

The effect of nicotine inhalation on taste receptor gene expression and fungiform papillae density

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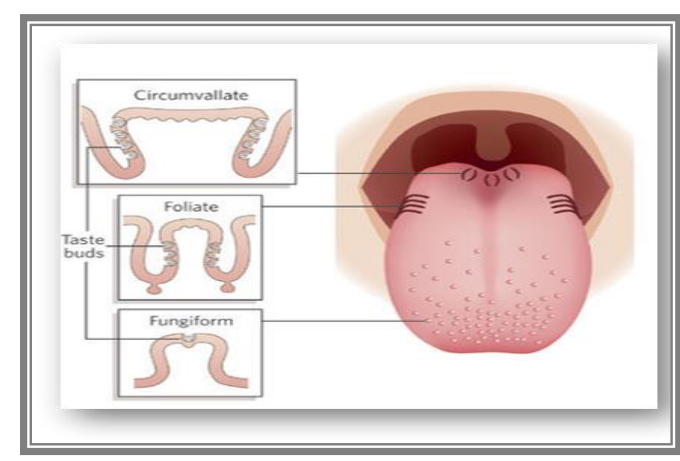
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Introduction

➤ Smoking is one of many acquired causes of smell and taste disorders. The effect on taste may be due to cigarette smoke causing a gustatory disturbance through changing the form, quantity, and vascularization of taste buds.

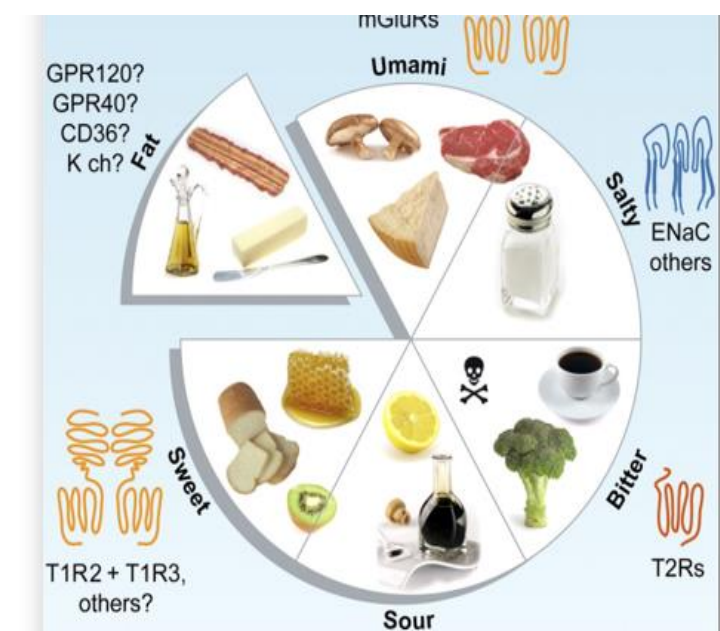


➤ Taste buds are located on fungiform, circumvallate, and foliate papillae found on the tongue.

➤ Taste receptor cells can be stimulated by one of five basic taste qualities, which are sweet, bitter, umami (savory), salty, and sour.

➤ More recently, fat has been proposed as a sixth taste quality.

➤ The goal of this study is to determine the combined effects of inhaled nicotine and high fat diet (HFD) on bitter, sweet, and fat taste receptor gene expression and the effect of inhaled nicotine and HFD on the density of fungiform papillae at the anterior portion of the tongue.



Methods

➤ Adult male C57BL/6N mice were used to investigate the combined effects of nicotine vapor inhalation and HFD on lingual taste receptor expression.

➤ Four groups:

- 1) Air + Chow
- 2) Air + HFD
- 3) Nicotine + Chow
- 4) Nicotine + HFD

➤ After 10 weeks of inhalation exposure and diet consumption, mice were sacrificed, and tongues were harvested.

