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ORIGINAL ARTICLE

Translation and cross-cultural adaptation of the sleep-related breathing disorder scale of the Pediatric Sleep Questionnaire into Danish language

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ABSTRACT

Objective/Background: Sleep-disordered breathing (SDB) is common but often underestimated in children. The gold standard for assessing SDB is polysomnography, but it is expensive and time-consuming. The Paediatric Sleep Questionnaire (PSQ/SRDB) is a validated screening tool for SDB, which represents an efficient and alternative tool for screening SDB among children. However, a translated and validated Danish version of the PSQ/SRDB is not available yet. Our aim was to cross-culturally translate the PSQ/SRDB into Danish language for use in clinical and research settings.

Patients/Methods: The translation was carried out through forward-backward translation techniques performed by a panel of experts, and the cross-cultural adaptation was achieved by pretesting of the pre-final version. Internal consistency of the Danish PSQ/SRDB version was measured by Cronbach's alpha coefficients, while Cohen's kappa was used to evaluate test-retest reliability. Construct validity was assessed by factor analysis of the principal components.

Results: The Danish PSQ/SRDB was administered to the caregivers of 348 children. An overall Cronbach's alpha of 0.72 was found, confirming the survey's consistency, with the results for the domains ranging 0.52–0.70. The Danish PSQ/SRDB showed moderate to perfect reliability for all items, except for one question (C14). Factor analysis performed on the Danish PSQ/SRDB showed that the predetermined four factors were similar with the original version of the PSQ/SRDB.

Conclusions: The Danish version of the PSQ/SRDB has been successfully translated and cross-culturally adapted, suggesting that it can be used as an appropriate paediatric screening tool for SDB in Denmark.

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Obstructive sleep apnoea; paediatric sleep questionnaire; cross-cultural adaptation; reliability; validation orthodontics

Introduction

The European Respiratory Society (ERS) Task Force has defined obstructive sleep disordered breathing (SDB) as: 'a syndrome of upper airway (UA) dysfunction during sleep, characterized by snoring and/or increased respiratory effort secondary to increased UA resistance and pharyngeal collapsibility', with severity of clinical entities ranging from primary snoring to obstructive sleep apnoea (OSA) [1]. In an epidemiological population-based study in adults, Young et al. estimated that 80% of people with SDB remain undiagnosed and are unaware of having this condition [2].

The reported prevalence of SDB in children is not consistent in published studies [3–5], probably due to different diagnostic criteria used, and because many paediatric subjects suffering from SDB remain undiagnosed [6]. Based on meta-analysis data, it was reported that the overall prevalence of parent-reported snoring in children was 7.45%, with the prevalence of habitual snoring ranging from 3 to 27.5% [3,4,7]. Paediatric OSA lies on the severe end of the spectrum of SDB, and is a condition that can result in severe complications, including neurocognitive impairment, behavioural problems, failure to thrive, and cardio-pulmonary diseases if left untreated [8–11].

Studies have reported that age, gender, ethnicity, and BMI are associated with paediatric SDB [3,4,11–15]. Especially for BMI measurement, substantial evidence suggests that overweight children are more at risk of SDB [3,12–14,16].

Polysomnography (PSG) is considered the gold standard to diagnose SDB in children [4]. Nevertheless, PSG cannot be used as a screening tool, as it is expensive, time-consuming, and relatively labour-intensive, thus long waiting times are to be expected between referral and diagnosis by PSG [17]. Therefore, alternative diagnostic methods for screening of SDB are desirable. The ERS task force stated that, when PSG is not available, one option is to use a validated questionnaire [1]. Questionnaires have been developed for screening

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Supplemental data for this article can be accessed here.

paediatric SDB, which are relatively easy to use, inexpensive and reliable [18–20].

