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Prevalence of Self Reported Allergic Rhinitis and its Relationship With Asthma Among Adult Nigerians

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Abstract

Objectives: The aims of the study were to establish the prevalence of self-reported allergic rhinitis in an adult Nigerian population and to examine the relationship between asthma and allergic rhinitis.
Methods: We conducted an epidemiological study of adults aged between 18 and 45 years in Ilorin, Nigeria from 2005 to 2006. An adaptation of the European Community Respiratory Health Survey questionnaire was administered by trained assistants to obtain information on demographics, history of nasal allergies, asthma symptoms, and smoking history. The participants also underwent spirometry.
Results: Of the 761 individuals screened, 733 were recruited, giving a participation rate of 96.3%; 441 (60.2%) were men and 292 (39.8%) were women. The prevalence of allergic rhinitis and asthma was 29.6% (n=217) and 14.7% (n=108), respectively. Of the individuals with allergic rhinitis, 31.8% (n=69) had asthma and of those with asthma, 63.9% (n=69) had allergic rhinitis. The mean (SD) age of those with allergic rhinitis was 31 (7.5) years and 65% (n=141) were men. The determinants of asthma in individuals with allergic rhinitis were a family history of asthma (odds ratio [OR], 3.38), a history of smoking (OR, –2.58), high socioeconomic status (OR, 3.82) obesity (OR, 3.32), and wheezing (OR, 250). Lung volumes were reduced in those with both asthma and allergic rhinitis compared to those with allergic rhinitis alone.
Conclusion: Our study revealed a high prevalence of allergic rhinitis in individuals with asthma. It is therefore important to increase awareness of the existence of allergic rhinitis and asthma as a common airway disease to ensure adequate management and control of both conditions.

Key words: Prevalence. Asthma. Allergic rhinitis. Comorbidity. Nigeria.

Resumen

Objetivos: Los objetivos de este estudio fueron establecer la prevalencia de la rinitis alérgica auto-comunicada en una población adulta nigeriana y examinar la relación entre el asma y la rinitis alérgica.
Métodos: Llevamos a cabo un estudio epidemiológico en adultos entre 18 y 45 años en Ilorin, Nigeria entre 2005 y 2006. Se realizó una adaptación del cuestionario Encuesta de Salud Respiratoria de la Comunidad Europea por personal entrenado para obtener información demográfica, historia de alergia nasal, síntomas de asma e historia de tabaquismo. Los pacientes también realizaron espirometría.
Resultados: De los 761 individuos interrogados se reclutaron 733, dando una tasa de participación del 96,3%; 441 (60,2%) eran hombres y 292 (39,8%) mujeres. La prevalencia de la rinitis alérgica y asma fue del 29,6% (n=217) y 14,7% (n=108), respectivamente. De los individuos con rinitis alérgica, 31,8% (n=69) tenían asma y de estos, 63,9% (n=69) tenían rinitis alérgica. La media (DE) de edad de los que tenían rinitis alérgica era de 29,3 (7,4) años y 65% (n=141) eran hombres. Los determinantes del asma en los individuos con rinitis alérgica fueron una historia familiar de asma (odds ratio [OR], 3,38), historia de tabaquismo (OR, –2,5), estatus socioeconómico alto (OR, 3,82) obesidad (OR, 3,32), y sibilancias (OR, 250). Los volúmenes pulmonares se redujeron en aquellos con asma y rinitis alérgica comparados con aquellos con rinitis alérgica exclusivamente.
Conclusión: Nuestro estudio revela una alta prevalencia de rinitis alérgica en individuos con asma. Es por tanto importante aumentar la atención acerca de la existencia de rinitis alérgica y asma como una enfermedad común de la vía aérea para asegurar un manejo adecuado y control de las dos condiciones.