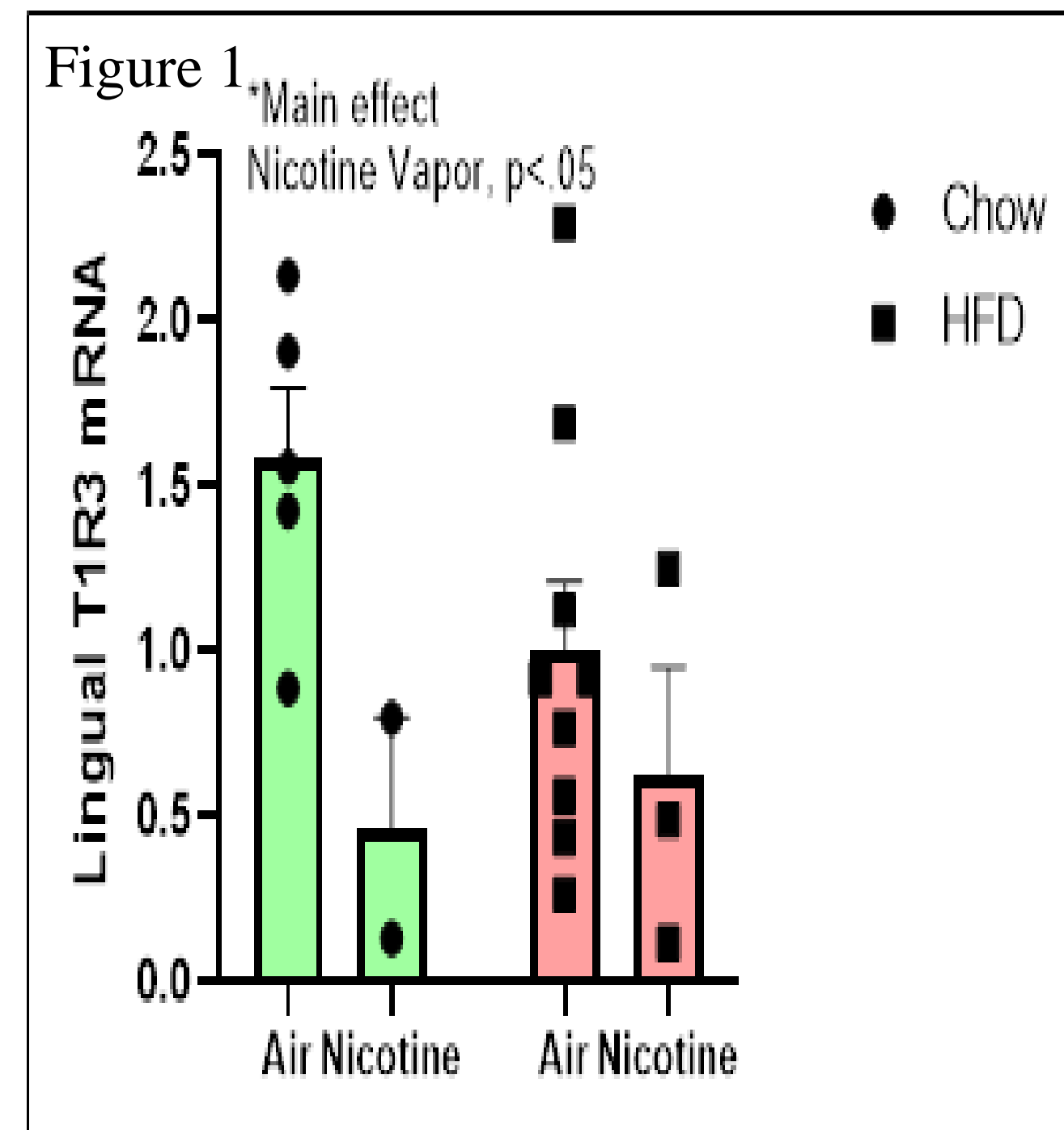
➤ RNA was isolated from the circumvallate papillae.

➤ qPCR measured the expression of the following:

