

## Prevalence of Aeroallergens in Allergic Rhinitis in a Tertiary Care Hospital

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### ABSTRACT

**Introduction:** The prevalence of allergic rhinitis has increased significantly globally over the last two decades. Detection of sensitizing aeroallergens plays a crucial role in the diagnosis and management of this troublesome disease. This study aims to investigate the spectrum of aeroallergens sensitization in patients with allergic rhinitis in a tertiary care hospital.

**Methods:** A descriptive cross-sectional study conducted in the Department of Otorhinolaryngology of our hospital between January 2016 to December 2019. Ethical approval was taken from the Institutional Review Committee (No: 210/19). Patients diagnosed with allergic rhinitis were enrolled using the convenience sampling technique. Data entry and analysis was done using IBM Statistical Package for Social Sciences version 20.0.

**Results:** Among 170 patients, altogether 103 (60.6%) patients yielded positive responses on the skin prick test. The most prevalent aeroallergens were Lepidoglyphus 86 (50.60%), Dermatophagoides pteronyssinus 85 (50%), Dermatophagoides farina 82 (48.20%), Thyrophagus 50 (29.40%), Blomia 46 (27.10%), Acarus 43 (25.30%), cat dander 26 (15.30%), dog dander 24 (14.10%), cow and buffalo dander 20 (11.8%), ragweed 20 (11.8%), grass pollen 18 (10.60%) and mugwort 17 (10%).

**Conclusions:** This study highlights that the frequency of aeroallergens based on skin prick test in patients presenting to a tertiary care hospital which showed the dominance of house dust mites, dog and cat hair, pollen, and grasses. Reduced exposure and training of patients about protection against these agents will possibly help in controlling the severity of allergic rhinitis in this region.

**Keywords:** allergic rhinitis; prevalence; skin prick test.

### INTRODUCTION

Allergic Rhinitis (AR) is a chronic allergen-specific, IgE-mediated hypersensitivity disorder affecting the nasal lining characterized by nasal congestion, rhinorrhea, sneezing, nasal itchiness, and/or postnasal drip.<sup>1</sup> Its global prevalence has risen significantly over the last two decades<sup>2-7</sup> accounting from 37.90% to 50.60%.<sup>5</sup>

The direct and indirect effects including the cost of treatment, impaired quality of life, and presence of co-morbidities due to AR cause significant impact on

the public health system.<sup>8,9</sup> Detection of aeroallergens sensitization plays a crucial role in diagnosis and management of this disorder.<sup>10,11</sup> Skin Prick test (SPT) is a reliable and well-tolerated method for the diagnosis and is routinely performed to identify allergens in a clinical setting.<sup>10,12</sup> Many studies have shown that the spectrum of aeroallergens is significantly diverse in different countries<sup>13</sup> and even in different parts of a

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country.<sup>14</sup>

Hence, the current study aims to illustrate the prevalence of common aeroallergens in the patients diagnosed with allergic rhinitis at the Kathmandu University School of Medical Sciences Dhulikhel Hospital.

## METHODS

This was a descriptive cross-sectional study conducted in the Department of Otorhinolaryngology and Head & Neck surgery at the Kathmandu University Dhulikhel Hospital between January 2016 to December 2019. The study was approved by the Kathmandu University School of Medical Sciences Institutional Review Committee (No: 210/19). Patients diagnosed as AR according to the AR and its Impact on Asthma (ARIA guidelines 2019) and residing in Kavre district were enrolled in our study. Patients with Chronic rhinosinusitis, nasal polyposis, benign or malignant tumors of the nose and paranasal sinuses, or other known cases of non-allergic rhinitis like occupational rhinitis were excluded. Patients with pregnancy and drug-induced rhinitis, wheezy bronchitis, and bronchiectasis were also excluded from the study. Similarly, patients with the parasitic infestation, patients under treatment with antihistamines, steroids, and antileukotrienes within 7 days period, patients under 18 years of age, severe eczema, dermographism, and those with a history of previous life-threatening anaphylaxis were not included. Convenience sampling was done and the sample size was calculated using the formula,

$$n = Z^2 \times p \times (1-p) / e^2 \\ = 1.96^2 \times 0.5 \times (1-0.5) / (0.08)^2 = 150$$

Where,

n = required sample size

Z = 1.96 at 95% Confidence Interval (CI)

p = prevalence, 50% from previous studies

e = margin of error, 8%

Taking a 10% non-respondent rate, the sample size becomes 165. However, 170 patients were enrolled in the study. The medical records containing demographic data, presenting symptoms, symptoms of co-morbidities, general medical history, drug use, occupational and environmental exposure, family history of allergy, and smoking were collected.

