Smyrna Tıp Dergisi *Araştırma Makalesi*

The Confirmatory Factor Analysis Of Beck Depression Inventory-II Scores Among Prelicense and License Students in a Turkish Universıty Based Primary Care Setting

Bir Türk Üniversitesi Lisans Ve Önlisans Öğrencileri Arasında Birinci Basamak Ortamında Beck Depresyon Envanteri-II Skorlarının Doğrulayıcı Faktör Analizi

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Abstract
Objective: To dispose the confirmatory factor analysis of Beck Depression Inventory-II amongst 610 voluntary prelicense and license students in a Turkish University Based Primary Care Setting.
Material and Method: A sociodemographic interview applied simultaneously with Turkish translated Beck Depression Inventory-II (BDI-II-T) to the students. The study was performed between September and October 2006 in Celal Bayar University, Faculty of Education. SPSS 16.0 statistical program, Lisrel 8.3, varimax rotation, Student's t test, Kaiser-Meyer-Olkin measure and confirmatory factor analysis were used for the data assessment.
Results: 38.1% were male, 61.9% were female. Depression prevalence was found 12.4%. Smoking rate was found 45.2% and alcohol drinking 30.6%. For the prelicense students; BDI-II-T had χ^2/df:1.93, GFI (Goodness of Fit Index):0.93, RMSEA (Root Mean Square Error of Approximation):0.05. For the license sample, χ^2/df:1.60, GFI (Goodness of Fit Index):0.94, RMSEA (Root Mean Square Error of Approximation):0.04.
Conclusion: In the confirmatory factor analysis of BDI–II, license students had higher good fit indexes than prelicense university students.
Keywords: Beck Depression Inventory-II, confirmatory factor analysis, depression.

Özet
Amaç: Beck Depresyon Envanteri-II'nin**,** bir Türk Üniversitesi birinci basamak sağlik tesisinde, 610 gönüllü lisans ve önisans öğrencisindeki konfirmatuar faktör analizini göstermek.
Gereç ve Yöntem: Öğrencilere sosyodemografik sorgulama ile eş zamanlı olarak Türkçe'ye çevirisi yapılmış Beck Depresyon Envanteri-II (BDI-II-T) uygulanmıştır. Çalışma Eylül ve Ekim 2006 tarihleri arasında Celal Bayar Üniversitesi Eğitim Fakültesi'nde gerçekleştirilmiştir. Verilerin değerlendirilmesinde; SPSS 16.0 istatistik programı, Lisrel 8,3, varimax rotasyon, student's t testi, Kaiser-Meyer-Olkin measure ve konfirmatuar factor analizi uygulanmıştır.
Bulgular: Katılımcıların %38,1'I erkek, %61,9'u kadındır. Depresyon prevalansı %12,4 olarak bulunmuştur. Sigara kullanım sıklığı %45,2 ve alkol kullanımı %30,6 olarak bulunmuştur. Önlisans öğrencileri için BDI-II-T χ^2/df:1.93, GFI (Goodness of Fit Index):0.93, RMSEA (Root Mean Square Error of Approximation):0.05 ; lisans öğrencileri içinse χ^2/df:1.60, GFI (Goodness of Fit Index):0.94, RMSEA (Root Mean Square Error of Approximation):0.04 olarak tespit edilmiştir.
Sonuç: BDI-II için konfirmatuar faktör analizinde, lisans öğrencileri önlisans öğrencilerine göre daha yüksek indeks değerleri gösterdiler.
Anahtar kelimeler: Beck Depresyon Envanteri-II, konfirmatuar faktör analizi, depresyon.

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Introduction

Depression is one of diseases that was encountered mostly since many years. DSM-IV describes depressive disorders under 'Mood Disorders' and it is categorized as a major depressive disorder, dysthymic disorder and depressive disorder not otherwise specified (1). They are kind of severe episode of mood disorders that manifests across the life span (2).

It is an important public-health problem and one of the leading causes of disease burden worldwide (3). According to World Health Organization data, it is still a leading cause of decreased quality of life and increased mortality and is the second most important health issue for individuals aged 15 to 44 years worldwide (4). At the same time, it is the most commonly reported psychiatric disorder between teenagers and a highly important group

in primary care (5,6). As all over the world, it is a substantive pathology with a high prevalence in Turkey, especially among the university youth (7).

