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Assessment of chemosensory disorders in allergic rhinitis

Mehmet Özgür Avinçsal[1], Aytuğ Altundağ[2], Denizhan Dizdar[3], Mehmet Emre Dinç[1], Seçkin Ulusoy[1], Mehmet Külekçi[1]

[1]*Department of Otorhinolaryngology, Gaziosmanpaşa Taksim Training and Research Hospital, Istanbul, Turkey*
[2]*Department of Otorhinolaryngology, Acıbadem Taksim Hospital, Istanbul, Turkey*
[3]*Department of Otorhinolaryngology, Istanbul Kemerburgaz University Bahçelievler Medical Park Hospital, Istanbul, Turkey*

Abstract

Objective: Allergic rhinitis (AR) is a globally common inflammatory disease that has a considerable effect on an individual's quality of life. It is estimated that AR affects 10% to 25% of the general population. Both gustatory and olfactory disorders affect the social activities and job performance resulting in impaired quality of life in patients suffering from AR. We think that these problems have not been sufficiently investigated in the past. We, therefore, decided to evaluate the smell-taste disorders in patients suffering from AR. Our objective is to evaluate the chemosensory perception in patients suffering from allergic AR.

Methods: Fifty-four patients with AR and 34 healthy controls were enrolled for the current study. "Sniffin' sticks" test and taste strips were used for chemosensory assessment.

Results: According to the "Sniffin' sticks" test results, patients with AR had significantly lower scores for odor threshold and identification subtasks, whereas there was no difference between the two groups regarding odor discrimination scores ($p<0.001$, $p<0.001$, and $p=0.3$, respectively). After evaluating the taste strip test results, we found that taste scores were significantly low in patients with AR when compared to controls for sweet, salty, bitter and sour tastes.

Conclusion: This study showed clinically important deficiency of chemosensory sensitivity in AR patients. Since chemosensory deprivation in AR patients has tended to be overlooked in the past, these outcomes suggest that chemosensory disorders should be part of the standard evaluation of patients with AR.

Keywords: Allergic rhinitis, chemosensory disorders, taste and smell disorders.

Özet: Alerjik rinitte kemosensöryal bozuklukların değerlendirilmesi

Amaç: Alerjik rinit (AR) bireylerin yaşam kalitesini hatırı sayılır derecede etkileyen ve dünya ölçeğinde sık görülen bir enflamatuvar hastalıktır. AR'nin dünya ölçeğinde genel popülasyonun %10–25'ini etkilediği tahmin edilmektedir. Hem tat alma hem de koku alma bozuklukları sosyal aktiveleri ve mesleki performansları etkileyerek AR'den rahatsız hastaların yaşam kalitesinin bozulmasına yol açmaktadır. Bu sorunların geçmişte yeterince araştırılmadığını düşünmekteyiz. Bu nedenle AR'den rahatsız hastalarda koku ve tat alma bozukluklarını değerlendirmeye karar verdik. Amacımız alerjik AR hastalarında kimyasal duyumsama algısını değerlendirmekti.

Yöntem: Bu çalışmaya 54 AR hastası ve 34 sağlıklı kontrol alınmıştır. Kimyasal duyumsama değerlendirmesi için kokulu çubukları koklama ve tat stripleri kullanılmıştır.

Bulgular: Kokulu çubukları koklama testi sonuçlarına göre AR hastalarının koku eşik ve tanımlama testleri skorları anlamlı derecede düşük olup iki grup arasında koku ayrım skorları açısından herhangi bir farklılık yoktu (sırasıyla $p<0.001$, $p<0.001$, $p=0.3$). Tat strip testi sonuçlarını değerlendirdikten sonra kontrollerle karşılaştırıldığında AR hastalarında tatlı, tuzlu, acı ve ekşi tatlarına ilişkin skorlar anlamlı derecede daha düşüktü.

Sonuç: Bu çalışma alerjik rinit hastalarında kimyasal duyumsama algısında klinik açıdan önemli bozulma olduğunu göstermiştir. Geçmişte alerjik rinit hastalarında kimyasal duyumsama yoksunluğu göz ardı etme eğilimi yaşandığından bu sonuçlar alerjik rinit hastalarının rutin değerlendirmesinde kimyasal duyumsama bozukluklarının da ele alınması gerektiğini akla getirmektedir.

