



Frequency and Clinical Features of the Oral Allergy Syndrome in Mexican Adults with Nasal Pollinosis

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RESUMEN

Antecedentes: el síndrome de alergia oral es una causa frecuente de alergia alimentaria en adultos. Nuestros objetivos fueron determinar su frecuencia y describir sus características clínicas entre sujetos mexicanos con polinosis nasal.

Métodos: el diagnóstico de síndrome de alergia oral se hizo mediante una historia clínica y pruebas cutáneas *prick-by-prick*. La muestra para estimar la frecuencia fue de 100 pacientes subsecuentes con polinosis nasal.

Resultados: la frecuencia de síndrome de alergia oral en los pacientes fue de 13%, la edad promedio fue de 29.9 años y 26 de los pacientes fueron mujeres. Los síntomas más frecuentes fueron prurito orofaríngeo, seguido de edema labial, con inicio al primer minuto después de ingerir el alimento. La media de los niveles de IgE sérica fue de 160 UI/mL y la media de eosinófilos fue de 278. Observamos que los alérgenos sensibilizantes predominantes fueron árboles, entre ellos, cedros. Detectamos un total de 23 diferentes alimentos relacionados a síndrome de alergia oral: durazno (23 casos), manzana (18 casos), pera (8 casos) y almendra (7 casos). El tiempo de evolución del síndrome de alergia oral se correlacionó significativamente con el tiempo de evolución de la rinitis alérgica ($\rho=0.49$ $P=0.006$) y la duración de síntomas de síndrome de alergia oral ($\rho=0.37$ $P=0.05$), mientras que las dos últimas variables mostraron una correlación independiente ($\rho=0.52$ $P=0.003$).

Conclusiones: los pacientes con polinosis nasal cursan con síndrome de alergia oral en una proporción considerable. En los pacientes sensibilizados a pólenes de cedros, ailé o ambos, debe sospecharse síndrome de alergia oral.

Palabras clave: aeroalergeno, alérgeno, reactividad cruzada, alergia alimentaria, sensibilización oral

ABSTRACT

Background: The oral allergy syndrome (OAS) is a common cause of food allergy in adults. Our objectives were to determine its frequency and to describe its clinical characteristics among Mexican subjects with nasal pollinosis.

Methods: The diagnosis of OAS was made using the clinical history and fresh food prick-by-prick tests. The sample to estimate the frequency consisted of 100 consecutive subjects with nasal pollinosis. The clinical features of OAS were described in thirty patients of this sample.

Results: The frequency of OAS among the subjects was 13%, the average age was 29.9 years and 26 subjects were women. The most common symptoms were oropharyngeal pruritus, followed by lip edema, starting mainly within the first minute after food ingestion. The median for the serum IgE levels was 160 UI/ml, while the mean for total eosinophils was 278. We observed that predominant sensitizing aeroallergens were trees, among them, oaks. A total of 23 different OAS-related foods was detected: peach (23 cases), apple (18 cases), pear (8 cases) and almond (7 cases). The OAS evolution time correlated significantly with the evolution time of allergic rhinitis ($\rho=0.49$ $P=0.006$) and the duration of OAS symptoms ($\rho=0.37$ $P=0.05$), whereas these last two variables showed an interdependent correlation ($\rho=0.52$ $P=0.003$).

Conclusions: The patients with nasal pollinosis have a considerable proportion of OAS. In subjects sensitized to pollen of oaks and/or alders, OAS should be suspected.

Key words: Airborne allergen, allergen, cross-reactivity, food allergy, oral-sensitization

OAS describes a number of subjects whose symptoms appear mainly in the oral cavity after consuming plant-derived food.¹ Its pathophysiological mechanism is the sensitization to pollen proteins through the respiratory tract and the induction of specific IgE, which also recognizes certain homologous proteins shared by some foods.²

Although the symptoms are mainly confined to the oropharynx, extra-oral manifestations are not infrequent: face and neck rash, ear pruritus, rhinorrhea, watery eyes, periorbital edema, among others. Systemic symptoms and anaphylaxis can be very rare.³

Approximately 8% of the subjects with nasal pollinosis have OAS (4), but this number can increase when

the pollens involved come from birch trees, 59-70%⁵ or from the *Oleaceae* family, > 50%.⁶

The plants mainly involved with OAS come from the botanical families *Rosaceae*, *Cucurbitaceae* and *Actinidiaceae*, to which the fruits such as peach, melon and kiwi belong, respectively.⁷

In Mexico, little is known about the frequency of OAS in subjects with nasal pollinosis; in the same way, the characteristics of the subjects suffering from this alteration and the pollens with which they co-exist are unknown. Hence, to determine their frequency and to identify the clinical characteristics and the foods most commonly related with their presentation, are some of the objectives of this study. In addition, the usefulness of the *in vitro* technique in comparison with the skin tests for allergens of plant origin was evaluated.