To predict the depression prevalence in randomly selected samples, some self-report assessment tools have been used for a long time. The most commonly used are Beck Depression Scale, Zung Depression Scale, Hamilton Depression Scale, Montgomery Asberg Depression Scale, Beck Hopelessness Scale, Multiple Oriented Depression Inventory, Automatic Thoughts Questionnaire, Depression Scale for Elderly, Hospital Anxiety and Depression Scale (8).

Among depression scales mentioned above; the most popular of them is Beck Depression Inventory which had been developed by Beck et al. in 1961 (BDI-I) and revised in 1996 (BDI-II) (8,9,10,11). BDI-II is constituted of 21 questions revealing most common depressive mood states observed in patients diagnosed with depression. Scale is degreed between 0-3 according to the density of the attitudes. Worldwide 17 points is accepted as the critical level to detect clinic depression. We can categorize depression according to these score dissociation as;

1. Mild Depression. (11-17 points)
2. Moderate Depression. (18-29 points)
3. Serious Depression. (30-63 points) (8).

BDI is one of the most useful measures for depression in many countries. In Turkey, there are two important studies to adapt BDI Turkish version (12,13). However, we couldn't found more in depth analysis of the instrument with Turkish university youth.

Factors of the Beck Depression Inventory found in the factor analysis, could have different number and property according to many different populations. In many studies, factor analysis of the Beck Depression Inventory-II have frequently produced 2 different 2-factor oblique structures.

Prelicense students are those who take 2-year education, which is also called 'vocational school' students who are generally graduated from vocational high schools. License students are those who take 4-year education after high school.

This study is performed in Celal Bayar University, Faculty of Education. Faculty of Education lies in a midtown 160 km. distant to Manisa City where cultural and socioeconomic facilities are limited for the university youth.

In this study, BDI-II data were analyzed by means of confirmatory factor analysis to test whether the factor structure model with three-factor analysis has a good fit and tried to provide comparative data for use with similar patient populations. At the same time, it was aimed to find out the depression prevalence and related factors for the university youth in a university based primary care setting.

Material and Method

This study was performed in September 2006 (for a period of two-months). Among 900 students, 610 voluntary were selected randomly in a university based medical clinic of the Educational Faculty at Celal Bayar University, Turkey. All the subjects gave informed consent. The study has local ethic commission approval. A sociodemographic interview applied simultaneously with Turkish translated Beck Depression Inventory-II (BDI-II-T) to the students in an appropriate duration. This research addressed the issue through the assessment of the psychometric properties of the BDI-II by means of factor analysis. By the way, an exploratory factor analysis was conducted using principal axis factoring with a varimax rotation and Kaiser normalization. Examination of the eigenvalues indicated an essentially factor structure for the Turkish BDI-II. Data were computed and analyzed by Statistical Package for the Social Sciences (SPSS 16.0, Chicago, IL) statistical program and Lisrel 8.3. Numerical data were expressed as arithmetical means±standard deviations (SD) and in numbers and percentages. Bivariate correlation tests were used for comparison of item score versus total score. Student's t test was used for imposing sexual differences. Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett's test of sphericity, principal component analysis and varimax rotation were used for factor analysis. A p-value of less then 0.05 was considered statistically significant.

Results

Six hundred and ten students who were randomly selected out of 900 students participated in the study. In the study, overall percentage of depressive disorder was 12.4. 8.4% of all students had mild depression, 3.8% moderate depression and 0.2% severe depression. Among prelicense students; depression score was 13.39±5.40 for mild depression and 21.09±5.62 for moderate depression. Among license students; depression score was 12.64±5.40 for mild depression, 21.25±5.43 for moderate depression and 32±0.00 for serious depression. 61.9% of the students (n:378) were female and 38.1% of them (n:232) were male. Their average age was determined to be 18.12±1.35 (Min-max: 16-20). Students, taking education in vocational schools (46.3%) are the prelicense students and students taking education in faculty of education (53.7%) are license students.