In the guidelines about diagnosis and management of childhood OSA, the American academy of paediatrics made eight recommendations, the first being that 'all children/adolescents should be screened for snoring' [4,10]. Among other questionnaires, the Paediatric Sleep Questionnaire (PSQ), in the form of the Sleep-Related Breathing Disorder (SRBD) subscale, appears to be of interest, as it has been validated against PSG, it is cost and time effective (only 22 questions), and it is characterized by a sensitivity of 0.85 and a specificity of 0.87 as reported by the authors [18,21]. The PSQ/SRDB was developed by Chervin et al. at the Department of Neurology, University of Michigan, Ann Arbour, USA in 2000 [18], and is designated to be applied in children and adolescents aged 2–18 years. A systematic review and meta-analysis by De Luca Canto and colleagues found that PSQ/SRDB presents a good diagnostic accuracy, so that it can be used as a screening tool [17], and its sensitivity has also been confirmed in a UK-based study [22]. The PSQ/SRDB questionnaire has been cross-cultural translated into many languages [23–30].

The recommendation for SDB screening has also been supported in the white paper published by the American Association of Orthodontists in 2019, aiming at offering guidance to the orthodontist about his/her role in the clinical risk assessment for management of obstructive SDB, where the PSQ/SRDB was recommended as a potential screening tool [31]. Indeed, as orthodontists, and dentists in general, see paediatric subjects more often than their medical colleagues, they are in a privileged position for SDB screening. Such screening could help identifying at-risk patients for prompt referral to a sleep specialist for further examinations and definitive diagnosis. Last, the orthodontist may contribute to the identification of underlying craniofacial dysfunction, thus assisting the physician in the disease management.

The PSQ/SRDB is an appropriate, highly-cited tool to screen for paediatric SDB (more than 720 citations on Scopus, as per February 2021). However, as no validated Danish translation is available, it was decided to translate the PSQ/SRDB into Danish. Moreover, to our knowledge, the prevalence of SDB in a population seeking orthodontic care in Denmark has not been reported in the literature.

The objective of this study was to create a validated and culturally adapted translation of the PSQ/SRDB into Danish, in a cohort of Danish paediatric orthodontic patients. The null hypothesis was that the Danish version of the PSQ/SRDB has adequate equivalence and validity to be used for screening for SDB in Danish-speaking children.

Materials and methods

The questionnaire

The PSQ/SRDB questionnaire used in this study is a one-page questionnaire, which comprises 22 closed questions, based on three categories: (1) 'snoring and breathing problems', including apnoeas and hypopneas (9 items); (2) 'day-time sleepiness' (7 items); (3) 'behavioral and growth', including inattentive or hyperactive behaviours (6 items). The questions are written in a simple and concise language. In the introduction to the PSQ/SRDB, it is emphasized that the questions should be answered regarding the child's general behaviour and not necessarily incidents that have happened recently, which may be of a more transient nature. There are three possible answers to each question, which are 'yes', 'no' or 'don't know'. A response of 'yes' or 'no', is weighted as '1' or '0' respectively. Missing answers or 'don't know' responses are not counted from the denominator when calculating the mean score. The overall SRBD score is the mean value of all the answered questions (i.e. excluding the answers 'don't know' and missing questions), and ranges from '0' to '1'. The optimum cut-off value to identify patients at risk for SDB is 0.33 (i.e. 33% positive answers out of the 22 questions): an overall SRBD score of 0.33 or greater suggests the presence of SDB.

Gender, age, height and weight (for BMI measurement) were also recorded. The prevalence of excessive daytime sleepiness was assessed as well, defined as the presence of 2 or more positive response out of the 4 sleepiness items in the PSQ/SRDB, as suggested by Archbold et al. [32].

