Innovative Nasal Filters Allow For Allergen Exposure Monitoring And Are Acceptable To Wear

Samantha Tyler[1], Ross Yarham[1] Anna Kuklinska-Pijanka[1], Peter Kenney[2,3]Torben Sigsgaard[2], Martin Chapman[1,] James Hindley[1].

1. Indoor Biotechnologies Ltd, Cardiff, UK. 2. Aarhus University, Aarhus, Denmark. 3. Rhinix ApS, Aarhus, Denmark.

samantha@indoorbiotech.co.uk; www.inbio.com

INTRODUCTION

• For over 25 years the examination of environmental allergens has shaped our understanding of the role of allergen exposure in the development of allergic disease.

• These studies have highlighted the important role allergens play in allergic sensitisation and exacerbation.

• The most common sample type analysed for monitoring allergen exposure is settled dust. Settled dust is an easily available source which yields lots of allergen.

• However, this sample type is only a snap shot of the allergen reservoir and may not take into account the full spectrum of allergen which a subject breathes in during their whole day.

Aim: We sought to assess the feasibility of using a new nasal filter for the assessment of allergen exposure.

MATERIALS AND METHODS

• Healthy volunteers (n=27) were provided with a nasal filter (Figure 1A) and requested to wear it for between 1 and 24 hours during their normal daily routine. The nasal filter consists of a membrane that removes particles by means of interception and impaction.

• For comparison, settled dust was collected from each volunteer's home using a dust collection device (Figure 1B) attached to a vacuum cleaner.

• The estimated effectiveness of the nasal filter is depicted in Figure 2.

• Bench top testing was also performed using a house dust nebuliser to test the capture of allergens by the nasal filter from a stock dust in a closed system. Air flow was set to between 2L/min and 6L/min for 1 to 6 hours, with a secondary 0.2µm PTFE filter to capture any allergens that were not captured by the nasal filter (Figure 3).

• Allergens were extracted from filters and settled dust by gentle rocking in phosphate buffered saline with Tween for two hours.

• The levels of major allergens from dust mite, cat, dog and pollen captured by these sampling methods were quantified using a multiplex array for quantification of indoor allergens (MARIA®).

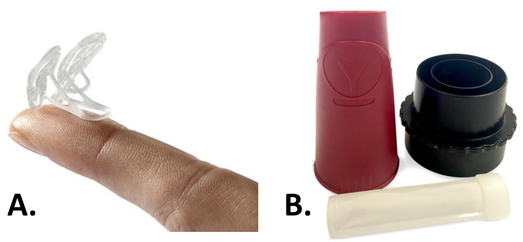

Figure 1. Nasal filter (A) and settled dust (B) sampling devices used for allergen collection.

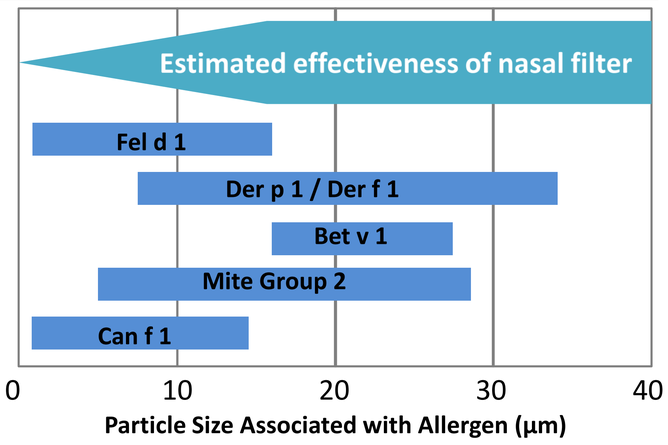

Figure 2. Estimated effectiveness of nasal filter in comparison with estimated particle size (in µm) associated with major allergens.

