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# Reliability and validity of the Turkish version of the pediatric sleep questionnaire: a tool for prediction of sleep related breathing disorder

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## ÖZET

**Pediatric uyku anketi Türkçe formunun geçerlilik ve güvenilirliği: Uyku ile ilişkili solunum bozukluğunun tahmininde bir araç**

Uyku ile ilişkili solunum bozukluklarının tanı ve etkilerini tahmin edebilen bir anket kullanılması hem tanı algoritmasında hem de tedavide maliyet-etkin olabilir. Bu nedenle, bu çalışmanın amacı; Pediatrik Uyku Anketi (PSQ)'nin Türkçe'ye çevrilmesi ve Türkçe anketin geçerlilik ve güvenilirliğinin test edilmesidir. Uyku ile ilişkili solunum bozukluğu ile uyumlu belirtileri olan 2-17 yaş arasında toplam 111 çocuk (59 erkek, 52 kız) sırasıyla çalışmaya alındı. Çalışmaya alınan tüm çocukların yaş ve cinsiyet gibi demografik özellikleri kaydedildi. Tüm ebeveynler, belirtilerin ağırlığı, sıklığı ve süresi hakkında sorgulandı. Son olarak, tüm ebeveynlere PSQ uygulandı. Çalışmaya alınan çocukların ortalama yaşı  $8.1 \pm 3.4$  yıl idi. Toplam PSQ puanı 0-0.95 arasında ve ortalama puan  $0.35 \pm 0.22$  idi. Farklı belirti sıklığı bildiren çocuklar arasında toplam PSQ puanlarının karşılaştırılması PSQ puanının belirti sıklığı arttıkça arttığını gösterdi ( $p < 0.001$ ). Gruplar arasında tüm PSQ puanları anlamlı farklıydı ( $p < 0.05$  tümü için). Toplam PSQ puanı, hiç horlama rapor etmeyen çocuklar için  $0.2 \pm 0.5$  iken, uyku boyunca horlayan çocuklar için  $3.8 \pm 0.5$  idi ( $p < 0.001$ ). PSQ'nun tüm alt puanları için Cronbach alfa değerleri başarılıydı. Tüm sorular kendi alt skalaları ile anlamlı koreleydi. PSQ'nun Türkçe versiyonu, uyku ile ilişkili solunum bozukluğunu düşündüren belirtileri olan Türk çocuklarının ilk değerlendirmesinde kullanılabilecek güvenilir ve geçerli bir ölçektir.

**Anahtar Kelimeler:** Pediatrik uyku anketi, uyku ile ilişkili solunum bozukluğu, çocuk.

## SUMMARY

**Reliability and validity of the Turkish version of the pediatric sleep questionnaire: a tool for prediction of sleep related breathing disorder**

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*Use of a questionnaire that predicts the diagnosis and influence of sleep related breathing disorder (SRBD) may be a cost-effective method to aid in both diagnostic algorithm and therapy. Therefore, the aim of this study was to adapt Pediatric Sleep Questionnaire (PSQ) into Turkish and to test the validity and reliability of the Turkish questionnaire. Total of 111 children (59 male, 52 female) aged 2 to 17 years who had symptoms suggestive of SRBD were enrolled consecutively. Demographic characteristics such as age and gender of all children enrolled in the study were recorded. All parents were questioned about symptom severity, frequency and duration. Lastly, PSQ was administered to all parents. Mean age of the children enrolled in the study was  $8.1 \pm 3.4$  years. Total PSQ score ranged between 0 and 0.95 and mean score was  $0.35 \pm 0.22$ . Comparison of total PSQ scores between children reporting different symptom frequencies demonstrated that PSQ score increased as the symptom frequency increased ( $p < 0.001$ ). There was a significant difference of all PSQ scores among the groups ( $p < 0.05$  for all). Total PSQ score for children that did not report snoring was  $0.2 \pm 0.5$  while that for the ones who snore throughout sleep was  $3.8 \pm 0.5$  ( $p < 0.001$ ). Cronbach's alpha values for all domains of PSQ were satisfactory. All items were significantly correlated with their corresponding scale. Turkish version of PSQ is a valid and reliable tool that may be used in the initial evaluation of Turkish children with symptoms suggestive of SRBD.*

**Key Words:** Pediatric sleep questionnaire, sleep related breathing disorder, children.

Sleep related breathing disorders (SRBD) that constitute a spectrum of symptoms that range from habitual snoring to obstructive sleep apnea (OSA) have many adverse effects on many aspects of a child's life and growth (1). The prevalence of habitual snoring has been reported to be in the range of 4-5% in our region and previous research has reported a prevalence of about 2% for OSA (2-4). Most common etiology of SRBD during childhood is adenotonsillar hypertrophy and allergic rhinitis but a pathology in neuromuscular tone has also been accused in etiology (5,6).