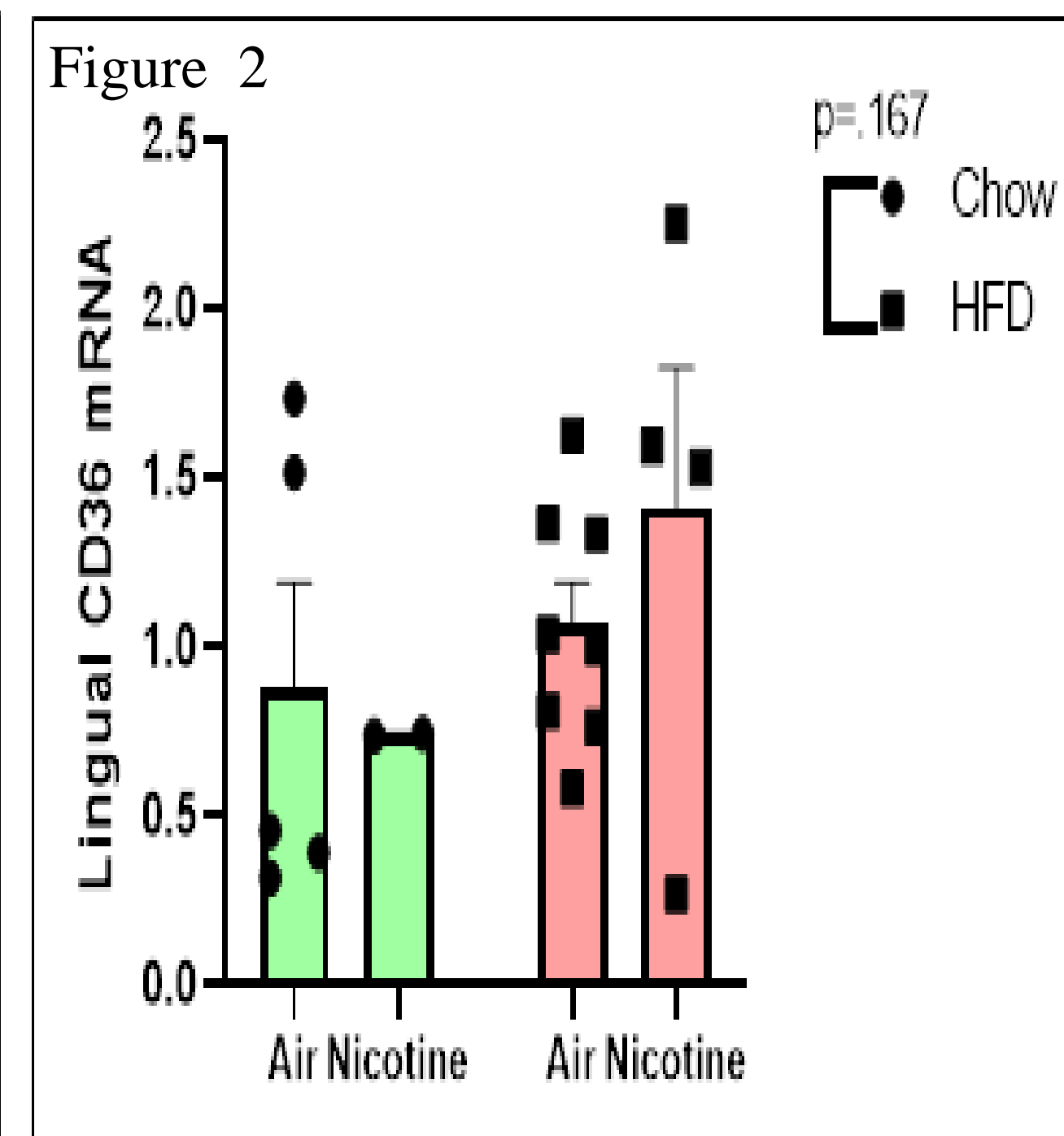
- CD36 mRNA (fat)
- T1R3 mRNA (sweet)
- T1R2 mRNA (sweet)
- T2R138 mRNA (bitter)

➤ To determine density of the fungiform papillae, the anterior 2/3 of the tongue was stained using 0.5% methylene blue to visualize papillae.

