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Prevalence of pollinosis in the Basque Country

Key words: age distribution; climate; epidemiology; hay fever; *Lolium*; prevalence.

Background: The prevalence of allergic diseases, mainly pollinosis, has increased within the last decades. Our study aimed to determine the prevalence of sensitization to Poaceae pollen in the Basque Country. This is a region of northern Spain, with an area of 7261 km² and a population of 2 109 009 inhabitants. Two different climatic regions may be distinguished in the Basque Country (the Atlantic and the Oceanic).

Methods: A transversal study was carried out on 2216 subjects, aged 10–40 years. A personal interview was carried out in order to compile study data, by means of a questionnaire that had been previously validated with a clinical history and an allergy study.

Results and Conclusions: Our results show the prevalence of pollinosis in the Basque Country to be 10.6% (C.I. 95% 9.35–11.96%) without significant differences between men and women. The prevalence in the Atlantic climate area (9.71%) was lower than in the Oceanic climate area (13.61%). There were no differences between persons living in a rural environment (10.87%) and those living in an urban setting (10.51%). Pollinosis was more frequent in individuals aged 10–20 (11.41%) and 20–30 (12.54%) than those aged 30–40 years (7.43%). Three features significantly distinguished pollinic from nonpollinic patients:

- 1) a more common complaint of symptoms after ingestion of Rosaceae fruits or nuts (10.2%)
- 2) a family history of atopy (8.8%)
- 3) a greater occurrence of bronchial asthmatic symptoms (23%).

It has been reported that the prevalence of allergic diseases (asthma, rhinitis, and atopic dermatitis) has increased progressively over recent years [1–3]. In particular, the prevalence of pollinosis has increased by two- to fourfold

over the last decades (4). In the light of this, our study aimed to determine the prevalence of pollinosis induced by Poaceae pollen in the Basque Country. The objective was to establish whether such a prevalence is comparable with that of other regions and whether it is influenced by climatic conditions. The Basque Country is a region of northern Spain with an area of 7261 km². Its population is 2 109 009 inhabitants.

Two different climatic regions may be distinguished (Fig. 1). Most of the territory is characterized by the Atlantic climate. The inner zone belongs to the inland Oceanic climate or Atlantic–Mediterranean transition area. In 1992, sampling stations at Vitoria (Oceanic climate area) and Bilbao (Atlantic climate area) collected 4400 and 3882 grass pollens/year, respectively.

Material and methods

Population

The study was carried out on a group of people aged 10–40 years. The sample universe population was 1 021 270 people.

The sample size required for an expected 12% prevalence with a 2% degree of accuracy and 95% confidence interval

was 1013 subjects. Therefore, a random sample of 1013 people was requested from the Basque Statistics Institute (EUSTAT), selected by age and sex and according to the distribution of these variables in the Basque Country. In order to maintain the privacy of the affiliation data, the EUSTAT provided a random sample, dividing the region into 200 weighted sections according to the number of inhabitants, and selected randomly six postal addresses within each of these sections (1200 homes altogether). Because all of the homes might not include persons belonging to the age group of the sample, two additional homes were provided within each section. We interviewed all the members in the family unit aged 10–40 years, thus resulting a final sample size of 2216 people.

Method – questionnaire

The survey was carried out between October 1992 and March 1993. Four interviewers, not attached to the health service and appropriately trained, were employed for this purpose. Given the fact that the great majority (98%) of the patients allergic to pollen who attended at the allergy units of the Basque Country were sensitized to Poaceae pollen, the design of the questionnaire aimed specifically to identify the patients allergic to this pollen.

First of all, the questionnaire was validated in two phases. The first phase was intended to check the degree of understanding, acceptability, and ease of interpretation by testing the questionnaire on groups from different cultural levels. As shown in Table 1, the definitive format of the different items on the survey was established according to the suggestions that resulted from the first phase. In the second phase, the questionnaire was tested on 171 students from either technical or university schools, in order to determine its internal validity. For those who reported any respiratory symptoms, even without a clinical relationship to pollinosis, a detailed medical history and a series of skin prick tests were carried out by the authors. Skin prick tests were performed by the usual method with *Lolium perenne* and *Dermatophagoides pteronyssinus* (Pharmacia, Uppsala, Sweden), histamine hydrochloride (10 mg/ml), and buffered saline solution (NaCl 0.9%). Skin tests were considered positive when a wheal diameter equal to or greater than the one induced by histamine control was obtained. Some 30% of the asymptomatic interviewees were also skin tested with these allergens, and detailed medical histories were taken as well, none of them revealing a respiratory disease related to pollen sensitization.

