Fatty Acids Enhance the Perceived Taste Intensity of Non-Nutritive Sweeteners, Saccharin and Sucralose, in Male and Female Rats

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Sweeteners

- Bimodal preference in sucralose avoiders and sucralose preferers
- Sex difference in bimodal preference for sucralose (Sclafani & Clare, 2004; Bello & Hajnal, 2005; Dess *et. al*, 2009)
- Loney *et. al* (2011) confirmed bimodal preference of preferers and avoiders of sucralose
- No sex difference between preferers and avoider rats of sucralose (Loney *et. al*, 2011)

•Bello, N.T., Hajnal, A., (2005). Male rats show an indifference-avoidance response to increasing concentrations of the artificial sweetener sucralose. *Nutritional Research*, 25, 683-699.
•Sclafani, A., Clare, R.A., (2004). Female rats show a bimodal preference response to the artificial sweetener sucralose. *Chemical Senses*, 29, 523-528.
•Loney, G.C., Torregrossa, A., Smith, J.C., Sclafani, A., Eckel, E.A., (2011). Rats display a robust bimodal preference profile for sucralose. *Chemical Senses*, 1-13.

Fat Taste?

- Rodents show preference for dietary fats and will modify their caloric intake to include more of these dietary fats (McCormack *et. al*, 2006).
- Fatty acids (linoleic) are the chemical components of dietary fat.
- Perceived intensity of taste solutions is increased when fatty acids are mixed with other tastants such as salt or sugar (Mattes, 2009; Pittman *et. al*, 2006).

- Mattes, R.D. (2010). Oral detection of short-, medium-, and long-chain free fatty acids in humans. *Chem Senses*, 34, 145-150.
- Pittman, D.W., Smith, K.R., Crowley, M.E., Corbin, C.H., Hansen, D.R., Watson, K.J., Gilbertson, T.A., (2008). Orosensory Detection of Fatty acids by Obesity-Prone and Obesity-Resistant Rats: Strain and Sex Differences. *Chemical Senses*, 33, 441-460.
- Pittman, D.W., LaMon, C.E., Anderson, A.A., and O'Connor, H.E. (2006) Linoleic and Oleic Acid Alter the Licking Responses to Sweet, Salt, Sour, and Bitter Tastants in Rats. Chemical Senses, 31: 835-843.
- McCormack, D.N., Clyburn, V.L., and Pittman, D.W. (2006) Detection of Free Fatty Acids following a Conditioned Taste Aversion in Rats. Physiology & Behavior, 87(3): 582-594.

Interaction Between Sweeteners and Fat Taste

- The ability for rats to detect the presence of fatty acids is evident through conditioned taste aversion testing with fatty acids, specifically linoleic and oleic acids (McCormack *et. al*, 2006; Pittman *et. al*, 2008).
- Presence of fatty acids may exaggerate taste perception causing pleasant tastes and unpleasant tastes to taste stronger (Pittman *et. al*, 2006)

- McCormack, D.N., Clyburn, V.L., and Pittman, D.W. (2006) Detection of Free Fatty Acids following a Conditioned Taste Aversion in Rats. Physiology & Behavior, 87(3): 582-594.
- Pittman, D.W., LaMon, C.E., Anderson, A.A., and O'Connor, H.E. (2006) Linoleic and Oleic Acid Alter the Licking Responses to Sweet, Salt, Sour, and Bitter Tastants in Rats. Chemical Senses, 31: 835-843.
- Pittman, D.W., Smith, K.R., Crowley, M.E., Corbin, C.H., Hansen, D.R., Watson, K.J., Gilbertson, T.A., (2008). Orosensory Detection of Fatty acids by Obesity-Prone and Obesity-Resistant Rats: Strain and Sex Differences. *Chemical Senses*, 33, 441-460.

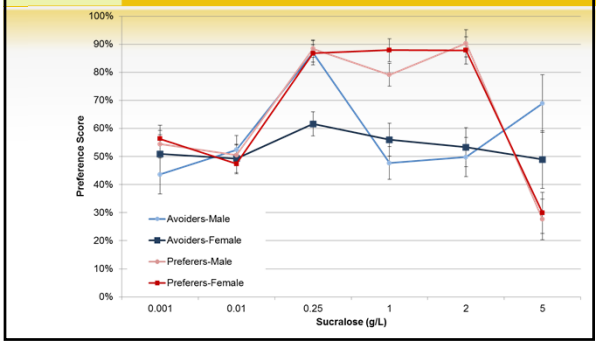
Current Study

- **Research Goals**
  - Identify rats that preferred or avoided sucralose and extend those findings to saccharin.
  - Examine the effects of adding fatty acids to varying concentrations of non-nutritive sweeteners.
  - Support evidence of fatty acid as a modulator of perceived intensity of gustatory tastants.