Anahtar sözcükler: Alerjik rinit, tat ve koku bozuklukları, kemosensör bozukluklar.

Allergic rhinitis (AR) has a substantial effect on quality of life (QOL). Approximately 25% of the world's population is influenced by this condition.[1] In addition to the characteristic symptoms of the disease (sneezing, nasal obstruction, rhinorrhoea, and pruritus), other atypical and less common symptoms may affect a patient's QOL, including

Correspondence: Denizhan Dizdar, MD. Department of Otorhinolaryngology, Istanbul Kemerburgaz University Bahçelievler Medical Park Hospital, Istanbul, Turkey.
e-mail: denizhandizdar@hotmail.com

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halitosis, fatigue, malaise, irritability, and smell-taste disorders.[2,3]

Smell and taste are important to our perception of the outside world, and the loss of smell and taste can be a deep blow to one's QOL. Among AR patients, 21–23% suffer from olfactory disorders.[2] Block of the airflow reaching the olfactory epithelium and allergic inflammation that damages the olfactory epithelium can cause reduced olfaction.[4] Smell and taste are closely related senses; impaired olfactory function has a considerable effect on taste perception.[2–5]

Olfactory and gustatory complaints can affect the QOL of patients with AR. We believe that these problems have not been recognized adequately in the past. Thus, we decided to evaluate smell-taste disorders in patients with AR.

Materials and Methods

Subject selection

This study was conducted according to the principles of the Helsinki Declaration and was approved by the Clinical Trials Committee of our hospital (09/07/2014, no. 63). Details of the study protocol were explained to all subjects and written informed consent was obtained before participation.

In total, 54 patients with AR and 34 healthy controls were enrolled. A medical history was taken to assess the occurrence of systemic disorders. All participants verified that they were not suffering from any known disease and were not taking any treatment. Patients with additional anatomical or systemic diseases that might decrease olfactory and/or gustatory function, including a previous head injury, stroke, head and neck radiotherapy, chemotherapy, major surgery of the head and neck, sinusitis, nasal polyposis, and nasal septal deviation were excluded. For all patients, a standardized otorhinolaryngological assessment was performed by the same ear, nose, and throat specialist. The age- and sex-matched control group consisted of people at the otolaryngology clinic for other reasons that met the above criteria.

Assessment of allergic rhinitis

The inclusion criteria were the diagnosis of AR based on history, physical examination, and allergy tests (sensitivity to at least one and maximum three of the tested allergens). The allergy (skin prick) tests involved six major allergens: *Alternaria* (a mold), *Oleacea* (olive tree), *cereals* (rye), *Dermatophagoides farinae* (dust mite), *Dermatophagoides pteronyssinus* (dust mite), and *graminées* (grass). Individuals in the control group underwent the same allergy tests after their physical examinations to ensure that they were free from allergies. We excluded subjects using any AR medication, including intranasal steroids and antihistamines, during the study.

Chemosensory assessment

The validated "Sniffin' sticks" test, in which odorants are presented in commercially available felt-tip pen-like devices (Sniffin' sticks; Burghart, Wedel, Germany),[6–8] were used to assess olfactory function. This test has been validated in a Turkish population[9] and consists of one threshold and two suprathreshold subtests: a test for the threshold of phenyl ethyl alcohol, a test for odor discrimination (16 triplets with two different odors), and a test for odor identification (16 common odors, presented in a four-choice, forced-choice procedure).[7] The maximum score for the subtests was 16, so the maximum composite score was 48 (threshold, discrimination, and identification [TDI] score). 'Normal' values for the TDI composite score are >30.3, with a cut-off between anosmia and hyposmia at 16.5.[7]