Gold standard for diagnosis and assessment of OSA in children is sleep laboratory based polysomnography (PSG) (1). However, PSG is an expensive technique that may not be available easily on many circumstances (7). Moreover, it is not thought to be very effective in predicting neurobehavioral morbidity due to SRBD because some features of OSA such as snoring that is not well quantified on standard PSG may be associated with cognitive and behavioral morbidity (8).

Pediatric Sleep Questionnaire (PSQ) developed and validated by Chervin et al. is a 22 item questionnaire which had been shown to have a sensitivity of 81% and specificity of 87% for SRBD (7). Considering the relative high prevalence of SRBD and the relative difficulties of obtaining PSG for all children suspected of having this disorder, use of a questionnaire that predicts the diagnosis and influence of SRBD may be a cost-effective method to aid in both diagnostic algorithm and therapy. Previous research with PSQ indicates that this questionnaire may be used with this aim (8-10).

Therefore, the aim of this study was to adapt PSQ into Turkish and to test the validity and reliability of the Turkish questionnaire.

## MATERIALS and METHODS

### Subjects

Total of 111 children (59 male, 52 female) aged between 2 to 17 years who presented to the pediatric allergy and pulmonology outpatient department and who had symptoms suggestive of SRBD were enrolled in the study consecutively. Symptoms suggestive of SRBD were defined as the presence of snoring, difficulty breathing during sleep, mouth breathing during sleep or apnea.

### Study Design

Demographic characteristics such as age and gender of all children enrolled in the study were recorded. All parents were questioned about symptom severity, frequency and duration. Symptom severity was assessed by asking the parents to classify the breathing of their child during sleep as loud breathing/snoring, difficulty breathing or apnea during sleep. Snoring frequency was classified as 1-3 nights a week, 4-6 nights a week and every night. Moreover, symptom duration was classified as snoring for less than half of the night, snoring for more than half of the night and snoring all night long. Lastly, PSQ was administered to all parents.

### Pediatric Sleep Questionnaire: Sleep Related Breathing Disorder Scale

PSQ: SRBD scale is a questionnaire that can be administered to parents of children aged 2-18 years and is composed of 22 items that question frequency and severity of snoring during sleep, apnea at night during sleep, breathing difficulty during sleep, daytime sleepiness, attention deficit, hyperactivity and other pediatric obstructive sleep apnea symptoms. Responses to the items are as "yes", "no" and "I don't know" which are

scored as 1, 0 and missing respectively. Four of the items are about sleepiness, four about snoring and six about attention deficit/hyperactivity disorder defined according to the diagnostic criteria of Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) (11). Total score of PSQ is the mean of the scores of all items excluding the missing items. Most effective cut-off value for pediatric obstructive sleep apnea has been defined as 0.33.

### Adaptation into Turkish

Turkish adaptation included four main steps:

1. Forward translation: Two independent translators translated the questionnaire into Turkish.
2. Consensus forward translation: Two independent pediatricians fluent in English and Turkish developed one consensus Turkish questionnaire from the two translations.
3. Backtranslation: This consensus forward version was back translated into English by two independent translators who have not seen the original questionnaire and the backward version and the original text were compared by an independent supervisor.
4. Cognitive debriefing: The questionnaire was administered to ten patients who were not included in the field testing analysis.

### Statistical Analysis

The data was analyzed by SPSS 13.0 (Chicago, IL) statistical package.  $p$  values  $< 0.05$  were regarded as statistically significant. The statistical analysis consisted of reliability and validity analysis.

Internal consistency and item-total score correlations were used for reliability analysis. Internal consistency was tested using Cronbach alpha for every sub-scale of the instrument since every sub-scale represents a different concept for the patients. The item score and total score relationships were explored by Pearson's correlation analysis.

Validity of the Turkish version of the PAQLQ was tested by construct validity analysis. Construct validity was tested by using known group method tested by ANOVA analysis.

## RESULTS

### Sociodemographic Characteristics

Mean age of the children enrolled in the study was  $8.1 \pm 3.4$  and ranged between 2 and 17 years. Among all children 53.2% were males and 46.8% were females.

Tonsil hypertrophy was present in 16.2% and 13.5% had allergic rhinitis (Table 1).

### Distribution of PSQ Scores

Total PSQ score ranged between 0 and 0.95 and mean score was  $0.35 \pm 0.22$ . Snoring score ranged between 0 and 1.25 and mean was  $0.26 \pm 0.36$ . Mean sleepiness and inattention domain scores were  $0.26 \pm 0.28$  and  $0.51 \pm 0.36$  respectively.

