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Original Article

Validity and reliability of the Turkish version of Sleep Disturbance Scale for Children

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ABSTRACT

Object: This study examines the validity and reliability of the Sleep Disturbance Scale for Children (SDSC) in the Turkish language.
Method: This scale was translated into the Turkish language by applying the translation-back translation method and content validity analysis. A total of 1903 participants aged 5–15 years were included in the study. A sociodemographic data form, SDSC, and the Children's Sleep Habits Questionnaire (CSHQ) were filled by the parents. Internal consistency analysis, correlation analysis, test-retest analysis, and confirmatory factor analysis were applied to evaluate the reliability and validity of the applied scale.
Results: The internal consistency of the scale was high (Cronbach $\alpha = 0.84$). Test-retest reliability was found to be high as well. According to the confirmatory factor analysis, the Turkish version of the scale was compatible with the model of the original scale. According to the T-score evaluation, the frequency of sleep disorders was determined to be 4.15%, and the most common sleep disorder was sleep hyperhidrosis. Correlations between the scores of the SDSC and CSHQ were at a satisfactory level.
Conclusions: These results revealed that the SDSC is a valid and reliable scale that can be used in children aged 5–14 years in Turkey to question sleep disorder symptoms.

1. Introduction*

Sleep disturbances are common throughout life, while various sleep problems have been identified in approximately 25%–50% of children, with different rates of sleep problems demonstrated across cross-cultural studies [1,2]. In an epidemiological study conducted in Turkey with 3485 adolescents, initiating and maintaining sleep disorders were found to be 9.7%–12.4%, while the parasomnia rate was 23.4% (12.8% for nightmares and 2.5% for sleepwalking and bruxism) [3]. Sleep disturbances impact different areas of life, including learning [4], executive functions [5], mood symptoms [6], and overall health [7]. Also, they are associated with risk behaviors and negative health outcomes among adolescents [8]. Sleep time in school-age children is closely related to cognitive functions and behavioral problems [9]. According to the Adolescent Brain Cognitive Development Study, longer sleep duration was correlated with higher brain volume in some areas which might be related to the outcomes above [10]. These findings have directed the attention of clinicians toward sleep symptomatology recently.

Nevertheless, some past studies have shown that sleep-related symptoms are not questioned, noticed, or treated by clinicians [11,12]. In the evaluation of sleep problems, it is recommended to perform an initial evaluation using sleep scales and sleep diaries before proceeding with further examinations such as polysomnography, which is time-consuming and labor-intensive [13]. There are many scales available to evaluate sleep in children; however, Sleep Disturbance Scale for Children (SDSC) [14] is one of the two questionnaires available, which fulfills the psychometric tool development requirements among childhood sleep scales [15]. SDSC has been used in sleep studies and validated in

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[*] Abbreviations: SDSC: Sleep Disturbance Scale for Children, CSHQ: Children's Sleep Habits Questionnaire, DIMS: disorders of initiating and maintaining sleep, SBD: sleep breathing disorders, DA: disorders of arousal, SWTD: sleep–wake transition disorders, DOES: disorders of excessive somnolence, SHY: sleep hyperhidrosis, CFA: confirmatory factor analysis, EFA: explanatory factor analysis.

