

RESEARCH ARTICLE

# House Dust Mite Awareness in the Ivorian Population from 2008 to 2021

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## Abstract

**Background:** Allergies are a real public health problem not confined to high-income countries. In tropical Africa, particularly in Ivory coast, allergies play a significant role after infectious diseases, and are increasingly the subject of numerous studies.

**Objective:** The aim of this study was to determine the prevalence and clinico-biological characteristics of dust mite sensitization in patients registered for allergological testing at the Institut Pasteur de Côte d'Ivoire (IPCI) Reception and Sampling Unit (URAP).

**Methods:** Patients were of both sexes (M or F) and aged from 1 to 82 years. Mites/blatts family identification tests (ALL CHECK) as well as mixed, respiratory and pediatric specificity panels using the immuno-transfer technique respectively detected serum IgE antibodies directed mainly against mites/blatts, *Dermatophagoides pteronyssinus* (*D. pteronyssinus* or D1), *Dermatophagoides farinae* (*D. farinae* or D2).

**Results:** Our series comprised 182 men (55.3%) and 147 women (44.7%). The mean age and sex ratio were 23 years and 1.2. The overall frequency of mite sensitization was 42 %, with *D. pteronyssinus* predominating (49 %), followed by *D. farinae* (37%) and the mites/blatts family (14%). The age group most affected was between 1 and 5 years. Specific IgE levels in the sensitized population increased with age, following a simple regression curve with  $r = 0.96$   $p < 0.00001$ . The percentage of children with detectable specific IgE against at least one house dust mite species rises to 43.75 % in children (1 to 5 years), followed by a decrease to 30.90 % in those aged 6 to 10 years.

**Conclusion:** The threshold for sensitization remains low in young people. Recommendations in favor of eviction measures should be focused on the habitat and on the pediatric population.

**Keywords:** Mites, Ivory Coast, Awareness.

## 1. Introduction

Numerous studies have shown a considerable increase in allergic diseases in all countries, whatever their level of development<sup>1,2-3</sup>. Allergy diagnosis is based on clinical and paraclinical data respectively. The latter is based on high lighting sensitization<sup>4-5</sup>. Sensitization can be determined on the basis of Prick-test results or those of specific IgE assays against the suspected

allergen (s). In tropical Africa, there are very few data on sensitization to house dust mites by assay. Indeed, most studies on sensitization have been carried out using skin prick tests and on adult patients, with inter-country variability<sup>6-7</sup>. Mite sensitization studies by assay performed were carried out on children<sup>8</sup>. Measuring allergenic sensitization in both children and adults is important because it provides information

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and enables better anticipation of management, with a view to preventing subsequent allergic diseases. The general objective was to determine dust mite sensitization in patients. Specifically, the aim was to determine prevalence data and describe the clinico-biological characteristics of house dust mite sensitization.

## 2. Methods

### 2.1 Study Framework

The study was carried out at the Pôle de Biologie de l'Immunité (PBI) of the Institut Pasteur de Côte d'Ivoire (IPCI), and included all adult and pediatric patients. The patients gave informed consent for this study. It was a retrospective descriptive study conducted from 2008 to 2021. It included all patients who underwent allergological testing at the Institut Pasteur de Côte d'Ivoire's Unité de Réception, Accueil et de Prélèvement (URAP). Patient age ranged from 1 to 82 years.

We used the nitrocellulose membrane enzyme-linked immunosorbent assay for the determination of specific IgE antibodies. This technique is based on the principles of the immunotransfer method. Various allergens bind to the surface of nitrocellulose membranes along separate lines, depending on the panel configuration. Allergen-specific IgE antibodies react to appropriate allergens whenever they are present in patient samples. In a second step, biotin-conjugated human IgE antibodies bind to the fixed antibodies. In a third incubation step, biotin binds to a streptavidin-peroxidase conjugate. In a final incubation step, the peroxidase converts the transparent tetramethylbenzidine (TMB) substrate into a violet-to-blue end product. After each individual incubation, a washing step removes unbound material. The intensity of the blue color is proportional to the amount of allergen-specific antibodies in the patient's serum. The simultaneous presence of a positive test to at least 1 of the 2 species (D1, D2) or to mites/blatts is defined as mite sensitization.