"Taste strips" were used to assess taste[10] (Taste strips; Burghart). This test consists of four concentrations each of the four basic taste qualities. Concentrations used for the taste strips were: 0.4, 0.2, 0.1, and 0.05 g/mL of sucrose (sweet); 0.3, 0.165, 0.09, and 0.05 g/mL of citric acid (sour); 0.25, 0.1, 0.04, and 0.016 g/mL of sodium chloride (salty); and 0.006, 0.0024, 0.0009, and 0.0004 g/mL of quinine hydrochloride (bitter). Distilled water was used as the solvent, and the taste solutions were prepared freshly at regular intervals. The left or right side of the anterior third of the extended tongue was tested using the strips, resulting in a total of 32 trials.[10] The mouth was rinsed before each use of the strips. Increasing concentrations were used. Taste qualities were applied in a randomized fashion at each of the four concentration levels and alternating the side of the presentation. Patients had to identify the taste from a list of four descriptors: sweet, sour, salty, and bitter (multiple forced choice). To obtain an impression of overall gustatory function, the number of correctly identified tastes per side was added up to a "taste score".[10] A total threshold of <9 was classified as hypogeusia. Inter-test reliability has been shown to be high (r=0.68).[10]

Statistical analysis

Data analyses were performed using SPSS software (ver. 21.0; SPSS Inc., Chicago, IL, USA). The normal distribution of variables was first evaluated using the Shapiro-Wilk test. Data are presented as means ± standard deviations for continuous variables, and the number of cases was used for categorical variables. Differences between groups were analyzed using t or χ^2 tests, as appropriate.

Results

The study cohort consisted of 88 subjects, 34 men and 54 women, with a mean age of 36 (range: 18 to 47; median: 36.9±13.3) years. There was no significant difference between the AR and control groups in terms of age or sex. Of the patients, 46% were allergic to *D. pteronyssinus*, 34% to *D. farinae*, 38% to *Alternaria*, and 31% to *graminées*.

As shown in Table 1, when the "Sniffin' sticks" results were evaluated, patients with AR had significantly lower scores for odor threshold and identification subtasks (p<0.001 and 0.001, respectively), whereas there was no difference between the groups in the odor discrimination scores (p=0.3; Fig. 1). On evaluating the taste strip test results, taste scores were decreased significantly in patients with AR versus controls for sweet, salty, bitter, and sour tastes (Figs. 2 and 3).

Discussion

Allergic rhinitis is a global public health issue. It is a common condition, affecting more than 400 million people worldwide. High prevalence rates have been noted in both industrialized and developing countries. Moreover, recent reports have revealed an increase in the prevalence of AR over the last four decades.[11] AR can be a substantial source

Table 1. Taste scores in patients and control group.

	Allergic rhinitis n=54	Control group n=34	p-value
Age	37.1±11.6	36.5±14.4	0.6
Gender (F/M)	34/20	20/14	0.7
TDI score	27.8±2.3	35.3±2.6	0.001
Total taste score for right side	9.3±4.2	13.1±1.7	<0.001
Total taste score for left side	9.5±4.1	13.2±1.6	<0.001

TDI: Treshold Discrimination Identification Score

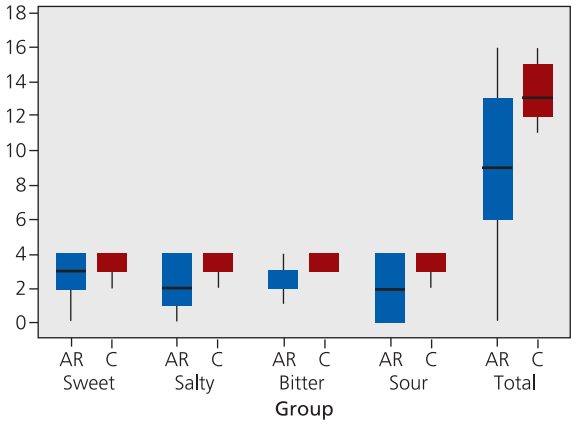

Fig. 2. Taste scores for the right side of the tongue.

