Olfactory Alterations in Allergic Rhinitis to Pollens and Mites

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Introduction: In the last 80 years, the presence of allergies has increased among Europeans from 0.28% to 14.2%. Allergic rhinitis is the main presentation, rising from 18% to 40% of cases. The aim of this study is to demonstrate that allergic rhinitis due to pollen and mites has an effect on the olfactory system.
Material and methods: We describe the impairment of olfactory function in 2 groups of individuals with allergic rhinitis due to mites or pollen (n=76; 42 with allergy to pollen [48.9%], and 34 with allergy to mites [39%]), compared with a group of healthy volunteers (n=120). Olfactory ability was measured by the BAST-24 (Barcelona Smell Test) olfactometer comprising 20 odours tested by the forced choice method to compare the levels of odour detection (knowing if there is odour in the environment), and efficacy (identifying what was smelt).
Results: The results show firstly that people with allergic rhinitis have a clear, definitive, and significant impairment (P>.05) in olfactory levels; secondly, there is a tendency towards greater olfactory loss in the case of people with pollen-related allergic rhinitis than in those allergic to mites; and thirdly, the different odours are affected differently in the 2 groups.
Conclusions: We propose consideration of the study of olfactory status in the assessment of patients with allergic rhinitis.

Key words: Rhinitis. Allergy. Smell. Pollen. Mites. Olfactory disorders. Barcelona Smell Test. Hyposmia.

Alteraciones olfativas en la rinitis alérgicas a pólenes y ácaros
Introducción: En los últimos 80 años, las alergias han pasado de afectar al 0,28 % al 14,2 % de la población europea. La rinitis alérgica es la principal de todas ellas con un progreso que va de un 18 a un 40 %. El objetivo de este trabajo es demostrar que la rinitis alérgica por pólenes o ácaros reduce las capacidades olfativas.
Material y métodos: Se describe el estado olfativo de dos grupos de personas con rinitis alérgica a polen o ácaros (n = 76): alérgicos al polen, 42 (48,9 %) casos; alérgicos a ácaros 34 (39 %). La exploración del olfato se realiza con el olfatómetro BAST-24 (Barcelona Smell Test), constituido por 20 olores controlados por el método de respuesta forzada, para valor la capacidad de percibir un olor (detección) y la eficacia olfativa (identificar correctamente el olor percibido). Estos resultados se comparan con los obtenidos en un grupo control de voluntarios sanos (n = 120).
Resultados: El estudio muestra: *a)* que en los dos tipos de rinitis alérgica hay un deterioro claro, definitivo y significativo (p > 0,05) del olfato, y *b)* que las personas con rinitis alérgica a pólenes presentan una tendencia de mayor pérdida olfativa que aquellas con rinitis alérgica a ácaros, y que los distintos olores se afectan de forma distinta según el tipo de rinitis alérgica se padezca.
Conclusiones: Se propone que se tenga en cuenta el estudio del estado olfativo en la valoración de las rinitis.

Palabras clave: Rinitis. Alergia. Olfato. Polen. Ácaros. Alteraciones del olfato. Barcelona Smell Test. Hiposmia.

INTRODUCTION

From an allergy standpoint, an increase in allergic rhinitis can currently be seen in the general population. In 1990, it was found that the yearly increase of people with rhinitis was 1% for the 4-6 age range, 5% to 7% for the 7-12 age range, and 12% to 18% in college students, being seen predominantly in males between the ages of 5 and 15 and in females between the ages of 15 and 24.[1] These allergic processes affect people of any age, regardless of whether or

The authors have not indicated any conflict of interest.