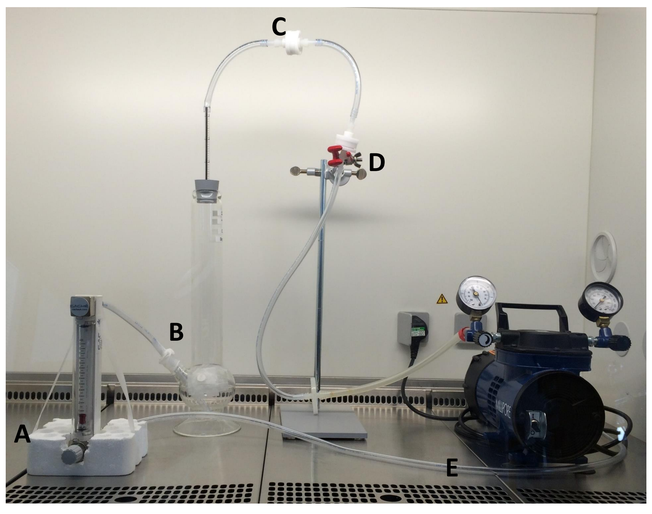

Figure 3. Bench Top Testing Set Up. Air flow meter and control (A). House dust nebuliser containing stock dust (B). 25mm nasal filter (C). 25mm 0.2µm PTFE trap filter (D). Pump creating the air flow and the closed system (E). This bench top test was performed in a safety cabinet.

RESULTS

• Detectable levels of allergens (up to 20ng per filter) were found in 24 of the 27 nasal filter extracts from volunteers (Figure 4).

• Allergens from house dust mite (Der p 1), cat (Fel d 1), dog (Can f 1) and pollen (Bet v 1) were most commonly detected (Figure 4).

• There was a significant correlation between the levels of dust mite, cat and dog allergens from nasal filter samples and the corresponding samples collected from settled dust (Figure 5).

• Bench top testing showed that when present in dust, the major allergens are captured by the nasal filter (Figure 6).

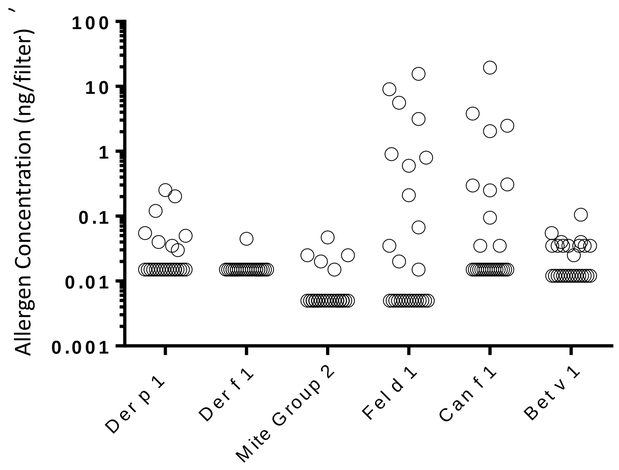

Figure 4. Concentration of major allergens quantified by MARIA® in samples collected from nasal filters.

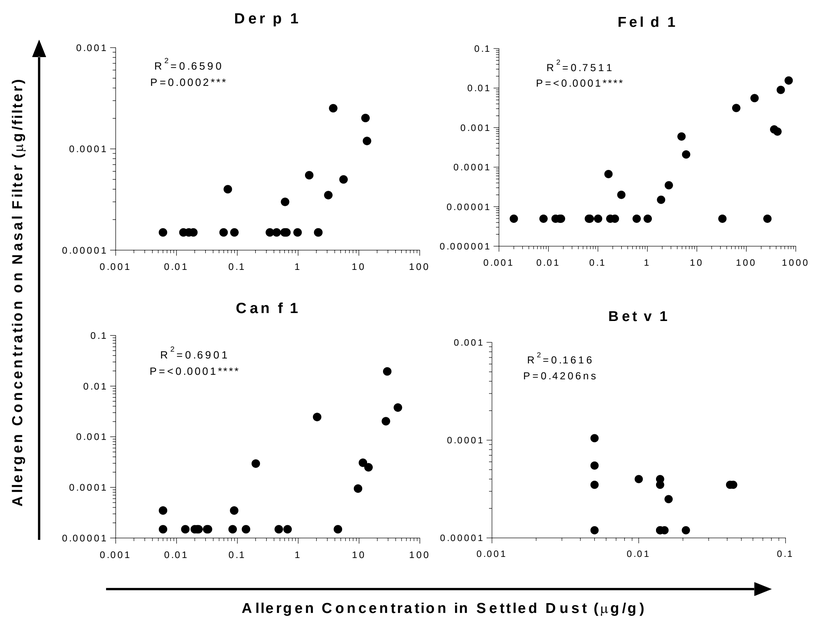

Figure 5. Correlation between the concentration of allergen in samples collected from settled dust and samples collected from nasal filters. Data sets were analysed using non parametric Spearman correlation .

