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Prevalence and risk factors for allergic rhinitis in bakers in Douala, Cameroon

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ABSTRACT

Objective: To determine the prevalence and risk factors of allergic rhinitis among bakers in Douala.

Design: A cross-sectional study; the logistic regression model was use to find the risk factors of allergic rhinitis.

Setting: The study was conducted in 42 bakeries randomly selected among a total of 151 bakeries in the city of Douala.

Participants: All bakers who consented to participate in the study between 1 May and 31 July 2013.

Outcome measures: Allergic rhinitis was the outcome of interest. It was defined as the presence of the following symptoms: itchy nose, rhinorrhea, nasal obstruction and sneezing.

Results: During the study period, a total of 273 bakers were invited and 229 finally agreed to participate in this study. Males were the most represented gender with 222 (96.9%) participants. The mean age of the participants was 36.29±8.9 years. Smoking was found in 55 participants (24.5%). The symptoms of allergic rhinitis were observed in 24.5% of participants. Work related nasal symptoms were present in 15% of participants. Sensitisation to wheat flour and α-amylase was found in 16.6% and 8.3% of participants, respectively. The Prick test was positive for mites in 12.2% of participants. After multivariate analysis, sensitisation to flour (OR 3.95, 95% CI 1.85 to 8.47) and storage mites (OR 3.44, 95% CI 1.45 to 8.18) were the factors independently associated with symptoms of allergic rhinitis.

Conclusions: Allergic rhinitis is frequent among bakers in Cameroon. Implementation of preventive measures against inhalation of airborne allergens in bakeries and clinical monitoring of bakers sensitised to wheat flour and mites could help to reduce the prevalence of allergic rhinitis among bakers.

Strengths and limitations of this study

- This study is among the first carried out in sub-Saharan Africa that have sought an association between workplace aeroallergens in bakers and the symptoms of allergic rhinitis.
- The logistic regression, which is a pretty solid statistical method for the detection of associations between variables, was used in this study.
- The measurement of the exposure to dust in bakeries was not made.
- The specific serum IgE antibodies measurements, a method with better specificity and sensitivity than that of skin tests, for the diagnosis of allergen sensitisation were not performed.

INTRODUCTION

Allergic rhinitis is a common condition in current medical practice. Allergic rhinitis, besides asthma, is a principal manifestation of respiratory allergy. This condition is present in all parts of the world and its prevalence varies with regions. Most prevalence studies on rhinitis have used the methods of the International Study of Asthma and Allergies in Childhood (ISAAC). These prevalences range from 23% to 30% in Europe, 12% to 30% in the USA and 5.5% to 45.1% in North America.[1] In Africa, it varies from 7.2% to 27.3%.[2] Although it is not fatal, allergic rhinitis generates costs and has a negative impact on the quality of life of patients. It harmfully affects school and professional performances.[3–5] The occurrence of allergic rhinitis is conditioned by the conjunction of several factors such as atopy and several environmental factors, of which the leading are allergens and pollution. Among the allergens, pollens from plants and house dust mites are the most represented.[6] Occupational allergens are involved in the onset of occupational allergic rhinitis. Flour and α-amylase used for the fermentation of yeast are the main risk factors of allergic rhinitis in bakers.[7 8] Storage mites present in the flour also contribute to the development of this condition.[9] In sub-Saharan Africa, few studies have been carried out on allergic rhinitis, even though this part of the world is increasingly being exposed to pollution and climatic conditions are getting more and more favourable to allergens such as dust mites and moulds.[10] Bakery employees, apart from their usual exposure to aeroallergens, are often in contact with specific aeroallergens of their workplace.

The objective of this study was to determine the prevalence of allergic rhinitis and associated factors in bakers in the city of Douala.

METHODS

Design and setting

This was a cross-sectional study conducted from 1 May to 31 July 2013 in 42 randomly selected bakeries in the city of Douala in Cameroon. Douala is a seaside city in the central part of Africa located just above the equator. It is the economic capital of Cameroon and hosts many industries. The climate is hot and humid most of the year.

Participants

Bakery employees in regular contact with flour were included. Participants under 15 years, those with a non-allergic rhinitis or sinusitis and those declining to participate in the study were excluded.