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Received July 25, 2007.
Accepted for publication October 18, 2007.

not they have had previous allergies. According to different countries, the affected population has gone from 0.28% to 14.2% (over 79 years of follow-ups) meaning that cases of allergic rhinitis have increased 50 fold; others cases have doubled in 10 years.[2]

Allergic rhinitis affects between 18% and 40% of the adult population in Europe and America, and 98.7% of Spanish paediatricians, general practitioners, and family doctors treat patients for allergic rhinitis and bronchial asthma, which are the illnesses they see most frequently. Between 2015 and 2020, it is estimated that 50% of the population will have some form of allergy. The areas most affected by allergies in Spain are La Rioja and Asturias, and the least affected areas are the Balearic Islands and Cantabria. The main causes are dust mites (30.4%) and pollen (30.3%).[3]

On another note, from an otorhinolaryngological perspective, it can be seen that these patients with allergies, when asked, also mention having olfactory alterations. These patients make up over 2% of the population. The causes have multiple aetiologies (over 200 pathological processes), including allergic rhinitis.

Our hospital's Ear, Nose, and Throat department carries out controls of 820 patients with olfactory alterations (hyperosmias, hyposmias, anosmias, cacosmias, olfactory illusions, phantosmias, olfactory hallucinations, etc) distributed, according to aetiology, as follows: 28% are from sinonasal polyposis, 23% from colds and flu, 10% from allergic rhinitis, 9% from idiopathic causes, 8% from neurological causes, 7% from trauma, and the remaining 15% is divided among congenital, infectious, endocrinological, psychiatric, pharmacological processes as well as other types of rhinitis, iatrogenic responses, neoplasias, drug addictions, and work environment issues.

Since it was seen that certain patients with rhinitic-allergic processes complained about a certain degree of impairment of their sense of smell, in order to stay in line with studies focused on those alterations,[4,5] it was decided that allergic rhinitis would be confirmed as well as its influence on the sense of smell and whether or not that olfactory alteration could be measured.

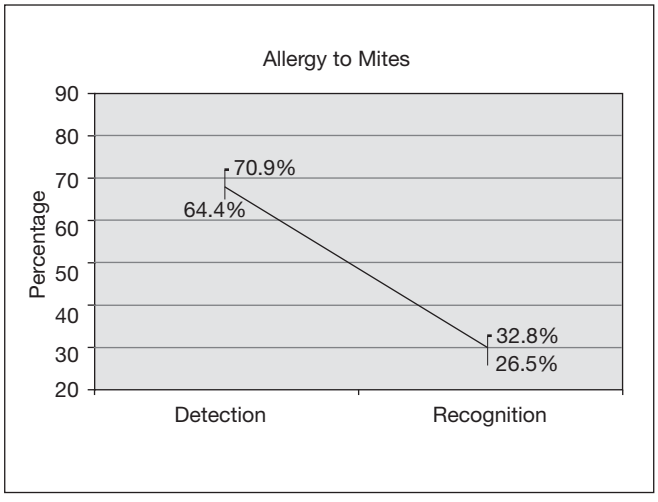

Figure 1. Olfactory sensitivity is altered by mites, with a confidence interval of 71%-64% for detection and 33%-27% for recognition.

In order to quantify these alterations we based our work on 2 aspects of the olfactory process: the first is the uptake of the odour to generate the detection phase in which only the ability to perceive volatile substances in the air occurs, without distinguishing which odour it is; and the second one is the phase that follows detection and corresponds to the ability to discriminate exactly and recognize the specific odour, with correct recognition of the odour being perceived.

In order to encompass these 2 parameters a detection (DT) and recognition (RG) olfactometry was performed systematically on each of the patients allergic to pollen or mites and who were diagnosed with allergic rhinitis, with the aim of confirming the concomitant presences of allergic rhinitis with olfactory alterations.

MATERIAL AND METHOD

We started with 2 groups: allergic patients (pollen vs mites) and the control group. The allergic patients group was made up of 76 people, between the ages of 10 and 70, with a mean age of 30 (1).

They were classified according to their allergic aetiology (clinical presentation and positive prick test): on one hand 48.9% of the people (n=42) were allergic to pollen; this group comprised 24 women and 18 men. On the other hand, 39% of the people (n=34) were allergic to dust mites and this group comprised 21 women and 13 men. Cases of intercurrent inflammatory processes (polyposis), mixed allergies to pollen, mites, dry skin cells and moulds, intrinsic rhinitis and toxic rhinitis (iatrogenic or otherwise), and those patients undergoing allergy treatments were excluded.

