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CLINICAL & BASIC RESEARCH

Association Between Voice Handicap Index and Reflux Symptom Index

A cross-sectional study of undiagnosed general and teacher cohorts in Saudi Arabia

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العلاقة بين مؤشر الإعاقة الصوتية ومؤشر أعراض الارتجاع

بحث استبياني لعامة الناس والمعلمين غير المشخصين بالمرض في المملكة العربية السعودية

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abstract: ***Objectives:*** This study aimed to assess potential associations between self-reported symptoms of laryngopharyngeal reflux (LPR) and voice disorders among two undiagnosed cohorts in Saudi Arabia. ***Methods:*** This cross-sectional study was conducted from February to April 2017 in Khobar, Saudi Arabia. Validated Arabic versions of the Reflux Symptom Index (RSI) and 10-item Voice Handicap Index (VHI-10) were distributed to 400 teachers at 13 schools and 300 members of the general population attending an ear, nose and throat clinic in Khobar. Scores of >13 and >11 on the RSI and VHI-10 indicated a potential subjective diagnosis of LPR and voice disorders, respectively. ***Results:*** A total of 446 individuals took part in the study, including 260 members of the general population (response rate: 86.7%) and 186 teachers (response rate: 46.5%). The mean age was 32.5 years. In total, 62.2% complained of voice and/or reflux problems, with the remaining 37.8% not reporting/unaware of any problems in this regard. Among the teachers, 30.6% and 18.3% had positive RSI and VHI-10 scores, respectively, while 43.1% and 14.6% of the individuals from the general population had positive RSI and VHI-10 scores, respectively. Overall, VHI-10 scores were significantly associated with RSI scores (P <0.001). ***Conclusion:*** A significant association between RSI and VHI-10 scores suggests that there may be an association between LPR and voice disorders. These tools would therefore be a valuable method of monitoring patients; however, they cannot be used to confirm a diagnosis. Thus, more detailed studies are needed to confirm this association using a larger sample size.

Keywords: Voice Disorders; Laryngopharyngeal Reflux; Hoarseness; Diagnostic Self Evaluation; School Teachers; Saudi Arabia.

الملخص: الهدف: تهدف هذه الدراسة لتقيم العلاقة المحتملة بين أعراض الارتجاع البلعومي الحنجري والتغيرات الصوتية المصاحبة لها للمرضى غير المشخصين من بين عامة الناس والمدرسين غير المشخصة بالمملكة العربية السعودية. **الطريقة:** تم عمل هذا البحث الاستبياني ما بين شهر فبراير إلى شهر أبريل 2017 في مدينة الخبر، بالمملكة العربية السعودية. وتم توزيع النسخة العربية لمؤشر اعراض الارتجاع ومؤشر الإعاقة الصوتية على 400 مدرس في 13 مدرسة مختلفة و 300 نسخة تم توزيعها على عامة الناس في عيادات الأنف والأذن والحنجرة في مدينة الخبر في مستشفى الملك فهد الجامعي، وإذا كانت النتيجة أكثر من 13 وأكثر من 11 في مؤشر اعراض الارتجاع ومؤشر الإعاقة الصوتية على التوالي أن هناك تشخيصا محتملا للارتجاع البلعومي الحنجري والتغيرات الصوتية المصاحبة لها. **النتائج:** كان اجمالي المشاركين في البحث 446 شخصا شاركوا معنا، 260 شخصا من عامة الناس (معدل الاستجابة: 86.7%) و 186 مدرسا (معدل الاستجابة: 46.5%). وكان متوسط العمر 32.5 عاما. المجموع الكلي لأعراض الارتجاع البلعومي الحنجري المبلغ عنها من المريض نفسه وعنده دراية عنها والتغيرات الصوتية هي 62.2%، بينما 37.8% لم يبلغ عن هذه الأعراض لو لم يكن مدركا لوجودها. بين المدرسين كان هناك 30.6% و 18.3% لديهم مؤشر اعراض الارتجاع و مؤشر الإعاقة الصوتية إيجابي، على التوالي، بينما كان لدى 43.1% و 14.6% من عامة الناس مؤشر اعراض الارتجاع و مؤشر الإعاقة الصوتية إيجابي، على التوالي. أثبتت المحصلة النهائية للبحث أثبتت أن هناك علاقة وطيدة بين مؤشر اعراض الارتجاع و مؤشر الإعاقة الصوتية مرتبطين بشكل علمي (P <0.001). **الخلاصة:** بسبب وجود علاقة وترابط علمي ما بين مؤشر أعراض الارتجاع و مؤشر الإعاقة الصوتية نستطيع أن نستنتج أن هنالك علاقة ما بين الارتجاع البلعومي الحنجري و التغيرات الصوتية. وبالتالي يمكننا أن نستخدم هذه المؤشرات في متابعة المرضى ونرى مدى تحسنهم مع العلاج، ولكن لا نستطيع استخدامها كأداة للتشخيص بحد ذاتها بسبب العدد القليل من المشاركين في البحث. لذا ننصح بعمل دراسات أخرى بأعداد أكبر من المشاركين.