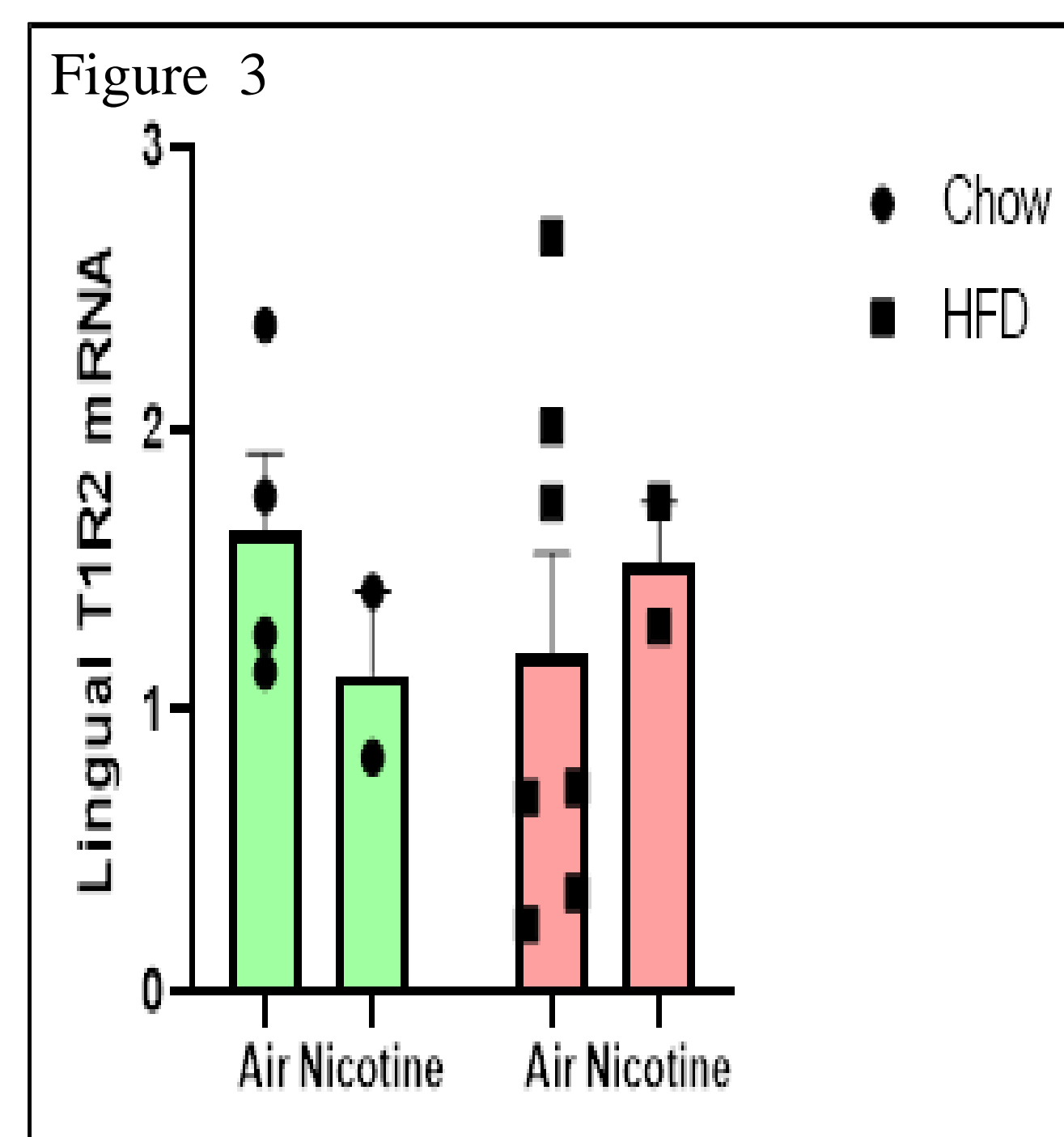
Results



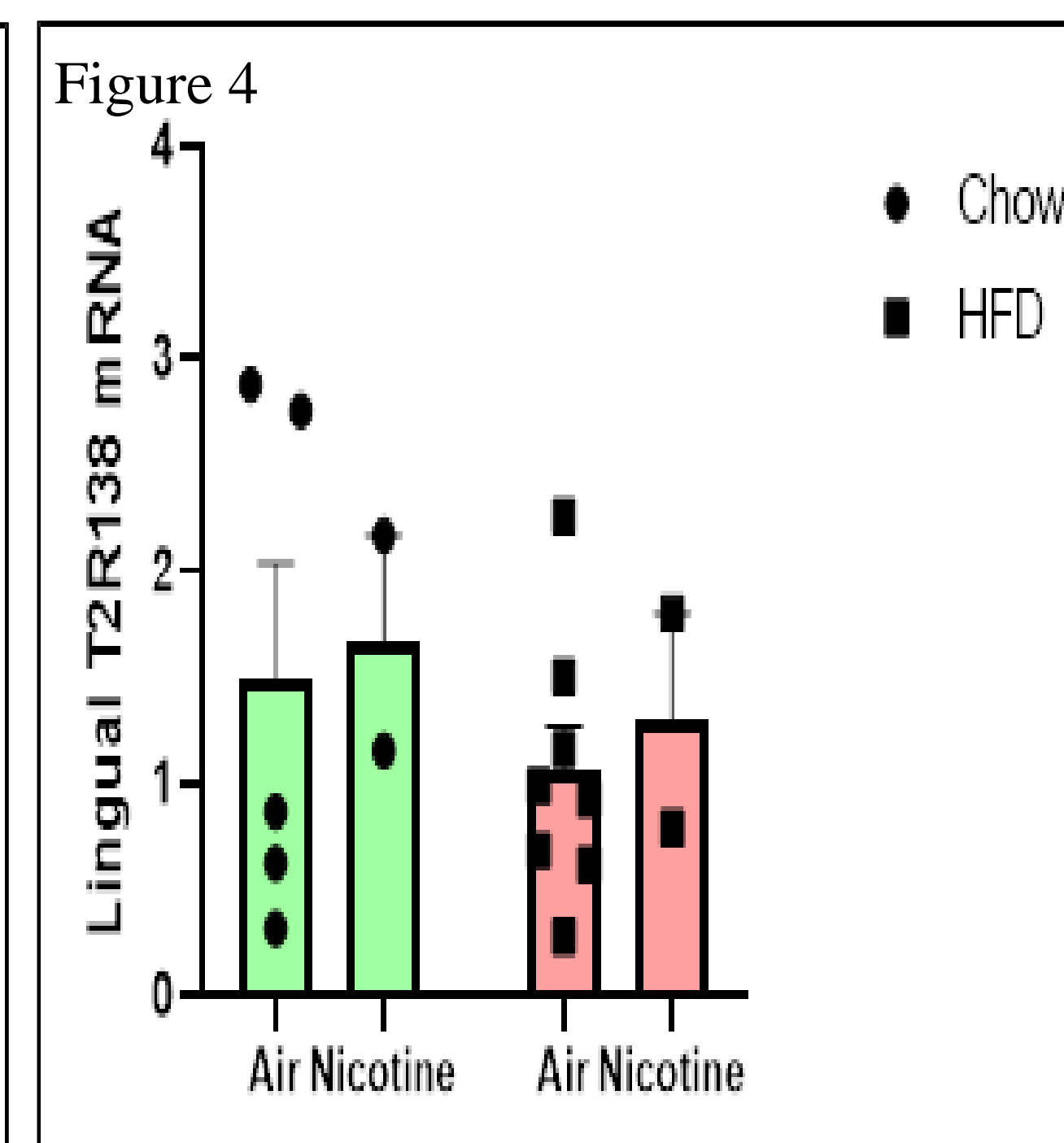
Nicotine vapor inhalation significantly decreases expression of lingual T1R3 mRNA.