METHODS

A cross-sectional study was carried out; we selected our population from patients referred to the outpatient department of allergy at the Guadalajara Dr. Juan I. Menchaca Civil Hospital, between the months of August 2010 and April 2011; the majority were adults and all of them residents of the metropolitan area of Guadalajara, Mexico.

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In order to determine the frequency of OAS, one hundred patients with nasal pollinosis were questioned about the presence of oral symptoms related to food consumption. Subsequently, for the clinical characterization, 30 patients with OAS were included. Also, the presence of any personal or family history of allergic illness, exposure to cigarette smoke, time of starting and duration of rhinitis and OAS symptoms was inquired.

In those subjects who reported any discomfort in the oral cavity related to food ingestion, a fresh sample of the same food was requested to be brought for a prick-by-prick skin test. Only those cases showing at least one positive test were considered in the final analysis.

A blood sample was taken from the patients to quantify the total serum IgE, and the specific IgE from a food panel.

Description of the skin test techniques

All of the subjects received indications to stop taking antihistamines, steroids or other medications that could interfere with the results, at least one week prior to the skin testing.

To confirm sensitization to allergens, the SPT puncture technique was performed with disposable 1 mm lancets (ALK- ABELLÓ®). The allergens were placed on both volar regions of the forearms; 15 minutes after the puncture, those allergens with a papule 3 mm or more than the negative control were considered as positive. The allergen extracts used were pollens from 10 weeds, 4 types of grass and 12 trees; a positive control (histamine) and a negative control (Evans solution) were also applied. Additionally and in a systematic manner, fungi, house-dust mites (*Dermatophagoides farinae*, *Dermatophagoides pteronyssinus*), a mixture of cockroaches (*Blatella germanica* and *Periplaneta americana*), epitheliums (cat and dog), house dust and a mixture of feathers were evaluated by SPT. All of these extracts were placed in a 1:20 weight/volume, with 50% of glycerin concentration.

In the verification of the sensitization of the foods associated with OAS, the prick-by-prick technique was used,⁸ doing tests with each fresh food previously identified; additionally, in those subjects who identified symptoms related to exposure to latex-derived products, the same technique was used, placing a latex surgical

glove. The interpretation of the tests was performed in a manner identical to that previously described for allergens.

***In vitro* studies**

Total serum IgE was determined by a chemoluminescent immunoassay of paramagnetic particles. For determining specific IgE, with a panel of 36 food-types, a semi-quantitative technique (*Multiple allergen simultaneous test chemoluminescent assay*, MAST-CLA), with an automated equipment (*Hitachi Chemical Diagnostics*, Inc., USA) was used. In the latter, only those results reported as class 1 or above were taken into consideration.

Ethics

This study was endorsed by the Ethics and Research Committee of the Guadalajara Dr. Juan I. Menchaca Civil Hospital. All the subjects signed their written informed consent.

Statistical Analysis

The frequency of OAS was determined, as well as the accompanying clinical characteristics. For the quantitative variables, the mean and standard error were determined. In order to establish the correlation between quantitative variables, Spearman's rho test was used. A value of $P \leq 0.05$ was considered significant. Furthermore, we calculated sensitivity, specificity, positive predictable value (PPV), negative predictable value (NPV) and the Youden index. The processing of the information was carried out with the SPSS Program (*Statistical Package for the Social Sciences*) for Windows, version 18.0.

RESULTS

Among the 100 subjects with nasal pollinosis, the prevalence of OAS was 13%. In the 30 patients included for their clinical characterization, the average age was 29.9 years and there was a predominance of women. Table 1, shows that a large proportion had a family history of allergic illnesses and the most common co-morbidity was hypersensitivity to medications; the evolution time of the allergic rhinitis and the OAS was similar. In 13 patients (43.3%), the symptoms of nasal pollinosis preceded the OAS; in 5 patients (16.7%),

the symptoms began the same year and in 12 (40%), the OAS preceded the nasal pollinosis.

