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ORIGINAL PAPER

Airborne pollen in Córdoba City (Spain) and its implications for pollen allergy

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Abstract Pollen allergy is among the most widespread allergic disease in Andalusia. However, few studies have examined patient information in conjunction with data on airborne pollen concentrations. This paper sought to identify the airborne pollen types prevalent in Córdoba, to examine the relationship between airborne pollen and the occurrence of allergies, and to investigate the use of drugs to treat various symptoms displayed by pollen-allergy sufferers over the study period. A prospective longitudinal study was conducted in Córdoba City between February and June in 2014 and 2015, using an original specific questionnaire to collect socio-demographic, symptom and pollen-allergy data. Airborne pollen was collected using a Hirst-type volumetric spore trap. Descriptive and inferential statistical analysis was applied. A total of 178 sensitive subjects were included in the study. The prevalence of allergy to olive, grass and plane-tree pollen was 70.73, 73.17 and 19.51%, respectively, in 2014, and 70.83, 70.83 and 21.12%, respectively, in 2015. In both years, rhinitis was the most common allergic symptom (93.90% in 2014, 87.75% in 2015) and a significant correlation between the occurrence of rhinitis and antihistamine consumption was found ($p < 0.05$ in 2014, $p < 0.001$ in 2015). The percentage of asthmatic subjects using an inhaler was significantly higher than those who did not used it (63.16% vs. 26.98%; $p < 0.01$). In conclusion, this paper supports previous studies showing that the most allergenic pollen types in spring were olive, grass and plane-tree pollen. In addition, we found that rhinitis was the main symptom and antihistamines the medication most widely used by the sensitized population in Córdoba.

Keywords Aerobiology · Pollen allergy · Seasonal symptoms · Allergology

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1 Introduction

The worldwide problem of pollen allergy has been increasing over recent years (D'Amato et al. 2007). In Europe, pollen-allergy sufferers reportedly account for between 5 and 30% of the population in industrialized countries (Asher et al. 2006). The most prevalent manifestation of allergy is respiratory allergic disease, a common designation for a set of related symptoms including rhinitis, conjunctivitis and asthma (Pawankar et al. 2011). The prevalence and intensity of these symptoms may vary both, among individuals (Berger et al. 2013) and also as a function of pollen-season characteristics and the abundance of airborne allergens is associated with other environmental factors (D'Amato et al. 2007; Bousquet et al. 2012). Pollen-monitoring networks provide valuable information on daily pollen concentrations and symptom risk levels, thus enabling local allergy sufferers and physicians to be forewarned (Scheifinger et al. 2013). Patients are treated with drugs such as antihistamines, nasal corticosteroids in case of rhinoconjunctivitis, and bronchodilators and inhaled corticosteroids for asthma (Brozek et al. 2010; Burks et al. 2013).

Airborne pollen patterns in any geographical area are largely predetermined by local vegetation and climate (Jato et al. 2002; Gioulekas et al. 2004), and pollen concentrations are governed mainly by the abundance of local pollen sources (Galán et al. 2016). Certain wild plants have great allergenic potential. Grasses are the main cause of pollen allergy in Europe (D'Amato et al. 2007; Frati et al. 2010; Recio et al. 2010; Nadih et al. 2012); in Cordoba City (S Spain), 73% of pollen-allergy sufferers are sensitive to these pollen (Sánchez-Mesa et al. 2005). The production of olives (*Olea europaea* L.) is one of the major economic activities and also a leading cause of respiratory allergic disease in the Mediterranean basin; in Andalusia it is regarded as the main cause of allergy (Orlandi et al. 2005; Aguilera and Valenzuela 2012; Oteros et al. 2015). Plane-trees (*Platanus* sp.) are widely used for ornamental purposes in southern Europe; the most commonly grown species is *Platanus* × *hispanica* Miller ex Münchh (López Lillo et al. 2000). A number of authors have identified the plane-tree as a major cause of pollen allergy in various Spanish cities (Alcázar et al. 2004; Iglesias et al. 2007; Recio et al. 2009). The Urticaceae family is represented by *Urtica* and *Parietaria* whose pollen—among the most potentially allergenic in the Mediterranean region (D'Amato and Spieksma 1992; Trigo et al. 2008)—is common in Córdoba (Galán et al. 2000; Velasco-Jiménez et al. 2013).