A general medical history as well as a specific olfactory one was taken for every patient. Evaluations using fibroscopic rhinoscopy, sinonasal CT scan, and tests of the respiratory function were performed to assess the state of the sinonasal cavities. Patients were given the BAST-24[6] validated olfactometric test by which each patient's ability to perceive an odour was studied (detection) as well as each patient's ability to correctly recognize what he or she was smelling (recognition), according to the forced choice method.[7,8] The results were compared with those from the control group (n=120) comprising 60 men and 60 women, with ages ranging from 15 to 85 and a mean age of 42 (1.7). All patients were healthy with no history of allergies or inflammatory processes. The data were analyzed statistically using SSPS 12.

RESULTS

Firstly, the results of the variations between the right and left nostrils were studied; they did not show significant differences between each side, which meant that the sensorial discrimination principle was applied (the acuteness of the senses is measured based on the best function).[9]

Secondly, a comparative analysis was made of the pollen-related allergic rhinitis and that due to mite allergies, where

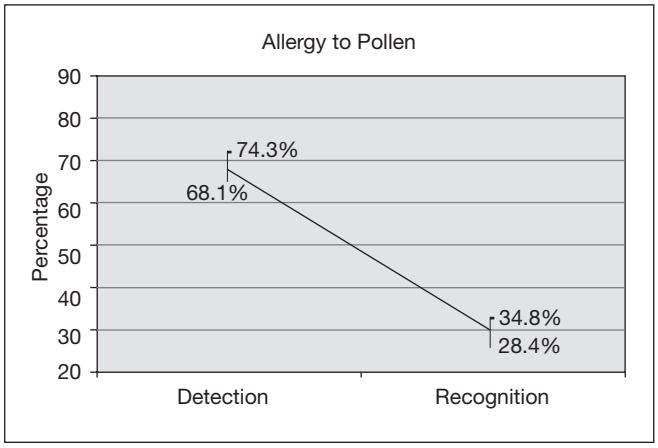

Figure 2. The sensitivity of the sense of smell is altered by pollen, with a confidence interval between 71%-64% for detection and 33%-27% for recognition.

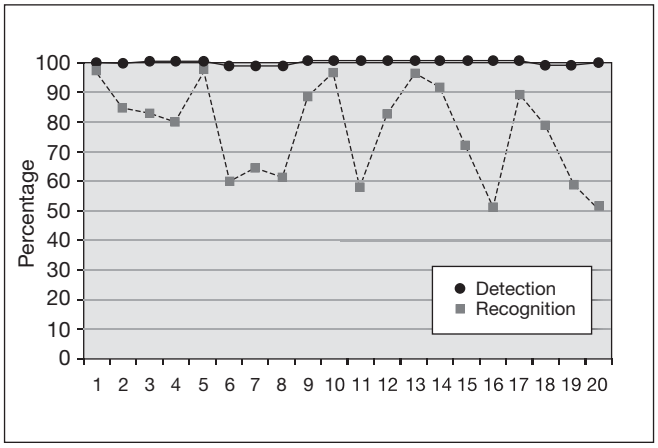

Figure 3. Within the control group the ability to detect smells, for all of the odours tested was almost 100% for the rate of detection. The ability to recognize shows inherent variations for each odour within the normal population.

there were no significant numbers. There was, however, a trend toward a higher degree of loss of smell in those patients with pollen-related allergic rhinitis (Figures 1 and 2).

Last of all, those patients with allergic rhinitis were compared with the control group, giving significant results. The control group had a 99% success rate in detecting the odours tested (Figures 3 and 4) while the group of patients with allergic rhinitis due to mites showed an ability to detect odours in between 60% and 80% of the smells tested, and the group of patients with pollen-related allergic rhinitis ranged between 53% and 83% (Figures 4 and 5). We must keep in mind that, in this examination model, "detect" means having enough ability to know that there is a smell in the environment, without going into the question of what the smell is.

