Clinical and Experimental Health Sciences

Bergen Insomnia Scale for Adults: The Psychometric Features of the Turkish Version

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ABSTRACT

Objective: Insomnia is an important health problem affecting physical, spiritual and social well-being of individuals negatively and it should be early diagnosed as well. The purpose is to appraise the psychometric features of the Turkish version of the Bergen Insomnia Scale (BIS) for adults.

Methods: A total of 495 adults were included in the methodological study in Turkey. Turkish form of BIS was designed within the scope of study conducted in adolescent sample. Construct validity was appraised with exploratory, confirmatory factor analysis, convergent and discriminant validity. Internal-consistency and test-retest analysis were used for reliability.

Results: According to results of explanatory, confirmatory factor analysis; it was identified that BIS showed a two-factor structure as daytime symptoms (α=.85) and nocturnal symptoms (α=.80). Item-total correlations were found as ≥.59 and test-retest correlation as .83.

Conclusions: The Turkish version of the Bergen Insomnia Scale for adults was assessed as valid and reliable.

Keywords: Insomnia, reliability and validity, adult

1. INTRODUCTION

Insomnia is an important health problem effecting physical, spiritual and social well-being of individuals negatively. Insomnia is being described a sleep-wake disorder in International Classification of Sleep Disorder (ICSD-3) and The Diagnostic and Statistical Manual of Mental Disorders (DSM-5). According to ICSD-3 and DSM-5 diagnostic measures, sleep-wake disorder is characterized by starting sleep difficulty, continue sleep difficulty and early waking up in the morning symptoms being presented at least three months and three times a week as well as dissatisfaction of the person with the quality of sleep. Such dissatisfaction is accompanied by disturbance and interference at day functions (1,2).

In literature, it was stated that majority of individuals having sleep disorder were not diagnosed medically. According to a study carried out in France, it was demonstrated that 53% of the people suffering from heavy insomnia and only 27% of people with rarely experiences sleep difficulties go to the doctor for such a problem (3). Such a result means that insomnia should be defined properly for the whole society. Variety of self-report questionnaire exist in literature in order to assess insomnia. Pallesen et al. (4) developed Bergen Insomnia Scale (BIS) within the basis of DSM-4 insomnia diagnosis criteria. Additionally, this scale meet diagnosis criteria of DSM-5.

According to DSM-4, the first four question of the scale met criteria A and the last two ones met criteria B. Latest studies expressed that 5 items of BIS might be used to identify insomnia regarding DSM-5 criteria. The first 3 questions of the scale met criteria A and the last two ones met criteria B. Scoring 3+ from at least one of the "A" criteria, additionally scoring 3+ from criteria "B" is defined as insomnia. According to DSM-5, if insomnia symptoms are lasted more than 3 months, it is defined as chronic insomnia, between 1-3 months as episodic insomnia, less than 1 month as acute insomnia (5). BIS is considered to define acute insomnia if assessed in terms of DSM-5 since it questioned only the last month (6,7).

The scale consists of six items and it is suitable for epidemiological studies and surveys since it is brief and easy-to-implement. Unlike other scales, BIS use 30 min cut-off value which has been suggested as clinical marker to measure time period to fall asleep and stay awake at night. In addition, the

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scale utilizes number of days experienced a sleep problem instead of expressions like “never” or “sometimes” used by many other scales (4). The scale was used in many studies having various age and sample groups to define insomnia based on self-report strategy (8-12).

The purpose of present study is to appraise the psychometric features of the Turkish version of BIS among the adults.

2. METHOD

2.1. Sample and Setting

This was a methodological study was carried out in March 2018 with adults working in a Fast-Moving Consumer Goods Company in 4 different provinces of Turkey. Instead of sample selection, the study was carried out on a volunteer basis. It was recommended in scale adaptation studies that 10-20 participants should be involved for each item of the scale (13). The study was completed with 495 (41.6%) volunteer adults by taking it into consideration. Two weeks following initial data collection, 108 of the participants were retested.

2.2. Data Collection

The required data were collected with descriptive questionnaire and BIS via e-mail basing on self-report. Descriptive questionnaire consists of 5 questions containing overall information about age, gender, education, marital status and employment status. Since the purpose of present study was to test the validity and reliability of the scale in Turkish, only basic socio-demographic questions were used. The questionnaires were web-based using an online platform belonging to the company and were sent to the employees via e-mail. In a preliminary section, the purpose of the study was introduced and the participants were inquired to give their consent for participation.

