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ORIGINAL ARTICLE

Reliability, validity, and psychometric properties of the Persian version of the Tayside children's sleep questionnaire

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Abstract

Tayside Children's Sleep Questionnaire (TCSQ) is a simple tool for screening the disorders of initiating and Maintaining Sleep among children aged between 1 and 5 years. This study aimed to translate TCSQ into Persian and evaluate its validity and reliability of TCSQ among Persian speakers. This cross-sectional study was conducted among 311 children aged 1–5 years in Isfahan. After permission, the forward–backward translation method was used to develop the Persian version. Finally, 311 children participated in this survey, which 30 were repeated a second time. Google Forms, SPSS16, and STATA14 were used for data collection, descriptive statistics, and factor analysis. BEARS questionnaire was used to assess concurrent validity. Three expert opinions were used for content validity. In this study, 404 mothers of children in Isfahan volunteered to participate in the survey, of which 311 remained. The mean and standard deviation age of their children were 3.47 ± 1.91 years. Cronbach Alpha of the Persian version of TCSQ was 0.76 CI (0.78–0.66). The intra-class correlation coefficient was 0.67 CI (0.60–0.74). The content validity index was 0.88, and three factors (disturbance, nighttime, parents) with a specific value greater than 0.4 is determined by factor analysis. The current study results indicate that TCSQ has good reliability and validity among Persian speakers.

Keywords Reproducibility of results · Sleep–wake disorders · Surveys and questionnaires

Abbreviations

SDH	Social determinants of health
DSM-V	Diagnostic and statistical manual of mental disorders, fifth edition
ICSD3	International classification of sleep disorders third edition
EEG	Electroencephalogram
TCSQ	Tayside children's sleep questionnaire
DIMS	Disorders of initiating and maintaining sleep
P-TCSQ	Persian version of the Tayside children's sleep questionnaire
ICC	Intra-class correlation coefficient
EFA	Exploratory factor analysis
PCA	Principal component analysis
SPSS	Statistical package for the social sciences
CFA	Confirmatory factor analysis
CFI	Comparative fit index
RMSEA	Root mean square error of approximation
GFI	Goodness-of-fit index
NFI	Normed fit index
TLI	Tucker–Lewis index
SEM	Structural equation modeling
CVR	Content validity ratio
CVI	Content validity index
KMO	Kaiser–Meyer–Olkin
SDSC	Sleep disturbance scale for children
K-CBCL	Korean-child behavior checklist

Background

Children who get sufficient sleep have better performance during the day [1]. Sleep is an active physiological phase of the circadian cycle that plays an essential role in various physiological aspects of childhood development [2]. The role of insomnia in obesity, learning disabilities, cognitive disorders, and behavioral disorders in childhood is not hidden from us [3–6]. Hypersomnia, insomnia, narcolepsy, parasomnia, and respiratory disorders during sleep are

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examples of sleep disorders considered in this classification. Sleep disorders are classified into two major categories in the Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-V) and the International Classification of Sleep Disorders, third edition (ICSD3) [7]. According to ICSD3, various sleep disorders can be classified into six major groups: insomnia, sleep-related breathing disorders, central disorders of hypersomnolence, sleep–wake disorders, parasomnias, and sleep-related movement disorders [8].In the DSM-IV, the Disorders of Initiating and Maintaining Sleep (DIMS) or non-restorative sleep lasting for at least 1 month is considered a class of sleep disorders in DSM-V; the last available version, this class has been changed. The duration changes from 1 month to 3 months, and disorders in initiating, maintaining, and inability to return to sleep after early morning awakening are considered criteria for quantity or quality sleep dissatisfaction [9].

There are several methods for assessing sleep disorders [10]. Currently, there are advanced diagnostic methods, such as polysomnography [11]. Polysomnography provides vast and accurate information about a patient's sleep, such as body movements, breathing patterns, sleep stages, EEG, and heart rate. However, these advanced methods have limited application for various reasons. One of the most important reasons for this is that these tests are not available in many areas. In addition, in many cases, they are not required, which increases cost [12]. Previous studies have shown that delayed sleep is a sleep problem in Iranian children before school. Between 24.4% and 56.4% of the children resisted going to bed and started sleeping later. In addition, 13.9 to 27.7 mentioned that they wake up during sleep.

