Evaluation of a Polish Version of the Depression Anxiety Stress Scales (DASS-21)

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Abstract

Introduction: The Depression Anxiety Stress Scales (DASS-21) is an instrument that assesses the negative emotional states of depression, anxiety, and stress.

Aim: The aim of this study was to psychometrically evaluate a Polish version of the brief 21-item version of the DASS.

Material and Methods: A 212 medical students who fully completed the DASS-21 questionnaire were included in the study. Validity was evaluated through the analysis of construct validity and reliability.

Results: The Cronbach's alpha for the overall score was 0.93 and for the three subscales were: Stress 0.85, anxiety 0.80, depression 0.86. The exploratory factor analyses identified three dimensions in a modified version of the DASS-21 (renamed DASS-18), with appropriate construct validity and good reliability. The three dimensions accounted for over 60%, 68% of variance between items.

Conclusion: Internal consistency of the Polish version of the DASS-21 as a whole and for each of three originally developed subscales was excellent. We supported the three-factor model of the DASS. The modified DASS-18 scale obtained in this study is measure of depression, anxiety and stress, with acceptable reliability and construct validity, but it requires confirmation in the next study.

Keywords: Depression; Anxiety; Validation

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Introduction

The 21-item Depression Anxiety Stress Scales (DASS-21) by Lovibond and Lovibond is a self-report measure that aims to assess negative emotional state of depression, anxiety, and stress [1]. Conceptually, depression and anxiety are quite distinct, but the clinical overlap of the two conditions was mentioned [1,2], the DASS was a response to the need for a tool that could distinguish them [1]. In developing the DASS, Lovibond and Lovibond first defined items based on clinical consensus, and then empirically refined using factor analysis. During this process the authors also identified a third factor defined as stress. For this reason DASS comprises three subscales: (1) a depression subscale that measures dysphoria, hopelessness, devaluation of life, self-deprecation, lack of interest, anhedonia and inertia; (2) an anxiety subscale assessing autonomic arousal, skeletal musculature effects, situational anxiety and subjective experience of anxious affect; and (3) a stress subscale that measures tension, difficulty relaxing, agitation, irritable and impatient [1]. There are two forms of DASS: The full 42-element version and the shortened version consisting of 21 items taken from the full DASS version. The DASS-21 items have been selected such that the scale scores for the short version can be converted to full scale by multiplying by 2. Because DASS-21 is shorter, it takes less time to fill up and is easier for participants with limited concentration [1,3].

The authors report that DASS evaluates depression, anxiety and stress in both the non-clinical and clinical groups, and can be used by both researchers and clinicians [1]. Since its release, DASS-21 has been used in a variety of studies; to measure psychological distress among high school and college students or the level of stress related to musculoskeletal pain and lower back pain, also to assess the relationship between emotional well-being and the work environment to examine correlation of depression, anxiety, stress with hypertension, to evaluation of depression and anxiety after spinal cord injury [4-13]. There are attempts to use DASS-21 to measure suffering in adolescents [14,15].

Table 1: Basic psychometric properties.

DASS	Mean	SD	MIN	MAX	Median	Skewness	Kurtosis
Depression subscale	4,89	4,368	0	21	4	1,369	1,467
Anxiety subscale	4,09	4,036	0	17	3	1,371	1,483
Stress subscale	6,89	4,833	0	20	6	0,664	-0,150
Total score	15,87	11,779	0	58	13	1,036	0,689

DASS-21 has been used in studies across different linguistic and ethnic groups. This was preceded by psychometric tests, the results of which usually showed good internal consistency, but the construct validity analysis was varied and was sometimes unsatisfactory.

This study aimed to examine construct validity and internal consistency of the Polish version of the DASS-21.

Material and Methods

Study design and setting

The study was conducted at Jagiellonian University Medical College in Krakow, Poland, which offered a six-year, full-time undergraduate medical program. It was held in the middle of the winter semester in 201 to 2019. The study was part of a larger project encompassing several scales to assess the educational environment and the student's motivation to work. Ethical approval to conduct the study was obtained from the Ethics Committee of Jagiellonian University.

Participants

The questionnaires were distributed among registered, active students (from all six years of study), during classes. Participation was voluntary, and the questionnaires were collected anonymously. The DASS inventory was administrated to the students after obtaining written informed consent.

Study instrument and procedure

This study used a Polish translation of DASS from the DASS public domain, carried out by Professor Marta Makara-Studzińska and her colleagues Beata Petkowicz, Anna Urbańska and Jacek Petkowicz.