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several languages such as Italian [14,16], Persian [17], Portuguese [18], Chinese [19], Finnish [20], French [21,22], Australian [23], Brazilian Portuguese [24], Indonesian [25], Malay [26], and Flemish [27]. It is a 26-item scale, based on hetero-evaluation, which is applicable to children aged 6–16 years and also valid for younger children in Italy [16] and France [22]. This scale questions the symptoms in the past six months. There are six subscales in the original version of the scale. These subscales are disorders of initiating and maintaining sleep (DIMS) (items 1, 2, 3, 4, 5, 10, and 11), sleep breathing disorders (SBD) (items 13, 14, and 15), disorders of arousal (DA) (items 17, 20, and 21), sleep–wake transition disorders (SWTD) (items 6, 7, 8, 12, 18, and 19), disorders of excessive somnolence (DOES) (items 22, 23, 24, 25, and 26), and sleep hyperhidrosis (SHY) (items 9 and 16). There are several scales available in the Turkish language to assess sleep patterns in childhood, including the Children's Sleep Habits Questionnaire (CSHQ), which is commonly used to question sleep habits in 6–10 year old children [28,29]. The CSHQ questions sleep-related behaviors in the past 1 week, which may involve overlooking some symptoms and parasomnias because of their frequency. In addition, a 3-point Likert scale may not sensitively assess the symptom severity. Moreover, CSHQ does not contain questions on sleep hyperhidrosis, hypnic jerks, hypnogogic hallucinations, and rhythmic limb movements. It is focused on sleep habits and behaviors rather than disorders. Therefore, there is a need for a scale to question sleep disorders by assessing different sleep problems both for persistence over time and for children and especially for adolescents. We aimed to investigate the validity and reliability of the SDSC in Turkish for 5–14 year old children by analyzing standard Cronbach's alpha, test re-test method, confirmatory factor analysis (CFA), concurrent validity, and T-scores.

2. Material and methods

Ethical approval was obtained from the Trakya University Faculty of Medicine, Scientific Research Ethics Committee (approval date and decision number: TÜTF-BAEK 2018/138).

2.1. Adaptation of the scale

Permission was obtained from Oliviero Bruni to adapt the scale. Language validity of the scale was evaluated by the translation-back translation method. The translation of the scale was performed independently by five experts, including an English language specialist, a native medical doctor, and three child psychiatrists (including the authors Seray Ağca and Işık Görker). Then, a single form was created from the five forms obtained with the common idea of the authors. The resulting Turkish form was translated back into English by two independent English language professionals. It was then edited with another English language expert by comparing it with the original scale.

Content validity of the scale was tested by providing the relevancy and clarity score between one and four for each item independently by a team of 6 experts composed of child and adolescent psychiatrists, a child allergy specialist, an English language specialist, and an adult psychiatrist. As a result of Lawshe's content validity assessment, 24 items were accepted with a ratio of 1. The content validity ratio was 0.67 for items 17 and 18 (“You have observed the child sleepwalking” and “You have observed the child talking in his/her sleep,” respectively). They were rejected due to the lack of clarity and simplicity of the translation. Content validity was ensured by making changes with the rejected items through expert recommendations. To test the comprehensibility, 16 forms were filled with the parents by the author at the child psychiatry outpatient clinic and minor revisions were made with their feedback.

2.2. Sampling

A total of six schools in the city center of Edirne province, including three primary schools and three secondary schools were selected based on the low, moderate, and high socioeconomic levels, and the necessary permission was obtained from the Directorate of National Education. It was planned to include the parents of all primary and secondary school children who could be reached. A total of 2962 questionnaires were sent for the survey. From the returned ones, 1903 forms, which were fully completed, were included in the study. The response rate was 64.2%. Incomplete forms and those who did not wish to participate in the study were excluded. For the test-retest reliability, 14 days after the first evaluation, a class from each level was randomly selected from a randomly selected school, and 130 parents were asked to fill the forms again.

2.3. Procedure

The children from the designated schools were asked to take the forms consisting of the Informed Consent Form, Sociodemographic Data Form, SDSC, and CSHQ [14,28,29] to their homes and convey them to their parents. The scales that were returned the next day were collected from the children.

2.4. Data collection tools

2.4.1. Sociodemographic data form

The questions included in the form inquired the date of birth, gender, school, class data, medical history, current disease, medication usage, previous operation, adenotonsillar hypertrophy, frequent tonsillitis, psychiatric admission history, sleep complaint, and the age, educational status, occupation, medical and psychiatric history of the parents, and the total monthly income of the family.