SPT was performed according to European guidelines.<sup>15</sup> SPT was performed after patients had stopped taking long-acting antihistamines for more than 1 week and short-acting antihistamines and sympathomimetic drugs for 5 days before the test. In the present study, allergens were selected based on the plant species existing in the Kavre district and other possible allergens. The aeroallergens included in the test battery were *Lepidoglyphus destructor* (storage mite),

*Dermatophagoides pteronyssinus*, *Dermatophagoides farinae*, *Thyrophagus*, *Blomia*, *Acarus*, cat dander, dog dander, cow and buffalo dander, horse dander, rat dander, *Artemisia douglasiana* (ragweed), *Poaceae* (grass pollen), *Artemisia vulgaris* (mugwort), *Hordeum vulgare* (barley), *Fraxinus* (ash) and *Ficus religiosa* (bodhi) tree pollen, *Betula* (birch) pollen, *Plantago* (plantain), *Alternaria alternata*, *Corylus* (hazel), and *Aspergillus*.

A small amount of allergen extract was placed on the volar aspect of the forearm and introduced into the skin with a lancet. The lancet was penetrated at a low angle and its tip was lifted gently to raise the epidermis, without inducing any bleeding. To avoid false-positive results, the drops were placed at least 3 cm apart from each other. The test areas were numbered with a skin marker. A positive control (0.1% histamine in phosphate-buffered saline) and negative control (physiological saline) were also included in the test. A separate lancet was used for each test. The test solution was wiped off immediately after the SPT with the help of an absorbent paper towel on the skin prick area and carefully pressing it on the skin, without blending the different dilutions. The mean wheal diameter was read at 15 minutes. Wheel diameter of more than 3 mm was considered positive. A positive histamine reaction ( $\geq 3$  mm) and a negative saline control reaction ( $< 3$  mm) was considered for the validity of SPT. Positive response to at least one of the allergens was accepted as the presence of sensitization.

Data entry and analysis was done using IBM Statistical Package for Social Sciences version 20.0.

## RESULTS

Out of 170 enrolled participants, 103 (60.6%) patients yielded positive response on SPT. The most prevalent aeroallergens were *Lepidoglyphus* 86 (50.60%), *Dermatophagoides pteronyssinus* 85 (50%), *Dermatophagoides farinae* 82 (48.20%), *Thyrophagus* 50 (29.40%), *Blomia* 46 (27.10%), *Acarus* 43 (25.30%), cat dander 26 (15.30%), dog dander 24 (14.10%), cow and buffalo dander 20 (11.8%), ragweed 20 (11.8%), grass pollen 18 (10.60%) and mugwort 17 (10%) (Figure 1).

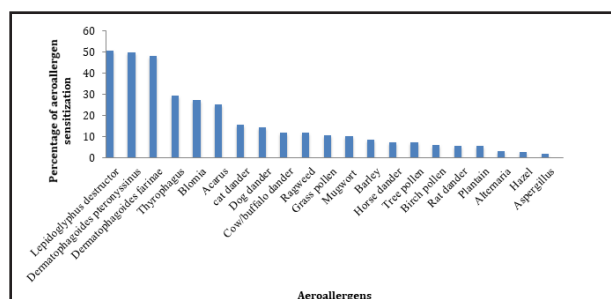


Figure 1. Prevalence of common aeroallergen sensitization in Kavre district.

There were 101 (59.40%) females and 69 (40.60%) males. The mean age was 31.84 years. The minimum age was 18 years, and the maximum was 66 years (Table 1).

