was listed in the diagonal in boldface type. **indicates p<0.01

Table 5. Factor structure of the DASS-42 Turkish version

	Factors		
	Depression	**Anxiety**	**Stress**
DASS-Depression			
DASS 3 no positive feeling	.50	.24	.23
DASS 5 not seem to get going	.49	.28	.27
DASS 10 to look forward to	.67	.16	.12
DASS 13 sad& depressed	.51	.20	.48
DASS 16 lost interest about everything	.65	.23	.26
DASS 17 wasn't worth as a person	.72	.13	.20
DASS 21 wasn't worthwhile	.71	.21	.10
DASS 24 couldn't seem enjoyment	.64	.19	.26
DASS 26 down hearted & blue	.58	.24	.39
DASS 31 unable to be enthusiastic	.60	.23	.12
DASS 34 worthless	.73	.12	.20
DASS 37 nothing to be hopeful	.75	.15	.10
DASS 38 life was meaningless	.73	.21	.08
DASS 42 difficult to work	.46	.21	.22
DASS-Anxiety			
DASS 2 dryness of mouth	.15	.47	.14
DASS 4 breathing difficulty	.12	.66	.12
DASS 7 feeling of shakiness	.27	.55	.26
DASS 9 anxious	.08	.32	.26
DASS 15 feeling of faintness	.23	.56	.08
DASS 19 perspired	.07	.50	.24
DASS 20 scared	.29	.43	.29
DASS 23 difficulty in swallowing	.20	.68	.10
DASS 25 awareness of heart action	.20	.63	.21
DASS 28 panic	.27	.38	.50
DASS 30 fear of being thrown	.43	.21	.39
DASS 36 terrified	.36	.51	.19
DASS 40 worried	.34	.35	.31
DASS 41 trembling	.21	.59	.15
DASS-Stress			
DASS 1 upset	.24	.07	.48
DASS 6 over-react	.21	.27	.54
DASS 8 difficult to relax	.25	.46	.36
DASS 11 getting upset easily	.42	.16	.51
DASS 12 using nervous energy	.28	.20	.63
DASS 14 getting impatient	.06	.21	.49
DASS 18 feeling touchy	.29	.08	.53
DASS 22 hard to wind down	.44	.40	.38
DASS 27 irritable	.17	.15	.75
DASS 29 hard to calm down	.18	.15	.67
DASS 32 difficult to tolerate	.03	.15	.54
DASS 33 state of nervous tension	.28	.19	.70
DASS 35 intolerant	.05	.20	.50
DASS 39 agitated	.36	.42	.20

Bold indicates a higher factor loading

was identical to the second model, but additionally permitted correlated error. Including correlated measurement error in the model tests the possibility that indicator variables correlate not just because of being caused by a common factor, but also due to common or correlated unmeasured variables. The fit statistics for the CFA models are presented in Table 6. It can be seen that the independent factor model, which accepted anxiety and depression as independent factors, had low fit indices. The model, which conceived anxiety and depression as correlated factors, had better fit indices ($\Delta\chi^2$=1674.81, Δdf=3 p<0.001), but the best fitting results came from model three, which was identical to model two, but additionally permitted correlated error ($\Delta\chi^2$=1764.09, Δdf=45 p<0.001). This model was associated with the optimal fit according to all criteria, with high fit indices and a χ^2 value that although statistically significant, was substantially lower than those for the other models.

The correlations for the optimal model are as follows: depression-anxiety (r=0.83), anxiety-stress (r=0.91), and depression-stress (r=0.85). These correlations are higher than the respective correlations between the scales: depression-anxiety (r=0.70), anxiety-stress (r=0.73), and depression-stress (r=0.68). This is because the factors in the CFA models are measured without error, whereas the correlations between the scales are attenuated by measurement error and the unique variance associated with each item (8).

The factor loadings or standardized regression weights were 0.54 for depression, 0.37 for anxiety, and 0.39 for stress. The lowest factor loading for depression was for item 42 (difficult to work); the lowest factor loading for anxiety was for item 9 (anxious), and the lowest factor loading for stress was for item 32 (difficult to tolerate). Figure 1 shows the graphic representation of the correlated three-factor model of the DASS-42.

ROC Analysis

A cut-off point for the DASS-depression is equal to or higher than 10, corresponding to a sensitivity of 71% and specificity of 80%. A cut-off point for the DASS-anxiety is higher than 7, corresponding to a sensitivity of 88% and specificity of 56%. These cut-off points are the same as those established by the developers of the DASS-42 (1). In addition, Table 7 shows the sensitivity and specificity of alternative cut-off points.

AUC for depression was 0.804 and AUC for anxiety was 0.755 (all p<0.001). Figures 2 and 3 show the ROC curves for the Turkish version of the DASS-42 depression and anxiety, respectively.

