Deep Brain Stimulation of the Nucleus Accumbens Shell at Different Stages of Stress-induced Binge Eating to Alter Bingeing Behavior in Mice

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Introduction

The Nucleus Accumbens Shell (NAS) is involved in the cognitive processes of motivational salience and reward. It is also involved in the mesolimbic dopamine system – alterations in dopamine signaling is implicated in reward-seeking behaviors.

Previous studies show that Deep Brain Stimulation (DBS) of the NAS modulates dopamine receptor-expressing neurons and ameliorates addictive behaviors.

Stress produce changes in stress neurocircuitry that leads to subsequent increased stress sensitivity and overconsumption of high fat foods.

We hypothesize that DBS of the NAS during food restriction will prevent addictive behaviors, such as binge eating.

We furthermore hypothesize that DBS of the NAS during stressful stimuli will alleviate reward-seeking behaviors (in this case, binge-eating).

Previous studies showed:

- NAS DBS at 150 μA blunted high fat consumption (fig. 1A).
- Stimulated on two alternating days – show significant decrease in binge eating (fig. 1C).
- DBS decreased daily intake (fig. 2A).
- Decreased total caloric intake of the high-fat diet (fig. 2C).
- Food deprivation increases sensitivity to stress (fig. 3).
- Stress and food deprivation causes binge eating behavior (fig. 3C and D).

Activity

- 10-week-old mice, 6-7 mice/group (3-4 per cage). Weights and food consumption measured daily.
- Animal groups will be sorted into three stimulation paradigms, based on their assigned treatment arm: A) no stimulation, B) stimulation during food restriction, and C) stimulation during stressful stimuli.
- Group A (n=7) – control mice:
  - Restraint
  - Novel object
  - Cage change
  - Medium Pellet

- Group B (n=6) – stimulation during food deprivation:
  - Restraint
  - Novel object
  - Cage change
  - Medium Pellet
  - High Caloric

- Group C (n=6) – stimulation during stressful stimuli:
  - Restraint
  - Novel object
  - Cage change
  - Medium Pellet

Stim group A
Stim group B
Stim group C

Stressful Stimuli

Outcomes

- Weight loss shows a 10-15% weight loss.
- No weight change during nutritional consumption.

Reflection

H₀: DBS of the NAS during food restriction will prevent addictive behaviors, such as binge eating – Was Rejected.
H₁: DBS of the NAS during stressful stimuli will alleviate reward-seeking behaviors (binge eating) – Did not reach significance.

Points to consider:

- Acute vs chronic food deprivation
- Other studies allowed mice to lose 10-15% of body weight over a 11 day period as opposed to this 5 day period (in this study).
- Chronic food deprivation can have a different influence on behavioral response to high fat foods.
- Stimulation during this acute deprivation period could have given different results.
- Increasing trend in nutritional consumption
- Allowing a stable occurrence of binge eating behavior prior to stimulation might have resulted in better observable effects of stimulation during CVS and nutritional exposure.
- Location of stimulation
- Potential experimental flaws.