Development of the 'Apollo': a novel static air sampler for the measurement of airborne allergen exposure

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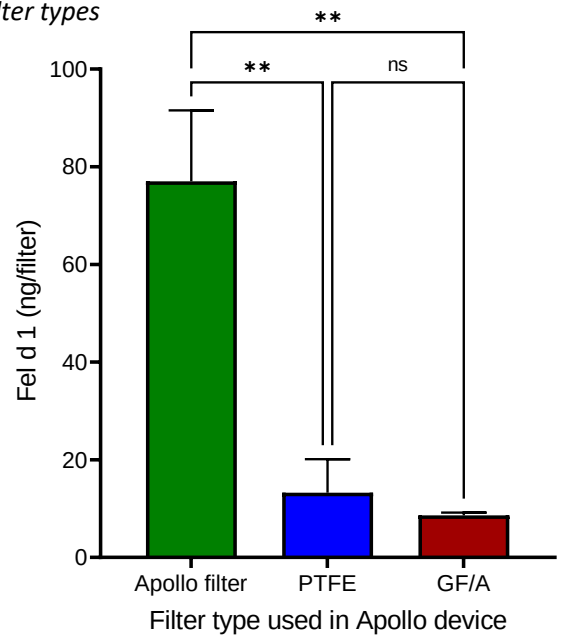
Background

Allergen exposure is an important factor in the sensitisation of individuals, as well as exacerbation of existing symptoms. Investigating allergen exposure relies heavily on the sampling methods used. Current methods such as industrial air sampling pumps can be complex in assembly, noisy, and cumbersome to the user. Therefore, we sought to develop a novel air sampling device (here after referred to as the 'Apollo') that is user-friendly and can be utilised in multiple indoor environments to measure allergen exposure.

Results

- The Apollo proved superior at collecting airborne allergens over traditional methods. **Table 1** shows the Apollo detected 10->100 fold more allergen than by IOM sampling. Similar results were observed for Apollo vs passive samplers (data not shown).
- The specialised filter provided enhanced efficiency of airborne allergen collection compared to traditional filter types used inside the Apollo. Fel d 1 levels dropped from a mean of 77ng/filter with the Apollo filter, down to 13ng/filter and 9ng/filter when PTFE and GF/A, respectively, were used (**Fig 1**).
- Longitudinal sampling analysis revealed that the Apollo was capable of continually collecting airborne allergens up to 7 days without reaching saturation **(Fig 2**). Sampling from a home with pet cats for 7 days resulted in ~2000ng of Fel d 1 being detected on the filter. Additionally, high levels of Bos d 5 and Gal d 2 were also detected.

Figure 1. *Allergen detection by Apollo with different filter types*



Conclusions

The novel Apollo device is a viable method of indoor air environmental sampling in homes due to its superior ability to detect allergens, its lack of complexity and almost silent design (~40 decibels when running), and its suitability for long sampling periods. Thus, the Apollo can provide valuable insight into the evaluation of longitudinal allergen exposure on a personal level.

Methods

The Apollo draws air across a specialised filter which efficiently captures airborne allergens. The device was placed in volunteers' homes alongside passive samplers and IOM pumps. Traditional filter material was also used as a comparison. Apollo devices were run up to 7 days to assess longitudinal airborne allergen capture. Allergens were extracted from all filters and measured using quantitative multiplex arrays for major indoor and food allergens.

Table 1. *Allergen detection by Apollo and traditional IOM filters*

	Nanogram of allergen per filter after 12 hours									
	Der p 1	Mite G2	Fel d 1	Ara h 3	Ara h 6	Gal d 2	Bos d 5	Cor a 9	Ana o 3	Gly m 5
Apollo	11.20	5.20	272.30	97.33	98.40	206.47	300.50	88.73	13.87	1.20
IOM	0.30	0.08	10.30	0.12	0.77	2.30	6.89	<LOD	0.31	<LOD

Figure 2. *Longitudinal allergen detection by Apollo over 7 days of sampling*