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Research Article

The 21-Item and 12-Item Versions of the Depression Anxiety Stress Scales: Psychometric Evaluation in a Korean Population

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ABSTRACT

Purpose: This study aimed to evaluate the psychometric properties of the Depression Anxiety Stress Scales 21 and 12 in a Korean population.
Methods: The Depression Anxiety Stress Scales were translated into Korean using a translation and back-translation technique, and the content validity was assessed by an expert panel. Participants were recruited from six community health centers ($n = 431$) and two community mental health centers ($n = 50$). A field test of the psychometric properties of the instruments was conducted using confirmatory factor analysis with bootstrap maximum likelihood estimation involving 1,000 samples, Pearson's analysis, t test, and Cronbach's α coefficient.
Results: Confirmatory factor analysis of the Depression Anxiety Stress Scales 21 and 12 supported both three-factor and second-order three-factor models. The Scales 21 and 12 satisfied convergent validity with the Patient Health Questionnaire-9, Generalized Anxiety Disorder-7, and Perceived Stress Scale-10 and discriminant validity with the Rosenberg Self-Esteem Scale. The scores for the Depression Anxiety Stress Scales 21 and 12 were higher for the psychiatric group than for the nonpsychiatric group, confirming the presence of known-groups validity. The Depression Anxiety Stress Scales 21 and 12 exhibited moderate-to-strong correlations with the Negative Affect. Cronbach's α coefficients for the Depression Anxiety Stress Scales 21 and 12 were .93 and .90, respectively.
Conclusion: The Depression Anxiety Stress Scales 21 and 12 appear to be acceptable, reliable, and valid instruments. However, the shorter Depression Anxiety Stress Scales 12 may be more feasible to use in a busy practice and also be less burdensome to respondents.

Introduction

Depression and anxiety are common mental problems worldwide. The number of people suffering from depression and/or anxiety is estimated over 300 million [1]. These depression and anxiety may lead to poor functioning at work or school, disturb social life, and even suicide at an individual level, and they can also represent a significant economic burden to society [2,3]. It is, therefore, important to be able to screen early for depression and anxiety in community or primary health care, which requires a measurement method that is rapid and easy to apply and has confirmed psychometric properties.

The Depression Anxiety Stress Scales (DASS) was empirically developed to measure symptoms of depression and anxiety, based on the tripartite model of depression and anxiety [4]. To develop the DASS, the authors selected items that were core symptoms of depression or anxiety but not both conditions. They empirically

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derived a third construct of stress, which is a negative symptom but clearly distinguished from depression and anxiety symptoms. The original DASS consists of 42 items, with 14 items in each of the three subscales (depression, anxiety, and stress), and it exhibits adequate psychometric properties in terms of convergent, discriminant, and structural validities [5]. This instrument is in the public domain, and therefore, it can be freely used in research or practice; however, it has a practical disadvantage of not being rapid to apply.

The DASS 21 is a short version of the original DASS comprising seven items selected from each of the three subscales [4]. The DASS 21 was first demonstrated to have slightly improved psychometric properties compared with the original DASS in both nonclinical individuals and patients with mental disorders [6]. The psychometric properties of the DASS 21 were subsequently evaluated in various populations, including psychiatric patients [7,8], general adults [9–12], nonpsychiatric patients [13], elderly individuals [14], and adolescents [15,16]. Overall, the DASS 21 has been reported to exhibit either good or adequate psychometric properties (internal consistency and convergent validity), with the exception of its underlying structure for factorial construct validity [9,10,12,13,17,18]. Several underlying dimensions of the DASS 21 have been proposed, ranging from a one- to three-factor structure.

Osman et al. [10] suggested 12 items for inclusion in a shorter DASS 12 based on the results of their psychometric study of the DASS 21 and reviews of other studies [7,9,16,19]. However, to our best knowledge, this shorter version of the DASS has never been tested empirically. If the DASS 12 is demonstrated to have satisfactory psychometric properties, it may be more feasible for health professionals to apply in a busy practice and also be less burdensome to respondents.

The DASS 21 has been translated into many languages (www2.psy.unsw.edu.au/dass/) and has been empirically evaluated in diverse cultures. Nevertheless, the psychometric properties of the DASS 21 have never been evaluated in the Korean culture. This study, therefore, evaluated the following psychometric properties of both the DASS 21 and DASS 12 in a Korean population: content validity, factorial structural validity, convergent validity, discriminant validity, known-groups validity, concurrent validity, and internal consistency.