Translation and cross-cultural adaptation of the PSQ/SRDB

The original English version of the PSQ/SRDB was translated and cross-culturally adapted into Danish, without any use of technical or incorrect grammatical terms. This was achieved not only by translating all the items linguistically, but also by adapting them culturally to maintain the content validity at a conceptual level, following the objective of cross-cultural adaptation to maximize the attainment of semantic, idiomatic, experimental and conceptual equivalence between the questionnaires in the two different languages as suggested by Beaton and colleagues [33] (Figure 1). The process of translation and cross-cultural adaptation comprised five stages:

- Stage I: Initial Translation. Forward translation of the questionnaire from English into Danish was performed independently by two bilingual health professionals: The two forward translators were both Danish and perfectly bilingual, with a high level of English.
- Stage II: Synthesis of the two translations. The differences between the translations of each question were compared and debated between the two translators and the supervisor of project (PMC). Ambiguities and discrepancies between the two initial Danish translations were resolved, and a synthesized version was produced.
- Stage III: Back-translation. Two different health professional translators, blinded to the original English version, independently translated the synthesized translation back to English.
- Stage IV: Expert committee evaluation. The two back-translated questionnaires were then evaluated against the original English questionnaire, to assess whether the literal, conceptual and semantic meanings were equivalent. Very few discrepancies were found, and a subsequent meeting was held to assess and solve each discrepancy. Adjustments took into account Danish language usage

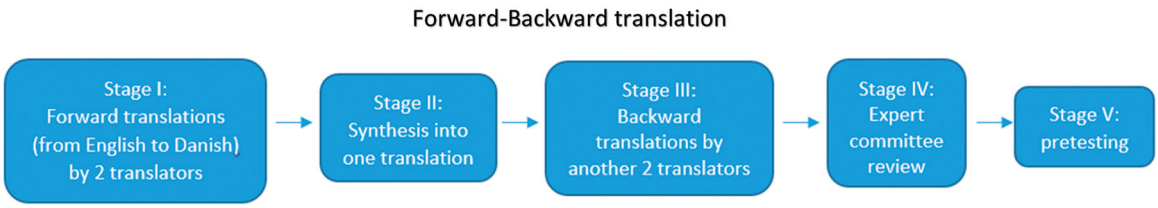

Figure 1. Overview of the linguistic evaluation process.

and conceptual equivalences aiming to avoid disagreement with the original PSQ/SRDB questionnaire. Upon completion, the consistency of the synthesized translation with the original could be confirmed, and the pre-final version of the Danish questionnaire was generated.

- Stage V: Pretesting of the pre-final version. The pre-final version was pretested on 38 patients at the Public Dental Service clinic of Aarhus municipality; the parents or legal guardians were asked to read the introduction to the project and were subsequently asked to fill out the questionnaire. Their feedback was recorded.

Subsequently, cognitive interviews were carried out by one of the authors (TBS), who has Danish as mother tongue, to confirm that the questions were understood as intended, in order to avoid situations where cultural backgrounds might potentially influence a person to apprehend or perceive certain questions. Five randomly selected parents or legal guardians (all native Danes) of children being treated at the Orthodontic Postgraduate Clinic, Department of Dentistry and Oral Health, Aarhus University, were interviewed and their understanding of each question was registered, to assess if questions were appropriate and clear. They were also allowed to suggest semantic changes. The results were analyzed by an expert panel (PMC, TBS, MAC) and a new version of the Danish PSQ/SRDB version was created and used for a second round of cognitive interviews of five new parents or guardians. No more objections were made, indicating that the parents had the intended understanding of the questions.

Study population

The final version of the Danish PSQ/SRDB was administered to the parents (or legal guardians) of all new orthodontic patients younger than 16 years of age, at the Public Dental Services clinics of the municipalities of Aarhus, Hjørring, Jammerbugt and Aars, from October 2017 to June 2020, and at the Orthodontic Postgraduate Clinic, Department of Dentistry and Oral Health, Aarhus University from January 2019 to July 2020. Inclusion criteria were as follows: (1) Children aged between 6 and 16 year-old; (2) Children about to receive orthodontic treatment; (3) Families fluent in the Danish language; (4) Informed consent obtained from a parent or legal guardian; (5) Absence of mental or physical impairment, severe enough to impede collection of behavioural information. Subjects with craniofacial syndromes were excluded. Questionnaires missing more than 2 questions and/or gender, height and weight information were considered as incomplete, and were excluded.

