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Original Article

Psychometric properties of the Kurdish version of Pittsburgh Sleep Quality Index

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ABSTRACT

Background: The Pittsburgh Sleep Quality Index (PSQI) is a standardized questionnaire that used for subjective assessment of sleep quality. It has been translated into several languages and is widely used in clinical research settings. Since there is no sleep-related scale standardized in the Kurdish language, the present study aimed to translate and validate the PSQI into Kurdish.

Methods: First, the PSQI was successfully translated into Kurdish then back-translated into English by independent professional bilingual translators. The translated version of PSQI was tested with 230 participants, 150 healthy subjects, 40 subjects with insomnia, and 40 subjects with physical symptoms. Internal consistency was calculated by the Cronbach Alpha method using SPSS-20 software. Spearman correlation via a test-retest process was used for reliability. The General Health Questionnaire (GHQ28) was used to analyze criterion validity. The construct validity of the scale was tested by exploratory factor analysis (EFA). Factor weight was checked by confirmatory factor analysis (CFA) using LISREL software version 8.8.

Results: The internal consistency and reliability for PSQI global score was acceptable (Cronbach's alpha = 0.70). The result showed a strong correlation between test and retest after six weeks (r = 0.83). Correlations between the global score and components of the PSQI with the GHQ28 were all statistically significant (r = 0.23–0.72, $p < 0.05$). Exploratory factor analysis revealed three factors with a significant correlation between the PSQI global score and these factors. All factor weights were above 0.40.

Conclusion: The results of this study support the PSQI's validity and reliability. This study offers a foundation for further studies in Kurdish populations.

1. Introduction

Sleep as a necessary homeostatic behavior plays a critical role in the mental, physical, and emotional health of human beings [1]. Globally, it is estimated that 30 to 40 percent of the general population is affected by different types of sleep disorders [2]. There is a bidirectional association between sleep disturbance and psychiatric conditions. Sleep problems are among the first signs of most prevalent mental disorders such as depression, anxiety, and alcohol abuse [3]. Because treating psychiatric disorders leads to better sleep quality, managing sleep disturbances in turn has a significant impact on treatment outcomes among patients with psychiatric conditions. Moreover, sleep-related problems may increase the risk of replacing psychiatric disorders [4].

Sleep quality is a core concept in sleep clinic care and research. It includes quantitative aspects of sleep, such as sleep duration, sleep latency, or the number of arousals, as well as more subjective aspects, such as “depth” or “restfulness” of sleep [5]. Sleep duration, sleep onset latency, number of arousals, and sleep efficiency could be evaluated via equipment such as Polysomnography (PSG) and Actigraphy. Whole night electroencephalography (EEG) monitoring

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by PSG is the gold standard measurement of objective sleep characteristics [6]. However, an expensive and time-consuming procedure may not be available in different research and treatment settings. In addition, the critical importance of subjective sleep quality in clinical and research settings should be considered. Discrepancies between objective and subjective sleep measures have a diagnostic value for some sleep disorders [7,8], and the subjective rating of sleep has a significant role for the evaluation of treatment outcomes among people with sleep disorder complaints [9]. Furthermore, because sleep quality is largely subjective, sleep laboratory measures may correlate with perceived sleep quality, but they cannot define it [10]. Therefore, the Pittsburgh Sleep Quality Index (PSQI) was developed to provide a brief, clinically useful assessment of sleep quality [5].

The PSQI is a self-reported questionnaire with seven sleep quality components including subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction, over a one-month time interval. A total score is calculated by adding the scores from the seven components [5]. The PSQI showed good reliability and validity when administered to healthy people, patients with mental conditions, as well as people with sleep disorders [11–16]. Systematic reviews and meta-analysis studies also confirmed strong reliability and validity, and moderate structural validity in a variety of samples, suggesting the tool fulfills its intended utility [11].

