ORIGINAL ARTICLE

Factor Structure and Reliability of the Persian Version of the Children's Sleep Habits Questionnaire in Children with Autism Spectrum Disorder

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ABSTRACT

Objectives: Sleep disturbance is a common difficulty in children with Autism Spectrum Disorder (ASD) that can affect daily functioning and quality of life. However, the assessment and intervention of this issue are less noticed by therapists. This study aimed to investigate the psychometric properties of the Children's Sleep Habits Questionnaire (CSHQ) in children with ASD, including content validity, factor analysis, internal consistency, and test-retest reliability.

Materials & Methods: In this descriptive and cross-sectional study, 306 parents of 4- to 10-year-old children with ASD were selected by convenience sampling from Tehran, Shiraz, Isfahan, Hamedan, Tabriz, Ahvaz, and Bukan, Iran. They answered the Persian version of the CSHQ. The Content Validity Index (CVI) and ratio were assessed based on the opinions of 11 ASD experts. Confirmatory factor analysis was conducted. Cronbach's alpha coefficient was used for internal consistency, and the intraclass correlation coefficient was calculated for test-retest reliability. Data were analyzed using LISREL 88 and SPSS 26.

Results: The CVI (0.81-1) and ratio (0.63–1) showed the necessity of all items. The acceptable confirmatory factor analysis results (RMSEA = 0.74; P < 0.001; Chi-Square =596.85; df = 224) confirmed the model obtained. The Cronbach's alpha for the subscales (0.43-0.79) and in total (0.83) showed homogeneity of the items. The intraclass correlation coefficient (0.90 in total and 0.82-0.91 for the subscales) demonstrated acceptable test-retest reliability.

Conclusion: The Persian version of CSHQ in children with ASD has acceptable validity and reliability and can be used by autism therapists as a suitable tool in research and clinical practice.

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Introduction

Sleep is a vital function of any organism. It is not just a silent state but also plays a role in facilitating the maturation, reorganization, and regeneration of the brain (1). Approximately 40-80% of children with Autism Spectrum Disorder (ASD) have sleep problems (2). Sleep problems experienced by children with ASD are often known as "insomnia" (delayed sleep onset, poor sleep continuity, and early morning awakening) (3). Bedtime resistance, breathing disorders, parasomnias, movement disorders, and circadian rhythm disorders have also been reported in the sleep of children with ASD (3, 4). Sleep-related problems are

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influenced by both environmental and biological factors (5). Chronic sleep problems in ASD do not disappear with increasing age and persist into adulthood (2). Considering that ASD is a collection of symptoms with multiple neurological causes, the prevalence and nature of sleep disorders may differ among children with different levels of ASD severity. The variety of sleep disorders in these children is more significant than in the typically developing population, and they do not have a unique form of sleep disorder (5). Studies have shown that children with ASD who have more significant overall sleep problems are more likely to experience poorer health-related quality of life (6). Due to the effect on behavior and emotional regulation, sleep problems increase the likelihood of symptoms such as aggression, anxiety, and depression (7). In addition, tactile sensitivity, the source of functional problems in the life of a child with ASD, is strongly associated with sleep disturbances (8). Sleep disturbances in these children have a detrimental effect on cognitive functions, such as memory consolidation, declarative memory, selective attention, spatial memory, immediate recall, overall memory recall, intellectual functioning, and impaired verbal skills (9).

Given the prevalence and consequences of sleep disorders in children with ASD, screening for these problems is critical. Assessment instruments for this purpose may be objective or subjective. Objective tools evaluate different aspects of sleep using technologies, such as polysomnography, actigraphy, and video recording. Subjective tools collect information from parents and include parent-report questionnaires and sleep diaries (10). Although objective measurements of sleep can provide more accurate information for diagnosis and treatment planning, subjective measurements have some advantages for screening, patients tolerability , availability, low cost, low time consumption, and no need for training (11). Furthermore, sleep occurs in the home environment and, parent-report tools that incorporate family involvement have great potential for the success of a family-centered approach as an effective treatment for ASD (12).