As the normal distribution of body mass index (BMI) in the paediatric population depends on age and sex, the overweight cut-off values were derived from age- and sex-specific growth charts [34].

The questionnaires were collected electronically, without collecting patients' names (only patients' birth dates (to determine their age), weight, and height were collected), in REDCap (Research Electronic Data Capture, Vanderbilt University, Tennessee, USA) and Klips (patient's record software at the Department of Dentistry and Oral Health, Aarhus University). All acquired data were stored on a password-protected server on the Aarhus University network.

Ethical approval

Following a request for this specific project to the Regional Committee on Health Research Ethics (Scientific Ethical Committee for Central Denmark Region: request no. 159/2016), the answer stated that questionnaire and interview studies are exempt from reporting, provided that an informed consent is acquired from the parents or the legal guardians to participate in the study. Indeed, for the patients of the Danish Public Dental Services, the participant study information was provided along with the SDB questionnaire and an informed consent was obtained from the parents or legal guardians. For the patients of the Orthodontic Postgraduate Clinic, Aarhus University, as informed consent was not requested, Ethical approval was obtained (from the Scientific Ethical Committee for Central Denmark Region: case no. 1-45-70-62-20). The project has been registered with the Data protection agency (Project identification: SDB_2017. Data protection agency journal no 2015-57-0002. Aarhus University journal no 2016-051-000001).

Test-retest reliability

In order to evaluate test-retest reliability, the final version of the Danish PSQ/SRDB was administered to 36 parents (or legal guardians) of new orthodontic patients, younger than 16 years of age, at the Orthodontic Postgraduate Clinic, Department of Dentistry and Oral Health, Aarhus University. One week after the questionnaire was filled out, an email with the same questionnaire was sent and the same parent/legal guardian was asked to complete the questionnaire once again.

Statistical analysis

The internal consistency was assessed by Cronbach's alpha, where a value of $\geq$0.7 indicated high internal consistency,

0.5–0.7 indicated moderate internal consistency, 0.2–0.4 indicated fair internal consistency, and ≤0.2 indicated low internal consistency [35]. Cohen's kappa was used to evaluate test-retest reliability [36]. The magnitude of the k-value was set according to Landis and Koch [37] (*k*-value equal to: 0 = poor; 0.01–0.20 = slight; 0.21–0.40 = fair; 0.41–0.60 = moderate; 0.6–0.80 = substantial; and 0.81–1 = almost perfect agreement).

The correlation between the items and each domain were tested using Spearman's correlation coefficient test. The values greater than 0.3 were considered as moderate correlations, and values above 0.8 were considered as strong correlations [38].

Construct validity was assessed by the confirmatory factor analysis of the principal components analysis (PCA) with promax rotation. The Kaiser–Meyer–Olkin index was applied to measure sampling adequacy [39].

The PSQ/SRDB scores were examined in relation to gender and BMI categories with the chi-square test. The datasets were analyzed using Stata 15 CI (StataCorp, College Station, Texas, USA).

Results

Translation and cross-cultural adaptation

The results of the pretesting of the pre-final version were analyzed: the introduction to the questionnaire was deemed to be too technical, so it was simplified accordingly. Following the results of the first round of cognitive interviews, minor adjustments were made: Two out of the five parents found that the Danish translation of one specific question (question C3 'This child often does not seem to listen when spoken to directly') contained a double negation, which in Danish, though grammatically correct, could be misleading (i.e. one can answer 'yes' if he does not listen, or 'no' if he does not listen – in both cases indicating that the child does not listen). Thus, the ambiguous formulation was changed to: 'This child is often inattentive when spoken to directly' (in Danish). During the second round of cognitive interviews, no more ambiguities were raised by the parents, thus confirming that every question was understood as intended in the original English questionnaire.

Internal consistency

The Cronbach's alpha coefficient scores (Table 1) showed that the Danish PSQ/SRBD scales and subdomains were of adequate internal consistency.

Test-retest reliability

Regarding the test-retest reliability, the results revealed that the PSQ/SRDB showed moderate to perfect test-retest reliability of all items, except question C14 (Table 2).