A diverse wide range of cultures and languages are present in the Middle East region. The common languages are Arabic, Persian, Turkish, and Kurdish. In recent decades, a large portion of the population has been exposed to armed conflicts, political and economic instability, particularly in Iraq and the Kurdistan Region of Iraq (KRI). Studies have reported a high prevalence of mental health illnesses among this population [17,18]. While there are substantial needs for diagnosis and treatment of psychological/behavioral disorders, validated mental health tools are scarce. The PSQI was translated into different languages of the Middle East, including Persian [19], Arabic [20], and Turkish [21] and showed good reliability and validity. To assess the Kurdish version of the PSQI, we aimed to translate and evaluate the validity and reliability of PSQI in Kurdish.

2. Methods

In the present study, psychometric properties for the Kurdish version of PSQI (PSQI-K) have been investigated. We aimed to develop a reliable PSQI-K by following a standardized procedure [22]. The process was a collaborative research project between the Sleep Disorders Research Center (SDRC) of Kermanshah University of Medical Sciences (KUMS)-Iran, and the Psychology Department of Garmian University, Kalar, KRI.

2.1. The translation process for the Kurdish version of PSQI

The translation of the original PSQI was performed according to the Functional Assessment of Chronic Illness Therapy's (FACIT) translation methodology [22]. First, the PSQI was translated into Kurdish by two independent Kurdish-English bilingual researchers in Kermanshah, Iran, and Kalar, KRI, and then the two versions were revised and combined by the correspondence author. Another two independent bilingual translators who did not have access to the original English version, conducted a reverse translation from Kurdish into English and the two versions aggregated by the first translators. The Kurdish translation and back-translation were critically analyzed and compared with the original English version by a research committee including a psychologist, psychiatrist, English, and Kurdish language professors, and sleep-disorder researchers, all fluent in both languages.

2.2. Setting

The validation process was conducted at Garmian University, KRI, between Januarys – July 2018.

The University of Garmian is a non-profit public higher education institution located in the suburban setting of Kalar, a city of 250,000 inhabitants. Approximately 4000 undergraduate and graduate students enrolled in the university during the academic year 2017–2018.

2.3. Participants and sampling

2.3.1. Pilot study

Fifty undergraduate students with a mean age of 20.21 ± 2.11 (25 male and 25 female) from Garmian University enrolled voluntarily in the study and completed the finalized version of the PSQI-K before conducting the main study (Fig. 1).

2.3.2. Main study

Two-hundred thirty participants, with a mean age of 23.85 years (SD = 6.88 years) were selected for the main study. The participants in the main study included three groups (Fig. 1).

a One-hundred and fifty healthy participants with a mean age of 23.85 years (SD = 6.88 years) were selected randomly among students at Garmian University. The response rate was 92%, and 19 invalid questionnaires were excluded. Finally, 131 healthy participants (mean age = 20.11 ± 4.32) were included.
b Forty participants (mean age = 26.12 ± 8.09; 29 male and 11 female) with insomnia complaints were selected purposively from the Bakhshein Medical Community, a non-governmental organization (NGO) in Kalar city, based on a cut-off point on the insomnia subscale of the General Health Questionnaire-28 (GHQ-28).
c Forty participants with physical symptoms (mean age = 25.32 ± 9.01; 23 male and 17 female) were selected purposively from Bakhshein Medical Community based on the physical symptoms subscale of GHQ-28 results.

2.3.3. Retest

Forty-eight participants (approximately 22% of participants) were selected randomly from healthy people and completed the PSQI-K after 4–6 weeks.

All participants were educated at least up to high school, were medically stable, were free from current (past three months) substance abuse and free from lifetime psychotic or bipolar disorder, and they did not show signs nor symptoms of any medical conditions. This information was obtained through interviews conducted by the primary investigator. Participants in the groups matched according to gender, age, marital status, and education level. All participants provided written informed consent.

2.4. Measures

PSQI: The PSQI comprises 19 self-rated questions grouped into seven component scores, including subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbance, hypnotic medication use, and daytime dysfunction. All questions weighted equally on a 0–3 point scale. The seven component scores then combined to provide a global PSQI score. A cutoff score of 5 has been recommended, with scores >5 indicating subjective insomnia

