

Development of a questionnaire for measuring health-related quality of life among children and adolescents with mouth breathing

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ABSTRACT

Background: Mouth breathing can exert an influence on quality of life and should be evaluated within a multidimensional context. However, there is no specific questionnaire to measure the impact of mouth breathing on quality of life.

Objective: To develop and validate a questionnaire for measuring the impact of mouth breathing on quality of life among children and adolescents.

Methods: Thirty-six items were evaluated by six health care professionals, one parent and one child with mouth breathing. After a qualitative evaluation, a modified set of 32 items was developed. The modified Mouth Breather Quality of Life (MBQoL) questionnaire was submitted to a pretest with a sample of 30 children and adolescents diagnosed with mouth breathing to evaluate comprehension, the order of the items, and the form of administration. The MBQoL questionnaire was then administered to 60 children and adolescents (30 mouth breathers and 30 nose breathers) for the evaluation of construct validity, internal consistency, and reproducibility. All the participants answered the questionnaire, and 50% of each group answered the questionnaire a second time after a 1-week interval (test-retest).

Results: Higher MBQoL scores (which indicated poorer quality of life) were significantly associated with mouth breathing. The Cronbach α coefficient for the items of the questionnaire was 0.88, and the Spearman correlation coefficient for test-retest reliability demonstrated that the questionnaire was reproducible ($r = 0.993$; $p < 0.01$).

Conclusion: Through this validation study, the MBQoL questionnaire demonstrated a good performance in the evaluation of the quality of life of children and adolescents with mouth breathing and may be a useful tool in clinical studies as well as public health programs. However, further studies are needed to establish its applicability in other populations with respiration disorders.

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There is growing interest in the use of health-related quality of life (HRQoL) measures for the evaluation of the effectiveness of clinical interventions and health programs.^{1,2} HRQoL is a multidimensional concept regarding the impact of health and illness on quality of life that encompasses physical, social, and emotional aspects.³ The identification of factors associated with HRQoL furnishes useful information for the implementation of important public health policies. Recently, more attention has been given to measuring the HRQoL of children and adolescents.⁴ However, HRQoL questionnaires need to have acceptable reliability, internal consistency, and construct validity.⁵

Quality of life can be evaluated by using either disease-specific or generic assessment tools. Disease-specific tools focus on a particular condition and its effect on patients.^{6–8} A number of questionnaires have been developed for the multidimensional estimation of HRQoL among individuals with respiratory problems, such as asthma, allergic rhinitis, and chronic respiratory conditions.^{9–15} However, to the best of our knowledge, there is no specific questionnaire designed to measure the impact of mouth breathing on quality of life. Some studies evaluated this issue by using generic or nonvalidated questionnaires.^{16,17}

Mouth breathing has a multifactor etiology and results in improper respiration mechanics.^{18–20} This condition is often found among children, with a prevalence rate that ranges from 43.1 to 59.5%.^{19,21–23}

Children and adolescents with mouth breathing may experience myofunctional repercussions regarding body posture, craniofacial morphology, and dental occlusion as well as behavioral problems and poor sleep quality.^{19,24–26} The treatment of this disorder can be non-surgical or surgical.²⁷ Thus, mouth breathing can exert an influence on quality of life and should be evaluated within a multidimensional context.

It is essential to consider cognitive, emotional, and language aspects when designing HRQoL questionnaires for children and adolescents.²⁸ In child developmental psychology, the age of 6 years is marked by the onset of abstract thinking and self-awareness, and children begin to develop an individual nature only at 9 years of age.^{29,30} Thus, the aim of the present study was to develop and validate a questionnaire for measuring the impact of mouth breathing on quality of life among children and adolescents ages 9–12 years.

METHODS

This study received approval from the human research ethics committee of the University of Pernambuco (no. 049/04). Letters of informed consent were obtained from those who agreed to participate in the study. The interviewer RBL was trained before conducting the survey.