Subjective instruments often used to assess sleep in ASD include the Modified Simonds and Parraga Sleep Questionnaire (MSPSQ), the Family Inventory of Sleep Habits (FISH), and the Children's Sleep Habit Questionnaire (CSHQ), of which the CSHQ is the most widely used (10). The CSHQ, developed by Owens et al. (2000) based on the Pediatric International Classification of Sleep Disorders (PICSD), is a comprehensive screening tool for assessing sleep in children ages 4-10 (13). It has been translated and evaluated into 19 different languages (14) and various disorders, such as Down syndrome and attention-deficit/hyperactivity disorder (15, 16).

In previous psychometric studies of the CSHQ, some changes have been made to the versions studied due to factor analysis. The psychometric properties of the scale were assessed in 2-10-year-old children with ASD by Johnson et al. (2016) (17). In their study, some changes were made to the questionnaire to obtain an adapted version for ASD. The authors concluded that although their statistical data were acceptable, more studies are needed to address challenges with the items and scoring (17). Katz et al. (2018) repeated the CSHQ psychometric study on a larger sample size of children (4-10 years old) with ASD. They conducted Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA); finally, a different factor structure, with four factors: Sleep initiation and duration, Sleep anxiety/co-sleeping, Night waking/parasomnias, and Daytime alertness, than suggested initially by Owens was obtained that differed from the Johnson et al.'s version (18). Zaidman et al. (2020) conducted a CSHQ psychometric study on 4-and 5-year-old children with ASD. First, the CFA was performed on the different factor structures of the Johnson and Katz questionnaire; however, the results were not acceptable. Zaidman et al. (2020) concluded that previous versions were not suitable for children with ASD in this age range, so they conducted an EFA and developed a new version of the CSHQ. The CFA conducted in their study confirmed the latest model (7). These results show that, to adapt this tool to a specific language and use it in a group with a specific disorder, psychometric testing, including factor analysis, requires the researcher first to develop a hypothesis about the factors they believe underlie the assessment to be used in a new population.

A psychometric study for the Persian version of the CSHQ was conducted by Fallahzadeh et al. (2015) in Iranian typically developing children aged 7-11 years. Content validity, convergent and divergent validity, EFA, internal consistency, and test-retest reliability showed that the Persian version of the CSHQ was a valid and reliable tool (19). Currently, this is the only sleep assessment tool that has been psychometrically tested in Persian for typically developing children. Since this tool is used with children with disabilities, the researchers examined the content validity, CFA, internal consistency, and test-retest reliability of the Persian version of the CSHQ in children with ASD. Because of the similarity of the sample age of this study with Katz's et al. (2018) study, Katz's version was selected for this purpose.

Materials & Methods

Setting and Participants

The participants were parents of children with ASD recruited from rehabilitation clinics in some cities of Iran (Tehran, Shiraz, Isfahan, Hamedan, Tabriz, Ahvaz, and Bukan). Parents had to be literate in Farsi reading and writing. Inclusion criteria for children were a diagnosis of ASD by a child psychiatrist, without comorbidity, based on the Diagnostic and Statistical Manual of Mental Disorders-Fifth Edition (DSM-5) in their medical record, age 4-10 years, and not taking melatonin. The inclusion criteria for experts participating in the content validity panel included being a member of a multidisciplinary autism treatment team (20) and having at least five years of experience in clinical practice, education, and autism research.