Palabras clave: Prevalencia. Asma. Rinitis alérgica. Comorbilidad. Nigeria

Introduction

Allergic rhinitis is clinically defined as a symptomatic disorder of the nose induced by an immunoglobulin E–mediated inflammation of the membranes of the nose following allergen exposure [1]. Chronic or acute inflammation of the mucous membrane of the nose due to allergens results in the generation of excessive amounts of mucus and fluid, commonly producing runny nose, nasal congestion, nasal and soft palate itching, and sneezing [1]. The incidence and prevalence of allergic rhinitis has increased worldwide over the past 10 years, as has the burden it places on already poorly financed health care systems [2]. It is the most common allergic respiratory disorder, affecting 19% of the general population in Europe, 8.8% to 16% in the United States of America (USA), and 39.2% of schoolchildren aged 13 to 14 years in Nigeria [3-5]. Allergic rhinitis frequently affects teenagers and young adults, with prevalence decreasing after the age of 20 years [6]. It is associated with limited or severe, incapacitating symptoms that can affect health-related quality of life, leisure activities, and work productivity [4, 6-8] even though the disease responds effectively to treatment [9].

Allergic rhinitis is frequently associated with comorbidities such as asthma, eczema, depression, and migraine [10]. Asthma and allergic rhinitis have different symptoms, but there is an overlapping of the pathophysiology of the 2 conditions and their prevalence is increasing at an alarming rate [11]. The prevalence of allergic rhinitis in patients with bronchial asthma is very high and many epidemiological studies have identified rhinitis as an independent risk factor for asthma [12-18]. Some authors have found that the treatment of nasal symptoms in patients with asthma has led to good disease control [1,12]. The coexistence of asthma and allergic rhinitis is characterized by severe clinical presentation and higher treatment costs [19]. Numerous studies have investigated the relationship between both diseases in developed countries but such studies are lacking in developing and resource-poor countries.

In light of the shortage of epidemiological studies on allergic rhinitis and asthma in adult African populations, we sought to determine the prevalence of self-reported allergic rhinitis and its association with asthma in adults in Ilorin, Nigeria.

Patients and Methods

Study Area and Design

We performed a cross-sectional study of individuals aged between 18 and 45 years in the city of Ilorin, Nigeria between October 2005 and April 2006. Ilorin is situated in West Africa, at a latitude of 8°30' N and a longitude of 4°30' E. Although Nigeria has about 250 local languages, the official language spoken by the inhabitants is English. A minimum sample size of 368 was arrived at using the Cochran formula $N = Z^2pq / d^2$, where N was the required sample size; p, the prevalence of allergic rhinitis in 13-14-year-olds in Nigeria (39.7%) [5]; q, (1 – p); Z, an SD of 1.96 (which corresponds to a 95% confidence interval); and d, the degree of accuracy desired (0.05 for an acceptable error margin of 5%).

The minimum sample size was designed to accommodate a questionnaire completion rate of 96.2% but only 32% of those interviewed in a pilot study completed spirometry. This low spirometry response rate was due to unreliable results and participant refusal to continue with the tests. Nonetheless, the minimum sample size was adjusted to compensate for the questionnaire and spirometry response rates and to thus achieve a truly representative sample of the population, reduce error, and improve the power of the study.

Participant Selection

The study area has 12 electoral wards, obtained from the state electoral commission. To select the participants, we used a multi-stage cluster sampling approach based on cluster equality and homogeneity. The electoral wards were defined as clusters and a sample frame containing the list of 12 clusters was constructed. Of these, 9 were selected by simple random sampling. A list of households was drawn up for each cluster and these were also randomly selected. We then recruited individuals who met the inclusion criteria (age of 18-45 years, residence in Ilorin for at least 1 year, and willingness to participate in the study) from the selected households.