2.2.1. Bergen Insomnia Scale

BIS include 6 items in order to measure nocturnal and daytime symptoms of insomnia. Individuals indicated the number of having sleep disorder days in a week between 0 and 7; 8-point measurement in total. Psychometric analysis of original study of BIS were realized with three separate sample group as student, community and patient. In student and patient samples, two factor construct was detected whereas in community sample, single factor construct was identified. In original study, Cronbach’s alpha coefficient of community sample was .87 and test-retest reliability was .77 (4).

Turkish version of the BIS was developed by Bay and Ergun (14) and its language equivalency-cultural adaptation, content validity and pilot test were conducted with an adolescent sample group. In the study, content validity index was determined as .99; internal consistency as α= .72 and test-retest coefficient as r= .74. The BIS items are available in English and Turkish (See supplementary material 1).

2.3. Ethical Considerations

A written permission was obtained from the author who developed the scale, namely Pallesen via e-mail. Additionally, an approval was obtained from the authors who conducted the Turkish version of BIS in the adolescent sample. Ethical approval was obtained from University Ethical Committee (05.03.2018-86). In addition, written permission was obtained both from the institution and from authorities in order to practice the scale in the workplaces.

2.4. Data Analysis

By using SPSS 21 (Statistical Package for Social Sciences Inc, IL, USA) and LISREL 9.20 (Scientific Software International [SSI]) programs, the data were evaluated. Initially, data set was examined to investigate univariate and multivariate outliers, and normality. Univariate outliers were examined with standardized scores (Z). Excess 3.29 of scores Z is outliers and there are no outliers in our data set. The criterion for multivariate outliers was Mahalanobis distance at p< .001. Mahalanobis distance was evaluated as $\chi 2$ with degrees of freedom equal to the number of variables (15); in our data set, it was 6. According to $\chi 2(6)= 22.458$, 4 outliers was found and removed from data set. The univariate frequency distributions of all items in scale were examined, and both skewness and kurtosis values were found to be within normality. Furthermore, in adult sample; convergent validity, discriminant validity, confirmatory and explanatory factor analysis were utilized for construct validity of the scale and internal consistency and test-retest analysis for reliability of the scale.

2.4.1. Construct Validity

In order to ensure construct validity, the data set including 495 participants were divided into 2 groups randomly by statistic programmed as n_1=244 and n_2=251. The first group (n=244) was implemented explanatory factor analysis (EFA) in order to examine structural relations of the scale in Turkish culture. The second group (n=251) was used confirmatory factor analysis (CFA) to confirm the factor analysis results obtained in the first group to ensure cross-validation. In CFA, by using maximum likelihood (ML) method; chi square ($\chi 2$), degrees of freedom (df), The Root Mean Square Error of Approximation (RMSEA), Standardized Root Mean Square Residual (SRMR), fit/unfit coefficient values of comparative fit index were assessed together with relation of theoretical model’s data set.

Convergent validity and discriminant validity were evaluated by calculating composite reliability (CR), average variance extracted (AVE) and maximum shared variance (MSV) using the results obtained from CFA.

2.4.2. Reliability

As for reliability analysis; Cronbach's Alpha reliability coefficient and McDonald's omega (ω) coefficient were calculated to ensure internal consistency. Omega coefficient was calculated by OMEGA macro for SPSS (16). Test-retest was utilized to assess invariance in time and Pearson correlation coefficient was benefited to assess the relation between test-retest scores. Descriptive results were evaluated with standard deviation, average and percentage.

3. RESULTS

3.1. Descriptive Results

The mean ages of participants were 32.71±6.97 and 44.8% of them were females. 55.6% of them were bachelor graduate; 56.0% of them married and 65.1% of them were working shiftlessly (Table 1).

Table 1. *Socio-demographic Characteristic of Adults (N:495)*

Variables		Min. – Max.	M±Sd
Age (N=491)		19-58	32.71±6.97
		n	**%**
Gender	Female	222	44.8
	Male	273	55.2
Educational status	Secondary School	2	.4
	High School	136	27.5
	Bachelor graduate	275	55.6
	Postgraduate	82	16.6
Marital Status	Single	201	40.6
	Married	277	56.0
	Divorced	17	3.4
Employment Status	In Shift	173	34.9
	Shiftlessly	322	65.1

Min*.:Minimum,* ***Max****.:Maximum,* ***M****:Mean,* ***Sd****:Standard deviation*

3.2. Construct Validity-related Results

In order to ensure construct validity, Kaiser-Meyer-Olkin (KMO) coefficient value, assessing the size of the sample according to explanatory factor analysis implemented to primary sample group (N=244), was found .82 and Bartlett's Sphere Test chi square value implemented to test the suitability of sample group for factor analysis was found 752.247, df=15 (p< .001). Explanatory Factor Analysis (EFA) results demonstrated that the scale was two factor structure explaining 77.38% of the total variant of the scale. The first factor included three questions (4th, 5th and 6th questions) about daytime symptoms of insomnia with a factor load ranging between .84 and .88 and the second factor involved three questions (1st, 2nd and 3rd questions) about nocturnal symptoms of insomnia with a factor load between .80 and .87. (Table 2).