Table 2 shows that the oral symptoms in the study group were present mainly within the first minute after consuming the offending food, and their time of duration had a mean of 32 minutes. The main discomfort was pruritus in the oral cavity, especially pruritus in the palate region, followed by pruritus of the lips. The most frequent extra-oral symptom was facial rash, nasal and otic pruritus; among the systemic symptoms were generalized pruritus, followed by wheezing (one of them was sensitized to fruits from the *Rosaceae* family and another to avocado, almond and latex).

Table 3 shows the aeroallergens and foods to which the population studied was most frequently sensitized.

Table 1. Characteristics of patients with nasal pollinosis and oral allergy syndrome

<i>Characteristics</i>	<i>Indicator n = 30</i>
Mean age in years $\pm$ SD (minimum-maximum)	29.9 $\pm$ 8.9 (14-47)
Sex	
Male, n (%)	4 (13.3)
Female, n (%)	26 (86.7)
Family history of atopy, n (%)	24 (80.0)
Personal history of atopy, n (%)	9 (30.0)
Drug hypersensitivity, n (%)	4 (13.3)
Urticaria, n (%)	3 (10.0)
Asthma, n (%)	3 (10.0)
Cigarette smoking	
Non-smoker, n (%)	25 (83.3)
Ex-smoker, n (%)	3 (10.0)
Smoker, n (%)	2 (6.7)
Duration of allergic disease (years)	
Allergic rhinitis, mean $\pm$ SD (minimum-maximum)	8.7 $\pm$ 7.5 (1-27)
OAS, mean $\pm$ SD (minimum-maximum)	8.7 $\pm$ 7.4 (0.08-28)
IgE (IU / ml), median (minimum-maximum)	175.6 (9.8-1954.6)
Eosinophils account, mean $\pm$ SD (minimum-maximum)	247.9 $\pm$ 151.6 (40-740)

SD: Standard deviation.

n: Number of subjects with the characteristic of interest.

OAS: Oral allergy syndrome.

IgE: Immunoglobulin E.

Table 2. Clinical features in 30 subjects with oral allergy syndrome

Onset of symptoms following the ingestion of food (minutes), median (minimum-maximum value)	1.0 (1-20)	
Duration of symptoms, (minutes) mean $\pm$ SD (minimum-maximum value)	33.5 $\pm$ 36.4 (1-120)	
Oral symptoms n (%)		
Oropharyngeal itching	26	(86.7)
Palatal pruritus	23	(76.7)
Pruritus of lips	12	(40.0)
Burning	5	(16.7)
Edema	11	(36.7)
Paresthesias	8	(26.7)
Laryngeal tightness	2	(6.7)
Extra-oral symptoms n (%)		
Rash	4	(13.3)
Nasal and/or otic itching	4	(13.3)
Ocular itching	3	(10.0)
Rhinorrhea	2	(6.7)
Systemic symptoms n (%)		
Generalized pruritus	5	(16.7)
Wheezing	2	(6.7)
Urticaria	1	(3.3)

SD: Standard deviation.

OAS: Oral allergy syndrome.

From among the pollens, those from trees were the ones more remarkable (96.7%), among these the *Quercus* genus.

As a result of the food-specific IgE determination, the most frequent food allergens were apple (46.7%), peach (43.3%) and almond (26.7%); a diversity of allergic sensitization was detected in products of animal origin.

The patients identified a total of 23 plant-derived foods involved in OAS; two patients identified as many as 8, Table 4. A total of 131 prick-by-prick tests were done on fresh foods; 105 (80.2%) were positive. The majority of foods belonged to the *Rosaceae* family: peach (23/30, 76.7%), apple (18/30, 60%), pear (8/30, 26.6%) and almond (7/30, 23.3%). The symptoms caused by contact with products derived from latex were reported in 5 subjects; the cutaneous test with a latex glove was positive in two patients; one of them had a positive test to mango and another to avocado, peach and apple (latex-fruit syndrome).