A number of studies have focused on the relationship between airborne pollen concentrations and the allergic disease, reporting a positive correlation in Europe (Feo-Brito et al. 2011; Kmenta et al. 2014; Bastl et al. 2014, 2015). In Córdoba, some studies have highlighted the role of certain plant families in the development of pollinosis: Domínguez-Vilches et al. (1995), for example, found a positive correlation between the increased optical density of airborne particles and the symptomatic response in patients; Cariñanos et al. (2002) concluded that privet pollen should be regarded as a potential causative agent of local allergy problems in areas where the shrub is widely grown and where there are certain aggravating urban factors; Alcázar et al. (2004) reported that symptoms in early spring are more intense and persistent in districts with a larger number of plane-trees; and Sánchez-Mesa et al. (2005) observed some differences in the symptoms in patients suffered by pollen-allergy patients in different areas of the city due to varying local emission of biological and non-biological particles.

Using the major pollen types identified by prior research in the city of Córdoba, and with a view to analyzing the effects of aeroallergens on the pollinosis, the objectives of this study were (1) to examine the relationship between airborne pollen and the problem of allergies and (2) to investigate the use of drugs to treat the various symptoms displayed by pollen-allergy sufferers over the study period.

2 Materials and methods

2.1 Study area

Data for this prospective longitudinal study were collected between February and June in 2014 and 2015 in the southern Spanish city of Córdoba (30S UTM X: 341642; UTM Y: 4192085), in the southwestern Iberian Peninsula. The city has 333,033 inhabitants (latest census, 2011); it lies at 123 meters above sea level and covers a surface area of 290.23 km^2. Córdoba has a Mediterranean climate with some continental features, characterized by cold temperate winters and hot dry summers. The mean annual temperature is 18.2 °C, and mean annual rainfall is 605 mm (30-year averages, 1981–2010, data from the Spanish Meteorological Agency, AEMET 2011). The natural flora is typical of the Mediterranean Basin, and the main agricultural crops are olive, cereals and sunflower. Cypress, privet, poplar, elm and plane-tree are widely grown as ornamentals urban green spaces. Grasses and some trees have been linked with pollen allergens and possible cross-reactions (http://www.allergome.org/).

2.2 Subject population

A total of 178 subjects (82 in 2014, 96 in 2015; 58.53% women in 2014 and 58.33% women in 2015) were included in the study. Mean age was 28.5 years (range 18–59). All subjects were sensitized to pollen; 70.40% were resident in Córdoba province and were studying or working at the Rabanales Campus, University of Córdoba.

The inclusion criteria were: (1) Subjects suffering from rhinitis, conjunctivitis or asthma during the spring pollen season (symptoms mainly between March and June). Common symptoms include wheezing, dyspnoea, congestion with phlegm, sore throat and persistent cough (Mohan et al. 2014); (2) resident for at least the last 2 years in Córdoba City; (3) aged over 18; (4) previous positive pollen allergy test performed by an allergy specialist. This method is reliable for diagnosis of IgE-mediated allergic disease in patients with rhinoconjunctivitis, asthma, urticaria, anaphylaxis, atopic eczema and suspected food and drug allergy. It is minimally invasive, inexpensive, and results are immediately available and reproducible (Heinzerling et al. 2013).

The exclusion criteria were: (1) gaps in 2-year data collection (2) nasal polyposis and sinusitis.