The characteristics studied were: sex and age, clinical information. As regards clinical information, the information extracted was organized, according to the coding of the reasons for clinical information, under the following headings:

- Non-asthmatic pulmonary pathologies;
- Manifestations ORL;
- Asthma;
- Urticaria ;
- Allergic rhinitis;

- Food allergy;
- Atopic dermatitis;
- Anaphylactic shock;
- Ocular manifestations

### 2.2 Statistical Analysis

A new database was created. Data were entered and saved using Microsoft Excel version 2007. All tests were performed by the program (Stata 14.2). Prevalences and averages were calculated for all quantitative parameters. A correlation study between quantitative parameters (age and IgE concentration) was carried out using a regression curve. A p value < 0.05 is statistically significant.

## 3. Results

### 3.1 Characteristics of the Study Population

In this study, we enrolled 329 patients, including 182 men (55.3%) and 147 women (44.7%). The mean age was  $23 \pm 6.43$  years (1-82), with no significant difference between men and women, and the sex ratio (M/F) was 1.2. The characteristics studied were found in similar proportions between men and women, with no significant difference (*Table 1*).

### 3.2 Prevalence of Sensitization

Of the 329 patients, 138 were sensitized to house dust mites. The overall prevalence of mite sensitization by assay was 42% (*Figure 1*). *D. pteronyssinus* was more prevalent in the patient sample (49%) than *D. farinae* (37%) mites/blatts (14%) (*Figure 2*).

### 3.3 Influence of the Characteristics Studied

In terms of gender, the proportion of patients positive for house dust mite allergens (Df, Dp, mites/blatts) was 39% in men and 46% in women. Clinical manifestations, mainly asthma and allergic rhinitis (47), rhinitis (40) and allergic asthma (33) were the most common clinical signs (*Table 2*). The majority of sensitized patients were between 1 and 5 years of age (*Figure 3*).

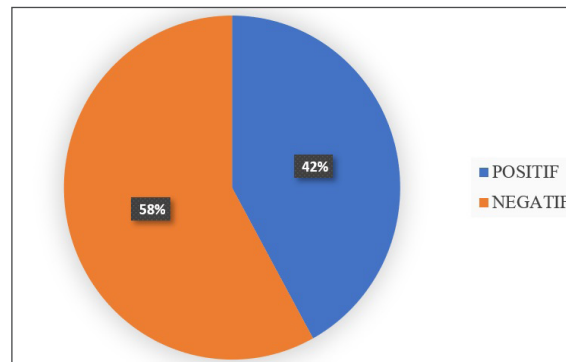
### 3.4 Specific IgE antibodies to *D. pteronyssinus*, *D. farinae* and mites/blatts bugs

Specific IgE values ranged from 0 to 100 international units per milliliter (IU/ml). Specific

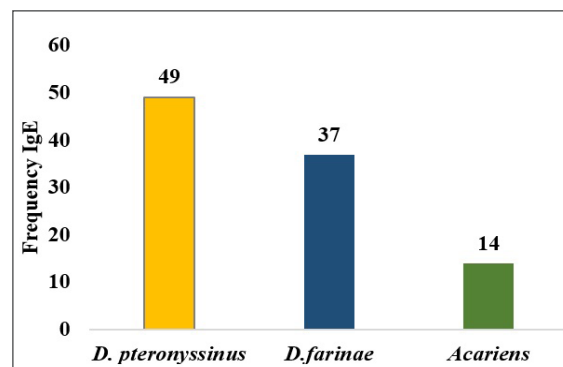
IgE levels in the sensitized population increased with age, according to a simple regression curve with  $r=0.96$   $p < 0.00001$ . The sensitization threshold is very low ( $\leq 1$  IU/ml) in children aged 1 to 10 years (*Figure 4*). Also, the percentage of children with detectable specific IgE against at least one mite species in the test increases to 43.75% (*Table 2*).

**Table 1.** Distribution of the study population (n = 329) according to characteristics studied: age,gender,clinicalinformation