Discussion

Previous normative data for the DASS comes from Lovibond and Lovibond's Australian sample, which was derived from a sample predominantly composed of students, and from Crawford and Henry's data, which were derived from the general UK adult

Table 6. Fit indices for CFA models of DASS-42 Turkish version

Model	χ^2	df	χ^2/df	GFI	CFI	RMSEA
1. Independent factors	5.880.32	819	7.18	.79	.75	.08
2. Correlated factors	4.205.51	816	5.15	.83	.83	.06
3. Correlated factors and correlated error	2.441.42	771	3.17	.90	.92	.04

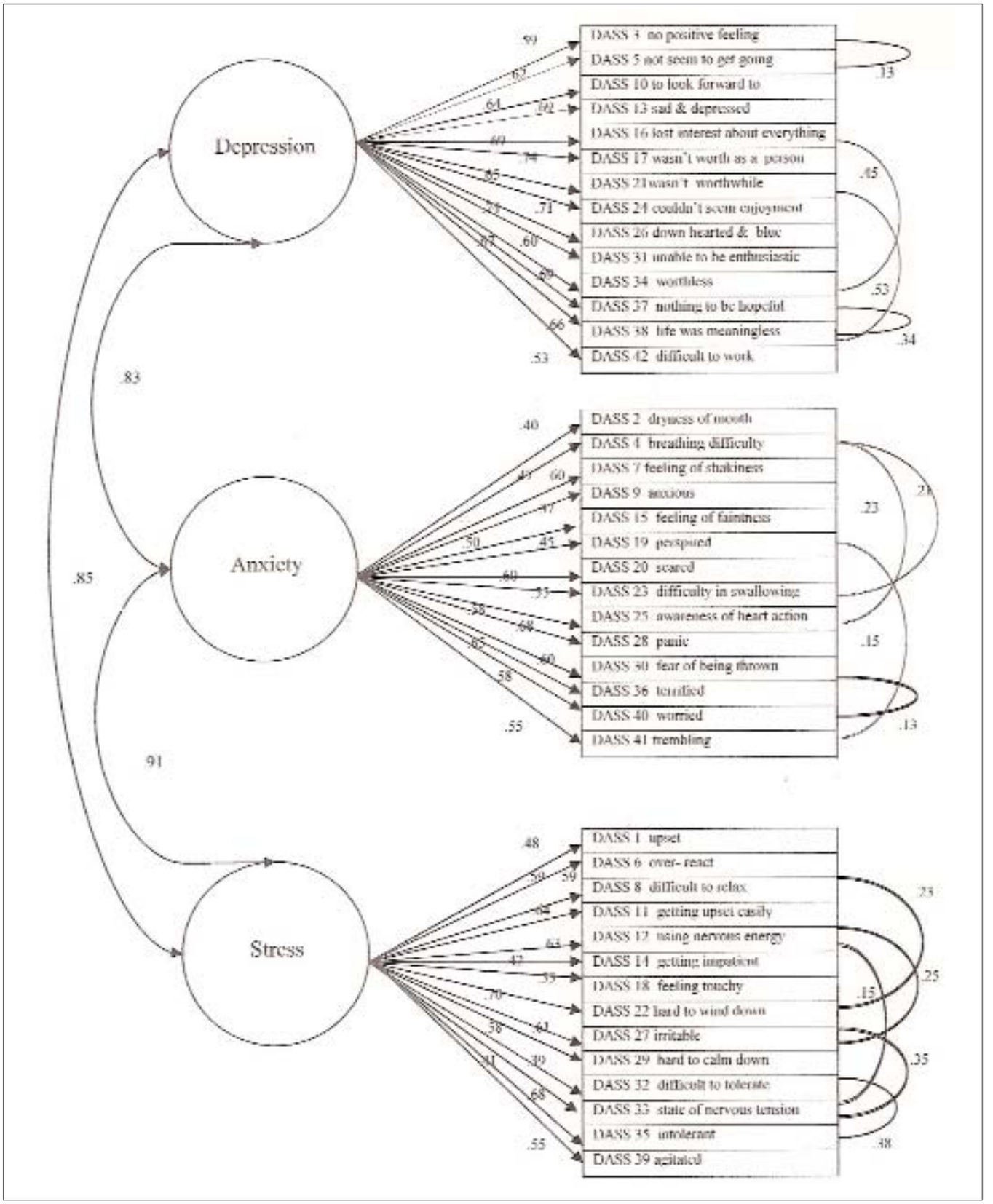

Figure 1. Graphical representation of a correlated three-factor model of the DASS (Model 3).
Boxes represent observed variables; Circles represent latent variables; Single headed arrows represent regression weights; Double headed arrows represent correlations.

