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Confirmatory Factor Analysis of Persian Version of Depression, Anxiety and Stress (DASS-42): Non-Clinical Sample

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Abstract

Background: Based on historical viewpoint, relationship among depression, anxiety and stress attracted clinical and theoretical consideration. Despite the relative overlap of these psychological disorders in general, these three syndromes are distinctive in terms of theoretically and conceptually aspects.
Objectives: The aim of current study is investigation confirmatory factor analysis and psychometric characteristics of Iranian version of depression, anxiety and stress scale (DASS-42) in student's population.
Methods: The student sample n = 664 studied in current study. The method of estimation Weighted Least Squares (WLS) used to investigate the confirmatory factor structure of this sample. NNFI, RMR, RMSEA, CFI, AGFI, GFI, ECVI, X2, X2 / df, were used to assess the adequacy of model fitness with data. In this study, MMPI -2 questionnaire, Cattell anxiety scale, and Beck depression inventory were used as criterion validity.
Results: The results suggest DASS-42 scale had satisfactory internal consistency, test-retest validity and concurrent reliability. The results showed three factors with first class fitted better with data and DASS-42 scale had desirable construct validity of student sample.
Conclusions: The results showed confirmatory factor structure and validity of this tool for application usages and clinical diagnosis are acceptable.

Keywords: Depression, Anxiety, Stress

1. Background

Depression and anxiety are among the most common mental disorders in human society. Although these emotional states are conceptually distinctly different, but high level of concomitant is always considered for clinicians and researchers of psychology and psychiatric. Thus, theorists and researchers have been trying to use theoretical progress in field, to explain this issue. In this regard, Clark and Watson (1) indicated to common variance and also specific variance between these two states in order to specify similarities and differences between these two emotional states by presenting tripartite anxiety and depression models. In fact, extensive studies showed anxiety and depression symptoms have high overlapping in young people (2).

Anxiety arises based on understood danger. In other words, anxiety seems as 'being afraid'. Thus, in order to keep us from understood danger we need self-protection mechanism. Therefore, symptoms of stress will be created by body as a reaction (3). People used stress as a common word in many difficult situations. It considered as a real problem. There is a difference between stress and anxiety that made them dissimilar. Stress is a reaction to a threat in a situation. Anxiety is a response to stress. It is important to think about stress as a wear and tear (4). Often, when a person faced with too much unresolved stress, it can be understood as depression. Additionally, depression may happens in overwhelming situations. Both stress and depression have mild, moderate or extreme styles. The person does not enjoy activities and feels sad when he faces with depression. Furthermore, lacking energy is another sign of depression (3).

Investigators need a tool can assess all core symptoms

of anxiety and depression. So that differentiate these two emotional states (5). Beck depression inventory (BDI) and Beck anxiety inventory (BAI) used to measure anxiety and depression (6). Although these instruments are sensitive and precise to measure the level of anxiety and depression, but these tools do not have ability to separate third state (Stress) (7). Various studies showed the high concurrent validity between this scales and DASS subscales (8). Most of available instruments in this field are faced with criticisms (9).

Depression, anxiety and stress scales (10), are most widely popular instruments in assessing negative emotions in adults. It overcomes shortcomings and criticisms. There are two versions of the depression, anxiety and stress scale (DASS). The version with 42 questions consisted of 14 questions related to signs and symptoms of depression, 14 questions about anxiety, and 14 questions related to stress. The version of 21 questions is the subset of version with 42 questions. There are 7 questions to assess each subscale. The individual score of related items summed and multiplied by number 2 in order to obtain total score and scores on each subscale in the short version. This version is comparable to DASS-42 through multiplied by number 2 (11). Questions of this scale are related to last week and rated from 0 (does not apply in my case) to 3 (applicable in my case) (12).

Results of different studies in internal consistency, convergent validity, and divergent validity among different ethnic groups were similar with clinical and non-clinical populations. In fact, a lot of studies evaluated the psychometric properties of DASS. This showed that DASS is a valid and reliable instrument in clinical and general population (13).

