AIR POLLUTION AND AIRWAY INFLAMMATION: A TIME LAG BETWEEN NO$_2$ AND O$_3$

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Background and Aims: Although studies have demonstrated that air pollution is associated with adverse health effects, little is thought about a time lag, particularly between NO$_2$ and O$_3$. Ozone is a secondary pollutant produced by the reaction of NO$_2$ in the presence of sunlight. So we observed a time difference between NO$_2$ and O$_3$ in detail when we evaluated acute effects of air pollution on biomarkers of airway inflammation.

Methods: The fraction of exhaled nitric oxide (FE$_{NO}$), a non-invasive measure of airway inflammation, was measured in 939 subjects. Air pollution levels were collected at a stationary monitoring site, and meteorological factors were monitored at a meteorological tower.

Results: NO$_2$ and O$_3$ showed a strong negative correlation. Air pollutant concentration was matched with a FE$_{NO}$ level on various lags adjusting age, gender, and meteorological factors. Both NO$_2$ and O$_3$ were associated with changes in the FE$_{NO}$. However, NO$_2$ and O$_3$ worked in the opposite direction. When we look the lag structure, NO$_2$ effects persisted from lag 0 until lag 9, whereas O$_3$ effects remained from lag 9 up to more than lag 24, prior to FE$_{NO}$ testing. NO$_2$ and O$_3$ were significantly associated with 8.3% (lag 0, p<.0001) and 11.9% (lag 12, p=0.0008) higher FE$_{NO}$ levels over the inter-quartile range of 19 ppb and 14 ppb, respectively.

Conclusions: Short-term increases in NO$_2$, a pollutant associated with traffic emissions and industry, and O$_3$, a secondary pollutant formed by the action of sunlight on NO$_2$, were associated with airway inflammation with an 8~12 hour difference in lag time.