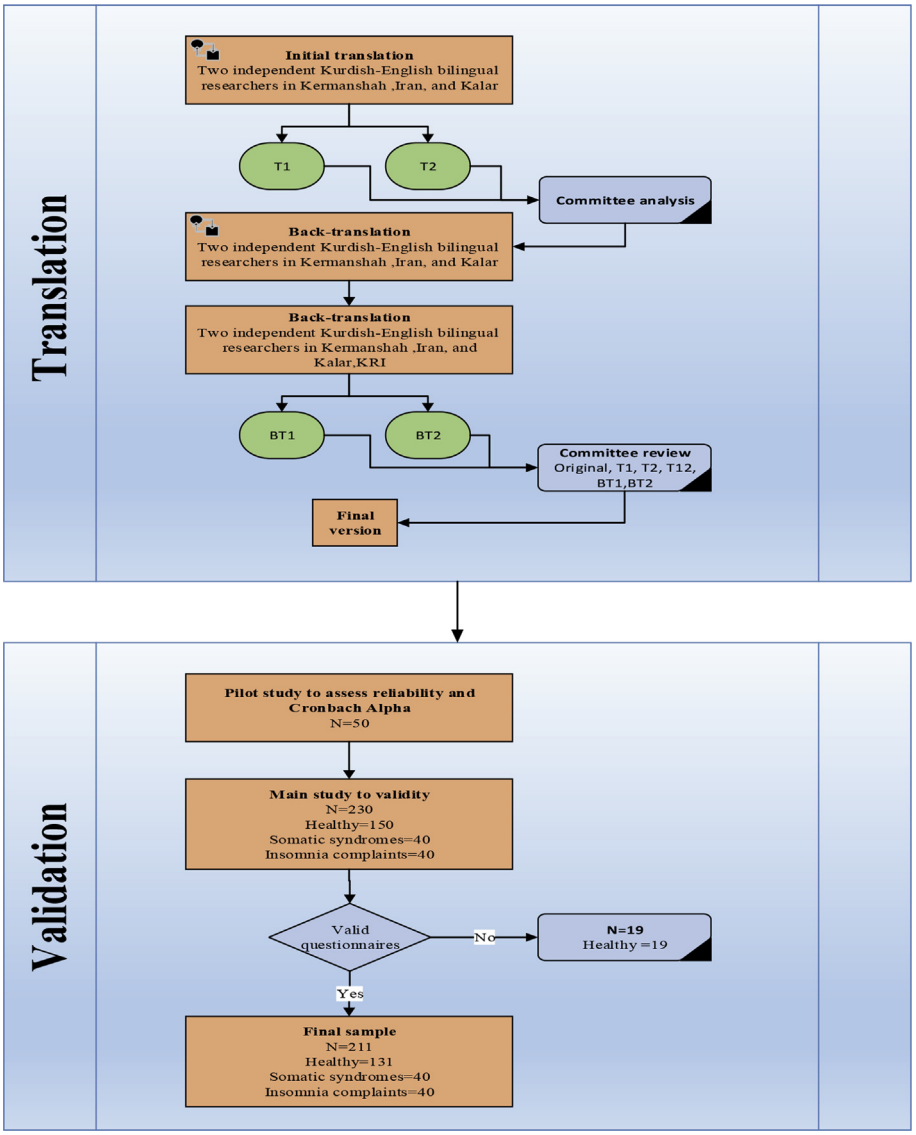

Fig. 1. Translation and validation processes of PSQI-K.

[5,23]. In a study conducted by Backhaus et al., among patients with primary insomnia, the PSQI global score correlation coefficient for test-retest reliability was 0.87 [24].

The General Health Questionnaire (GHQ-28): The Kurdish version of GHQ-28 was completed by participants; it consisted of a 28 item self-rated questionnaire divided into four components: somatic symptoms (items 1–7); anxiety/insomnia (items 8–14); social dysfunction (items 15–21), and severe depression (items 22–28). Each response is scored from 0 to 3. A higher score on the GHQ-28 represents poorer mental health status, and a total score of 23/24 was the threshold for the presence of distress. It has been reported that the PSQI has a strong correlation with the GHQ-28, including total score and subscales for anxiety, depression, insomnia, and physical symptoms [25]. The coefficient correlation of the Kurdish version of GHQ28 subscales was significant ($r = 0.79$), and the internal consistency of the total scale was 0.75 [26].