DASS were translated and used in Iran. Psychometric features of the form with 42 items were studied in Iran on the high school students. The exploratory factor analysis used for the study. The results showed the correlation of depression subscale with BDI as 0.849; the correlation of anxiety subscale with anxiety test was reported as 0.831 and the correlation of stress subscale with student stress as 0.757 (14). In another study form with 42 questions of this questionnaire run on 420 adults (18 - 56 years) with BDI and the four- systems anxiety questionnaire. The results of exploratory factor analysis confirmed three-factor structure of DASS. Furthermore, findings show a correlation of subscales for the depression scale with BDI and anxiety subscale with four subscales of four- systems questionnaire. The overall score is in group from moderate to strong correlation (15). The form with 42 questions measures assessing validity in 2006 and the alpha coefficient was reported for depression, anxiety and stress as 0.89, 0.84 and 0.68 respectively. But no study has been done on confirmatory factor structure. The strength is the differentiation of three structures of depression, anxiety and stress in Iran.

2. Objectives

The aim of current study relates to investigation confirmatory factor analysis and psychometric characteristics of Iranian version of depression, anxiety and stress scale (DASS-42) in the field of student population.

3. Methods

A data pool from university students were collected by convenience sampling method. The sample consisted of 664 students, 55.4% females, aged between 18 and 38 years (mean = 20.2, SD = 1.9). The instruments were used are presented as follow.

The student information were collected from Shahid Beheshti university campus at Tehran. Participants filled out DASS, MMPI-2, BDI and CAS.

3.1. Minnesota Multiphasic Personality Inventory (MMPI -2)

MMPI-2 is a widely used questionnaire to assess psychological functioning (16). We used the Persian translation and Persian norm scores of MMPI-2 for this study. The MMPI-2 is a 567-item true–false questionnaire. Psychological functioning measured by ten clinical scales. In this study we used only these clinical subscales: hypochondria, depression and psychasthenias. Higher scores indicate less functioning. The functioning reflected in T-scores. A T-score of 65 or higher interpreted as a score in clinical range (17). The reliability coefficient of scales for main test are 0.70 and 0.80 with split method. The correlation coefficient of scales are 0.50 and 0.90 with test-retest method (18). The minimum reliability coefficient was among 0.43 to 0.89. The maximum test-retest coefficient was between 0.42 and 0.76. There was convergent validity between subscales of MMPI-2 subscales and EPQ-RS, SCL-90 (19).

3.2. Cattell Anxiety Scale (CAS)

The anxiety scale contains 40 questions. This tools provide as a short questionnaire. The total score of first 20 questions shows hidden anxiety and the other 20 questions shows the overall anxiety. This scale was normed by Dadsetan and colleagues among 24894 students population (20). The validity of the test was done through test-retest method. It is reported always higher than 0.70. It is capable of distinguishing between Anxious and non-anxious (21). Salary Far and Poor Etemad calculated reliability of the questionnaire using Cronbach's alpha. Alpha coefficient obtained for the subscales were 0.59 for hidden anxiety, 0.69 for apparent anxiety and 0.77 for whole scale (22).

3.3. Beck Depression Inventory (BDI)

The BDI-II is a 21-item self-report measure assesses common depressive symptoms. The recommended interpretive guidelines score from 0 to 29 (23). Psychometric studies on second edition of the questionnaire show this edition has appropriate reliability and validity. The internal consistency of instrument reports 0.73 to 0.92. The alpha coefficient reported 0.86 for patients group and 0.81 for non-patient (24). Results showed Cronbach's alpha 0.78 and test-retest reliability 0.73 in a study on 125 students (25).

3.4. Depression, Anxiety and Stress Scale (DASS-42)

The DASS is a self-administered instrument with well-established psychometric properties (26, 27). The results of study showed the results of equity stressors, depression and anxiety 9.07, 2.89, 1.23 respectively. The alpha coefficients for these factors were 0.97, 0.92 and 0.95 respectively. The results of calculation of the correlation between factors showed the correlation coefficient 0.53 between anxiety and stress and 0.28 between anxiety and depression.