Survey Instrument

The survey instrument contained questions taken from the European Community Respiratory Health Survey (ECRHS) questionnaire [20], with inclusion of sociodemographic characteristics to reflect the social structure and culture of the study area. We also added questions on body weight, height, and local nasal allergens. The questionnaire was administered in a face-to-face interview by trained assistants, who compiled information on demographics, nasal allergies, asthma symptoms and medications, diagnoses of asthma by a physician, and smoking history. The assistants were health information officers and social scientists who participated in a day-long training program comprising a detailed review of the questionnaire and guidance on correct questionnaire completion and interview techniques (in the form of role play with assessment of level of understanding and suitability for the task). Inter-interviewer variability was insignificant, with a κ value of 0.91. The survey was piloted for 1 week with ongoing supervision and regular monitoring by investigators. The study investigator paid a house visit to 10% of the study participants (randomly selected) to confirm that they had indeed been interviewed.

The second phase of the study involved follow-up spirometry using a micro GP MS07 Gold standard transducer spirometer (Micro Medical limited, Rochester, Kent, UK). Spirometry was conducted in accordance with the European respiratory society guidelines [21], with a 12% adjustment for the African population. The highest values for forced expiratory volume in 1 second (FEV_1), forced vital capacity (FVC), FEV_1/FVC ratio, and peak expiratory flow (PEF) obtained with a difference of less than 0.2 L were used for each participant. Height, weight, and body mass index were also measured.

Definition of Allergic Rhinitis

Participants were classified as having allergic rhinitis if they had had 2 or more recurrent nasal symptoms such as excessive sneezing, nasal itching, nasal discharge, or nasal congestion or obstruction that were reversible either spontaneously or with treatment in the preceding 12 months [1,6,22,23]. Although the use of questionnaires only to define allergic rhinitis has been associated with overestimation of the disease [1]. Validation studies performed in Europe have found that the combination of rhinitis symptoms and itchy-watery eyes is a useful epidemiological measure of the prevalence of allergic rhinitis [22,23].

Definition of Asthma

Asthma was diagnosed in individuals with either 2 or more recurrent asthma symptoms (current asthma) or physician-diagnosed asthma in addition to a PEF variability of ≥10%. It is important to mention that in diagnosing asthma, reversible and variable airflow limitations can be measured with either a spirometer (FEV_1) or a peak flow meter [24].

The degree of reversibility that indicates a diagnosis of asthma is a change of ≥12% in FEV_1 or of ≥15% in PEF from the prebronchodilator value [24,25]. A diagnosis of asthma can also be made if there is a PEF variability of ≥20% [26] in patients receiving bronchodilator therapy or of ≥10% in those not receiving this therapy, as was the case in this study [24].

Statistical Analysis

The data obtained were analyzed using the SPSS statistical package version 15 (SPPS Inc., Chicago, Illinois, USA). Descriptive and frequency statistics were generated to examine the characteristics of the group as a whole and the subgroup with allergic rhinitis. The χ^2 test was used to determine *P* values and to test statistical significance, which was set at a *P* value of <.05. Multivariate logistic regression analysis was performed to determine the risk of developing allergic rhinitis and to examine the association between allergic rhinitis and asthma.

We obtained institutional approval for the study from the ethics and research committee at the University of Ilorin Teaching Hospital and informed consent was obtained from all participants.

Results

Of the 761 individuals screened for inclusion in the study, 733 were recruited (participation rate, 96.3%). Of these, 441 (60.2%) were men and 292 (39.8%) were women. The age of the participants ranged from 18 to 45 years and the mean (SD) age was 31 (7.5) years. Table 1 shows the general characteristics of the study population.

The prevalence of allergic rhinitis in the study group was 29.6% (n=217) and the mean age was 29.3 (7.4) years. The male to female ratio for allergic rhinitis was 2:1, with 141 men (65%) and 76 women (35%). Allergic rhinitis was commonest in individuals aged between 18 and 30 years, with prevalence decreasing with increasing age. One hundred and ninety-nine (91.7%) individuals with allergic rhinitis were from a low and middle socioeconomic background, while 18 (8.3%) were from a high socioeconomic background.

