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Adaptation into Turkish and Psychometric Properties of Athens Insomnia Scale

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ABSTRACT

Introduction: The study aimed to adapt the "Athens Insomnia Scale" developed by Soldatos et al. into Turkish and to conduct validity and reliability analysis.

Methods: This research was conducted on 215 patients with insomnia complaints and applied to Family Medicine, Neurology (Sleep Polyclinic), and Psychiatry outpatient clinics. Introductory Information Form, 8-item Athens Insomnia Scale, and Pittsburg Sleep Quality Index were administered to the participants. After the language adaptation of the scale, Cronbach's alpha value was used as the consistency coefficient for reliability analysis. Exploratory factor analysis was examined for structural validity, and correlation coefficients between the Athens Insomnia Scale and its subscales and the Pittsburg Sleep Quality Index were examined for concurrent validity.

Results: Cronbach's alpha coefficient was calculated as 0.87. "Kaiser-Meyer-Olkin value was calculated for factor analysis." In the Exploratory Factor Analysis, a two-factor structure with eigenvalues >1.0 and explaining 73.4% of the variance was obtained. According to the Exploratory Factor Analysis results for the Atina Insomnia Scale, the absolute value of the factor loadings of the eight items ranged between 0.650 and 0.865. The correlation coefficients between the total score and sub-dimensions of the Athens Insomnia Scale and the Pittsburg Sleep Quality Index-a scale assessing sleep quality were between 0.489–0.725 (p<0,01). For discriminant validity, Athens Insomnia Scale discriminated well between patients and healthy volunteers (Z=2.630, p=0,009).

Conclusion: The Athens Insomnia Scale has been shown to have adequate reliability and validity in Turkish.

Keywords: Athens Insomnia Scale, insomnia, psychometrics, reliability, validity

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INTRODUCTION

Sleep is crucial in maintaining brain function and systemic physiology and is a critical indicator of overall health. People spend approximately one-third of their lives in sleep, and consistent, high-quality sleep increases cognitive functioning and improves decision-making and acquiring new information (1,2).

Although there are different views on the definition of insomnia disorder, a large consensus has been reached on the standard diagnostic criteria (3). According to the Diagnostic and Statistical Manual of Mental Disorders-5 (DSM-5), insomnia is diagnosed when symptoms persist three times a week for at least three months, causes significant functional impairment, and is not due to other sleep disorders, other mental disorders or substance use disorders (4). The diagnostic criteria for insomnia in the International Classification of Sleep Disorders-3 (ICSD-3) largely overlap with DSM-5. According to ICSD-3, in the diagnosis of insomnia, there must be disruption in night sleep accompanied by impairment in daytime functionality. In common with DSM-5, this definition requires symptoms to last at least three nights a week for three months (4,5). Ongoing differences in the definition of insomnia, the population studied, and the scope of the study lead to variability in prevalence data (6). According to the data from prevalence studies conducted in different European countries between 2000 and 2014, insomnia disorder varies between 5.7% and 19% while the prevalence of insomnia in Türkiye is 44.7%. in lung cancer patients (7), 38.2% in university students (8) and according to the National Sleep Epidemiology Survey (TAPES), the prevalence of insomnia is 15% in the adult population (9).

Insomnia adversely affects daily life, causing decreased quality of life, increased risk of falls and accidents, and deterioration in social relationships

Highlights

- **The Athens Insomnia Scale (AIS) is a practical and brief self-assessment tool for insomnia.**
- **It provides ease of one-dimensional measurement.**
- **It is functional in distinguishing diagnostic groups regarding insomnia.**

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(10,11). Besides that, it is associated with many comorbidities, such as diabetes mellitus, cardiovascular diseases, and psychiatric disorders (12–14). Considering the wide-ranging effects of insomnia, it is necessary to identify, comprehensively evaluate, and manage sleep disorders (15). The Athens Insomnia Scale (AIS), developed by Soldatos et al., was intended to measure the severity of insomnia and, unlike other psychometric tools, to enable clinicians to make a diagnosis in the light of widely accepted criteria for the diagnosis of insomnia (16). In diagnostic validity studies, it has been reported that the AIS is a short, easy-to-use, and reliable self-assessment screening tool compared to other measurement tools used to evaluate insomnia, such as the Pittsburgh Sleep Quality Index (PSQI), Leeds Sleep Evaluation Questionnaire and Karolinska Sleepiness Scale (16,17). This study aimed to adapt the "Athens Insomnia Scale," developed in English by Soldatos et al., into Turkish and to conduct validity and reliability analysis.