### Validity of the Turkish PSQ

Comparison of total PSQ scores between children reporting different symptom frequencies demonstrated that PSQ score increased as the symptom frequency increased ( $p < 0.001$ ). Similarly, snoring and inattention scores were significantly higher in children for whom higher symptom frequency was reported ( $p < 0.001$  and  $p = 0.007$  respectively). However, sleepiness scale was not found to be significantly different between different symptom frequency groups (Table 2).

When children were grouped according to symptom severity, there was a significant difference of all PSQ scores among the groups ( $p < 0.05$  for all). Total score was calculated to be  $0.2 \pm 0.6$  in children who did not report severe symptoms while it was calculated as  $3.6 \pm 0.9$  in children with apnea during sleep ( $p < 0.001$ ) (Table 2).

**Table 1. Descriptive characteristics of the children enrolled in the study.**

Characteristic	
Age	$8.1 \pm 3.4$
Gender	
Male	59 (53.2%)
Female	52 (46.8%)
Adenoid hypertrophy	
Positive	22 (19.8%)
Negative	89 (80.2%)
Tonsil hypertrophy	
Positive	18 (16.2%)
Negative	93 (83.8%)
Allergic rhinitis	
Positive	15 (13.5%)
Negative	96 (86.5%)
Obesity	
Positive	5 (4.5%)
Negative	106 (94.5%)

Another grouping category to test for known group analysis was the symptom duration. It was demonstrated that total, snoring and inattention scores were all significantly different scores while sleepiness score was not. Total PSQ score for children that did not report snoring was  $0.2 \pm 0.5$  while that for the ones who snore throughout sleep was  $3.8 \pm 0.5$  ( $p < 0.001$ ) (Table 2).

#### Reliability of the Turkish PSQ

Cronbach's alpha value for snoring domain was 0.824 (Table 3). Item scale correlations for snoring domain were significant for all items. Pearson's correlation coefficient for item "Does your child snore more than half the time?" was 0.86 while that of "Does your child always snore" was 0.82. The items "Does your child snore loudly" and "Does your child have "heavy" or loud breathing?" had correlation coefficients of 0.83 and 0.75 respectively.

For sleepiness domain, Cronbach's alpha value was 0.511 (Table 3). When correlated with the total sleepiness score, items "Does your child wake up feeling unrefreshed in the morning?" and "Does your child have a problem with sleepiness during the day?" had Pearson's correlation coefficients of 0.73 and 0.59 respectively. Similarly, the items "Has a teacher or other supervisor commented that your child

**Table 3. Internal consistency of the PSQ (Cronbach alpha values).**

Domain (number of items)	Cronbach alpha
Snoring domain (4)	0.824
Sleepiness domain (4)	0.511
Inattention domain (6)	0.696
Total (22)	0.802

appears sleepy during the day?" and "Is it hard to wake your child up in the morning?" were significantly correlated with the total domain score ( $r = 0.49$  and  $r = 0.69$  respectively).

Cronbach's alpha value for inattention domain was 0.696 (Table 3). Item scale correlations for the items "does not seem to listen when spoken directly", "has difficulty organizing tasks and activities" and "Is easily distracted by extraneous stimuli" were 0.74, 0.56 and 0.65 respectively. Similarly items "Fidgets with hands or feet or squirms in seat", "Is "on the go" or often acts as if "driven by a motor" and "interrupts or intrudes on others (eg., butts into conversations or games)" were all significantly correlated with the inattention domain score ( $r = 0.62$  for all).