2.4.2. SDSC

Each item is scored between one and five by using the Likert-type rating scale. The total sleep time and latency of sleep forms the first and second questions. From the third question onward, scoring is performed in accordance with the frequency of the behavior in the item corresponding to, one = never, two = rarely (once or twice a month or less), three = sometimes (once or twice a week), four = often (three or five times a week), and five = always (every day). The total score is 26–130. Bruni et al. suggested a cut-off value of 39 for the total score. At this value, they found that the sensitivity of the scale was 0.89 and the specificity was 0.74. The internal consistency ranged from 0.71 to 0.79 in studies conducted across different countries, with test-retest reliability of 0.71 and diagnostic precision (area under the curve) of 0.91.

2.4.3. CSHQ

This questionnaire is one of the most frequently used ones for the evaluation of sleep habits among primary school children. There is no validity and reliability in the secondary school-age group. This questionnaire consists of 33 items and questions on the sleep habits for the past one week. Owens et al. developed the relevant scale and defined 8 subscales, which can be listed as bedtime resistance, sleep onset delay, sleep duration, sleep anxiety, night waking, parasomnias, sleep-disordered breathing, and daytime sleepiness [28]. The parents were asked to evaluate their child's sleeping habits over the past week using a 3-Likert-type

scale. The Turkish validity and reliability study of the questionnaire was conducted by Perdahli Fis et al. [29]. In our study, the CSHQ was added to the form to be filled by the parents immediately after the SDSC. The validity and reliability of the CSHQ was checked for primary school children. The CFA and correlation analyses were separately conducted among primary and secondary school groups as well as for the entire sampling. As a result of the analysis, no significant difference was noted between the primary and secondary schools, and hence the entire sample was included in the concurrent validity analysis.

2.5. Statistical analysis

The Lisrel 9.30 Statistical Software program was used to perform CFA using a structural equation model. The model fit in the present study was considered a good fit if the root mean square error of approximation (RMSEA) value was <0.06 [30]. In addition, the following goodness of fit indices were used to assess the model fit, goodness of fit index (GFI) > 0.90 acceptable, Adjusted GFI (AGFI) > 0.90 [31], and root mean square residual (RMR) < 0.05 perfect, standardized RMR (SRMR) < 0.08 acceptable [32]. CFI >0.80 (moderate fit) and values > 0.90 were considered to be a great fit [33]. If the results of CFA were not compatible, then explanatory factor analysis (EFA) would be implemented. The results indicated a good fit with the original version and hence no further analysis was performed.

The normality of the data was examined by using the Shapiro–Wilks test. Arithmetic mean ± standard deviation and median (minimum–maximum) values were considered as descriptive statistics. The scale and subscale internal consistencies were assessed using the Cronbach alpha, inter-item correlation, and intra-class correlation coefficients (two-way mixed-effects model) as the inter-rater reliability. The correlation between total and subscores and the concurrent validity that was non-normal distributed and nonparametric variables were determined with Spearman Rho correlation coefficient. Intra-class correlation, Spearman Rho correlation, and the Wilcoxon T-test were used to evaluate the test-retest reliability. The Mann–Whitney U-test was used for comparisons between the groups derived from sociodemographic data. The T-score table was prepared similar to that in the original study by converting the mean scores of the scale into T-scores using the following formula: T-score = 50 + (value−mean)/standard deviation × 10. A child with T-score > 70 was considered to have a significant sleep disorder [14]. The package program IBM SPSS Statistics for Windows (Version 22.0; IBM Corp. Released 2010 Armonk, NY: IBM Corp.) was used for the data analysis. In all analyses, $p < 0.05$ was considered to be statistically significant.

3. Results

3.1. Participants

The average age of the 1903 children was 10 years 4 months ±2 years 3 months ranging from 5 years 8 months–15 years 8 months (see Supplementary Fig. 1 for size sample of each age). The rates for the girls and boys were respectively 50.8% (n = 967) and 49.2% (n = 935). Of the subjects, 40.1% (n = 764) were primary school children and 59.9% (n = 1139) were secondary school children.

