

RESEARCH ARTICLE

Validation of Arabic versions of three sleep surveys

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ABSTRACT

Background: Research on sleep health is lacking in developing countries, particularly among the Sudanese population. This contributes to a number of social and safety risks such as workplace injury, daytime sleepiness, automobile accidents, and more. The current study aims to validate three Arabic questionnaires related to sleep health, namely the Epworth Sleepiness Scale (ESS), Insomnia Severity Index (ISI), and Restless Legs Syndrome (RLS).

Methods: A random sample of 83 Sudanese participants was surveyed for the purpose of testing the reliability and validity of the Arabic version of the ESS, ISI, and RLS. The present study used exploratory factor analysis (EFA) of item scores to examine a potential single-factor structure of the ESS, ISI, and RLS. Reliability and validity of the instruments were assessed by internal consistency and construct validity, respectively.

Results: The internal consistency within the ESS, ISI, and RLS subscales was high, with Cronbach's alpha of 0.84, 0.87, and 0.94, respectively. EFA results showed the RLS and ISI scales were dominated by a single-factor structure that explained at least 84.2% and 65.70% respectively of the total variance. The ESS required a two-factor solution that explained 64.5% of the total variance, so the single-factor structure does not appear to be a good measure of the Arabic version of the ESS.

Conclusion: The Arabic versions of the ESS, ISI, and RLS are valid and reliable tools. The RLS and ISI seem to have better psychometric properties than the ESS.

Keywords: sleep disorders; daytime sleepiness; restless legs syndrome; insomnia; Sudan

INTRODUCTION

It is a fact that every individual has a biological need for sleep, in the sense that sleep automatically comes to an individual. Potentially harmful individual practices such as sleeping during the daytime [1] or excessive tea or coffee intake or chocolate at night, may cause sleep disturbance [2]. Several studies have suggested that sleep disturbance may be caused by anxiety, psychological stress, depression, or for other reasons [3,4,5,6,7]. In turn, sleep disorders have significant implications for morbidity and mortality, highlighting the importance of such a study [8,9].

According to the National Commission on Sleep Disorders Research, there are about 40 million Americans who experience chronic sleep disturbances, suffering specifically from insomnia or sleep-related problems [10]. The prevalence of sleeping problems was 56% in the USA, 31% in Western Europe and 23% in Japan [11]. The importance of public awareness with respect to sleep health has gained significant recognition and has been given considerable attention in developed countries. Poor quality of sleep can occur as a result of excessive daytime sleepiness (EDS), difficulty initiating sleep, frequent awakenings, or restless legs syndrome (RLS). Insomnia is a type of sleep disorder in which there is an inability to fall asleep or to stay asleep as long as desired [12,13]. The insomnia scale was translated into Arabic with an internal consistency reliability of 0.84 [14].

The Epworth Sleepiness Scale provides a measure of a person's general level of daytime sleepiness, or their average sleep propensity in daily life [15]. The ESS is a reliable scale for assessing persistent daytime sleepiness among normal subjects and subjects with various sleep disorders (Cronbach's alpha of 0.88) [16].

Excessive daytime sleepiness affects 12% of Americans [17]. The Arabic version of the ESS is also a reliable instrument [18]. The internal consistency was examined in the Saudi population. It was found that Cronbach's alpha coefficient was above 0.86 [18].

RLS is a common, distressing movement disorder, yet many sufferers are not diagnosed or managed adequately [19]. However, a study has developed and validated a questionnaire for assessing the symptoms of RLS [20]. The prevalence of severe RLS was investigated, using the International Restless Legs Syndrome Study Group (IRLSSG) criteria in a Saudi sample of participants between the ages of 45 and 60 years. The result was 5.2% [21]. This study

showed that 11.8% of the participants reported mild RLS symptoms, 42.6% were moderate, 42.6% were severe, and 2.9% were very severe. The prevalence of RLS was fairly equal between males and females [21]. The prevalence of daytime sleepiness in healthy Saudi subjects was 19% [18]. The prevalence of insomnia in Egypt was 36.4% [22]. No work has been published on sleep health in Sudan and the prevalence of insomnia, excessive daytime sleepiness, and RLS. Despite their widespread prevalence in Arab countries, these sleep disorders remain unaddressed in the people of Sudan.

Sleep disorders are among the most common diseases in African countries [23]. The prevalence of sleep problems among South African females is 31.3% and 27.2% among males [23]. Despite this, sleep health remains unrecognized in developing countries. There are different sleeping habits from one person to another and from one region to another, and there are many factors that make up these habits. Many of these relate back to the dominant culture in the region, and the norms, as well as external factors, such as the climate and temperature, are important factors in the formation of these habits. The Sudanese society is predominantly a society of Muslims and Christians, culturally containing some factors that may constitute the sleeping habits of the people, including the timeliness of prayer, decrease of activity in the afternoon, and more. These all greatly affect sleep habits among people of all ages and backgrounds, practical and cultural.