Table 7. Cut off points and coordinates of the ROC curve

Cut off point	Sensitivity	Specificity	+LR	-LR
DASS-Depression				
<=5	43.48	93.33	6.52	0.61
<=6	50.72	86.67	3.80	0.57
<=7	57.25	80.00	2.86	0.53
<=8	64.49	80.00	3.22	0.44
<=9*	71.01	80.00	3.55	0.36
<=10	74.64	73.33	2.80	0.35
<=11	79.71	60.00	1.99	0.34
<=12	82.61	46.67	1.55	0.37
<=13	84.06	46.67	1.58	0.34
<=14	86.23	46.67	1.62	0.30
<=15	89.13	40.00	1.49	0.27
<=16	93.48	33.33	1.40	0.20
<=17	97.10	33.33	1.46	0.087
<=18	97.83	33.33	1.47	0.065
<=19	98.55	33.33	1.48	0.043
<=20	99.28	33.33	1.49	0.022
DASS-Anxiety				
>2	92.00	11.33	1.04	0.71
>3	92.00	20.67	1.16	0.39
>4	92.00	28.67	1.29	0.28
>5	90.00	34.67	1.38	0.29
>6	88.00	44.67	1.59	0.27
>7*	88.00	56.00	2.00	0.21
>8	72.00	67.33	2.20	0.42
>9	68.00	72.00	2.43	0.44
>10	64.00	76.00	2.67	0.47
>11	52.00	78.00	2.36	0.62
>12	48.00	84.67	3.13	0.61
>13	42.00	86.67	3.15	0.67
>14	38.00	88.67	3.35	0.70
>15	34.00	91.33	3.92	0.72
>16	30.00	94.00	5.00	0.74
>17	28.00	96.00	7.00	0.75
>18	24.00	96.67	7.20	0.79

+LR: Positive likelihood ratio; -LR: Negative likelihood ratio

population (1,8). The mean score in the present sample for depression was 10.11 (SD=7.80), for anxiety 9.55 (SD=6.47), and for stress 15.94 (SD=7.51). These means are higher than the norms presented by Lovibond and Lovibond: depression= 6.34 (SD=6.97); anxiety= 4.70 (SD=4.91), and stress=10.11 (SD=7.91) (1). They are also higher than those presented by Crawford & Henry: depression=5.55 (SD=7.48); anxiety= 3.56 (SD=5.39); and stress= 9.27 (SD=8.04) (8). In their study on the Arabic version of the DASS, Taouk, Lovibond, and Taube found the means and standard deviations in a sample of 220 immigrants as follows: depression=11.86 (SD=9.73); anxiety=10.72 (SD=8.56); and stress=14.42 (SD=10.17) (22). These means are closer to our findings. Another study on the DASS-42 Spanish version involving University students found scores lower than ours (38). The higher levels of depression, anxiety, and stress mean scores confirm elevated rates of psychological disturbance in the Turkish student populations (39-41). We found the mean anxiety and stress scores significantly higher among females compared to males, whereas the mean depression scores were not significantly different. Lovibond and Lovibond, and Crawford and Henry mentioned very modest gender effects on DASS scores (1,8). In his study on DASS-42 measures among 850 University students in Malaysia, Imam found female students significantly more anxious and stressed when compared to male students (42).

The reliabilities of the Turkish version of the DASS-42, as measured by Cronbach's alpha were 0.92 for depression, 0.86 for anxiety, and 0.88 for stress. There is no absolute criterion for the reliability of an instrument. However, as a rule of thumb, Anastasi has suggested that α should be at least 0.85 if the intention is to use an instrument for raw inferences concerning an individual (43). By this criterion, all three DASS subscales can be viewed as possessing adequate reliability. Bados, Solanas, and Andres found the reliability of the Spanish version of the DASS-42 as 0.92, 0.84, and 0.91 for depression, anxiety, and stress, respectively (38). For the Arabic version of the scale, Cronbach's alpha values were 0.93 for depression, 0.90 for