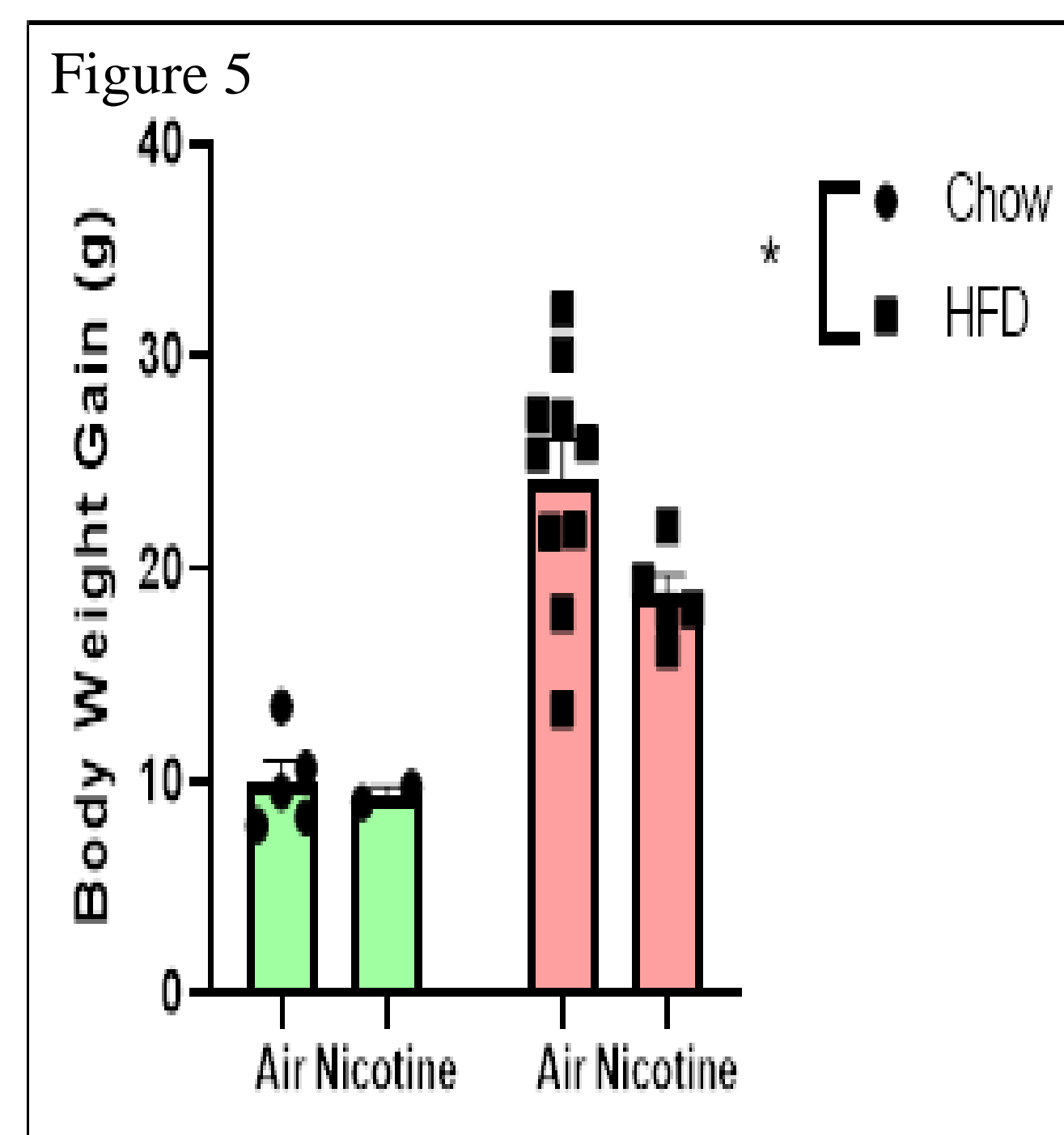
HFD moderately increases the expression of lingual CD36 mRNA.