Characteristics of the studied population

A total of 415 questionnaires were gathered from the five clinics. After exclusion of questionnaires due to incompleteness, 348 questionnaires (149 boys and 199 girls) were included in the present pilot study (Figure 2). The mean age of the children was 12.5 years (12.5 ± 2.17).

Descriptive statistics are presented in Figure 3. Two questions in the snoring domain (A24, A25), two questions in the sleepiness domain (B1, B2), and two questions in the behaviour domain (C8, C10) obtained the most 'yes' responses, whilst questions A6, A7, B9 and B22 obtained the least 'yes' responses. Questions A24 and A25 obtained the most 'don't know' responses from the participants.

The calculation of the body mass index (BMI), using the corresponding BMI-for-age cut-off points [34], revealed that 316 children (90.8%) had a normal body weight, while 32 of them were overweight (9.2%) (Table 3). Using the cut-off value of 0.33 in the PSQ/SRBD scale as suggested by Chervin et al. [18], there were 36 children (10.3%) at risk of SDB. Among these 36 children, the proportion of overweight children was statistically significantly greater ($p = .025$), when compared to the children identified as not at risk of SDB (Table 4). On the other hand, the number of self-reported overweight children (as per question B22) was only 11. There was no statistically significant relationship between gender and presence of SDB ($p = .358$).

Problems with excessive daytime sleepiness were found in 92 out of 348 (26.4%) children.

Construct validity

Regarding the correlations between the items and the different subdomains, the results from the Spearman's test

Table 2. Test–retest reliability.

Items	Kappa (SE)
A2	0.633 (0.128)
A3	0.645 (0.125)
A4	0.808 (0.137)
A5	0.664 (0.132)
A6	1.000 (0.167)
A7	0.788 (0.140)
A24	0.507 (0.128)
A25	0.425 (0.115)
A32	0.786 (0.163)
B1	0.936 (0.166)
B2	0.886 (0.147)
B4	0.786 (0.163)
B6	0.862 (0.167)
B7	1.000 (0.169)
B9	1.000 (0.169)
B22	1.000 (0.167)
C3	0.471 (0.167)
C5	0.690 (0.141)
C8	0.581 (0.148)
C10	0.471 (0.164)
C14*	0.000 (0.000)*
C18	0.723 (0.155)

SE: standard error; *cannot show reliability.

Table 1. Internal consistency of the Danish-PSQ scale.

PSQ/SRDB domain	Cronbach's α
All (22)	0.722
Snoring (9)	0.586
Sleepiness (7)	0.518
Behaviour (6)	0.699

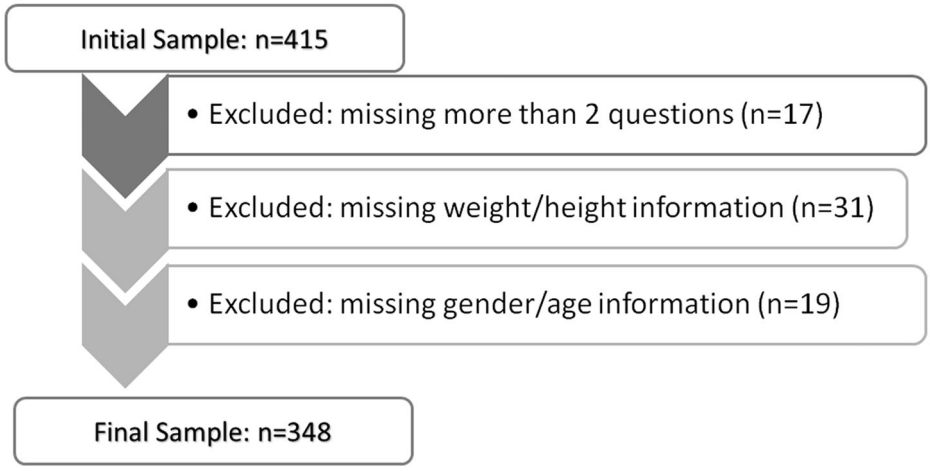

Figure 2. Flow chart of sample.