Data collection and variables

Sociodemographic data, respiratory symptoms, medical history, family history of atopy, smoking status and characteristics of exposure to flour were collected using a face-to-face administered questionnaire. Allergic rhinitis was defined by the presence of at least one of the following symptoms: itchy nose, sneezing, nasal obstruction and rhinorrhea. Work-related symptoms were those triggered in the workplace. Rhinoconjunctivitis was defined by the association of symptoms of allergic rhinitis, ocular itching or eye tearing. Skin prick tests to 13 aeroallergens were performed. Allergens used were those from ALK laboratories (Varennes in Argonne, France). Aeroallergens present in bakeries included those from wheat flour and α-amylase, and four types of storage mites; and common aeroallergens included house dust mites, moulds and those originating from cat and dog fur, and German cockroaches. When searching for risk factors of allergic rhinitis, aeroallergens were grouped as follows: sensitisation to house dust mites was defined by positive skin prick tests to *Dermatophagoides farinae* and/or to *Dermatophagoides pteronyssinus*. Similarly, sensitisation to storage mites was considered when a positive prick test to at least one of the following type of mites was observed: *Lepidoglyphus destructor*, *Glycyphagus domesticus*, *Acarus siro* and *Tyroglyphus putrescentiae*.

Atopy was defined as a positive skin prick test to at least one of the common aeroallergens. The positive control was histamine and the negative control was glycerosaline solution. The test was read 15 min after application of the allergen solution. The test was positive when the diameter of induration was greater than (or equal to) 3 mm, or greater than 50% of the positive control.

Data analysis

Data was entered and analysed using SPSS V.20 for Windows. Descriptive statistics were used for general presentation of the sample. Univariate analysis was then performed, followed by logistic regression in order to identify risk factors of allergic rhinitis. Variables for which p value was less than (or equal) to 0.2 were introduced in the final model for multivariate analysis. The OR and CIs of 95% were determined. Statistical tests were considered significant for a p value of less than 0.05.

Ethical clearance

The protocol was submitted to the National Ethics Committee and the recruitment started after obtaining an ethical clearance as well as an oral consent from each participant.

RESULTS

During the study period, a total of 273 bakers were invited and finally 229 bakers agreed to participate in this study, giving a response rate of 83.8%. The general characteristics of the study population are shown in table 1.

Table 1 General characteristics of participants

Variables	Number	Percentage
Gender		
Male	222	96.9
Female	7	3.1
Age		
Mean±SD (range)	36.29±8.9 (20–58 years)	
20–29 years	56	24.5
30–39 years	99	43.2
40–49 years	49	21.4
50–59 years	25	10.9
Exposure to flour (duration)		
Mean	11.7±7.3 (3–34 years)	
<5 years	31	13.5
5–9 years	81	35.4
10–14 years	50	21.8
15–19 years	27	11.8
≥20 years	40	17.5
Daily exposure (duration)		
Mean±SD (range)	9.21±1.5 (6–12 h)	
≤8 h	104	45.4
>8 h	125	54.6
Smoking		
Yes	55	24
Passive smoking	41	17.9
Ex-smoker	7	3.1
No smoking	126	55
Symptoms of asthma		
Cough at night	59	25.8
Ever wheezing	9	3.9
Ever wheezing during exercise	8	3.5
Allergic rhinitis		
Yes	56	24.5
No	173	75.5
Work-related allergic rhinitis	35	15.3
Rhinoconjunctivitis	15	6.6

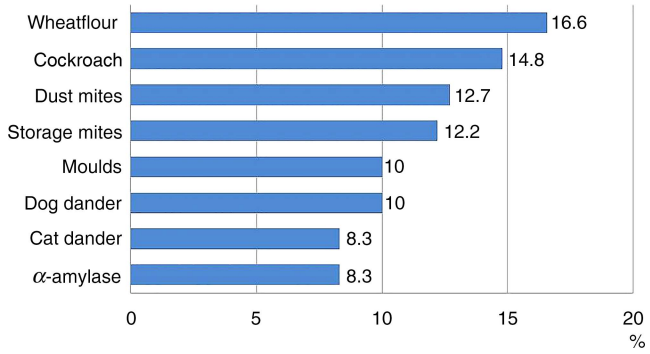

Figure 1 Prevalence of sensitisation to aeroallergens.

Males were the most represented gender with 222 (96.9%) participants. The mean age was 36.29±8.9 years (range 20–58). The mean length of stay duration in the profession was 11.7±7.3 years (range 3–34), while the average duration of daily exposure to flour dust was 9.21 ±1.5 h (range 6–12). Smoking was found in 55 (24.5%) participants. The symptoms of allergic rhinitis were observed in 56 (24.5%) participants (24.5%). These symptoms were work related in 15.3% (35 participants). The prevalence of allergic rhinoconjunctivitis was 6.6% (15 participants) and the main symptoms of lower respiratory tract involvement were cough (25.8%) and wheezing (3.9%). The skin prick tests were positive in 51.5% of participants' cases (figure 1).