METHOD

Type of Research and Sample

This research is a methodological psychometric study. The sample size of the study was determined to be ten times larger than the 8-item scale; it was planned to have at least 200 patients. Patients who applied to Manisa Celal Bayar University Hospital Family Medicine Outpatient Department, Neurology-Sleep Clinic, and Psychiatry Outpatient Department with subjective complaints of insomnia and who volunteered to participate in the research were included in the study. The diagnosis of insomnia was made according to DSM-5 with a clinical interview. The presence of neurocognitive dysfunction, psychotic disorder, and chronic neurodegenerative disease (Alzheimer's disease and Epilepsy) and the use of sedative and hypnotic-derived drugs were determined as exclusion criteria. Participants completed the data collection tools themselves under the supervision of the research team. Eighteen patients were excluded from the study because they could not complete the study procedure, and 15 did not want to participate. The study was terminated with a total of 215 patients.

Data Collection Tools

In the research, an introductory information form, AIS and PSQI questionnaires were applied to the participants, and each form was filled out once by the participants.

Introductory Form

It consisted of 13 questions to determine the descriptive characteristics of the patients and was prepared by the researchers in line with the literature.

Athens Insomnia Scale

The Athens Insomnia Scale was developed by Soldatos et al. It is a psychometric self-assessment tool intended to determine the severity and impact of insomnia encountered in various clinical and research settings and consists of eight items. In the original development study of the scale, the AIS was shown to have very satisfactory internal consistency and diagnostic validity: Cronbach's alpha was 0.89 and remained practically unchanged when any of the items were deleted. The item-total correlation coefficient was 0.67, and the scale was composed of a single dimension in the factor analysis. However, in other studies, 2- or 3-factor solutions were also obtained (16,17). In addition, for the "test-retest" reliability, the correlation coefficient of the scale was found to be 0.89 at 1-week intervals, and the correlation with the Sleep Problems Scale was 0.90.

Pittsburg Sleep Quality Index

Pittsburg Sleep Quality Index (PSQI) is a scale that evaluates a person's sleep quality and disorders, developed by Buysse et al. in 1989 (18). In the research by Ağargün and his team in Türkiye in 1989, the validity and reliability study of PSQI was performed, and Cronbach's alpha was found to be 0.80 (19). Pittsburg Sleep Quality Index determines sleep construct and quality, including 18 items and seven components. Each component is rated between 0 and 3 points. The total score is between 0 and 21. A total score of higher than 5 indicates poor sleep quality. In a meta-analysis where the diagnostic accuracy of screening tools for insomnia was evaluated, it was shown that PSQI could screen individuals with insomnia, regardless of the underlying cause (20).

Procedure

Adaptation of AIS to Turkish and content validity

Following the standard forward translation-back translation and pre-test step principles, two researchers (MVB, HE) first translated the scale into Turkish using the English version of AIS (21). Two (EÖÖ and MVB) clinical researchers prepared a joint text to ensure that the original and translated English versions were equivalent. Three clinical researchers (AKA, HY, ÖA) who were fluent in both languages, cultures, terminology, and clinical practice completed the final Turkish version of the AIS. They were then used in a pilot study with ten adults to test its clinical utility. Since the items of the AIS are concise, understandable, and clear (for example, the originals of a few items of the scale; "Total Sleep Duration," "Overall Quality of Sleep," and "Sleepiness During the Day"), translation-back-translation, expert researcher consensus, and pilot study were used. Then, the data collection phase started.