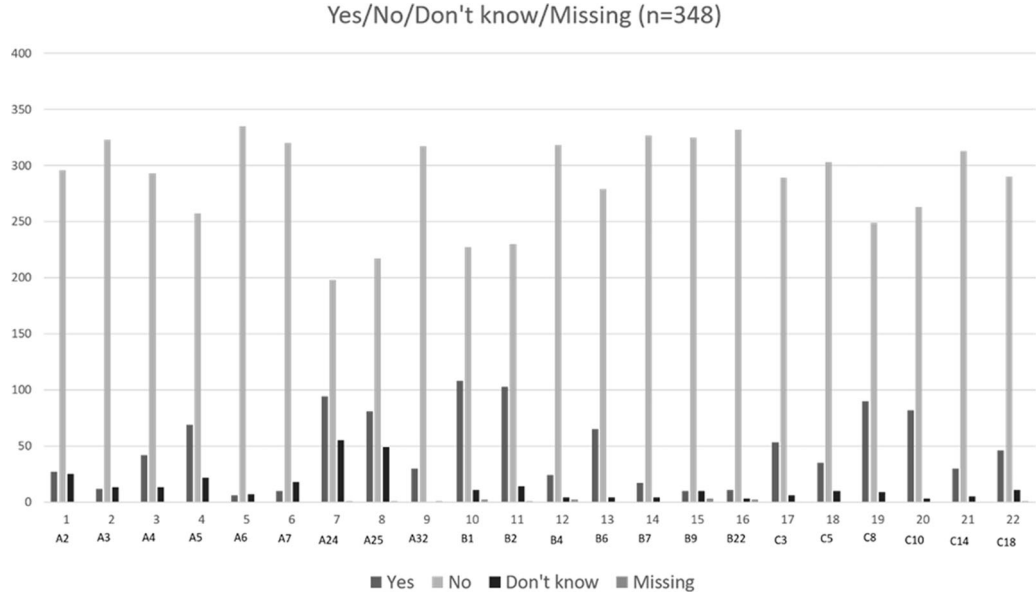

Figure 3. Descriptive statistics of the answers of all questions of the Danish- PSQ/SRDB ($n = 348$), classified into the three domains (snoring, sleepiness and behaviour).

Table 3. Characteristics of the sample.

Characteristics	$n = 348$
Gender (*n* (%))	
Male	149 (42.8%)
Female	199 (57.2%)
Age (years)	
Mean ± SD	12.5 ± 2.17
Median	12.8
Range	6.9–16.9
BMI (*n* (%))	
Normal	316 (90.8%)
Overweight	32 (9.2%)

Table 4. Descriptive data.

	Group of children at risk of SDB (score >0.33: $n = 36$)	Group of children with low risk of SDB (score <0.33: $n = 312$)	*p* Value
Body mass index, BMI			.025*
Normal ($n = 316$)	29	287	
Overweight ($n = 32$)	7	25	
Gender			.358
Male ($n = 149$)	18	131	
Female ($n = 199$)	18	181	

*p Value ≤.05, statistically significant different (chi-square test); BMI calculated using the BMI-for-age curve.

showed moderate correlations except for three items (Supplementary Table 1).

All the values of Kaiser–Meyer–Olkin index were more than 0.5, so overall the variables had in common to warrant PCA (Supplementary Table 2) [39]. For the factor analysis by PCA of the 22 variables, the screen plot of eigenvalues displayed that eight factors had an eigenvalue greater than 1 and that an 'elbow' shape exists after component four (Supplementary Figure 1). The final predetermined number of factors was based on documented factor structure. Considering the original questionnaire, factor loadings on four factors were retained and are shown in Table 5 [18]. Based on the highest loadings and the original questionnaire, the factors are named: 'Breathing', 'Sleepiness', 'Behavior', and 'Other'.

Discussion

In the present study, the PSQ/SRDB was translated and cross-culturally adapted into Danish according to international

Table 5. Factory analysis for the Danish PSQ questions – a rotated component promix.