**Table 2. Comparison of PSQ scores between different symptom groups.**

		PSQ Scores			
		Total	Snoring	Sleepiness	In attention
Symptom frequency	None	$0.26 \pm 0.16$	$0.17 \pm 0.45$	$0.23 \pm 0.26$	$0.42 \pm 0.34$
	1-3/week	$0.37 \pm 0.17$	$1.36 \pm 1.1$	$0.2 \pm 0.3$	$0.6 \pm 0.3$
	4-6/week	$0.5 \pm 0.2$	$2.3 \pm 1.7$	$0.4 \pm 0.3$	$0.6 \pm 0.6$
	Everyday	$0.6 \pm 0.2$	$3.3 \pm 1.2$	$0.3 \pm 0.3$	$0.7 \pm 0.3$
<b>p*</b>		<b>&lt; 0.001</b>	<b>&lt; 0.001</b>	<b>0.349</b>	<b>0.007</b>
Symptom severity	None	$0.2 \pm 0.6$	$0.2 \pm 0.3$	$0.4 \pm 0.3$	$0.3 \pm 0.2$
	Loud snore	$2.4 \pm 1.4$	$0.4 \pm 0.3$	$0.6 \pm 0.4$	$0.5 \pm 0.2$
	Difficulty breathing	$1.6 \pm 1.5$	$0.2 \pm 0.2$	$0.7 \pm 0.4$	$0.5 \pm 0.2$
	Apnea during sleep	$3.6 \pm 0.9$	$0.5 \pm 0.4$	$0.6 \pm 0.3$	$0.7 \pm 0.2$
<b>p*</b>		<b>&lt; 0.001</b>	<b>&lt; 0.001</b>	<b>0.032</b>	<b>0.011</b>
Symptom duration	Never	$0.2 \pm 0.5$	$0.2 \pm 0.3$	$0.4 \pm 0.3$	$0.3 \pm 0.2$
	Snore < half of sleep	$1.3 \pm 0.9$	$0.3 \pm 0.3$	$0.6 \pm 0.3$	$0.4 \pm 0.2$
	Snore > half of sleep	$2.9 \pm 1.5$	$0.3 \pm 0.3$	$0.7 \pm 0.3$	$0.5 \pm 0.2$
	Snore throughout sleep	$3.8 \pm 0.5$	$0.4 \pm 0.4$	$0.8 \pm 0.4$	$0.7 \pm 0.2$
<b>p*</b>		<b>&lt; 0.001</b>	<b>&lt; 0.001</b>	<b>0.354</b>	<b>0.003</b>

\* One way ANOVA analysis.

## DISCUSSION

Sleep disordered breathing disorders that constitute a wide spectrum of symptoms ranging from habitual snoring to OSA have prevalences reported as low as 2% for OSA and as high as 27.6% for habitual snoring (1-4,12). SRBD is clinically and epidemiologically important because it influences not only growth but is also associated with deterioration in quality of life and neurocognitive deficits as well as emotional immaturity in children and treatment of SRBD with adenotonsillectomy was shown to improve quality of life and behavior of children with OSA (13-17). Moreover, children with SRBD during kindergarten years were found to have lower school performance during the first year of sleep (15). Poor sleep quality leading to neurocognitive developmental defects and deficits in verbal abilities is a cause for lower academic achievement in children and adolescents with OSA (14,15,18). Gold standard for diagnosis and assessment of OSA in children is sleep laboratory based polysomnography (PSG) (1). However, PSG is an expensive technique that may not be available easily on many circumstances therefore a questionnaire based initial evaluation may aid in patient selection for PSG.

PSQ developed and validated by Chervin et al. is a 22-item questionnaire which had been shown to have a sensitivity of 81% and specificity of 87% for SRBD (7). The responses to the scale depend on subjective parent impressions in part and it is thought to reflect the impact of disruptive behavior on affected families (8). Therefore, validation of the questionnaire was performed based on known groups method by questioning symptom severity, duration and frequency in our study. It was shown that both total and all domain scores including snoring, sleepiness and inattention were significantly different among different severity groups. This is an expected results since both the severity and scale itself are the subjective reports of parents. When the scores were compared on the basis of frequency and duration, it was observed that total score as well as the snoring and inattention scores differed significantly but sleepiness domain score did not. This might be due to the fact that sleepiness is a more indirect consequence of SRBD so although severity had an influence on sleepiness, frequency and duration did not.

Reliability analysis of the Turkish PSQ consisted of Cronbach alpha calculations and item-scale correlations. According to the general guidelines suggested by Colton, correlations ranging 0.00 to 0.25 indicate little or no relationship; those from 0.25 to 0.50 suggest a

fair degree of relationship; values of 0.50 to 0.75 are moderate to good; and values above 0.75 are considered good to excellent. Item-scale correlations for the Turkish PSQ were all above 0.50 indicating moderate to good correlation indicating a successful internal consistency of the adapted scale.

All Cronbach alpha values were above 0.50 for the PSQ domains. Considering that reliability is a measure of a scale's stability, these results indicate that Turkish questionnaire is a valid tool that may be used for initial evaluation of children suspected of having SRBD (19).

Main limitations of this study were absence of PSG evaluations for all children since PSG is a gold standard for diagnosis of SRBD. However, the validity and reliability of the original questionnaire had already been performed by Chervin et al. by comparisons with PSG results (7,8). Therefore, we did not try to reproduce their findings but only evaluated for the validity and reliability of the Turkish questionnaire. Therefore, absence of PSG may not be considered a major draw-back.

In conclusion, Turkish version of PSQ is a valid and reliable tool that may be used in the initial evaluation of Turkish children with symptoms suggestive of SRBD.

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## CONFLICT of INTEREST

None declared.

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