At the same time, 48.5% of the students (n:296) were attending to a daytime education and 51.5% of the students (n:314) were attending to an evening education. Most of them (71.5%) were living in the city center. When the familial monthly income were analyzed, 48.6% were gaining <333$. Four hundred six students (66.6%) had sibling ≤1. According to maternal and paternal education levels, primary school was found to be the common. Some of the sociodemographic features of the subjects are listed in Table 1.

Table 1. *Some of the sociodemographic features of the students in our study group*

Students	n	%
Male	232	38.1
Female	378	61.9
Dwelling		
Village	92	15.1
Small town	82	13.4
City center	436	71.5
Familial Monthly Income		
<333$	297	48.6
333-666	215	35.3
>666$	98	16.1
Number of siblings		
≤ 1 sibling	406	66.6
2-3 sibling	74	12.1
>3 sibling	130	21.3

At the same time, we tried to find out some medical characteristics that could be related with depression in the university youth. Smoking was noted in 45.2% of students (n:275). In addition, alcohol drinking (1 glass/wk.) habit found in 30.6% (n:193) of the students. There was a familial depression history in 3.6% (n:22) of the students. Moreover; familial addiction history (smoking/drinking) was 28.2% (n:172) (Table 2).

Table 2. *Medical characteristics of the subjects*

	N	%
Smoking	275	45.2
Alcohol drinking (1 glass/wk)	193	30.6
Familial depression history	22	3.6
Familial addiction history (smoking /drinking)	172	28.2

According to sociodemographic features, families with higher monthly income and higher level of education, reside in cities (all p<0.01). Families with higher income had much less children (p<0.01). There was a significant relation between decrease in sibling number and increase in suicidal risk (p<0.01). Students with higher familial monthly income and higher parental education, are trained in evening education (p:0.041). Daytime education students' monthly family income was found less than of evening education students' (t:2.017, p<0.05). Evening education students' mother and father education level were found higher than of daytime education students (respectively mother: t:2.017, p<0.05; father: t:3.209, p<0.01). In comparison of depression prevalence, no difference was found among Faculty of Education and Vocational School students. While prelicense students come from cities, license students come from much more small areas (midtown, village) (Somer's d:-0.135, t:3.536, p<0.01). Students in the faculty of education had fathers much more educated than those in vocational school (t:2.674, p<0.01). License students had much more siblings than prelicense students (t:3.766, p<0.01). Prelicense students had much more feelings of past failure than license students did (t:2.069, p<0.05). Prelicense students had much more guilt feelings than license students did. Prelicense students had much more sleeping changes than license students did (t:2.381, p<0.05).

Loss of interest was meaningfully higher in smoking students then non-smokers (p:0.028). Besides; there was a statistical meaning between familial depression history and familial addiction history (smoking/drinking) (p:0.018)

We thought that, there could be some differences between prelicense and license students because of their educational status. Because of this, we evaluated students in two different groups (prelicense and license groups). Among prelicense freshmen, internal consistency of BDI-II-T α Cronbach was 0.813. Kaiser-Meyer-Olkin (KMO) test value (KMO:0.785) and Bartlett's test of sphericity (p:0.000) had allowed us to do factor analysis. With principal component extraction and varimax rotation method with Kaiser Normalization, we found 7 factors for prelicense students. Among license freshmen, internal consistency of BDI-II-T α-Cronbach was found 0.808. Kaiser-Meyer-Olkin (KMO) test value (KMO:0.684), and Bartlett's test of sphericity (p:0.000) had allowed us to do factor analysis. With principal component extraction and varimax rotation method with Kaiser Normalization, like prelicense freshmen, we found 7 factors.