2.3 Symptoms and medication surveys

Data collection was carried out in the Rabanales Campus, University of Córdoba. The dossier designed for data collection included: (1) an informative letter which stressed that participation was voluntary and anonymous; (2) an explicit request for collaboration; (3) a signed and dated consent form in which the subject agreed to participate in the study; and (4) an original specific questionnaire used to collect socio-demographic, symptom and pollen-allergy data. The questionnaire was hand-delivered to subjects, and completed dossiers were returned directly to the researchers. The variables recorded were: gender, age, previous positive pollen allergy test (yes, no), pollen allergy (olive, grass, plane-tree, nettle/parietaria, others), symptom data (asthma, conjunctivitis, allergic rhinitis) and consumption of medication (eyedrops, nasal sprays, antihistamines, immunotherapy, inhalers). The category of "other" pollen types comprised those with a lower percentage of sensitization in patients, i.e., *Pinus*, Asteraceae and *Quercus*. Most subjects voluntarily provided a phone number. Telephone interviews, carried out during workdays once a week, lasted an average of 2 min.

This study focused only on subjects sensitized to pollen. The range of potential symptoms included those prompted by various pollen types (grass, olive, plane-tree and Urticaceae pollen), since the majority of subjects were polysensitized.

All procedures involving human participants were conducted in accordance with the ethical standards of the institutional committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

2.4 Airborne pollen

Airborne pollen was collected using a Hirst-type volumetric spore trap based on the impact principle (Hirst 1952). The trap is located 22 m above ground level, in the Rabanales Campus, University of Córdoba.

Monitoring and data management were carried out in accordance with guidelines published in the Spanish Aerobiology Network (REA) Management and Quality Manual (Galán et al. 2007). Data were expressed as daily average of pollen grains/m^3 of air.

Grass, olive, plane-tree and Urticaceae pollen were studied, since these are regarded as the main cause of pollinosis in Córdoba during the spring (Sánchez-Mesa et al. 2005).

2.5 Statistical analysis

Statistical analyses were carried out using G-STAT version 2.0 for Windows. Data on airborne pollen and the sensitive population were expressed as absolute frequencies, percentages and 95% confidence intervals. Chi-square test or Fisher's exact test were applied to study the association between symptoms and use of medication. p values of <0.05 were considered significant in all statistical tests.

3 Results

3.1 Airborne pollen and sensitive population

Over the study period, the major cause of allergy in the sensitized population was grass pollen, followed by olive pollen, plane-tree pollen and finally Urticaceae pollen. A total of 73.17 and 70.83% of subjects manifested allergy symptoms in response grass pollen in both study years, respectively; 70.73 and 70.83% of the subjects showed symptoms in response to olive pollen, 19.51 and 21.12% to plane-tree pollen and 4.88 and 4.17% to Urticaceae pollen (Table 1). Data for symptoms in response to pollen by age group in 2014 and 2015 are shown in Table 2.

3.2 Subjects suffering symptoms and using medicaments

Rhinitis was the symptom most frequently reported by subjects (93.90% in 2014, 87.75% in 2015); asthma was the least frequent (35.36% in 2014, 18.75% in 2015). The occurrence of rhinitis, conjunctivitis and asthma was greater in 2014 than in 2015. Antihistamines were the most common medication for allergy (80.49% in 2014, 77.08% in 2015). Eyedrops were used to a lesser extent, by 25% of patients in 2015 and 19.51% in 2014 (Table 3).

3.3 Meteorological results

Over the study period, average temperatures from January to June were fairly similar in 2015 (15.69 °C) and 2014 (15.28 °C). However, January–June rainfall was considerably higher in 2014 (319.4 mm) than in 2015 (158.9 mm).