A series of Linear Structural Relations using LISREL, version 8.54 applied to examine three-factor structure of DASS-IR. Confirmatory factor analysis offers a variety of statistical tests. It indices designed to assess "goodness-of-fit" of identified models (28-30)). The goodness-of-fit evaluated using the following statistics: goodness-of-fit index (GFI > 0.85), adjusted goodness-of-fit index (AGFI > 0.80), non - normal fit index (NNFI > 0.90), comparative fit index (CFI > 0.90), root mean square residual (RMSR < 0.10), normal chi-square ($3 > \chi^2 / df < 2$) and root mean square error of approximation (RMSEA). Itis 90% interval confidence (31-33). The concurrent validity is investigated by the correlations between DASS-IR scores with BDI, MMPI-II (Pt, D, HS), and CAS. Intra-class correlation coefficients was calculated at two-time points over two weeks in order to evaluate test-retest reliability of the DASS-IR, for the total scale and three subscales. Cronbach alpha coefficients calculated for total DASS-IR score and subscale (31). The LISREL model showed in Figure 1.

Table 1. Means, Standard Deviations, Internal Reliability Coefficients, and Mean Inter-Item Correlations DASS-IR Scales

Varietals	Stress	Anxiety	Depression	DASS-IR
Total				
M	14.62	9.64	10.11	33.41
SD	9.5	8.1	9.8	25.06
α	0.92	0.89	0.94	0.97
r	0.46	0.38	0.53	0.41
Female				
M	15.55	10.08	10.79	35.58
SD	10.2	8.5	10.7	27.1
α	0.94	0.90	0.95	0.97
r	0.52	0.40	0.58	0.45
Male				
M	13.47	9.10	9.22	30.74
SD	8.3	7.4	8.6	22.0
α	0.89	0.88	0.92	0.96
r	0.38	0.35	0.46	0.36

4. Results

The findings of this study presented based on research questions as follow:

4.1. What is the Factor Structure of DASS?

The statistical fitness of three models tested with study data using software LISREL8.7 (32). Model 1 includes single factor model with loading 42 questions on a general single factor entitled general stress index; Model 2 contains independent three factors model with loading 14 questions on three factor orthogonal model under depression, anxiety and stress. Model 3 includes dependent three-factor oblique model with loading 14 questions on dependent three factors. Given the assumption of in violation of maximum distribution most of the questions, the resistant regulate violated maximum likelihood robust procedure used to estimate of model. The following indices are for fitness model: Satorra-Bentler Scaled chi-Square (χ^2), the ratio of the chi-square on degree of freedom (df/χ^2), goodness of fit index (GFI), adjusted goodness of fit index (AGFI), comparative fit index (CFI), root mean square error of approximation (RMSEA) and Root mean square residual (RMR).

The investigation of the differences for fitness three models indicated model 2 have better fit than model 1 ($P < 0.0001$,$df = 2$, $\chi\Delta^2 = 389.8$). In other words, results of study support three factor model orthogonal in contrast with general single factor. But examining differences of goodness in model 2 and 3 (10) by loading 14 questions on three-factor oblique model through chi-square Anderson test showed model 2 has a better fit to data ($P < 0.001$, $df = 1$, $\chi\Delta^2 = 110.57$).

Examining the goodness indices of model 2 showed appropriate goodness with data relatively. If the chi-square test is not statistically significant, indicating a very good fit. However, the index of sample greater than 100 often is significant. Therefore it is not a good indicator to measure