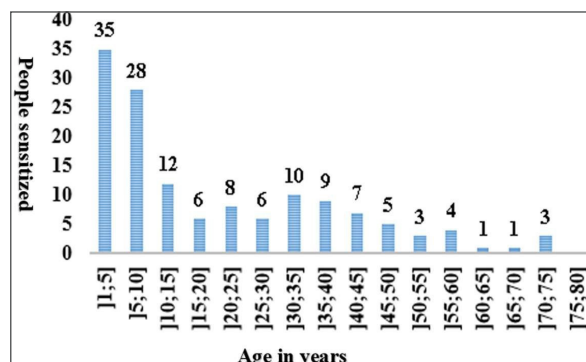
Characteristics	Sex (%)		Total
	Men	Women	
<b>Age</b>			
<b>1-20</b>	96(53)	73(49,6)	169(51)
<b>21-35</b>	41(22)	28(19)	69(22)
<b>36-65</b>	43(24)	42(28,6)	85(26)
<b>66-90</b>	2(1)	4(2,8)	6(2)
<b>Clinicalsigns</b>			
<b>Non-asthimaforme pathologies</b>	12(6,6)	9(6)	21(6,38)
<b>Asthma;</b>	25(24,7)	36(24)	61(18,5)
<b>Urticaria;</b>	11(29,7)	10(7)	21(6,38)
<b>Allergicrhinitis</b>	45(24,7)	33(23)	78(23,7)
<b>Asthma+rhinitis</b>	54(29,7)	35(24)	89(27)
<b>Eczema</b>	12(6,6)	7(5)	19(5,7)
<b>Atopicdermatitis;</b>	11(6,1)	11(7)	22(6,7)
<b>Anaphylacticshock;</b>	2(1,1)	4(3)	6(2)
<b>Ocularmanifestations</b>	10(5,5)	2(1)	12(3,64)



**Figure 1.** Overall Prevalence Of Dust Mite Sensitization



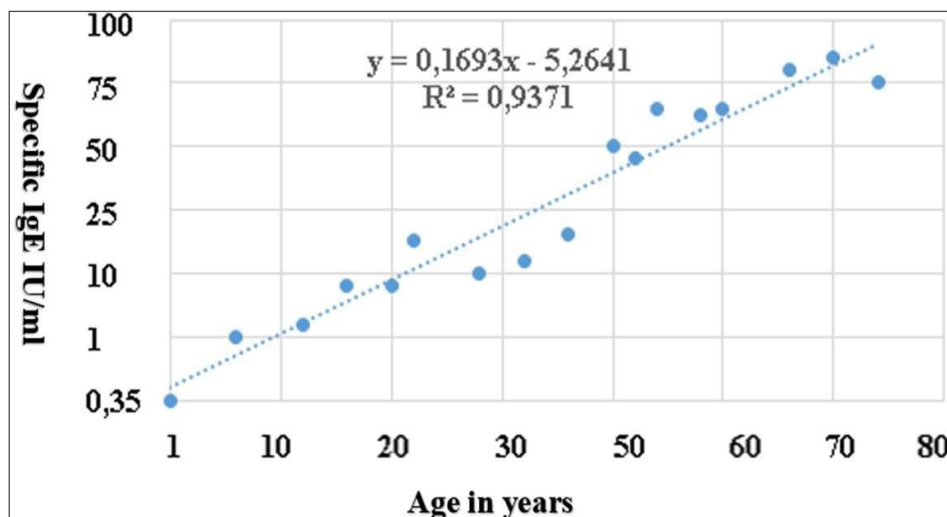
**Figure 2.** IgE frequency according to mite species



**Figure 3.** Age of sensitized patients

**Table 2.** Distribution of mite sensitization according to the characteristics studied: gender, age and clinical symptoms.

Features	Mites				
	D. pteronyssinus Positive	D. farinae Positive	Mite/blatts Positive	Total Positive(%)	Negative(%)
<b>Gender</b>					
Male	32	28	11	71(39)	111(61)
Female	36	23	8	67(46)	80(54)
<b>Age</b>					
]1;5]	20	13	2	35 (43,75)	45
]5;10]	11	10	7	28	27
]10;15]	8	4	-	12	4
]15;20]	5	1		6	12
]20;25]	2	5	1	8	5
]25;30]	3	3		6	16
]30;35]	3	6	1	10	24
]35;40]	6	3		9	24
]40;45]	1	3	3	7	9
]45;50]	3		2	5	10
]50;55]	1	1	1	3	8
]55;60]	2	2		4	2
]60;65]	1			1	3
]65;70]	1			1	
]70;75]	1		2	3	
]75;80]					1
<b>Clinical signs</b>					
Asthma	17	10	6	33	28
Urticaria	2		2	4	17
Rhinitis allergies	24	15	1	40	38
Asthma+rhinitis	18	21	8	47	42
Eczema	1	2		3	16
Atopic dermatitis	3	2	2	7	15
Anaphylactic shock	1			1	5
Ocular manifestations	1	1		2	10
Nonasthma form pathologies	1			1	20



**Figure 4.** Correlation between specific IgE titres and age in the sensitized population n=13

#### 4. Discussion

The patients in our study, 182 men (55.3%) and 147 women (44.7%), ranged in age from 1 to 82 years. The Institut Pasteur de Côte d'Ivoire is a reference center for medical analysis and scientific research, and therefore welcomes the entire population, regardless of age or sex. The mean age, which was 23 years with a sex ratio (M/F) equal to 1.2, is different from that of Kwasi and colleagues, which was 33 years with a sex ratio equal to 0.7<sup>9</sup>.

