# Mite and pet allergen exposure in Brazilian private cars

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**Background:** The role of mite and pet allergens in the development of allergic diseases has been recognized for many years.

**Objective:** To determine mite (*Dermatophagoides pteronyssinus* [Der p 1] and *Dermatophagoides farinae* [Der f 1]), cat (*Felis domesticus* [Fel d 1]), and dog (*Canis familiaris* [Can f 1]) allergen levels in Brazilian private cars.

**Methods:** Mite, cat, and dog allergens were measured in dust samples collected from 60 upholstered seats of private vehicles using enzyme-linked immunosorbent assays.

**Results:** Mean levels of Der p 1 (0.24 μg/g of dust; range, 0.06–2.05 μg/g of dust) and Der f 1 (0.29 μg/g of dust; range, 0.06–2.07 μg/g of dust) were extremely low in most dust samples analyzed. In contrast, sensitizing mean levels of Can f 1 (1.51 μg/g of dust; range, 0.14–30.96 μg/g of dust) and Fel d 1 (0.43 μg/g of dust; range, 0.02–5.75 μg/g of dust) were observed in 32 (53%) and 12 (20%) samples, respectively. Mean Can f 1 levels were significantly higher in cars whose owners kept dogs at home (3.27 μg/g of dust) than in those without pets (0.57 μg/g of dust; $P = .008$). There were no significant differences in allergen levels regarding the age of the vehicle or the number of users and whether the owners transport pets inside the vehicles.

**Conclusions:** Private cars constitute an important pet, but not mite, allergen reservoir for continuous contamination of the indoor environment. Pet allergens may be present even in cars whose owners do not have pets. Effective measures to reduce allergen exposure in cars should be taken routinely, especially for pet-allergic patients.

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## INTRODUCTION

In recent decades, there has been a global increase in the prevalence of allergic diseases associated with a change in the lifestyle of modern societies.[1] Mites and pets are important sources of indoor allergens,[2] and their role in the development of allergic diseases has been recognized for many years.[3] Besides homes, public places such as day-care centers and schools,[4] hospitals,[5] cinemas,[6] and public transport vehicles[7] have been considered important mite and pet allergen reservoirs for continuous contamination of the indoor environment. The presence of allergens in public places is mainly due to passive allergen transport on clothing, and environmental factors such as temperature and relative humidity can affect mite allergen levels.[8,9]

It is widely recognized that exposure levels of 2 μg/g of dust or more of *Dermatophagoides pteronyssinus* (Der p 1) or *Dermatophagoides farinae* (Der f 1) allergens and 1 μg/g of dust or more of cat (*Felis domesticus* [Fel d 1]) or dog (*Canis familiaris* [Can f 1]) allergens are considered risk factors for allergenic sensitization in genetically predisposed individuals.[10] The aims of this study were to determine the levels of Der p 1, Der f 1, Fel d 1, and Can f 1 allergens in private cars and to investigate the relationship between allergen levels in cars and pet ownership.

## METHODS

### *Dust Sampling and Allergen Extraction*

Private cars from 60 university student or staff owners were randomly selected in the parking lot at the Federal University Campus of Uberlāndia, Brazil, and enrolled in a study on allergen exposure. Informed consent was obtained from all car owners. A questionnaire regarding the age of the vehicle, the number of users, whether the car owners keep pets at home, and the habit of transporting pets in the car was completed by the car owners.

Composite dust samples were obtained from car seats (driver's seat and passenger's front and rear seats) by using a portable vacuum cleaner (Car Vac Plus; Black & Decker Inc, Hunt Valley, MD) adapted with a paper filter for dust retention for approximately 3 minutes in each vehicle (0.1–0.5 g of dust). Dust sampling was performed between January 8, 2001, and June 29, 2001, with the temperature ranging from 20.2°C to 25.1°C (mean ± SD, 23.2°C ± 2.2°C) and relative humidity ranging from 64% to 74% (mean ± SD, 69.2% ± 4.4%). All sampled seats were upholstered, and their surfaces

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were coated by cushion and woven fabrics. The same investigator (C.M.J.) performed all the dust sampling.

Fine dust was obtained by sieving through a 0.3-mm mesh screen (US Standard Sieve Series ASTM). Allergens were extracted from 100 mg of fine dust in 2 mL of 5-mmol/L borate-buffered saline solution (pH 8.0) overnight at 4°C. After centrifugation for 10 minutes at 10,000*g*, supernatants were stored at −20°C before immunoassays.

