# Psychometric Properties of Beck Depression Inventory-II for High School Children in Shiraz City, Iran

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## Abstract

**Background:** Depression causes poor academic performance, substance abuse, antisocial behavior, school avoidance, and running away from home in adolescents. Due to the high prevalence of depression in adolescents, reliability, and validity of this questionnaire in this age group is of special importance. Symptoms of depression in children and adolescents are different from their indications in adults.

**Objectives:** The current study aimed at assessing reliability and validity of the Beck depression inventory- second edition (BDI- II) in high school students in Shiraz, Iran.

**Methods:** A total of 1150 high school students from Shiraz were selected to assess the validity and a sum of 128 students from the same city were tested to measure the reliability of the study. Concurrent validity and factor analysis were used to assess validity. Concurrent validity was assessed using Beck anxiety inventory and depression anxiety stress scale (DASS)-21. Factor analysis was computed using varimax rotation method. To assess reliability, test-retest and Cronbach's alpha were adopted.

**Results:** Correlation coefficients for the concurrent validity of this inventory with Beck anxiety inventory and DASS-21 were 0.45 and 0.55, respectively. The results of factor analysis with varimax rotation method showed 4 factors that predicted 43.69% of the total variance of the test. The reliability and correlation coefficients 0.55 and 0.83 were obtained from test-retest and Cronbach's alpha methods, respectively.

**Conclusions:** Based on the results of the current study, researchers can use BDI- II in psychological research and clinical use for high school students in Shiraz.

*Keywords:* Beck Depression Inventory- II, Validity, Reliability, High School Students

## 1. Background

Depression affects people in different ways and its symptoms appear in different aspects of behavior such as depressed mood, loss of interest, or pleasure and cognitive symptoms such as inability to concentrate and difficulty in thinking. Depression reduces the useful function of patients and affects the mental health of family and society. Experiencing various crises in life can lead to depression; the most important crisis can be the puberty crisis, especially in adolescence. Poor academic performance, substance abuse, antisocial behavior, school avoidance, and running away from home are the possible symptoms of depression in adolescents (1).

Symptoms of depression in children and adolescents are different to some extent from those of the adults. Temper tantrums in young children, long and unexplained crying with anger and irritability in a way that it is difficult to calm the child, is also observed. Parents feel that their child is not cheerful as before, often is bored and nervous, ag-

gressive, and his/her tolerance for frustration has reduced. Energy reduction, fatigue, physical complaints, decreased interest in playing with other children and not enjoying these pleasurable activities are other symptoms that may be observed. Symptoms such as anorexia, weight loss, or lack of weight gain, insomnia or hypersomnia daily, slowness of movement, poor concentration, feeling of worthlessness or guilt, and repeated thoughts of death are also observed. However, the rate of incidence of these symptoms at various ages is different. In younger ages nervousness and irritability, moodiness and tantrum is more common and in older age groups the sadness, isolation, and loneliness, boredom, loss of energy, feeling tired, and thoughts of death is more common. Sometimes, anxiety symptoms in adolescents are comorbid with depression. Symptoms such as the extreme anxiety about the health status of relatives, anxiety of being separated from parents or over dependence on parents, fear of darkness and loneliness are observed. It should be considered that just having 1 or 2 of these symptoms are not enough to diag-

nose depression. Sometimes individuals have these symptoms temporarily or some of the events or stresses create these symptoms temporarily. To diagnose major depressive disorder, symptoms should be stable for at least 1 week, and cause tension during interaction with others, or may result in academic failure, decline in individual performance, and social problems such as isolation (2). Children and adolescents with depression, in addition to early signs of depression, develop a series of other complications such as academic failure, school avoidance, tension during interaction with peers, and tendency toward particular groups or criminals, anti-social behaviors, alcohol consumption, and drug addiction may also be observed. In such patients, the desire to leave home, restlessness, and aggression are common. Temper tantrums, lack of interest in familial activities and withdrawal from social activities or taking refuge in their room are frequently observed. Lack of attention to appearance and extreme sensitivity to rejection are other reported symptoms (3).