Regarding the ability to recognize a smell, or the ability to know correctly what it is they were smelling, the group of patients with allergic rhinitis due to mites or pollen showed significant differences ($P>.05$) in comparison with the control group (Figures 3 and 4). Within the control group, a wide range of recognition can be seen, going from correctly recognizing smells at 51% (worst case) to 99% (best case) (Figures 3 and 4), while the group of patients with allergic rhinitis due to mites ranged from 12% to 52% recognition, respectively, and the group of patients with pollen-related allergic rhinitis ranged from 5% to 49% (Figures 4 and 5). Once again this confirms an impairment of the sense of smell in people with allergic rhinitis.

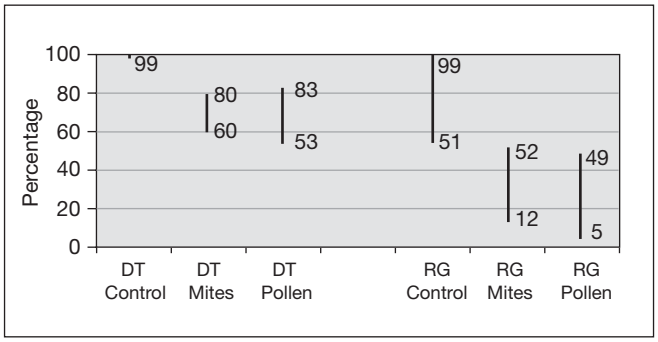

Figure 4. Variation ranges in comparisons between the control group and the pollen-related allergic rhinitis and the group of those with rhinitis from mite allergies. The control group was able to detect (DT) almost 100% (99%) of the odours, while in the allergic rhinitis groups the percentage of odours detected (DT) ranges from 53% to 83%. As for whether or not the patient can correctly recognize each smell, the numbers from the control group vary between 55% and 99% for those odours correctly identified (RG) while in the allergic rhinitis groups the odours were correctly identified between 5% and 52% of the time. In fact, it can be observed that the point where the ability was the highest (52%) for the group with patients suffering from allergic rhinitis is the point where the ability was the lowest for the group of people not suffering from allergic rhinitis (control group, 51%).

DISCUSSION

Allergic rhinitis is something frequently seen by otorhinolaryngologists and its incidence has been increasing over the past decades. The worldwide rate of people suffering from it ranges from 10% to 25% of the population.[10] The growing trend of this disease has opened up the field for detecting concomitant alterations not detected previously, one of which is the impairment of the sense of smell.[11] By using the BAST-24 olfactometric test, which is a quantitative-qualitative multisensorial system, the perception of different smells is analyzed and quantified, based on whether they are pleasant or unpleasant. This type of research differs from quantitative monosensorial tests (only pleasant substances or unpleasant ones).[12] Both complement each other and are dependent in such a way that variations in the olfactometric model correspond to variations in the other model.[13] The BAST-24 system provides us with significant variations of the olfactory alterations in pollen-related allergic rhinitis and those due to allergies to mites. The reason why this alteration occurs is as yet unexplained. There may be certain explanations that may justify this disorder, one of which may be the degree of interference with the Ag-Ac (IgE) reaction