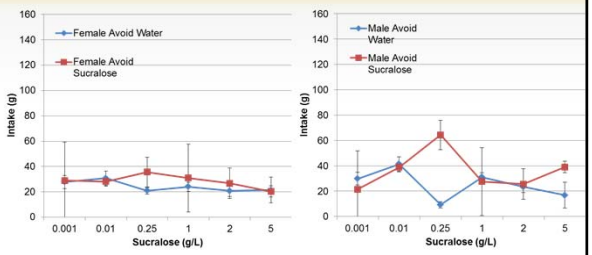
Methods

- **Experiment 1:**
  - Two bottle preference test with sucralose to determine preferers and avoiders.
  - Two bottle preference test with saccharin.

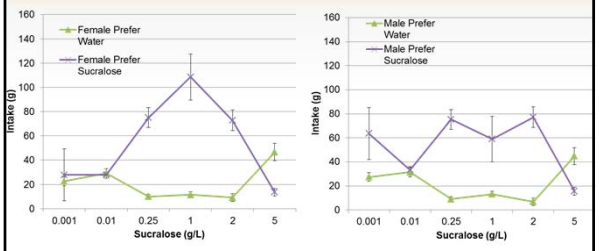
Experiment 1: Preference (Sucralose)



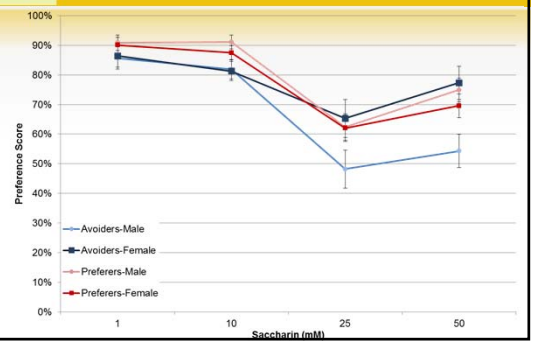
Experiment 1: Intake (g)



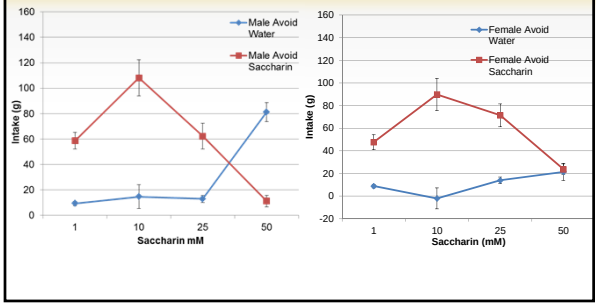
Experiment 1: Intake (g)



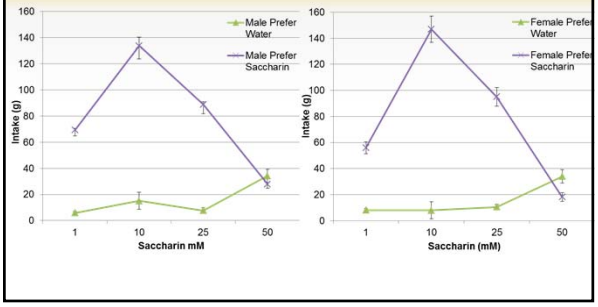
Experiment 1: Preference (Saccharin)



Experiment 1: Intake (mM)



Experiment 1: Intake (mM)



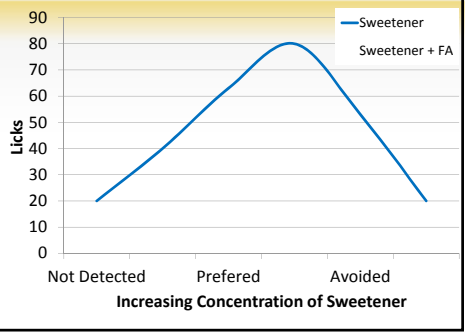
METHODS

- Experiment 2:
  - Licking was assessed during brief-access testing using 30s stimulus trials in the Davis Rig. The latency time to first lick and number of licks in each trial were recorded.
  - We tested the rats under a water-deplete condition and under a water-replete condition.