We performed varimax rotated iterated principal factor analysis of BDI-II-T for prelicense student sample. For this group; after the rotation, the eigenvalues over 1 were found 3.372, 1.891, 1.847, 1.618, 1.526, 1.463 and 1.405. Among these 7 factor weights, 0.40 was considered as criteria value. According to this criteria value, only 3 factors had been found interpretable (Table 3). Other factors were found dispersedly related to main 3 factors. Totally explained variance was 64.8%. Factor 1 (item no.12: loss of interest, item no.19: weight loss, item no.14: worthlessness, item no.18: changes in appetite, item no.17: fatigue, item no.15: loss of energy, item no.16: changes in sleeping, item no.2: agitation) was considered somatic-depressive, factor 2 (item no.15: loss of energy, item no.10: crying, item no.21: loss of sexual interest, item no.8: self-criticalness) affective and factor 3 (item no.3: past failure, item no.6: punishment feeling, item no.8: self-criticalness, item no.13: indecisiveness) cognitive. The Beck

Depression Inventory-II for the prelicense students had an unacceptable fit index of χ2/df:7.62, GFI (Goodness of Fit Index):0.87, RMSEA (Root Mean Square Error of Approximation):0.078 and CFI (comparative fit index):0,70. These values in the independent factors model are found very low for an acceptable model among the prelicense students. According to the modification indices advised by Lisrel 8.3 where the correlated factors are included to analysis, some improvements on the index levels are found so as: GFI:0.93, χ2/df:1,93, RMSEA:0.048 and CFI:0.89

Table 3. *Varimax rotated iterated principal factor analysis of BDI-II-T for prelicense sample. Values for item weights greater than 0.40 are cited in the table.*

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Total variance
Common variance %	16%	9%	8.8%	7.7%	7.3%	7%	6.7%	**62.5%**
	Factor 1	**Factor 2**	**Factor 3**	**Factor 4**	**Factor 5**	**Factor 6**	**Factor 7**	
12.Loss of interest	0.815							
19.Weight loss	0.722							
14.Worthlessness	0.702			0.329				
18.Changes in appetite	0.669							
17.Fatigue	0.637			-0.305				
15.Loss of energy	0.529	0.325					0.363	
16.Changes in sleeping	0.449						0.341	
11.Agitation		0.703					0.361	
10.Crying		0.685		0.309	0.314			
21.Loss of sexual interest		0.559		-0.383				
8.Self-criticalness		0.557	0.384					
3.Past failure			0.815					
13.Indecisiveness			0.751					
7.Self-dislike				0.689				
2.Pessimism	0.384			0.547				
1.Sadness					0.831			
5.Guiltfeeling					0.498	0.481		
6.Punishment			0.384		0.446		0.372	
20.Somatic concern						0.853		
4.Loss of pleasure				0.506		0.549		
9.Suicidal thoughts or wishes							0.882	

For the license student sample; after the rotation, the eigenvalues over 1 were found 2.951, 1.905, 1.881, 1.817, 1.755, 1.586 and 1.568. Among these 7 factor weights, 0.30 was considered as criteria value. According to this criteria value, only 3 factors had been found interpretable (Table 4). Other factors were found dispersedly related to main 3 factors. Totally explained variance was 62.5%. Factor 1 (item no.2: pessimism, item no.1: sadness, item no.13: indecisiveness, item no.4: loss of pleasure, item no.20: somatic concern, item no.15: loss of energy, item no.12: loss of interest, item no.7: self-dislike) was considered depressive, factor 2 (item no.6: punishment feeling, item no.19: weigth loss, item no.20: somatic concern) somatic and factor 3 (item no.3: past failure, item no.5: guilt feeling, item no.8: self-criticalness, item no.15: loss of energy) cognitive-depressive.

Table 4. *Varimax rotated iterated principal factor analysis of BDI-II-T for license sample. Values for item weights greater than 0.30 are cited in the table*

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Total variance
Common variance %	14.1%	9.1%	8.9%	8.7%	8.4%	7.6%	7.5%	64.3%
	Factor 1	**Factor 2**	**Factor 3**	**Factor 4**	**Factor 5**	**Factor 6**	**Factor 7**	
2. Pessimism	0.760							
1. Sadness	0.734							
13. Indecisiveness	0.661		0.373					
4. Loss Of Pleasure	0.604							
6. Punishment		0.816			0.307			
19. Weight Loss		0.778						
20. Somatic Concern	0.477	0.485						
17. Fatigue			0.726					
11. Agitation			0.568				0.459	
3. Past Failure			0.475	0.433				
5. Guilt Feeling				0.755				
8. Self-criticalness			0.372	0.586				
15. Loss of energy	0.335		0.370	0.491				
14. Worthlessness					0.739			
12. Loss of interest	0.576				0.650			
10. Crying			0.416		0.639	0.364		
18. Changes in appetite						0.674		
9. Suicidal thoughts/wishes						0.624	0.486	
7. Self-Dislike	0.390					0.546		
21. Loss of sexual interest							0.746	
16. Changes in sleeping				0.383			0.551	