2.5. Data collection

After approval of the final version of the PSQI, a pilot study was conducted on 50 participants to assess reliability; the Cronbach Alpha was 0.63. In the next step of the study, participants were recruited and divided into three groups of 150 healthy volunteer students, 40 participants with somatic syndromes and 40 participants with insomnia according to the results of the GHQ-28. They completed the final version of the PSQI-K. Questionnaires were revised; 19 incomplete questions were invalid and excluded from the study.

2.6. Statistical analysis

The mean and standard deviation of quantitative variables were calculated in healthy, insomnia, and somatic symptom groups. The normal distribution of quantitative data was investigated by the Kolmogorov–Smirnov test. Age, PSQI-K total score, and GHQ-28 total score were compared between groups by ANOVA followed by the Tukey post-hoc test.

Cronbach's α coefficient was calculated to examine the PSQI-K global score and components of the inter-item internal consistency. Spearman correlation-coefficient analysis was used to examine test-retest reliability and criterion validity because the PSQI components are structured as categorical variables. These analyses were done using SPSS version 20. The level of statistical significance was set at a P-value < 0.05, and all tests were two-sided.

We completed an exploratory factor analysis (EFA) with the Promax oblique rotation method to assess the factor structure of the PSQI-K. Bartlett's test of sphericity and the Kaiser-Meyer-Olkin measure of sampling adequacy were investigated as prerequisites to the appropriateness of EFA to assess the factor structure of the PSQI-K. As PSQI consists of seven components derived from the 19 item questionnaire, and each component ranges from 0 to 3, we performed EFA on the matrix of polychoric inter-item correlations for construct validity. This method is more suitable when dealing with Likert type ordinal items like the PSQI [27–29]. LISREL software version 8.8 was used to estimate the polychoric correlations among the indicators and their covariance matrix [30]. This matrix was then used to estimate factor models using weighted least squares.

The calculation of the factor weight of PSQI components was completed with confirmatory factor analysis (CFA) in LISREL software. We used absolute and comparative fit indices to identify how well the model fits the data. The number of factors was identified following previous studies [19,31].

2.7. Ethical considerations

The current study followed the ethical principles for medical research involving human subjects presented in the declaration of Helsinki [25]. The study was approved by the ethics committee of Kermanshah University of Medical Sciences with the code number of IR.KUMS.REC.1397.629. Written informed consent was obtained from all participants, including those who participated in the pilot study. Participants were given the right to decline to complete the questionnaire.

3. Results

We matched group with insomnia and participants with somatoform symptoms with the healthy group, and statistical analysis did not reveal a significant difference in age and sex between groups ($p > 0.05$). According to the result of the pilot study, the PSQI-K has good reliability (Cronbach Alpha = 0.63).

The global score of the PSQI-K was compared between groups by ANOVA, and Tukey test was performed for between-group comparisons (Table 1).

There was a significant difference in the PSQI-K total scores between the three groups ($F = 12.80$, $p < 0.01$). Tukey post-hoc analysis revealed a significant difference between healthy group ($M = 4.27$, $SD = 2.19$) and participants with insomnia ($M = 6.58$, $SD = 3.12$). No significant differences were found between healthy group and group with the somatic syndrome ($M = 4.95$, $SD = 2.88$) as well as between the group with insomnia and the group with somatic syndrome. According to this analysis, the PSQI-K could differentiate healthy people from people with insomnia. The frequency distribution of the seven components is presented in Table 2.

3.1. Reliability

3.1.1. Internal consistency

Cronbach Alpha was adequate for global scores ($\alpha = 0.70$), sleep quality ($\alpha = 0.98$), sleep latency ($\alpha = 0.98$), sleep duration ($\alpha = 0.75$), sleep efficiency ($\alpha = 0.97$), sleep disturbance ($\alpha = 0.66$), hypnotic medication use ($\alpha = 0.96$), and daytime dysfunction ($\alpha = 0.82$).

3.1.2. Test-retest reliability

Forty-eight healthy participants were selected randomly and completed PSQI after 4–6 weeks. There was a significant correlation between test and retest scores analyzed by Spearman correlation coefficient ($r = 0.83$, $p < 0.01$).