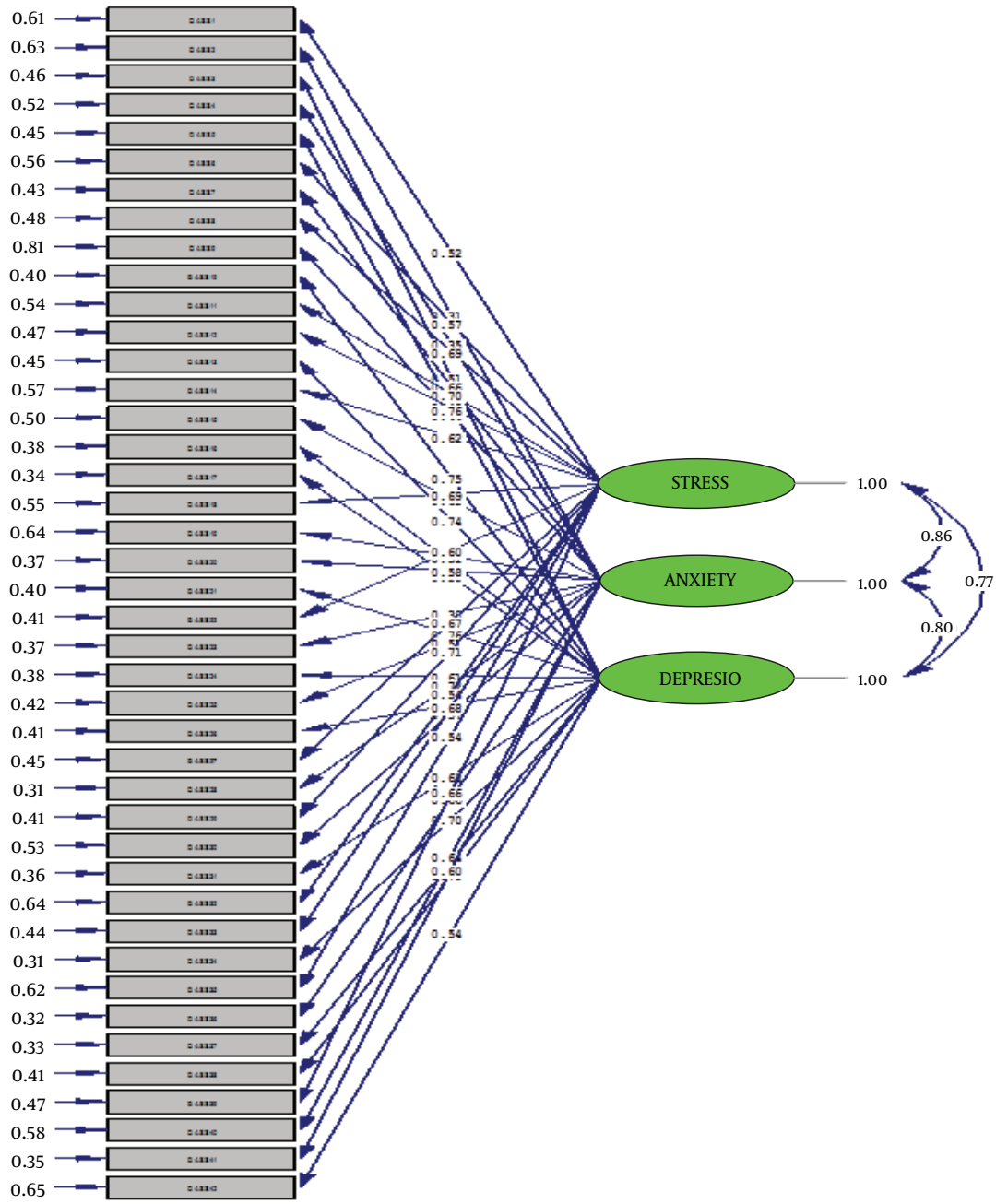

Figure 1. Figure 1

the fit of model. If the ratio index of chi-square on degree of freedom is less than 3, it indicates a very good fit. The indices of RMSEA and RMR are smaller than 0.05; it indicated the optimum fit. If it is smaller than 0.08, it refers to appropriate fit (32).

Thus, indices of CFI, AGFI, GFI implies on a very appropriate fit. The indices of RMSEA and RMR implies the appropriate fit. The goodness does not have satisfaction based on ratio of chi-square on degree of freedom (Table 2).