3.2. Construct validity

According to the standardized analysis model of the factor analysis performed on the defined subscales of the scale, the factor loads of the items varied between 0.20 and 0.74, and error variance varied between 0.45 and 0.96 (see Supplementary Fig. 2 for standardized resolution diagram), and the factor loadings and eigenvalues of the original study is depicted in Table 1. Since the model fit was at a good level in the results of the compatibility analysis, all the items were analyzed. To evaluate the suitability of the model, the t-values diagram was examined, and the model with $t > 2.56$ values for all items, $p < 0.01$, was considered appropriate. According to the fit evaluations of the model described in CFA, RMSEA = 0.0527, RMR = 0.0283, SRMR = 0.0534, GFI = 0.921, and the AGFI = 0.903 values were determined. CFI = 0.826. According to these values, the factor structure of the Turkish form of the scale was believed to be compatible and showed a good fit with the original form.

3.3. Reliability analysis

3.3.1. Internal consistency reliability

The Cronbach alpha value for the whole scale was 0.839 for the 26 items. Item-total correlations ranged from 0.19 (item 1) to 0.53 (item 23) (Supplementary Table 1). Only item 1 showed a low correlation of <0.20. Item 1 questions the total sleep time. Since the Cronbach alpha value did not change when deleted, the item was not excluded to ensure the integrity of the scale. The mean intra-class correlation coefficient (two-way mixed-effects model inter-rater reliability) was determined to be 0.806. The mean inter-item correlation from the item–item correlation matrix of 26 items was 0.17. Reliability analysis was performed separately for the

Table 1
Eigenvalues and factor loadings of the original version of Sleep Disturbance Scale for Children (taken from Bruni et al., 1996).

Factors		Variance explained	Factor loading
DIMS		**16.58%**	
	1 Sleep duration		0.55
	2 Sleep latency		0.64
	3 Going to bed reluctantly		0.55
	4 Difficulty in falling asleep		0.68
	5 Falling asleep anxiety		0.46
	10 Night awakenings		0.47
	11 Difficulty in falling asleep after awakenings		0.45
SBD		**6.29%**	
	13 Breathing problems		0.74
	14 Sleep apnea		0.67
	15 Snoring		0.63
DA		**5.91%**	
	17 Sleepwalking		0.46
	20 Sleep terrors		0.77
	21 Nightmares		0.72
SWTD		**5.53%**	
	6 Hypnic jerks		0.60
	7 Rhythmic movement disorders		0.40
	8 Hypnagogic hallucinations		0.42
	12 Nocturnal hyperkinesia		0.43
	18 Sleeptalking		0.46
	19 Bruxism		0.49
DOES		**5.10%**	
	22 Difficulty in waking up		0.67
	23 Tired when waking up		0.71
	24 Sleep paralysis		0.53
	25 Daytime somnolence		0.52
	26 Sleep attacks		0.41
SHY		**4.80%**	
	9 Falling asleep sweating		0.85
	16 Night sweating		0.79
	Total variance explained	**44.21%**	

(DIMS, disorders of initiating and maintaining sleep; SBD, sleep breathing disorders; DA, disorders of arousal; SWTD, sleep–wake transition disorders; DOES, disorders of excessive somnolence; SHY, sleep hyperhidrosis).
Bolds describe explained variance percentages.

subscales. The DIMS and SHY subscales showed the highest Cronbach alpha values (0.688 and 0.693, respectively). These subscales were followed by SBD, DOES, and SWTD subscales (0.652, 0.645, and 0.607, respectively). The Cronbach alpha value of the DA subscale was the lowest (0.467).

3.3.2. Correlation analysis

Since all the scale and subscale scores did not demonstrate a normal distribution, the nonparametric Spearman Rho correlation analysis was applied. While a strong correlation was noted between the scores of the 3 subscales (DIMS, SWTD, and DOES) and the total score, a moderate correlation was noted between the other subscales and the total score (Table 2). The correlations between subscales were <0.40, which indicated that the subscales were not correlated with each other. Between the scales, only a moderate correlation of 0.46 was observed between DOES and DIMS.

