Comparison of Allergic Rhinitis Responses During Grass Pollen Season to Those Induced by Controlled Grass Pollen Exposure in the Environmental Exposure Unit (EEU)

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Abstract

Rationale: The Environmental Exposure Unit (EEU) is a controlled allergen challenge model of allergic rhinitis(AR). We sought to characterize the comparability of symptoms experienced by grass pollen allergic volunteers during the regular grass pollen season to those developed during controlled grass pollen exposure in the EEU.

Methods: Eighteen persons with grass pollen allergy completed mail-in surveys in real time during the 2011 grass pollen season, documenting self-perceived AR symptom severity during average and peak pollen exposure days. These same individuals also recorded self-perceived symptom severity while exposed to grass pollen for 3 hours in the EEU. Paired t-tests were used to compare ratings during grass pollen season to the EEU (data averaged over entire 3hr pollen exposure minus baseline).

Results: Severity of stuffy nose, runny nose, and itchy/gritty eyes were not significantly different in the EEU from an average grass pollen season day ($p = 0.21, 0.75, 0.17$, respectively), while sneezing and watery/red eyes were somewhat less severe in the EEU than that reported during outdoor exposure ($p < 0.001$ and 0.02, respectively). Similar findings were noted when comparing peak seasonal symptoms to those in the EEU - stuffy nose and runny nose were not significantly different, but itchy/gritty eyes, sneezing, and watery/red eyes were significantly less severe in the EEU ($p < 0.001$ for all).

Conclusion: Most SAR symptoms were of comparable severity during EEU exposure to those experienced in grass pollen season, with sneezing and eye symptoms often less severe in the EEU than noted in the natural season.

Background

- The Environmental Exposure Unit (EEU) is a unique, validated, internationally recognized research facility that allows for the exposure of groups of 5 to 150 volunteers to ambient levels of airborne pollen allergens.
- Within this specially designed room located within Kingston General Hospital, allergen levels can be precisely maintained at predetermined levels and environmental variables including air quality, temperature, humidity and CO_2 levels are tightly regulated.
- With the ability to control these variables, study conditions can be reproduced on different days and at any time of the year, something that cannot be achieved with any other research model for allergic rhinitis.
- We had previously validated the pollen dispersal equipment for adaptation to grass pollen dispersal.

Objective

- Characterize the comparability of symptoms experienced by grass pollen allergic volunteers during the regular grass pollen season to those developed during controlled grass pollen exposure in the EEU.

Methods

- In May and June of 2011, participants in the Kingston Allergy Research Unit database were mailed a voluntary survey for completion documenting real-time self-perceived grass allergy AR symptom severity during average and peak pollen exposure days.
- In August of 2012, we also conducted a clinical validation of grass pollen utilization in the EEU.
- In this study, participants on file from previous enrolment in an EEU study were approached to participate
- Healthy males or females between the ages of 18 and 65 with a positive skin prick test to grass allergen and at least a two year history of seasonal allergic rhinitis symptoms during the grass pollen season who were non-asthmatic and able to abstain from the use of restricted medications (See Table 1) were eligible to participate.
- After providing written consent, participants underwent the following procedures at screening: vital signs, skin testing to a panel of allergens (including rye grass), height & weight, physical examination including detailed nasal examination, and urine pregnancy testing (women of childbearing potential only)
- The same participants later attended two back to back 3 hour grass pollen exposure visits in the EEU.
- Prior to entering the EEU, participants were reviewed for medication and adverse events to ensure eligibility was still met, and peripheral blood was collected for biomarker analysis.
- In the EEU, participants recorded the severity of their allergic rhinitis symptoms of runny nose, stuffy nose, sneezing, red/watery eyes, and itchy (Table 2), every half hour during the 3 hour pollen exposure sessions.
- We utilized the data from those participants who completed both the in-season survey and the grass validation study for the purposes of the current evaluation
- Survey data were condensed from a 10-point severity scale to the 4-point severity scale used in the EEU as outlined in Table 2. As well, the categories of red eyes and watery eyes in the EEU data were combined, with the higher of the two severity ratings being used, to allow comparison with the single red/watery eyes category used in the survey.
- Ratings of symptom severity were compared using paired samples t-tests, comparing the EEU results (averaged over entire 3hr pollen exposure minus baseline) to both the average and peak ratings. Due to the small sample size, results were confirmed using the non-parametric Wilcoxon Signed Ranks test.

