

# BMJ Open Sensitisation to mites in a group of patients with asthma in Yaounde, Cameroon: a cross-sectional study

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## ABSTRACT

**Objectives:** Sensitisation of asthmatic patients to mites in sub-Saharan Africa has been less described. The aim of this study was to assess the prevalence and determinants of sensitisation to mites in asthmatic adolescents and adults in Yaounde, Cameroon.

**Design:** This was a cross-sectional study. Logistic regression models were employed to investigate the determinants of sensitisation to mites.

**Setting:** This study was carried out at the Jamot Hospital and CEDIMER private centre, in Yaounde, capital city of Cameroon.

**Participants:** All asthmatic patients received in consultations from January 2012 to June 2013 and in whom prick-skin tests for perennial aeroallergens were performed were included.

**Outcome measures:** Prevalence of sensitisation to mites and associated factors.

**Results:** In total, 201 patients (132 being women, 65.7%), with a median age of 36 (25th–75th centiles: 20–54) years were included, with 135 (67.2%) having a positive skin test for mites. Sensitisation to *Dermatophagoïdes pteronyssinus*, *Dermatophagoïdes farinae* and *Blomia tropicalis* was found in 53.2%, 49.8% and 47.8% of the patients, respectively. Intermittent rhinitis (16.3% vs 7.6%) and persistent rhinitis (43.0% vs 22.7%) were more frequent in sensitised patients than in the non-sensitised ones ( $p < 0.010$ ). Independent allergological determinants of sensitisation to mites were sensitisation to *Alternaria alternata* (adjusted OR 14.98 (95% CIs 1.96 to 114.4)) and sensitisation to *Blattella germanica* (3.48 (1.34 to 9.00)).

**Conclusions:** Sensitisation to mites was found in about two-thirds of asthmatic patients in this setting, with a frequent multiple sensitisations to *A alternata* and *Blattella germanica*. Systematically investigating asthmatic patients for mites' sensitisation and determinants will help optimising the care in this setting by combining the aetiological treatment for the allergy with symptomatic treatment for asthma, in order to modify the natural course of the disease.

## INTRODUCTION

Allergy to aeroallergens is one of the determining factors for the occurrence of

## Strengths and limitations of this study

- This was a first study exploring sensitisation to mites in Cameroon.
- This study uses robust methods to assess the determinants of sensitisation in asthma patients.
- The study was conducted only in two centres.

asthma.<sup>1–4</sup> In most parts of the world, mites are the commonest source of perennial respiratory allergies.<sup>4–6</sup> Of the many species of mites known to date, only a few are responsible for respiratory allergies. These include for dust mites: *Dermatophagoïdes pteronyssinus* (DP), *Dermatophagoïdes farinae* (DF) and *Euroglyphus maynei*, and storage mites: *Blomia tropicalis* (BT), *Lepidoglyphus destructor*, *Glycyphagus domesticus*, *Tyrophagus putrescentiae* and *Acarus siro*.<sup>5–7,8</sup>

The prevalence of sensitisation to different species of mites varies across regions in the world, mostly influenced by differences in climatic and environmental conditions.<sup>9–12</sup> Allergenic sensitisation, particularly sensitisation to mites, has been less investigated in patients with respiratory atopy in sub-Saharan Africa, causing the management of these patients to be less than optimal in this part of the world. The aims of the current study were to determine the prevalence of sensitisation to mites and the distribution of such sensitisation across the three commonest mites (DP, DF and BT) among adolescents and adults with asthma in Yaounde, Cameroon; and additionally, to investigate the determinants of sensitisation to mites in these patients.

## MATERIALS AND METHODS

### Study setting and participants

The study was conducted in the outpatient department of the pneumology service of the Yaounde Jamot Hospital (YJH) and the CEDIMER private centre. YJH is a public

hospital and the referral centre for chest diseases for the capital city of Cameroon (Yaounde) and surrounding areas. CEDIMER is a private medical practice which offers ambulatory care to patients in Yaounde.

## Methods

This was a cross-sectional study involving all consenting adolescents (age  $\geq 10$  years) and adults Cameroonians followed for asthma from January 2012 through June 2013 (18 months). Diagnosis of asthma was confirmed by a specialist physician, and was based on the criteria of the Global Initiative for Asthma (GINA).<sup>13</sup> Demographic and clinical data were collected including age, sex, ethnic group, known duration of asthma, family history of asthma, other existing allergic conditions (rhinitis, conjunctivitis and atopic dermatitis) and smoking.