Sensitisation to flour and α-amylase was observed in 16.6% and 8.3% of participants, respectively. Sensitisation to the German cockroach was found in 14.8% of participants. Table 2 shows the results of univariate analysis of risk factors of allergic rhinitis in the study population.

Length of time spent in the profession, sensitisation to wheat flour, to the German cockroach, to dog fur, to dust mites and to all common aeroallergens were associated with allergic rhinitis. The independent risk factors after multivariate analysis were sensitisations to flour and storage mites (table 3).

DISCUSSION

This study on allergic rhinitis in bakers shows a prevalence of 24.5% of allergic rhinitis in this profession. It was work-related in 15.3%. Sensitisation to flour, α-amylase and current aeroallergens was found respectively in 16.6%, 8.3% and 39.7% of participants. Flour and storage mite sensitisation was found to be an independent risk factor of allergic rhinitis.

From the 1980s, studies on the prevalence of allergic rhinitis in bakers increased. In Europe, the prevalence varies from 7% to 21% depending on the authors.[11] In Africa, studies on respiratory allergies in bakers are scarce. In Morocco, Alaoui Yazidi *et al*[12] found that 33% of bakers had allergic rhinitis. As for allergic rhinitis related to work, Houba *et al*[13] and Jacobs *et al*[14] reported 21% and 23%, respectively, in the Netherlands. Other authors reported higher prevalence of around 25% to 35%.[15 16] This study had found 15.3% of work-related allergic rhinitis. This disparity could be explained by the different definitions of allergic rhinitis used in each study.

With respect to risk factors of allergic rhinitis in this study, after adjustment, the sensitisations to wheat flour and storage mites were associated with the presence of allergic rhinitis. Several studies in the literature have found a significant relationship between sensitisation to wheat flour and allergic rhinitis.[8 14 17 18] Indeed, wheat flour is a complex mixture of polypeptide and polysaccharide substances, many of which are potential allergens that can cause IgE-dependent sensitisation after inhalation. The analysis of wheat flour shows more than 100 spots of IgE binding proteins and analysis of bakers sensitised serum highlights not only several reactions to these antigens, but also a great individual sensitisation variability.[19] Wheat flour consists of four classes of proteins, which include albumin, globulins, gliadins and glutenins. The most important IgE reaction in bakers' respiratory allergy is due to proteins of molecular weight ranging between 12 and 17 kDa that are considered 'major allergens'.[20]

In this study, sensitisation to storage mites was independently associated with allergic rhinitis. This result corroborates that of Blainey *et al*[21] who found an association between sensitisation to storage mites and respiratory allergy. However, De Zotti *et al*[22] consider that storage mites are not real occupational aeroallergens in bakers and are instead a cause of immunological cosensitisations.

Univariate analysis showed association between some factors and allergic rhinitis. These factors were no longer significantly associated in multivariate analysis. The named factor is length of time spent in the current profession of more than 10 years. Indeed, the latency period for the development of sensitisation to aeroallergens in professional bakers is short and longer for the occurrence of respiratory symptoms.[23 24] Atopy was associated with allergic rhinitis. While most studies show that it is a risk factor for workplace aeroallergen sensitisation in bakers,[7 8 14 16] its role as a factor associated with the occurrence of respiratory symptoms in bakers was not found by all authors.[15 22 25] In this study, after multivariate analysis, atopy was not associated with allergic rhinitis. The limited definition of atopy in this study could explain this finding. In addition, the effect of atopy could have disappeared because of the significant sensitisation association between storage mites and allergic rhinitis, and atopy has been demonstrated to be associated with sensitisation to storage mites.[26] As found by De Zotti *et al*,[22] age and smoking were was not associated with allergic rhinitis.

