

University

Purpose

To determine the effects of prenatal exposure to nicotine and/or cannabis on hippocampal development, a brain area important for learning and memory.

Background

Although nicotine use during pregnancy has been recognized as a potential danger for the developing fetus, in recent years cannabis use has been gaining popularity among pregnant individuals. There is growing concern of the impact that the psychoactive component of cannabis, tetrahydrocannabinol (THC), may have on fetal brain development and consequent cognitive function. With polysubstance use being common as well, it is important to examine the combined effects of nicotine and THC on the developing brain, as these substances may interact with one another. The hippocampus, a brain region crucial for learning and memory, may be particularly vulnerable to these substances, as it is rich in receptors for both nicotine and THC. Thus, this study used a rodent model to explore the effects of nicotine, THC, and a combination of both substances on the PSD95 expression levels in the offspring's hippocampus. PSD95 is a key synaptic protein that plays a vital role in hippocampal synaptic signaling and neural plasticity, processes essential for learning and memory.

Methods

Experimental Design. Pregnant Sprague- Dawley rats were assigned to one of 4 exposure groups; nicotine (36 mg/mL), THC (100 mg/mL), nicotine and THC combination, or propylene glycol (vapor vehicle control). All drugs were administered via e-cigarette chamber. Offspring were behaviorally tested for learning and memory performance. On postnatal day (PD) 61-65, corresponding to early adulthood, brain tissue was collected and the hippocampus was microdissected from offspring to assess the effects of each drug exposure on PSD95.



Drug Exposure. From gestational day (GD) 5 and 20, pregnant dams were placed in vapor chambers for 30 minutes; subjects received 5-sec vapor puffs every 5 minutes from e-cigarette tanks containing their assigned drug. This occurred daily.



Combined Prenatal Cannabis and Nicotine Exposure Impacts Hippocampal Development

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Figure 1. vehicle (cc category, PSD95 lev nicotine re hippocamp

Our data indicate that the combination of THC and nicotine may influence long-lasting synaptic structure and function. These data suggest that these commonly used drugs of abuse may have synergistic effects and that combined exposure poses a serious and long-lasting risk to the developing fetus. Understanding how substances such as nicotine and THC impact brain function and plasticity may provide insights into the long-term cognitive consequences of prenatal exposure and the risks associated with polydrug use during pregnancy.

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Methods - Protein Analysis

Western Blot. 1) Total proteins were extracted from the selected offspring hippocampal tissue 2) Gel electrophoresis was utilized to separate proteins based on size through an electric current 3) Proteins on the gel were transferred to a porous membrane 4) The membrane was imaged using LI-COR imaging systems and analyzed for protein signals

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Conclusion

Acknowledgments

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responding to different treatment conditions otures a consistently prominent band at 95 kDa, icating the presence of PSD95. The intensity of ch band indicates the effect of each treatment on target protein, PSD95, expression. This mbrane was imaged and analyzed using LI-COR aging software.

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