3.4 Airborne pollen versus symptoms

Higher pollen concentrations were detected in 2014 (Annual Pollen Index-API 53,112 vs. 48,867 in 2015). Olive pollen counts were higher than those of other pollen types in both study years: API 39,035 in 2014 and 40,758 in 2015. Grass pollen concentrations were higher in 2014 (9342 API) than in 2015 (4300 API), plane-tree pollen concentrations were higher in 2014 (3629 API) than in 2015 (2934 API), and Urticaceae pollen concentrations were higher in 2014 (1106 API) than 2015 (875 API). In 2014, a significant positive correlation was found between all pollen types and occurrence of rhinitis and conjunctivitis, except between occurrence of conjunctivitis and plane-tree pollen. In 2015, a significant positive correlation was observed between grass pollen concentrations and the presence of all symptoms; a significant positive correlation was also noted between both plane-tree and olive pollen concentrations and the occurrence of asthma (Fig. 1; Table 4).

Table 1 Airborne pollen and sensitive population in Córdoba during 2014 and 2015

Variables	Year 2014			Year 2015		
	Frequency ($n = 82$)	Percentage	95% CI	Frequency ($n = 96$)	Percentage	95% CI
Grass						
Yes	60	73.17	62.24–82.36%	68	70.83	60.67–79.67%
No	22	26.83	17.64–37.76%	28	29.17	20.33–39.33%
Olive						
Yes	58	70.73	59.65–80.26%	68	70.83	60.67–79.67%
No	24	29.27	19.74–40.35%	28	29.17	20.33–39.33%
Plane-tree						
Yes	16	19.51	11.58–29.74%	21	21.12	14.08–31.47%
No	66	80.49	70.26–88.42%	75	78.12	68.53–85.92%
Urticaceae						
Yes	4	4.88	1.34–12.02%	4	4.17	1.15–10.33%
No	78	95.12	87.98–98.66%	92	95.83	89.67–98.85%
Others						
Yes	10	12.20	6.01–21.29%	16	16.67	9.84–25.65%
No	72	87.80	78.71–93.99%	80	83.33	74.35–90.16%

CI confidence interval

Table 2 Percentages of subjects with allergy to pollen types by age group

Age group	Percentages of subjects with allergy to pollen types
2014	
18–31	43.11%: olive and grass pollen; 24.14%: olive pollen; 13.62%: grass pollen; 13.62%: grass, olive and plane-tree pollen; 3.45%: grass and plane-tree pollen and 2.06%: other pollen type
32–45	50%: olive and grass pollen; 50%: olive, grass, plane-tree, Urticaceae and other pollen type
46–59	25%: olive and grass pollen; 25%: grass pollen; 12.50%: olive pollen; 6.25%: other pollen type; 6.25%: grass and other pollen type; 6.25%: olive, grass and other pollen type; 6.25%: olive, grass and plane-tree pollen; 6.25%: olive, grass, plane-tree and other pollen type and 6.25%: olive, grass, plane-tree, Urticaceae and other pollen type
2015	
18–31	38.89%: olive and grass pollen; 15.26%: olive pollen; 9.72%: olive, grass and plane-tree pollen; 8.34%: olive, grass and other pollen type; 8.33%: grass pollen; 5.56%: grass and plane-tree pollen; 4.17%: olive and other pollen type; 2.78%: olive and plane-tree pollen; 2.78%: olive, grass, plane-tree and other pollen type; 1.39%: other pollen type; 1.39%: grass and other pollen type and 1.39%: olive, grass, plane-tree, Urticaceae and other pollen type
32–45	42.86%: olive and grass pollen; 28.57%: olive pollen and 28.57%: olive, grass, plane-tree, Urticaceae and other pollen type
46–59	29.41%: olive and grass pollen; 23.53%: grass pollen; 11.76% olive pollen; 5.88%: other pollen type; 5.88%: grass and other pollen type; 5.88%: olive, grass and plane-tree; 5.88%: olive, grass and other pollen type; 5.88%: olive, grass, plane-tree and other pollen type and 5.88%: olive, grass, plane-tree, Urticaceae and other pollen type

Table 3 Percentage of subjects suffering symptoms and using medicaments in 2014 (82 subjects) and 2015 (96 subjects)