the content validity of the translated version of the CSHQ was examined. The content validity form was sent to the eleven experts, including two child psychiatrists, one child psychologist, and eight occupational therapists. They were asked to review each item and rate it in terms of necessity (not necessary = 1, not necessary but useful = 2, somewhat necessary = 3, absolutely necessary = 4), quality (poor = 1, fair = 2, good = 3, excellent = 4), and relevance (not relevant = 1, low relevance = 2, moderately relevant = 3, completely relevant = 4). To calculate the Content Validity Index (CVI), the number of experts who rated 3 or 4 for relevance and quality was divided by the total number of all content experts. Therefore, the Relevancy Content Validity Index (R-CVI), Quality Content Validity Index (Q-CVI), and Total Content Validity Index (T-CVI) for each item were determined. Furthermore, the Content Validity Ratio (CVR) for investigating the necessity of the items was checked based on the Lawshe method: CVR = (ne - N/2) / (N/2); ne = number of panelists indicating "essential"; N = total number of panelists (21). As a result of the CVR and CVI, the number of items remained unchanged, and their wording did not change.

To collect data for subsequent analysis, sampling began by selecting parents of children with ASD who were selected through available sampling in rehabilitation centers. The Persian version of the CSHQ was provided in person and virtually to the parents who met the sampling criteria. Three hundred sixty questionnaires were sent. Among these, 54 questionnaires were excluded from the study due to incomplete information. In this way, the data from 306 questionnaires were analyzed to assess CFA and internal consistency. After two weeks, the questionnaire was again presented to 40 parents to assess test-retest reliability.

Instrument

The Children's Sleep Habits Questionnaire (CSHQ) was developed by Owens et al. (2000) to screen sleep disturbances in normal children aged 4-10 years (13). This tool has been used as an outcome measure in several studies (4, 22). The questionnaire contains 33 items across eight subscales; two items are repeated across the other two subscales, for a total of 35 items. The subscales include 1) Bedtime resistance, 2) Sleep onset Delay, 3) Sleep duration, 4) Sleep anxiety, 5) Night waking, 6) Parasomnia, 7) Sleep disordered breathing, and 8) Daytime sleepiness. Items are rated on a three-point Likert: 3 = usually (5-7 times/week), 2 = sometimes (2-4 times/week), and 1 = never / rarely (0-1 time/week). Some items are reverse-scored. Owens et al. (2000) reported the instrument's reliability and validity in a normal sample (n = 469) and a clinical sample (n = 154). The internal consistency of the entire CSHQ was 0.68 for normal and 0.78 for clinical samples. The total score and subscales of the CSHQ discriminated between normal and clinical samples. A total score of 41 was identified using Receiver Operator Characteristic (ROC) analysis as the cutoff for sleep problems. This score had a sensitivity of 0.8 and a specificity of 0.72 (13).

The psychometric study of the CSHQ in Iranian children was conducted by Fallahzadeh et al. (2015) on 300 normal children. The Cronbach's alpha coefficient for the entire questionnaire was 0.80. A positive correlation was observed between the CSHQ and the BEARS test (B: Bedtime issues, E: Excessive daytime sleepiness, A: Night Awakenings, R: Regularity and duration of sleep, S: Snoring). Convergence and divergence validity were 0.4 - 0.86 and 0.006 – 0.66, respectively. The obtained results showed that the Persian version of CSHQ has acceptable psychometric properties (19).

Statistical Analysis

Descriptive statistics were computed for the variables. CVI scores of 0.79 or higher, 0.70 to 0.79, and less than 0.70 were considered appropriate, needing revision, and unacceptable, respectively (23). According to the Lawshe method and the number of experts (n = 11), the minimum score of 0.59 was considered acceptable for the CVR (21). Considering that the minimum sample size for factor analysis is 5 to 11 times the number of instrument items (24). Seemingly, 306 subjects were a sufficient sample size for the CFA. The LISREL 88 was used for factor analysis. Cronbach's alpha was calculated to evaluate internal consistency; values were interpreted as: 0.9 = high, 0.7 - 0.9 = good, 0.6 - 0.7 = acceptable, 0.5 - 0.6 = weak, and less than 0.5 = unacceptable internal

consistency (25). The Intraclass Correlation Coefficient (ICC) values used to determine test-retest reliability were considered desirable, good, and weak if they were ≥ 0.75, 0.6 - 0.75, and < 0.59, respectively (26). The internal consistency and test-retest reliability were calculated using the SPSS 26 software.