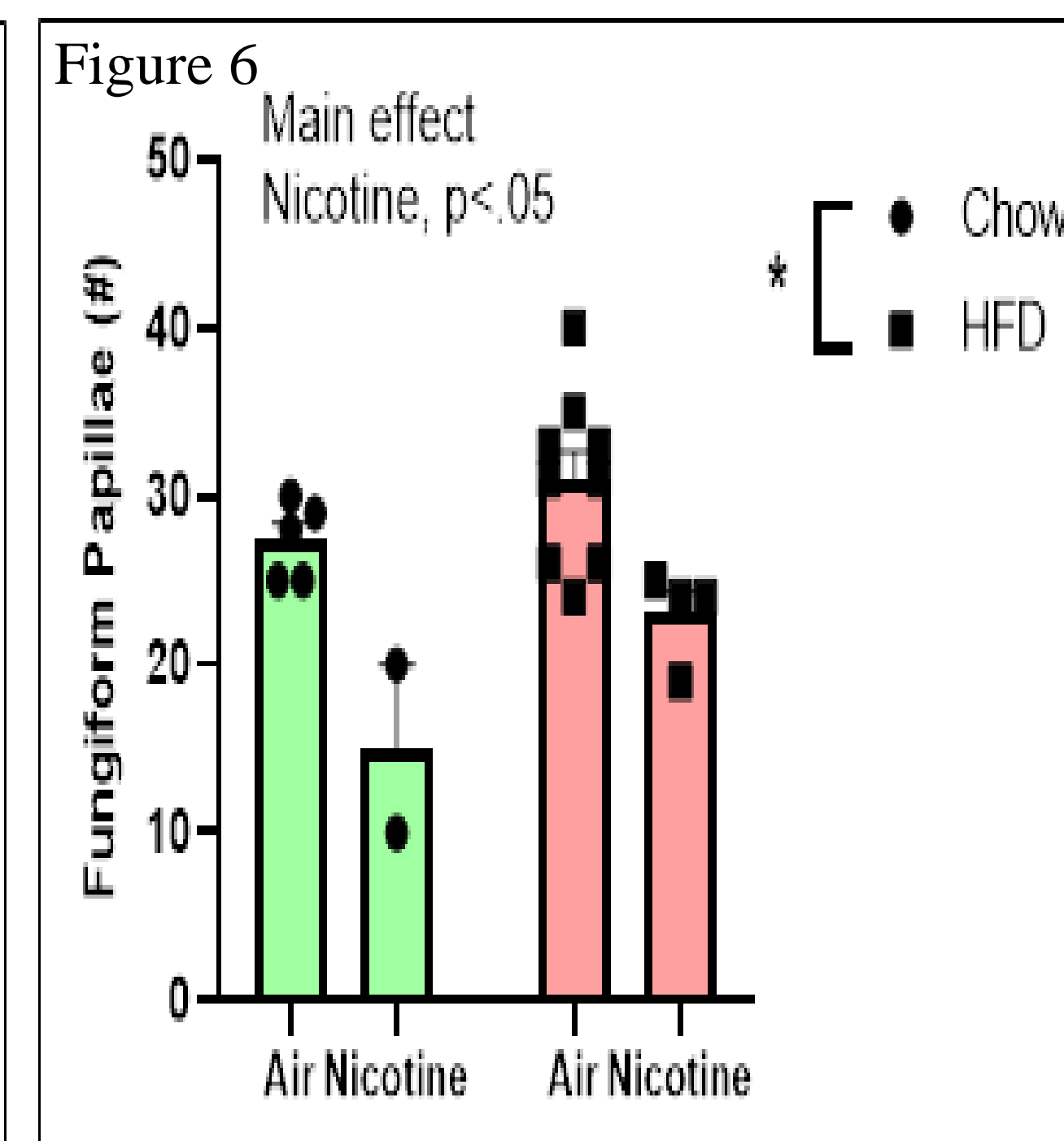
Nicotine and HFD have no effect on expression of lingual T1R2 mRNA.



