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Acute detrimental effects of e-cigarette and tobacco cigarette smoking on blood pressure and sympathetic nerve activity in healthy subjects

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Background/Introduction: Tobacco cigarette smoking is related with atherosclerosis progression, blood pressure increase and changes in sympathetic nerve activity. However, there are scarce data on the impact of e-cigarettes that have been proposed as less harmful alternatives on the cardiovascular system and sympathetic drive.

Purpose: This study aimed to assess the acute effects of tobacco cigarettes, e-cigarettes and sham smoking on blood pressure and sympathetic nervous system in healthy subjects.

Methods: We studied 10 normotensive male habitual smokers (mean age 33 years, body mass index: 24.1 kg/m2, office blood pressure=117/72 mmHg) free of cardiovascular disease. The study design was randomized and placebo controlled with 3 experimental sessions (sham smoking, tobacco cigarette smoking, and e-cigarette smoking) in random order, each session on a separate day. Subjects smoked 2 tobacco cigarettes containing 1.1 mg nicotine or simulate smoking (sham smoking) with the 2 cigarettes separated by 5 minutes, while 45 minutes after finishing the second cigarette, subjects smoked a third cigarette or sham cigarette. Additionally, participants smoked e-cigarettes for a period of 5 and 30 minutes. In all occasions, sympathetic drive was assessed by muscle sympathetic nerve activity (MSNA) (baroreflex-dependent) and skin sympathetic nerve activity (SSNA) (baroreflex-independent) based on established methodology (microneurography).

Results: After the first, second and third tobacco cigarette smoking there was markedly and significantly increase in mean arterial pressure (by 11.2±1.4%, 12.3±1.3% and 13.1±1.4%, respectively, p<0.05 for all) and heart rate (by 25.1±3.7%, 26.3±2.7% and 25.9±3.7%, respectively, p<0.05 for all). Similarly e-cigarette smoking at 5 and 30 minutes was accompanied by augmentation of mean arterial pressure (by 10.9±1.2% and 12.8±1.4%, respectively, p<0.05 for both) and heart rate (by 22.5±3.3% and 23.9±3.8%, respectively, p<0.05 for both). Regarding the effect on sympathetic nervous system, the first, second and third tobacco cigarette smoking was accompanied by lower MSNA (by 28.1±4.4%, 29.6±5.3% and 30.1±5.2%, respectively, p<0.05 for all), whereas SSNA was increased (by 98.2±19.4%, 100.2±22.7% and 101.5±21.6%, respectively, p<0.05 for all). Additionally, e-cigarette smoking at 5 and 30 minutes caused a decrease in MSNA (by 26.9±3.6%, and 28.3±5.1%, respectively, p<0.05 for both), and an augmentation in SSNA (by 97.9±20.1% and 100.9±20.6%, respectively, p<0.05 for both). Sham smoking was devoid of any effects on blood pressure, MSNA and SSNA.

Conclusions: E-cigarette smoking acutely increases blood pressure and has a detrimental effect on sympathetic nerve activity regulation similar to tobacco smoking in healthy subjects. Our findings underscore the negative impact of e-cigarettes on cardiovascular and autonomic nervous system and could aid further recommendation in their use.