Table 2. Results of Calculated Indices for Confirmatory Factor Analysis of DASS

Model	$\chi^2\Delta$	χ^2 Satorra-Bentler	df	df/χ^2	GFI	AGFI	CFI	RMSEA	RMR
1	389.8	4423.45	819	5.40	0.75	0.73	0.93	0.081	0.051
2	-110.57	4033.65	818	4.93	0.77	0.75	0.95	0.077	0.05
3		4144.22	819	5.06	0.80	0.78	0.96	0.078	0.049

4.2. Whether DASS Has Satisfactory Validity?

Cronbach's alpha used for validity of the DASS subscales. The results of Cronbach's alpha showed validity of total score of stress and each of subscales of depression, anxiety and stress for the total normal group 0.97, 0.94, 0.89, 0.92 respectively; 0.96, 0.92, 0.88, 0.89 for male students; 0.97, 0.95, 0.90 and 0.94 for female students. Test-retest validity coefficient achieved 0.80 for total stress, 0.78 for depression subscale, 0.72 for anxiety subscale and 0.74 for stress subscale. These scores of correlation showed the stability of DASS index scores over time.

4.3. Whether DASS Has a Simultaneous Convergent Validity with BDI; Cattell Anxiety; D, PT and HS Subscales of MMPI-2?

To determine the convergent validity of index DASS test on 30 students, results of multiple correlation matrix (Table 4) showed that there is a positive significant relationship between the temperament health characteristics of students including stress, anxiety and depression with BDI, anxiety, and subscales of D, PT and HS for MMPI- 2 and all achieved coefficients were significant at 0.01.

5. Discussion

The results of this study confirmed the results of previous studies. The Statistical goodness of three theoretical models with data of study using confirmatory factor analysis showed that model 2, had a better goodness. However, investigation the differences of goodness for model 2 and 3 by chi square Anderson test showed that model 2 has better goodness. This result is in line with study by Lovibond and Lovibon (10). It identified three factors model with exploratory and confirmatory factor analysis. The above study showed that the three factors orthogonal model coincide with data among three model. Although DASS has done total successful for the separation of these three negative emotions, but there is still a moderate correlation between these three factors.

The results of the exploratory factor analysis showed (15) 14 phrases for stress placed on a single factor, 2 phrases of depression, 2 phrases of anxiety placed on three factors of stress, anxiety and depression had high loading factor; after removing these four phrases, results of exploratory factor analysis confirmed three factors structure. The study of Afzali et al. (14), also achieved three-factors model by eliminating one of the factors related to anxiety subscales. Moreover, this result is consistent with the study by Bayram and Bilgel (8), Szabo (5) and Webster et al (7).

Cronbach's alpha and Guttman-halve validity coefficient used to investigate the validity of DASS subscales. The results showed validity of total score of stress and each of subscales for male and female students groups. The correlation between DASS and BDI, Cattell anxiety scale and depression, hypochondria and psychasthenia subscales of MMPI-2 were used for studying the convergent validity. The results showed a significant positive correlation between DASS subscales questionnaire with each of above subscales. There is a high correlation between BDI and DASS depression subscales (r = 0.72); while although correlation is significant between the MPPI depression subscales and DASS depression (r = 0.37), but the correlation is less. In explaining this result, it can be said questions of depression subscale of DASS identified more by lack of self-confidence, weak motivation and weak possibility in accessing important goals for individuals. There are no ways to measure the physical symptoms; while depression scale of MMPI has more words to measure the physical symptoms. Although the correlation of anxiety scale with Cattell anxiety questionnaire (r = 0.55) is significant, but it is less than BDI and psychasthenic. The correlation between anxiety and BDI is reported 0.58. The stress subscale has the most correlation with PT subscale (r = 0.61). As stress scale evaluate tension, restlessness and negative affect. There is somewhat comorbidity with psychasthenic evaluates the restlessness and mental weakness. So the results of the investigation in convergent validity DASS on 664 students demonstrated the confirmed convergent validity of DASS subscales.

Investigations carried out on the reliability and validity of DASS. It is suggested this scale has satisfactory reliability and validity. It used as the tool for rapid evaluation and selection of mood states of students in the health care area and educational field.