Structural Equation Modeling of the Beck Depression Inventory-II applied for the license students has three latent variables: cognitive, affective, somatic. In the independent factors model for the confirmatory factor analysis of license students, GFI found 0.88, $\chi 2/df$:8.85, RMSEA:0.072 and CFI:0.76. This independent model does not show an acceptable model for the confirmatory factor analysis among license students. According to modification indices advised by Lisrel 8.3 and with the inclusion of correlated factors between item variables, we had obtained a good result so as: GFI:0.94, $\chi 2/df$:1.6, RMSEA:0.039, CFI:0.93 (Figure 1). Moreover, we could say that the license students showed a more satisfying test results compared with prelicense students.

Finally; item score–total score correlations all found $p<0.01$ except suicidal thought or wishes for both group and worthlessness for license group. No significant difference found between all Pearson correlation coefficients (r) of prelicense and license students according to paired samples student's t test (t:1.005, $p>0.05$) (Table 5).

Figure 1. *Correlated factors model for the confirmatory factor analysis of BDI-II among license students*

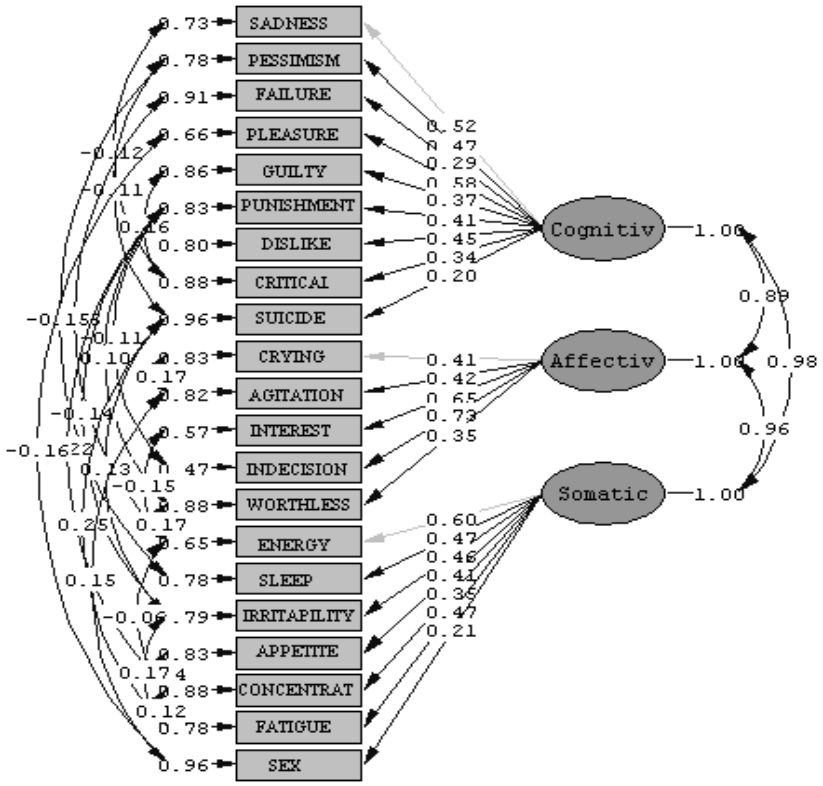

Table 5. *Item score versus total test score correlations.*

Items score versus Total of BDI-II-T test score correlations	Prelicence Students Pearson (r)	License Students Pearson (r)
Sadness	0.276*	0.279*
Pessimism	0.468*	0.237*
Past Failure	0.370*	0.348*
Loss of pleasure	0.441*	0.375*
Guilt feeling	0.504*	0.379*
Punishment feeling	0.548*	0.471*
Self-dislike	0.249*	0.431*
Self-criticalness (accusation)	0.472*	0.470*
Suicidal thoughts or wishes	0.131⊕	0.162⊕
Crying	0.356*	0.662*
Agitation	0.277*	0.411*
Loss of interest	0.478*	0.501*
Indecisiveness	0.498*	0.484*
Worthlessness	0.423*	0.157⊕
Loss of energy	0.581*	0.622*
Changes in sleep patterns	0.613*	0.430*
Fatigue	0.476*	0.482*
Changes in appetite	0.579*	0.352*
Weight loss	0.454*	0.300*
Somatic concern	0.243*	0.506*
Loss of interest in sex	0.347*	0.256*