The world prevalence of depression is 2% in children and at about 4% to 8% in adolescents and reaches 20% at the age of 18. Various studies reported the prevalence of this disorder from 2% to more than 50% in children and adolescents. The prevalence of depression in childhood is equal in males and females. In adolescents, females are twice more likely to develop depression than males. After puberty, the risk of depression increases in both genders, especially in females (4). Merkingas et al. (5) studied the rate of depression in 10 123 teenagers. Results showed that the rate of depression in teenagers was 3.14%. In Iran, the results of a study (6) showed that 73% of female and 58% of male students had depression. Another research group (7) studied 240 college students in Kazeroon, Fars province in Iran. The results indicated that 28.8% of the students in Kazeroon had mild depression, 9.6% moderate depression, 3.3% severe depression, and 1.3% had deep depression. It seems that depression in children and adolescents is a major mental health problem, which is expanding even further.

One appropriate scale for the objective evaluation of depression is the Beck depression inventory- second edition (BDI-II). This questionnaire was introduced by Beck et al. in 1961 (8) revised in 1971 and published in 1978 (9). But BDI-II was introduced in 1996. It can be said that BDI-II is quite comparable with the previous forms and, accordingly, the results of previous studies can be extended to BDI-II. This questionnaire was made according to diagnostic criterion of depressive disorders in the 4th edition of the diagnostic and statistical manual of mental disorders (DSM-4). Four Items associated with severe depression (anxiety, feelings of worthlessness, difficulty in concentrating and loss of energy), and 2 items related to appetite and sleep were changed in this questionnaire (10). BDI-II and its initial forms assess depression among patients with psychiatric disorders (11) and normal people (10, 12). It is reported that to diagnose depression, BDI functions as effectively as long and structured interviews (13). This test is popular among clinical specialists.

Due to the importance of this tool in diagnostic and clinical interventions, many psychometric studies are conducted to evaluate this test. According to a meta-analysis study, the internal consistency coefficient of BDI-II ranged from 0.73 to 0.93 with the average of 0.86. Reliability coefficients are, in terms of the intervals between test and retest and the type of population, ranged from 0.48 to 0.86. Previous studies showed high internal consistency coefficient ranging from 0.89 to 0.94 for different populations (10, 11, 14). Reliability coefficient of retest administration at 1 week interval was 0.93 (10). The results of content validity and factor analysis were also generally favorable. In addition, it had acceptable correlation with other related measures that assessed depression. These measures included Hamilton rating scale for depression (0.71), Beck hopelessness scale (0.68) (10), and depression anxiety and stress sale (0.88) (15). BDI-II could differentiate patients with mental disorders from healthy people (10). Ability of this questionnaire to distinguish between anxiety disorders against primary disorders of depression is confirmed, because its scores had higher correlation (0.71) with the depression Hamilton rating scale than with Hamilton anxiety rating scale (0.47). Besides, Steers et al. (14) reported high correlation between the BDI-II and depression dimension of SCL-90-R (0.89), but low correlation with the anxiety dimension of this test (0.71). It is known that these coefficients are consistent among different samples such as students (10), adolescents (16), and elderly patients (14), and outpatients with depression (11). Osman et al. (15) found slightly different factor structure on a sample of students. Some studies (17) reported retest reliability coefficient of 0.96 for 46 students.