It should be noted some of the limitations of this work contain the following items. The lack of interview protocol based on principles of DSM-5 for the investigation of accurate diagnosis validity of this test. Determination the cut-off points are the main limitations of the study. It is sug-

Table 3. Parameter Estimates from Confirmatory Factor Analysis[a]

Items	P.S.	R^{2} [b]	Z.S.S[c]
Factor 1: Stress			
1. I found myself	0.52	0.27	0.43
6. I tended to over	0.57	0.32	1.67
8. I found it difficult	0.69	0.48	4.54
11. I found myself	0.70	0.49	1.81
12. I felt I was	0.76	0.58	2.94
14. I found myself	0.62	0.38	1.86
18. I felt I was	0.69	0.48	2.69
22. I found it hard	0.60	0.36	4.50
27. I found I	0.67	0.45	5.19
29. I found it hard	0.71	0.50	3.62
32. I found it	0.54	0.29	2.50
33. I was in a state	0.68	0.46	6.00
35. I was intolerant	0.54	0.29	2.43
Factor 2: Anxiety			
2. I was aware of	0.31	0.10	6.16
4. I experienced	0.35	0.12	10.80
7. I had feeling	0.66	0.44	8.28
9. I found myself	0.44	0.19	0.66
15. I had feeling	0.65	0.42	4.12
19. I perspired	0.51	0.26	8.60
20. I scared	0.58	0.34	9.61
23. I had difficulty	0.38	0.14	11.61
25. I was aware	0.51	0.26	8.57
28. I felt I was close	0.72	0.52	6.31
30. I feared	0.57	0.32	6.52
36. I felt terrified	0.66	0.44	9.08
40. I worried	0.64	0.41	4.02
41. I experienced	0.60	0.36	9.05
Factor 3: Depression			
3. I couldn't seem	0.51	0.26	6.63
5. I couldn't	0.49	0.24	8.00
10. I felt I had	0.75	0.56	6.98
13. I felt sad	0.74	0.55	2.89
16. I felt I had	0.75	0.56	7.03
17. I felt I wasn't	0.59	0.35	10.34
21. I felt life	0.76	0.58	7.56
24. I couldn't seem	0.61	0.37	6.66
26. I felt down	0.72	0.52	3.56
31. I was unable	0.68	0.46	6.69
34. I felt I was	0.70	0.49	10.00
37. I could see not	0.75	0.56	8.16
38. I felt life	0.79	0.62	8.90
42. I found it	0.54	0.29	4.21

Abbreviations: P.S., Parameter Estimation items in study; P.S.C., Parameter Estimation study Crawford; P.S.L., Parameter Estimation study of Loviboond.
[a] $P < 0.05$.
[b] R^{2}, Coefficient Determination of parameter estimation items.
[c] Z.S.S, Univariate test Normality for linear transformed Skewness.

Table 4. Multiple Correlation Matrix of DASS Index[a]

Variables	DASS Subscales		
Convergent Scales	**Stress**	**Anxiety**	**Depression**
Beck Depression	0.28[b]	0.60[b]	0.72[b]
Cattell Anxiety	0.36[b]	0.55[b]	0.60[b]
D Scale-MMPI-2	0.53[b]	0.35[b]	0.37[b]
PT D Scale-MMPI-2	0.61[b]	0.59[b]	0.56[b]
HS D Scale-MMPI-2	0.44[b]	0.49[b]	0.38[b]

[a] $P < 0.05$.
[b] $P < 0.01$.

gested conducting clinical interview and checklist according to questions of this scale for diagnosis of anxiety, depression and stress in future studies. Also, it is determined for each clinical group of DSM-5 axes according to mental disorders, chronic physical, acute and cut-off point developmental. It is suggested to use the clinical diagnostic for the investigation of diagnostic validity of this scale in the measure of identifying power of these groups. The results showed confirmatory factor structure and validity of this tool for application usages and clinical diagnosis is acceptable.

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