Results

Approximately 85% of the parents were mothers (n = 258). Fathers accounted for a small proportion of participants (n = 48). Children's age range was 4-10 years, with a mean ± standard deviation of 6.12 ± 2.04. The descriptive statistics for demographic variables for children are shown in Table 1.

Table 1: Descriptive statistics of children with autism spectrum disorder

Variable	n	%
Gender		
Male	241	78.8
Female	65	21.2
Kindergarten*	129	42.2
Medication (except melatonin)*	210	68.6

Note. N = 306
* Reflects the number and percentage of parents answering "yes" to the question.

The CVR for the items ranged from 0.63to 1, and the mean across the entire questionnaire was 0.94. The CVI values ranged from 0.81 to 1, with a mean of 0.97. Considering the acceptable values for CVI and CVR based on the Lawshe method, all items remained unchanged during the content validity phase (Table 2).

Confirmatory Factor Analysis

The CFA was conducted using the four-factor questionnaire obtained from Katz et al. (2018) as they examined the psychometrics of the CSHQ in children with ASD. The age range of the subjects they selected (4-10 years) matched that of the current study's samples, and their study used a large sample (18). The analysis was done using LISREL 88. The appropriate fitting index considered in the study included the following: 1) The X2 / df ratio was 2.3 and less than 3 to accept the model (27); 2) The Goodness of Fit Index (GFI) = 0.85, Incremental Fit Index (IFI) = 0.90, Adjusted Goodness of Fit Index (AGFI) = 0.82, and Comparative Fit Index (CFI) = 0.90 indices were all 0-1. As the values were close to 1, the goodness of fit to the model with the observed data was high (27, 28); 3) Root Mean Square Error of Approximation (RMSEA) = 0.074; the fit of the model was good because it was lower than 0.08, and P < 0.001; Chi-Square = 596.85; df = 224 (27). The results showed an appropriate fit to the sample data, and the four-factor questionnaire version (18) was confirmed for this study (Figure 1).

Internal Consistency and Test-Retest Reliability

The total Cronbach's alpha coefficient was 0.83, so the deletion of each item did not significantly change the alpha. The Cronbach's alpha ranged from 0.43 to 0.79 for various subscales (Sleep initiation and duration = 0.79; Sleep anxiety/co-sleeping = 0.75; Night waking/parasomnias = 0.43; Daytime alertness = 0.75). These values were unacceptable to good (25).

Table 3: Intraclass correlation coefficient for each subscale of Children's Sleep Habits Questionnaire

Subscale of CSHQ*	Lower bound	Upper bound	ICC
Sleep initiation and duration	0.69	0.91	0.84
Sleep anxiety/co-sleeping	0.74	0.93	0.86
Night waking/parasomnias	0.67	0.90	0.82
Daytime alertness	0.84	0.95	0.91
Total	0.82	0.95	0.90

* Children's Sleep Habits Questionnaire

The ICC was calculated using a re-test on 40 samples after two weeks to estimate the reliability of the CSHQ. The subscale ICCs ranged from 0.82 to0.90. As it exceeds0.75, the results can be considered excellent (Table 3) (26).