Table 1: Medication Washout Periods

Medication	Washout Period
Antihistamines	7 days
Intranasal or inhaled corticosteroids	14 days
Intranasal or inhaled cromolyn	14 days
Systemic corticosteroids or astemizole	30 days

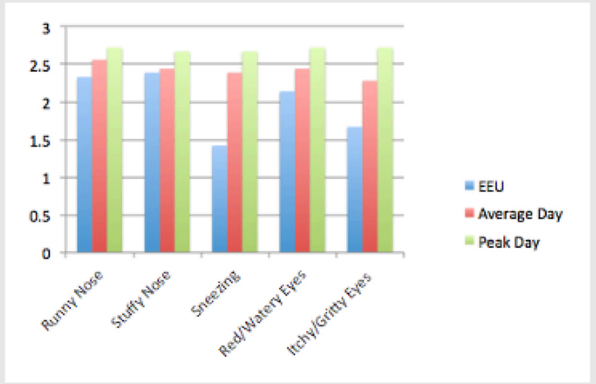
Table 2: Symptom Score Definitions

Survey Rating	EEU Rating	Severity	Definition
0	0	None	Completely absent
1 - 3	1	Mild	Present, but not bothersome
4 - 6	2	Moderate	Bothersome, but tolerable
7 – 9	3	Severe	Hard to tolerate, desiring treatment

Results

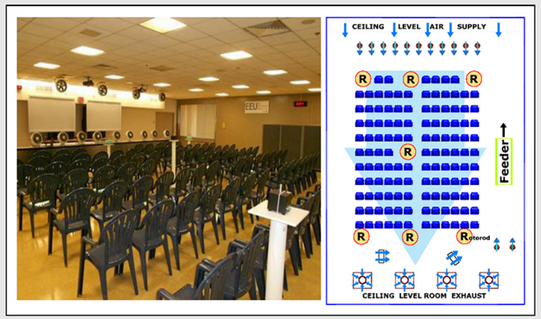
- 78 participants were screened, of whom 39 were eligible and attended the 2x3h EEU visits, plus 8 non-atopic controls*
- 18 of these participants also completed the in-season survey, and results are reported here
- Severity of runny nose and stuffy nose in the EEU were not significantly different from an average ($p=0.21$ and 0.75, respectively) or peak day ($p=0.08$ and 0.14, respectively) during grass pollen season.
- Itchy/gritty eyes in the EEU were not significantly different from an average day ($p=0.17$), but were significantly less than from a peak day ($p=0.01$).
- Sneezing and red/watery eyes were significantly less than from both an average ($p<0.01$ and 0.02, respectively) and a peak day ($p<0.01$ for both).

Figure 1: Average symptom severity scores during an average and peak day during natural grass pollen season and during exposure to grass pollen in the EEU.



Discussion

- The EEU has been in operation since the late 1980's but has heretofore distributed primarily ragweed pollen due to the high local prevalence of ragweed allergy (Day and Briscoe, Ann Allergy Asthma Immunol 1999; 83: 83-93)
- We had validated the dispersal equipment for the distribution of grass pollen and clinically validated the allergic rhinitis responses of grass allergic individuals, but not compared symptom severity in the EEU to the natural grass pollen season (Walker and Ellis, Ann Allergy Asthma Immunol 2011; 107(5): A9)
- The current study confirms that nasal symptoms were of comparable severity during EEU exposure to those experienced in grass pollen season, while sneezing and eye symptoms often less severe in the EEU than noted in the natural season.
- Limitations of this study include the small sample size, the use of different rating scales and slightly different symptom categories in the survey compared to the EEU symptom diary cards.



Conclusions

- Exposure in the EEU produces comparable symptoms severity nasal symptoms, with sneezing and eye symptoms often less severe in the EEU than noted in the natural season.

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