	2014	2015
Symptoms (%)		
Rhinitis	93.90	87.75
Conjunctivitis	65.85	62.50
Asthma	35.36	18.75
Medicaments (%)		
Antihistamines	80.49	77.08
Inhalers	23.17	15.62
Nasal spray	15.85	12.50
Eyedrops	19.51	25.00
Immunotherapy	6.09	6.25

3.5 Association between medication and symptoms

In 2014, the proportion of subjects with rhinitis using antihistamines (96.67%) was significantly higher than that of subjects not doing so (81.25%; ($p = 0.0486$). The proportion of asthmatic subjects using inhalers (63.16%) was also significantly higher than that of subjects not doing so (26.98%) ($p = 0.0038$).

In 2015, a significant correlation was observed between the occurrence of rhinitis and the use of antihistamines ($p = 0.0006$). Use of eyedrops displayed a significant correlation with occurrence of rhinitis ($p = 0.0337$) and conjunctivitis ($p = 0.0149$). Moreover, the proportion of asthmatics using inhalers (66.67%) was significantly higher than that of asthmatics not doing so (9.88%; $p = 0.0007^{-2}$; Table 5).

4 Discussion

The period January–June was drier in 2015 than in 2014, and the highest pollen concentrations were detected during 2014. However, findings for these study years suggest that herbaceous plants, including most Poaceae species, display a more immediate response to weather conditions than woody species (Alcázar et al. 2009; Dahl et al. 2013). In this sense, the prevalence of grass and olive pollen allergy in subjects aged under 46 was lower in 2015 than in 2014. The results show that olive and grass pollen were the most troublesome for the sensitive population over the study period. In Córdoba, olive pollen concentrations were higher in both study years than those of other pollen types, confirming the findings for the spring pollen calendar reported by Martínez-Bracero et al. (2015). This may well be due to the extensive olive-groves in the Andalusia region. In other areas of southern Spain, such as Jaén, olive pollen causes clinical symptoms in 84% of pollen-allergy sufferers

