Low level \(O_3\) exposure at rest causes nasal inflammation and neutrophilic bronchitis

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**BACKGROUND**
- Ambient ozone \((O_3)\) is a common environmental trigger for asthma exacerbation given its ubiquitous presence.
- Epidemiologic evidence suggests exposure to ambient air \(O_3\) at concentrations below the National Ambient Air Quality Standard of 0.07 parts per million (ppm) increases risk of respiratory morbidity and mortality.
- The dose of \(O_3\) is dependent on minute ventilation and exposure duration and is known to impact lung function, inflammation, and cause respiratory symptoms.
- Study evaluates whether exposure to \(O_3\) below the NAAQS while an individual is sedentary leads to reductions in lung function or a decrease in lung function.

**STUDY DESIGN**

**DEMOGRAPHIC INFORMATION**

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<thead>
<tr>
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<th>All Subjects</th>
<th>Male</th>
<th>Female</th>
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</thead>
<tbody>
<tr>
<td>n</td>
<td>14</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Age [Mean ± SD]</td>
<td>32.3 ± 6.2</td>
<td>32.4 ± 7.1</td>
<td>32.2 ± 6.1</td>
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<tr>
<td>BMI [Mean ± SD]</td>
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<td>24.8 ± 5.1</td>
<td>24.6 ± 5.0</td>
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<td>6</td>
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<tr>
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<td>2</td>
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<tr>
<td>ethnicity (%)</td>
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<tr>
<td>Ethnicity (%)</td>
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<td>Mixed: 1</td>
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</tbody>
</table>

Table 1. Demographic characteristics of 14 participants who completed a crossover study comparing a sedentary \(O_3\) exposure at an average concentration of 0.07 ppm \(O_3\) versus a CA exposure for 6.6 hours.

**QUICK START**

- **POWERPOINT** or “Print-quality” PDF.
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- How to add Tables: click on TABLE. A drop-down box will help you select rows.
- How to change the column configuration: click on TABLE. A drop-down box will help you select rows.
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**CONCLUSIONS**
- \(O_3\) exposure at levels below the National Ambient Air Quality Standards (0.07 ppm) while an individual is sedentary leads to reductions in lung function in healthy adults.
- Exposure to low-dose \(O_3\) at rest promotes upper and lower airway inflammation.
- Changes in lung function and neutrophil recruitment are sex-specific, with a more pronounced pulmonary function decrease and increase in inflammation in females.

**FUTURE DIRECTIONS**
- Evaluate mechanisms of female specific differences in \(O_3\)-induced inflammation such as hormonal effects, intrinsic responses to \(O_3\), and production of pro-inflammatory cytokines.
- Investigate the \(O_3\)-induced inflammatory response and effect on pulmonary function in individuals with underlying pulmonary disease such as asthma.

**REFERENCES**


**FUNDING**

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EPA: Assistance Agreement No. 83578501-0 to UNC

**Figure 1:** Crossover exposure study design of healthy volunteers comparing a sedentary \(O_3\) exposure at an average concentration of 0.07 ppm \(O_3\) versus a CA exposure for 6.6 hours (A). CONSORT diagram outlining subject randomization and participation (B).

**Figure 2:** %Predicted FVC (A) and FEV1 (B) before and after 6.6 hour exposures to CA and to an average \(O_3\) concentration of 0.07 ppm. Change from each exposure’s baseline %predicted FVC and FEV1 measures are shown in C and D. Group means (+ SEM) are shown in A-B, while individual changes are shown in C and D. Horizontal bars in C-D denote the mean.

**Figure 3:** Change from each exposure’s baseline %predicted FVC (A-B) and FEV1 (C-D) in females (n=7) and males (n=7) comparing a 6.6 hour exposure to CA to 0.07 ppm \(O_3\). Horizontal bars denote the mean.

**Figure 4:** Sputum %Neutrophils (PMNs) at baseline and the morning after each exposure session for the entire cohort (n=14 paired samples) (A), and by sex (n=4 females, n=4 males) (C-D). Change from baseline %PMNs of the O3 and CA exposures for the entire study cohort (B), with horizontal bars denoting the mean.

**Figure 5:** Inflammatory mediators derived from nasal epithelial lining fluid (NELF) the day before the exposures (pre) and six and 24 hours after the beginning of the exposure sessions (post). Mean and SEM are shown. N=14