Therefore, in most cases, diagnosis is based on a good medical history. Some sleep disorders, such as sleep apnea, may not be known to the patients[13]. It is essential to obtain the medical history of the patients and their companions. In early childhood, diagnosis is often based on information provided by the patient's mother [14].

A simple and widely used tool for screening and conducting research on sleep disorders is the questionnaire [12, 15]. Various questionnaires have been developed to assess the sleep disorders. Each of these has specific applications and each age group has a questionnaire [16]. They can also be used as screening methods to assess sleep disorders in primary healthcare centers [17].

Tayside Children's Sleep Questionnaire (TCSQ) is a simple sleep questionnaire developed by McGreavey et al. with ten questions to assess DIMS among children aged between 1 and 5 years during the last 3 months ago. This questionnaire can be used for research purposes or as a screening tool for clinical practice [18]. In 2020, Yesol et al. developed a Korean version of the TCSQ [19]. As mentioned above, DIMS is a class of sleep disorder in the DSM-IV, with minor changes in the DSM-V. However, the TCSQ is still usable for screening disorders to initiate and maintain sleep in children [19].

This study aimed to translate the TCSQ into Persian and evaluate the reliability and validity of the Persian version of the Tayside Children's Sleep Questionnaire (P-TCSQ) among Iranian preschoolers as a screening tool to assess sleep disorders in initiating and maintaining sleep in the last 3 months in children aged between 1 and 5 years.

Methods

This is a cross-sectional study. In this study, 311 mothers of children aged 1–5 years from Isfahan were randomly selected. First, the goals of this study were explained to the mothers. Four hundred and four mothers participated in this study. We found mothers of children between 1 and 5 years of age in kindergartens in Isfahan City. We obtained access through social media channels to inform kindergarten news and sent them electronic forms, along with additional explanations. The questionnaire was completed using WEB. The participants are chosen randomly. Each participant was assigned a unique code. This code does not indicate an individual's identity. However, this made him completely different from others. This code was generated based on the person's birthday, the first letter of the person's name, and the person's favorite color. The combination of these three questions created distinct and non-repetitive codes. When the person completed the form for the second time, by answering the questions that made up the individual's specific code, his questionnaire was pinned to the previous form filled out by her. This made it possible to calculate ICC.

A total of 311 children were included in this study. Two weeks later, 30 participants answered the questionnaire (Fig. 1).

Translation

We used forward–backward translation and a pretest. In this way, the English version of the TCSQ was translated into Persian by two people who were proficient in translating medical texts and had experience translating questionnaires. The translations were compared, the questions were matched in terms of meaning and concept, and a Persian version of the tool was prepared by selecting the best options. To ensure that the Persian translation matched the original text and that the sentences were clear, the translated version was translated into the original language by two fluent English translators, who had not previously seen the initial questionnaire.