Overview of Questionnaire Development and Testing

The criteria for the selection of the items to compose the Mouth Breather Quality of Life (MBQoL) questionnaire were both conceptual and psychological. On the conceptual level, defined by the Quality of Life Group of the World Health Organization (1998), broad-scoped items from the original World Health Organization Quality of Life - BREF³¹ were selected. The psychometric properties that questionnaires should contain were also considered.³²

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Item Generation

A set of 36 items was proposed for the evaluation of HRQoL among children and adolescents with mouth breathing when considering physical health, psychological health, degree of independence, and social relationships. These domains of the World Health Organization Quality of Life - BREF³¹ were chosen because they address different life situations. The environment domain was not evaluated because individuals in the age group analyzed (9–12 years) would not be capable of answering any of the items in this domain. Moreover, no items in this domain were related to the quality of life of mouth breathers.

Specific facets were evaluated in each domain. Pain, discomfort, energy, fatigue, sleep, and rest made up the physical health domain. Thinking, learning, memory, concentration, self-esteem, body image, appearance, and negative feelings made up the psychological health domain. The degree of independence was evaluated by using facets related to activities of daily living and dependence on medications or treatment. Social relationships were analyzed by using facets related to personal relationships and social support.

Item Reduction

Six health care specialists who work directly with mouth breathers (otolaryngologist, allergist, physiotherapist, dentist, pediatrician, and speech therapist), one parent or guardian, and one child or adolescent with mouth breathing were consulted for the evaluation of the initial 36-item questionnaire to determine whether they felt that any item related to the quality of life of mouth breathers was left out. Any such items were added to the questionnaire, and confusing items were either removed or rewritten. The participants in this phase offered suggestions regarding changes to the items. Qualitative selection was performed by eliminating items considered redundant, ambiguous, or difficult to understand. This process led to the modified 32-item questionnaire.

The modified MBQoL questionnaire was administered to a convenience sample of 30 children and adolescents diagnosed with mouth breathing. To be eligible for this phase, the participants needed to be between 9 and 12 years of age, diagnosed with mouth breathing, and not be scheduled for surgery. The participants were recruited from medical records of the otolaryngology clinic of the Hospital of the Federal University of Pernambuco (Brazil). The diagnosis of mouth breathing was previously determined by the otolaryngological team through a detailed patient history and signs and symptoms of the condition.³³ When necessary, confirmation of mechanical obstruction was performed with complementary examinations (radiography and fiberoptic nasopharyngolaryngoscopy).^{34,35} The following criteria were considered:

- Observation of mouth position (lips not in contact) and facial characteristics (dark circles around eyes, drooping eyes, dry lips, upper lip narrower than lower lip, and narrow nostrils)
- Verification of lip closure for 1 minute without the individual's awareness (lip commissure initiating muscle effort before the end of the stipulated time indicated a positive diagnosis of mouth breathing)
- Analysis of tonsil hypertrophy, fiberoptic nasopharyngolaryngoscopy, and radiography (profile, cavum, and paranasal sinus radiographs) that was evidence of the presence of adenoids, hypertrophied conchae, and deviated septum.

The purpose of the pretest was to evaluate reading capacity, ease of interpreting the order of the proposed items and the questionnaire itself, the self-administered format, and the time required to complete the questionnaire.

Reliability

To determine reproducibility, the MBQoL questionnaire was administered again after making the necessary changes. The validated questionnaire was administered to a sample of 60 children and ado-

lescents recruited from the Otolaryngology and Pediatric Clinics of Hospital of the Federal University of Pernambuco (Brazil). Thirty individuals were mouth breathers and 30 were nose breathers. All the participants answered the questionnaire, and 50% of each group answered the questionnaire a second time after a 1-week interval for the determination of test-retest reliability.

Internal consistency of the Mouth Breather Quality of Life (MBQoL) questionnaire was assessed by using the Cronbach α coefficient. To be considered a scale, all items should be correlated and an analysis should be performed to determine whether the removal of an item would lead to an increase in the α coefficient. Values ≥ 0.70 are considered acceptable for comparisons between the groups.³⁶ The Kolmogorov-Smirnov test was used to determine the normality of the questionnaire.