الكلمات المفتاحية: التغيرات الصوتية؛ الارتجاع البلعومي الحنجري؛ بحة الصوت؛ التقييم التشخيصي الذاتي؛ المعلمون؛ المملكة العربية السعودية.

Advances in Knowledge

- *To the best of the authors' knowledge, no previous study has investigated associations between Reflux Symptom Index (RSI) and 10-item Voice Handicap Index (VHI-10) scores in Saudi Arabia.*
- *This study found a significant association between RSI and VHI-10 scores among two undiagnosed cohorts in Saudi Arabia.*

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Application to Patient Care

- *The association between RSI and VHI-10 scores may be useful as a monitoring method in the management of laryngopharyngeal reflux and voice disorders.*

Laryngopharyngeal reflux (LPR) is an inflammatory reaction which causes laryngitis and pharyngitis due to the backflow of gastric acid into the *larynx* and *pharynx*, as opposed to gastro-esophageal reflux which is restricted to the oesophagus.[1,2] Although both of these commonly associated diseases are attributed to a loose lower oesophageal sphincter, they are considered different diseases and present with different symptoms.[2–5] The most common symptoms of LPR are idiopathic hoarseness, chronic coughing, *globus pharyngeus*, choking episodes and clearing of the throat.[3] Previous research has not documented the crude incidence of LPR in the general population.[5] Currently, the Reflux Symptom Index (RSI) is the only tool available to subjectively assess LPR severity.[6] The RSI is a self-administered nine-item questionnaire which has been validated and translated into several languages, including Arabic.[6,7]

Up to 50% of patients with voice disorders also have LPR.[8] The Voice Handicap Index (VHI) is among the most widely used tools worldwide for the measurement of the physical, functional and emotional aspects of voice disorders.[9] The original 30-item VHI (VHI-30) has also been validated and translated into Arabic.[9,10] Franic *et al.* concluded that the VHI-30 is the best scale to obtain the most relevant clinical information in patients with voice disorders.[11] Furthermore, the VHI-30 can be used to predict the occurrence of voice disorders in non-symptomatic high-risk populations, such as smokers and professional voice users.[12,13] Other scales to assess voice disorders have been found to correlate with the VHI-30.[14,15] In 2004, a simplified 10-item version of the VHI (VHI-10) was developed; this version was found to be less time-consuming, easier to administer in a clinical setting and statistically more robust than the full scale.[16]

Belafsky *et al.* administered the RSI and VHI-30 to 25 patients with LPR.[6] After a six-month course of proton pump inhibitors (PPIs), both scales were re-administered; their findings indicated that those with greater improvement in RSI scores were 11 times more likely to have corresponding improvements in VHI-30 scores.[6] Other research has also indicated clinically significant improvements in both RSI and VHI scores among LPR patients after treatment, thus confirming the usefulness of these indices for the assessment of voice disorders and LPR-related symptoms.[17] Wang *et al.* also noted higher VHI scores among subjects with RSI scores of >13 versus those with scores of <13.[18] However, to the best of the authors' knowledge, no studies have yet been published on this topic in Saudi Arabia. This study therefore aimed to evaluate the potential association between self-reported symptoms of voice disorders and LPR using the VHI-10 and RSI, respectively, among two cohorts of undiagnosed members of the general population and teachers in Saudi Arabia.

Methods

This cross-sectional study was conducted between February and April 2017 in Khobar, Saudi Arabia. An Arabic-language questionnaire was compiled by a trained healthcare professional, consisting of a set of standardised data collection sheets to determine sociodemographic and clinical data (i.e. age, gender, occupation, smoking status, health complaints and allergies) as well as validated Arabic versions of the VHI-10 and RSI.[7,10] The questionnaires were then randomly distributed to two cohorts.