Several studies are conducted on adults in Iran. Dobson and Mohammad Khani (18) studied the psychometric characteristics of the BDI-II. They assessed 354 people diagnosed with severe depression. The total reliability coefficient was 0.91 and the correlation between BDI-II and depression scale brief symptom inventory was 0.87. Rajabi et al. (19) in a study on 196 male students of Shahid Chamran University reported Cronbach's alpha coefficient of 0.87, split-half reliability coefficient of 0.83, and retest reliability coefficient within a 3-week interval, of 0.49. Also the correlation coefficient between BDI-II and Minnesota multiphasic personality inventory (MMPI) subscale of depression was significant. Rahimi (20), in a recent research, studied BDI-II in Iranian students and reported acceptable

reliability and validity of the test. To sum up, different studies reported suitable psychometric properties of BDI-II.

## 2. Objectives

Due to the high prevalence of depression in adolescents, reliability and validity of this questionnaire in adolescents is of great importance. The studies conducted in different countries reported acceptable psychometric properties for this age group. Osman et al. (15) studied BDI-II in this age group and reported Cronbach alpha of 0.92 with correlation coefficient of 0.35 for its subscales. They viewed the test as a valid and reliable measure. Teri (21), in a study on high school students, in line with previous studies, reported Cronbach alpha of 0.87, with an average correlation coefficient of 0.26 for its subscales. The questionnaire was considered appropriate for the age group under study. However, psychometric properties of the BDI-II are not studied for this age group in Iran yet. The current study aimed at investigating the validity and reliability of the BDI-II for high school students in Shiraz, Southern Iran.

## 3. Methods

### 3.1. Population and Sampling Method

Participants were recruited from high school students in Shiraz, using the cluster sampling method. Shiraz was divided into 4 areas based on school districts. High school students of both genders participated in the study. Therefore, considering the fact that males and females are educated in separate high schools in Iran, including Shiraz, 2 high schools from each area were selected for each gender. From each school, 1 class was randomly selected; they were then asked to complete the questionnaire. A total of 1150 students completed the questionnaire; ie, 620 (53.9 %) female and 530 (46.1%) male students; 407 participants (35.4 %) were 1st grade students; 364 participants (30.8%) 2nd grade, and 379 participants (32.1 %) 3rd grade students. To compute reliability, 128 high school students completed the scale within 2 weeks once more. These high school students from different grades were randomly selected using the cluster sampling method. For this purpose, from the high schools in the 4 districts of Shiraz, the medical sciences high school, in the second district, was randomly selected. All students from the randomly selected classes participated in the study. The number of students from the 1st, 2nd, and 3rd grade were 32, 53, and 43, respectively. A total of 128 students were asked to take part in the study to assess the reliability of the questionnaire, and 1150 students were asked to participate in the study to evaluate the validity of the questionnaire BDI-II.

### 3.2. Instruments

#### 3.2.1. Beck Depression Inventory-II

BDI-II (10) is a self-report questionnaire including 21 items that measure the severity of depression. Each item reflects 1 of the symptoms of depression scores based on 4 items. It is completed in 5 to 10 minutes and is suitable for people above 13 years old. Students in grades of 5 or 6 were able to read and understand the items. BDI-II is scored based on a 4-point Likert scale, from 0 to 3. The total score ranges from 0 to 63. Scores from 0 to 13 indicate no or minimal, 14 to 19 mild, 20 to 28 exact, and 29 to 63 severe depression. The scores less than 4 can indicate a possible denial of depression, pretending good and usual, even for the healthy people. Very high scores, even among severely depressed individuals, show a possible overstatement of depression, or probability of the existing hysteric or borderline personality disorders. However, severe depression is also observed in such patients. The cut-off point of 18 can diagnose approximately 92% of patients with severe depression (22).

#### 3.2.2. Beck Anxiety Inventory

BAI (23) is a self-report questionnaire including 21 items that measure the severity of anxiety. Each item reflects one of the symptoms of anxiety scores based on 4 items. Scores of subjects in this questionnaire range from 0 to 63 and higher scores indicate more severe anxiety. Reliability and validity of this scale was assessed and reported good. The internal consistency of this scale is 0.92 and its retest reliability 0.75, and the correlation of this scale with Hamilton anxiety scale-revised is satisfactory (0.75) (23). Kaviani et al. (24) studied the psychometric properties of this test in Iran. The results showed that the test was valid ($r = 0.72$) and reliable ($r = 0.83$) with a suitable internal consistency of $\alpha = 0.92$.