The following associations were identified: mugwort-peach was found in 3 out of 5 subjects with sensitivity to *Artemisia vulgaris*; *Ambrosia*-melon-banana in 2 out of 8 subjects sensitive to *Ambrosia*, and the wormseed-fruit (peach, banana or melon) association in 5 out of 8 patients sensitized to *Chenopodium*; of 6 subjects allergic to *Ricinus communis*, 3 presented OAS associated with the consumption of pineapple.

The OAS evolution time correlated significantly with the evolution time of allergic rhinitis ($\rho=0.49$ $P=0.006$) and the duration of OAS symptoms ($\rho=0.37$ $P=0.05$); whereas the last 2 variables showed an interdependent correlation ($\rho=0.52$ $P=0.003$). The total count of eosinophils was significantly correlated with the duration time of OAS symptoms ($\rho=0.39$ $P=0.032$).

In order to estimate the sensitivity and specificity of the MAST CLA, in comparison with the prick-by-prick test, we selected those foods that were most commonly detected by this technique (peach, pear and almond), Table 5. The sensitivity was acceptable for the apple; however the test was more specific for apple and almond. In general, the positive predictable value was excellent for the 3 foods; however, the negative predictable value was low. According to the Youden index, the main usefulness of MAST CLA was to detect allergy to apple, and the least was for pear.

DISCUSSION

This study shows that the frequency of OAS among subjects with nasal pollinosis was 13%, which is greater than that observed in the United States, where children and adults sensitized to pollen was between 5% and 8%, respectively.⁴ In contrast, in Denmark 30% of the subjects studied presented some type of reaction following the ingestion of food related to pollen, with variations from 0% to 52%, depending on the pollen involved.⁹ In Mexico, OAS associated with sensitization to pollens of the *Oleaceae* family, was above 50%.⁶ With these discoveries, it is evident that the frequency of OAS is closely related to the predominance of sensitization to different pollens. In our study, we did not focus our attention on a particular type of pollens; instead, we decided to estimate the general frequency of OAS in subjects with nasal pollinosis sensitized both to seasonal

Table 3. Frequency of sensitization to aeroallergens and food in patients with oral allergy syndrome

Aeroallergens	n	%	Food *	n	%
Indoor	21	70.0	Apple	14	46.7
Cat	17	56.7	Peach	13	43.3
<i>Dermatophagoides pteronyssinus</i>	15	50.0	Almond	8	26.7
<i>Dermatophagoides farinae</i>	14	46.7	Peanut	7	23.3
Cockroaches Mix **	9	30.0	Citrus	7	23.3
Dog	8	26.7	Soy	7	23.3
House dust	8	26.7	Beans	6	20.0
Feathers mix	2	6.7	Carrot	5	16.7
			Avocado	5	16.7
Trees	29	96.7	Strawberry	5	16.7
<i>Quercus castanea</i>	21	70.7	Pea	4	13.3
<i>Quercus resinosa</i>	15	50.0	Tomato	4	13.3
<i>Alnus sp.</i>	15	50.0	Banana	4	13.3
<i>Prosopis sp.</i>	15	50.0	Oats	4	13.3
<i>Fraxinus sp.</i>	12	40.0	Wheat	4	13.3
<i>Cupressus lusitanica</i>	3	10.0	Corn	4	13.3
<i>Juniperus sp.</i>	3	10.0	Rice	4	13.3
<i>Acacia sp.</i>	2	6.7	Calabaza	3	10.0
<i>Eucalyptus sp.</i>	2	6.7	Potato	3	10.0
<i>Populus sp.</i>	2	6.7	Shrimp	3	10.0
<i>Schinus molle</i>	2	6.7	Cabbage	2	6.7
<i>Pinnus sp.</i>	1	3.3	Pepper	2	6.7
<i>Casuarina equisetifolia</i>	-	-	Yeast	2	6.7
			Seafood	2	6.7
Weeds	22	73.3	Chicken	2	6.7
<i>Amaranthus palmeri</i>	14	46.7	Turkey	2	6.7
<i>Ambrosia trifida</i>	9	30.0	Beef	2	6.7
<i>Chenopodium album</i>	8	26.7	Nut	1	3.3
<i>Helianthus annuus</i>	8	26.7	Chocolate	1	3.3
<i>Ricinus communis</i>	6	20.0	Tuna	1	3.3
<i>Artemisia vulgaris</i>	5	16.7	Pork	1	3.3
<i>Taraxacum officinale</i>	4	13.3	Milk	1	3.3
<i>Salsola pestifer</i>	3	10.0	Cheese	1	3.3
<i>Franseria tenifolia</i>	2	6.7	Egg	1	3.3
<i>Rumex crispus</i>	1	3.3	Casein	-	-
			Yolk	-	-
Grasses	15	50.0			
<i>Cynodon dactylon</i>	17	56.7			
<i>Phleum pratense</i>	13	43.3			
<i>Sorghum halepense</i>	12	40.0			
<i>Lolium perenne</i>	9	30.0			
Fungi	5	16.7			
<i>Alternaria alternata</i>	2	6.7			
<i>Hormodendrum sp.</i>	2	6.7			
<i>Helminthosporium halodes</i>	1	3.3			
<i>Aspergillus fumigatus</i>	-	-			
<i>Candida albicans</i>	-	-			
<i>Cladosporium spp.</i>	-	-			