The first cohort consisted of 400 teachers working at 13 public and private schools in Khobar. The second constituted 300 members of the general population attending the Ear, Nose & Throat Clinic of the King Fahd University Hospital (KFUH). Individuals with a history of laryngology surgery, laryngeal cancer and reflux disease or those with a recent history of PPI use were excluded from the study. As per previous research, RSI scores of >13 and VHI-10 scores of >11 were deemed to indicate LPR-related symptoms and voice disorders, respectively.[6,19]

Data were compiled and analysed using the Statistical Package for the Social Sciences (SPSS), Version 20.0 (IBM Corp., Armonk, New York, USA). Descriptive statistics such as frequencies and percentages were used to summarise data for the VHI and RSI scores among the teacher and general population cohorts. Continuous and categorical variables were analysed using the Student's t-test and Chi-squared test, respectively. A multiple linear regression analysis was performed to determine significant risk factors for voice disorders among both cohorts. For all statistical analyses, a P value of <0.050 was considered significant.

This study was approved by the KFHU institutional review board (#2016-01-147). All participants gave verbal consent after being informed that their participation in the study was entirely voluntary and that all data would be kept confidential.

Table 1: Prevalence of self-reported symptoms and risk factors of laryngopharyngeal reflux and voice disorders* among members of the general population and teachers in Khobar, Saudi Arabia (N = 446)

Symptom/ risk factor	n (%)*	
	Teachers (n = 186)	Members of the general population (n = 260)
VHI-10		
>11	34 (18.3)	38 (14.6)
<11	152 (81.7)	222 (85.4)
RSI		
>13	57 (30.6)	112 (43.1)
<13	129 (69.4)	148 (56.9)
Smoking		
Yes	13 (7)	31 (11.9)
No	173 (93)	229 (88.1)
Allergies		
Yes	35 (18.8)	137 (52.7)
No	151 (81.2)	123 (47.3)

VHI-10 = 10-item Voice Handicap Index; RSI = Reflux Symptom Index.

**Self-assessed using validated Arabic versions of the RSI and VHI-10, respectively.[7,10]*

Table 2: Multiple linear regression analysis for risk factors of voice disorders* among members of the general population and teachers in Khobar, Saudi Arabia (N = 446)

Risk factor	Unadjusted		Adjusted	
	β	*P* value	β	*P* value
Teachers				
Smoking status	−2.937	0.259	-	-
Allergies	0.064	0.967	-	-
RSI score†	0.514	<0.001	-	-
Members of the general population				
Smoking status	3.795	0.009	2.755	0.027
Allergies	0.505	0.610	-	-
RSI score†	0.376	<0.001	0.361	<0.001

RSI = Reflux Symptom Index.

**As per scores of >11 on a self-assessed validated Arabic version of the 10-item Voice Handicap Index.[10] †Self-assessed using a validated Arabic version of the RSI.[7]*

Results

A total of 446 participants took part in the study, including 186 teachers (41.7%; response rate: 46.5%) and 260 members of the general population (58.3%; response rate: 86.7%). In total, there were 222 men (49.8%) and 224 women (50.2%). The mean age was 32.5 years old. The prevalence of smoking was slightly higher among the general population compared to the teachers (11.9% versus 7%). Overall, 112 members of the general population (43.1%) and 57 teachers (30.6%) had RSI scores of >13, while 38 members of the general population (14.6%) and 34 teachers (18.3%) had VHI-10 scores of >11, respectively [Table 1]. In total, 62.2% of participants complained of voice and/or reflux problems, whereas the remaining 37.8% did not report or were unaware of any issues in this regard.

A statistically significant association was found between positive VHI-10 and RSI scores (r = 0.597; *P* <0.001). A univariate regression analysis indicated that positive RSI and VHI-10 scores were significantly associated among teachers (*P* <0.001). In the multiple linear regression analysis, smoking was significantly associated with positive VHI-10 scores among members of the general population (β = 2.755; *P* = 0.027). A subgroup analysis showed that this association was not significant among teachers (β = −2.937; *P* = 0.259). The adjusted analysis also indicated that positive RSI scores were significantly associated with VHI-10 scores among members of the general population (β = 0.361; *P* <0.001) [Table 2]. According to a pairwise comparison, there were statistically significant differences in mean VHI-10 scores according to smoking status (*P* <0.001) [Table 3].

