GABAergic influences increase ingestion across all taste categories

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Benzodiazepine Drugs

- Benzodiazepines are a depressant
- Facilitate the main inhibitory neurotransmitter in the brain called GABA (\(\text{gamma-aminobutyric acid}\))
- Six million people are diagnosed with generalized anxiety disorder (GAD) per year
  - Half are given anti-anxiety drugs which contain benzodiazepines
- Typical benzodiazepines include: Valium, Xanax, and Librium (chlordiazepoxide, CDP)
Concerns about Benzodiazepines

- Some side effects include drowsiness, muscle weakness, depression, and weight gain.
- In 2007 around 31% of people in the US were diagnosed with obesity, defined as having a body mass index (BMI) above 30.
Benzodiazepines Influence Palatability

This graph shows the significance of direct injection of benzodiazepines into the PBN.

Fig. 2. Microinjections of midazolam (7.5 μg) into the parabrachial nucleus (PBN), nucleus of the solitary tract (NTS), pedunculopontine nucleus (PPT), and the fourth ventricle (experiment 1). Amount of food consumed after the time course 15 min, 1 h and 2 h. Midazolam (7.5 μg) into the PBN increased food intake over NTS, PPT, and the fourth ventricle (P<0.001). The results are presented as mean±S.E.M. An asterisk denotes significant elevations in food intake relative to vehicle.

PBN as site for GABA to influence taste palatability

BEFORE INJECTION

AFTER SALINE

AFTER CDP

- Proportion of PBN neurons that respond BEST to a taste stimulus
- CDP increases sweet and salt responsiveness and decreases sour and bitter responsiveness

Previous Research in the Pittman Lab: *Dinnen & Farr 2007*

- Tested both male (n=12) and female (n=12) rats
- Tested both long-term and brief-access in same group of rats (counterbalanced)
- Only 1 concentration of sucrose, NaCl, citric acid, and quinine in long-term tests
- Found no differences between sexes
- Found equivocal effects of CDP across the microstructural variables
Objectives of this Study

- The purpose of this study was to examine the effects of CDP on the feeding patterns of rats.
- We tested both appetitive and aversive stimuli.
- Low, medium, and high concentrations of the following tastants were used:
  - Sucrose
  - Saccharin
  - NaCl
  - QHCl
  - Citric Acid
  - MSG
Data Collection in the AC-108 Gustometer

- Dependent variable: licks measured during daily 60 min test sessions
Independent Variables

- Between-subjects effect: concentration of the tastant (low, medium, or high)

- Within-subjects effect: CDP_{(10 mg/kg)} versus saline
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Total Licks in the Meal

- **Appetitive:**
  - CDP increased the number of licks in meals

- **Aversive:**
  - No effect of CDP for sour and strong salt
  - CDP increased mild bitter
Duration of the Meal (seconds)

- Appetitive:
  - No effect of CDP

- Aversive:
  - No effect of CDP
Mean Duration of Pauses (seconds)

- **Appetitive:**
  - CDP decreased the duration of pauses across all appetitive stimuli

- **Aversive:**
  - CDP decreased length of pauses for sour and bitter
  - CDP increased the duration for strong salt
Number of Bursts in the Meal

- **Appetitive:**
  - No effect of CDP for sweet or mild salt
  - CDP increased number of bursts for MSG

- **Aversive:**
  - No effect of CDP
Mean Duration of Bursts (seconds)

- **Appetitive:**
  - CDP increased the duration of bursts for sucrose & strong MSG

- **Aversive:**
  - CDP increased mild bitter and NaCl
Number of Licks per Burst

- **Appetitive:**
  - CDP produced small increases in sucrose and MSG licks

- **Aversive:**
  - CDP increased strong NaCl and mild bitter
Rate of Licking (*licks per second*)

- **Appetitive:**
  - CDP increased the average lick rate

- **Aversive:**
  - CDP increased the average lick rate
Licks within the First Minute

**Appetitive:**
- No effect of CDP for sweet or MSG – *ceiling effect*

**Aversive:**
- CDP increased 1\textsuperscript{st} minute licks for sour, bitter and salt
Summary & Conclusions

- Baird has shown that CDP increased responsiveness to appetitive stimuli and decreased responsiveness to aversive stimuli in the PBN.
- These results show a general increase in palatability across all tastants that support his PBN data.
- Our behavioral results indicate that CDP increased the appetitive qualities and decreased the aversive qualities of each stimulus primarily through changes in taste-mediated variables.
Acknowledgements

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