The effect of nicotine on anxiety behavior

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Nicotine is an alkaloid which isolated from tobacco leaves in 1828 and since then it has been extensively studied. Nicotine in its pure form is a volatile, colorless and strongly alkaline liquid that turns pale yellow to dark brown on exposure to air producing a properties tobacco smell. From tobacco smoke, nicotine arrives in the blood stream through the lungs, but, nicotine in smokeless tobacco enters the mucosal membrane of the mouth and nose or the skin. After absorption, nicotine transfers rapidly and reaches the brain in seven seconds. It freely crosses in the blood–brain barrier (BBB). Then, nicotine affects numerous physiological processes such as anxiety, nociception, depression, learning and memory. On the other hand, it produces many behavioral processes directly associated with its addictive characteristic including rewarding effect and physical dependence. Nicotine indicates diverse effects on anxiety behavior both in humans and animals. Several studies have revealed that nicotine induces both anxiolytic- and anxiogenic-like behaviors in animals. In fact, nicotine may induce anxiolytic, anxiogenic and neutral effects on anxiety behavior depending on the doses, route of injection, species, strain, experimental model or number of trials used. The nicotinic acetylcholine receptor (nAChRs) stimulates by acetylcholine (Ach) or nicotine in the brain which are mostly located presynaptically, where they regulate the release of various neurotransmitters (for instance Ach, glutamate, dopamine, norepinephrine, serotonin and GABA which participate in anxiety behavior). These neurotransmitters, binding on diverse post-synaptic receptors, change the anxiety related behaviors in animals. A number of researches indicated that the anxiolytic or anxiogenic responses of nicotine may be due to variation of the brain neurotransmitter release. For example, nicotine application enhanced glutamate release in the prefrontal cortex. This release of glutamate may enhance anxiety-like responses. Also, anxiogenic-like effect of nicotine produced via nicotinic and adrenergic mechanisms. Furthermore, it has been revealed that anxiogenic-like property of nicotine may be due to nicotine-activated dopamine release which both dopamine D1 and D2 receptors are participated in regulation of anxiety-like behavior produced by nicotine. Additionally, there is report displaying the modulatory effects of nicotine on nitric oxide produced anxiogenic-like responses in rodents. In contrast, stimulation of the nAChRs causes the release of GABA neurotransmission, which may mediate nicotineinduced anxiolytic-like behaviors.

In conclusion, this study clarifies the role of nicotine and its interaction with other neurotransmitters on anxiety behavior.

Biography

Fatemeh Khakpai has extensive experience on "physiology" and has many projects on this subject. My researches had included behavioral study.

Received: May 16, 2022; **Accepted**: May 18, 2022; **Published**: June 15, 2022