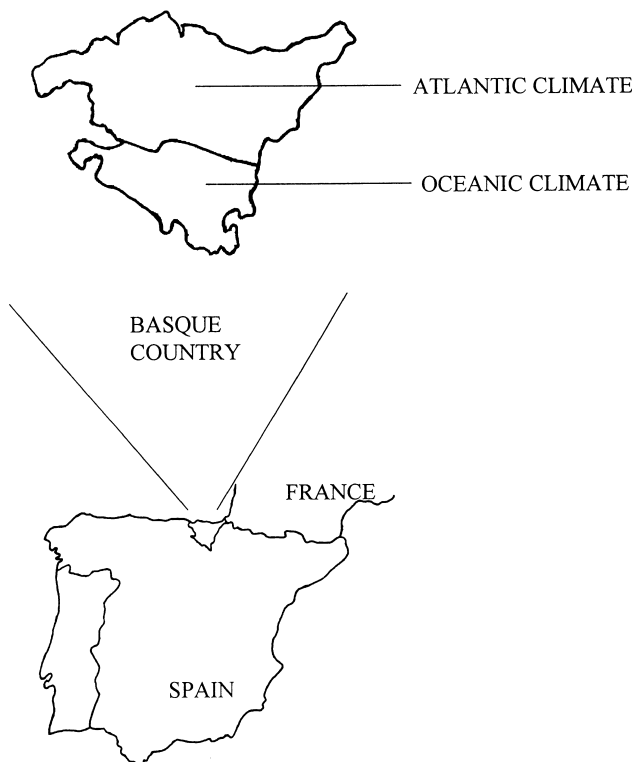


Figure 1. Map and climate regions of Basque Country.

According to this survey, any person whose answers conformed to all of the following was defined as pollinic:

- at least two or more of the symptoms of question 1
- over 1–3 months or 1 week to 1 month (question 2)
- during the spring or spring and summer (question 3)
- with greater intensity in spring than in the rest of the year (question 4)
- at least one previous year (question 5).

In the validation sample, we found 14 true-positive cases, 151 true-negative cases, six false-positive cases, and no false-negative cases. Therefore, the sensitivity was 100% and the specificity was 96%.

Statistical analysis of the results was carried out by Student's *t*-test to compare averages, and the chi-square test, with Yates correction when necessary, to compare qualitative variables, in the SPSS statistical program. The accepted significance level was $P < 0.05$.

Results

The total of surveyed people was 2216 (1063 men and 1153 women) with an average age of 24.42 years (SD 8.74). This sample showed no significant differences from the same age group in the general population of the Basque Country in sex, age groups, distribution by province, and place of residence (rural or urban) (Table 2).

The total of people classified as pollinic was 235 with a prevalence of 10.6% (CI 95% 9.35–11.96%) in the Basque Country. The average age of the pollinics was significantly lower than that of the nonpollinics in the sample (Table 2). The sex distribution for pollinics was 110 men (10.35%) and 125 women (10.84%) without significant differences between the two groups. No significant differences were found between the age of male (21.85, SD 7.74) and female pollinics (23.51, SD 8.23 years) ($t = -1.59$, $P = 0.112$).

When comparing the two climatic areas of the region, the prevalence was greater in the Oceanic (13.61%) than in the Atlantic climatic area (9.71%) (Table 2).

No significant differences were found between the rural (up to 10000 inhabitants) and urban (over 10000 inhabitants) places of residence (Table 2) in the prevalence of pollinosis among the Basque population.

The greater prevalence among the three age groups into which the sample was divided (Table 2) was in the intermediate age group (12.54%), constituted by individuals aged 21–30, followed by the youngest, the 10–20 years of age group (11.41%). Significant differences were found between

the younger age groups and the oldest age group (prevalence: 7.43%), but not between the two younger age groups.

All the pollinic subjects had nasal symptoms: 86% itching, 78% sneezing, and 59% nasal blockage. Exactly 71.49% suffered from eye symptoms. Bronchial symptoms (chest tightness and/or wheezing) were mentioned by 23% of the pollinics. In contrast, bronchial symptoms were reported by only 3.5% of the individuals classified as nonpollinic (chi square = 180.02; $P < 0.001$).

Family allergy background was reported by 24.4% of the pollinics, in contrast to only 8.8% of the nonpollinic subjects (chi square = 49.99; $P < 0.001$).

In addition, symptoms after contact with or ingestion of Rosaceae fruits (peach, apricot, plum, etc.) or nuts were reported by 10.2% of pollinics, but by only 1.5% of the nonpollinic subjects (chi square = 63.21; $P < 0.001$).

Discussion

Pollinosis is one of the most common and characteristic allergic diseases worldwide. In Spain, it is the main reason for attending allergology units (5). Over the last few decades, several epidemiology control studies have reported an increasing prevalence for pollen allergy. In Switzerland, Wüthrich et al. (4) observed an evident increase over the current century, from 0.82% at the beginning of the century to 13.5% in 1993. Despite numerous studies made on the topic, figures of prevalence reported have been as variable as 3% (6) or 39% (7); therefore, the real prevalence is not certainly known. Over the last few years, different European studies report prevalence rates ranging between 10% and 15% (8, 9). In Spain, few epidemiologic studies have been carried out (10), and the estimated prevalence (10.6%) resembles the European mean.