Methods

Design, participants, and data collection

The study was approved by the institutional review board at a university hospital (Approval no. AJIRB-SBR-SUR-16-215). This methodological study evaluated the psychometric properties of the DASS 21 and DASS 12 by recruiting participants (from September 2016 to May 2017) using a convenience sampling method from two different types of institute: six community health centers and two community mental health centers.

The first sample of 431 participants was recruited from six community health centers. The inclusion criteria for the participants were being aged at least 19 years and articulate in Korean. Researchers placed a desk in the corner of each health center lobby and displayed a poster containing information about the study. If people expressed an interest in the study, we asked them to become study participants. The recruitment at the six community health centers was exempted from the need for a consent form by the institutional review board because individual-identifying information was not collected. Three of the 431 individuals were removed owing to faithless responses to items (e.g., responding to only the first page of general characteristics). The participants were aged 39.25 ± 12.08 years (mean ± standard deviation), with a range from 19 to 72 years, and 77.8% were women, while 57.7% were married or living with a partner (Supplementary Table 1).

The second sample of 50 participants were recruited from two community mental health centers as a comparison group to test the known-groups validity of the DASS 21 and DASS 12 because it was assumed in this study that the scores on these scales would be lower in a nonpsychiatric group than in a psychiatric group [17,20]. The inclusion criteria were being aged at least 19 years, articulate in Korean, diagnosed with a depression disorder by psychiatric physicians, and no cognitive dysfunction based on patient records. Potential patients were informed about this study by mental health professionals at the centers. If they wanted to participate in this study, they were requested by the researchers to sign a formal consent form and to complete the questionnaires. One of the 50 patients was removed because of faithless responses to items. The patients with a depression disorder in the comparison group ($n = 49$) were aged 48.02 ± 16.95 years, with an age range from 19 to 79 years, and 67.3% were women, while 30.6% were married or living with a partner. About half of them (49%) had graduated from high school, their duration of having depression disorder was 5.46 ± 1.28 years, and most of them (83.7%) were taking antidepressive drugs.

Measures

DASS 21 and DASS 12

The DASS 21 measures symptoms of depression, anxiety, and stress [4]. It comprises three subscales that each has seven items: depression (DASS 21-D), anxiety (DASS 21-A), and stress (DASS 21-S). Each item is scored on a 4-point Likert scale ranging from 0 (“did not apply to me at all”) to 3 (“applied to me very much”). The scores for the total DASS 21 and for each subscale are summed. The English version of the DASS 21 was translated into Korean with the permission of the original author (Dr. Lovibond) in accordance with the translation and back-translation model of Brislin [21]. Two bilinguals independently translated the English version into Korean based on semantic equivalence rather than word-to-word equivalence. An expert panel of three bilinguals (one psychiatric physician and two professors in nursing) resolved any discrepancies among the translators' versions and then achieved consensus on a single Korean version. This Korean version was then independently translated into English by another two bilinguals. The panel checked the back-translated versions against the original English version. They discussed any discrepancies among the two English versions to finally produce the Korean version of the DASS 21.

The content validity of the Korean version of the DASS 21 was assessed by six experts (two psychiatric physicians and four psychiatric nurses). The experts were asked to rate the relevance of each item on a 4-point ordinal scale with values of 1 (“not relevant”), 2 (“somewhat relevant”), 3 (“quite relevant”), and 4 (“highly relevant”). An item-level content validity index (I-CVI) was calculated as the number of experts who gave ratings of either 3 or 4 divided by the total number of experts. An I-CVI value of .78 or above was considered to indicate good content validity [22]. I-CVI was 1.00 of all items except Item 2 (“I was aware of dryness of my mouth”), but the I-CVI value of Item 2 (.83) still satisfied the criterion for content validity. Therefore, all 21 items were retained without any deletions. The experts also considered the term “panic” in Korean in items 9 and 15 to be jargon, and so it was rephrased into an everyday expression. The produced content-validated Korean version of DASS 21 was used in this study.

The DASS 12 version used in this study comprises four items from each of the following corresponding three subscales of the Korean version of DASS 21, which was suggested as a shorter scale by Osman et al. [10]: depression (DASS 12-D; items 3, 10, 13, and

17), anxiety (DASS 12-A; items 2, 4, 7, and 19), and stress (DASS 12-S; items 1, 11, 12, and 18).