Table 2. *Factor loads of the BIS Turkish form for adults (N=244)*

Factors	Items	Two Factors	
		1	2
Nocturnal Symptoms	BIS 1		.81
	BIS 2		.87
	BIS 3		.80
Daytime Symptoms	BIS 4	.86	
	BIS 5	.84	
	BIS 6	.88	
Variance (%)		59.7	17.6

BIS*: Bergen Insomnia Scale*

The fit/unfit coefficient values of two factor structure of the scale determined by the result of confirmatory factor analysis implemented to secondary sample group (n=251) was reported as better than single factor structure. When the overall fit/unfit coefficient values related with theoretical model were examined, it was indicated that fit/unfit coefficient values were perfect (CFI= .99, SRMR= .03 and $\chi 2$/SD=1.96) and acceptable (RMSEA= .06) except for chi square test results considered to be effected by the number of samples (Table 3).

Table 3. *The fit/unfit coefficient obtained by the BIS confirmatory factor analysis (N=251)*

Model	χ^2	p	df	χ^2/df	CFI	RMSEA	SRMR
Theoretical (two factors)	**15.68**	**.04**	**8**	**1.96**	**.99**	**.06(.01-.11)**	**.03**
Single factors	90.05	.00	9	10.0	.86	.19(.16-.22)	.08
***Perfect fit**	-	>.05	-	χ2/sd<3	.97≤CFI≤1	.00< RMSEA<.05	.00≤SRMR≤ .05
***Acceptable fit**	-	>.05	-	χ2/sd<5	.95≤CFI≤.97	.05< RMSEA<.1	.05≤ SRMR≤ .1

BIS*: Bergen Insomnia Scale; χ2; Chi-square* ***df****: Degrees of freedom;* ***RMSEA****: The Root Mean Square Error of Approximation;* ***SRMR****: Standardized Root Mean Square Residual;* ***CFI****: Comparative Fit Index (17).*

The factor loads of items in daytime symptoms subscale was between .73 and .85; in the nocturnal symptoms subscale ranged between .64 and .77 (Figure 1).

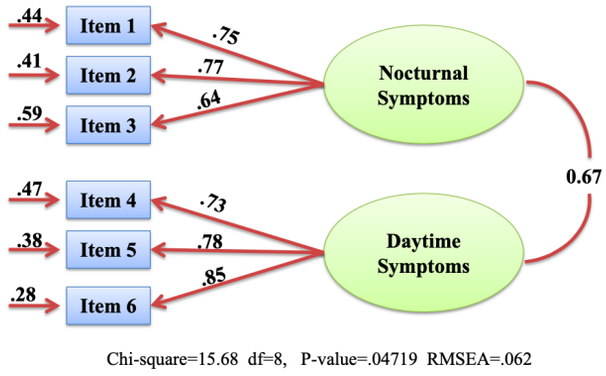

Figure. 1 *BIS confirmatory factor analysis graphic*

Composite reliability (CR) was .83 for daytime symptoms subscale and .76 for nocturnal symptoms subscale. Average variance extracted (AVE) for the daytime symptoms and nocturnal symptoms were .62 and .52, respectively. Maximum Shared Variance (MSV) was .43.

3.3. Results Related with Item Analysis and Reliability

Cronbach's alpha coefficient of daytime symptoms subscale was .85, for nocturnal symptoms subscale was .80 and for total BIS .85. Cronbach's Alpha coefficient was found age interval 19-30 (n=218) .85, age interval 31-40 (n=204) .84 and age interval 41-58 (n=69) .89; shiftlessly operator .81, in shift operator .89. McDonald's omega coefficients for the daytime symptoms, nocturnal symptoms and the whole scale were .85, .80 and .85, respectively (Table 4).