#### 3.2.3. Depression, Anxiety, and Stress Scale-21

DASS-21 (25) is a 21-item self-report scale that measures depression, anxiety, and mental stress. It is scored based on a 4-point Likert scale, from 0 to 3. The scale includes 3 subscales and each subscale has 7 items. In a study on Iranian students, Samany and Joker (26) reported satisfactory reliability and validity of this questionnaire. Also, the level of acceptable internal consistency of the scale was achieved.

### 3.3. Procedure

With the permission from Fars research council of the education department, the list of schools in the 4 areas was obtained. Then, from each district, a female school and a male school were randomly identified. Then, from each school a class was randomly selected. To reduce sampling

error, all students were included in the study. There was no time limit on the completion of the scales.

### 3.4. Ethical Considerations

The study was conducted after obtaining permission from Fars research council education department. All participants were recruited after explaining the purpose of the study to them. The questionnaires were anonymous for data confidentiality.

### 3.5. Data Analysis

To calculate the reliability of BDI-II, test-rest (the Pearson correlation coefficient) and internal consistency measures (Cronbach's alpha) were used. To study the validity of the questionnaire, 2 methods known as concurrent validity and factor analysis were used. To compute concurrent validity, BAI and DASS-21 were performed. To perform factor analysis of BDI-II, the principal components analysis method was used. To identify factors that may form the basis of this scale and its simple structure, the varimax rotation was used for ultimate solutions.

## 4. Results

### 4.1. Reliability

To calculate validity of the test, test-retest, and internal consistency were used.

### 4.1.1. Test-Retest

To compute test-retest, 128 people completed BDI-II twice with a 2-week interval. Reliability coefficient of the questionnaire was 0.55 that was statistically significant (P value < 0.0001). Comparison of the mean scores, using t test, showed no significant difference. The results are presented in Table 1. It means that the mean scores of the participants in 2 different times were not very different.

### 4.1.2. Internal Consistency

To assess the internal consistency of the questionnaire, Cronbach's alpha coefficient was computed. Cronbach's alpha for the whole questionnaire was 0.83, which seemed satisfactory. Table 2 shows the mean, standard deviation (SD), and correlation coefficient of each item with the total score of BDI-II. Item-total correlations ranged from 0.40 to 0.60. All of the corrected item-total correlations were statistically significant (P value < 0.05). Cronbach's alpha coefficients for factors 1 to 4 were 0.75, 0.67, 0.60 and 0.75, respectively. Table 2 also presents the means and SD for the BDI-II in the current study sample. Item means ranged from 0.49 to 1.47.

### 4.2. Validity

To calculate the validity of the questionnaire, concurrent validity and factor analysis method were used.

### 4.2.1. Concurrent Validity: To Assess the Concurrent Validity of BDI-2, BAI, and DASS-21 Were Performed

The results showed that the correlation coefficient between the scores of the study group, in both, BDI-2 and BAI was 0.45, which was significant (P value < 0.0001). The correlation coefficient between the scores of BDI-II and DASS-21 was 0.55, which was also significant (P value < 0.0001).