Patient Health Questionnaire-9

The Patient Health Questionnaire-9 (PHQ-9) is a self-reported questionnaire assessing depression severity [23]. This questionnaire comprises nine items asking about the frequency of depressive symptoms during the previous 2 weeks. Each item is scored on a 4-point scale ranging from 0 ("not at all") to 3 ("nearly every day"). The summed total scores range from 0 to 27, with higher scores reflecting more severe depressive symptoms. This study used the Korean version of the PHQ-9 available at the Patient Health Questionnaire website that exhibits internal consistency, test–retest reliability, known-groups validity, and convergent validity in Koreans [24]. Cronbach's α coefficient of the PHQ-9 was .87 in the present study. The PHQ-9 was used in this study to test convergent validity. It was hypothesized that each of the DASS 21-D and DASS 12-D would exhibit a moderate positive correlation with the PHQ-9, which is designed to parallel the DSM-IV (fourth edition of the Diagnostic and Statistical Manual of Mental Disorders) symptoms [25].

Generalized Anxiety Disorder

The Generalized Anxiety Disorder (GAD-7) is a self-reported questionnaire for rapid screening and measuring the severity of general anxiety disorder [26]. It comprises seven items scored on a 4-point scale ranging from 0 ("not at all") to 3 ("nearly every day"). The items are summed to give a total score that ranges from 0 to 21. The Korean version of the GAD-7 is freely available at the Patient Health Questionnaire website. Cronbach's α coefficient of the GAD-7 was .91 in the present study. The GAD-7 was used in this study to test convergent validity of anxiety. It was hypothesized that the DASS 21-A and DASS 12-A would exhibit moderate-to-strong positive correlations with the GAD-7 [27].

Perceived Stress Scale-10

The Perceived Stress Scale-10 (PSS-10) is a self-administered questionnaire that was developed to measure perceived psychological stress based on the transactional model of stress and coping [28]. The questionnaire comprises 10 items categorized into positive and negative subscales. The items are rated on a 5-point Likert-type scale, with those on the positive subscale scored in reverse. Items are summed to give a total score, where a higher score indicates higher perceived stress. The Korean version of the PSS-10 was demonstrated to exhibit excellent psychometric properties in Koreans [29], and Cronbach's α coefficient was .81 in the present study. The PSS-10 was used in this study to test convergent validity. It was hypothesized that the DASS 21-S and DASS 12-S would exhibit moderate-to-strong positive correlations with the PSS-10 [10].

Rosenberg Self-Esteem Scale

The Rosenberg Self-Esteem Scale (RSES) [30] consists of 10 items scored on a 4-point Likert scale. The possible total score ranges from 10 to 40, with higher scores implying higher self-esteem. The Korean version of the RSES has been validated in adults [31], and Cronbach's α coefficient was .94 in the present study. The RSES was used to test discriminant validity in this study. It was hypothesized that the DASS 21 and DASS 12 would exhibit weak negative correlations or no correlations with RSES [11].

Positive Affect and Negative Affect Schedule

The Positive Affect and Negative Affect Schedule (PANAS) is a self-reported instrument consisting of two 10-item scales designed to rapidly assess positive and negative feelings and emotions [32]. The Negative Affect (NA) subscale measures subjective distress and unappeasable engagement, while the Positive Affect (PA) subscale measures pleasurable engagement with the environment. Responses are scored on a 5-point scale ranging from 1 ("very slightly or not at all") to 5 ("extremely"). The scores on the NA and PA potentially range from 10 to 50, with higher scores indicating higher affect. The Korean version has been validated with college students and workers [33], and Cronbach's α coefficient for the NA and PA were .89 and .86, respectively, in the present study. Only the NA was used in this study for assessing concurrent validity. It was hypothesized that the DASS 21 and DASS 12 would exhibit moderate-to-strong correlations with the NA because anxiety and depression are predominantly associated with negative affectivity [34].

Statistical analyses

Data were analyzed using IBM SPSS Statistics for Windows (version 23) and SPSS AMOS (version 20) (IBM Corp., Armonk, NY, USA). Before conducting the analysis, the data for the 21 items of the DASS 21 were screened for missing values and normality. Missing values for the items were replaced using expectation–maximization, and interitem correlations were analyzed using Person's correlation analysis. The normality of the distributions was assessed at both the univariate and multivariate levels.