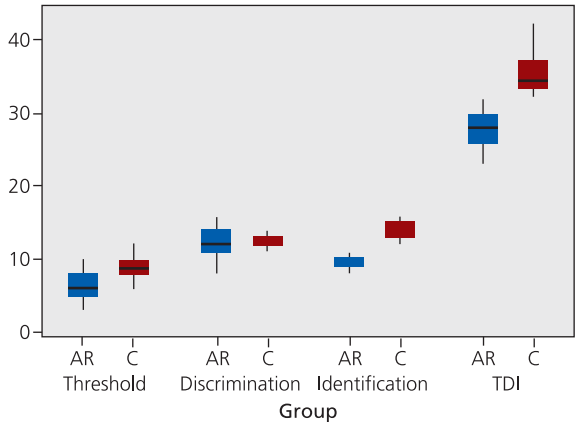

Fig. 1. Sniffin' Sticks olfatory testing scores according to groups.

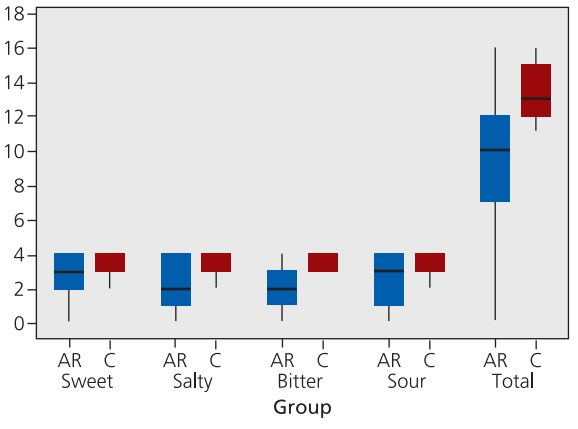

Fig. 3. Taste scores for the left side of the tongue.

of morbidity in poorly managed patients. Although not life-threatening, the symptoms of AR impair social and work function and can affect patient QOL significantly. In affected patients, one or more symptoms, including rhinorrhoea, sneezing, nasal itching, and congestion, may influence the QOL.[12]

AR may also be associated with smell-taste disorders. Olfactory dysfunction is a common symptom in AR: up to 23% of patients suffer from a reduced sense of smell.[11–13] Olfactory dysfunction in AR patients is believed to be caused by block of the airflow to the olfactory epithelium, secondary to nasal mucosal edema due to inflammation. However, medical or surgical treatments that decrease nasal blockage may not adequately treat hyposmia. These conclusions, verified in numerous studies, suggest that nasal blockade is not the individual mechanism of olfactory dysfunction in patients with AR. Another mechanism is the damage of the olfactory epithelium by allergic inflammation, directly triggering olfactory dysfunction.[4] Although it remains unclear, the pathogenesis of olfactory dysfunction seems to involve obstruction and inflammation.

We used the "Sniffin' sticks" test, which has been approved by the German Olfactory and Gustatory Committee. This test assesses the sense of smell quantitatively concerning threshold, discrimination, and identification. It is a suitable and accurate method for analyzing olfactory dysfunction, which may be linked to various diseases. However, several factors can affect the test including age, smoking status, and environment.[11] Thus, we sought to exclude all variables that might affect performance scores. We found that olfactory function was decreased regarding threshold and identification in patients with AR, whereas there was no significant change in discrimination scores.

Most patients who complain of a loss of taste actually have some degree of smell dysfunction as well. Most of a food's flavor comes from our ability to smell it. The tongue can sense only salty, sweet, sour, bitter, and umami. This is why it is difficult to sense a food's flavor when one has a stuffy nose. Most gustatory dysfunction is, in fact, caused by smell disorders instead of taste perception. One of the furthermost mutual reasons of olfactory dysfunction is AR. However, any situation that causes in a compromised situation for the chemosensory mediators (e.g., neurotransmitters, neural pathways, oral mucosa, saliva, and tongue) can result in impaired taste perception.[14] Thus, we excluded all other conditions that may cause taste disorders. We found that gustatory function was decreased in all parameters in patients with AR. However, this decrease may not only be related to olfactory dysfunction. Further research is needed to fully understand taste dysfunction in AR.

Conclusion

Our study demonstrates clinically important chemosensory perception disorders in AR patients; these impairments may cause a reduced QOL. Due to the chemosensory disorders in AR, and particularly their impacts on QOL, they have been ignored in the past, and our results propose that chemosensory disorders would be part of the standard evaluation of AR patients.

Conflict of Interest: No conflicts declared.

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