Effects of Chronic Alcohol Consumption on Taste Sensitivity in Female Mice

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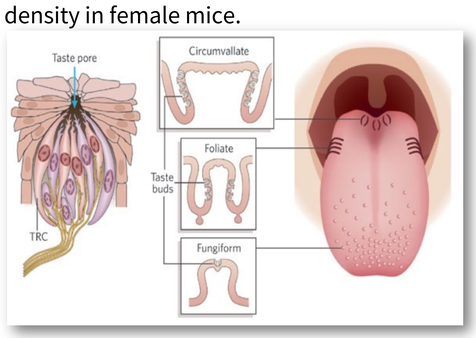
Introduction

- Alcohol use among women has increased by 6% over the past two decades, whereas alcohol use in men has remained steady (-0.2%). Alcohol use among men has historically outnumbered women 3:1 for measures of alcohol use, and research on the effects of chronic alcohol consumption in females is lacking despite the closing gender gap in use. Escalating alcohol consumption among females poses significant health concerns, including an increased risk for metabolic disorders.
- Taste is a primary sensory modality that guides organisms in their determination of food and beverage preferences. Chronic alcohol use may influence taste perception, and alterations in taste preferences may also increase the risk of metabolic disorders. This study aimed to examine the effects of two alcohol delivery methods on body weight and lingual taste bud density in female mice.



Taste Receptors → Taste Perception → Taste Preferences → Food & Beverage Consumption

Methods

- Female C57BL/6 mice were provided with either a liquid ethanol diet or ethanol via vapor inhalation.
- Mice fed the Lieber-DeCarli diet were provided with *ad libitum* liquid diet containing 5% ethanol or an isocaloric control solution for 30 days.
  - Following the NIAAA chronic-plus-binge alcohol feeding model, the ethanol group received an oral gavage of 5g/kg body weight of ethanol on days 10 and 30 of the study.
  - Food intake was measured daily, and body weights were measured weekly.
  - The mice were euthanized at least 24 hours after their last binge, and the tongues were harvested.

- Mice exposed to vapor were given intermittent ethanol vapor or volatilized water exposure for 16 hours, followed by room air for 8 hours.
  - Exposure was repeated for 4 days, followed by a 3-day break before a second 4-day cycle. Mice were provided with *ad libitum* access to standard chow diet and water.
  - Body weights were measured weekly.
  - Mice were sacrificed between 41-45 days of age, and the tongues were collected.
- The tongues of mice in both exposure models were stained with 0.5% Methylene Blue and histologically examined to determine the density of fungiform papillae.
- Changes in body weights were calculated for each group.

Body Weight

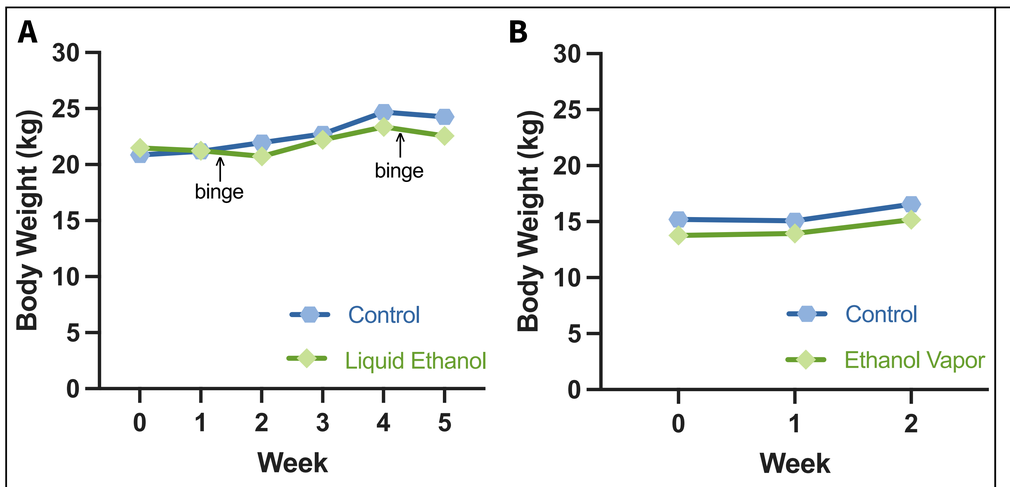


Figure 1. Weekly body weight. (A) Lieber-DeCarli mice. Average body weight of the ethanol mice decreased after each binge. (B) Vapor mice. There was no decrease in weight in the ethanol mice after vapor chamber exposure.