3.3.3. Test-retest reliability

For a total of 130 participants, the mean age was 10 years 5 months ±1 year 8 months. The score distribution was non-normative. The correlations of the scale at two different time points were evaluated with intra-class correlation analysis to test the intra-rater reliability. Intra-class correlation coefficients were 0.90 for the total scale, 0.88 for DIMS, 0.66 for SBD, 0.65 for DA, 0.88 for SWTD, 0.83 for DOES, and 0.87 for SHY. The Spearman Correlation Coefficient was 0.79 for the repeated scales. Inter-item correlation was highly significant at $p < 0.001$. The correlation coefficient between the items varied between 0.71 and 0.24. No statistically significant difference was noted between the subscale and total scores evaluated with the Wilcoxon paired two-sample tests ($p = 0.297$).

3.4. Concurrent validity

The scores were distributed non-normally according to the Shapiro–Wilks test. Nonparametric Spearman Rho correlation analysis was accordingly performed. The total correlation between SDSC and CSHQ was 0.62, indicating that the two scales were moderately correlated with each other. The subscale correlations were conducted by matching the similar questions and subscales of the questionnaires. The DA and SWTD subscales corresponded to one subscale which is parasomnias in CSHQ, therefore the parasomnias subscale was analyzed in 2 parts and the question about nocturnal enuresis was excluded. The SHY subscale did not correspond to any questions in CSHQ and hence it was excluded from analysis. Supplementary Table 2 demonstrated the item groupings and correlation values between the subscales.

Table 2
Total and subscale correlations of the Sleep Disturbance Scale for Children.

	DIMS	SBD	DA	SWTD	DOES	SHY
DIMS	1					
SBD	0.20	1				
DA	0.23	0.23	1			
SWTD	0.37	0.30	0.34	1		
DOES	0.46	0.24	0.29	0.38	1	
SHY	0.22	0.30	0.17	0.32	0.21	1
TOTAL	0.76	0.44	0.46	0.73	0.71	0.45

(DIMS, disorders of initiating and maintaining sleep; SBD, sleep breathing disorders; DA, disorders of arousal; SWTD, sleep–wake transition disorders; DOES, disorders of excessive somnolence; SHY, sleep hyperhydrosis; nonparametric Spearman ρ correlation; $p < 0.001$ for all correlations).

3.5. Scale score distribution

The mean total scale score was 36.75 ± 8.54. This score demonstrated a non-normal distribution. The minimum value was 26, while the maximum value was 99. According to the T-score table, at > 70 considered as the pathological cut-off, the presence of sleep disorder was considered in 4.2% of the participants. DIMS rate was 4.2%, SBD was 4.0%, DA was 3.7%, SWTD was 4.2%, DOES was 4.7%, and SHY was 5.2%. The total and subscale scores obtained the following thresholds: 55 for the total, 19 for DIMS, 7 for SBD, 7 for DA, 15 for SWTD, 13 for DOES, and 6 for SHY. The rate of 122 subjects who reported sleep complaint was 6.4% of the whole sample, and their mean score was 49.80 ± 7.51, which indicated a T-score of 65. Additionally, Bruni et al. noted 39 points as the cut-off value in the original study; in our study, 31.9% of the sample was above their cut-off point.

The total score and sub-score differences between the sociodemographic features were evaluated with Mann–Whitney U-test between the groups considering the gender and school. Participants who had psychiatric admission history, sleep complaint, medical illness, adenotonsillar hypertrophy, frequent tonsillitis, and medication usage were compared to those who did not have these (see Table 3). It was found that the group with a high maternal education level provided a significantly higher score than those with a low level ($p = 0.010$).

4. Discussion

4.1. Statements of principal findings

The main objective of this study was to investigate the validity and reliability of SDSC in the Turkish language. We found the Turkish version to be highly reliable. The 6-factor model from the original study was found to be compatible. The 6 sleep disorders DIMS, SBD, DA, SWTD, DOES, and SHY were screened with the T-score table given with cut-off values to evaluate sleep disorders among children aged 5–14 years.