*Enzyme-Linked Immunosorbent Assays for Measuring Mite and Pet Allergen Levels*

Group 1 *Dermatophagoides* (Der p 1 and Der f 1), cat (Fel d 1), and dog (Can f 1) allergens were measured using enzyme-linked immunosorbent assays as described elsewhere[11] and their respective capture monoclonal antibodies: anti–Der p 1 (clone 5H8), anti–Der f 1 (clone 6A8), anti–Fel d 1 (clone 6F9), and anti–Can f 1 (clone 6E9F9). The detection antibodies consisted of biotinylated anti–group 1 *Dermatophagoides* allergens (clone 4C1) or anti–Fel d 1 (clone 3E4C4) monoclonal antibodies or polyclonal rabbit serum against Can f 1. Absorbance results are expressed in micrograms per gram of dust as described previously,[11] and the detection limit of the assay was 0.04 μg/g of dust for mite, 0.01 μg/g of dust for Fel d 1, and 0.08 μg/g of dust for Can f 1 allergens. All allergen measurements were performed on 2 different days, and the coefficients of variation of the interassays were less than 6% for all allergens.

*Statistical Analysis*

Allergen concentrations were log transformed to normalize the distribution and are expressed as the geometric mean (gm) with the 95% confidence interval (CI). Differences between the means were analyzed using the unpaired *t* test, and $P < .05$ was regarded as statistically significant.

## RESULTS

The pet ownership distribution related to the 60 car dust samples was 20, 19, 11, and 10 for individuals with no pets, dogs, cats, and both cats and dogs, respectively. Mite allergen levels were found at very low levels, and only 1 sample (2%) contained more than 2 μg of Der p 1 or Der f 1 per gram of dust (Fig 1A). However, sensitizing levels of Can f 1 (≥1 μg/g of dust) were observed in 32 samples (53%), of which 11 (18%) contained more than 10 μg of Can f 1 per gram of dust; 12 samples (20%) contained at least 1 μg of Fel d 1 per gram of dust. The mean level of Can f 1 (gm, 1.51 μg/g of

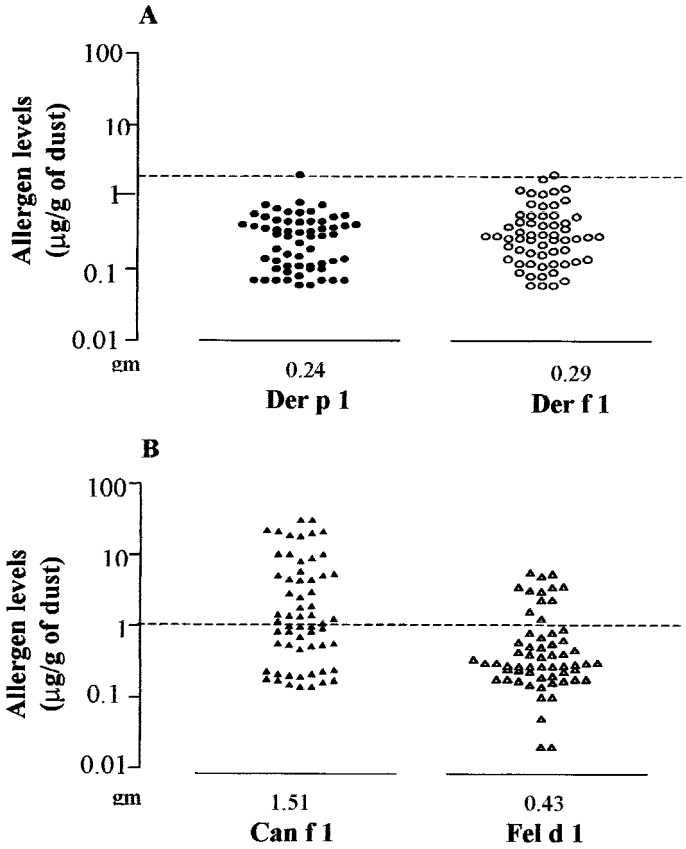


Figure 1. Levels of mite (*Dermatophagoides pteronyssinus* [Der p 1] and *Dermatophagoides farinae* [Der f 1]) (A) and pet (*Canis familiaris* [Can f 1] and *Felis domesticus* [Fel d 1]) (B) allergens in 60 dust samples from private cars. The dashed lines indicate levels considered to be risk factors for allergenic sensitization in genetically predisposed individuals (2 μg/g of dust for mite allergens and 1 μg/g of dust for pet allergens); gm, geometric mean.