Abstract

Air pollutants have been associated with increased diabetes in humans. We hypothesized that ozone could impair glucose homeostasis by altering insulin signaling and/or endoplasmic reticular (ER) stress in very young and aged rats. Brown Norway (BN) rats, 1, 4, 12, and 24 months old were exposed to ozone at 0, 0.25 or 1.0ppm, 6h/day for 2 days (acute) or 2d/week for 13 weeks (subchronic). Additionally, 4 month old rats were exposed to 0 or 1.0ppm ozone, 6h/day for 1 or 2 days (time-course). Glucose tolerance tests occurred immediately after exposure in all studies. Serum and tissue biomarkers were analyzed 18h after final ozone for acute and subchronic studies, and immediately after each day in time-course study. Age-related glucose intolerance, and increases in metabolic biomarkers were apparent at baseline. Acute ozone caused glucose intolerance and hyperglycemia in rats of all ages. Ozone-induced glucose intolerance was reduced in rats exposed for 13 weeks. Acute, but not subchronic ozone increased α_2-macroglobulin, adiponectin and osteopontin. Time-course analysis indicated hyperglycemia at day 1, glucose intolerance at days 1 and 2 (2>1), and a recovery 18h post ozone. Leptin increased day 1 and epinephrine at all times after ozone. Ozone tended to decrease pIRS in liver and adipose tissues. ER stress markers were reduced at day 1 but increased day 2. In conclusion, age-related metabolic impairments occur in a healthy aging BN rats. More importantly, acute ozone exposure is associated with marked impairment of glucose homeostasis, likely through the sympathetic hormones such as epinephrine.

Key words: aging, air pollution, ozone, metabolic syndrome, serum biomarkers, epinephrine