EXPERIMENT 2

- The Davis Rig measures rat licking behavior at a resolution of 1 ms during the controlled presentation of up to 16 taste stimuli.
- Each daily test session consisted of one block of ten trials with stimulus durations of 30 s, wait times for the first lick of 30 seconds, and interstimulus interval of 10s. Each block included one trial of each test stimulus and one trial of water stimuli.

HYPOTHESIZED EFFECT OF FATTY ACIDS + SWEETENER



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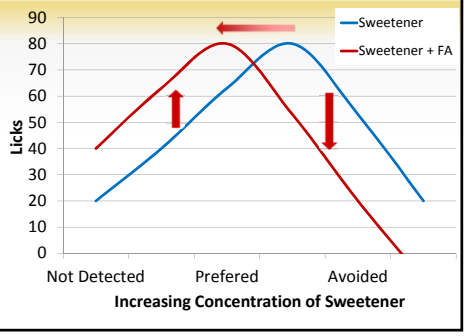
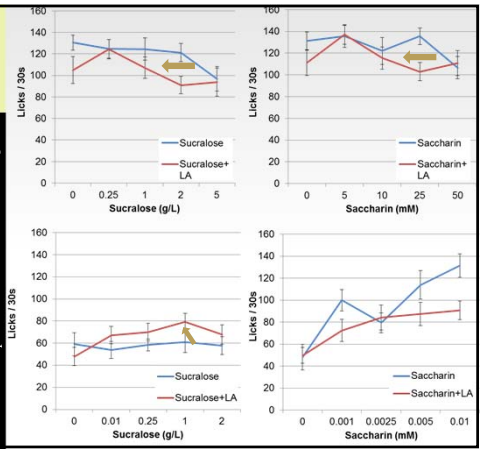


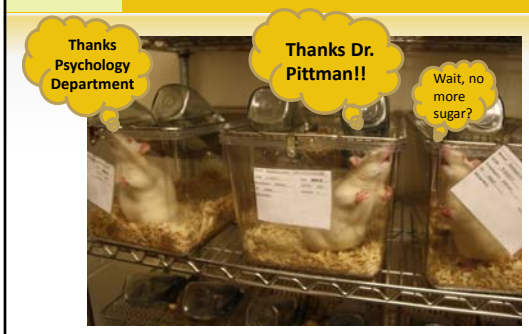
Results



CONCLUSIONS

- Our results replicate & extend the findings of Loney *et. al* that rats show biphasic preference for sucralose.
- We did not see any sex differences in the present study
- Our results replicate the findings of Pittman *et. al* that perceived taste intensity increases when fatty acids are present.
- Sucralose preferring and avoiding behavior did not extend to saccharin because saccharin activates receptors for bitter taste for all rats.
- Linoleic acid intensifies perceived intensity of sweeteners increasing preferences at lower concentrations and increasing avoidance at lower concentrations.

THANK YOU!!



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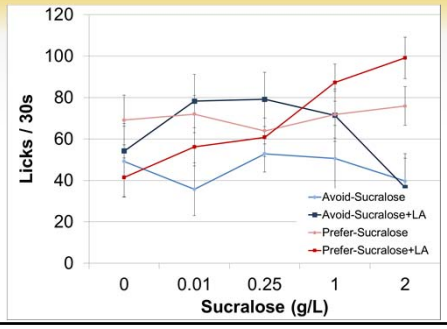

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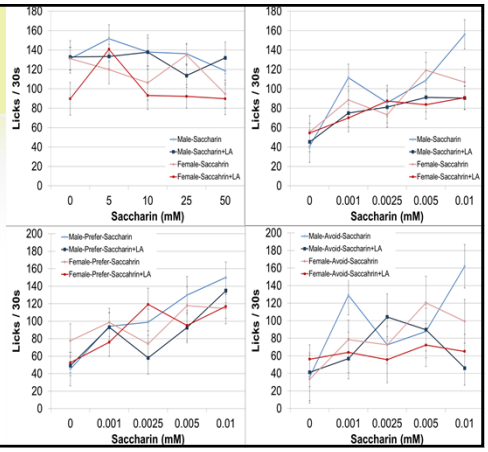

DAVIS RIG COLLECTION