Table 1. General Characteristics of the Study Population (n=733)[a]

Sex	
Female	292 (39.8)
Male	441 (60.2)
Socioeconomic class	
Lower-middle	634 (86.5)
High	99 (13.5)
Prevalence of allergic rhinitis	217 (29.6)
Prevalence of asthma	108 (14.7)
Physician-diagnosed asthma	13 (1.8)
History of smoking	124 (16.9)
Obesity	68 (9.3)
Mean (SD) age, y	31 (7.5)

[a] All values are expressed as frequencies (percentage of whole group) unless otherwise specified.

Table 2. Self-reported Causes of Allergic Symptoms in Individuals With Allergic Rhinitis (AR) and Asthma and AR

	AR Frequency (%)	Asthma and AR Frequency (%)
Dust	121 (55.8)	35 (32.4)
Kitchen fumes	45 (20.7)	15 (13.9)
Cold weather	23 (10.6)	3 (2.8)
Smoke	11 (5.1)	4 (3.7)
Fuel (gasoline)	10 (4.6)	6 (5.6)
Feathers	3 (1.4)	3 (2.8)
Perfume	3 (1.4)	3 (2.8)
Corn	1 (0.5)	0 (0.0)
Total	217 (100.0)	108 (100.0)

The prevalence of asthma in the group as a whole was 14.7% (n=108) but only 1.8% (n=13) had physician-diagnosed asthma. The most common allergy reported by those with allergic rhinitis and rhinitis and asthma comorbidity was dust allergy (55.8% and 32.4%, respectively), followed by allergy to kitchen fumes from cooking (20.7% and 13.9%, respectively) (Table 2).

Table 3 shows that allergic rhinitis was significantly associated with a family history of asthma (odds ratio [OR], 7.55), an age of less than 30 years (OR, 1.75), low and middle socioeconomic status (OR, 2.06), and a history of smoking (OR, 1.57). The prevalence of asthma in individuals with allergic rhinitis was 31.8% (n=69), while that of allergic rhinitis in those with asthma was 63.9% (n=69). Individuals with allergic rhinitis were 6 times as likely to develop asthma as those without (OR, 5.7; confidence interval [CI], 3.70-8.80; degrees of freedom, 1; *P*<.01).

Table 3. Determinants of Allergic Rhinitis in the Study Population (n=733)

	Allergic rhinitis	No Allergic Rhinitis	Odds Ratio (95% Confidence Interval)	*P* Value
Sex				
Male	141	300	1.00	
Female	76	216	0.75 (0.54-1.04)	.084
Age, y				
<30	134	248	1.00	
>30	83	268	0.57 (0.42-0.79)	<.01
Socioeconomic class				
High	18	81	1.00	
Low-middle	199	435	2.06 (1.20-3,52)	.01
Home				
Single room	151	353	1.00	
Apartment	66	162	0.95 (0.67-1.34)	.75
History of smoking				
No	170	439	1.00	
Yes	47	77	1.57 (1.05-2.36)	.03
Family history of asthma				
No	177	501	1.00	
Yes	40	15	7.55 (4.07-14.00)	<.01
Obesity				
No	198	467	1.00	
Yes	19	49	0.91 (0.52-1.52)	.75

Table 4. Determinants of Asthma in Individuals With Allergic Rhinitis (AR) (n=217)

	AR With Asthma	AR Without Asthma	Odds Ratio (95% Confidence Interval)	*P* Value
Sex	23	53	1.00	
Female				
Male	46	95	1.16 (0.61-2.04)	.72
Age, y				
>30	30	53	1.00	
<30	39	95	0.73 (0.41-1.30)	.28
Socioeconomic class				
Low-middle	58	144	1.00	
High	11	7	3.82 (1.41-10.3)	.01
Home				
Apartment	22	44	1.00	
Single room	47	104	0.90 (0.49-1.68)	.75
History of smoking				
No	46	124	1.00	
Yes	23	24	2.58 (1.33-5.03)	<.01
Family history of asthma				
No	47	130	1.00	
Yes	22	18	3.38 (1.67-6.85)	<.01
Obesity				
No	58	140	1.00	
Yes	11	8	3.32 (1.27-8.68)	.01
Wheezing				
No	4	139	1.00	
Yes	65	9	250 (76.92-1000.00)	<.01

Determinants of Asthma in Individuals With Allergic Rhinitis

The determinants of asthma in patients with allergic rhinitis were a family history of asthma (OR, 3.38), a history of smoking (OR,–2.58), high socioeconomic class (OR, 0.73), obesity (OR, 3.32), and wheezing (OR, 250). Age, sex, and type of residence were not significantly associated with asthma (Table 4).