Scale's test-retest correlation was identified as r= .78 for daytime symptoms subscale and r= .77 for nocturnal symptoms subscale (p< .001). In addition, item sub-dimension correlations of the BIS varied between .70-.76 for daytime symptoms and .60-.69 for nocturnal symptoms (p< .001) (Table 4). 48.7% of the adults experienced insomnia according to DSM-5. As for mean scores of BIS sub-dimensions; the mean score of daytime symptoms sub dimension was 3.93±2.13 and it was 2.07±1.94 for nocturnal symptoms sub-dimension. The lowest score was for the item 2 (staying awake more than 30 minutes at night after waking up) and the highest score was item 4 (feeling not rested enough after waking up). It was stated that 73.3% of the participants felt unrested after waking for three days or more in a week; 72.1% of them were not satisfied with their sleep and 57.6% of them felt tired and sleepy effecting their daily functions. Not any statistically significant differences occurred for insomnia in terms of gender (Table 5).

Table 4. *Psychometric Properties of Bergen Insomnia Scale for Adults (N=495)*

Factors	Scale Items	Item-factors r	Item-Total r	Test-retest r	Cronbach's alpha (α)	McDonald's omega (ω)
Nocturnal symptoms	Item 1	.64	.61	.78	.80	.80
	Item 2	.69	.60			
	Item 3	.60	.59			
Daytime symptoms	Item 4	.70	.64	.77	.85	.85
	Item 5	.70	.64			
	Item 6	.76	.71			
Total	-	-	-	.83	.85	.85

r: *Correlation*

Table 5. *Introductory Features of Adults According to BIS and Factors*

Items	≥3 day n (%)	M±Sd
Nocturnal Symptoms	-	2.07[a]±1.94
I1: You are not able to fall asleep within 30 minutes, after you leave your phone/tablet and switched off the light although you wanted to sleep	196 (39.6)	2.34±2.31
I2: You stay awake for more than 30 minutes when you woke up at night	145 (29.3)	1.81±2.24
I3: You wake up at least 30 minutes earlier than you are supposed to wake up and then could not fall asleep again	165 (33.3)	2.07±2.36
Daytime Symptoms		3.93[a]±2.13
I4: You feel not rested appropriately after waking	363 (73.3)	4.29±2.46
I5: You feel sleepy/tired in a manner that shall affect your school/job or private life	285 (57.6)	3.39±2.43
I6: You dissatisfied with your sleep	357 (72.1)	4.12±2.39
BIS Total		3.00[a]±1.78
Person who has insomnia according to DSM-5[b]	241 (48.7)	
Female	104 (46.8)	p=.471[c]
Male	137 (50.2)	

[a]The average score divided by the number of questions. [b] questioned only the past month. [c] Chi-square test
BIS*: Bergen Insomnia Scale,* ***M****:Mean,* ***Sd****:Standard Deviation*

4. DISCUSSION

The results of the present study suggested that BIS is a valid and reliable instrument to assess insomnia for Turkish adults. BIS consisted of two sub-dimensions as daytime symptoms and nocturnal symptoms.

The term "validity" is related with test or a scale actually measures what it sets out to, or how well it reflects the reality (13,18). In order to assess construct validity, EFA and CFA are being used. EFA leads to some new structures and factors utilizing the relations between variables (13). On the other hand, confirmatory factor analysis assesses whether items' relation with factors are sufficient or not. Furthermore, it is validity analysis method that can be used in cultural adaptation studies (18). At present study, it was identified that Turkish version of BIS showed a two-factor structure and it was confirmed by CFA.

In CFA, chi square value which is one of the fit indices is expected to be insignificant however chi square value is rather sensitive to size of the sample. Thus, it is recommended in the assessment of the model that the value obtained from chi square value's dividing independence degree ($\chi 2/df$) should be taken into consideration (19). At present study CFI, SRMR and χ^2/df fit indices related with theoretical model were ascertained as perfect and RMSEA fit index were identified as acceptable (19,20). In original study, Bergen Insomnia Scale had two-factor structure in adolescent sample and one-factor structure in adult sample. It was determined in our study that Turkish version of BIS was compatible with two factor structure in adults like adolescents (4,14). The first subscale included daytime symptoms of insomnia and the second subscale included nocturnal symptoms similar to adolescent sample of Turkish version.

Factor loads are commended to be ≥ .40 to ensure construct validity (13,21). In adult sample of the original study factor loads were determined between .69 and .88. Similar to original study, rather high factor loads in our study (.80-.88 in the first sample; .64-.85 in the second one) indicated a supportive result regarding to construct validity.

