

# Evaluation of Pediatric Voice Handicap Index in Children With Allergic Rhinitis

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**Summary: Objective.** The study sought to determine impact of voice disability on children with allergic rhinitis (AR). The Turkish version of the Pediatric Voice Handicap Index (pVHI) was used to assess the impact of voice disability on functional, physical, and emotional aspects of voice and oral communication. The degree of talkativeness was also determined.

**Methods.** One hundred twenty-three children with AR aged 6–17 years and age-matched 84 children of controls without present or past record of voice disorder were admitted in the cross-sectional study. The pVHI was carried out by an otolaryngologist.

**Results.** Children with AR show higher scores on pVHI compared to healthy children, indicating a greater chance of voice disorders observed in them ( $P < 0.001$ ). The scores of three domains and total score of pVHI were prevalent in children with AR. In addition, as the severity of AR increased, high scores of pVHI were observed ( $P = 0.044$ ). The mean talkativeness scores in AR group were lower than those of the healthy controls ( $P < 0.001$ ).

**Conclusion.** In children with AR, voice disorders are more frequently observed and correlate positively with AR severity.

**Key Words:** Allergic rhinitis—Pediatric Voice Handicap Index—Voice disorders—Pediatric—Talkativeness.

Allergic rhinitis (AR) is a common chronic respiratory disease affecting 10%–20% of the pediatric population<sup>1</sup> and is generally associated with numerous multimorbid disorders.<sup>2</sup> Voice disorders are frequently seen in children and can cause severe drawbacks in communication and influence social and academic function in childhood.<sup>3,4</sup> Some reports have demonstrated an association between AR and voice disorders.<sup>5,6</sup> Children with AR seem to be more prone to develop throat symptoms, including irritation, sensation of difficult-to-shift mucus, laryngitis, cough, and vocal problems.<sup>2</sup> Chronic cough and laryngeal tension may lead to reduced vocal quality.<sup>7</sup>

The recent publication of the Pediatric Voice Handicap Index (pVHI) has become the most accepted tool to evaluate voice disorders in childhood. The pVHI is a quality-of-life questionnaire completed by parents and gives information about how dysphonia affects the child's social and emotional life. Thus, the pVHI appears to be a useful tool in following a child's development after surgical, medical, and behavioral interventions.<sup>8</sup> The original Voice Handicap Index was translated into Turkish by Kılınç et al, and Özkan et al validated the Turkish version for use with the pediatric population.<sup>9,10</sup>

It is known that many children with AR may experience voice disorders associated with adenoid hypertrophy, otitis media with effusion, olfactory dysfunction, and laryngitis.

To the best of our knowledge, there are no published reports that have examined the relationship between AR and voice disorders in children using the pVHI.

The aim of this study was to assess the Turkish version of the pVHI in school-aged children with AR and compare the results with those of healthy children.

## METHODS

### Participants

This cross-sectional study was conducted in the Pediatric Allergy and Otorhinolaryngology Outpatient Clinics of Antalya Training and Research Hospital between January and June 2017. The Ethics Committee of Antalya Training and Research Hospital approved the study, and written informed consent was given by the parents or legal guardians of the patients. The diagnosis of AR was made from the patient history, clinical examination, and skin prick test according to Allergic Rhinitis and Its Impact on Asthma (ARIA) guidelines (2016).<sup>11</sup> Patients with AR were classified as mild intermittent, mild persistent, moderate persistent, and severe AR, according to the duration and severity of symptoms. A total of 123 children with AR aged 6–17 years were recruited from the Pediatric Allergy Department between June 2016 and March 2017. The control group consisted of 84 age-matched children selected from the Pediatric Department without any present or past record of voice disorder, hearing loss, or related disability that might affect the children's speech and voice and no signs of atopic disease. At the time of the first assessment, a careful history, physical examination, and videolaryngoscopy (in all cases without anesthesia) using a flexible Mooncare fiberscope 3.4 mm (8300019728, Medikasis, Germany) were applied for the evaluation of voice disorders to all the participants.

The pVHI is a quality-of-life questionnaire completed by parents, which measures the impact of a voice disorder.<sup>8</sup> The pVHI is in the form of parental proxy and consists of 23 questions divided into functional (seven questions), emotional

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(seven questions), and physical domains (nine questions) to which the children's parents are asked to answer, using a five-point scale ranging from 0 (never) to 4 (always). The maximum score attainable from these questions is 92, and normophonic control populations typically have total scores <2. The other section of the pVHI asks the parents to rate the degree of talkativeness of their child (1 = quiet listener, 4 = average talker, 7 = extremely talkative). The parents of each participant in both the study and control groups independently completed the Turkish pVHI.