Spirometry Results in Individuals With Allergic Rhinitis

In both sexes, reduced lung volumes were more common in patients with both asthma and allergic rhinitis than in those with allergic rhinitis alone, but the differences were only statistically significant ($P<.05$) for FEV_1/FVC ratio and PEF in men and women, respectively. Table 5 shows the spirometry results for patients with allergic rhinitis in combination or not with asthma.

Table 5. Spirometry Test Results for Individuals With Allergic Rhinitis (AR)[a]

Parameters	AR With Asthma	AR Without Asthma	*P* Values
FEV_1, L			
Men	2.21 (0.56)	2.61 (1.83)	.10
Women	1.64 (0.46)	1.99 (0.63)	.45
FVC, L			
Men	2.51 (0.48)	2.80 (1.48)	.30
Women	1.92 (0.29)	2.20 (0.45)	.89
FEV_1/FVC, %			
Men	87.9 (11.7)	93.4 (12.4)	.04
Women	85.0 (15.8)	90.5 (14.1)	.09
PEF, L/min			
Men	284 (114)	300 (130)	.86
Women	196 (72)	235 (104)	.04

Abbreviations: FEV_1, forced expiratory volume in 1 second; FVC, forced vital capacity; PEF, peak expiratory flow.
[a]Data are expressed as means (SD).

Discussion

The combination of allergic rhinitis symptoms with itchy-watery eyes has been found to be a useful measure of the prevalence of allergic rhinitis [19,22]. We detected a prevalence of 29.6% for allergic rhinitis in our study group—adult Nigerians aged 18 to 45 years based in Ilorin, Nigeria. This rate is lower than that of 39.7% detected in Nigerians aged 13 to 14 years old by the International Study of Asthma and Allergies in Childhood (ISAAC) study in Nigeria [5] but in agreement with those reported for European countries, where allergic rhinitis prevalence has been found to be higher by the ISAAC study than by the ECRHS [23,27]. The prevalence rate of 29.6% is also higher than figures reported for the United Kingdom (22.1%), Turkey (27.1%), Sweden (20.5%), and the USA (20.4%) [1,5,28-33]. Geographical variations in the prevalence of allergic rhinitis may be attributable to differences in environmental factors that influence an individual's genetic susceptibility to developing this disease, in addition to variations in methodologies and age groups studied. In the present study, the majority of patients with allergic rhinitis (61.8%) were below the age of 30 years. This result is consistent with the observation that the disease is common in childhood, peaks in the early 20s, and then decreases [1,6,34]. Sixty-five percent of the members of the allergic rhinitis group in our study were men but this could be because 60% of the study group were men. Our findings contrast with those reported by many studies worldwide [1,6], in which there has been a predominance of female sex, attributed to a greater cough reflex sensitivity of the female airway, the impact of hormones on the airway, and physiological differences between men and women in airway reactivity to allergens.

A very large proportion of the patients with allergic rhinitis in our study were from a low or middle socioeconomic background, contrasting with reports from both developed and developing counties [1]. It is very surprising that of the individuals found to have asthma in our study (14.7%), only a small minority (1.8%) had a physician's diagnosis of the disease. This large difference could perhaps be explained by a low level of awareness of asthma in the study area and a preference for traditional over conventional (western) medical care.