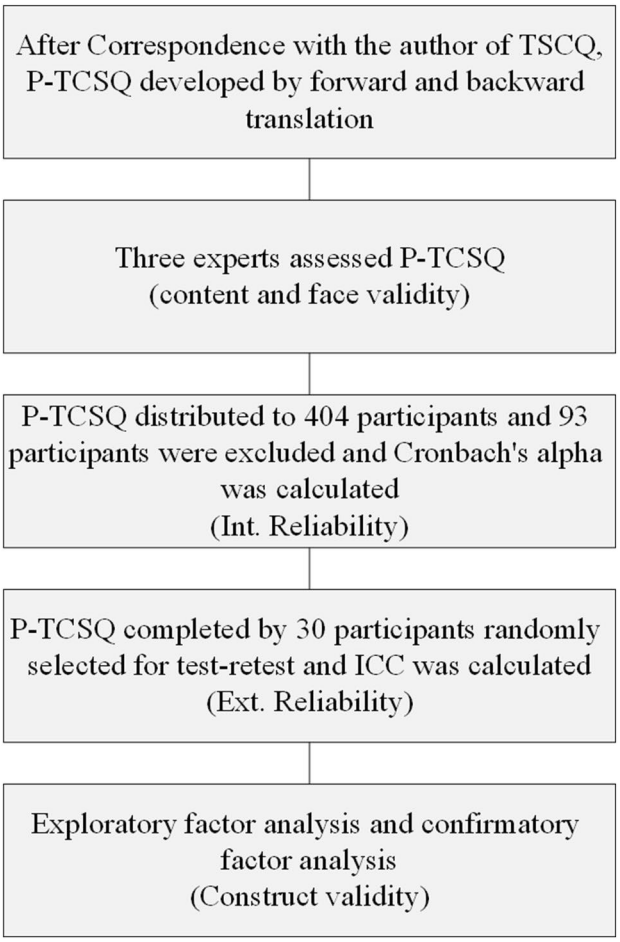

Fig. 1 Flow chart showing the participants

Sample size

Psychometric instructions suggest 8 to 12 samples for each question [20]. We selected 404 Iranian children between the ages of 1 and 5.

Materials

Tayside children's sleep questionnaire (TCSQ)

The TCSQ is a 10-item questionnaire used to assess DIMS in children 1–5 years. The first version was developed in 2005 by McGreavey et al. with a Cronbach's alpha of 0.85. The questionnaire was scored on a Likert scale. The first nine questions score from zero to four. The final questions were considered separately [18]. Instrument for screening difficulties in falling and staying asleep.

BEARS questionnaire

The psychometric properties of the Persian version have been approved by Mohammadi et al., and the Cronbach's alpha was > 0.8. The questionnaire consists of two parts. One section was used for children 2–6 years, and the other for children 7–12 years. In this study, we used the first part of this test. If the mother placed a positive sign in front of the questions, this indicates that the child had a sleep disorder. In this study, we used this questionnaire to assess convergent validity[21].

Inclusion criteria

Children aged between 1 and 5 years who lived with both biological parents were included in this survey.

Exclusion criteria

Mothers who declare that they had any psychiatric disorder, their Children with any history of certain medical conditions 3 months ago, or who lost their parent(s) during the study are excluded.

Test–retest reliability

Te internal consistency coefficient known as Cronbach's alpha to calculate the P-TCSQ internal reliability. We invited 40 people to participate in the second phase, of which 30 responded (response rate = 75%). The intraclass correlation coefficient (ICC) was calculated by repeating the survey with 30 mothers after 2–4 weeks [22].

Validity

Face validity

The opinions of three experts about the clarity, simplicity, and eloquence of P-TCSQ were asked.

Content validity

The questionnaire was given to three experts to determine whether the measured elements can measure the concept and whether the questions used in the questionnaire represent the whole questions or not.

Concurrent validity

We used the BEARS sleep questionnaire to assess the Concurrent validity between TCSQ and BEARS.

Exploratory factor analysis (EFA)

For construct validity, exploratory factor analysis (EFA) is used with varimax rotation. In addition, to evaluate the suitability of the data for factor analysis, two preliminary tests of sampling adequacy, KMO and Bartlett's test at $P < 0.0001$ level, were used. For analyzing the relevant factor in sampling adequacy, a score of 0.6 and above was considered.

Statistical analysis

We extracted the data from Google Forms and imported them into Microsoft Excel. Then, using the "replace" tool, answers were converted to a Likert scale according to the TCSQ guideline. We then used the STATA 14th version for factor analysis and the SPSS 16th version for descriptive statistics (STATA SE software, version 14(Stata Corp, College Station, TX, USA), SPSS software version 16 (SPSS Inc., Chicago, IL, USA). The Cronbach's alpha was calculated to determine the internal consistency of the TCSQ. The test–retest reliability was confirmed using the intraclass coefficient (ICC). Spearman correlation coefficients and EFA were used to perform factor analysis.

Results

Questionnaires were distributed to 404 mothers of Isfahan children who volunteered to participate in the study. A total of 311 participants who completed the questionnaire remained; however, 93 were excluded. Their children's mean and standard deviation age was 3.47 ± 1.91 years, with a minimum age of one and a maximum of five. The 311 children included 164 boys (52.7%) and 147 girls (47.3%) (Table 1).

The mean and standard deviation of the overall score of the questionnaire were 14.64 ± 6.9. The mean and standard deviation of the domains are listed in Table 2.