3.2. Validity

3.2.1. Criterion validity

The correlation between PSQI scores (global and seven components) and the GHQ28 global score was analyzed by Spearman correlation coefficient. Correlations between the global score and seven components of the PSQI with the GHQ28 were all statistically significant ($r = 0.23–0.72$, $p < 0.05$) (Table 3).

Table 2
Frequency distributions for the seven components of PSQI-K.

Components	scores	Frequency	Percentage
C1 (sleep quality)	0	81	38.4
	1	72	34.1
	2	40	19.0
	3	18	8.5
C2 (sleep latency)	0	16.6	16.6
	1	56.4	56.4
	2	25.6	25.6
	3	1.4	1.4
C3 (sleep duration)	0	163	77.3
	1	43	20.4
	2	5	2.4
C4 (habitual sleep efficiency)	0	173	82.0
	1	30	14.2
	2	8	3.8
C5 (sleep disturbances)	0	8	3.8
	1	169	80.1
	2	34	16.1
C6 (use of sleeping)	0	164	77.7
	1	40	19
	2	6	2.8
	3	1	0.5
C7 (daytime dysfunction)	0	60	28.4
	1	117	55.5
	2	32	15.2
	3	2	0.9

Table 1
Comparison of PSQI-K total scores between the healthy group, participants with insomnia, and participants with somatoform symptoms.

ANOVA	Groups	Mean	SD	Df	F
	Healthy (n = 131)	4.27	2.19	2	12.80*
	Insomnia (n = 40)	6.58	3.12		
	Somatoform symptoms (n = 40)	4.95	2.88		
Tukey	Groups		Mean difference	SD	Sig
	Healthy	Insomnia	−02.30	0.45	<0.01
		Somatoform symptoms	−0.68		0.26

*sig>0.05.
PSQI-K; Pittsburgh Sleep Quality Index – Kurdish version.

Table 3
Spearman correlation coefficient between GHQ28 and components of PSQI-K.

Variables	C1 (sleep quality)	C2 (sleep latency)	C3 (sleep duration)	C4 (habitual sleep efficiency)	C5 (sleep disturbances)	C6 (use of sleeping medication)	C7 (daytime dysfunction)	PSQI-K global score
GHQ	0.62*	0.23**	0.34*	0.50*	0.53**	0.57*	0.45*	0.72*

PSQI-K; Pittsburgh Sleep Quality Index-Kurdish version. GHQ; General Health Questionnaire.
*sig>0.01 **sig>0.05.

Table 4
Polychoric correlation matrix.

Variables	C1 (sleep quality)	C2 (sleep latency)	C3 (sleep duration)	C4 (habitual sleep efficiency)	C5 (sleep disturbances)	C6 (use of sleeping medication)
C1 (sleep quality)	1					
C2 (sleep latency)	0.39	1				
C3 (sleep duration)	0.24**	0.34*	1			
C4 (habitual sleep efficiency)	0.57*	0.57*	0.42*	1		
C5 (sleep disturbances)	0.29**	0.37*	0.56*	0.33**	1	
C6 (use of sleeping	0.53*	0.22**	0.40**	0.47*	0.36**	1
C7 (daytime dysfunction)	0.40*	0.20**	0.20**	0.38*	0.42*	0.35*

*sig>0.01 **sig>0.05.

3.2.2. Construct validity

To investigate the factor structure of the PSQI-K, EFA was performed on the matrix of polychoric inter-item correlations with the Promax oblique rotation method. All prerequisites (Bartlett's test of sphericity, $P < 0.001$; the Kaiser-Meyer-Olkin measure of sampling adequacy = 0.76) confirmed the appropriateness of EFA to assess the factor structure of the PSQI-K. First, we did the matrix of polychoric inter-item correlations, and the result revealed the suitability of ordinal factor analysis for EFA (Table 4).

Then an EFA with Promax rotation was performed. The EFA result revealed the factor weight for each of the seven PSQI components on the three recognized factors with Promax rotation (Table 5).

After EFA, we performed CFA using LISREL 8.8. Software. According to the result, adequate (above 0.40) factor weight for each of the seven PSQI components on the three recognized factors was noted (Fig. 2). Therefore, the components are valid.