Symptom category	Item	Breathing	Sleeping	Behaviour	Other
Snoring					
Frequency	A2: Snore more than half the time	0.486			
	A3: Always snore	0.474			
Quality	A4: Snore loudly	0.473			
	A5: Have 'heavy' or loud breathing	0.321			
Breathing problems	A6: Have trouble breathing, or struggle to breathe	0.341			
	A7: Stop breathing during the night	0.322			
Mouth breathing	A24: Tend to breathe through the mouth during the day				0.400
	A25: Have a dry mouth on waking up in the morning				0.318
Daytime sleepiness	B1: Wake up feeling unrefreshed in the morning		0.494		
	B2: Have a problem with sleepiness during the day		0.488		
	B4: Has a teacher commented that your child appears sleepy during the day		0.289		
	B6: It is hard to wake your child up in the morning		0.490		
Inattention/hyperactivity	C3: Does not seem to listen when spoken to directly			0.371	
	C5: Has difficulty organising tasks and activities			0.371	
	C8: Is easily distracted by extraneous stimuli			0.329	
	C10: Fidgets with hands or feet or squirms in seat			0.496	
	C14: Is 'on the go' or often acts as if 'driven by a motor'			0.392	
	C18: Interrupts or intrudes on others			0.335	
Other symptoms	A32: Occasionally wet the bed				0.210
	B7: Does your child wake up with headaches in the morning				0.402
	B9: Did your child stop growing at a normal rate at any time since birth				0.506
	B22: Is your child overweight				0.242

translation guidelines [33]. Although an overnight sleep remains the gold standard for diagnosis of SDB, it is widely recognized that the PSQ/SRBD scale is a valid and accessible tool for screening SDB [17,31,40]. Indeed, it is easier to perform when compared to PSG, and it is characterized by a high validity, as reported by the authors of the original questionnaire[18]. This lead the American Association of Orthodontists to recommend the use of the PSQ/SRDB questionnaire as the preferred SDB screening tool for a paediatric population [31]. For the same reason, the PSQ/SRDB questionnaire has been translated and adapted into several languages [23–30].

The original English PSQ/SRDB indicated good internal consistency, with a Cronbach's alpha of 0.89 for the PSQ/SRDB scale, 0.86 for the snoring scale, 0.66 for the sleepiness scale, and 0.84 for the behaviour scale [18]. The translated versions of the PSQ/SRDB in other languages displayed similar results, with Cronbach's alpha values lying in the range 0.46–0.86 [23–30]. The results of the present study showed that the Danish version of the PSQ/SRDB possess excellent content validity and acceptable internal consistency of the scale (Cronbach's alpha of 0.72) and subscales (0.52–0.70), thus the Danish version of the PSQ/SRDB can be regarded as a reliable screening tool to identify children at risk of SDB.

The PSQ/SRDB scale showed moderate to perfect reliability for all items, suggesting that the scores remained stable over two weeks, except for question C14 ('This child is often 'on the go' or often acts as if 'driven by a motor'). The reason of the poor agreement of C14 resides on the fact that only one parent answered 'Yes', whilst 35 out of 36 parents answered 'No' during the first round. The same parent changed the answer to 'No' the second time, with all the other ones keeping the 'No'. This situation, despite the almost perfect agreement, creates a known mathematical problem in the calculation of Cohen's kappa, producing a kappa value of zero. One option to solve this issue would be to increase considerably the sample size used for test-retest reliability, while another option would be to remove the question from the questionnaire. Both solutions were not considered applicable, as increasing the size would probably not solve the issue (given the above-described scenario), while removing one question would render the PSQ/SRDB not valid. Most importantly, the high level of agreement in the test-retest answers for this specific item clearly shows that the reliability was high, and therefore we decided to include all the questions for calculation and report.

The Spearman's test showed a moderate correlation between items and subdomains except three items (items A6, B9 and B22). The results of the same three items were also found not to be significant in the French version [24].