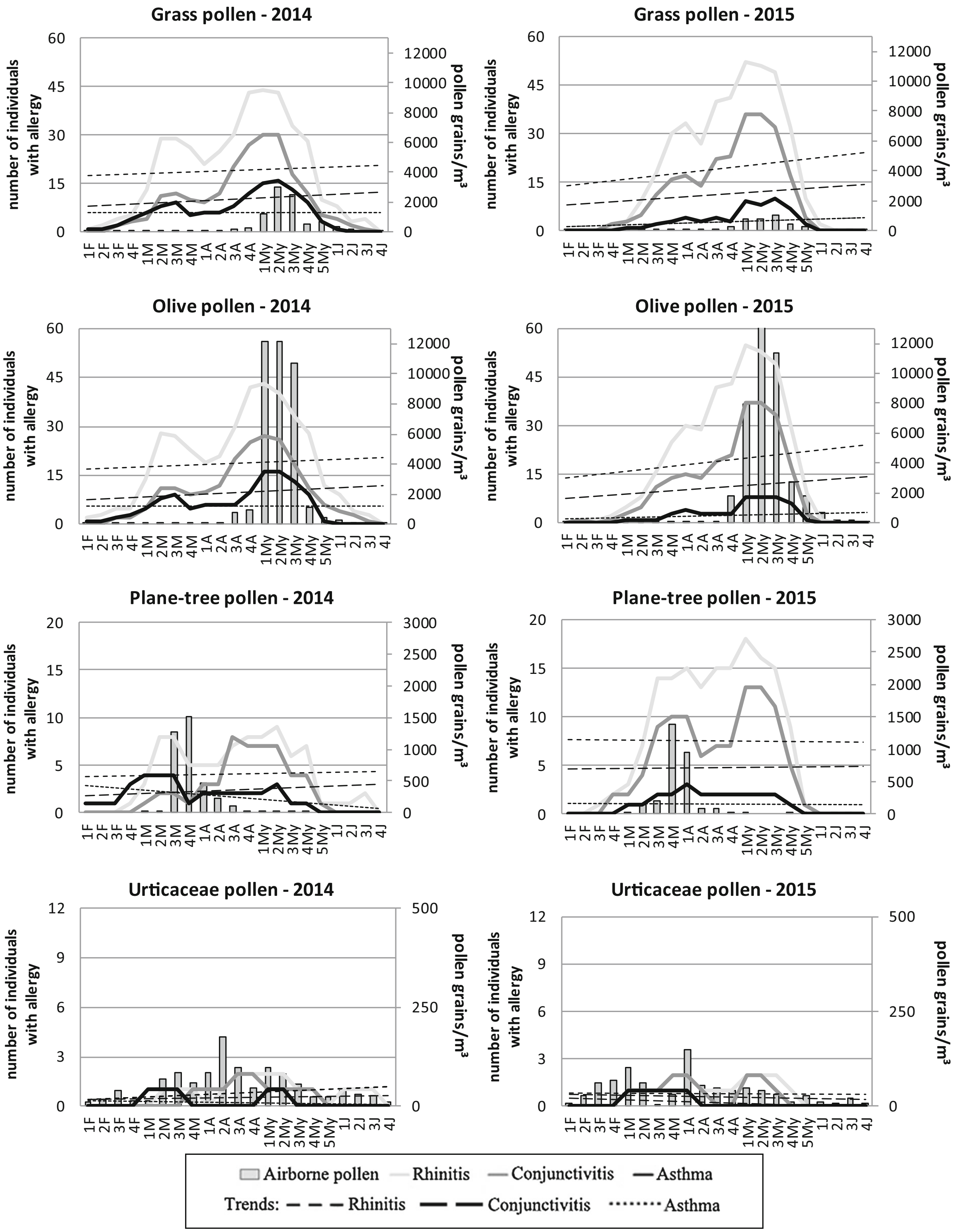

Fig. 1 Airborne pollen and symptoms (2014–2015)

Table 4 Correlation between airborne pollen of the different pollen types and allergic individuals

Variables	Year 2014						Year 2015					
	Subjects with rhinitis		Subjects with conjunctivitis		Subjects with asthma		Subjects with rhinitis		Subjects with conjunctivitis		Subjects with asthma	
	SCC	*p*	SCC	*p*	SCC	*p*	SCC	*p*	SCC	*p*	SCC	*p*
Grass	0.56	<0.01**	0.62	<0.01**	0.44	0.04*	0.72	<0.001***	0.68	<0.001***	0.72	<0.001***
Olea	0.64	<0.01**	0.66	<0.01**	0.48	0.03*	0.42	0.06	0.40	0.08	0.49	0.02*
Plane-tree	0.51	0.04*	0.47	0.06	0.24	0.37	0.32	0.23	0.34	0.20	0.59	0.02*
Urticaceae	0.67	<0.001***	0.64	<0.01**	0.30	0.19	0.38	0.09	0.38	0.09	−0.27	0.24

SCC Spearman correlation coefficient

* If trend at $\alpha = 0.05$ level of significance

** If trend at $\alpha = 0.01$ level of significance

*** If trend at $\alpha = 0.001$ level of significance

(Florido et al. 1999), while rates as high as 87% have been reported in Ciudad Real, in central Spain (Feo-Brito et al. 1998). High percentages were also recorded in the present study (70.73% in 2014, 70.83% in 2015). The onset of allergic symptoms (seasonal allergic rhinitis) in olive pollen-sensitive patients has been linked to airborne pollen concentrations above an extremely high daily average threshold of 400 pollen/m^3 (Florido et al. 1999). In Córdoba, high daily olive pollen peaks were recorded in 2014 (3914 pollen grains/m^3; May 6th) and in 2015 (3304 pollen grains/m^3; May 13th). These daily peaks are classed as high by the REA (Galán et al. 2007) and, in this study, coincided with an increase in the number of subjects developing allergic rhinitis.