Regarding factorial construct validity, one-factor, three-factor, and second-order three-factor models as used in the original DASS study were assessed in this study, whereas a two-factor model was not used because it is rarely supported [18,35]. The validity was assessed using confirmatory factor analysis (CFA) with bootstrap maximum-likelihood estimation with 1,000 samples. The sample size required for CFA is five to 10 times the estimated parameter. The sample size of 428 in this study satisfied the estimated size requirement [36]. Because the χ^2 statistic is sensitive to sample size, the following indices were used to evaluate model fit: standardized root mean square residual (SRMR), goodness of fit index (GFI), comparative fit index (CFI), and root mean square error of approximation (RMSEA). SRMR, GFI, and CFI values of <.05, >.90, and >.90, respectively, were considered to indicate an acceptable fit, while RMSEA values of < .06, .08–.10, and >.10 were considered to indicate good, adequate, and poor fits, respectively [37–39]. A significant difference in the χ^2 ($\Delta\chi^2$) value between a model and its modified model indicates a substantial improvement in model fit [40].

The convergent validity with the PHQ-9, GAD-7, and PSS-10 and discriminant validity with RSES were tested using Pearson's correlation. Known-groups validity comparing the scores for the patient group diagnosed with depression was assessed using the *t* test and Cohen's effect size. Concurrent validity with the NA subscale of the PANAS was tested using Pearson's correlation. Internal consistency was examined using corrected item-total correlations with a criterion range of $r = .3–.8$ and Cronbach's α coefficient with a criterion of > .70 [41].

Results

Missing data, item distributions, and interitem correlations

The rate of missing data for items of the DASS 21 was low, ranging from 0.4% to 1%. Cases with two or more missing values for each seven-item scale were removed, in accordance with the scoring guideline (www2.psy.unsw.edu.au/dass/). This resulted in three cases from the data set of the six community health centers and one case from the data set of the two community mental health centers being removed from the study. The remaining missing values were replaced using expectation-maximization.

Table 1 *Mean Scores for the DASS 21 and DASS 12 Items and Their Distribution Parameters (N = 428).*

No	Abbreviated item	Mean ± SD	Skewness	Skew ratio	Kurtosis	Kurtosis ratio
1	Hard to wind down.[a]	0.65 ± 0.67	0.68	5.73	−0.04	−0.18
2	Dryness of my mouth.[a]	0.50 ± 0.67	1.23	10.36	1.13	4.75
3	No positive feeling.[a]	0.53 ± 0.62	0.87	7.33	0.31	1.33
4	Breathing difficulty.[a]	0.20 ± 0.52	2.82	23.8	8.35	35.27
5	No initiative.	0.83 ± 0.71	0.62	5.20	0.31	1.30
6	Over-react.	0.79 ± 0.71	0.63	5.33	0.25	1.06
7	Trembling (e.g., in the hands).[a]	0.31 ± 0.57	1.92	16.22	3.71	15.69
8	Nervous energy.	1.08 ± 0.79	0.42	3.54	−0.19	−0.84
9	Panic and make a fool of myself.	0.50 ± 0.68	1.23	10.38	1.06	4.45
10	Nothing to look forward to.[a]	0.41 ± 0.68	1.81	15.26	3.19	13.48
11	Agitated.[a]	0.53 ± 0.72	1.23	10.40	0.95	4.03
12	Difficult to relax.[a]	0.33 ± 0.56	1.64	13.84	2.53	10.67
13	Down-hearted and blue.[a]	0.76 ± 0.73	0.66	5.56	0.04	0.15
14	Intolerant.	0.61 ± 0.69	0.96	8.12	0.61	2.58
15	Close to panic.	0.26 ± 0.54	2.24	18.87	5.35	22.58
16	Unable to become enthusiastic.	0.36 ± 0.54	1.13	9.54	0.26	1.10
17	Not worth much.[a]	0.18 ± 0.48	2.92	24.69	8.99	37.96
18	Touchy.[a]	0.67 ± 0.74	0.86	7.25	0.16	0.68
19	Action of heart.[a]	0.36 ± 0.61	1.75	14.76	2.93	12.36
20	Scared without reason.	0.21 ± 0.48	2.36	19.89	5.56	23.49
21	Life meaningless.	0.40 ± 0.68	1.90	16.06	3.58	15.14
Multivariate					107.35	60.58

Note. DASS = Depression Anxiety Stress Scales; Kurtosis ratio = kurtosis/standardized error of kurtosis for each item; SD = standard deviation; Skew ratio = skewness/standard error of skewness for each item.
Absolute values of the skew ratio and kurtosis ratio exceeding 1.96 indicate a non-normal distribution.
The DASS 21 questionnaire is in the public domain and can be downloaded from the DASS website (www.psy.unsw.edu.au.dass/).
[a] DASS 12 items.