The Cronbach's alpha coefficient for the total reliability of the questionnaire was equal to 0.76 CI (0.78–0.66), and by removing each items, no significant change in Cronbach's alpha was observed. In other words, participants had similar perceptions of the tool. The intraclass correlation index (ICC coefficient) was calculated to estimate the reliability of the instrument. The intraclass correlation index (ICC) coefficient was 0.67 CI (0.60–0.74), which confirmed the repeatability of this test, Table 3.

Face validity

No ambiguity was reported in the questionnaire questions when examining face validity.

Content validity

The average content validity (CVR-Save) based on the opinion of 3 experts as an estimate of CVI was 0.88, and the minimum and maximum CVR was between 0.73 to 0.94.

Table 1 Frequency and percentages of children

N (%)	Variable	
164 (52.73)	Male	Gender
147 (47.26)	Female	
3.47 ± 1.91	Age($\overline{X} \pm$SD)	
7 (2.25)	Primary school	Mother's educational level
10 (3.21)	Middle school	
12 (3.85)	High school	
90 (28.93)	Diploma	
27 (8.67)	Associate	
120 (38.58)	Bachelor	
42 (13.50)	Master	
2 (0.64)	doc/PhD	
1 (0.32)	Postdoc	

Table 2 Mean and standard deviation of the domains

Domain	*N*	Minimum	Maximum	Mean	Std. Deviation
Disturbance	311	.00	20.00	7.73	4.23
Nighttime	311	.00	16.00	5.13	3.87
Parents	311	1.00	2.00	1.78	0.41
TCSQ	311	1.00	37.00	14.64	6.89
Valid *N* (listwise)	311				

Table 3 KMO and Bartlett's test

TEST		Results
KMO measure of sampling adequacy		0.72
Bartlett's test of sphericity	Approx. Chi-Square	534.89
	Df	45
	Sig	0.00

Concurrent validity

The correlation coefficient between the Tayside and BEARS questionnaires was calculated using the Spearman's correlation coefficient. The correlation coefficient between the two scales ($r = 0.277$ and $p = 0.00$) was calculated and is significant at the level of $P < 0.01$.

For construct validity, exploratory factor analysis was used. The KMO value was 0.723, and the level of significance of Bartlett's test of sphericity was less than 0.001.

Therefore, based on both criteria, it can be concluded that the implementation of factor analysis based on the correlation matrix in the sample groups can be justified, and that the data are suitable for exploratory factor analysis, Table 4.

Extraction Method: Principal Component Analysis. Three components were extracted.

In the present study, to achieve the definitions of factors, a coefficient equal to 0.40 was considered the factor load limit. Thus, based on the results of factor analysis and the indicators mentioned, three factors (Disturbance, nighttime, parents) with a specific value greater than 0.4 emerged from the set of questions, which together explained 55% of the variance. The extracted factors must be transferred to new axes using a varimax rotation to obtain a meaningful structure for the data under analysis, Table 5.

Table 4 Component matrix

TCSQ question	Component		
	1	2	3
T1	0.44	0.46	0.35
T2	0.49	0.61	0.14
T3	0.64	0.03	0.06
T4	0.62	0.15	0.53
T5	0.50	0.50	0.43
T6	0.66	0.33	0.14
T7	0.58	0.17	0.55
T8	0.39	0.08	0.03
T9	0.39	0.53	0.46
T10	0.51	0.43	0.33

Confirmatory factor analysis

Confirmatory Factor Analysis (CFA) results showed that the model had a good fit and the two fit indices (CFI = 0.94 and RMSEA = 0.05) suggest that this model provided the best fit for the data, Table 6.

Discussion

In 2005, the first version of the TCSQ was evaluated for validity and reliability. The questionnaire was prepared from two different groups of questions. The first group consisted of questions 1, 2, 3, 5, and 6. These questions were adapted from the Sleep Disturbance Scale for Children (SDSC) questionnaire developed by Bruni et al. in 1996 [23]. These questions can be used to screen for sleep disorders in all age groups. The second group, which included questions 4, 7, 9, and 10, was more concerned with children's sleep disorders, especially at 1–5 years of age [18].