Pollen grains from grass species allergic responses in 35% of the European population (De Weger et al. 2013). In Spain, the average percentage of sensitivity to grass pollen varies depending on the region (Jato et al. 2009). In southern Spain, sensitization to grass pollen is found in up to 59% of the population with respiratory allergy (Pereira et al. 2006) and, together with olive pollen, grass pollen is regarded as the cause of pollen allergies in most sensitized subjects in Córdoba (Sánchez-Mesa et al. 2005). This finding is borne out by the results of the present study, which showed that 73.17% of subjects were allergic to grass pollen in 2014 and 70.83% in 2015. Findings also highlighted a significant correlation between grass pollen concentrations and the occurrence of rhinitis, conjunctivitis and asthma in both study years. Research suggests that grass pollen concentrations of 10–20 pollen/m^3 are sufficient to trigger symptoms in sensitive individuals (Solomon and Mathews 1988; Subiza 2001).

In southern and central Europe, plane-tree pollen is among the main causes of pollinosis in urban areas, contributing to the development of asthma and rhinoconjunctivitis (Fernández-González et al. 2010; Damialis et al. 2011; Alcázar et al. 2011; Nowak et al. 2012; Asero et al. 2012; Ozturk et al. 2013). Plane-tree pollen is a greater contributor to asthma than other pollen types (Alcázar et al. 2004). Here, a positive correlation was noted between the occurrence of asthma and plane-tree pollen concentrations in 2015 ($r = 0.59$; $p = 0.02$). A total of 19.51 and 21.12% of subjects displayed allergy to plane-tree pollen in 2014 and 2015, respectively. Similar findings are reported by Alcázar et al. (2011) for cities in southwestern Spain. Córdoba is currently among the Spanish cities with the highest airborne plane-tree pollen concentration (Alcázar et al. 2015); here, counts were exceeded only by those of olive pollen.

As noted in other studies carried out in Spain (Belmonte et al. 1999; De Benito and Soto 2001), the Urticaceae pollen type had fewer allergic repercussions (4.88% of subjects were allergic in 2014 and 4.17% in 2015).

In general, treatment of allergic subjects is aimed at relief of symptoms (Small and Kim 2011). The first-line treatment of allergic rhinitis includes the avoidance of relevant allergens. Pollen exposure can be reduced by keeping windows closed, using an air conditioner, and limiting the amount of time spent

Table 5 Association between the use of medicaments and symptoms in subjects during 2014 and 2015

Variables	Rhinitis				p	Conjunctivitis				p	Asthma				p
	Yes		No			Yes		No			Yes		No		
	n	%	*n*	%		*n*	%	*n*	%		*n*	%	*n*	%	
2014															
Antihistamines															
Yes	64	96.67	2	3.03	0.04*	44	66.67	22	33.33	0.75	26	39.39	40	60.61	0.12
No	13	81.25	3	18.75		10	62.50	6	37.50		3	18.75	13	81.25	
Inhalers															
Yes	16	84.21	3	15.79	0.08	11	57.89	8	42.11	0.40	12	63.16	7	36.84	<0.01**
No	61	96.83	2	3.17		43	68.25	20	31.75		17	26.98	46	73.02	
Nasal spray															
Yes	13	100	0	0	1	8	61.54	5	38.46	0.76	5	38.46	8	61.54	1
No	64	92.75	5	7.25		46	66.67	23	33.33		24	34.78	45	65.22	
Eyedrops															
Yes	14	87.50	2	12.50	0.25	13	81.25	3	18.75	0.15	9	56.25	7	43.75	0.05
No	63	95.45	3	4.55		41	62.12	25	37.88		20	30.30	46	69.70	
Immunotherapy															
Yes	5	100	0	0	1	4	80	1	20	0.66	3	60	2	40	0.34
No	72	93.51	5	6.49		50	64.94	27	35.06		26	33.77	51	66.23	
2015															
Antihistamines															
Yes	70	94.59	4	5.41	<0.001*	50	67.57	24	32.43	0.06	16	21.62	58	78.38	0.23
No	14	63.64	8	36.36		10	45.45	12	54.55		2	9.09	20	90.91	
Inhalers															
Yes	11	73.33	4	26.67	0.09	8	53.33	7	46.67	0.42	10	66.67	5	33.33	0.0007^{-2}*
No	73	90.12	8	9.88		52	64.20	29	35.80		8	9.88	73	90.12	
Nasal spray															
Yes	12	100	0	0	0.35	9	75.00	3	25.00	0.53	2	16.67	10	83.33	1
No	72	87.71	12	14.29		51	60.71	33	39.29		16	19.05	68	80.95	
Eyedrops															
Yes	24	100	0	0	0.03*	20	83.33	4	16.67	0.02**	7	29.17	17	70.83	0.14
No	60	83.33	12	16.67		40	55.56	32	44.44		11	15.28	61	84.72	
Immunotherapy															
Yes	6	100	0	0	1	3	50	3	50.00	0.67	1	16.67	5	83.33	1
No	78	86.67	12	13.33		57	63.33	33	36.67		17	18.89	73	81.11	