### Skin Test

A total of 18 allergen solutions, including negative and positive controls, were employed. Saline and histamine were included as negative and positive controls, respectively. Allergens and positive and negative controls were applied to the volar surface of the arm epidermally with Allergopharma prick test solutions. The allergens used included pollens (grass mixture, tree mixture, and cereal weeds), mold mixture, cat, dog, cockroach, and house dust mites (*Dermatophagides pteronyssinus* and *Dermatophagides farinae* [Allergopharma, Germany]). When the positive control edema was >3 mm and there was no reaction in the negative control, this was considered as positive in the epidermal skin prick test.

### Statistical analysis

Data were analyzed using Statistical Package for the Social Sciences (SPSS) version 20.0 (SPSS Inc, Chicago, IL). Numeric variables were defined as mean  $\pm$  standard deviation and/or

median (min-max), and categorical variables were defined as number and percentage. The normality hypothesis was tested using the Kolmogorov-Smirnov test. For continuous numerical variables, a *t*-test or Mann-Whitney *U* test was used to determine whether there was any difference between the experimental and control groups; and for categorical variables, the chi-square test. The level of significance was accepted as  $P < 0.05$ .

## RESULTS

The study included a total of 207 patients (110 girls and 97 boys [boy:girl ratio, 0.88]) with a mean age of  $12.05 \pm 3.18$  years. There was no statistically significant difference between the AR group and the control group in respect of age or gender ( $P = 0.304$ ,  $P = 0.09$ ) (Table 1).

According to the severity and duration of AR, 36 patients (29.3%) were classified as mildly intermittent, 56 (45.5%) as mildly persistent, and 31 (25.2%) as moderate AR.

The mean total Turkish pVHI score was 12.39 in the AR group and 6.5 in the control group. According to the Mann-Whitney *U* test, the difference between the mean scores of the three domains and the total score of the Turkish version of pVHI was significant between the two groups ( $P = 0.025$  for emotional domain and  $<0.001$  for the other domains) (Table 2).

There was no significant difference between boys and girls in terms of total pVHI scores in all patient groups (mean total pVHI was  $9.87 \pm 11.36$  for girls and  $10.02 \pm 10.62$  for boys,  $P = 0.802$ ).

**TABLE 1.**  
**The Demographic Characteristics of the Patients**

	Children With Allergic Rhinitis (n = 123)	Healthy Children (n = 84)	<i>P</i>
Gender (F/M)			0.09*
Female	59	51	
Male	64	33	
Age (year)	$12.25 \pm 3.01$	$11.76 \pm 3.41$	0.304†
Epidermal prick test			
House dust mites	29 (23.57 %)		
Pollens	27 (21.95%)		
Mould mixture	6 (5%)		
Cat and dog	5 (4%)		
Multiple allergy	47 (38.2%)		
Allergic rhinitis severity			
Mild intermittent	36 (29.3%)		
Mild persistent	56 (45.3%)		
Moderate persistent	31 (25.2%)		
Allergic rhinitis medication			
Antihistaminics	10 (8.1%)		
Nasal corticosteroid	12 (9.6%)		
Montelukast	9 (7.3%)		
Antihistaminic + nasal corticosteroid	55 (44.4%)		
Antihistaminic + nasal corticosteroid + montelukast	38 (30.6%)		

\* Chi-square test

† Mann-Whitney *U* test.

**TABLE 2.**  
**A Comparison of the Mean Scores of the Turkish pVHI Scores and Talkativeness of Allergic Rhinitis and Healthy Children**

Scale	Allergic Rhinitis (n = 123)		Healthy (n = 84)		P Value
	Mean ± SD	Minimum-maximum	Mean ± SD	Minimum-maximum	
pVHI-F	4.53 ± 4.34	0–23	2.49 ± 3.25	0–16	<0.001
pVHI-P	5.74 ± 5.61	0–23	2.75 ± 4.33	0–17	<0.001
pVHI-E	2.25 ± 3.54	0–18	1.3 ± 2.41	0–14	0.0025
pVHI Total	12.39 ± 11.33	0–54	6.5 ± 8.6	0–47	<0.001
Talkativeness	4.15 ± 1.38	0–7	4.81 ± 1.57	0–7	<0.001

Abbreviations: pVHI, Pediatric Voice Handicap Index; pVHI-F, pVHI functional, pVHI-P, pVHI physical, pVHI-E, pVHI emotional, P value is for Mann-Whitney U test.