### 4.2.2. Factor Analysis

To analyze the factors of BDI-II, principal component analysis method was employed. Beck et al. (10) also used this method. This method explains all of the variance of the variables. As an ultimate solution to identify factors that may form the basis of this scale and its simple structure, the varimax rotation method was used. Initially, based on screen test, it was determined that the scale had 4 significant factors with Eigen value greater than 1. The Eigen values for all factors, from the 1st to 4th, were 5.35, 1.60, 1.15, and 1.06, respectively. The amount of total variance explained for factors 1st to 4th were 25.49%, 7.61%, 5.50%, and 5.07%, respectively. These 4 factors explained 43.69% of the total variance of the test (Table 3). Using the matrix method, factor loadings of each item were compared by the 4 extracted factors. Selection criterion for items was load factor greater than 0.35. The results showed that 8 items; ie, items 1, 2, 3, 4, 7, 9, 11 and 12 were on the 1st factor. Also 7 items; ie, items 5, 6, 8, 10, 13, 14 and 15 were on the 2nd factor. Four items including items 17, 19, 20 and 21, were on the 3rd factor and finally 2 items of 16 and 18 were on the 4th factor. Results of factor analysis are shown in Table 4.

## 5. Discussion

The current study aimed at investigating the psychometric properties of BDI-II in high school students and young people in Shiraz, Iran. For several reasons, such as enough research background and excellent psychometric properties worldwide, BDI-II is used in many countries. The current study findings point to the strength of the BDI-II as a measure of depression among young people in Shiraz. Previous investigations did not address these psychometric issues with adolescents in Iran.

Results of the current study evidenced good reliability and validity of BDI-II in the sample. Reliability of the inventory was measured using 2 methods, including test-retest and Cronbach's alpha. The BDI-II revealed acceptable consistency across time. The Pearson correlation coefficient for the BDI-II total scores across the 2 time intervals

**Table 1.** Comparing the Mean Scores of Participants for the Test-Retest

| Indicators | Test Performance | | | | |
|---|---|---|---|---|---|
| | N | Mean $\pm$ SD | df | t | P Value |
| First time | 128 | 16.19 $\pm$ 10.68 | 127 | 3.22 | 0.09 |
| Second time | | 14.95 $\pm$ 13.04 | 127 | 3.22 | 0.09 |

**Table 2.** Mean, Standard Deviation, and Correlation Coefficient of Each Item for the Total Score of BDI-II and Cronbach's Alpha

| Items | Mean $\pm$ SD | Item-Total Correlation | Cronbach's Alpha If Item Deleted |
|---|---|---|---|
| 1 | 0.84 $\pm$ 0.76 | 0.46 | 0.73 |
| 2 | 0.49 $\pm$ 0.89 | 0.53 | 0.72 |
| 3 | 0.69 $\pm$ 0.96 | 0.55 | 0.72 |
| 4 | 0.99 $\pm$ 1.05 | 0.49 | 0.72 |
| 5 | 1.01 $\pm$ 0.91 | 0.43 | 0.73 |
| 6 | 1.11 $\pm$ 1.17 | 0.54 | 0.72 |
| 7 | 0.75 $\pm$ 1.05 | 0.56 | 0.72 |
| 8 | 1.34 $\pm$ 1.20 | 0.43 | 0.72 |
| 9 | 0.51 $\pm$ 0.89 | 0.48 | 0.73 |
| 10 | 1.18 $\pm$ 1.32 | 0.49 | 0.72 |
| 11 | 0.85 $\pm$ 1.09 | 0.58 | 0.72 |
| 12 | 0.83 $\pm$ 1.04 | 0.49 | 0.72 |
| 13 | 0.95 $\pm$ 1.10 | 0.51 | 0.72 |
| 14 | 0.81 $\pm$ 1.06 | 0.60 | 0.72 |
| 15 | 0.77 $\pm$ 1.04 | 0.47 | 0.72 |
| 16 | 1.47 $\pm$ 1.53 | 0.46 | 0.72 |
| 17 | 0.83 $\pm$ 1.20 | 0.44 | 0.72 |
| 18 | 1.44 $\pm$ 1.56 | 0.49 | 0.72 |
| 19 | 1.06 $\pm$ 1.07 | 0.55 | 0.72 |
| 20 | 0.89 $\pm$ 1.08 | 0.55 | 0.72 |
| 21 | 0.83 $\pm$ 1.30 | 0.40 | 0.73 |
| Total | 19.63 $\pm$ 11.55 | | |