Notably, the original English versions of these three sleep questionnaires were examined for a single-factor structure. For example, the ESS has only one factor structure for students [16]. Factor analysis of the International Restless Legs Severity Scale (IRLS) revealed two subscale scores: one for symptoms and the other for symptom impact [20]. No similar work has been published on Arabic translations of the original English questionnaires. The aim of the present study is to investigate the psychometric properties of the Arabic translation of the original English questionnaires of the ESS, ISI, and RLS, as well as to examine its factor structure with exploratory factor analysis. This investigation is also concerned with the reliability and internal consistency of these questionnaires.

METHODS

A self-administered survey was used to collect information on each individual's age, gender,

education, and tea/coffee intake. The survey also included a set of three questionnaires comprising the ESS, ISI, and RLS. A professional translation office translated the three original instruments from English to Arabic and back-translated to English. Two sleep consultants compared the original English version of each instrument with its Arabic translation as it presently stands. The study was conducted in August of 2013 at Sudan University of Science and Technology (SUSTech), which is one of the main public universities in Khartoum, Sudan. Ethical approval of the study was obtained from the Research Committee at the College of Medical Radiological Sciences, SUSTech.

Daytime sleepiness was measured by eight-item scores representing the Epworth Sleepiness Scale (ESS) [15]. The ESS measures the chance of falling asleep in eight different situations: "sitting and reading," "watching TV," "sitting, inactive in a public place," "as a passenger in a car for an hour without a break," "lying down to rest in the afternoon when circumstances permit," "sitting and talking to someone," "sitting quietly after lunch without alcohol," and "in a car, while stopped for a few minutes in traffic." Cultural modification was considered when translating the ESS. This modification appears in item seven: "sitting quietly after lunch without alcohol." The statement "without alcohol" was deleted, as alcohol consumption is prohibited and is socially unacceptable in Sudanese society and most Arab countries. The total ESS score is the sum of the eight-item scores with the scale range between 0 and 24. The presence of EDS was based on a total ESS score with a value > 10 to indicate EDS. The presence of insomnia was evaluated by four items: "difficulty falling asleep," "frequent awakening," "wake up too early," "feel tired," and "sleep loss affects your mood." The presence of RLS was measured using a four-item evaluation [20]: "... uncomfortable or unpleasant sensations in the legs," "... unpleasant sensations begin or worsen during periods of rest ... such as lying or sitting," "... unpleasant sensations are ... totally relieved by movement," and "... unpleasant sensations are worse in the evening or at night than during the day, or only occur in the evening or night." Two sleep questionnaires (Arabic versions) are reliable scales for measuring insomnia [14] and daytime sleepiness [18]. A research assistant explained the purpose of the study to the participants. Despite the use of an anonymous self-administered survey, subjects were

asked whether they agreed to participate in the study. One hundred students were randomly chosen to complete the questionnaires from a classroom size of 300 students. A total of 83 completed questionnaires were returned out of the 100 that were distributed, with an overall response rate of 83%. Of the 83 questionnaires, there were 5 to 12 missing responses from ISI items, 1 to 7 missing responses from the ESS items, and 2 to 11 missing responses from RLS items. It was assumed that if any item was missing, then the overall response is missing. The total number of fully completed surveys seemed to vary by questionnaire types. It was determined that 64 participants fully completed the ISI survey, 66 fully completed the ESS survey, and 71 fully completed the RLS survey.

Data Analyses

Data was analyzed using IBM Statistical Package for the Social Sciences (SPSS), version 21.0 (IBM, Chicago, IL). Descriptive statistics such as means and standard deviation, mean \pm SD, were used to describe the continuous variables. Frequencies and percentages, n(%), were used to describe the categorical variables. Associations between the presence of EDS, ISI, RLS, and demographic characteristics were examined using Chi-square tests. A p-value < 0.05 was considered statistically significant. Internal consistency of each of the three sleep questionnaires was investigated using Cronbach's alpha (α) coefficient. Exploratory factor analysis with varimax rotation was used to examine whether the single-factor/component structure exists for each scale by retaining components with eigenvalues > 1.

