8-Isoprostane as a Biomarker of Effect of Woodsmoke Exposure

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INTRODUCTION

In the past decades, rising fossil fuel energy costs and the desire for more renewable energy resources have led to an increased residential use of biomass fuels, such as wood, in North America (Neter et al., 2006). Biomass combustion is an important energy resource in both developed and developing countries, and these populations are exposed to biomass smoke. Common applications include residential heating and cooking, andrepresentation of smoke. Local forest fire activity is a potential exposure risk as well. Biomass smoke is most commonly characterized by particulate matter (PM) concentrations. The health effects of PM2.5 have been studied extensively. Wood smoke's contribution to PM2.5 is substantially smaller than that from motor vehicles (Klemmensen et al., 1997). Wood smoke also contains toxic compounds such as polycyclic aromatic hydrocarbons, which are precursors to the formation of nitrous oxide, a potent greenhouse gas.

METHODS

Woodsmoke Exposure:

Woodsmoke exposure studies were conducted. Four subjects in the first burn and five subjects in the second burn were exposed to woodsmoke from a wood-burning stove. Woodsmoke exposure was measured during the entire exposure using the Dust Trak Aerosol Spectrometer (Trek, Minneapolis, MN).

Sample collection:

EBC samples were collected from all subjects at both exposures. EBC samples were collected using the Respironics device. EBC samples were collected following 90 minutes of exposure. Prior to sample collection, subjects were seated and allowed to breathe comfortably. EBC samples were collected for 90 minutes from each subject at each exposure.

Sample analysis:

Analysis of EBC and urine samples from both woodsmoke exposures was done using Cayman Chemical’s 8-Isoprostane Enzyme Immunoassay. The EBC was analyzed using the immunoassay to determine the concentration of 8-Isoprostane. The EBC samples were collected following exposure. The EBC and urine samples were then analyzed by the immunoassay to determine the concentration of 8-Isoprostane. The EBC and urine samples were then analyzed by the immunoassay to determine the concentration of 8-Isoprostane.

RESULTS

I. 8-Isoprostane

1. Urinary 8-Isoprostane Concentrations:

   a. First Burn Experiment

   b. Second Burn Experiment

2. Exhaled Breath Condensate 8-Isoprostane Concentrations:

   a. First Burn Experiment

   b. Second Burn Experiment

3. EBC pH: First Exposure Before Deaeration

   a. Pre

   b. Post

4. EBC pH First Exposure After Deaeration

   a. Pre

   b. Post

II. Exhaled Breath Condensate pH

   a. Pre

   b. Post

EXPOSURE DATA

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LITERATURE CITED

ACKNOWLEDGMENTS

CONCLUSIONS

I. 8-Isoprostane is a useful biomarker of systemic inflammation in healthy individuals following high woodsmoke exposure. Further evaluation of this biomarker in lower exposure residential settings is warranted.

II. The EBC pH findings were inconsistent as it showed neither an overall significant increase or decrease in pH. It is possible that this biomarker is relevant only in susceptible populations.

III. According to our data, purification of EBC and urine samples was a necessary step in determining 8-Isoprostane concentrations.