Scoring and Analysis for Validity and Reliability Assessments

A Likert scale was used for the response options: 1 (never), 2 (very little), 3 (more or less), 4 (a lot), and 5 (always) for items 1 to 17; 1 (very dissatisfied), 2 (dissatisfied), 3 (neither satisfied nor dissatisfied), 4 (satisfied), and 5 (very satisfied) for items 18 to 24; and 1 (never), 2 (rarely), 3 (sometimes), 4 (repeatedly), and 5 (always) for items 25 to 32. For the statistical analysis, a higher score was considered indicative of a poorer quality of life. On items for which a higher score indicated a better quality of life, the scores were inverted so that the total would be appropriate. Thus, the measures of central tendency and dispersion were maintained.

Construct Validity

With no established criterion standard, the validation process depended strongly on construct validity. Data on the 60 children and adolescents were used to evaluate the validity of the questionnaire. A subjective measure was used for this purpose as the reference measure for quality of life: the participant's report of feeling bothered by the oral breathing pattern in the previous 6 months (divergent validity). Consequently, the participants who reported being bothered by their oral breathing should be considered to have a poorer quality of life. The Spearman correlation coefficients were calculated for the evaluation of validity and to determine the capacity of the questionnaire in distinguishing differences in quality of life between the mouth breathing group and the nose breathing group. The following classification was used for the interpretation of the strength of the correlations: $r < 0.4$ = weak correlation; ≥ 0.4 $r < 0.5$ = moderate correlation; and $r \geq 0.5$ = strong correlation. The Kolmogorov-Smirnov test was used to determine the normality of the questionnaire. The level of significance was set to 5% ($p < 0.05$) for all statistical analyses.

RESULTS

The sociodemographic characteristics and breathing type of the participants whose data were used to validate the MBQoL questionnaire ($n = 60$) are displayed in Table 1. Boys and girls accounted for 53.3% and 46.7% of the sample, respectively. Ages ranged from 9 to 12 years (mean, 10 years). Fifty percent were mouth breathers, and 50% were nose breathers. The MBQoL scale had a mean of 120.1, median of 120.0, and standard deviation of 3.7. The Kolmogorov-Smirnov test demonstrated that the questionnaire was statistically significant in terms of normality ($Z = 2.13$).

The Cronbach α coefficient for the internal consistency of the items on the questionnaire was 0.88. The α coefficients for each item are displayed in Table 2. The Cronbach α coefficient for the items ranged from 0.87 to 0.91, which demonstrated that the questionnaire had acceptable internal consistency. The Spearman correlation coefficient for test-retest reliability demonstrated a similar response pattern on

Table 1 Characterization of sample of children and adolescents

Variables	Frequency, no. (%)
Sex	
Boys	32 (53.3)
Girls	28 (46.7)
Age	
9 y	10 (17.0)
10 y	10 (17.0)
11 y	10 (17.0)
12 y	30 (49.0)
Breathing type	
Oral	30 (50.0)
Nasal	30 (50.0)

Table 2 Cronbach α coefficients for items on Mouth Breather Quality of Life questionnaire*

Items	Cronbach α
1. Difficulty breathing though the nose	0.87
2. Feel tired on awaking	0.87
3. Difficulty falling asleep	0.87
4. Understand what you see, hear, or are asked	0.90
5. Height hinders you or makes you sad	0.87
6. Feel sad in day-to-day living	0.88
7. Find homework or school work difficult	0.87
8. Difficulty eating with mouth closed	0.87
9. Receive complaints for eating with mouth open	0.87
10. Difficulty drinking liquids	0.87
11. Receive complaints for way of drinking: juice, milk, soft drink	0.87
12. Need medication because of breathing	0.87
13. Others say you are bigger or smaller than your friends	0.87
14. Get tired quickly when running	0.87
15. Other say you are more restless or quieter than your friends	0.87
16. Others say you are taller or shorter than your friends	0.87
17. Others say you are fatter or thinner than your friends	0.87
18. Feel energetic throughout the day	0.90
19. How do you feel about your type of sleep?	0.91
20. How do you feel when you look at your face in the mirror?	0.91
21. How do you feel with your family?	0.89
22. How do you feel with your school mates?	0.89
23. What do you think about your sleep?	0.91
24. What do you think about your memory?	0.91
25. Trouble breathing	0.87
26. Others say you snore	0.87
27. Need to wet your lips all the time because they get dry	0.87
28. Able to smell food, perfume, garbage	0.90
29. Drool on pillow	0.87
30. Toss and turn a lot or stay awake at night	0.87
31. Feel sad or blue during the day	0.87
32. Miss school a lot due to illness	0.87

