The Beijing HEART Study: The Health Effects of Air Pollution Reductions Trial

CARDIO-RESPIRATORY BIOMARKER RESPONSES OF HEALTHY YOUNG ADULTS TO DRASTIC AIR QUALITY CHANGES

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Background and Aims. Associations between air pollution and cardio-respiratory health have been well established; but direct human data to support biological mechanisms are limited. We investigated biological responses, at the biomarker level, to air quality changes brought by unprecedented control measures implemented during the Beijing Olympic period, compared with before and after periods.
Methods. Biomarkers reflecting multi-pathways hypothesized to underlie adverse cardio-respiratory effects of air pollution were serially obtained in 125 non-smokers. We used mixed-effects models to estimate changes in biomarker levels by period and to examine associations between biomarkers and pollutants, controlling for ambient temperature, RH, sex, and day of week.
Results. We observed 13% to 60% decreases in mean concentrations of particulate and gaseous pollutants in During-Olympic Period compared to Pre-Olympic Period. In Post-Olympic Period, mean concentrations of most pollutants increased to levels similar to or higher than Pre-Olympic levels. Simultaneously we observed significant decreases from Pre-Olympic Period to During-Olympic Period in levels of FeNO (-51%), exhaled breath condensate (EBC) nitrate (-38%), nitrate + nitrite (-26%), and malondialdehyde (-26%), plasma sCD62p (-34%) and sCD40L (-6%), and von Willebrand factor (-13%). The proportions of above-detection values for EBC 8-isoprostane and plasma C-reactive protein were lower in During-Olympic Period than in Pre-Olympic Period. We observed significant increases in levels of many of these from During-Olympic Period to Post-Olympic Period. Moreover we found most biomarkers significantly associated with $PM_{2.5}$ mass and constituents and/or gaseous pollutants measured on the same day and/or 1 to 5 days prior to biomarker measurement. We observed weak associations for a few autonomic tone biomarkers.
Conclusions. In response to drastic air quality changes**,** healthy young adults demonstrated changes in biomarkers of pulmonary and systemic inflammation, oxidative stress, and platelet activation. Our findings provide mechanistic data to support actions to improve air quality and public health.