The structured questionnaire had two parts: a) Demographics, and b) DASS inventory.

The DASS-21 is a set of three four-point Likert subscales for self-reporting. Each subscale consists of seven items, aimed at assessing the emotional states of depression, anxiety and stress. Participants are asked to mark the extent to which each statement applied to him/her during the last week [1]. The result is obtained by adding up the scores of the items for each of the three subscales.

Data analysis

In this study, the data were analyzed using IBM SPSS Statistics (Statistical Package for the Social Sciences) version 25.0.0.2.

First, the basic characteristics of the DASS (mean, standard deviations etc.) were calculated.

Second, Cronbach's alpha coefficient was used to assess the internal consistency of the overall and original subscale's scores of the instrument, and a minimum coefficient alpha of 0.7 was used to indicate an adequate level of consistency. Cronbach's alpha >0.7 demonstrated that the individual items that constituted a test, the DASS tool, in this case, correlate well with one another or with the

Table 2: Results for the overall DASS score and the three subscale scores.

Subscale	Cronbach's alpha
Depression	0.86
Anxiety	0.8
Stress	0.85
Total	0.93

test total.

Third, the Exploratory Factor Analysis (EFA) with the Varimax rotation was performed. In the explorative factor analysis, both the Kaiser's criterion and a scree plot inspection were used to determine the number of factors to be extracted. The data was screened for factorability using the Kaiser-Meyer-Olkin test, the Bartlett's sphericity test and anti-image matrix correlations.

Results

Basic psychometric properties

There were 212 medical students who fully completed the DASS questionnaire (97.7% response rate), with 120 females (56.6%) and 91 males 42.9% (one person did not indicate gender).

The basic psychometric properties of the DASS were conducted; the data are reported in Table 1.

Internal consistency

The Cronbach's alpha value of 21 items of DASS was 0.93 and for the three subscales were: Stress 0.85, anxiety 0.80, depression 0.86 (Table 2).

Construct validity

The values of Kaiser-Meyer-Olkin test (KMO=0.913) and Bartlett's sphericity test (χ^2 (210) = 2393, 757; p<0.0001) justified the use of the exploratory factor analysis. For all items anti-image correlation matrix was above 0.5, therefore there was no need to remove any of them. According to the Kaiser criterion, a four principal-component analysis with the 21 DASS items was suggested to determine structure validity (accounting for 61%, 95% of the total variance) (Table 3). On the basis of the scree plot examination, three factors were extracted, accounting for 56%, 68% of the total variance (Figure 1). In the interpretation of the scree plot, we adopted the principle of finding a point from which a slight decrease in Eigenvalues occurs to the right, and taking into account the number of factors to the left of this point [16].

We decided to perform exploratory factor analysis with four- and with three-factor structure. The results of EFA with three-factor structure are presented in the Table 4.

We received four factors with a varied number of items, factor 4 consisted of only three items: item number 1 "I found it hard to wind down", item number 12 "I found it difficult to relax" (both questions are belonged originally to stress subscale), and item number 2 "I

Table 3: Initial Eigenvalues and variances of each factor.

	Eigenvalue	% of explained variance	Cumulative % of explained variance
1	8,784	41,829	41,829
2	1,752	8,344	50,173
3	1,367	6,508	56,681
4	1,106	5,269	61,950
5	0,965	4,596	66,546
6	0,813	3,872	70,418
7	0,771	3,671	74,089
8	0,718	3,419	77,508
9	0,592	2,818	80,326
10	0,533	2,539	82,864
11	0,505	2,406	85,270
12	0,440	2,095	87,365
13	0,415	1,976	89,341
14	0,397	1,892	91,233
15	0,369	1,759	92,993
16	0,350	1,667	94,660
17	0,293	1,395	96,055
18	0,256	1,218	97,273
19	0,229	1,091	98,363
20	0,181	0,864	99,227
21	0,162	0,773	100,000

was aware of dryness of my mouth" originally belonging to anxiety subscale. In our opinion, these three questions did not create a subscale with specific properties that would make it stand out from the rest. Cronbach's alpha in this four-factor model was higher than 0.7 for the overall score and all factors except for factor 4 (Table 5).

Then we carried out EFA with three factors, i.e. the structure originally proposed by Lovibond and Lovibond. [1]. the results of EFA with three-factor structure are presented in Table 6.