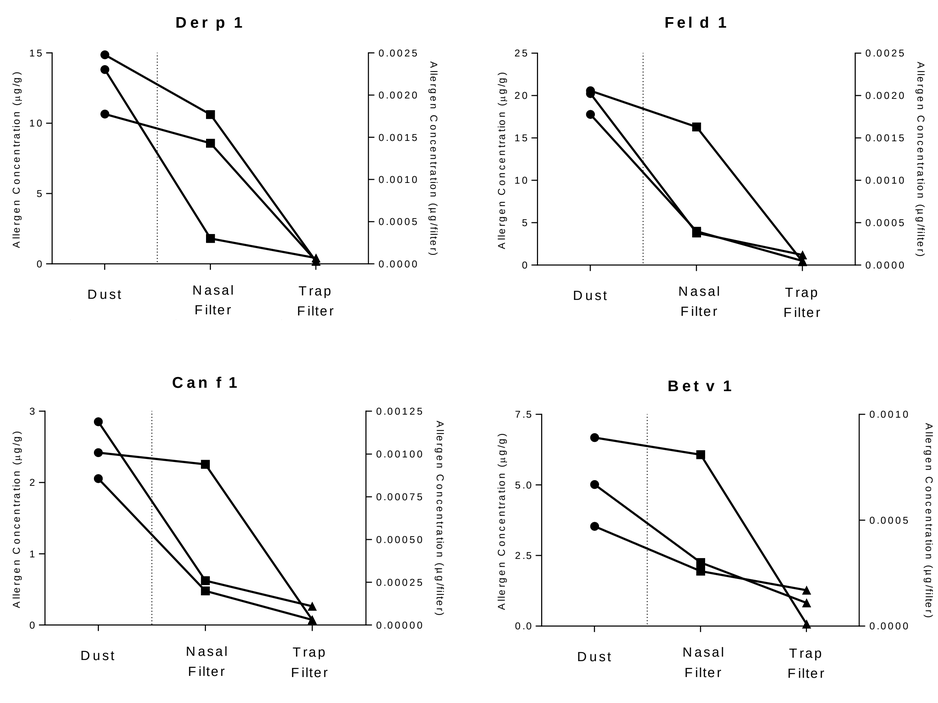

Figure 6. Allergen detection during bench top testing, showing concentrations of allergen in the stock dust, and concentration of allergen captured by the nasal filter and trap filter.

CONCLUSIONS

• The data indicate that these novel nasal filters may be considered a simple and easily wearable method for monitoring personal allergen exposure to multiple allergens.

• This personal sampling method, which takes into account a wider spectrum of potential allergen exposure sources, may improve our understanding of the role of allergens in the development of allergic disease.

REFERENCES

• Kenney P, Hilberg O, Laursen AC, Peel RG, Sigsgaard T. Preventive effect of nasal filters on allergic rhinitis: A randomized, double-blind, placebo-controlled crossover park study. J Allergy Clin Immunol. 2015 Dec;136(6):1566-1572.e5.

• King EM, Filep S, Smith B, Platts-Mills T, Hamilton RG, Schmechel D, Sordillo JE, Milton D, van Ree R, Krop EJ, Heederik DJ, Metwali N, Thorne PS, Zeldin DC, Sever ML, Calatroni A, Arbes SJ Jr, Mitchell HE, Chapman MD. A multi-center ring trial of allergen analysis using fluorescent multiplex array technology. J Immunol Methods 2013;387(1-2):89-95.

Disclosure: In relation to this poster I declare the following, real or perceived conflicts of interest:
Samantha Tyler, Ross Yarham, Anna Kuklinska-Pijanka, Martin Chapman and James Hindley are employees of Indoor Biotechnologies. Peter Kinney designed and provided the nasal filters.