Lungs of female mice exposed in utero to cool mint-flavored Puff Bar aerosol have increased susceptibility to Th2-mediated immune responses and greater functional decline following house-dust mite exposures

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INTRODUCTION

Recently, there has been a strong increase in the number of individuals who use nicotine products. This increase is largely contributed to the prevalence and popularity of electronic nicotine delivery system (ENDS), such as the disposable Puff Bar. Puff Bar, and similar devices, offers a variety of flavors and nicotine contents. These devices aerosolize electronic liquid (e-liquid) as an inhalant. These e-liquids contain propanoyl glycol, glycerin, nicotine salt, and flavoring chemicals. Unfortunately, these aerosolized e-liquids as inhalants are largely unstudied and are of great concern in respiratory pathology and inflammation. While many people believe that ENDS could be a safer alternative to cigarettes, the health effects of vaping during pregnancy are mostly unknown.

Objectives

The two overarching goals of this study was 1) to assess the outcomes of pregnancy in mice exposed to cool mint-flavored Puff Bar aerosols and 2) to analyze the respiratory health status of the offspring.

METHODS

Experimental Design

- Pregnant BALB/c mice were exposed to either HEPA filtered air or cool mint-flavored Puff Bar aerosol, 1 hour/day, during gestational days 1 to 20.
- The in utero exposed offspring were exposed to total particulate matter (TPM) of 0.52 ± 0.21 mg/puff of the Cool Mint Puff Bar aerosol.
- Female offspring were sacrificed at 7 weeks of age following intranasal instillation of house dust mite (HDM) or saline once a week for three weeks, from 4 to 7 weeks of age, to induce asthmatic responses.

Biological Endpoints

- Lung function in the female offspring was assessed using SCIREQ flexVent system with methacholine challenge.
- Broncho-alveolar lavage fluid (BALF) was analyzed for total and differential cell counts.
- Qiagen RT² Mouse Allergy & Asthma Profiler PCR Array was used to assess lung gene expression.

Offspring Lung Gene Expression

- In utero exposure to cool mint-flavored Puff Bar aerosol plus HDM treatment alters lung function in 7-week-old female mouse offspring.
- Respiratory system compliance was significantly decrease, and following methacholine challenge, the maximum respiratory resistance as well as the Newtonian resistance were significantly increased in offspring exposed in utero to Puff Bar aerosol and that received HDM treatment compared to air controls.
- HDM treatment significantly increased the percentage of BAL neutrophils and decreased the percentage of macrophages in both the in utero air and Puff Bar exposed offspring compared to their respective saline controls.
- Numerous lung genes related to allergy and asthma were significantly dysregulated when compared to Air + Saline control.
- In utero exposures to Puff Bar aerosols may predispose the lungs 1) to Th2-mediated immune responses, and 2) following exposure to an allergen, to greater lung function decline in childhood. Thus, our data support the argument that e-cig use during pregnancy is not ‘safe’ for the respiratory health of the offspring.

RESULTS

Cool Mint Puff Bar Aerosol Chemical Analysis

Pregnancy Outcomes

Lung Function

BALF Cytology

SUMMARY

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