The epidemiological characteristics of dust mite sensitization are a difficult task due to the variability of the criteria used from one study to another<sup>10</sup>. However, several epidemiological studies carried out in hospitals at different times and in different places, including Morocco, Brazil, Benin, Côte d'Ivoire, the Philippines, India and Taiwan, have produced converging results: Global sensitization to house dust mites is common in allergic patients worldwide, but varies from country to country (Table 3). The predominance of women (44.7%) noted in the study is not shared by all. Indeed, the relationship between gender and allergic diseases, especially asthma, has been variously perceived in the literature<sup>10</sup>. For some authors, the male sex is predominant in adults<sup>11</sup>.

For other authors, female predominance has also been noted<sup>12-13</sup>. The under-21 age group was the most represented at 51%, and 2% of patients were over 65. All patients had allergic clinical symptoms. The most frequent clinical manifestations were asthma associated with allergic rhinitis (27%), followed by allergic rhinitis (23.7%) and allergic asthma (18.5%). Our results are in line with those of Kwasi, who indicate a predominance of allergy-associated asthma at 61.3% followed by conjunctivitis at 37.9% in their study cohort<sup>9</sup>. In Benin, on the other hand, Agodokpessi observed, a value of 55.5% linked to asthma associated with rhinitis followed by 28.6% linked to allergic rhinitis and 16% linked to allergic asthma<sup>8</sup>. There is a diversity of single or associated triggers in the same patient. House dust mites, including *D. pteronysissinus*, *D. farinae* and other mites/blights, were found in our study. Sensitization to at least one house dust mite allergen was recorded in 138 patients, i.e. 42% of our series, represented by *D. pteronysissinus* (49%), *D. farinae* (37%) and other house dust mites/blights (14%). Similar figures have been reported in the literature but in children consulting for allergy symptoms in a study carried out in Italy, and the overall prevalence was 44%<sup>14</sup>. On the other hand, a hospital-based study carried out in

Côte d'Ivoire on 140 patients with chronic respiratory diseases (asthma, rhinitis, rhinoconjunctivitis) showed a prevalence of 65.7%<sup>15</sup>. The M/F sex ratio in our sensitized population was 0.84, with 39% men and 46% women. Our results are contrary to those of Ghadi et al., who found a sex ratio (M/F) in their population of sensitized children equal to 1.4, with 58% boys and 42% girls<sup>16</sup>. In the literature, male sex is recognized as a factor significantly associated with atopy, particularly in asthmatics, with a boy/girl sex ratio ranging from 1.5 to 3.3<sup>17</sup>. In Morocco, the prevalence of mite sensitization was 63.3%, represented by *D. pteronysissinus* (92%), *B. tropicalis* (Bt) (57.2%) and *D. farinae* (50.8%)<sup>18</sup>. In Iran, the prevalence of mite skin sensitization among subjects consulting for allergic manifestations was 85%<sup>19</sup>. In Toulouse, among subjects with respiratory allergy, 71.3% were sensitized to house dust mites<sup>20</sup>. In a study of 493 children with asthma in Peru, 80% were sensitized to house dust mites, including 71.1% to *D. pteronysissinus*, 56.9% to *D. farinae*, and 54.6% to *B. tropicalis* (Bt)<sup>21</sup>.