* Specific IgE determined by MAST- CLA

***Blatella germanica* + *Periplaneta americana*

Table 4. Results of skin tests against fresh foods using *prick* by *prick*

		Patient																														
Number		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
Sex		F	F	F	F	M	F	F	M	F	F	F	M	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	F	F	F	
Age		40	41	39	38	17	25	35	24	31	14	26	16	28	37	32	47	28	25	41	37	19	38	21	30	24	17	40	25	26	38	
Food																																
Peach																																
Skin		+	+	+	+	-		+	+	+	+	+	+	+	+	+	-	+	-	+	+	+	-		+	+	+	+	+	+	+	+
Pulp		+	+	+	+	-		+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+		+	+	+	+	+	+	+	+
Apple		+	+	-			+	+	+	+	-	+	+	+		+	+	+	+	+	+	+			+	+	+	+	+	+	+	+
Almond		+	+							+			+	+		+				+	+	+				+			+	+	+	-
Pear		+	+						+		-		+	+		+				+	+											-
Strawberry			+						+												+				+				+			
Plum		-							+		-										+				+							
Mango						+	+								+														+			
Avocado										+			+		+																	
Kiwi											+												+	+	+							
Nut		+							-			+																		+		
Peanut		-											+																			
Pineapple					+			+							+		-							+					+			
Grape						-																										
Tomate		-																														
Papaya		-													+								+									
Melon						-			+						+	+					+		+						+			
Banana					+	+		-						+	+	+	-					+										
Orange						-											-															
Mandarin																																
Guava										-																						
Carrot													+																+			
Potato													+																			
Soy			+										+																			+
Others													+																			
Latex						-	+	-		+			-																			
F: Female																																
M: Male																																

Table 5. Evaluation of MAST-CLA in comparison with skin prick tests to plant foods

	<i>Peach</i>		<i>Apple</i>	<i>Almond</i>
	Skin	Pulp		
Sensitivity (%)	47.4	47.6	73.3	57.1
Specificity (%)	50.0	50.0	100	100
PPV (%)	81.0	90.9	100	100
NPV (%)	16.6	8.3	42.9	25
Youden index	-0.03	-0.02	0.73	0.57

PPA: Positive predictive value.

NPA: Negative predictive value.

MAST-CLA: Multiple allergen simultaneous test-chemiluminescent assay

pollens and perennial pollens; hence, in order to predict the frequency, the patients with nasal pollinosis should be stratified in accordance with the sensitization to different types of pollens. Two additional points that influence the frequency of OAS are concerned with the definition used and the degree of the physician's suspicion;⁴ the other one, is related to the intensity of symptoms, since when the severity is noticeable, its detection is expected to be easier.

In the patients studied here, a very high proportion of sensitization to tree pollens was observed; this phenomenon is due to the fact that the patients live in a city located in a large valley in the West of Mexico, surrounded by mountains, and a large forested zone with pines and oaks, and with a large number of *Prosopis* trees in the proximity. Moreover, there are important species within the city such as ficus, ashes, alders, eucalyptus and poplars among others; consequently, there exists a considerable aerial dissemination of, and exposure to, pollen coming from all of these sources.