Diagnosis of rhinitis was based on the following nasal symptoms: clear rhinorrhoea, nasal obstruction, sneezing and itching. Persisting rhinitis was retained for a patient who reported symptoms for at least 4 days/week and during 4 weeks or more; otherwise rhinitis was considered as intermittent.<sup>14</sup> Diagnosis of atopic dermatitis was based on the criteria of the UK Working Party.<sup>15</sup>

The control of asthma was assessed with the use of the Asthma Control Questionnaire (ACQ).<sup>16 17</sup> Asthma was considered to have been insufficiently controlled in the week preceding the inclusion, in the presence of an ACQ score of one or greater.<sup>16 17</sup> The baseline forced expiratory volume in the first second (FEV1) was recorded for all patients in the absence of any exacerbation. Predicted FEV1 was based on the 2012 equations of the Global Lung Initiative for Blacks participants.<sup>18</sup>

Prick-test and standardised allergenic extracts of Stallergenes Laboratories (Anthony, France) were used for skin tests. The following perennial aeroallergens were tested: mites (*Dermatophagoïdes pteronyssinus*, *Dermatophagoïdes farinae* and *Blomia tropicalis*), moist (*Alternaria alternata*), *Blattella germanica*, cat dander and dog dander. Diluted solution of the allergenic extracts and histamine were used, respectively, as negative and positive controls. A prick test was considered positive if the diameter of the papula was greater than 3 mm, relative to the diameter of the negative control, or 50% that of the positive control. The patients for whom skin allergological tests were not performed were excluded from the study.

## Statistical methods

Data were analysed with the use of SPSS statistical software V.17 for Windows (SPSS Inc, Chicago, USA). Results are reported as mean (SD) or median (25th–75th centiles) and count (percentages). The  $\chi^2$  and Fisher's exact tests were used to compare qualitative variables and the Mann-Whitney U test used for quantitative variables. Logistic regression models were employed to investigate the determinants of sensitisation to mites. A p value  $< 0.05$  was used to characterise statistically significant results.

## RESULTS

### General characteristics of the study population

Of the 209 asthmatic adolescent and adults received in consultations during the inclusion period, 8 (3.8%) did not receive the skin allergological tests and were excluded. Clinical and demographic characteristics for the 201 patients in the final analytic sample are summarised in table 1. They comprised 132 (65.7%) women and 69 (34.3%) men and the median age (25th–75th centiles) was 36 (20.5–54.0) years. Twenty-seven (13.4%) patients had intermittent rhinitis and 73 (36.3%) had persistent rhinitis. Asthma was not well controlled during the last week preceding the inclusion in 77 (42.8%) patients and the mean FEV1 (SD) was 84.1% (22.3%).

### Prevalence of the sensitisation to mites

One hundred and forty (69.7%) patients had sensitisation to at least one of non-pollenic allergens. The prevalence of the sensitisation to the three mites tested in the current study was 67.2% (135/201), with a 95% CI 60.7% to 73.7%. The prevalence of the sensitisation to each of the species was 53.2% for DP, 49.8% for DF and 47.8% for BT. The distribution of the sensitisation of our participants to different species of mite is presented in table 2. Thirty-seven (27.4%) patients had an isolated sensitisation to one of the three species of mites and monosensitisation to mites (ie, the absence of sensitisation to other perennial aeroallergens) was present in 70 (51.9%) patients. Isolated sensitisation to BT was the most frequent and was found in 15 (11.1%) patients. The most common sensitisation to two species of mites was the cosensitisation to DP and DE, which was found in 17 (12.6%) patients. Seventy (51.9%) patients had a sensitisation to the three species of mites tested.

### Determinants of the sensitisation to mites

The prevalence of the sensitisation to mites was similar between women and men (63.6% vs 73.9%,  $p=0.157$ ) and the median age was similar between sensitised patients and non-sensitised ones (33 vs 40 years,  $p=0.204$ ). Sensitised patients were more likely to have intermittent (16.3% vs 7.6%) or persisting rhinitis (43.0% vs 22.7%) than non-sensitised patients ( $p<0.001$  for the distribution of rhinitis). The frequency of asthma control and mean FEV1 were not significantly different between sensitised and non-sensitised patients (table 1). In multivariable logistic regression analyses, the main determinants of sensitisation to mites were: sensitisation to *A alternata* (adjusted OR 14.98 (95% CI 1.96 to 114.4)) and sensitisation to *B germanica* (3.48 (1.34 to 9.00)), table 3.