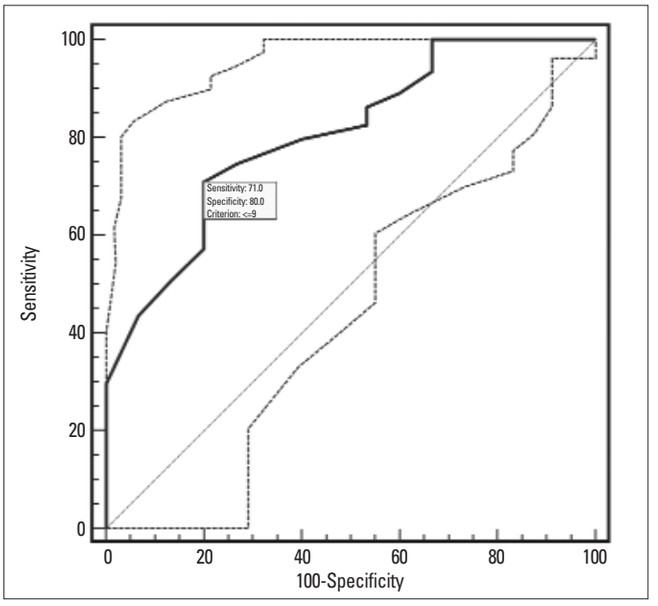

Figure 2. Receiver operating characteristic (ROC) curve for DASS-Depression

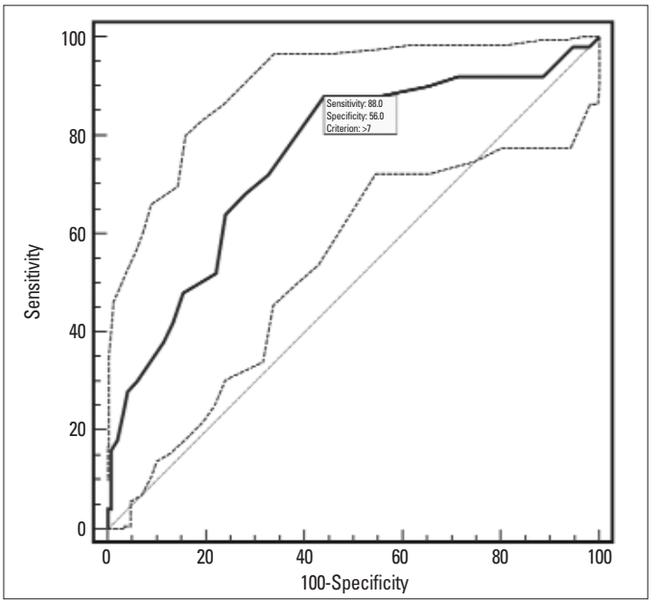

Figure 3. Receiver operating characteristic (ROC) curve for DASS-Anxiety

anxiety, and 0.93 for stress (22). The convergent validity of the Turkish version of the DASS-42 was assessed by the Turkish version of the HAD scale, and we found positive significant correlations, which indicates good convergent validity of the Turkish DASS-42. The correlations between depression and anxiety subscales of the DASS-42 and the HAD scale were highly significant, however, the correlation coefficients were moderate (for anxiety 0.58 and for depression 0.64). This may be because the HAD scale was developed for the measurement of depression and anxiety among patients, rather than in a normative population. HAD scale showed a tendency towards higher correlations in studies with more somatic pathology compared with healthy samples (44). In the validation study on the HAD scale Turkish version, the correlations between the Beck Depression Inventory and the HAD scale were found to be highly significant, whereas the correlation coefficients for the student group were found to be lower (0.63) than those for the participants with somatic pathology (0.72). In their study in a large non-clinical sample, Crawford and Henry (8) found also a significant correlation between the HAD scale and the DASS with moderate correlation coefficients (for depression 0.66 and for anxiety 0.62). Similar results were obtained from a study by Apostolo, Mendes and Azerdo on the Portuguese version of the DASS-21 (45).

CFA was used to test the latent structure of the DASS. From the fit statistics in Table 6, it is clear that model 3 is the best fitting model, with correlated factors and correlated errors. Figure 1 shows the graphical presentation of this model. The conclusion from the CFA modeling is consistent with previous empirical findings; the depression, anxiety, and stress scales do represent legitimate constructs in their own right (8,23,38).

To determine the cut-off scores of the Turkish version of the DASS-42, for a non-clinical student population, we used ROC analysis. The results indicated a good level of accuracy and showed that the Turkish version of the DASS-42 discerns 71% of the students with depression and 88% of the individuals with anxiety. The cut-off scores determined in the Turkish non-clinical student population for minimal, mild, moderate, and severe depression and anxiety were similar to those proposed by Lovibond and Lovibond (1).

There were several limitations in this study. Firstly, all the data regarding the psychometric properties of the DASS-42 were obtained from self-reports. This may have caused recall bias and underreporting. Secondly, a more heterogeneous sample would have more accurately tested this measure as a screening instrument and therefore, the results of this study should be limited to Turkish adult student population and should not be generalized.

This study found the Turkish version of the DASS-42 a valid and reliable instrument to assess the presence and severity of depressive symptomatology in the non-clinical adult Turkish student population. The DASS-42 is not a diagnostic tool, but a brief measure which can be used for screening purposes and assessment of the risk groups. Further validation studies are needed on the use of the DASS-42 Turkish version in somatic patients together with the studies using the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) criteria for individuals with clinical depression (46). It is hoped that the potential contribution of the Turkish version of the DASS-42 will aid clinicians and researchers in a more accurate assessment of the general psychopathology in Turkish.

Acknowledgements

We thank Scribendi Inc. for their professional assistance in proof-reading and editing the English language of this manuscript.

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