In this case, we received set of three factors, each consisting of seven items. Factor 1 was the most correlated with items 21, 10, 16, 17, 13, 3 which originally created depression subscale, and with item 11 which originally created stress subscale. Factor 2 was correlated with items 4, 19, 7, 20, 15, 2 which originally belonged to anxiety subscale and with item 14 which originally created stress subscale. Factor 3 was correlated with items 6, 18, 8, 12, 1 which originally describes stress and with the item numbered 5 which originally belonged to the depression subscale and with the item 9 which originally belonging to the anxiety construct. Summarizing most items loaded on the expected factors similar to the original structures found by Lovibond and Lovibond [1]. The obtained three-factor solution accounted for 56.68% of total variance *vs.* 41.3% obtained by Lovibond and Lovibond. The Cronbach's alpha value of this three-factors model was 0.93 and for the three subscales were: factor 1 to 0.90, factor 2 to 0.80, factor 3 to 0.83.

However, item 5 "I found it difficult to work up the initiative to do things" was characterized as a stress symptom in this study but

Table 4: EFA results with four-factor structure.

	Items (original subscale)	Factor loadings			
		1	2	3	4
21	1 felt that life was meaningless (D)	0.84			
10	I felt that I had nothing to look forward to (D)	0.84			
16	I was unable to become enthusiastic about anything (D)	0.75			0.341
17	I felt I wasn't worth much as a person (D)	0.71			
13	I felt downhearted and blue (D)	0.66	0.361		0.335
3	I couldn't seem to experience any positive feeling at all (D)	0.61			0.557
5	I found it difficult to work up the initiative to do things (D)		0.67		
19	I was aware of the action of my heart in the absence of physical exertion (e.g., sense of heart rate increase, heart missing a beat) (A)			0.76	
4	I experienced breathing difficulty (e.g. excessively rapid breathing, breathlessness in the absence of physical exertion) (A)			0.74	
7	I experienced trembling (e.g. in the hands) (A)			0.68	
20	I felt scared without any good reason (A)			0.57	0.35
9	I was worried about situations in which I might panic and make a fool of myself (A)		0.522	0.343	
2	I was aware of dryness of my mouth (A)			0.301	0.46
15	I felt I was close to panic (A)	0.386	0.43	0.412	
6	I tended to over-react to situations (S)		0.689	0.305	
18	I found that I was rather touchy (S)		0.68		
8	I felt that I was using a lot of nervous energy (S)		0.538	0.335	0.439
1	I found it hard to wind down (S)				0.79
12	I found it difficult to relax (S)	0.355			0.71
11	I found myself getting agitated (S)	0.54	0.439		0.327
14	I was intolerant of anything that kept me from getting on with what I was doing (S)	0.306	0.466	0.47	
Scale variance [%]		20,49	14,72	14,50	12,24
Total scale variance [%] = 61,95					

The loadings <0.3 have not been displayed

D: Depression subscale; A: Anxiety subscale; S: Stress subscale

Table 5: Cronbach's alpha in this four-factor model.

Subscale	Cronbach's alpha
Factor 1	0.9
Factor 2	0.81
Factor 3	0.79
Factor 4	0.69
Total	0.93

was initially proposed as a depressive symptom. Three items (Item number 9 "I was worried about situations in which I might panic and make a fool of myself", item 11 "I found myself getting agitated" and item 14 "I was intolerant of anything that kept me from getting on with what I was doing") were loaded above 0.3 on more than one factor and the highest load was not for the correct factor.

Given the content of the questions and Cronbach's alpha value for different variants, we decided to reject questions 5, 9 and 14 and carried out another analysis based on a three-factor structure and eighteen elements. The results are shown in Table 7.

We received a set of 18 items, arranged in three factors. This analysis recreated the original layout on three subscales, with the exception of one element of anxiety, i.e. item number 15 "I felt close to panic." This time the item performed more-weakly to the correct anxiety scale than in previous data sets. Deleting three questions did not cause significant changes in Cronbach's alpha value (Table 8).

Discussion

This study explored the factor structure of the brief 21-item version of the Depression Anxiety Stress Scales. Our results of internal consistency indicated very good reliability and were comparable with those reported in other studies [3,17-21] and in study conducted by the scale developers [1].

From a structural viewpoint, our three-factor solution revealed better data organization than four-factor structural model and was similar to the originally structure found by Lovibond and Lovibond [1]. It is worth mentioning that some authors failed to maintain the three-factor model, they proposed other models with a different number of dimensions e.g. (one-dimensional [22], two-dimensional [17].