Climatology and vegetation determine the level of exposure to pollen in a given region, both in quantity and pollen type (11). This circumstance is evident in the medical literature, with different prevalence rates obtained according to geographic and climatic variations. Strachan (12) found a 19.8% prevalence in southeastern England but 11.7% in the north. Charpin et al. (13) found even greater differences between two cities of southwestern France, Senas and Marseille. Senas, with a high level of exposure to grass and cypress pollens, showed a high prevalence of pollinosis (31.5%), in comparison with Marseille (14.1%), where the exposure level was lower. In our study, we could also detect a significantly lower prevalence of pollen allergy at the seashore (9.7%) with an Atlantic-type climate than in the

Table 1. Questionnaire items used in study

1. During the current spring (May to July) did you suffer from any of the following symptoms?		
Sneezing	Yes	No
Itchy nose	Yes	No
Itchy or red eyes	Yes	No
Nose blockade	Yes	No
Runny nose	Yes	No
Chest tightness or wheezing	Yes	No
If your answers were No to all the above, move on to question number 6.		
2. How many days of the year do you suffer from these symptoms?		
Less than 1 week	From 1 week to 1 month	
1–3 months	More than 3 months	
3. In which season of the year do these symptoms appear?		
Spring	Summer	Autumn Winter
4. Are the symptoms more severe in spring than the rest of the year? Yes No		
5. In which previous years have you also had these symptoms?		
1987	1988	1989 1990 1991
6. Have you ever had itching in the mouth or urticaria when eating fruits (peach, apple) or nuts? Yes No		
7. Is anyone in your family allergic to pollen (parents, brothers or sisters, children)? Yes No		

inland, Oceanic-type climatic area (13.61%). This difference may be due to the cereal crops and the different pollen counts in the latter area.

Age is also an important variable. Like other allergic diseases, pollinosis, mainly affects people in their twenties and thirties; therefore, most studies have focused on subjects in these age groups, such as students or military recruits. In our study, unlike those mentioned above, we included patients belonging to all the age groups in which the highest rates of prevalence are described (15–25 years in England and Wales, 10–19 in Denmark, 24 in the USA, and 25–35 in Australia) (14–16). As expected, in our population

sample – 10–40 years of age – the highest frequency of pollinosis was also found in these age groups, especially 20–30 years (12.5%) and 10–20 (11.1%), with significant differences between these groups and the oldest age group.

Over the last few years, publications have disputed the classic view that pollinosis is more frequent in urban than in rural areas. In contrast to Broder et al.'s classic study (17) reporting a prevalence of pollinosis in Tecumseh, Michigan, three times higher in the urban population than in the rural population, Wüthrich in Switzerland (18) and Strachan (14) in the UK did not find differences between rural and urban habitats, but rather between polluted habitats (usually urban)

Table 2. Percentage of sensitization to Poaceae pollen distributed by age, sex, habitat, climate, and age group

	Age (years)	Sex	Residence (inhabitants)	Climate (inhabitants)	Age groups (years)
Pollinic <i>n</i> = 235 (10.6%)	22.73 ± 8.03	Men: 110 (10.35%) Women: 125 (10.84%)	Rural: 64 (10.87%) Urban: 171 (10.51%)	Atlantic: 166 (9.71%) Oceanic: 69 (13.61%)	10–20: 99 (11.41%)* 21–30: 88 (12.54%)** 31–40: 48 (7.43%)
Nonpollinic <i>n</i> = 1981	24.62 ± 8.80	Men: 953 Women: 1028	Rural: 525 Urban: 1456	Atlantic: 1543 Oceanic: 438	10–20: 769 21–30: 614 31–40: 598
	<i>t</i> = 3.14 <i>P</i> = 0.0009	χ^2 = 0.0946 <i>P</i> = 0.758	χ^2 = 0.0263 <i>P</i> = 0.871	χ^2 = 5.86 <i>P</i> = 0.015	* χ^2 = 6.23; <i>P</i> = 0.0126 ** χ^2 = 9.11; <i>P</i> = 0.0025

and unpolluted habitats (usually rural). In this sense, over the past few years, several authors have described a possible link between the prevalence of allergic respiratory diseases and the level of environmental pollution, determined by the presence of sedimentary material, ozone, and nitrogen and sulfur dioxides (19). In our work, no differences were found between rural and urban habitats, a fact probably related to the high level of industrialization of the whole region.

Lower airways symptoms (wheezing/chest tightness) associated with nasal-ocular symptoms are frequent in patients with pollen allergy, although wide variations have been described according to environmental pollinic pressure and the predominate type of pollen (20), ranging from 5% to 34% (21). In our series, approximately 25% of the

subjects identified as pollinic reported chest symptoms during the season, compared to 3.5% of the subjects who were not allergic to pollen. We considered this percentage within the limits expected in our environment.

The association between pollinosis and fruit allergy (with oropharyngeal symptoms in particular) is strong. Regarding birch pollen and Rosaceae fruits, this association has been found in up to 50% of cases (22), a finding which could probably be explained by common antigens. In our series, the percentage of pollinic subjects who answered "yes" to the question, "Have you ever had itching in the mouth or urticaria when eating fruit (peach, apple) or nuts?", was also significantly higher than that of the rest of the interviewees (24.4% vs 8.8%).

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