Statistical Analysis

Data analysis was performed using IBM Statistical Package for Social Sciences (SPSS) program version version 18.0 (IBM Inc., Chicago, IL, USA) and LISREL 8.54 (Scientific Software Inc., Chicago, IL, USA) statistical software. In the study, categorical variables were given as number (n) and percentage (%), and numerical data were presented as mean and standard deviation to show the patient distribution. It was determined whether the variables' distribution was normal according to the Skewness-Kurtosis values (-2/+2) (22).

The scale sub-dimension averages, standard deviation values, and total item scores were calculated. The Cronbach alpha value used as the consistency coefficient in the reliability analysis was considered satisfactory above 0.7. In validity analysis, exploratory factor analysis was performed using principal component analysis with varimax rotation, and the adequacy of the sample for factor analysis was examined with Kaiser-Meyer-Olkin and Bartlett's sphericity test. In criterion validity, correlation coefficients between PSQI and its subscales used for concurrent validity were examined. To discriminate between patient and healthy groups using AIS, a Student's T-Test was used between the groups' mean scores. In the known groups' validity, independent variables such as gender, marital status, income perception, and educational level were analyzed with Student's t-test, Mann-Whitney U test, and one-way analysis of variance.

Ethical Aspect

Constantin R. Soldatos was contacted via e-mail to obtain permission to conduct the validity and reliability study of the Turkish form of AIS. Approval for the research was obtained from the Health Sciences Ethics Committee of Manisa Celal Bayar University Ethics Committee. (Ethics committee date/decision no: 08.12.2021/1079). The study was conducted within the framework of the principles of the Declaration of Helsinki. Writen informed voluntary consent were obtained from the participants.

RESULTS

Demographic Features

The mean age of the study sample is 43.03±14.70 (range 18–78) years; the majority of the study group is male (54.9%) and married (63.7%). In

Table 1. Descriptive characteristics of the research sample (n=215)

Sociodemographic characteristics	n	%
Gender		
Female	97	45.1
Male	118	54.9
Marital status		
Married	137	63.7
Single	78	36.3
Education		
Primary school and before	79	36.7
High school	53	24.7
University	83	38.6
Income status		
Income less than expenses	51	23.7
Income equal to expenses	139	64.7
Income more than expenses	25	11.6
Where he/she lives		
Rural	98	45.6
Urban	117	54.4
Who does he/she live with?		
Family or partner	140	65.1
Alone	75	34.9
Psychiatric disorder		
Yes	31	14.4
No	184	85.6

the study group, 14.4% of the participants had a history of psychiatric disorders such as depression or anxiety disorder (Table 1).

Internal Consistency of AIS-8

The average AIS total score of 215 participants was 10.05 [standard deviation (SD)=5.42]. As in its original structure, the total scale of Cronbach's alpha coefficient was calculated as 0.87. When the item was deleted, the Cronbach's alpha value change was evaluated, and no significant difference was found. When the eighth item was deleted, Cronbach's alpha coefficient value of the scale was 0.876 (0.006 increase). It was observed that the item-total score correlation coefficients of the scale varied between 0.41 and 0.78. Since there were no items with item-total score correlation values below 0.30 or negative values, it was decided not to remove any items from the scale (Table 2).

Validity Analysis

Exploratory factor analysis (EFA)

Kaiser-Meyer-Olkin (KMO) value and Bartlett's sphericity test were calculated regarding sample adequacy for factor analysis. Kaiser-Meyer-Olkin value was found to be 0.854 and was considered significant at $p<0.001$. In Exploratory Factor Analysis (EFA), a two-factor structure was obtained with Eigen Values >1.0 and explaining 73.4% of the variance. According to the EFA results for AIS , the absolute value of the factor loadings of the eight items varies between 0.650 and 0.865. The first factor was named "Insomnia Symptoms" because it included items describing the details of the insomnia symptoms. The second factor was named "Effects of insomnia and quality of life" because it contains items about the effect of insomnia on daily life. When the distribution of these two factors according to the dimensional structure of the original scale was examined, it was observed that some items were located in different factors in two separate sub-dimensions instead of the one-dimensional structure in the original scale. Although the distribution of the items does not fully match the original factor structure, the two-factor structure obtained as a result of EFA is distributed in a way that creates meaningful structural integrity in determining insomnia (Table 3).