## DISCUSSION

This cross-sectional study conducted in a sub-Saharan African country has shown that: (1) two of the three asthmatic patients in Yaounde have a sensitisation to

**Table 1** Demographic and clinical characteristics of asthmatic patients in Yaounde according to the sensitisation to mite

Characteristics	Overall	Mite sensitisation	No mite sensitisation	p Value
N	201	135	66	
Sex n (%)				0.157
Men	69 (34.3)	51 (37.8)	18 (28.3)	
Women	132 (65.7)	84 (62.2)	48 (72.7)	
Median age, years (25th–75th centiles)	36 (20.5–54)	33 (20–51)	40 (21–56)	0.204
Ethnic groups, n (%)				0.604
Semibantu	141 (70.9)	92 (68.1)	49 (74.2)	
Bantu	42 (21.1)	29 (21.5)	13 (19.7)	
Fulani/Sudanese	16 (8.0)	12 (8.9)	4 (6.0)	
Others	2 (1.0)	2 (1.5)	0 (0)	
Median age at the onset of asthma, years (25th–75th centiles)	20 (10–39)	20 (10–36)	21.5 (12.5–43.5)	0.475
Rhinitis, n (%)				<0.001
None	101 (50.2)	55 (40.7)	46 (69.7)	
Intermittent rhinitis	27 (13.4)	22 (16.3)	5 (7.6)	
Persistent rhinitis	73 (36.3)	58 (43.0)	15 (22.7)	
Atopic dermatitis, n (%)				>0.999
Yes	4 (2.0)	3 (2.2)	1 (1.5)	
No	197 (98.0)	132 (97.8)	65 (98.5)	
Smoking, n (%)				0.200
Non-smoker	194 (96.5)	129 (95.6)	65 (98.5)	
Smoker/ex-smoker	3 (1.5)	2 (1.5)	1 (1.5)	
Second hand smoker	4 (2.0)	4 (3.0)	0 (0)	
Family history of asthma, n (%)				0.250
Yes	37 (18.4)	28 (20.7)	9 (13.6)	
No	164 (81.6)	107 (79.3)	57 (86.4)	
Asthma control, n (%)				0.748
Well controlled	107/184 (58.2)	76/129 (58.9)	31/55 (56.4)	
Not well controlled	77/184 (41.8)	53/129 (41.1)	24/55 (43.6)	
FEV1, %, mean (SD)	84.1 (22.3)	84.2 (22.3)	88.4 (21.7)	0.294

FEV1, forced expiratory volume in the first second.

mites; (2) about one-third of patients have an isolated sensitisation to one of the three mites tested; (3) intermittent and persistent rhinitis are more frequent in patients sensitised to mites; (4) sensitisations to *Alternaria* and *B germanica* are the main predictors of sensitisation to mites.

Mites are minuscule cosmopolite arthropods which live and prosper in humid zones (optimal humidity of 60–80%) and at an optimal temperature of 20–30°C.<sup>5 8</sup> Of the hundreds of species of mites identified so far, a few are responsible for over 90% of allergenic

sensitisation.<sup>5</sup> In most parts of the world, DP and DF account for over 70–80% of sensitisations due to mites.<sup>7</sup> However, during the last decade, sensitisation to BT has been increasingly reported in intertropical and temperate zones.<sup>10 19</sup> The prevalence of the sensitisation to mites to different species of mites among atopic patients varies substantially across regions around the world. For instance, the prevalence of sensitisation to mites in patients with asthma varies between 31% and 88% in Europe,<sup>9</sup> between 39% and 56% in America<sup>9 10</sup> and between 53% and 88% in Asia and Oceania.<sup>9 11 12</sup> The