Nicotine and HFD have no effect on expression of lingual T2R138 mRNA.



HFD significantly increases body weight gain.



Nicotine significantly decreases fungiform papillae density; HFD significantly increases fungiform papillae density.

Results Cont.

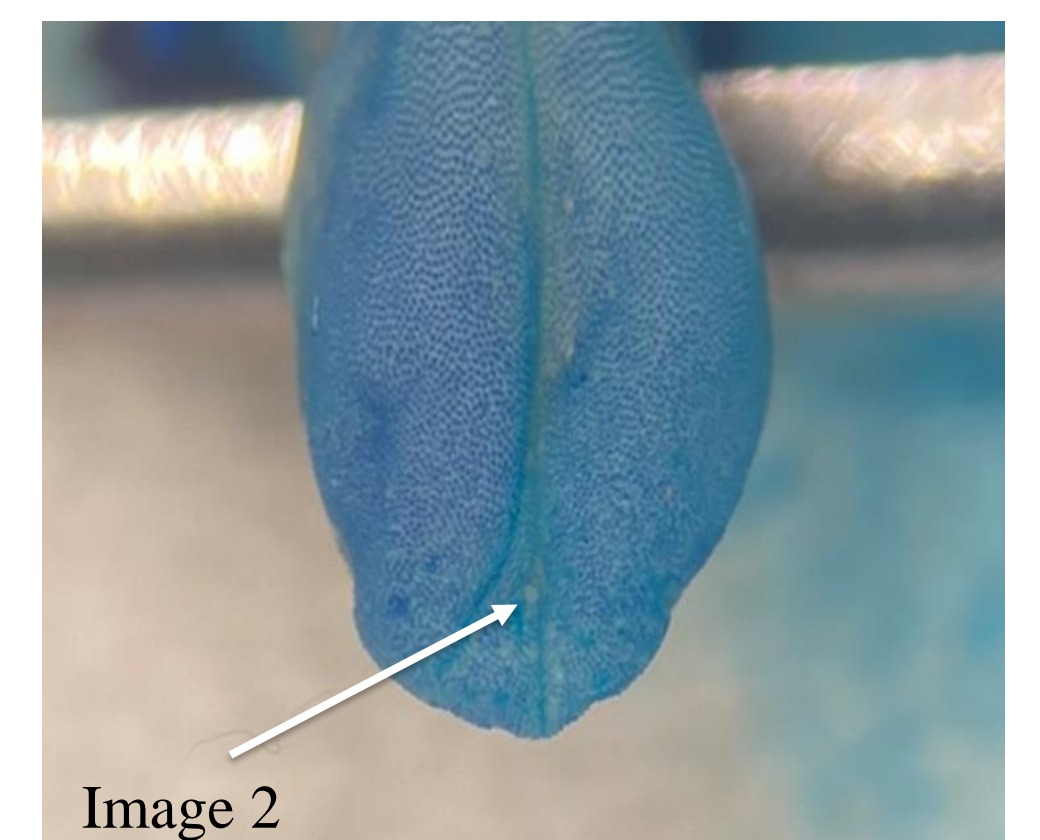
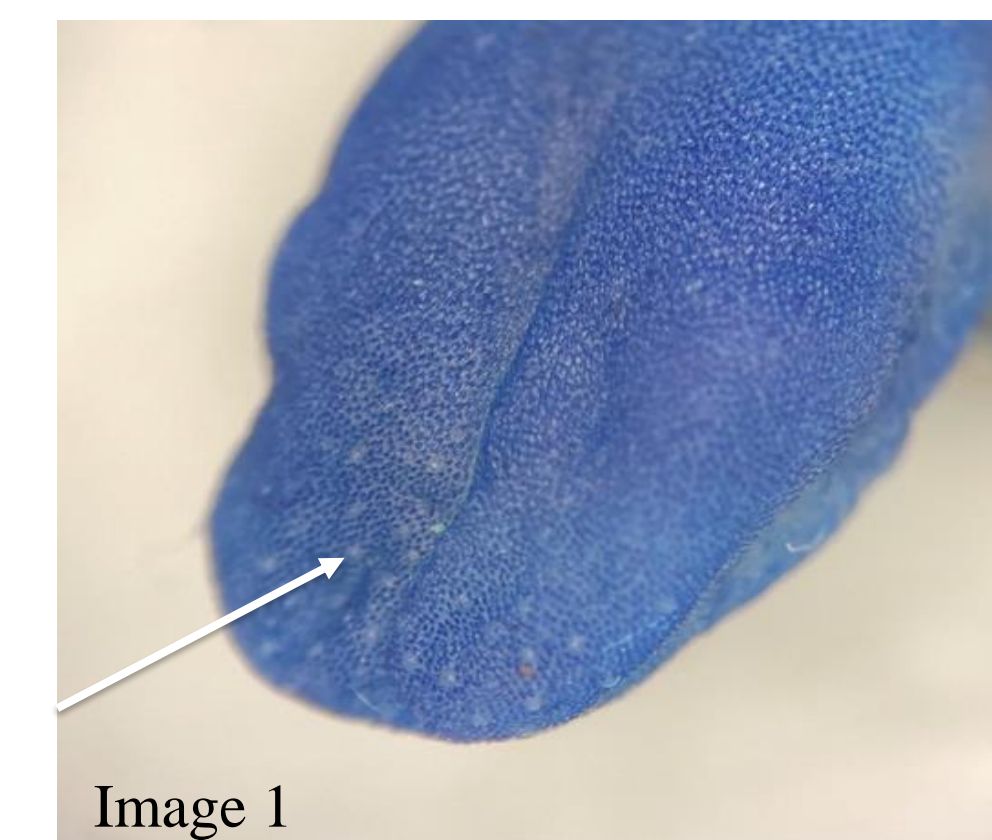


Image 1: Fungiform papillae staining from Air + Chow Cohort
Image 2: Fungiform papillae staining from Nicotine + Chow Cohort

Summary

- T1R3 expression was significantly downregulated in the nicotine groups when compared to the groups receiving room air.
- CD36 expression did not significantly differ between nicotine and room air groups, but there was a trend toward the HFD consuming mice having higher CD36 mRNA levels (p=.167).
- There was a significant main effect of diet on body weight gain with increased body weight gain in the HFD groups.
- There was a significant main effect of diet and a significant main effect of nicotine on fungiform papillae density.
- Nicotine exposure had no effect on body weight gain, T1R3 expression, and T2R138 expression.

Conclusion

- The results suggest that nicotine inhalation leads to a downregulation in sweet taste receptor gene expression and a decrease in fungiform papillae density. This may be due to the harming effects of nicotine inhalation on taste buds. HFD has a significant effect on body weight gain, significantly increases fungiform papillae density, and is correlated to increased fat taste receptor gene expression. In the current study, nicotine inhalation did not alter bitter taste receptor expression or influence body weight gain.