Cerebrovascular Dysfunction and Microvessel Density Changes in Offspring of Rat Dams Exposed to Electronic Cigarette Aerosols

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Electronic cigarette (E-cig) usage has steadily been increasing and it is even being promoted as a safer option to traditional tobacco cigarettes; however, there is little evidence supporting this theory as it relates to the cerebrovasculature. We examined the effects of maternal E-cig exposure (Joyetech eGrip OLED using 5-sec puffs @17.5 W) on cerebrovascular function and microvessel density in offspring with maternal exposure to ambient air (control, n=6), E-cig with 18 mg/ml nicotine (E-cig18, n=6), and without nicotine (E-cig0, n=7). Exposure consisted of 60 puffs over 1-hour each day, 5 days/week, and resulted in an average daily TPM of ~120 mg/m3. Maternal exposure was started on gestational day 2 and continued until pups were weaned. Pups themselves we never directly exposed. The middle cerebral arteries (MCA) were obtained from 3-month old pups, isolated and positioned in a pressurized myobath, and exposed to increasing concentrations of acetylcholine (Ach; 10 -9 M to 10 -4 M), serotonin (5-HT; 10 -9 M to 10 -4 M), and sodium nitroprusside (SNP; 10 -9 M to 10 -4 M), in the presence or absence of Tempol (a superoxide dismutase mimetic). Brains were also flash frozen, sectioned, and analyzed for microvessel density (MVD). The MCA dilation of offspring to Ach was impaired in both E-cig0 and E-cig18 by 63% and 62%, respectively, compared to controls (<0.05). Incubation with tempol reversed the cerebrovascular dysfunction seen in both E-cig groups, suggesting the superoxide pathway is involved in the impairment observed in offspring with maternal E-cig use. The MCA dilation to SNP and constriction to serotonin was similar between all groups. Preliminary data (n=2 per group) shows a 12% and 29% decrease in MVD in the cortex of E-cig0 pups and E-cig18 pups, respectively. These data suggest that E-cig usage during pregnancy impairs the cerebrovascular reactivity and induces rarefaction of cortical microvessels in offspring.