

## **Vaporized Nicotine Inhalation Increases Arterial Pressure in both Supine and 70° Head-up Positions**

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### ABSTRACT

Electronic cigarettes (e-cigs) are popular with smokers looking for a healthier alternative to tobacco cigarettes. E-cigs utilize a battery, activated on inhalation, to heat propylene glycol-suspended nicotine which is inhaled as vapor, and which does not include harmful poisons found in conventional cigarettes. Although the health claims of e-cigs continue to be debated, the effects of nicotine delivered as vapor on the cardiovascular system have not been studied. Because nicotine is a sympathomimetic agent, we tested the hypothesis that e-cigs would increase arterial pressure and protect against challenges associated with upright posture. Ten non-smoking subjects (5 male) participated in two experimental trials, separated by one week (randomized). Seated blood pressures were taken after a 10 min quiet rest period, and then subjects either inhaled (once every 30 s for 10 min) on an e-cig with a placebo cartridge (0 mg nicotine) or an active cartridge (18 mg nicotine). After an additional 10 min quiet seated rest, we measured blood pressure again, and then subjects provided a urine sample for analysis of cotinine (a nicotine biomarker). We recorded ECG and finger photoplethysmographic arterial pressure. Subjects breathed to a metronome set at 15 breaths/min for 5 min supine, 5 min head-up (70°), and 5 min supine (recovery). Cotinine readings failed to register the presence of nicotine in urine, but a majority of subjects experienced dizziness and nausea after the active, but not the placebo cartridge. Seated arterial pressures were similar after the placebo cartridge ( $p \geq .05$ ), but increased from  $112 \pm 3/62 \pm 2$  mmHg to  $115 \pm 3/67 \pm 3$  after the nicotine cartridge ( $p \leq .05$ ). Systolic and diastolic pressures were higher (all  $p \leq .05$ ) after the nicotine trial compared to placebo for supine ( $115 \pm 3/69 \pm 2$  vs.  $106 \pm 4/62 \pm 2$  mmHg), tilt ( $105 \pm 4/66 \pm 3$  vs.  $93 \pm 4/60 \pm 3$  mmHg), and recovery ( $117 \pm 5/72 \pm 2$  vs.  $106 \pm 4/64 \pm 3$  mmHg). No subject experienced presyncope during tilt for either trial. We show, for the first time, that inhalation of vaporized nicotine increases arterial pressure in the seated, supine and head-up tilt positions - suggesting sympathomimetic properties. Although mild, acute increases in arterial pressure may seem harmless, it is possible that daily, continuous use of e-cigs could result in consistently elevated arterial pressure, resulting in higher afterload and chronic cardiac strain.