RESULTS

The distribution of demographic factors and the presence of sleep disturbance is described in Table 1. The mean age for the entire sample was 29.8 (SD, 7.4), range 18-60 years. Males accounted for 75% of the overall sample, 85.9% had university degrees, 42.1% were unemployed, and 58.6% were single. Only 7.6% were smokers, 41% were coffee consumers, while 30.1% were tea consumers. In the study sample, the presence of excessive daytime sleepiness (ESS scores > 10) was 48.5%. Also the presence of insomnia was 32.8% and RLS was 28.2%. The three sleep questionnaires demonstrated high internal consistency with Cronbach's alpha values ranging between 0.84 and 0.94. Item analysis showed

Table 1. Demographic factors and the presence of EDS, ISI, or RLS.

Factors		Overall	EDS 32/66 (48.5%)		ISI 21/64 (32.8%)		RLS 20/71 (28.2%)	
		n(%)	%	P	%	P	%	P
Gender	Female	19(25.0)	53.3	0.767	37.5	0.721	38.9	0.122
	Male	57(75.0)	48.9		32.6		19.6	
Education	High school or less	11(14.1)	85.7	0.104	36.4	1.000	50.0	0.117
	University	67(85.9)	45.6		32.7		22.8	
Occupation	Non-employee	32(42.1)	31.0	0.036	17.9	0.055	29.2	0.886
	Employee	44(57.9)	57.6		40.6		27.5	
Marital status	Single/Others	41(58.6)	47.2	0.155	31.4	0.610	28.1	0.919
	Married	29(41.4)	66.7		38.1		26.9	
Smoking	Smoker	5(7.6)	60.0	0.841	20.0	0.651	20.0	1.000
	Non-smoker	61(92.4)	55.3		35.4		24.5	
Coffee intake	No	49(59.0)	52.6	0.432	38.5	0.229	21.3	0.071
	Yes	34(41.0)	42.9		24.0		41.7	
Tea intake	No	58(69.9)	56.3	0.039	31.9	0.799	19.2	0.006
	Yes	25(30.1)	27.8		35.3		52.6	

EDS: excessive daytime sleepiness, ISI: Insomnia Severity Index, RLS: restless legs syndrome.

high internal consistency within the ESS questionnaire (Cronbach's alpha = 0.84), the insomnia questionnaire (Cronbach's alpha = 0.87), and the RLS questionnaire (Cronbach's alpha = 0.94).

The distribution of demographic characteristics and risk factors for EDS, ISI, or RLS is described in Table 1. The presence of EDS, ISI, and RLS was similar among gender groups, educational levels, marital status, smoke status, and coffee intake (p -value > 0.05). However, EDS was reported by 27.8% of tea drinkers compared to 56.3% of non-tea drinkers (p -value = 0.039). RLS was reported by 52.6% of tea drinkers compared to 19.2% of non-tea drinkers (p -value = 0.006). Factor analysis of item scores showed that the insomnia scale had a single-factor structure with 65.7% total variance explained (Table 2).

The factor loadings for the insomnia scale ranged from 0.64 "wake up too early" to 0.89 "sleep loss affects your mood." Also the factor analysis showed a single-factor structure for the RLS scale with 84.2% total variance explained (Table 3). The factors loading ranged from 0.801 "... unpleasant sensations are worse in the evening or at night than during the day, or only occur in the evening or night" to 0.965 "... unpleasant sensations are ... totally relieved by movement." Table 4 displays the structure of the Epworth Sleepiness Scale, as well as the factor loadings.

In terms of the ESS, the factor analysis showed a two-factor structure that accounted for 64.5% of the variance. Factor one accounted for 48.4% of the variance. It consists of five items reflected mainly on

Table 2. Exploratory factor analysis of ISI.

#	Item	One component extracted
1	Difficulty falling asleep	0.83*
2	Frequent awakening	0.81*
3	Wake up too early	0.64*
4	Feel tired	0.86*
5	Sleep loss affects your mood	0.89*
	Variance explained	65.70%

*One main component is the composition of all five items.

Table 3. Exploratory factor analysis of RLS.

#	Item	One component extracted
1	Uncomfortable and unpleasant sensations in the legs	0.949*
2	Unpleasant sensations begin or worsen during periods of rest such as lying or sitting	0.946*
3	Unpleasant sensations are totally relieved by movement	0.965*
4	Unpleasant sensations are worse in the evening or at night than during the day or, only occur in the evening or at night	0.801*
	Variance explained	84.20%

*One main component is the composition of all four items.

Table 4. Exploratory factor analysis of ESS.

#	Item	First component extracted	Second component extracted
1	Sitting and reading	0.868*	0.079
2	Watching TV	0.786*	0.286
3	Sitting, inactive in a public place	0.785*	0.234
4	As a passenger in a car for an hour without a break	0.766*	0.19
5	Lying down to rest in the afternoon when circumstances permit	0.729*	0.105
6	Sitting and talking to someone	0.338	0.753 ⁺
7	Sitting quietly after lunch	0.105	0.811 ⁺
8	In a car, while stopped for a few minutes in traffic	0.107	0.709 ⁺
	Variance explained	40.5%	24.0%

*First component is the composition of items 1, 2, 3, 4, and 5.