*Standardized $\alpha = 0.88$.

the two tests, which demonstrated that the MBQoL questionnaire was reproducible ($r = 0.993$, $p < 0.01$).

When regarding divergent validity, the scale produced a strong, statistically significant correlation coefficient (Spearman $r = 0.84$, $p <$

Table 3 Divergent validity of Mouth Breather Quality of Life questionnaire

	Normal Scale	Ordinal Scale	
		Spearman r	p Value
Mouth breathers		0.84	0.001
Nose breathers		0.84	0.001

Table 4 Mean scores on Mouth Breather Quality of Life questionnaire among oral and nasal breathers (t -test)

	Mean (standard deviation)	p Value
Mouth breathers	120.13 $\pm$ 3.73	<0.05
Nose breathers	73.73 $\pm$ 2.66	

.001) (Table 3). Thus, analysis of the data demonstrated a favorable direction of the results. Moreover, the mean MBQoL questionnaire score of the mouth breathers was significantly higher than that of the nose breathers ($p < 0.05$), which demonstrated a poorer quality of life (Table 4).

DISCUSSION

The present article describes the development and validation of a questionnaire designed to measure the impact of mouth breathing on HRQoL among children and adolescents. The MBQoL questionnaire proved to be easy to administer, reliable, and reproducible based on international standards for quality of life assessment tools.^{2,32,37} The use of health care professionals from different fields, the parents, and the children and adolescents in the development process allowed the identification of items considered important to individuals who are closely involved in ensuring the health and well-being of children and adolescents.

Content analysis revealed that the condition-specific MBQoL questionnaire was beneficial to the evaluation of children and adolescents with mouth breathing, and this novel measure should be placed at the disposal of health care professionals. Disease-specific questionnaires are often used for the assessment of quality of life because such instruments are more accurate at describing problems associated with adverse health conditions and offer greater sensitivity to changes in quality of life in comparison with generic questionnaires.^{6,8} Moreover, the MBQoL questionnaire followed the recommended protocol for the development of quality-of-life assessment tools, such as the definition of relevant domains, development of the questionnaire, testing, modifications, and validation.^{2,38}

Although often considered a less-severe respiratory condition in comparison with asthma, allergic rhinitis, and chronic lung disease, mouth breathing can exert a negative influence on activities of daily living as well as functional, esthetic, and emotional aspects.^{18,26,39–41} The analysis of the domains and items of the MBQoL questionnaire revealed that all associations were significant and in the expected direction, with higher scores among the group of mouth breathers, which indicated a poorer quality of life. Moreover, the Cronbach α coefficient (0.88) indicated that this questionnaire exhibited excellent internal reliability.⁴² Thus, the MBQoL questionnaire for the assessment of quality of life among children and adolescent with mouth breathing proved to be valid and highly reliable.

The development of a valid, reliable measure of HRQoL for children and adolescents has important implications for research and clinical practice. Such an assessment tool can provide information on the impact of adverse health conditions on quality of life in this period. Thus, HRQoL assessment tools can assist in clinical decision making and the evaluation of the effectiveness of treatment as well as the evaluation of health promotion programs.⁴³

CONCLUSION

Despite the positive preliminary findings reported herein, the evaluation of the MBQoL questionnaire should be an ongoing process. It is important to evaluate the applicability and performance of this questionnaire in other populations with representative samples. Longitudinal studies are also needed to determine the longitudinal construct validity, agility, and minimal clinically important difference.

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