Finally, Fraisse reported that over 50% of allergic patients were sensitized to house dust mites in a respiratory allergy consultation involving 3962 files<sup>22</sup>. In Benin, on the other hand, it was 71.4% for *D. pteronysissinus* and 38.7% for *D. farinae* for skin prick tests, and 34.6% for *D. pteronysissinus* and 37.7% for *D. farinae* for IgE assays. In fact, the immune system is immature, as the baby has not yet encountered microbial agents at birth, and is brutally overwhelmed by these agents, whether pathogenic or not, during delivery and exposure to the environment and the introduction of solid food. Antigen penetration is facilitated by defective epithelial barriers, and allergen elimination is made more difficult by reduced phagocytic capacity<sup>23-24</sup>. The majority of our patients had asthma and allergic rhinitis (47 cases), or rhinitis (40 cases), or allergic asthma (33 cases). The rate of sensitization in our asthmatic patients is lower than that reported in the literature, where figures of 70-90% have been reported in school-age asthmatic children, and 62% in adolescents<sup>14</sup>. The prevalence of rhinitis is low in early childhood, and high in adolescence and adulthood<sup>16</sup>. The atopic march is the progressive development of diseases associated with allergy (atopic dermatitis, allergic rhinitis, asthma, food allergies) in predisposed individuals, especially children. It begins with food sensitization, followed by sensitization to pneumallergens. In allergic individuals, these IgE-mediated immune reactions are associated with epithelial diseases (also known

as “barrier diseases”). First atopic dermatitis, then, given the damage to the skin barrier, they become sensitized to different allergens through the skin and develop respiratory allergies: allergic rhinitis, asthma in preschool and school-age children <sup>25</sup>. In fact, children who develop eczema in the first few months of life are at greater risk of developing respiratory allergies, particularly asthma. Similarly, young children suffering from a food allergy (especially to eggs, milk and peanuts) have a definite risk of developing a respiratory allergy. Allergic reactions are particularly pronounced in the airways. Thus, the development of allergic rhinitis in childhood constitutes a significant risk of later developing asthma <sup>26</sup>. Various studies carried out on cohorts have made it possible to evaluate the allergic progression from exposure to sensitization to allergy, and the transition from one disease to another <sup>27</sup>. In our study, children under the age of 10 were the most exposed, with the lowest IgE titres. The increasing effect of mite sensitization frequency with age in the exposed population has also been well established in the

literature <sup>28-29</sup>. Indeed, the data on specific IgE titres in our study indicate a significant increase with age. Several authors confirm this indication.

For Berciano et al., the geometric mean of IgE also increases with age, with the highest values observed in children with a family history of allergy<sup>28-29</sup>. Not all hospitals in the Abidjan district responsible for testing specific IgE antibodies in children were able to take part in the study. The limited number of participating centers could lead to a probable bias in the interpretation of results. Despite this possible bias, this study has the merit of being original, and provides basic information on house dust mite sensitization in an Ivorian population. This study provides information on mite sensitization in the Ivorian environment. Indeed, mite sensitization is more frequent in tropical environments, with varying frequencies between species (*Table 3*). These results reveal the ubiquitous nature of *D. pteronyssinus* as the most frequent sensitization in Ivory coast. The same observation was made in a previous study in asthmatic adults <sup>30</sup>.

**Table 3.** Comparison of sensitization frequencies between different studies by IgE specific assay

References country, years	Sample size	Age	IgE
<b>Our series, 2008-2022</b>	329	1-82	
<i>D. pteronyssinus</i>			49
<i>D. farinae</i>			37
acarions/blattes			14
<b>Bénin, 2014 <sup>8</sup></b>	119	3—15	
<i>D. pteronyssinus</i>			34,6
<i>D. farinae</i>			37,7
<i>B. tropicalis</i>			36,6
<b>Taiwan, 2002 <sup>31</sup></b>	93	3-15	
<i>D. pteronyssinus</i>			87
<i>D. farinae</i>			85
<i>B. tropicalis</i>			65
<b>Brésil, 2004 <sup>32</sup></b>	457	1-12	
<i>D. pteronyssinus</i>			66,7
<i>D. farinae</i>			64,5
<i>B. tropicalis</i>			55,2
<b>Inde, 2010 <sup>33</sup></b>	1079	5-50	
<i>D. pteronyssinus</i>			71,7
<i>D. farinae</i>			88,7
<i>B. tropicalis</i>			92
<b>Malaisie, 2011 <sup>34</sup></b>	82	1-66	
<i>D. pteronyssinus</i>			74,4
<b>Philippines, 2011 <sup>35</sup></b>	202	16-21	
<i>D. pteronyssinus</i> 33,3			33,33
<i>D. farinae</i> 47,6			47,6
<i>B. tropicalis</i> 38,2			38,2

## 5. Conclusion

In conclusion, this study has provided information on mite sensitization in the tropical environment of Côte d'Ivoire. Sensitization is frequent in order of species: *D. pteronyssinus* and *D. farinae* and other mites. The most important clinical signs were asthma and rhinitis, followed by allergic rhinitis and asthma, and the most vulnerable were in the 1 to 5 age group.

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