Interestingly, in our study a considerable proportion of the patients (16.3%) showed some type of systemic symptoms. A survey among United States allergists showed that 20% of their patients with OAS had systemic symptoms.⁴ This behavior led this group of researchers to propose that instead of the term OAS, the term pollen-food syndrome (PFS) should be used to identify those subjects sensitized to pollen and who present symptoms related to fruits or vegetables. We decided to continue using the term OAS since the term PFS

has not yet been generalized; moreover, an additional definition exists that has been proposed for identifying these patients, which is: hypersensitivity syndrome due to contact with food.¹⁰

We observed that the main botanical family implicated with OAS was *Rosaceae*, where the peach predominated (more than 75%). Similar findings were found by Cuesta-Herranz *et al.* in 95 subjects allergic to pollen, from Madrid.¹¹ In Switzerland, by means of the detection of specific IgE for several different foods, Bircher *et al.* found a predominant sensitization in the *Rosaceae* family, but the predominating fruit was apple, and not peach.¹² A recent study in Tokyo, by Inomata *et al.* showed a discreet predominance of sensitization with apple over peach.¹³ From these studies, we can infer that the patterns of the consuming of plants and their capacity of sensitization are strongly related with the predominance of the foods involved in OAS.

Although OAS becomes common in patients with nasal pollinosis, a large proportion of them do not develop OAS. The risk factor that has mainly been related with OAS is the species of pollen that sensitizes the patients;^{5,6,15} other factors, such as female sex,^{13,14} asthma, increased levels of IgE and time of duration of the pollinosis (5) have also been associated with OAS. Our study contributes additional data regarding the predominance of OAS in women.

One of the most common associations with OAS occurs between sensitization to *Betula* and *Rosaceae* family pollens.^{16,17} To our knowledge, it has not been possible to document the existence of birch trees in this geographical area; however, there was a predominance of sensitization to foods proceeding from the *Rosaceae* genus. It is probable that other species of trees may be related, among them the *Alnus* and *Quercus* genera. In the same way, it has not been possible to document the presence of privet trees or bushes in the areas surrounding the metropolitan zone of Guadalajara; however the latter does exist in a large ecological reservation to the West of the city, where diverse species of these predominate. Mexico is a country with a great diversity of species of the *Quercus* genus.¹⁸ The point of convergence of this behavior could be found in the botanical order to which all these belong, the *Fagales*, where the families such as *Fagaceae* and *Betulaceae* are found.

The latex-fruit syndrome was found in five patients of our study (16.7%). Previous studies have shown similar results, with frequencies varying from 10.5 to 20%.^{7,19} On the other hand, the frequency of allergy to fruits in subjects sensitized to latex has been estimated at approximately 70%.²⁰

More than 15 years ago, Valenta and Kraft²¹ claimed that the sensitization to pollen precedes the development of OAS. Two recent studies confirmed that more than 90% of the cases with OAS were preceded by respiratory symptoms.^{5,7} A Japanese study showed that 47% of the subjects studied with OAS, this was preceded by nasal pollinosis;¹⁷ in our sample, we observed that the behavior is concordant with these latter findings; however, the average time of commencement of both ailments was very similar (8.7 years) and likewise, these correlated significantly with one another.

In a complementary manner, in the subjects studied, specific IgE was determined using a food panel by means of an *in vitro* technique. Using the cutaneous prick-by-prick tests as a standard, we found that MAST CLA had a variable sensitivity and specificity, depending on the food under analysis. These variations have also been documented in Korea, where the minimum and maximum limits of sensitivity and specificity varied between 0% and 100%, with a mean of 44.5% and 96.0%, respectively.²² The allergens that have more constantly shown a greater diagnostic validity by MAST CLA are the house dust mites.^{22,24} As a consequence of these variations in the results, we consider that MAST CLA should be reserved for those cases where the skin tests have a risk for anaphylaxis or could be inhibited by medications (e.g. antihistamines), or where a skin disorder may impede its use.²⁵

CONCLUSIONS

The process of sensitization to pollens, modulated by the geographical and climatic differences significantly influences the process of crossed reactivity with foods; as a consequence, the frequency of OAS in patients with nasal pollinosis will depend on these variations. One of the botanical families most frequently associated with OAS is the *Rosaceae*. OAS symptoms are usually mild and confined to the oral cavity; however, in some cases

these symptoms can become severe. Skin tests with fresh foods are mostly effective to detect sensitization; but in those cases where it is not possible to use them, an *in vitro* technique is recommended.

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