Table 3: Pairwise comparison of self-reported symptoms of laryngopharyngeal reflux and voice disorders* among members of the general population and teachers in Khobar, Saudi Arabia (N = 446)

Index	Mean score ± SD				*P* value†
	Teachers (n = 186)		Members of the general population (n = 260)		
	Non-smokers (n = 173)	Smokers (n = 13)	Non-smokers (n = 229)	Smokers (n = 31)	
RSI	11.6 ± 9.6	10.5 ± 8.6	11.5 ± 10.3	14.4 ± 12.5	0.705
VHI-10	7.5 ± 8.1	4.6 ± 5.6	5.0 ± 6.7	8.7 ± 10.9	<0.001

SD = standard deviation; RSI = Reflux Symptom Index; VHI-10 = 10-item Voice Handicap Index.

**Self-assessed using validated Arabic versions of the RSI and VHI-10, respectively.[7,10]*
†Using the Kruskal-Wallis test.

Discussion

Voice disorders are among the most serious occupational hazards for professional voice users. In particular, teachers have a distinctly higher occurrence of voice disorders in comparison to individuals in other occupations.[20,21] Martins *et al.* showed that the prevalence of dysphonia among teachers varies in different regions (20–80%).[22] In a study of teachers in Iowa, USA, almost 40% reported having to cut back on their teaching load due to voice problems.[23] In contrast, Roy *et al.* found

that nearly 30% of a general adult population in Iowa and Utah, USA, developed a voice disorder during their lifetime, with 7% already suffering from a voice disorder.[24] A combination of personal, behavioural and environmental factors may lead to an increased risk of voice disorders in teachers.[24,25] Identifying and treating voice disorders at an early stage will improve patient outcomes and quality of life in this population.[21,26]

The pathophysiology of voice disorders in LPR remains unknown, although a recent systematic review suggested that the disease alters the *mucosa* at the vibratory margin of the vocal folds due to exposure to acid and pepsin.[27] These changes may be related to epithelial cell dehiscence, microtrauma, inflammatory infiltrates, Reinke's space dryness, mucosal drying and epithelial thickening. However, due to the microscopic nature of such changes, many patients with LPR may not be diagnosed using conventional techniques, such as videolaryngostroboscopy.[27] A recent study conducted in Saudi Arabia showed that almost 58% of teachers had symptoms of acid reflux.[28] In a study of 119 singers, 70 teachers and 111 control subjects, Hočevar-Boltežar *et al*. observed that subjective reports of LPR was more common among the singers and teachers.[29] Another study indicated that LPR were frequent among teachers with dysphonia.[30] However, in the current study, there was a similar percentage of subjects with RSI scores of >13 in both the general population and teacher cohorts.

According to two studies, LPR was prevalent in 55–79% of patients with hoarseness persisting for more than three months; associations were also observed between RSI and VHI scores.[31,32] In comparison to 2,643 volunteers, Wang *et al*. found that 127 patients with dysphonia had greater LPR-related morbidity based on their RSI, Reflux Finding Score (RFS), VHI and Short Form Health Survey-36 scores, a physical examination and 24-hour ambulatory double pH monitoring.[18] In the current study, there was a statistically significant association between RSI and VHI-10 scores in two undiagnosed populations. In addition, there was a strong association with smoking status among members of the general population, although not teachers. This may be because there were fewer smokers among the teachers compared to the general population.

Limitations of the present study include the subjective self-reported nature of the assessment tools and the lack of objective clinical and endoscopic evaluations of the *larynx* and head and neck region to confirm the diagnosis of LPR and voice disorders. For example, the RSI does not cover all symptoms of LPR, including common complaints such as earache, ear pressure and throat pain.[6] A more accurate diagnostic evaluation of LPR would therefore include the RFS or assessment of the patient's pH levels.[31,33] Furthermore, certain factors—such as allergies, rhinosinusitis, smoking status and laryngeal overuse—can affect both RSI and VHI-10 scores.[3,12,17,22,24] The relatively short study period as well as the need for a larger sample size may have also affected the results. The latter issue is particularly concerning given the low response rate among teachers, as previous research has indicated that awareness of vocal hygiene is low in this subset and that 79% of teachers in Saudi Arabia have never consulted an otolaryngology service.[34] Other limitations include the low response rates and difficulties in the interpretation of certain items.

Conclusion

There was a significant association between RSI and VHI-10 scores in the current study, suggesting a potential link between LPR and voice disorders. This may constitute a valuable monitoring method in LPR and voice disorder cases; however, these tools are subjective in nature and thus cannot be used to confirm a diagnosis. Therefore, more detailed objective studies are required to confirm the correlation in a larger sample size.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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