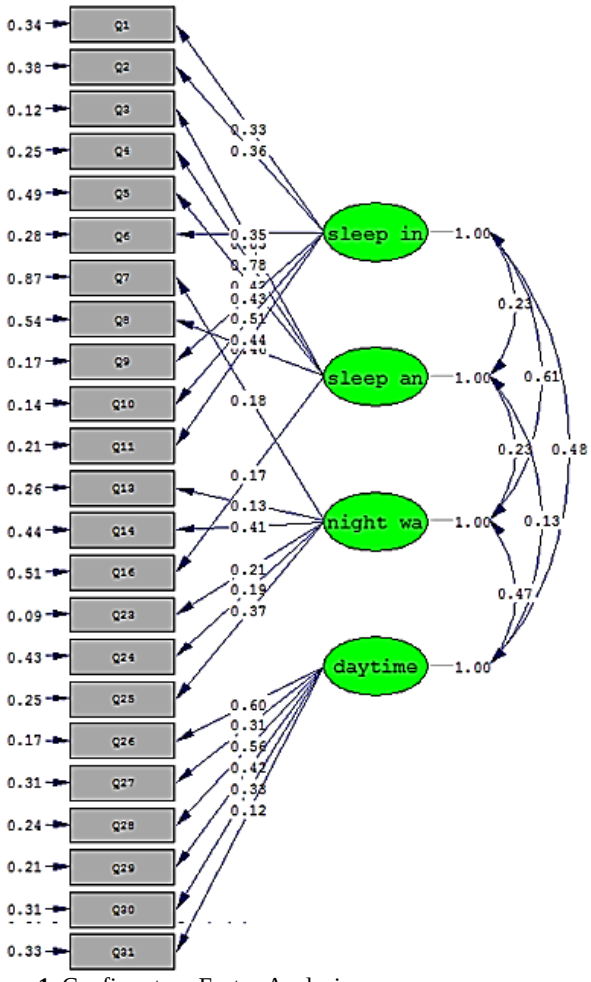

Figure 1. Confirmatory Factor Analysis

Discussion

This study aimed to investigate the psychometrics of the CSHQ in a sample of 4-10-year-old Iranian children with ASD. Content validity, CFA, internal consistency, and test-retest reliability were measured. The CVI and CVR results showed that each item in the Persian version of the CSHQ is necessary for measuring sleep problems in ASD. Falahzadeh et al. (2015) also reported similar results for the Persian version of CSHQ in typically developing children. A difference was that the experts of their study were only three psychiatrists (19), whereas in the present study, the experts were more people (11 experts), including a variety of professions (psychiatrists, occupational therapists, and psychologists). Given that a multidisciplinary mental health team should provide the treatment of ASD, the multidisciplinary expert panel is a strength of the present study (23).

Table 2: The content validity index and the content validity ratio of the Persian version of the Children's Sleep Habits Questionnaire

CSHQ* Items	CVR	R-CVI**	Q-CVI***	T-CVI****
Bedtime Resistance				
Goes to bed at same time	0.63	1	0.81	0.9
Falls asleep alone in own bed	0.81	0.9	0.9	0.9
Falls asleep in parent's or sibling's bed	1	0.9	0.81	0.85
Needs parent in the room to fall asleep	0.81	0.9	0.81	0.85
Struggles at bedtime	1	1	0.9	0.95
Afraid of sleep alone	1	0.9	0.9	0.9
Sleep Onset Delay				
Falls asleep in 20 minutes	1	1	0.81	0.9
Sleep Duration				
Sleeps too little	1	1	0.81	0.9
Sleeps the right amount	1	1	0.9	0.95
Sleeps same amount each day	0.63	0.81	0.9	0.85
Sleep Anxiety				
Needs parent in room to sleep	1	1	1	1
Afraid of sleeping in the dark	0.81	0.9	1	0.95
Afraid of sleeping alone	1	1	0.9	0.95
Trouble sleeping away	1	1	1	1
Night Waking				
Moves to other's bed in night	0.81	1	0.9	0.95
Awakes once during night	0.63	0.9	0.81	0.85
Awakes more than once	0.81	1	1	1
Parasomnias				
Wets the bed at night	0.81	0.81	1	0.9
Talks during sleep	0.81	0.81	1	0.9
Restless and moves a lot	1	0.9	1	0.95
Sleepwalks	1	0.9	1	0.95
Grinds teeth during sleep	1	0.9	1	0.95
Awakens screaming, sweating	0.63	0.81	0/9	0.85
Alarmed by scary dream	0.81	0.81	1	0.9
Sleep Disordered Breathing				
Snores loudly	0.81	0.81	1	0.9
Stops breathing	0.81	0.81	0.9	0.85
Snorts and gasps	0.81	0.81	0.9	0.85
Daytime Sleepiness				
Wakes by himself	0.81	1	0.81	0.9
Wakes up in negative mood	1	0.9	0.9	0.9
Others wake child	1	0.9	1	0.95
Hard time getting out of bed	1	0.9	1	0.95
Takes long time to be alert	1	0.9	1	0.95
Seems tired	1	0.9	1	0.95
Watching TV	0.81	1	0.9	0.95
Riding in car	1	0.81	0.81	0.81