**Table 3.** Correlation Coefficients Between the Different Questionnaires to Calculate the Concurrent Validity

| Questionnaires | Beck Anxiety Inventory | DASS-21 |
|---|---|---|
| BDI-II | 0.450[a] | 0.55[a] |

[a] P value < 0.001.

was 0.55, consistent with the significance level reported in meta-analysis of Beck et al. (23). Test-retest reliability coefficient with 3 weeks interval (0.49) in a study by Rajabi

et al. (19) in Ahvaz was also consistent with test-retest reliability coefficient of the current research. Besides, the results of the current study were in line with researches conducted on teenagers outside Iran. For example, test-retest reliability coefficient of 0.96 in the study by Sprinkler (17) was also consistent with the results of the current study. Beck et al. (10) reported a 1-week test-retest correlation coefficient of 0.93 in a sample of outpatients. In the current study, Cronbach's alpha for the BDI-II was 0.83. Beck et al. (10) reported Cronbach's alpha of 0.93 in students. The reported Cronbach's alpha in the current study (0.83) was also comparable to that of Osman et al. (15) on teenagers with the Cronbach's alpha of 0.92. Item-total correlations ranged from 0.40 (lack of sexual interest) to 0.60 (worthlessness). The Cronbach's alpha coefficients and the item-total correlations in the study indicated a high level of internal consistency among the items.

In line with many studies in other countries, concurrent validity method was used. It was examined by computing the relationship among the BDI-II total score, BAI, and DASS-21 scores. The BDI-II total score was significantly correlated with BAI and DASS-21 scores. Results of the correlation coefficients between BDI-II and BAI, and DASS-21 reported in the current study were in line with the results of Beck (10) and Osman et al. (15). To analyze the factors of BDI-II, principal component analysis method was employed and 4 factors, for the current study, were identified, but in the study by Osman et al. (15) on teenagers, 3 factors, and in the study by Rahimi (20) on adults, 5 factors were identified. The current study findings supported the 4-factor solution of the BDI-II in high school students that included all items. One probable reason for such differences is that the factor solution differs depending on the nature of the sample (eg, high school children versus university students or clinical subjects).

To sum up, results of the current study showed that BDI-2 was a valid and reliable test for teenagers and high school students and can be used in investigations and psychological assessment of teenagers. The current study had certain limitations that should be noted. First, the sample was limited to high school students in Fars province, which limits the generalizability of the results to all other Iranian students, because students in other areas of the

**Table 4.** Results of Factor Analysis of BDI-II

| Variables | Eigen Value | Percentage of Variance Explained | Cumulative Percentage of Explained Variance | Items |
|---|---|---|---|---|
| **1** | 5.35 | 25.49 | 25.49 | 1-2-3-4-7-9-11-12 |
| **2** | 1.60 | 7.61 | 33.11 | 5-6-8-10-13-14-15 |
| **3** | 1.15 | 5.50 | 38.62 | 17-19-20-21 |
| **4** | 1.06 | 5.07 | 43.69 | 18-16 |

country are culturally different from those of the Fars province. Therefore, generalization of the results of the current study to all the other students nationwide should be done cautiously. Second, using a patient group sample with depression disorder could help to get a cutoff point score that could define the differences between patients and normal students. On the other hand, as the sample size was large enough, the results can be trusted and accordingly used for high school level students in Fars province; additionally, it can also be used in other parts of the country, but with great caution. The questionnaire was a powerful tool to screen the students with depression at high school level. For future research, it is recommended to select a more extensive sample size to represent the students nationwide. Future studies need to evaluate the psychometric properties of the test in provinces other than the 1 investigated in the current study or nationwide, including Fars province. Also, with regard to the acceptable psychometric properties obtained for the questionnaire, further studies are recommended to standardize BDI-II at high school level in Iran. Besides, future research had better consider replication of the present results using clinical samples.

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