**Table 1. Sociodemographic characteristics of patients with AR (n = 170).**

Variables	Category	Frequency n (%)
Sex	Male	69 (40.60)
	Female	101 (59.40)
Age (years)	18-20	20 (11.76)
	21-30	76 (44.70)
	31-40	41 (24.11)
	41-50	15 (8.82)
	51-60	12 (7.05)
	61-70	6 (3.52)
Family history of allergy	Present	68 (40)
	Absent	102 (60)
Smoking status	Present	36 (21.20)
	Absent	134 (78.80)
Pet ownership	Yes	40 (23.50)
	No	130 (76.50)

## DISCUSSION

In the current study, we revealed some interesting findings regarding the aeroallergens sensitization spectrum in patients with AR. We observed that *Dermatophagoides pteronyssinus*, *Dermatophagoides farinae*, *Lepidoglyphus destructor*, *Thyrophagus*, *Blomia*, *Acarus* which belong to a family of House Dust Mite (HDM)s were the predominant aeroallergens followed by dog and cat dander.

Our findings correspond with previously published studies in literature.<sup>16,17</sup> This could be related to the high humidity and ambient temperatures which have been reported as optimal conditions for HDM propagation.<sup>18</sup> Kavre district is located at a height of 1007 meters to 3018 meters from sea level and constitutes of 23.70% of the area belonging to the tropical region and 65.30% of the area constituting of the subtropical zone. The characteristics of the local climate are optimal for HDM propagation. Lifestyle may be another potential contributor to the high prevalence of sensitization to HDMs. Most of the Nepalese use cotton pillows, mattresses, and carpets which act as sources of HDM. At the same time, the exacerbating air pollution caused by automobile exhaust also contributes to the high detection of HDMs.<sup>19</sup> Our study is in contrast with a study performed by Mohammadi et al.<sup>20</sup> where the authors found that the most common allergens in that area were trees, weeds, grasses, and *Dermatophagoides pteronyssinus* respectively. This could be explained by the fact that the spectrum of aeroallergens is significantly diverse in different countries and even in different parts of a country.<sup>21</sup>

Our study findings also illustrate the prevalence of plant pollen in Kavre. A possible explanation could be that there is a larger percentage of cultivated land in Kavre district. Hence, a greater proportion of people in this particular area are involved in farming for household or agricultural purposes, cutting grasses for feeding cattle and collecting firewood for cooking purposes which exposes them to plant-borne aeroallergens in particular pollen seasons.

Previous studies have shown that the more contacts one person has with pet allergens, the more possible he or she develops a symptom of airway hyper-reactivity.<sup>22</sup> In our study, animal dander was also identified as an important risk factor for the development of AR. This finding is the following study by Wang J et al and in contrast with a study performed by Mohammadi et al.<sup>20,23</sup> In Nepal, as in many other developing countries, many households keep cats and dogs as indoor pets. This could increase the chances of being exposed to dog and cat dander which act as allergens. This factor must be taken into account since avoiding contact with cat-dog dander allergens could probably help in the prevention of AR.

In the present study, the total positive rate of SPT was found to be significantly higher in women than in men. This finding may be due to our study population, which itself consisted of more women which are supported by a study in Turkey.<sup>24</sup>

This is in contrast with the study performed by Wang J et al<sup>23</sup> and Sattar HA et al.<sup>25</sup> However, no convincing clarifications have been found in previous literature to suggest that sex leads to differential exposure to aeroallergens<sup>26</sup> and no convincing clarifications have been given in previous literature regarding this aspect.

Our results demonstrated that the most frequently affected age group was between 20-40 with the highest peak in mid-twenties. Our findings are supported by a study by Boulet et al,<sup>27</sup> where the authors suggested that the sensitization of all allergens tended to increase and reached its highest degree in young adults. Conversely, studies from other countries reported no difference in the prevalence of positive SPT in AR between younger and older patients.<sup>28,29</sup>

To the best of our knowledge, this is the first study addressing the prevalence of common aeroallergen sensitization patterns in patients with AR in the Kavre region. However, there are several limitations to this study. The study was conducted by retrospective analysis. This study was primarily a single-center study. Hence, we hope that more multicenter studies will be conducted in the future to reach a more accurate and comprehensive conclusion. We could not include some

less common inhalant allergens in the SPT battery. Although in theory a patient may be solely sensitized to that particular aeroallergen not included in the test battery.

## CONCLUSIONS

This study demonstrated that the frequency of aeroallergens based on SPT in Kavre district showed the dominance of house dust mites, dog and cat hair, pollen, and grasses. Reduced exposure and training of patients about protection against these agents will possibly help in controlling the severity of AR in this region.

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**Conflict of interest: None.**

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