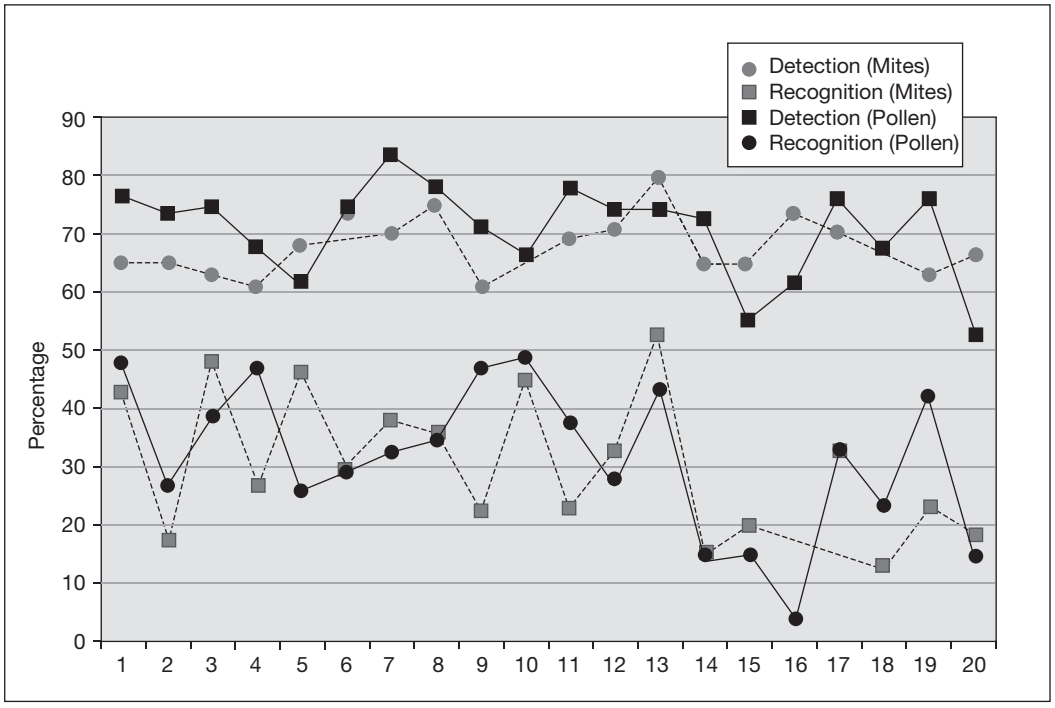

Figure 5. The ability to detect smells is altered less in those people allergic to pollen, who detect 14 more smells than those people allergic to mites, whereas the ability to recognize smells is almost equally affected in those people allergic to pollen as well as those allergic to mites.

that develops in the respiratory mucous mastocytes, which causes oedema, mucous secretion, itching and sneezing,[14] and is transported by trigeminal terminals that are activated by the same mediators[15] released by the mites through cysteine protease (an enzymatic structure from the mites' digestive tube transported in their faeces), while pollen-related rhinitis is due to glycoproteins found in the pollen's starch.[16,17] Both of these mechanisms would lead to alterations in the amount and quality of the mucous covering the olfactory receptor areas, thus influencing the transduction of the olfactory signal, which in turn would influence the sensorial ability to discriminate smells (the existence of odours more susceptible of being perceived and recognized than others).

We can conclude that, within the realm of general medicine as well as for allergologists and ENT specialists, the field of allergies is growing due to the progressive increase of immuno-allergic disorders. On the other hand, little by little, the olfactory alterations that patients describe demand answers from otorhinolaryngologists.

Thus the need for interdisciplinary knowledge is greater in order to handle these disorders. Observing allergic alterations together with olfactory changes leads us to confirm and quantify the presence of both manifestations. Thus, the following may be confirmed: *a)* allergic rhinitis produces olfactory alterations in both the detection and correct recognition of smells; *b)* these alterations may indicate slightly different mechanisms depending on the cause of the allergic rhinitis; *c)* not all people suffer from the same degree of olfactory alteration, depending on the degree of impairment produced by allergic rhinitis; *d)* not all smells have the same degree of altered perception, since we have confirmed that the perception of some is altered less than others (Figure 5); *e)* a trend (albeit not significant) can be seen, indicating that pollen-related allergic rhinitis leads to a greater loss of the sense of smell than rhinitis due to a mite allergy; however, this result may be due to the size of the sample; and *f)* those people with allergic rhinitis, independently of the fact whether or not they are allergic to pollen or to mites, present clear and significant ($P>.05$) alterations with a loss of being able to correctly recognize the controlled odours in relation to the general population (control group).

This information shows us the need for more detailed research regarding the possibility that there are different olfactory alterations according to the different types of allergic rhinitis. At the same time, we can infer the possibility of treating patients with olfactory alterations, whether or not they have been diagnosed as having allergic rhinitis, as well as the opposite situation of treating patients with allergic rhinitis that have not been treated for olfactory impairment. This is why we suggest that every patient with olfactory alterations or allergic rhinitis should be asked about the state of his or her sense of smell.

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