Concurrent Validity Analysis

The correlation coefficients between the AIS total score, subscales, and PSQI were 0.489–0.725. In the analyses, it was determined that there was a significant correlation between AIS and its subscales and PSQI total score ($p<0.01$) (Table 4).

Discriminant Validity Analysis

To see how the scale distinguishes patients from healthy people, the variable "presence of a known mental illness" was evaluated. Athens Insomnia Scale total scores were found to be higher in patients who were diagnosed with major depressive episodes or with anxiety disorder ($Z=2.630$, $p=0.009$) when compared with healthy subjects.

Known Groups Validity

As a result of univariate analyses, a significant relationship was determined between the AIS score and the participants' education level, presence of chronic disease, family history of insomnia, and company of a psychiatric disease diagnosis (depressive disorder and anxiety disorder) ($p<0.01$, Table 5). Individuals with a higher education level, no chronic disease, no family

Table 2. Descriptive statistics of the Athens Insomnia Scale

AIS Scale items	Score distribution mean ± SD	Item-total correlation coefficients	Cronbach's Alpha value when item is removed	The value of Cronbach's alpha
AIS Total				0.870
AIS 1	1.19±1.04	0.499	0.869	
AIS 2	1.24±0.88	0.607	0.855	
AIS 3	1.07±0.96	0.561	0.860	
AIS 4	1.22±0.94	0.777	0.836	
AIS 5	1.46±0.84	0.782	0.838	
AIS 6	1.27±0.91	0.718	0.843	
AIS 7	1.30±0.95	0.685	0.847	
AIS 8	1.32±0.94	0.411	0.876	

AIS: Athens Insomnia Scale; SD: standard deviation.

Table 3. Exploratory factor analysis result of the Athens Insomnia Scale (Varimax)

Item	Dimensions	
	Factor 1 Insomnia symptoms	Factor 2 Effects of insomnia and quality of life
Item 1. Sleep induction	0.824	
Item 2. Awakenings during the night	0.858	
Item 3. Final awakening earlier than desired	0.753	
Item 4. Total sleep duration	0.650	
Item 5. Overall quality of sleep		0.670
Item 6. Sense of well-being during the day		0.865
Item 7. Functioning (physical and mental) during the day		0.854
Item 8. Sleepiness during the day		0.807
Eigen Value	4.319	1.473
Exploratory variance (%)	53.989	18.410

Kaiser-Meyer-Olkin: 0.854; Bartlett's test of sphericity: p<0.001, Number of explained variance=2; Accumulated percentage of variance explained for two dimensions: 72.399%

Table 4. Correlation coefficients between scales (r)

Scales	Subdimensions and Total Athens Insomnia Scale Score		
	Factor 1 Insomnia symptoms	Factor 2 Effects of insomnia and quality of life	AIS Total Score
PSQI total score	0.489*	0.725*	0.694*

*p<0.001; AIS: Athens Insomnia Scale; PSQI: Pittsburg Sleep Quality Index.

Table 5. The ability of the Athens Insomnia Scale to detect differences according to basic descriptive features

Sociodemographic characteristics	n	mean ± SD	Statistical test
Gender			
Female	97	10.22±5.33	t=-0.404 p=0.686
Male	118	9.92±5.51	
Marital status			
Married	137	10.44±5.60	t=1.389 p=0.166
Single	78	9.37±5.06	
Education*			
Primary school and before[a]	79	11.41±5.09	F=5.362 p=0.005
High school[b]	53	10.19±5.60	
University[c]	83	8.67±5.31	
Income status			
Income less than expenses	51	9.76±5.84	F=0.396 p=0.674
Income equal to expenses	139	10.00±5.31	
Income more than expenses	25	10.92±5.25	
Where he/she lives			
Rural	98	10.17±5.70	t=0.302 p=0.763
Urban	117	9.95±5.20	
Who does he/she live with?			
Family or partner	140	10.20±5.72	t=0.549 p=0.584
Alone	75	9.77±4.84	
Psychiatric disorder			
Yes	31	11.85±6.29*	Z=-1.487 p=0.009
No	184	9.79±5.25	

*a >c (Posthoc analysis result); SD: standard deviation.

history of insomnia, and no psychiatric disease have lower AIS scores; therefore it has been determined that they have a lower risk of insomnia.