4.2. Strengths and weaknesses of the study

The study is population-based with a large sample size of 1903 children from different socioeconomic levels and across a wide age range. The response rate of the survey was >60%, which is recommended for scale studies [34]. The original scale structure was compatible with that of the Turkish version. The fit indexes were in the recommended range. The 6-factor model describes sleep disorders parallel with sleep disorder classification systems. Internal validity revealed high reliability of the scale including 26-items from the original form. Intra-class correlation was good. The 26-item structure of the scale was not distorted as the contribution of the items to the total was demonstrated by intra-class, inter-item, and item–total correlation analyzes. The average inter-item correlation was within the range reported in the literature [35]. For broad higher-order construct, a mean correlation of as low as 0.15–0.20 is probably desirable in the literature as it highlights the discrimination of items from each other [35]. The DIMS, SBD, SWTD, DOES, and SHY subscale Cronbach values were at a good level, although the DA subscales Cronbach's alpha was low. The correlation of the whole scale with the subscales was found to be strong between the total score and DIMS, SWTD, and DOES. A moderate correlation was noted between the total score and the subscales of SBD, DA, and SHY. But these differences need to be addressed. The low DA Cronbach's alpha value may be related to the low reporting values of sleep disturbances by families, particularly for these symptoms (such as parasomnias)

Table 3
Sleep Disturbance Scale for Children subscale and total score comparisons between groups.

	N	%	DIMS	SBD	DA	SWTD	DOES	SHY	TOTAL
Primary/Secondary school	764/1139	40.1/59.9	0.34	0.00*	0.03*	0.49	0.06	0.00*	0.79
Female/Male gender	967/935	50.8/49.2	0.64	0.15	0.21	0.15	0.03*	0.00*	0.80
Psychiatric admission	244	12.8	0.00*	0.06	0.06	0.00*	0.00*	0.00*	0.00*
Sleep complaint	122	6.4	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*
Medical illness	209	10.9	0.04*	0.00*	0.09	0.00*	0.00*	0.07	0.00*
Adenotonsillar hypertrophy	133	6.9	0.02*	0.00*	0.00*	0.03*	0.00*	0.00*	0.00*
Frequent tonsillitis	91	4.7	0.52	0.00*	0.08	0.15	0.20	0.06	0.00*
Medication usage	134	70.4	0.06	0.00*	0.99	0.02*	0.00*	0.00*	0.00*

(DIMS, disorders of initiating and maintaining sleep; SBD, sleep breathing disorders; DA, disorders of arousal; SWTD, sleep–wake transition disorders; DOES, disorders of excessive somnolence; SHY, sleep hyperhydrosis; nonparametric Mann Whitney U test; * = $p < 0.05$).

[36]. In a previous study, researchers stated that self-notifications and family notifications differed mostly from each other in terms of excessive sweating during sleep, waking disorders, and nightmares. This observation could be attributed to the fact that the parents were not close enough to evaluate the children objectively when they presented with these symptoms [37]. A moderate relationship between the DIMS and DOES subscales was observed in subscale correlations, which may be related to the fact that patients who have sleep initiation problems possibly experience daytime sleepiness due to decreased sleep quality. In addition, in the delayed sleep phase type of circadian rhythm disorders, problems in falling asleep can be accompanied by daytime sleepiness. Bruni et al. stated that the differences between correlations occurred because sleep disorders were not unidirectional phenomenon and they formed different subgroups that may be more or less related to each other, and hence can be seen together [14]. Therefore, correlations between subscales seem congruent based on our clinical knowledge.