Table 1 indicates that the distribution of each item showed positive skewness. The multivariate kurtosis *Z*-statistic was 60.58, implying multivariate non-normality in this sample. These non-normal data were processed using bootstrapping for CFA because normality is an important assumption of structural equation modeling [40].

The interitem correlation coefficients of the DASS 21 and DASS 12 ranged from .27 to .65 at $p < .05$ and from .33 to .65 at $p < .05$, respectively. These values indicate that there were no redundant or unrelated items.

Factorial construct validity

Regarding the factor structure of the DASS 21, a one-factor model (Model 1) was tested first. As indicated in Table 2, Model 1 provided a poor fit to the data. Modifying the covariance between error terms of items 17 and 21 and between items 6 and 18 (to produce Model 1a) significantly improved the model fit compared with Model 1 ($\Delta\chi^2 = 80.47$, $p < .05$). However, most of the model fit indices remained unsatisfactory.

The three-factor model (Model 2) was tested next, and it was found that all the fit indices other than RMSEA did not meet their respective criteria. The modified three-factor model with two covariance error terms from the same scales (Model 2a) represented a significant improvement over Model 2 ($\Delta\chi^2 = 58.26$, $p < .05$) and yielded a good fit across all indices except for GFI. All the items loaded meaningfully on their designated factors (with a critical ratio value of >1.96), and their standardized factor loading values ranged from 0.555 to 0.781 (Supplementary Figure 1). However, there were strong interfactor correlations between the DASS 21-D and DASS 21-A ($\varphi = .867$), the DASS 21-A and DASS 21-S ($\varphi = .898$), and the DASS 21-S and DASS 21-D ($\varphi = .923$).

These interfactor correlations led to the application of a second-order three-factor model with modification of the two covariance error terms, in which a second level of factors was named “general negative emotion” [5]. Given the same number of estimated

Table 2 *Summary of Model Fit Indices for the DASS 21 and DASS 12 from CFA.*

Models	χ^2	*df*	SRMR	GFI	CFI	RMSEA (90% CI)	χ^2 difference ($\Delta\chi^2$)
DASS 21							
Model 1: one factor	766.966**	189	.055	.843	.846	.085 (.078–.091)	
Model 1a: modified, one factor	686.501**	187	.052	.859	.882	.079 (.073–.085)	Model 1—Model 1a = 80.47*
Model 2: three factors	651.361**	186	.051	.870	.890	.077 (.070–.083)	
Model 2a: modified, three factors	593.098**	184	.049	.883	.903	.072 (.660–.079)	Model 2—Model 2a = 58.26*
Model 2b: second-order three factors	593.098**	184	.049	.883	.903	.072 (.660–.079)	
DASS 12							
Model 3: one factor	297.975**	54	.056	.891	.888	.103 (.092–.114)	
Model 3a: modified, one factor	269.621**	53	.053	.899	.901	.098 (.086–.110)	Model 3—Model 3a = 28.35*
Model 4: three factors	235.092**	51	.036	.922	.951	.087 (.076–.099)	
Model 4a: modified, three factors	200.263**	50	.034	.934	.960	.079 (.068–.091)	Model 4—Model 4a = 34.83*
Model 4b: second-order three factors	201.700**	51	.034	.934	.960	.079 (.068-.091)	

*$p < .05$.
**$p < .01$.
Note. CFI = comparative fit index; *df* = degrees of freedom; DASS = Depression Anxiety Stress Scales; GFI = goodness of fit index; RMSEA (90% CI) = root mean square error of approximation with 90% of confidence interval; SRMR = standardized root mean square residual.

parameters, a second-order model produces the same goodness of fit as a first-order model [39], but it is meaningful to evaluate such a model to assess the magnitude of the second-order parameters (i.e., second-order factor loadings) [42]. The second-order three-factor model produced γ values of .944, .918, and .978 between the factor of the general negative emotion (second level of factors) and the depression, anxiety, and stress scales, respectively (Supplementary Figure 1). In other words, the second level of factors accounted for 88%, 84%, and 96% of the variance in the first-order factors of the DASS 21-D, DASS 21-A, and DASS 21-S, respectively.