* Children's Sleep Habits Questionnaire; **Relevancy - Content Validity Index; *** Quality- Content Validity Index; ****Total- Content Validity Index

This study checked the CFA on the 23-item questionnaire with four subscales (18), and the results (RMSEA = 0.74; CFI =0.90) were similar to those of Katz et al. (2018) (CFI = 0.84; RMSEA = 0.078) and showed that the sample data of the current study were fitted to Katz et al.'s study. The result of Zaidman-Zait et al. (2020) was different ($p < 0.001$; CFI = 0.96; RMSEA = 0.05) (7). The acceptable CFA results showed that the items were correctly selected to measure each nominated factor, and the factorization resulting from the EFA was highly robust.

The modified CSHQ (18) has at least five items per factor. This provides a similar range across subscales and better symptom coverage than some of the original CSHQ subscales (25, 29). Therefore, the result of internal consistency in the present study (Cronbach's alpha = 0.43 - 0.79) was better than the study of Owens et al. (2000) (Cronbach's alpha = 0.36 - 0.70); thus, this version maintained the homogeneity of the items in the original version (13).

The retest in this study was conducted under the same conditions and by the same assessor. According to Table 3, the results of test-retest reliability were calculated to be more acceptable compared to the study by Falahzadeh et al. (2015), where the ICC for different sections of the CSHQ was measured at 0.51 - 0.88 (19), and the study by Owens et al. (2000), where the test-retest reliability was 0.62 – 0.79 (13). A literature review showed that none of the similar psychometric studies on children with ASD evaluated test-retest reliability. They reported evaluating this type of reliability as a suggestion and a limitation (7, 17, 18). These results show that the Persian version of the CSHQ for ASD can be used in clinical trials to assess the changes resulting from interventions. \The good test-retest reliability shows that environmental influences and natural child development phenomena over several weeks do not affect CSHQ scores.

The researchers were limited in reporting the level of autism to assess the severity of the subjects' symptoms in this study, because the subjects were from different cities, their psychiatrists were not directly available to the researchers, and parental reports of autism levels were dubious. Therefore, no report has been submitted in this regard. Another limitation was the convenience sampling. Due to the large sample size relative to the inclusion criteria, random sampling was not feasible within the project implementation timeframe.

For future research, it is suggested to determine the cutoff point of the Persian version of CSHQ for children with ASD and non-autistic children. Examining the effect of demographic factors, such as the level of autism or the type of medication used, on the sleep habits of children with ASD, or the relationship between autism severity and the score of each factor, can provide important findings. Furthermore, to pay more attention to sleep problems, it is suggested that CSHQ psychometrics be investigated in children with other developmental disabilities.

In Conclusion

This research attempts to carefully psychometrically analyze the Persian version of the CSHQ for children with ASD. The findings showed that the obtained version has acceptable validity and reliability in ASD, so that it can be used in clinical practice and sleep research in children with ASD.

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Author Contributions

Homeyra Mousazade: Conceptualisation, Data collection, Writing - Original Draft. Samauneh Karamali Esmaili: Conceptualisation, Supervision, Review & Editing. Malek Amini: Conceptualisation, Analysis, Review & Editing.

Conflict of Interest

None.

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