The factor analysis by PCA showed that the predetermined four factors were similar to the original version of the PSQ. There are four items that were included into the different factors compared with the original version, which was similar to the French version [24] and the Chinese version [41]. A possible reason could be related to the linguistic specificities. Moreover, in this validation study, items A32 and B22 indicated the lower factor loading, which coincides with the findings of the Hebrew version [42]. Regarding item B22, besides displaying a lower factor loading in factor analysis, also showed a lower correlation between items and subdomains: interestingly, the results of this question did not matched with the actual BMI, which was calculated based on the actual height and weight and considering the age-related overweight curve [34].

Some difficulties were encountered in translating one question (C3) into Danish: an alternative translation was proposed, which was correctly understood as in the original English version.

Compared to the other questions, the 'Don't know' answer was mostly chosen for questions A24 ('Tend to breathe through mouth during the day') and A25 ('Have a dry mouth on waking up in the morning'). This could reflect the difficulty for parents to know the answers, especially when they are not aware of the problem in advance, and

this could also be seen from the results of the Spearman's test.

A meta-analysis performed by Lumeng et al. has reported an overall prevalence of habitual snoring in a general paediatric population to be more than 7%, and estimated the prevalence of SDB to be in the range 4–11% [3]. Higher prevalence and risk of having SDB in an orthodontic population could be anticipated, as craniofacial vertical, transversal and sagittal discrepancies might be contributing anatomical risk factors for developing SDB [43]. Among the few studies assessing the prevalence of SDB in paediatric orthodontic populations using the PSQ/SRDB, Fritz and colleagues reported a prevalence of 18% [44]; Rohra et al. reported a prevalence of 7.3%; and in a more recent study, Abtahi et al. reported a prevalence of 10.8% [43]. These numbers are significantly higher than those reported for a general paediatric population (5%) [32]. In the present study, performed in a paediatric orthodontic population, the prevalence of children at risk of SDB was found to be 10.3%, thus corroborating the results of previous studies. Excessive sleepiness, defined as two or more positive responses in the sleepiness items of the PSQ/SRDB questions, attained a prevalence of 26.4% in our sample. This value is greater than the reported percentage of 17.9% in an orthodontic population [43] and 12.4% in a general paediatric population.

Last, our study indicated that more overweight children were at risk for SDB compared to children with normal weight. This result is in agreement with the findings of previous studies, which identified obesity as a risk factor for SDB [4,45]. It is worth reporting that the number of overweight children reported by the parents in question B22 of the PSQ/SRDB (i.e. 11 children) was lower than the number calculated using the BMI (i.e. 32 children), based on the overweight curve [34].

The PSQ/SRDB is a validated, consistent, and user-friendly screening tool designed for a paediatric population, which has been translated into several languages [23–30]. This makes it suitable for integration into a busy dental or orthodontic clinic. The current study has shown that the Danish version of the PSQ/SRDB is an adequate translation and culturally appropriate adaptation of the original English PSQ/SRDB, prepared following the international recommendations for transcultural adaptation [33]. Consequently, it can now be used to screen paediatric SDB in Denmark. With the PSQ/SRDB and a clinical examination, children identified at risk could be informed about such an elevated risk and referred to their general practitioner or suitable sleep specialist for definitive diagnosis and any further necessary management [31]. This would be beneficial for the patients, who could be identified and treated early, improving patients' quality of life and preventing possible complications.

Conclusion

The PSQ/SRDB was translated, validated, and culturally adapted into Danish. It possesses excellent content validity, acceptable internal consistency for the PSQ/SRDB scale and subscales, suggesting that it is useful as a tool to screen SDB in Danish-speaking children. The prevalence of paediatric SDB was estimated as 10.3% in an orthodontic population from the present pilot study. It is advisable that all orthodontic practitioners in Denmark screen for SDB as a routine part of their clinical practice, which is in line with the recommendation of the American Association of Orthodontists.

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Disclosure statement

No potential conflict of interest was reported by the author(s).

Date availability statement

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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