The factorial construct validity of the DASS 12 was tested by applying a one-factor model (Model 3), for which the GFIs indicated a poor model fit (Table 2). Modifying the covariance between the error term of items 10 and 17 (to produce Model 3a) significantly improved the model fit compared with Model 3 ($\Delta\chi^2 = 28.35$, $p < .05$) and fulfilled the CFI and RMSEA criterion to indicate a marginal fit.

A three-factor model of DASS 12 after modification (Model 4a) demonstrated a good fit for SRMR, GFI, and CFI and an adequate fit for RMSEA. All items loaded on their designated factors (critical ratio value > 1.96), and their standardized factor loading values ranged from .655 to .850 (Supplementary Figure 2). There were also strong interfactor correlations between the DASS 12-D and DASS 12-A ($\varphi = .887$), the DASS 12-A and DASS 12-S ($\varphi = .910$), and the DASS 12-S and DASS 12-D ($\varphi = .910$).

A second-order three-factor model for the DASS 12 was a saturated model, with six known parameters at the first-order three-factor level and six estimable parameters at the second level. To solve this problem, an equality constraint on parameters at the second level was applied based on the critical ratio difference method [40]. Equal constraints were imposed on the residuals of the DASS 12-D and DASS 12-S in the present study. The γ coefficients for the regression of the factor of general negative emotion on the DASS 12-D, DASS 12-A, and DASS 12-S were .987, .903, and .988, respectively (Supplementary Figure 2).

Convergent validity

As hypothesized, the DASS 21-D, DASS 21-A, and DASS 21-S were moderately positively correlated with the PHQ-9, GAD-7, and PSS-10, as were the DASS 12-D, DASS 12-A, and DASS 12-S, respectively (Table 3). Convergent validity was, therefore, satisfied for both DASS 21 and DASS 12.

Discriminant validity

The total DASS 21 and DASS 12 and their subscales exhibited weak negative or no significant correlations with the RSES, indicating that they exhibited discriminant validity (Table 3).

Known-groups validity

Table 4 presents the mean scores for two groups (a nonpsychiatric group vs. a psychiatric group with a depression disorder) on the DASS 21 and DASS 12. As expected, the total scores and the subscale scores of the DASS 21 and DASS 12 were significantly higher for the group with a depression disorder, confirming the presence of known-groups validity. In addition, all the effect sizes of the differences were large.

Concurrent validity

As hypothesized for the concurrent validity, the total DASS 21 and DASS 12 and their subscales exhibited moderate-to-strong positive correlations ($r = .57–.75$, $p < .001$) with the NA (Table 3).

Internal consistency

Table 5 indicates that the corrected item-total correlation coefficients for the DASS 21 ranged from .54 to .72. Cronbach's α coefficient was .93 for the total DASS 21, and .84, .85, and .90 for the DASS 12-D, DASS 12-A, and DASS 12-S, respectively. Similarly, the corrected item-total correlation coefficients for the DASS 12 ranged from .53 to .71. Cronbach's α coefficient was .90 for the total DASS

Table 4 *Known-Groups Validity of the DASS 21 and DASS 12.*

Scale/subscale	Group with depression disorder ($n = 49$)	Group without depression disorder ($n = 428$)	t[a]	d
	Mean ± SD	Mean ± SD		
DASS 21				
Total scale	34.48 ± 15.92	10.49 ± 8.88	10.36*	1.86
Depression subscale	12.35 ± 5.70	3.48 ± 3.23	10.70*	1.91
Anxiety subscale	10.49 ± 5.87	2.35 ± 2.94	9.57*	1.75
Stress subscale	11.64 ± 5.43	4.67 ± 3.57	8.77*	1.52
DASS 12				
Total scale	19.41 ± 9.59	5.44 ± 5.24	10.03*	1.81
Depression subscale	6.86 ± 3.49	1.88 ± 1.91	9.82*	1.77
Anxiety subscale	6.06 ± 3.60	1.37 ± 1.85	8.97*	1.64
Stress subscale	6.50 ± 3.39	2.19 ± 2.14	8.70*	1.52

Note. DASS = Depression Anxiety Stress Scales; d = Cohen's effect size=$(\text{mean}_1 - \text{mean}_2)/(\text{pooled SD})$, where pooled SD=$\sqrt{(SD_1^2+SD_2^2)}/2$; SD = standard deviation.