⁺Second component is the composition of items # 6, 7, and 8.

the chances of falling asleep when engaged in activities with a low somnificity, and the factor loadings ranged from 0.729 "lying down to rest in the afternoon when circumstances permit" to 0.868 "sitting and reading." Factor two accounted for 16.1% of the variance, it consists of three items reflected mainly on the chances of falling asleep when engaged in activities with high somnificity, and the factor loadings ranged from 0.709 "in a car, while stopped for a few minutes in traffic" to 0.811 "sitting quietly after lunch."

DISCUSSION

The results showed that the Arabic-translated version of the three sleep questionnaires had acceptable reliability coefficients (Cronbach's alpha). The internal consistency within the ESS questionnaire was: Cronbach's alpha = 0.84. This result was higher than that found in the original ESS questionnaire [15], and the reliability was 0.73 among healthy

university students. The current investigation reported a high reliability of 0.87 within the insomnia questionnaire. The results were similar to those found in previous research [13,14], and the internal consistency within the insomnia questionnaire was 0.88 [13]. The internal consistency within the RLS questionnaire was 0.94. The Arabic-translated versions of the RLS, and ISI are shown to be reliable, internally consistent, and each has a single-factor structure in its variance. Thus, these two scales were thought to have perfect construct validity.

When the factor analysis of the 83 students was conducted on the ESS, it revealed a two-factor solution. Our findings suggest that the single-factor structure of the eight-ESS items proposed by Johns [16] was not a precise model to represent this data. While Johns' model may be correct when applied to a Western culture, our findings suggest that future research of ESS in the Sudanese population should consider a two-factor solution. Particularly, item six

"sitting and talking to someone," item eight "in a car, while stopped for a few minutes in traffic," and item 7 "sitting quietly after lunch," do not appear to be correlated with the other items. This finding supports the two-factor solution in Smith et al., [24]. It was also noted in Smith's study that item six "sitting and talking to someone" and item eight "in a car, while stopped for a few minutes in traffic" do not appear to be good measures of the construct. Johns studied 104 students [16], and the data showed that there was only one main factor of the ESS. However, Johns noted that the factor loadings were relatively high on all items except for item six "sitting and talking to someone" and item eight "in a car, while stopped for a few minutes in traffic" for the students. The author reported that these two items were the least soporific for the student group [16]. According to his results, item six showed a factor loading of 0.25 and item eight showed a factor loading of 0.37 [16]. Several studies investigated factor loading cut-offs [25,26,27], but no study recommended loading below 0.40 unless the sample size was 250 respondents. It was not clear whether the Johns model followed the guidelines and recommendations of these studies. According to the current investigation, item seven (loading = 0.105) and item eight (loading = 0.107) show very low loading, as well as item six (loading = 0.338), whereas items one to five showed factor loadings over 0.72. This would necessitate a second factor containing items six, seven and eight which were the least soporific items. Based on the current study, 48.5% of a sample of 66 respondents reported EDS, 32% of a sample of 64 respondents reported insomnia, and 28.2% of a sample of 71 respondents reported RLS. The present sample was randomly extracted from the university student population. Since this sample is not representative of the general Sudanese population, the findings should be interpreted with caution. A number of factors could contribute to the higher presence of EDS in the study sample, such as the former's high unemployment rate (e.g., 42% of 76 respondents), cultural factors, climate, and more. This data shows an undeniable need for this research,

as EDS could lead to safety and social malefactors such as workplace injury, automobile accidents, and more. Although the main purpose of the study was to construct validity and test the reliability of the Arabic version of the three sleep questionnaires, a sample of 83 participants are too small to make conclusions on the prevalence of sleep disorders. A large epidemiological study is needed to determine the prevalence of sleep disorders among the general Sudanese population. However, the investigation had a number of strengths. This study demonstrated the validity and reliability of ISI, ESS, and RLS (Arabic versions). Since no work has previously been published on sleep disorders in Sudan, the research provides insight into the presence of sleep disorders among Sudanese students. Sleep problems have not been given full consideration in Sudan, thus future epidemiological studies are needed to understand the sleep problems and develop proper management and medical treatment.

CONCLUSION

We conclude that the current study supports the original subscale structure of the ISI and RLS. The findings suggest that ESS can be evaluated using separate subscale scores. Clinicians should consider the different meanings of the two factors of the ESS when using this tool to assess daytime sleepiness in the Sudanese population.

COMPETING INTERESTS

The author declares that he has no competing interests.

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