In terms of the arrangement of items, we have found some difficulties. Ten items were loaded on more than one factor, three of them (items 9, 11 and 14) were loaded the strongest on nominally unrelated construct. Finally, item number 5 was loaded only to one factor which was different than originally.

Similar discrepancies, especially regarding items from the anxiety and stress subscales, which simultaneously loaded on more than one factor were shown by other researchers [17,18,20,23,24]. In addition, in the DASS properties study (42 and 21) conducted by the developers [1], ten of 42 items were loaded into two factors, sometimes with a very small difference between the loading weights,

Table 6: EFA results with three-factor structure.

	Items (original subscale)	Factor loadings		
		1	2	3
21	1 felt that life was meaningless (D)	0.838		
10	I felt that I had nothing to look forward to (D)	0.827		
16	I was unable to become enthusiastic about anything (D)	0.789		
17	I felt I wasn't worth much as a person (D)	0.712		
13	I felt downhearted and blue (D)	0.693		0.42
3	I couldn't seem to experience any positive feeling at all (D)	0.673		0.33
5	I found it difficult to work up the initiative to do things (D)			0.657
4	I experienced breathing difficulty (e.g. excessively rapid breathing, breathlessness in the absence of physical exertion) (A)		0.782	
19	I was aware of the action of my heart in the absence of physical exertion (e.g., sense of heart rate increase, heart missing a beat) (A)		0.758	
7	I experienced trembling (e.g. in the hands) (A)		0.685	
20	I felt scared without any good reason (A)		0.637	
15	I felt I was close to panic (A)	0.398	0.435	0.415
2	I was aware of dryness of my mouth (A)		0.423	
9	I was worried about situations in which I might panic and make a fool of myself (A)		0.335	0.47
6	I tended to over-react to situations (S)		0.361	0.701
18	I found that I was rather touchy (S)			0.667
8	I felt that I was using a lot of nervous energy (S)		0.442	0.614
12	I found it difficult to relax (S)	0.444	0.448	0.465
1	I found it hard to wind down (S)	0.308	0.384	0.45
11	I found myself getting agitated (S)	0.575		0.506
14	I was intolerant of anything that kept me from getting on with what I was doing (S)		0.423	0.372
	Scale variance [%]	22.3	17.68	16.7
	Total scale variance [%] = 56.68			

The loadings <0.3 have not been displayed

D: Depression subscale; A: Anxiety subscale; S: Stress subscale

Table 7: EFA results with three-factor structure.

	Items (original subscale)	Factor loadings		
		1	2	3
21	1 felt that life was meaningless (D)	0.84		
10	I felt that I had nothing to look forward to (D)	0.83		
16	I was unable to become enthusiastic about anything (D)	0.79		
17	I felt I wasn't worth much as a person (D)	0.71		
13	I felt downhearted and blue (D)	0.69		0.42
3	I couldn't seem to experience any positive feeling at all (D)	0.67		0.33
5	I found it difficult to work up the initiative to do things (D)			0.66
4	I experienced breathing difficulty (e.g. excessively rapid breathing, breathlessness in the absence of physical exertion) (A)		0.78	
19	I was aware of the action of my heart in the absence of physical exertion (e.g., sense of heart rate increase, heart missing a beat) (A)		0.76	
7	I experienced trembling (e.g. in the hands) (A)		0.69	
20	I felt scared without any good reason (A)		0.64	
15	I felt I was close to panic (A)	0.398	0.44	0.415
2	I was aware of dryness of my mouth (A)		0.42	
9	I was worried about situations in which I might panic and make a fool of myself (A)		0.335	0.47
6	I tended to over-react to situations (S)		0.361	0.7
18	I found that I was rather touchy (S)			0.67
8	I felt that I was using a lot of nervous energy (S)		0.442	0.61
12	I found it difficult to relax (S)	0.444	0.448	0.47
1	I found it hard to wind down (S)	0.308	0.384	0.45
11	I found myself getting agitated (S)	0.58		0.506
14	I was intolerant of anything that kept me from getting on with what I was doing (S)		0.42	0.372
	Scale variance [%]	22.3	17.68	16.7
	Total scale variance [%] = 56.68			

The loadings <0.3 have not been displayed
D: Depression subscale; A: Anxiety subscale; S: Stress subscale

Table 8: Comparison of Cronbach's alpha values for different variants.