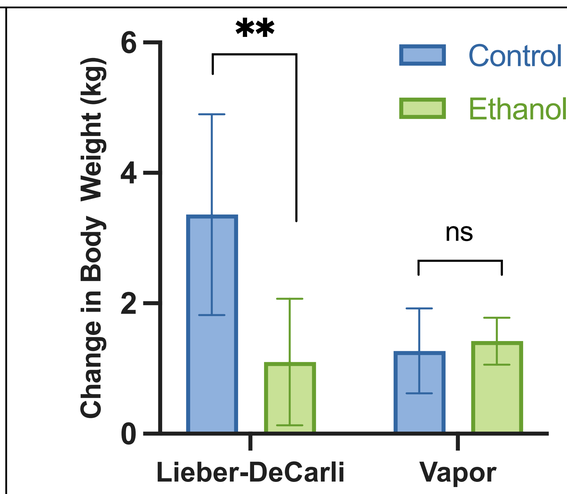
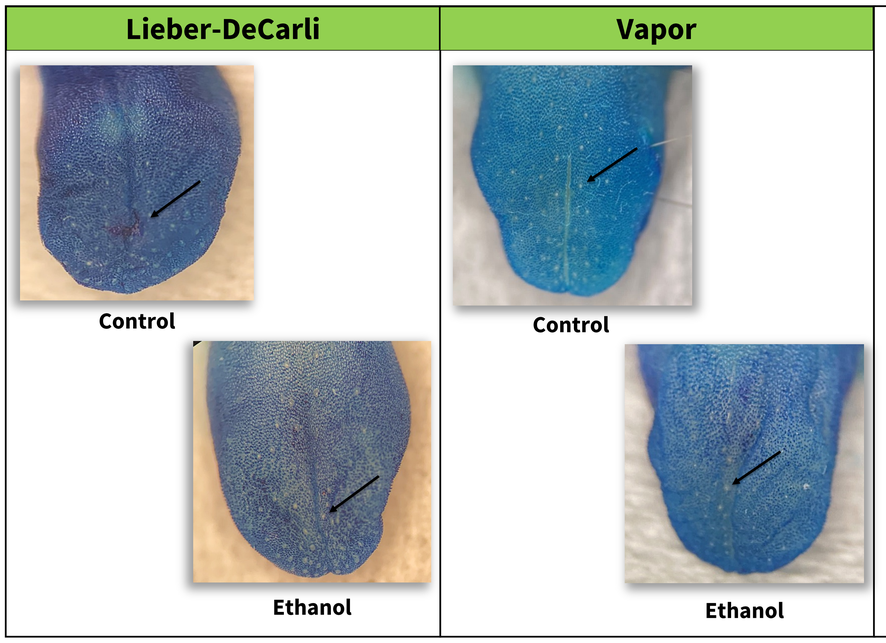


Figure 2. Mean changes in body weight. The ethanol mice in the Lieber-DeCarli group gained significantly less weight than their controls ($p < 0.05$). There was no significant difference in weight gain between the vapor groups.

Fungiform Papillae



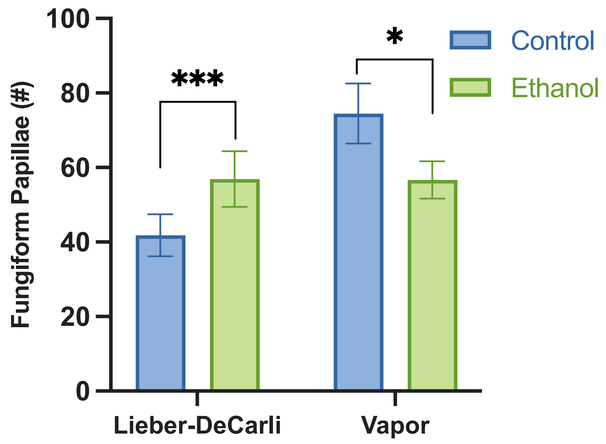


Figure 3. Fungiform papillae density. The Lieber-DeCarli diet led to a significant increase in fungiform papillae in the ethanol mice compared to their controls ($p < 0.05$). Exposure to ethanol vapor led to a significant decrease in fungiform papillae density ($p < 0.05$). Overall, Lieber-DeCarli mice had a lower density of fungiform papillae.

Results

- The Lieber-DeCarli diet led to a significant increase in the density of fungiform papillae, while the ethanol vapor exposure led to a significant decrease in fungiform papillae.
- Mice in the Lieber-DeCarli ethanol group gained less weight than their controls, whereas ethanol administration via inhalation did not significantly affect weight gain.
- Despite a difference in weight gain, the ethanol and control mice on the Lieber-DeCarli diet consumed nearly equal amounts of food.

Conclusions

- Overall, the fungiform papillae density was lower in the mice with the Lieber-DeCarli diet, suggesting an effect of that diet.
- Altogether, these data suggest that the route of administration of ethanol in female mice may significantly affect taste sensitivity and body weight.
- Care should be taken in choosing a method of alcohol administration when designing studies to assess the effects of ethanol on taste preferences and sensitivities.

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