Analyses for test-retest reliability revealed that the SDSC has a good level of compliance stability and consistency in evaluations made at different time points. SDSC and CSHQ in total were strongly correlated with the correlational analyses, although there are several differences between the 2 scales. In subscale correlations, a moderate correlation was noted for DIMS, SBD, SWTD, and DOES scales, while a low-level correlation was noted in the DA subscale. DA items that are about parasomnias may not have been observed in the last week, but may have been observed in the last 6 months [38,39]. SDSC may have detected all these incidents, rather than CSHQ which may be the reason for the low correlation. When the relationship between the scale scores and the sociodemographic variables were examined, DA was found to be significantly higher among secondary school children than in primary school children. This seems to contradict the literature finding that parasomnias decrease in adolescence [40,41]. SBD was found to be more frequent among primary school children than among secondary school children; this finding is consistent with the literature [42]. In our study, the SHY scores were found to be significantly higher for primary school children, which conforms to the findings of the scales development study [14]. DOES was significantly higher in girls and SHY in boys, which agrees with the literature [14,43,44]. All scale scores were found to be higher in adenoid hypertrophy, and SBD was higher in frequent tonsillitis, parallel to that reported in the literature [45]. In participants with drug use and chronic diseases, higher scores were found, which is consistent with the literature results [46,47]. Similarly, the group with a psychiatric reference history was found to have significantly higher scores on all subscales, except for the SBD and DA subscales. Although high scores were expected [2], it is difficult to make conclusive remarks because of the lack of detailed information about the psychiatric admission reason and the diagnoses of the samples.

4.3. Strengths and weaknesses in relation to other studies

The age range of the original form is 6–16 years. In our study we showed the applicability of the scale in 5–14 year olds due to the methodological design and school ages in Turkey. There was only two participants over 15 years (see Supplementary Fig. 1) thus the age range was considered as above. Factor loadings were found to be acceptable, but lower than that reported in the original scale study and the adaptation study conducted in China [19,48]. The SDSC revealed a 5-factor model in some adaptation studies conducted in France and Australia [21–23]. Marriner et al. suggested that clinical groups with neurodevelopmental problems may differ from community samples in factor structure, hence they applied the EFA first. In our study, the fit indices were compatible; therefore, EFA was not applied. In our study, a higher reliability value was noted than that in the scale's original study [14]. Similar reliability coefficients were recorded in preschool adaptation study conducted in Italy; validity and reliability studies conducted in China and Iran; two versions both for school and preschool in France; and in different clinical studies [16,17,19,21,22]. Total sleep time item indicated a similar low correlation among studies conducted in China and Iran [17,19]. As low item correlation for total sleep time was observed only in adaptation studies from the Eastern countries, we may suggest that the reason may be the geographic and/or cultural difference in time perception. Time perception is more incidental and cyclic than linear in Eastern countries, which may explain the parents' inconsistent answers to a linear time question [49]. Saffari et al. explained this difference with the high interindividual variability in the sleep need and total sleep time of the children, which is why it may not clearly correlate with sleep disorders [17]. Also, the sleep duration differs across cross-cultural studies, and the decreased sleep time, if only with insufficient sleep, is related to sleep disturbances [1]. DA consists of three items that question the parasomnia group, including sleepwalking, night terrors, and nightmares. Similar alpha values were noted for the DA subscale in studies conducted in other countries [17,19,20]. In the Iranian study, the authors believed that the low reliability of DA may be related to the fact that most of the families marked the "never" option and that their awareness about this situation was low [17]. A similar relationship was also recorded between the subscales in the original scale development study and the study of Blunden et al. [14,36]. Test-retest reliability was found to be higher in our study than in the original study, which may be attributed to time interval differences [14].

We noted that the T-score statistics of the scale made in different countries were similar [14,16,19,50]. For instance, in China, the rate of sleep disorders was 3.9% [50]. In Egypt, unlike these results, the rate of sleep disorders was 24.3% [51]. In epidemiological studies, the frequency of insomnia was 1%–6% [52]; the frequency of sleep breath disorders was 4%–11% [53], the frequency of parasomnias was 14.4% [41], the frequency of sleepwalking was

15% during the early childhood and 2.5% in adolescence [3,39], and the rate of restless leg syndrome was 2% [54]. In contrast, sleep problems were detected in 31.9% of the sample according to the cut-off value of the SDSC original study. The frequency of sleep problems yielded similar results as from the original study and the literature [2,14]. However, these differences may be related to the discrepancy between sleep problems and sleep disorders in terms of nosological and methodological issues in studies.