Subscale	Cronbach's alpha for the original DASS-21	Cronbach's alpha for our 21-item DASS model with three factors	Cronbach's alpha for our 18-item DASS model with three factors
Depression	0.86	0.9	0.91
Anxiety	0.8	0.8	0.75
Stress	0.85	0.83	0.86
Total	0.93	0.93	0.92

e.g. 0.34 to anxiety subscale *vs.* 0.41 to proper stress subscale for the question "I felt that I was using a lot of nervous energy" and 0.38 to anxiety subscale *vs.* 0.40 to proper stress subscale for the question "I was in a state of nervous tension". It may be explained by the fact that as was mentioned before, depression, anxiety, and stress are treated as psychological distress along three dimensions. Existing concepts regarding negative affective states speak about their mutual overlap, especially the dimension of anxiety and stress. This was confirmed by the analyses by Lovibond and Lovibond [1]. That while the DASS successfully discriminates between three negative emotional syndromes, these syndromes are still correlated with each other, and in particular the stress scale is more closely associated with anxiety than with depression [1].

Also, the situation in which some items loaded the wrong factor the most has already been encountered by other authors [17,18,20,22], including Lovibond and Lovibond [1]. On the original scale, the question "I feared that I would be" "thrown" by some trivial but unfamiliar task had a higher factor weight in the stress subscale than in the proper anxiety subscale. Lovibond and Lovibond [1] explained that the allocation of objects was based primarily on logical considerations and could not be defended as an optimal solution. An explanation based on cultural factors regarding the concept of sensitivity should also be considered.

The last issue that required analysis was improper loading of item number 5. Similar problem was encountered by Vignola and Tucci [18] and concerned the item 18, Apostolo et al. [17] and concerned questions 6 and 9, Tonsing [20] and concerned the questions 3, 4 and 5. Also Alfonsson et al. [25] postulated that removal the questions 2, 5 and 8 improved the overall fit in two out of three study groups. Analyzing our results, it can be concluded that the study participants
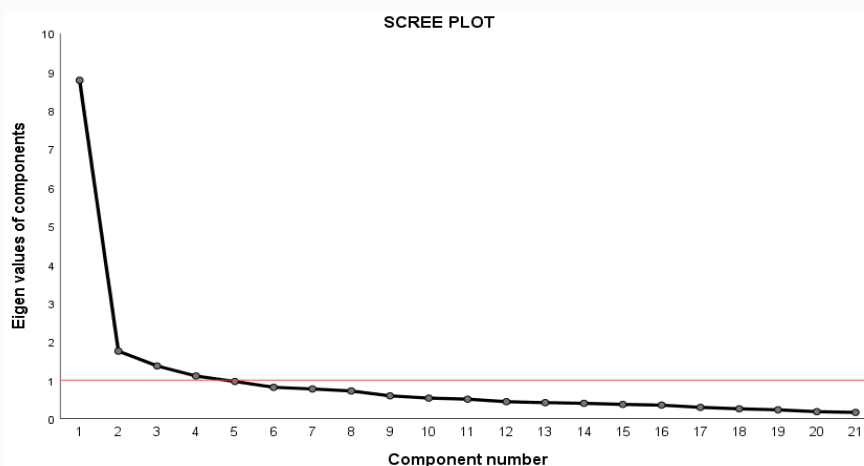
Figure 1: Eigenvalues of DASS - scree plot.

understood this question in such a way that someone is not able to start any activity because he is so stressed.

Finally, we decided to remove questions number 5, 9 and 14. We think that maintaining these items may reduce the ability to measure three related conditions separately, i.e. depression, anxiety and stress. What's more, conducting another factor analysis after removing these items allowed us to reconstruct the original set of questions except for question 15 that previously charged the anxiety factor correctly. The new 18-item version of the DASS obtained in this study could be a reliable tool for assessing depression, anxiety and stress in Polish conditions, but it requires confirmation in the next examination.

A modified version of DASS-21 (renamed DASS-14) was proposed by Wise et al. [26] as the most suitable for research among healthcare professionals. A modified 18-item version of the DASS scale was proposed after Rasch analysis by Shea et al. [27]. Other published, modified versions of DASS-21 are the DASS-12 described by Osman et al. [23] and DASS -17 by Ali and Green [22].

Conclusion

The best of our knowledge, this is the first study which examine the factor structure of the Polish version of the DASS-21 in a non-clinical adult sample. The present study shows following findings: (1) the internal consistency of the Polish version of the DASS is very good (2) we maintained the three factor model of the DASS after removing three questions (4) difficulties we encountered during the analysis were similar to those reported by other authors including the creators of the scale.

We are going to confirm the obtained modified DASS-18 in another study on a different population with the use of confirmatory factor analysis.

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