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REVIEW ARTICLE

# Acoustic rhinometry in mouth breathing patients: a systematic review☆,☆☆

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**KEYWORDS**
Acoustic rhinometry;
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**Abstract**
*Introduction:* When there is a change in the physiological pattern of nasal breathing, mouth breathing may already be present. The diagnosis of mouth breathing is related to nasal patency. One way to access nasal patency is by acoustic rhinometry.
*Objective:* To systematically review the effectiveness of acoustic rhinometry for the diagnosis of patients with mouth breathing.
*Methods:* Electronic databases LILACS, MEDLINE via PubMed and Bireme, SciELO, Web of Science, Scopus, PsycInfo, CINAHL, and Science Direct, from August to December 2013, were consulted. 11,439 articles were found: 30 from LILACS, 54 from MEDLINE via Bireme, 5558 from MEDLINE via PubMed, 11 from SciELO, 2056 from Web of Science, 1734 from Scopus, 13 from PsycInfo, 1108 from CINAHL, and 875 from Science Direct. Of these, two articles were selected.
*Results:* The heterogeneity in the use of equipment and materials for the assessment of respiratory mode in these studies reveals that there is not yet consensus in the assessment and diagnosis of patients with mouth breathing.
*Conclusion:* According to the articles, acoustic rhinometry has been used for almost twenty years, but controlled studies attesting to the efficacy of measuring the geometry of nasal cavities for complementary diagnosis of respiratory mode are warranted.


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**PALAVRAS-CHAVE**
Rinometria acústica;
Respiração bucal;
Diagnóstico;
Cavidade nasal

**O uso da rinometria acústica em respiração oral: revisão sistemática**

**Resumo**
*Introdução:* Quando há alteração no padrão respiratório nasal fisiológico, a respiração oral de suplência já pode estar presente. O diagnóstico da respiração oral vincula-se à permeabilidade nasal. Uma das possibilidades para avaliação da permeabilidade nasal é a rinometria acústica.
*Objetivo:* Revisar, de forma sistemática, a eficácia da rinometria acústica no auxílio diagnóstico de pacientes com respiração oral.
*Método:* Foram consultadas as bases de dados eletrônicas LILACS, MEDLINE via Bireme e via PUBMED, SciELO, Web of Science, Scopus, PsycInfo, CINAHL e Science Direct, de agosto a dezembro de 2013. Foram encontrados 11.439 artigos, sendo 30 da LILACS, 54 da MEDLINE via Bireme, 5.558 da MEDLINE via Pubmed, 11 da Scielo, 2.056 da Web of Science, 1.734 da Scopus, 13 da PyscInfo, 1.108 da CINAHL e 875 Science Direct. Desses, foram selecionados dois artigos.
*Resultados:* A heterogeneidade no uso dos equipamentos e materiais utilizados para a avaliação do modo respiratório nesses estudos mostra que ainda não há um consenso na avaliação e diagnóstico de indivíduos com respiração oral.
*Conclusão:* De acordo com os artigos, a rinometria acústica é utilizada há quase vinte anos, porém são necessários estudos controlados que atestem a eficácia da mensuração da geometria das cavidades nasais como auxílio diagnóstico do modo respiratório.


## Introduction

Nasal breathing plays an important role in vital body functions, such as air filtration, heating and humidification of inspired air, a first defense barrier against inhaled allergens, and protection of the paranasal sinuses, ear cavities and lower airways; as its primary function, nasal breathing prepares the air for its optimal utilization in the lungs.[1–3] When a person is unable to use his/her nasal airways, changes in physiological nasal breathing pattern will occur and, thereafter, mouth breathing ensues.[4]

However, the literature exhibits conflict in defining what is considered normal breathing through the nose, as well as in objectively identifying nasal obstruction.[5,6] Moreover, although the diagnosis of mouth breathing is related to nasal obstruction, this situation is not always the case, especially when oral breathing mode has become chronic.

For decades, specific tests for evaluation of nasal permeability have been used in order to quantify the subjective symptom of nasal obstruction.[5]

The Altman graph mirror, for example, is one of the instruments used in clinical practice to assess nasal patency. Its metal plate has a smooth side, and the other side shows millimeter markings, allowing for a precise measurement of the area marked by the nasal exhalation,[7] comparing the condensation area between the nasal cavities.[8]

However, acoustic rhinometry is one of the newest methods for statically measuring different segments of the nasal cavity, from the nostrils to the choanae, quickly and non-invasively, and 'requiring little patient cooperation.[9,10] The technique is based on the analysis of the nasal cavity's reflected sound from incident sound waves, taking into account the properties of this sound in relation to the intensity and arrival time of the echo.[9] Therefore, this technique enables the measurement of the distances corresponding to the cross-sectional areas, usually of the nasal valve area and the front and rear areas of the conchae, and the calculation of nasal volumes, allowing the identification of the loci of constrictions that contribute to nasal resistance[11,12] thus providing topographical information on the individual profile of the nasal and nasopharyngeal airways.[13]

Its reproducibility and accuracy were confirmed by several authors,[14–18] the procedures are standardized and shown to be reliable,[11,19–22] and research on reference values in adults and children have also been reported.[12,23–27]

The technique is also used by several authors to estimate nasal airway obstruction in different etiologies, as well as the effect of distinct pathologies and surgical and orthopedic procedures on nasal and nasopharyngeal cavities in pediatric and adult populations.[18,28–37]

The clinical value of acoustic rhinometry rests in its ability to measure nasal geometry, thus being an important tool for the clinical rhinological follow-up,[9,38,39] allowing for the discrimination between mucosal functional effects and structural changes related to nasal obstruction, when used in tests before and after treatment with a vasoconstrictor.[39]

Although the test does not provide an etiological diagnosis of nasal obstruction, it quantifies the magnitude of the obstructive symptom at any given time, and is therefore considered a specific test in the investigation of nasal patency,[5,21,40] complementary to clinical examination.

Given the importance of nasal patency for the establishment of a physiological nasal breathing and the negative impact of nasal obstruction on stomatognathic system functions,[41] including speech/articulation, this article aims to systematically review the effectiveness of acoustic rhinometry as a complementary procedure to the diagnosis of mouth breathers.