DISCUSSION

In this study, the psychometric properties of the AIS were evaluated. Our findings show that the AIS is a reliable and valid tool for assessing insomnia symptoms in the Turkish population, consistent with its use in its original language and adaptation studies in other languages (17,23,24).

In the reliability analysis of AIS, high internal consistency (night sleep problem factor: α=0.83, AIS-total: α=0.86) was found, similar to previous studies (23–26). Item-total correlations, which reflect the harmony of each scale item with the scale's general structure and total score, have values ranging between 0.41 and 0.78, similar to the studies conducted in Japan and Spain (25–27). High and positive correlation values in item-total score correlation analysis indicate that the items measure similar trends and have increased internal consistency, as in other validity studies.

In the EFA, a two-factor structure emerged, unlike the one-dimensional structure of the original AIS. However, it is noteworthy that this result is not specific to our research. A similar two-factor structure was observed in other validation studies of AIS (28,29). In the EFA analysis, the Japanese version of AIS-8 revealed a two-factor structure: nighttime sleep problems and daytime dysfunction, similar to the Turkish version of the scale (23). Variation in AIS subscales may emphasize cultural differences' effect on sleep and wakefulness. However, the fact that the items in the dimensions are different in studies suggests that the AIS should be used as a single scale, regardless of its original eight items or the number of dimensions it contains.

The concurrent validity of the Turkish form of AIS supports the two-dimensional single-scale structure, and the correlation coefficient between the total score of the scale and PSQI was found to be significant (r=0.694). This significant relationship in the concurrent validity of AIS with PSQI shows characteristics similar to the results of other validation studies (23,24). These results reaffirm the ability of AIS to identify sleep-related problems effectively.

When the discriminant and known group validity of AIS were evaluated, it was revealed that the scale could distinguish various factors affecting insomnia symptoms and sleep quality. In the discriminant validity analysis, it was shown that the AIS can effectively discriminate between individuals with depressive disorders and anxiety disorders and healthy individuals, indicating that the scale is sensitive to psychopathology. Additionally, the analysis of known groups confirmed measurement invariance across gender, marital status, income level, living alone, and urban-rural living groups, meaning that the meaning and results of the scale remained consistent across these variables. However, no measurement invariance was observed based on education level, which suggests that groups with primary school education or less may interpret the AIS differently. This educational level-related difference in interpretation may require careful analysis and interpretation when comparing scores in the groups with lower levels of education.

Limitations

This research has some limitations. First, the sample size is relatively small and may limit generalizations. Second, the study was conducted with people who had self-competency. This may limit our ability to determine the applicability of the results in the broader society. However, the fact that this research was conducted on individuals with insomnia complaints who applied to three different polyclinics (sleep polyclinic, psychiatry outpatient clinic, and family medicine outpatient clinic) supports the fact that AIS is easy to use.

In conclusion, this study shows that the AIS is a practical, reliable, and valid tool in the Turkish population. The scale has been suggested to be suitable for clinical and research applications. The use of this scale for clinical and research purposes is expected to increase, especially in the evaluation and monitoring of insomnia. However, additional research with larger samples and different populations is needed. Such studies will help to understand the psychometric properties of the scale better and make generalizations.

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Ethics Committee Approval: Constantin R. Soldatos was contacted via e-mail to obtain permission to conduct the validity and reliability study of the Turkish form of AIS. Approval for the research was obtained from the Health Sciences Ethics Committee of Manisa Celal Bayar University ethics committee. (Ethics committee date/decision no: 08.12.2021/1079) The study was conducted within the framework of the principles of the Declaration of Helsinki.

Informed Consent: Informed voluntary consent forms were obtained from the participants.

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