* Significance using Fisher's exact test

** Significance using Chi-square test

outdoors during peak pollen seasons. However, exposure to pollen cannot be completely avoided (Small et al. 2007). In the present study, the proportion of subjects with rhinitis using antihistamines was significantly higher in both study years than that of those using other medication. Antihistamines and local steroids are currently recommended for the treatment of allergic rhinitis (Tran et al. 2011).

Allergic rhinitis and asthma are physiologically, therapeutically and pathologically linked (Cauwenberge et al. 2007). In fact, allergic rhinitis usually precedes asthma and can be regarded as a risk factor for the development of asthma (Leynaert et al. 2004). Here, the prevalence of asthma was lower than that of allergic rhinitis, a finding supported by Natt et al. (2011). In addition, some medicaments, such as inhaled corticosteroids, long-acting beta agonists and montelukast, are effective in controlling asthma symptoms and attacks (Yukselen and Gunuser 2014). In the present study, a significant correlation was found between the use of inhalers and the occurrence of asthma.

Finally, ocular allergy, which includes seasonal allergic conjunctivitis, is among the most common eye conditions encountered in clinical practice (Leonardi et al. 2007). Results showed that conjunctivitis was the second most frequent symptom displayed by allergic subjects. Since the eyes present a large surface area and it is often impossible to avoid ocular exposure to airborne allergens, the management of ocular allergy involves the use of anti-allergic therapeutic agents, multiple action anti-allergic agents and mast cell stabilizers (La Rosa et al. 2013). In the present study, a significant correlation was observed between the use of eyedrops and the occurrence of conjunctivitis. In fact, combination treatments using decongestants with antihistamines are very effective when administered as eyedrops (Abelson et al. 1990).

Further research over a longer period of time is required in order to study sensitization thresholds in the allergic population, with a view to avoiding both exposure to pollen and the indiscriminate use of medication by allergic subjects, thus improving their quality of life.

5 Conclusion

The findings of the present study generally bear out the results of previous research on the spring sensitized population in Córdoba in the course of the decade. However, there was a marked difference weather conditions in the two study years: The drier year (2015) was distinguished by lower exposure to pollen and fewer symptoms than in 2014. Rhinitis was the symptom most frequently suffered by the study subjects, and antihistamine was the most common medication for this allergic symptom. Usage of eyedrops was linked to the presence of rhinitis and conjunctivitis; inhalers were used to combat asthma symptoms. Research in this field is essential for a better understanding of the implications of aeroallergens for pollinosis; however, further research is required with a view to avoiding both exposure to pollen and the indiscriminate use of medication by allergic subjects, thus improving their quality of life.

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