This study is among the first in sub-Saharan Africa that has sought an association between workplace

Table 2 Univariate analysis of risk factors of allergic rhinitis

Variables	Allergic rhinitis		Crude OR (95% CI)	p Value
	Yes	No		
Age (years)				
≤30	12 (16.9%)	59 (83.1%)		
>30	44 (27.8%)	114 (72.2%)	1.89 (0.93 to 3.86)	0.078
Smoking				
Yes	16 (29.1%)	39 (70.9%)	1.37 (0.89 to 2.71)	0.36
No	40 (23%)	134 (77%)		
Family atopy				
Yes	8 (34.8%)	15 (65.2%)	1.75 (0.70 to 4.39)	0.22
No	48 (23.3%)	158 (76.7%)		
Daily exposure to wheat flour (h)				
≤8	29 (27.9%)	75 (72.1%)		
>8	27 (21.6%)	98 (78.4%)	0.71 (0.38 to 1.30)	0.27
Exposure to wheat (years)				
≤5	6 (12.8%)	41 (87.2%)		
6–10	21 (25.3%)	62 (74.7%)	2.31 (0.86 to 6.22)	0.096
>10	29 (29.3%)	70 (70.7%)	2.83 (1.08 to 7.39)	0.034
Wheat sensitisation				
Yes	20 (52.6%)	18 (47.4%)	4.78 (2.29 to 9.95)	0.000
No	36 (18.8%)	155 (81.2%)		
α-amylase sensitisation				
Yes	7 (36.8%)	12 (63.2%)	1.91 (0.71 to 5.13)	0.19
No	49 (23.3%)	161 (76.7%)		
Cockroach sensitisation				
Yes	13 (38.2%)	21 (61.8%)	2.18 (1.01 to 4.72)	0.046
No	43 (22.1%)	152 (77.9%)		
Dog dander sensitisation				
Yes	11 (47.8%)	12 (52.2%)	3.28 (1.35 to 7.92)	0.008
No	45 (21.8%)	161 (78.2%)		
Cat dander sensitisation				
Yes	6 (31.6%)	13 (68.4%)	1.47 (0.53 to 4.08)	0.45
No	50 (23.8%)	160 (76.2%)		
Dust mite sensitisation				
Yes	10 (34.5%)	19 (65.5%)	1.76 (0.76 to 4.05)	0.18
No	46 (23%)	154 (77%)		
Storage mite sensitisation				
Yes	15 (53.6%)	13 (46.4%)	4.5 (1.98 to 10.20)	0.000
No	41 (20.4%)	160 (79.6%)		
Mould sensitisation				
Yes	9 (39.1%)	14 (60.9%)	2.17 (0.88 to 5.34)	0.09
No	47 (22.8%)	159 (77.2%)		
Atopy				
Yes	29 (31.9)	62 (68.1%)	1.92 (1.04 to 3.53)	0.035
No	27 (19.6%)	111 (80.4%)		

aeroallergens and the symptoms of allergic rhinitis in bakers. The logistic regression, which is a pretty solid statistical method for the detection of associations between variables, was used in this study. Despite these strengths, there are some weaknesses: the measurement of the exposure to dust in bakeries was not made and the specific serum IgE antibodies measurements, a method with better specificity and sensitivity than that of skin prick tests, for the diagnosis of allergen sensitisation were not performed.

CONCLUSION

This study on respiratory allergies in bakers in Sub-Saharan Africa shows a high prevalence of allergic rhinitis and highlights the role of sensitisation to wheat flour and dust mites as risk factors for allergic rhinitis in bakers. Implementing protective measures against these aeroallergens and clinical monitoring of sensitised workers towards occupational aeroallergens could reduce the prevalence of this condition that, though not life-threatening, can significantly alter a baker's quality of life.

Table 3 Multivariate analysis of risk factors of allergic rhinitis

Variables	Crude OR (95% CI)	p Value
Exposure to wheat flour (years)		
≤5		
6–10	2.17 (0.75 to 6.25)	0.15
>10	2.19 (0.79 to 6.02)	0.12
Atopy		
Yes	0.69 (0.21 to 2.23)	0.54
No		
Dust mite sensitisation		
Yes	1.52 (0.6 to 3.83)	0.37
No		
Mould sensitisation		
Yes	1.80 (0.67 to 4.82)	0.24
No		
Cockroach sensitisation		
Yes	1.85 (0.81 to 4.23)	0.14
No		
Wheat sensitisation		
Yes	3.95 (1.85 to 8.47)	0.000
No		
Storage mite sensitisation		
Yes	3.44 (1.45 to 8.18)	0.005
No		

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Contributors BHMN conceptualised the study, designed the protocol, analysed the data and drafted the manuscript. EN collected the data. EAZ, FN and RNL revised the manuscript. YMN participated in administrative and technical support.

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