Levels of house dust mite allergen in cars

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sampling techniques has been fully reported (7), but essentially all household samples were obtained by vacuuming the seat of a well-used lounge chair and nearby floor area for approximately 5 minutes. Car dust samples were obtained by vacuuming the driver’s seat and foot-well.

Dust samples were weighed and extracted for 2 hours by mixing them with 0.1 % Tween 20 (Sigma-Aldrich, Poole, UK) in phosphate buffered saline at 10 % weight/volume ratio. Extracts were centrifuged and the supernatant analysed for Dermatophagoides species group 2 allergens (Der p 2 + Der f 2) using the ELISA kit (Indoor Biotechnology, Cardiff, UK) and total soluble protein using the standard bicinchoninic acid colorimetric assay (Sigma-Aldrich, Poole, UK). The batch-to-batch method imprecision for the allergen and protein methods are 14 % and 10 % respectively. The lower limit of quantification calculated for the allergen assay using ProQuant software (QIVX Inc. Fort Collins, CO, USA) was 2 ng g⁻¹ dust. We measured Der group 2 allergens rather than the more usual Der p 1, as the latter can be underestimated in the presence of bakery/wheat components (9).

RESULTS AND DISCUSSION

The levels of HDM in the 12 bakery households matching the cars were not different from the larger data set of 24 bakery homes.

Measurable levels of the Der group 2 allergens were detected in all dust samples collected from the twelve houses and the matching cars. Their medians (and ranges) were 55 (5-12,863) ng g⁻¹ and 23 (3-454) ng g⁻¹ dust, respectively, or 6.48 (0.28-740.1) and 2.93 (0.14-65.11) when expressed as ng mg⁻¹ soluble protein (Figure 1). Although allergen levels were higher in house samples expressed either way, these differences did not achieve statistical significance (Friedman test; \( p = 0.082 \) and 0.586, respectively). However, allergen levels correlated significantly between the paired dust samples from cars and houses; Spearman’s coefficients of correlation (rho) were 0.657, \( p = 0.02 \) for the results expressed per gram of dust and 0.769, \( p = 0.0034 \) when expressed per mg of soluble protein (Figure 2).

For the reason noted earlier, we measured Der group 2 rather than the more usual Der p 1. Attempting to convert our results to likely Der p 1 levels can only yield approximate values. Custovic (10) showed good correlation in UK field samples between Der p 1 and p 2, whereby 1 ng of Der p 2 was equivalent to 1.9 ng of Der p 1. Our group 2 measurement also theoretically includes any Der f 2 present, but in the UK D. pteronyssinus is predominant over D. farina. Thus we assume that likely Der p 1 levels are somewhere between the same as, or require doubling of, our measurements.

Justino et al. (6) measured Der group 1 allergens in car dust samples from Brazilian university staff and students, reporting a geometric mean [Der p 1 + Der f 1] of 540 ng g⁻¹ dust. Car allergen levels in our study are lower than these. Neal et al. (5) conducted a study of paired vehicles and homes in Ohio, USA. Their overall means of Der group 1 in houses and vehicles were 25,600 and 1,300 ng g⁻¹ dust, respectively. While Neal et al. (5) presents arithmetic means without any indication of the distribution of allergen data, which were very non-normal in both Justino’s and our study, their results suggest much higher vehicle and household levels of HDM allergens than we report. Interestingly, Neal et al. (5) also found a positive association between house and vehicle allergen levels.
The value of 2000 ng g⁻¹ of Der p 1 in settled dust is often quoted as the threshold for the risk of sensitisation (11). Our data suggest that 25% of the matched households would exceed this. No allergen levels in the cars exceed it, and therefore suggest no risk of sensitisation. However, a number of studies (12-14) show that exposure to allergen levels of less than 2000 ng g⁻¹ can still be a significant sensitisation risk. Dose-response relationships for other outcomes (rhinitis, upper and lower respiratory symptoms) in sensitised individuals are unclear. Therefore, while the health risk in this small vehicle group is probably small, their HDM levels deserve further investigation in a larger UK cohort, particularly if focussed on households that are likely to have high HDM levels. What also deserves further investigation is the use of allergen levels in settled dust as the inhalation exposure metrics for health outcomes (15). Such metrics have been employed for HDM allergens, as air measurements have often failed to detect airborne levels of Der p 1 unless there is significant dust disturbance or human activity. This possibly relates to the Der p 1 particle size. Analysis of airborne HDM allergens after normal human activity in both the house and the car may help clarify exposure-risk relationships.

Our household allergen levels are comparable with those reported in a Dutch study of living room carpets (16). The group 2 measurement reflects mite body proteins and is more heat-stable than the Der p 1 allergen associated with a faecal protein (11), and Der p 2 has been shown to correlate with mite numbers indoors (17). However, we do not know whether the vehicle results reflect the transfer of the living mites from home or only the transfer of the allergenic protein.

The significant association between the allergen levels in matched household and car dust samples suggests transfer from home to car. We have already established transfer of allergens between workplaces and homes through contaminated clothes, hair, skin, with increased bakery allergen levels found in bakers’ cars used for commuting (7). This study also suggests that the car could be a relatively neglected micro-environment for secondary exposure to indoor and occupational allergenic material.

Levels of house dust allergen in a car may reflect the levels of the allergen in the house and the extent of house-to-car transfer. While HDM allergen levels measured in this study in north-east Scotland indicate low risk (18), the small sample size can hardly serve to predict the distribution of HDM allergen, especially the levels that might constitute a health risk. Further investigations of HDM levels (including Der p 1 measurements) in UK households and vehicle dust are warranted, especially where high household HDM levels are likely to be found (i.e. higher ambient temperatures and humidity). Given that the major health risks are due to inhalation rather than indirectly from settled dust content and that airborne HDM allergen derives largely from human activity and disturbance of settled dust, we suggest measuring vehicle airborne allergen levels during real-life use of vehicles. We also hope this study will raise further interest in exposure to allergens and their possible health risks in all forms of transport.

REFERENCES
Razine alergena prašinskih grinja u automobilima

U ovome smo preliminarnom istraživanju izmjerili razine alergena prašinskih grinja u automobilima i domovima njihovih vlasnika u sjevernoistočnoj Škotskoj. Uzorci prašine uzeti su na standardiziran način iz dvanaest domova i dvanaest odgovarajućih automobila. Nakon ekstrakcije izmjerene su razine 2. skupine alergena grinja roda *Dermatophagoides* (Der f 2 i Der p 2) te njihove ukupne topljive bjelančevine. Razine alergena u kućama bile su mahom više nego u odgovarajućim automobilima. Nakon ekstrakcije izmjerene su razine 2. skupine alergena grinja roda *Dermatophagoides* (Der f 2 i Der p 2) te njihove ukupne topljive bjelančevine. Razine alergena u kućama bile su mahom više nego u odgovarajućim automobilima.

KLJUČNE RJEČI: Der f 2; Dermatophagoides; Der p 2; Škotska; vozila

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