Neuronal damages and cognitive impairments induced by electronic cigarette refill liquid in rats: a comparison to nicotine

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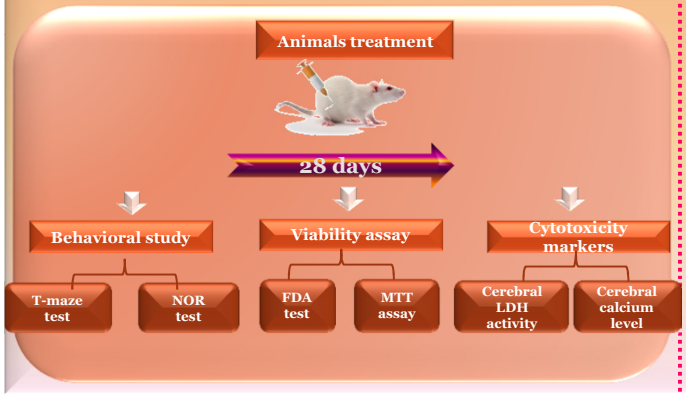
Introduction

Electronic cigarettes, or e-cigarettes, are electrical devices intended to substitute conventional cigarettes, as they simulate the act of smoking. These revolutionary systems are currently moot, not only among health professionals but also in the general population, because the lack of data regarding their safety.

Aim

Our study was performed in order to assess the impact of electronic cigarette refill liquid (e-liquid) associated or not to nicotine at a dose of 0.5 mg/kg of body weight/day or its equivalent in nicotine on the hippocampus, a critical brain region implied in memory and learning;

Materials & Methods



Results & Discussion

Our results showed that sub-chronic exposure to e-liquid without nicotine (E-CIG 0%) induced neurotoxicity, as shown by the increase of the activity of lactate dehydrogenase (LDH), accompanied by an increased cerebral calcium level leading to neurodegeneration hippocampal cells that manifested by cognitive dysfunctions. In fact, E-CIG 0% treated rats showed an amnesic effect which is manifested by a fault of recognition during the NOR test and a fault of alternation during the T-maze test. This excitotoxicity led to hippocampal cells death demonstrated by a significant decrease in cells viability observed both in Fluorescein Diacetate (FDA) test and MTT assay. However, supplementation of nicotine partly restored this cognitive decline and protected hippocampal neurons against cell death induced by the base e-liquid, highlighting the neuroprotective effect of nicotine.

Conclusion

The exposure to e-liquid associated or not to nicotine is the origin of an abundant neurotoxicity. This neurotoxicity may be in the long term a trigger element of certain neurodegenerative diseases.

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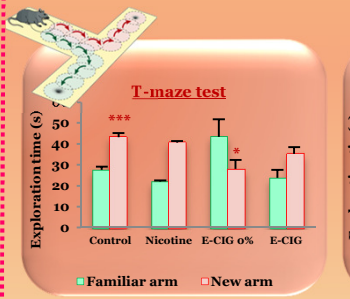
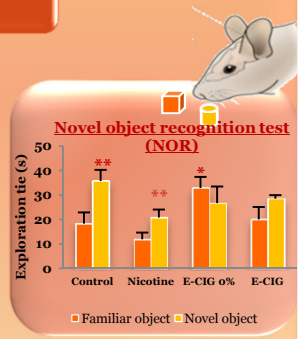
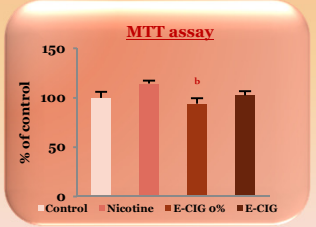
Tables

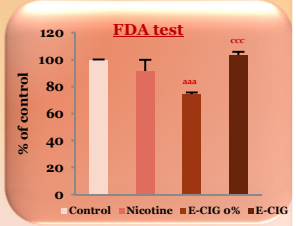
Cytotoxicity markers	Cerebral LDH activity (U/l)	Cerebral calcium level (mg/l)
Control	16361,2±200,7	3,1±0,3
Nicotine	13273,3±824,9[a]	2,8±0,3
E-CIG 0%	17958,3±138,1[aaa,b]	5,4±0,4[a,b]
E-CIG	16103,6±187,3[ccc]	3,5±0,3[ccc]

Graphs









a: control group was compared with other groups b: Nicotine group was compared with E-CIG 0% and E-CIG groups, c: E-CIG 0% group was compared with E-CIG group.