**Table 2** Frequency and association of sensitisation to mites in asthma patients in Yaounde, Cameroon

Type of mite sensitisation	Frequency (%)
N	135 (100)
Monosensitisation to <i>Dermatophagoïdes pteronyssinus</i>	13 (9.6)
Monosensitisation to <i>Dermatophagoïdes farinae</i>	9 (6.7)
Monosensitisation to <i>Blomia tropicalis</i>	15 (11.1)
Sensitisation to <i>D pteronyssinus</i> and <i>D farinae</i>	17 (12.6)
Sensitisation to <i>D pteronyssinus</i> and <i>B tropicalis</i>	7 (5.2)
Sensitisation to <i>D farinae</i> and <i>B tropicalis</i>	4 (3.0)
Sensitisation to 3 mites	70 (51.9)

**Table 3** Univariable and multivariable analysis of perennial allergenic factors associated to mite sensitisation

Factors	Crude OR (CI à 95%)	p Value	Adjusted OR (95% CI)	p Value
Sensitisation to <i>Alternaria</i>	21.03 (2.81 to 157.51)	0.003	14.98 (1.96 to 114.4)	0.009
Sensitisation to cockroaches	5.00 (2.01 to 12.45)	0.001	3.48 (1.34 to 9.00)	0.010
Sensitisation to cat dander	7.52 (0.97 to 58.48)	0.054	5.96 (0.73 to 48.86)	0.096
Sensitisation to dog dander	0.98 (0.24 to 4.03)	0.974	—	—

prevalence in our study was 67.2%, with a sensitisation to each of the three species (DP, DF and BT) found in about a half of our patients. Inclusion of these three mites in the pool of allergological test appears to be important in this setting, considering the fact that more than one-third of the patients had an isolated sensitisation to one of the three mites. This could possibly reflect a cross-sensitisation due to shared allergens across species, or a true multiple sensitisation to major allergens of these mites.<sup>7</sup>

While about a half of our patients with asthma had rhinitis, the proportion was much higher among patients sensitised to mites, regardless of the clinical form of rhinitis. This suggests that respiratory allergy to mites affects the entire respiratory tract including the upper and the lower respiratory airways. We did not find other significant differences in the clinical characteristics between patients who were sensitised to mites and those who were not. For instance, sensitisation to mites was not associated with age at the clinical onset of asthma, sex, family history of asthma, ethnicity or alteration of lung functions. Therefore, unlike the presence of rhinitis, other clinical variables may not be useful for the screening of patients for allergy to mites.

In our sample, sensitisation to mites was independently associated with sensitisation to *Alternaria* and sensitisation to *B germanica*. Indeed, one-third of the patients sensitised to mites were also sensitised to *B germanica*. These associations, at least in part, could be explained by the cross-reactivity between mites and cockroaches via tropomyosin, but could also reflect multiple sensitisation.<sup>20–22</sup> The association between sensitisation to mites and sensitisation to *Alternaria* likely reflects a multiple sensitisation, considering the phylogenetic distance between the two species. Not so much has been reported on this association which deserved further investigation and confirmation in other settings in tropical Africa.

This study has some limitations including the reliance on skin tests alone to diagnose sensitisation and enrolment of patients from only two health facilities in the city of Yaounde. Indeed, measurements of specific IgE could reveal more sensitisations, in particular in patients with hyporeactivity to skin tests, and may also help to differentiate between cross-sensitisation and multiple sensitisations to major mite allergens. The two recruitment health facilities for this study are referral centres for chest diseases in Yaounde. It is therefore possible that patients recruited from these facilities are representative

of the population of patients with asthma seen across all health facilities in the city. It remains, however, that recruitment from health facilities as opposed to a community-based sample could potentially bias our estimates of the prevalence of mite sensitisation. The direction of the effect of such a bias is difficult to predict, and the challenges and logistics for conducting a study of this nature in a setting with a possibly low prevalence of asthma at the population level, have to be considered. In conclusion, sensitisation to mites is frequent among patients with asthma in Yaounde, where it is frequently associated with a sensitisation to *Alternaria* and/or sensitisation to *B germanica*. The presence of rhinitis in patients with asthma is suggestive of a sensitisation to mites. Systematically investigating patients with asthma for an allergy to mites as well as the determinants of such an allergy will help optimising the care of patients with asthma in this setting through a combination of an aetiological treatment for the allergy with a symptomatic treatment for asthma, in order to modify the natural history of the disease.

**Contributors** EWP conceived the study, collected the data, coanalysed the data and drafted the manuscript. APK contributed to study design, data analysis, drafting and critical revision of the manuscript. CK supervised data collection and critically revised the manuscript. All authors approved the final version of the manuscript.

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