*$p < .001$

[a] Adjusted t value due to that equal variances not being assumed.

Table 3 *Convergent, Discriminant, and Concurrent Validity of the DASS 21 and DASS 12.*

Scale/subscale	Convergent validity			Discriminant validity	Concurrent validity
	PHQ-9	GAD-7	PSS-10	RSES	NA
DASS 21					
Total scale				−.11 ($p = .025$)	.75 ($p < .001$)
Depression subscale	.78 ($p < .001$)			−.14 ($p = .004$)	.66 ($p < .001$)
Anxiety subscale		.66 ($p < .001$)		−.10 ($p = .044$)	.64 ($p < .001$)
Stress subscale			.61 ($p < .001$)	−.06 ($p = .201$)	.73 ($p < .001$)
DASS 12					
Total scale				−.11 ($p = .022$)	.73 ($p < .001$)
Depression subscale	.75 ($p < .001$)			−.13 ($p = .006$)	.64 ($p < .001$)
Anxiety subscale		.59 ($p < .001$)		−.08 ($p = .085$)	.57 ($p < .001$)
Stress subscale			.66 ($p < .001$)	−.08 ($p = .098$)	.73 ($p < .001$)

Note. DASS = Depression Anxiety Stress Scales; GAD-7 = Generalized Anxiety Disorder-7; NA = Negative Affect; PHQ-9 = Patient Health Questionnaire-9; PSS-10 = Perceived Stress Scale-10; RSES = Rosenberg Self-esteem Scale.

Table 5 *Internal Consistency of the DASS 21 and DASS 12.*

Scale/subscale	DASS 21		DASS 12	
	Corrected item-total correlation	Cronbach's α	Corrected item-total correlation	Cronbach's α
Total scale	.54–.72	.93	.53–.71	.90
Depression subscale	.52–.64	.81	.52–.56	.74
Anxiety subscale	.46–.67	.84	.55–.62	.78
Stress subscale	.54–.64	.85	.54–.67	.80

Note. DASS = Depression Anxiety Stress Scales.

12, and .74, .78, and .90 for the DASS 12-D, DASS 12-A, and DASS 12-S, respectively. Both DASS versions, therefore, satisfied internal consistency.

Discussion

This study comprehensively evaluated the psychometric properties of the DASS 21 and DASS 12. A three-factor model was originally proposed for the factorial construct validity of the DASS 21 [5]. This model was supported not only in that study but also in other studies involving general adults or patients in primary care [11,12,14,43]. However, many studies, including the present study, found strong correlations among the three subscales [9,10,12,13]. A possible method for dealing with these strong correlations is to collapse structural constructs into a smaller number of factors [13]. With this aim in mind, researchers have investigated one-factor and two-factor models. As mentioned previously, the two-factor model has rarely been supported. Similarly, the one-factor model exhibited a poor model fit compared with the three-factor model in this study, as has also been demonstrated previously [11–13,17,43]. The poor fit of the one-factor model might not be surprising, given that the DASS was originally constructed to assess the multiple dimensions of depression, anxiety, and stress symptoms [5].

Henry and Crawford [9] suggested a bifactor model (quadripartite structure) as an alternative for the DASS 21, which comprises a general factor measured by all items plus domain-specific factors explaining the residual variance shared by subsets of items [44]. They reported that both the three-factor and bifactor models provided an adequate fit, but the bifactor model was better. This finding was confirmed by Bottesi et al. [17] and Randall et al. [13]. However, these studies overlooked an important pattern of the factor loadings on the bifactor model: strong loadings on the general factor and weak loadings on the specific factors. This pattern of loadings indicates that only the general factor score can lead to reliable interpretation, while the observed subscale scores may result in misleading interpretations because the largest proportion of the subscale scores is due to the general factor [45]. In a similar vein, Osman et al. [10] strongly suggested using the total DASS 21 score rather than its subscale scores. However, this is not simple to implement because the original conceptualization of the DASS was multidimensional [5]. Using a three-factor model is, therefore, recommended, especially where the DASS 21 subscale scores are important [12]. Overall, the three-factor model of the DASS 21 (including the second-order three-factor model) seems to be better than alternative models. In the case of DASS 12, no empirical evidence of factorial construct validity exists because the present study is the first to test it; however, the underlying structure of the DASS 12 is very similar to that of the DASS 21.

