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ORIGINAL ARTICLE

## Vocal nodules in school age children

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Acoustic assessment;  
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Dysphonia;  
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### Abstract

**Introduction:** Vocal nodules are the most common organic and functional lesions among the paediatrics population, being the main cause of dysphonia during childhood. In Portugal, a few studies that describe the vocal parameters in school age children with this pathology were found. The objective of this paper is to analyse the perceptual and acoustic vocal parameters of school age children with vocal nodules and to compare them with a group of children without vocal nodules.

**Methodology:** The perceptual and acoustic parameters of 5 children, of both genders, aged from 7 years and 2 months to 12 years and 10 months, where clinical diagnosis of vocal nodules were analysed. The following assessment instruments were used: software Praat, GRBASI scale, maximum phonation time and s/z coefficient. The obtained data was compared to children without vocal nodules. The Mann-Whitney *U* test, with  $p < .05$  significance level, in SPSS Statistics, version 22.0 was used for statistical analysis. The results are presented as mean and standard deviations.

**Results:** Statistically significant differences were registered between the group of vocal nodules vs. the group without vocal nodules, on the following parameters: fundamental frequency, shimmer, HNR, maximum phonation time for /a/ e /z/, s/z coefficient and GRBASI. On jitter and maximum phonation time for /s/ there were no statistically significant differences.

**Discussion and conclusions:** This study underlines the importance of assessing the perceptual and acoustic parameters in children with vocal nodules.

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### PALABRAS CLAVE

Disfonía;  
Medidas fonatorias;  
Niños;  
Nódulos vocales;

### Los nódulos vocales en niños en edad escolar

### Resumen

**Introducción:** Los nódulos vocales son las lesiones orgánicas funcionales más comunes en la población pediátrica, la principal causa de disfonía en la infancia. En Portugal se encontraron

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pocos estudios que describan los parámetros vocales de los niños en edad escolar con esta patología. El objetivo de este trabajo es analizar los parámetros acústico-perceptivos vocales de niños en edad escolar con nódulos vocales y compararlos con un grupo de niños sin nódulos vocales.

**Metodología:** Se analizaron los parámetros acústico-perceptivos de 5 niños de ambos sexos, con edades entre 7 años y 2 meses y 12 años y 10 meses, con diagnóstico clínico de nódulos vocales. Se utilizaron los instrumentos de evaluación: software Praat, rango GRBASI, el tiempo máximo de fonación y el coeficiente s/z. Los datos obtenidos se compararon con los de los niños sin nódulos vocales. El análisis estadístico utilizando la prueba *U* de Mann-Whitney, con nivel de significación de  $p < .05$ , el SPSS *Statistics*, versión 22.0. Los resultados se presentan como medias y desviaciones estándar.

**Resultados:** Hubo diferencias estadísticamente significativas entre el grupo de nódulos vocales frente al grupo sin nódulos vocales en los parámetros: frecuencia fundamental, *shimmer*, HNR, tiempo máximo de fonación de /a/ y /z/, el coeficiente s/z y GRBASI. En *jitter* y tiempo máximo de fonación de /s/, no hubo diferencias estadísticamente significativas.

**Discusión y conclusiones:** Este trabajo subraya la importancia de la evaluación de los parámetros acústico-perceptivos en los niños con nódulos vocales.

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## Introduction

Vocal nodules are masses of tissue that are benign, bilateral, symmetric or not, of fibrotic or oedematous nature, usually located on the anterior region of the membranous vocal folds (Bodt et al., 2007; Cielo, Finger, Rosa, & Brancalioni, 2011; Gindri, Cielo, & Finger, 2008; Guimarães, 2007; Ongkasuwan & Friedman, 2013; Roy, Holt, Redmond, & Muntz, 2007; Valadez et al., 2012). These lesions, of organic and functional origin, occur due to the trauma resulting from the contact between the opposite surfaces of the vocal folds, on the maximum impact zone between them (Behlau, 2001; Bodt et al., 2007; Holmberg, Hillman, Hammarberg, Södersten, & Doyle, 2001).

Vocal nodules are the most common laryngeal lesions in the paediatric population being the main cause of dysphonia during childhood (Gramuglia, Tavares, Rodrigues, & Martins, 2014; Martins, Branco, Tavares, & Gramuglia, 2013). Its prevalence is higher in male gender, probably as a result of a social response to a more aggressive role (Behlau, 2001; Boone & McFarlane, 1994; Gindri et al., 2008; Şenkal & Çiyiltepe, 2013). The incidence of vocal nodules varies between 17% and 30%, in children aged from 4 to 12 years, associated with a greater involvement in school group activities (Gindri et al., 2008; Martins, Ribeiro, Mello, Branco, & Tavares, 2012; Ongkasuwan & Friedman, 2013). The physiology of a child's vocal tract, associated to misuse and vocal abuse and the child's psycho-emotional factors, are the causes for the emergence of vocal nodules in this population (Gindri et al., 2008). Several authors report that screaming, imitating sounds, speaking during physical activity, coughing and/or clearing the throat frequently, talking for long periods of time, lack of hydration, talking under stress and/or tension and in noisy environments, constitute the most frequent vocal abuses in children (Gindri et al., 2008; Pinho, Jarrus, & Tsuji, 2004). These behaviours are constant and they manifest in the various contexts

where children socialise (school, home and sports activities) (Behlau, 2001). The excessive and inappropriate use of the voice as well as an emotional profile of anxiety, agitation, aggression and hyperactivity are often reported by the parents of these children (Gindri et al., 2008). The following symptoms are pointed out, in scientific literature, as the most common for this pathology: hoarseness, breathiness, vocal fatigue and/or excessive strain, roughness and reduced vocal range, which in some cases may cause aphonia (Valadez et al., 2012). Araújo et al. (2004), quoted by Gindri et al. (2008), mentions hoarseness as the most frequent otorhinolaryngological symptom.

The otorhinolaryngological evaluation for school age children that manifest this symptom is of the utmost importance, since it is at these ages that the concentration and dedication to achieve educational attainment is essential (Gindri et al., 2008). The clinic diagnosis of these lesions is done by an ENT doctor, through rigid or flexible endoscopy, or through an indirect laryngoscopy (Ongkasuwan & Friedman, 2013). Cielo, Conterno, Carvalho, & Finger (2008), Gindri et al. (2008), Gramuglia et al. (2014), Martins et al. (2013), Şenkal and Çiyiltepe (2013) and Shah, Woodnorth, Glynn, and Nuss (2005) emphasise, in their studies, the importance of perceptual evaluation concurrently with the use of quantitative methods in vocal assessment. These methods refer to acoustic voice analysis, deemed valuable for the measurement of fundamental frequency, jitter, shimmer and HNR on vocal pathologies (Cielo, Finger, et al., 2011; Cielo, Lasch, Miglioranza, & Conterno, 2011; Gindri et al., 2008; Gramuglia et al., 2014; Lopes et al., 2008; Valadez et al., 2012). Maximum phonation time and s/z coefficient are phonatory measures valued by Bodt et al. (2007), Cielo, Finger, et al. (2011), Cielo, Lasch, et al. (2011), Gindri et al. (2008) and Speyer (2008), in their studies, in the context of vocal assessment.

As reported by Valadez et al. (2012), there are several studies, in the international literature, that analyse

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