Early Life Lung Antioxidant Levels and Response to Ozone: Influence of Sex and Maturation in Wistar Rats

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Epidemiologic studies of air pollution effects on respiratory health report significant modification by sex. Studies of children suggest stronger effects among boys in early life and girls in later childhood. In adults, particularly the elderly, studies report stronger effects among women. Differential inflammatory and antioxidant responses are purported. Herein we examined sex or maturation influences in prepubertal Wistar rats [a strain prone to ozone (O_3)-induced lung injury/inflammation] on (A) lung antioxidant and related enzyme levels and (B) antioxidant response to O_3. Female (F) and male (M) 14, 21, and 28 d (pre-, at, post-weaning) pups were exposed to air, 0.5 or 1.0 ppm O_3 x 2h. In air controls, no sex-based differences in lung antioxidant levels were observed. From 14-28 d, weight increased (F: 1.7-2.7-fold; M: 1.7-3.1-fold); with M>F at 28 d. Likewise, lung uric acid increased (1.1-1.2-fold), as did ascorbic acid (1.4-2.7-fold), glutathione (GSH) peroxidase (1.0-3.5-fold), GSH transferase (1.0-2.9-fold), GSH reductase (1.2-4.2-fold), and G-6-PDH (10-fold) (per g wet wt). Conversely, SOD declined 30-42%. Lung GSH was relatively unchanged. At 0h, 1 ppm O_3-exposed F 14 d pups had decreased GSH and related enzyme activity. At 21 d, exposure was without effect on GSH; and males showed O_3-induced increases in uric acid. At 28 d, no antioxidant changes were apparent. Together, data suggest health risk due to early life pollutant exposure is greatest in very immature females. With maturity, especially post-weaning, rat lung antioxidant reserve increases, thus reducing susceptibility to pollutant-induced oxidative stress. (Abstract does not reflect USEPA policy).