The proportion of patients with self-reported allergy to house dust was 55.8% in individuals with allergic rhinitis and 32.4% in those with asthma. Both figures are higher than the rate of 24.2% reported for Sweden [29]. Although we did not perform skin tests, our results are consistent with prevalence rates for allergic rhinitis determined by immediate skin tests in Nigerian, Spanish, and Chinese patients [17,34,35], where house dust was the greatest cause of allergic rhinitis. House dust allergy was common in our population because the study area has an average yearly temperature of over 20ºC and an average humidity level that is conducive to the optimal growth of mites [1]. In our study, house dust was reported to be responsible for eliciting the majority of rhinitis and asthma symptoms, an observation that may support the theory of the united airway disease. The implications of a link between asthma and rhinitis link are of major importance as patients who have both diseases tend to have more severe disease manifestations and higher treatment costs. Moreover, the treatment of allergic rhinitis may improve asthma control and the early treatment of allergies may prevent the development of severe asthma [1,17-19] .The determinants of allergic rhinitis were found to be a family history of asthma (OR, 7.55), an age of less than 30 years (OR, 1.74), a low and middle socioeconomic status (OR, 2.06) and a history of smoking (OR, 1.57).

The prevalence of asthma in patients with allergic asthma in our study group was 31.8%, considerably higher than the rate of 13.1% reported for China [31]. Several other studies

have reported prevalence figures ranging from 10% to 40% [1,17]. Furthermore, we found that patients with allergic rhinitis were 6 times as likely to develop asthma as those without the disease (OR, 5.7; CI, 3.70-8.80; *P*<.01). Allergic rhinitis and asthma comorbidity was inversely associated with age as 49.3% of individuals with both diseases were under the age of 30 years. This observation is in agreement with reports from Spain [17]. The presence of allergic rhinitis commonly exacerbates asthma, increasing the risk of attacks, emergency visits, and hospitalization. Indeed recent pathophysiologic findings support the theory that allergic rhinitis and asthma are linked by a common airway [1,17,36] and moreover, the type of inflammation in allergic rhinitis and asthma involving type 2 helper T cells, mast cells, and eosinophils is very similar.

The majority of patients with asthma in our study had allergic rhinitis (63.9%), an observation that is in agreement with findings from several other studies worldwide [12-13,17,36]. Studies from Brazil and Sweden, in contrast, have reported a prevalence of less than 50% for rhinitis in patients with asthma [15,29]. In our allergic rhinitis group, a history of wheezing was the strongest determinant of asthma (OR, 250), followed by a family history of asthma (OR, 3.38), obesity (OR, 3.32), a history of smoking (OR,–2.58), and high socioeconomic status (OR, 3.82). Age, sex, and type of residence were not significantly associated with asthma.

We are not surprised that smoking was a risk factor for allergic rhinitis and asthma-allergic rhinitis comorbidity. This may be because smoking causes eye irritation and odor perceptions, alterations in mucociliary clearance, and eosinophilic and allergic-like inflammation in the nasal mucosa in the absence of atopy [37]. Obesity was not a risk factor for allergic rhinitis, supporting findings from a study in Japan, where obesity had negative associations with the prevalence of allergic rhinitis in schoolchildren [38]. Obesity was, in contrast, a determinant of asthma in patients with allergic rhinitis, possibly due to the effect it exerts on ventilatory function and its contribution to the development of asthma. Our spirometry findings revealed that airway obstruction was more common in patients with both asthma and allergic rhinitis than in those with allergic rhinitis alone, but these differences were not significant except for FEV_1/FVC ratio in men and PEF in women. Future studies on lung function are needed to evaluate the role of spirometry in the early diagnosis and treatment of allergic rhinitis and allergic rhinitis-asthma comorbidity.

Conclusions

Our study revealed a high prevalence of allergic rhinitis in patients with asthma. This comorbidity is characterized by severe symptoms and higher treatment costs, and it is important to increase the awareness of the fact that both allergic rhinitis and asthma exist as a single or common airway disease that requires appropriate management to achieve adequate control of both conditions.

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