We also used absolute fit indices including a chi-square test, a root mean square error of approximation (RMSEA), a root mean square residual (RMR), a goodness of fit index (GFI), a comparative fit index (CFI), a normed fit index (NFI) and a non-normed fit index (NNFI) for CFA. According to our results, all fit indices are adequate (Table 6).

The inter-correlation of factors showed a significant correlation between daily dysfunction with sleep quality ($r = 0.70$, $P < 0.01$) and sleep disturbance ($r = 0.27$, $P < 0.01$). Also, there was a significant relationship between sleep quality and sleep disturbance ($r = 0.30$, $P < 0.01$) (Table 7).

4. Discussion

The current study aimed to translate and validate the Kurdish version of the PSQI (PSQI-K). Results indicated an appropriate internal consistency in the pilot and main study for global score ($\alpha = 0.70$) and components ($\alpha = 0.66$–0.98). Previous studies reported similar results in the general population [13] and sleep clinic samples [33]. Forty percent of the sample completed the PSQI after 4–6 weeks. The correlation between test-retest scores was significant ($r = 0.83$), which indicated good reliability of PSQI among participants. This finding is in agreement with Backhaus et al., who found the overall PSQI global score correlation coefficient $r = 0.87$ for test-retest reliability [24].

A Spearman correlation was conducted among the seven components and the global score of the PSQI-K. The correlations between global score and each component were all statistically significant. This finding is in agreement with Chegini et al., who reported a correlation coefficient $r < 0.6$ between global score and seven components of the Persian version of PSQI [25]. In a study in India, the internal homogeneity was significant, and correlation was strong ($r > 0.7$) between global and component PSQI scores [32].

Inter-correlations between the three factors (daily dysfunction; sleep quality and sleep disturbance) of the PSQI-K showed a significant correlation. EFA was conducted to find evidence concerning

Table 5
Exploratory factor analysis components with Promax-rotated factor loadings.

	Factor1	Factor2	Factor3	Unique Var
Comp1	0.122	−0.104	0.713	0.452
Comp2	0.846	0.027	−0.039	0.304
Comp3	0.190	0.276	0.238	0.692
Comp4	0.474	−0.103	0.520	0.305
Comp5	−0.003	1.324	−0.027	−0.721
Comp6	−0.129	0.016	0.799	0.446
Comp7	−0.039	0.126	0.488	0.717

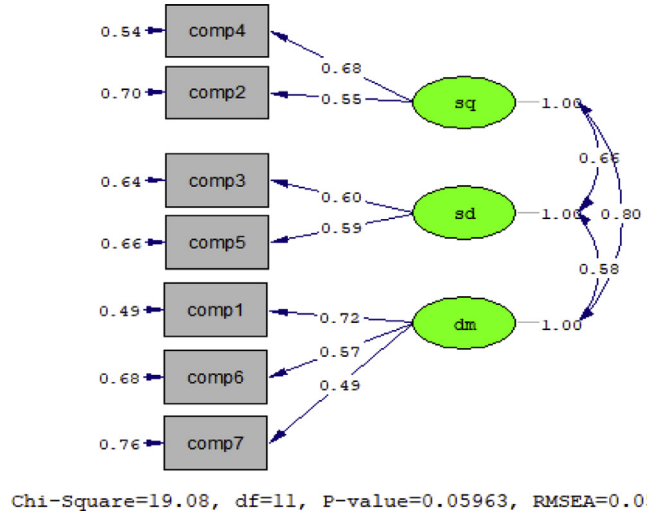

Fig. 2. Factor weight calculation of components of PSQI-K in three factors. The conceptual model fit with standard correlation coefficients. From the left, column1: error bar. Column2; components, column3; factor loading, column4, factors, Error bar. sq; sleep quality, sd; sleep disturbances, dm; daytime malfunctions (dysfunctions).

Table 6
Results of confirmatory factor analysis.

Fit indexes	Accepted values	Result
GFI	<0.90	0.91
RMSEA	>0.08	0.06
RMR	>0.05	0.04
NFI	<0.90	0.97
NNFI	<0.90	0.99
CFI	<0.90	0.99

GFI; Goodness of fit index, RMSEA; root mean square error of approximation, RMR; root mean squared residual; NFI; normed fit index, NNFI; non-normed fit index, CFI; comparative fit index.