Convergent validity is satisfied when the scores on an instrument are positively correlated with those of other instruments measuring similar constructs [46]. Previous psychometric studies have demonstrated that the DASS 21 has good convergent validity [5,9,10,12,14,17,43]. However, the instruments used to check the validity have mainly been limited to the revised Beck Depression Inventory, the Beck Anxiety Inventory, and the Hospital Anxiety and Depression Scale. The present study established convergent validity for the DASS 21 and DASS 12 with other self-reported instruments measuring similar constructs (e.g., PHQ-9, GAD-7, and PSS-10).

Regarding known-groups validity, the total and subscale scores of the DASS 21 and DASS 12 in this study were higher for the psychiatric group diagnosed with depression than for the nonpsychiatric group, as expected. In addition, the magnitude of the differences (effect sizes) was large, based on Cohen's criterion [47], Consistently, Asghari et al. [20] reported that scores on the DASS 21 subscales were higher for clinical patients with mood, generalized anxiety, or obsessive compulsive disorders than for nonclinical individuals. Other authors have also reported moderate-to-large differences in the DASS 21 subscale scores between psychiatric and nonpsychiatric groups [6,17]. From these findings, it may be conjectured that both DASS 21 and DASS 12 can be used to differentiate nonpsychiatric and psychiatric individuals.

Mokkink et al. [48] defined concurrent validity as the degree to which the scores of a measurement instrument adequately reflect an existing standard at the same time. The DASS 21 and DASS 12 exhibited moderate correlations with the concurrent instrument of the NA in the present study, which is consistent with the findings of previous psychometric studies of the DASS 21 in an adult population [9] and an older population [14].

The values of Cronbach's α coefficient in this study (.81–.94) indicated good internal consistency for both the total DASS 21 and its subscales. Other studies involving nonclinical and clinical samples in the USA, Canada, China, UK, and Portugal have similarly found Cronbach's α coefficient ranging from good to excellent [7,9–12,49]. Together these findings suggest that the DASS 21 exhibits good internal consistency across different populations and languages. The values of Cronbach's α coefficient for DASS 12 in this study were a little lower (.74–.90) than those for DASS 21, but they still satisfied the generally accepted criterion of >.70. The differences could be due to the smaller number of items in the DASS 12 because the number of items affects calculations of Cronbach's α coefficient [42].

Strength and limitation

The strength of this study was that it has performed the first tests of the DASS 12 as suggested by Osman et al. [10]. Yusoff [50] attempted to reduce DASS 21 down to 12 items using college students in Malaysia with a set of items that differed from the set of 12 items reported by Osman et al. [10], and their findings were unsatisfactory (e.g., Cronbach's α values for the subscales were .54–.59). In contrast, the DASS 12 in the present study exhibited good psychometric properties.

This study did not assess test–retest reliability because the DASS 21 and DASS 12 are state measures rather than trait measures [4]. However, the lack of a responsiveness test was a limitation of this study. For the responsiveness test, a longitudinal study is required in which the changes in the DASS 21 and DASS 12 scores are expected to occur.

Implication for further research

Psychometric studies of the DASS 21 have been conducted in various populations, but the present study is the first to involve a Korean population. Nevertheless, a systematic review of the existing psychometric evidence of the DASS 21 was not performed. Such

a systematic review could quantify the overall strengths and weaknesses of the measurement properties of the DASS 21. On the other hand, this study is the first to evaluate the version of the DASS 12 as suggested by Osman et al. [10], and so the DASS 12 needs to be further investigated in psychometric studies involving various populations and cultures.

Conclusion

This study found that the psychometric properties of the DASS 21 and DASS 12 were satisfactory in a Korean population. The underlying construct of the instruments comprises three subscales: depression, anxiety, and stress symptoms. Their content, convergent, discriminant, concurrent, known-groups validity, and internal consistency were satisfied, indicating that both the DASS 21 and DASS 12 can be applied in research and practice. However, the DASS 12 may be more feasible to use in a busy practice and also be less burdensome to respondents.

Conflict of interest

There are no conflicts of interest to disclose.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.anr.2018.11.006.

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