Hair et al (22) proposed using AVE to evaluate the convergent validity for each construct. AVE is calculated as the mean variance extracted for the item loading on a construct (derived from CFA). It is expected that AVE is supposed to be ≥.50 and <CR. Discriminant validity was established where MSV was lower than AVE. In the present study, convergent validity was well for both nocturnal and daytime factors and MSV was low enough to propose independence between the factors in the model and so, it shows that discriminant validity is well.

In order to realize reliability analysis, each item of the tool should be identified to what degree they are related with the tool in total and its correlation coefficient should be calculated through item analysis. Higher correlation coefficient for each item mean that the item is efficient and sufficient to measure the intended theoretical model. Literature suggested that item-total correlation should be >.30 (23). At present study, item-subscale correlations for daytime symptoms were found between .70 and .76; it is between .60 and .69 in nocturnal symptoms subscale and it is between .59 and .71 for item-total correlation that is similar to original study (r= .57 – .80). These results demonstrated that the correlation of items with total score and subscales' item scores with total score of their subscales correlation were sufficient and reliability of the scale together with its subscales was rather high.

Cronbach's alpha and omega coefficient is being used to evaluate internal consistency, which is, how closely related a set of items are as a group. It is considered to be a measure of scale reliability. Furthermore, in literature, alpha and omega reliability coefficient is suggested to be over .70 (24-26).

At present study, Cronbach's Alpha value of BIS was .85 that is similar to community sample of original study (α= .87) and it showed a high level of reliability (4). Moreover, reliability coefficients obtained from subscales were found .85 for daytime symptoms and .80 for nocturnal symptoms that meant a high level of reliability. Additionally, according to employment status and age interval, Alpha reliability coefficient was found out > .81 which is very high level in terms of reliability. For the BIS Turkish version, the omega and alpha coefficients of the scale and sub-dimensions were same and higher than .70. These findings showed that the Turkish version of BIS had good reliability. Since the McDonald's Omega coefficient was not calculated in the original scale, the findings of present study were not able to be compared (4).

Test-retest reliability is a measure of reliability acquired by applying the same test twice over a period of time to a group of people. Literature suggested that at least two weeks and four weeks at most (27) should be between two measurements and it should be held at least with 100 people (23). The correlation coefficient of test retest is recommended to be ≥ .40 (24). In our study, test-retest total correlation of BIS was .83 as rather high and .77-.88 in two subscales respectively that is fairly good. According to these results, it was identified that daytime and nocturnal symptoms of insomnia for adults were consistent in two weeks period.

When the descriptive results were examined, daytime symptoms subscale mean score was higher than that of nocturnal symptoms for adults. Thus, adults experience daytime symptoms more often than nocturnal symptoms. In this study, as similar to original one, the question "How many days a week do you feel not rested enough after waking?" had the highest score.

In Literature, 33%-50% of the adults suffer from insomnia and 10%-15% of them experience sleep disorder (5). Sleep disorder rate was 14.9% in Denmark (28), objective insomnia prevalence was 32% in Brazil and subjective insomnia prevalence was 45% and it was 15% in terms of DSM-4 criteria (29), according to a study conducted in Sweden, insomnia symptoms were 24.6% (30) and insomnia prevalence according to DSM-4 criteria was 15.3% in our country (31). Insomnia prevalence was determined between 49.8% and

66.8% in studies conducted with the help of Bergen Insomnia Scale. Bjorvatn et al (8) found out the rate of insomnia as 53.6% in 1346 patients awaiting their doctor appointments; Katsifaraki et al (12) found the rate as 49.8% in 1032 nurses; Blagestad et al (32) found it as 54.0% in 291 patients admitted to orthopedics clinic; Brevik et al (33) found it as 66.8% in 268 adults. In present study, subjective insomnia prevalence was determined 48.7%. We used BIS for assessment of insomnia, and insomnia was defined according to DSM-5 diagnostic criteria. These findings are in line with other studies.

There are various limitations for the present study. The first limitation was that due to collection of data by self-report, it might affect the quality of data with the recall bias and social desirability bias limitations of participants. Another one is that the number of individuals working in the company operator age between 41-58 is low. In further studies, its reliability can be tested for adults over 41 years old and elderly people. In addition, no evaluation was made between BIS and study variables in our study and this can be considered as a limitation.

5. CONCLUSION

To conclude; Turkish version of BIS, developed by Pallesen et al (4) in English, was confirmed as a valid and reliable tool. Turkish version of BIS might be utilized in studies focusing on sleep disorders and mental health studies in order to assess adults' insomnia conditions.

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