Table 7
Inter-correlations between the three identified factors in PSQI-K.[a]

Factors	Daily dysfunction	Sleep Quality	Sleep Disturbances
Daily dysfunction	1		
Sleep Quality	0.70[b]	1	
Sleep Disturbances	0.27[b]	0.30[b]	1

PSQI-K; Pittsburgh Sleep Quality Index-Kurdish version.
[a] Indicate correlation of each factor with itself.
[b] Correlation was significant at the 0.01 level.

the fit of the three-factor model. Results showed a clear factor structure of the PSQI-K, obtained through ordinal components analysis using Promax rotation. This indicates that the three-factor model of PSQI is also applicable for the PSQI-K. These findings are consistent with the findings obtained from a factor analysis of English and Persian versions of the PSQI [19,32]. As the number of factors varies in different studies, a recent systematic review suggested the investigations of the factor analysis of questionnaires should employ both exploratory and confirmatory factor analysis [11]. Therefore, the factor loading of each component also was conducted, and results revealed adequate factor loading for all components.

Finally, the GHQ28 was used to test concurrent validity. Results indicated a significant correlation between the PSQI-K with GHQ-28 global and subscales scores ($r = 0.23–0.72$) implying that the PSQI has a proper concurrent validity. Similar findings were reported in a study using the Persian version of the PSQI [19].

5. Limitations

The range of the PSQI global score was 1–14 in our study sample, which is less than the maximum possible range of zero to 21. Therefore, we did not include extremely sleep-disturbed participants. This may have resulted from the exclusion criteria we applied to participants who were taking medications so participants with extreme sleep problem did not meet our criteria to participate in the study.

In this study, the sample size was limited to students of a small town in KRI, and future validation studies in Kurdish populations with a larger sample size are needed. For criterion validity, we had difficulty finding validated scales, and only the GHQ28 was found adequate for this purpose. Despite these limitations, the psychometric properties examined in this study suggest that the PSQI-K is a valid, brief, and self-reported instrument for the investigation of sleep quality. The results were generally supportive of the PSQI's validity and reliability and thus, represent a foundation for further studies among the Kurdish population.

6. Conclusion

Our results show that the PSQI-K demonstrated good reliability and validity in clinical and healthy participants. PSQI-K scores based both on the traditional single factor and the new three-factor model showed high reliability and validity. However, we only reported the correlation of three factors, as the factor loading was higher in the three-factor model. The present findings have broad generalizability to healthy subjects and in clinical settings.

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Availability of data and materials

The datasets supporting the findings of this article are available from the corresponding author.

Authors' contribution

PAMS and HM participated in the design of the study, data collection, interpretation of the data, and drafted the manuscript. HK participated in the interpretation of the data and critically revised the manuscript. NQ participated in the design of the study, data collection, and drafted the manuscript. DJ participated in the development of the conceptual framework of the study, critically revised the manuscript, and reviewed the final version of the manuscript. All authors read and approved the final manuscript.

Ethics approval and consent to participate

The study was approved by the Ethical Committee of KUMS (Ref: IR.KUMS.REC.1397.629), and written consent forms were obtained from all participants.

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List of abbreviations

PSQI	Pittsburgh Sleep Quality Index
GHQ28	General Health Questionnaire-28
KRI	Kurdistan Region of Iraq
EFA	exploratory factor analysis
CFA	confirmatory factor analysis
GFI	Goodness of fit index
RMSEA	root mean square error of approximation
RMR	root mean squared residual
NFI	normed fit index
NNFI	non-normed fit index
CFI	comparative fit index
KMO	Kaiser-Meyer-Olkin
SDRC	Sleep Disorders Research Centers
KUMS	Kermanshah University of Medical Sciences
PSG	Polysomnography
EEG	electroencephalography
SDRC	Sleep Disorders Research Centers

Conflict of interest

The authors declare that they have no competing interests.

The ICMJE Uniform Disclosure Form for Potential Conflicts of Interest associated with this article can be viewed by clicking on the following link: https://doi.org/10.1016/j.sleep.2019.04.022.

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