4.4. Meaning of the study: possible implications for clinicians

The SDSC is an easily useable and highly reliable tool to assess children and adolescents. In the present study, the total scores and subscale scores were converted into the corresponding T-scores, and a 1-page table was created to rapidly evaluate the symptoms (Appendix A). This table enables comparison of both with the whole sample of this study and between the child's total and subscale scores on its own. The cut-off score could not be evaluated in this study because of the lack of a patient group. The recommended T-scores of >70 (which represents > 95 percentile of the sample) are not diagnostic, but they are intended to guide the clinicians. The T-score was 65 for the ones who had sleep complaints. Although >70 may represent the pathological sleep-disordered children, lower scores (yellow zone in Appendix A) may address clinically significant sleep problems. To clarify this point, further studies with a patient group is the rule of the thumb.

Although CSHQ reflects similarity with the items of SDSC, there are clear differences that distinguish the two scales from each other. For example, CSHQ is a scale that scans sleep habits at ages 6–10, which is a narrower age range, and questions the incidents of the last one week. On the other hand, SDSC evaluates the incidents that occurred in the past six months, considering that low symptom frequencies of some sleep disorders (eg parasomnias) may affect the reporting that can hamper distinguishing chronic sleep problems from temporary sleep problems [14]. SDSC is a 5-point Likert-type scale, whereas CSHQ is a 3-point Likert-type scale. SDSC questions about excessive sweating during sleep, hypnic jerk, hypnagogic hallucinations, and rhythmic movement disorders under sleep–wake transition disorders, which CSHQ does not. On the other hand, CSHQ contains more detailed questions about sleep behaviors and habits related to bedtime resistance, sleep time, sleep fear, night awakenings, daytime awakening, as well as nocturnal enuresis, which SDSC does not. Therefore, clinicians and researchers should choose between these two scales regarding their hypothesis.

4.5. Unanswered questions and future work

Our study has some limitations. For instance, the sample of this study consisted of those who returned to the distributed scales, which may have created a response bias. Returned forms may have been filled in by parents whose children have sleep problems, and who were interested and conscious about this issue. Lack of information about family characteristics of unreturned forms is a limitation. Body mass index data were not collected. Hence, this variable could not be evaluated. The specificity and sensitivity of the scale could not be evaluated in our country due to the lack of a patient group diagnosed by other methods. Sleep disorder rates determined in this study cannot be considered as epidemiologic data because of methodologic issues. In the construct validity analysis, EFA was not performed; hence, the possible other factor structure was not explored in this study. However, the factor structure of the Turkish form may vary in other populations, we suggest EFA to be applied in accordance with the study design. Moreover, as Lecuelle et al. suggested, multi-group modeling CFA might detect possible invariances [22] and invariance measurement studies might be eligible in developing the scale's transcultural versions.

5. Conclusions

Our study results indicated that the SDSC is a valid and reliable scale that can be used in Turkey to question sleep disorder symptoms (Appendix B). This scale is applicable to children of age 5–14 years, and it evaluates chronic symptoms occurring in the past 6 months, provides detailed information on sleep disorders with subscales and sleep disorders and their status according to the average T-score; moreover, it can be applied in a short amount of time.

Author contribution

Seray Ağca, Methodology, Investigation, Data curation, Writing – original draft. Işık Görker, Term, Supervision, Resources, Project administration. Fatma Nesrin Turan, Methodology, Software, Formal analysis. Levent Öztürk, Conceptualization, Writing – review & editing.

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Conflict of interest

None declared.

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.2021.05.016.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.sleep.2021.05.016.

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