In the current cross-sectional study, the Persian version of the TCSQ using the forward–backward translation method was created from the English version prepared by

Table 6 Fit indices

Index	$\chi 2$/df	CFI	RMSEA	TLI
Result	2	0.98	0.005	0.99

Table 5 Total variance explained

Item	Initial eigenvalues			Extraction sums of squared loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.83	28.25	28.25	2.83	28.25	28.25
2	1.47	14.67	42.92	1.47	14.67	42.91
3	1.25	12.45	55.37	1.24	12.45	55.37
4	0.93	9.26	64.63			
5	0.81	8.06	72.70			
6	0.70	6.98	79.68			
7	0.59	5.91	85.58			
8	0.52	5.17	90.75			
9	0.51	5.07	95.82			
10	0.42	4.18	100.00			

Extraction method: principal component analysis

McGreavy et al. In a similar study in Korea in 2020, Yesol et al. published a Korean version of the TCSQ [19].

We asked for the opinions of three experts, and it appeared that the P-TCSQ, at face value, measured what it claimed to be, and the items on the P-TCSQ are representative of the entire domain of sleep disorders among children in terms of face and content validity, respectively. Similar face and content validity results were obtained in surveys by Yesol et al. and McGreavy et al. [18, 19].

In the EFA of Yesol et al.'s study, the K-TCSQ had two factors with three items in each factor. The initiating sleep factor consists of questions 1,2, and 3, and the maintenance factor consists of questions 5,6, and 8 [19].

In the current survey, we used EFA to uncover the underlying hypothetical constructs of our variables (questions). The primary purpose of the EFA is to summarize many variables in a limited number of factors to achieve the least amount of information loss. In addition, the orthogonal rotation of varimax was used to maximize the variance of the variables loaded in the factor columns of the factor matrix to find the best solution and evaluate the construct validity of P-TCSQ. The factor analysis indicated that the ten questions of the P-TCSQ can be summarized into three factors: disturbance, nighttime, and parents.

Another subtype of construct validity was concurrent validity, which was evaluated using the BEARS sleep questionnaire. This indicates that a positive correlation exists between BEARS and P-TCSQ, and shows that their theoretically related measures are correlated. Similarly, in the study of the Korean version, the Korean-Child Behavior checklist 1.5–5 (K-CBCL) was used to check the concurrent validity. A positive correlation has been reported and confirmed in terms of concurrent validity [19].

The intraclass correlation coefficient (0.67) indicated that the reproducibility of the results was moderately acceptable and desirable.

Cronbach's alpha for the English version was 0.85, whereas that for the Persian version was 0.76. Although Cronbach's alpha decreased in this study, according to Bland and Altman's theory, scales with an internal consistency coefficient greater than 0.7, can still be used for research purposes [24].

After exploratory factor analysis, confirmatory factor analysis was performed. Chi-square (χ 2/df), Goodness-of-Fit Index (GFI), Comparative Fit Index (CFI), Tucker–Lewis Index (TLI), and Root Mean Square Error of Approximation (RMSEA) were used for structural equation modeling (SEM). Factor analysis confirmed that the model fits well with the data.

Limitations: This survey was conducted at a single location. Therefore, the recruited participants may not be representative of the general population. A retrospective sleep survey has the risk of recall bias. However, this limitation is intrinsic to all types of questionnaire.

Conclusions

The P-TCSQ had good validity and reliability. It can be used as a simple and accessible tool in various sleep-medicine studies. This sleep questionnaire can be applied in other countries.

Suggestion

We suggest that researchers use P-TCSQ in their future surveys. In addition, P-TCSQ can be used in clinical practice.

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Author contributions Both authors contributed to writing all sections.

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Data availability On reasonable request, the data set of the current survey is available from the authors.

Declarations

Conflict of interest We declare that there is not any conflict of interest.

Ethical approval According to the request made to clarify satisfaction with participating in the study, we must say that all children who participated in this study were informed about the study according to their understanding, and their questions in this regard were answered. We corresponded with the developer of the original version of the TCSQ and obtained permission. This study was approved by the Research Ethics Committee of the Kashan University of Medical Sciences (approval ID: IR.KAUMS.NUHEPM.REC.1400.027).

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