**TABLE 3.**  
**Comparison of the Severity of Allergic Rhinitis With pVHI Values**

	Mild Intermittent		Mild Persistent		Moderate Persistent		P Value
	Mean ± SD	Minimum-Maximum	Mean ± SD	Minimum-Maximum	Mean ± SD	Minimum-Maximum	
pVHI Total	9.77 ± 7.89	0–32	10.52 ± 9.66	0–54	18.74 ± 16.32	0–53	0.044
pVHI-F	4.17 ± 3.67	0–18	3.98 ± 4.29	0–21	5.81 ± 4.95	0–17	0.199
pVHI-P	4.23 ± 4.28	0–18	4.79 ± 4.41	0–22	9.16 ± 7.35	0–17	0.005
pVHI-E	1.51 ± 1.96	0–7	1.89 ± 2.75	0–11	3.74 ± 5.40	0–18	0.551
Talkativeness	4.43 ± 1.06	2–7	4.20 ± 1.50	1–7	3.74 ± 1.43	1–7	0.100

Abbreviations: pVHI, Pediatric Voice Handicap Index; pVHI-F, pVHI functional, pVHI-P, pVHI physical, pVHI-E, pVHI emotional, P value is for Kruskal-Wallis test.

The mean talkativeness scores were 4.15 in the AR group and 4.81 in the control group ( $P=0.001$ ). The overall mean values for pVHI total and each domain and talkativeness are shown in Table 2. In the epidermal prick test, 29 patients were determined with allergy to house dust mites (23.57%), 27 patients (21.95%) to pollens, 6 patients to mold mixture (5%), 5 patients (4%) to cat and dog, and 47 patients (38.2%) had multiple allergies. In the AR group, 10 (8.2%) patients were receiving antihistaminics only, 10 (8.2%) topical corticosteroids only, 9 (7.4%) patients montelukast only, 55 (45.1%) both antihistaminics and topical corticosteroids, and 37 (30.3%) antihistaminics + topical corticosteroids + montelukast (Table 1). There was a significant relationship between AR severity and pVHI total score ( $P=0.044$ ). There was also an observed relationship between physical domain and AR severity, but no significant relationship was seen between emotional and functional domains ( $P=0.005$ ,  $P=0.551$ ,  $P=0.199$ , respectively). There was no significant difference between AR severity and talkativeness ( $P=0.10$ ) (Table 3).

### DISCUSSION

Dysphonia and AR are common issues in children that may affect the child's quality of life psychologically, socially, and academically.<sup>12,13</sup> There is limited literature regarding voice disorders in the allergic population, especially in children. To the best of our knowledge, this is the first paper to investigate pVHI in children with AR.

The results of this study demonstrated that children with AR show higher scores on pVHI when compared to healthy children, indicating a greater likelihood of the development of voice disorders. The scores of three domains and the total score of the pVHI were significantly higher in children with AR. In addition, as the severity of AR increased, pVHI scores also increased.

The scores of the physical domain of the test were higher than the scores of the functional and emotional domains in both groups, which was consistent with the results of the original study performed by Zur et al<sup>8</sup> and also with the Turkish version of the pVHI.<sup>10</sup>

The mean talkativeness scores in the AR group were lower than those of the healthy controls. As children with AR tend to have impaired cognitive functioning and academic performance, this group might show lower talkativeness scores compared with the control group.

AR is a systemic allergic disease and is generally associated with numerous multimorbid disorders.<sup>14</sup> Laryngitis, cough, and vocal problems are common in children with AR. Due to the postnasal drip in AR, there could be backward passage of mediators, cytokines, and secretions from the nose to the larynx, which may cause voice disorders.<sup>5</sup> Chronic middle ear effusion and eustachian dysfunction may also cause hearing problems associated with voice disorders in children with AR.<sup>15</sup>

Endoscopic examination, acoustic, aerodynamics, and subjective self-assessment are used to evaluate voice disorders in adults.<sup>16</sup> However, these evaluation instruments cannot be applied easily in children. The pVHI is a self-assessment tool for pediatric voice disorders that assigns a numerical value to quantify the parent's perception of the child's functional, physical, and emotional disability related to voice use. Dysphonia and AR are common issues that may negatively affect the social relationships of children in many aspects. To evaluate and treat voice disorders in children with AR, the pVHI plays a very important role in preventing the social problems of children with AR.

There are several limitations of this study that should be considered. First is that the results are based on a relatively small sample (n = 123). Larger samples should be included in future studies. Second is that no further aerodynamics, perceptual, and acoustic tests could be performed due to technical and financial restraints. Also, as the study group was composed of mild and moderate AR, our results may not represent all patients with AR. There should be future studies that include severe AR patients.

### CONCLUSION

In conclusion, pVHI seems to be a useful and easily applicable tool for both parents and clinicians to assess voice disorders in children with AR. The findings emerging from this preliminary study indicate that in children with AR, voice disorders are more frequently observed and correlate positively with AR severity. In studies using quality-of-life scales of children with AR, it is also important to assess voice disorders as these have a significant effect on social communication.

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