THE ROLE OF THE CHORDA TYMPANI NERVE IN THE DETECTION OF FREE FATTY ACIDS IN RATS.

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Introduction

Free fatty acids have been shown to depolarize the membrane potential of isolated rat taste receptor cells through the inhibition of delayed-rectifying potassium channels. Previously our laboratory has shown that the free fatty acids, linoleic acid (LA) and oleic acid (OA) commonly found in dietary fats, such as corn oil, can be detected and avoided by rats during 2-bottle preference tests following a conditioned taste aversion (CTA). Furthermore, we have also demonstrated that the detection of linoleic acid in this CTA paradigm requires an intact chorda tympani nerve.

This study extends our previous investigations of the ability of rats to detect free fatty acids on the basis of gustatory cues through three experimental objectives:
1. Assess the detection threshold for linoleic & oleic acid using short duration stimulus presentations following a CTA;
2. Examine the effect of bilateral chorda tympani transections on the ability to detect linoleic & oleic acid following a CTA;
3. Characterize the effect of stimulus presentation duration on the ability to demonstrate an avoidance of linoleic & oleic acid following a CTA.

Methods

Chemical Stimuli

Linoleic Acid (LA)

EXP A: A, 48, 88, 176 uM
EXP B: 45, 55, 65, 75, 85 uM

Oleic Acid (OA)

EXP A: 48, 88, 176 uM
EXP B: 40, 55, 70, 85, 100 uM

Conditioning and Behavioral Testing

EXP A: Male Sprague-Dawley rats at least 90 days old were placed on a 24h water restriction schedule and trained to reliably drink from bottle spouts in the MS-160 Davis Rig. After being trained to lick in the Davis Rig, 32 rats received bilateral chorda tympani transections and 20 rats received sham surgeries. Following 6 days of recovery from CTA or sham surgery with ad lib access to water, the rats were placed in a 24h water restriction schedule divided into four groups based on the surgery, CS free fatty acid, and UCS injection conditions [LA/LC = 8:1, CTA/LC = 8:1, LA/LC = 4:1, CTA/LC = 4:1] and given 15 min access to the CS (either 150 mM LiCl or NaCl at a dosage of 13.33 ml/kg). Following injections day of rest after the injection day, all rats were tested in the MS-160 Davis Rig receiving 48 randomized trials consisting of 24 water trials and 4 trials each of 44, 88, 176 uM linoleic and oleic acid.

EXP B: Male Sprague-Dawley rats at least 90 days old were placed on a 24h water restriction schedule and trained to reliably drink from bottle spouts in the MS-160 Davis Rig. After being trained to lick in the Davis Rig, the rats were divided into four groups based on the CS free fatty acid and UCS injection conditions [LA/LC = 8:1, CTA/LC = 8:1, LA/LC = 4:1, CTA/LC = 4:1] and given 15 min access to the CS (either 150 mM LiCl or NaCl at a dosage of 13.33 ml/kg). Following injections day of rest after the injection day, all rats were tested in the MS-160 Davis Rig receiving 48 randomized trials consisting of 24 water trials and 4 trials each of 44, 88, 176 uM linoleic and oleic acid.

Conclusions

• Following a CTA, rats avoid future consumption of linoleic acid at concentrations > 44 uM regardless of assessment technique or stimulus duration.
• Rats lacking the chorda tympani gustatory pathway are unable to avoid linoleic acid following a CTA.
• Stimulus duration appears to affect the ability of rats to demonstrate avoidance of oleic acid following a CTA, such that 8s stimulus durations are insufficient to demonstrate the formation of a CTA, whereas 30s stimulus durations demonstrate significant decrease in licking responses to oleic acid at concentrations > 70 uM.
• Given a single choice decision, thirst motivation may mask the formation of CTA compared to a two-choice decision assessment of conditioned taste aversions.

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