**:p<0.01 (item score vs.total score) ⊕: p>0.05 (item score vs.total score)*

All Pearson correlation coefficients (r) of prelicense and license students were found insignificant between them according to paired samples student's t test (t:1.005, p<0.05)

Discussion

In our study, generally, percentage of depressive disorder was 12.4. In literature, we found two studies done at two different universities in Ankara, Turkey in 1990. In these studies, prevalence of depression was found to be 13.8% and 16.4% respectively (14,15). In other two studies in mid-1990's, depression prevalence was 34.5% and 34.7% (16,17). These findings indicate an increase in depression among young adults in Turkey. However, we can speculate that, depression prevalence is stable for our region among young adults and this can be related with the comfortable life conditions both in our university and in our region.

In the study that was conducted by Bostancı et al. in neighbor city, Denizli, it was suggested that student's financial problems may negatively affect students' self-esteem and psychological status (13). By the way, no relation between financial status and depression was found for the study group.

In the study; two groups had same number of factors (3 factors). We can deduct from this result that the two groups had same depressive causes. These two groups' schools are in the same midtown. They suffer from same facility, economical problems. Goodness of fit index of license students showed more adaptation to the theoretical model. Because of this, the structural equation model for prelicense students is not inserted in this article.

In the study wherein cross-cultural validity of BDI-II is assessed in Japan, 776 subjects were contributed. Internal consistency α-cronbach found 0.87. In the factor analysis, two factors were found: cognitive and somatic-affective (18). In the study that was conducted by Viljoen and et al. in a primary care setting 2003; a two-factor model (cognitive-affective and somatic symptoms) appeared to be the most parsimonious representation of the data. The rotated factors accounted for approximately 53% of the variance (19). In another study in USA; a confirmatory factor analysis was performed in a large sample of undergraduates and results suggest that revised measure is internally consistent and consists of two underlying factors assessing cognitive-affective and somatic symptoms of depression (20). In a different study that was carried out in patients with chronic pain; a series of exploratory factor analysis suggested 2 factors. (Factor 1: loaded heavily onto negative cognitions about the self plus mood symptoms, factor 2: onto changes in behavior and activity plus low mood) (21). In another study; in a sample of 414 undergraduates studying in two universities, factorial structure, reliability and validity of BDI-II were analyzed; cognitive-affective and somatic-depressive factors were found as factor during factor analysis (22). In the study that healthy 414 adolescents (210 boys, 204 girls) had contributed in San Antonio, internal consistency of BDI-II, α-Cronbach found 0.92. In the factor analysis somatic and cognitive-affective factors had been found (23). In the trial that validity of BDI-II test among 690 university students (77% female, 23% male) in Jamaica, internal consistency α-Cronbach found 0.90 (24). In another study conducted in Yale University with 576 university students, internal consistency found high reliable and factor analysis of BDI-II denoted cognitive-affective and somatic factors (25).

As seen in literature, most of the studies are related with two-factor analysis. We found some studies about three-factor analysis too. The meaning loaded on the factors could be different from our factor weight orientations (depressive, somatic, cognitive etc.). In one study among adolescents, three factors (negative self attitude, performance difficulty and somatic symptoms) were indicated (26).

Suggestion

In this study, generally, percentage of depressive disorder was 12.4. This high frequency shows us the importance of depression among university youth. Alcohol consumption, smoking and familial depression history were detected as related factors with depression. Presently the best method for measuring severity of depression in primary care is not known (27). Related with the factor analysis; results are consistent with studies using previous versions of the BDI in suggesting that three-factor scores may be more clinically useful in the assessment of patients referred in an university based primary care setting.

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