INCREASED FRACTIONAL EXHALED NO AND DECREASED LUNG FUNCTION ARE ASSOCIATED WITH ULTRAFINE PARTICLES AND NOT OTHER PM CHARACTERISTICS: HEALTH EFFECT ASSESSMENT IN THE RAPTES PROJECT

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Background and aims: Epidemiological studies demonstrated adverse health effects of ambient particulate matter (PM), but it is not clear which characteristics (e.g., size, composition) or sources of PM are responsible for observed effects. The aim of RAPTES (Risk of Airborne Particles: Toxicological-Epidemiological hybrid Study) is to study effects of various PM characteristics on volunteers exposed experimentally to air pollution in several real-world settings.
Methods: Thirty healthy volunteers were exposed multiple times at different sites in the Netherlands: two traffic sites, underground train station, farm and urban background. High contrast and low correlation between PM characteristics were documented in a preceding screening phase. Exposure of volunteers and air pollution characterization took place on 30 days (March-October 2009) over five-hour sampling periods and included measurements of PM_{10}, $PM_{2.5}$, particle number concentration (PNC), trace metals, and total PM oxidative potential. Participants followed a fixed exercise protocol on stationary bicycles. Fractional exhaled nitric oxide (FE_{NO}; non-invasive marker of airway inflammation) and spirometry were measured before and at three different time points after exposure.
Results: Exposure to PNC during five-hour exposure was significantly associated with volunteers' FE_{NO}: immediately and two hours after exposure we observed an 11.6% increase over baseline in FE_{NO}, with 7.4% increase the next morning. PNC was also significantly associated with a 1% decrease in FEV_1 and FVC at most time points.
PM_{10}, $PM_{2.5}$ and total PM oxidative potential were not associated with changes in respiratory health parameters. PM characteristics were not associated with changes in PEF and FEF_{25-75}.
In multi-pollutant models, effects of PNC remained significant whereas effects of other PM characteristics still did not show (significant) associations.
Conclusions: An increase in FE_{NO} and decrease in lung function was observed in young, healthy volunteers following a five-hour exposure to ambient air pollution. These effects were specifically associated with PNC and not with other PM characteristics.