The Effect of Lesion in Insular Cortex on Taste and Feeding Behaviors

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Background

- **The Insular Cortex (IC) is implicated in many critical functions supported by its strong connectivity to extensive networks of brain regions serving sensory, emotional, and cognitive functions.[1]**
- **The IC contains the gustatory and visceral cortex that suggests its involvement in interoception: being able to sense and respond to internal sensations of the body including hunger and pain. [2,3]**
- **The IC might be the *integrative hub* based on its extensive inputs and outputs[1], particularly those involving taste and visceral feedback.**

Objective

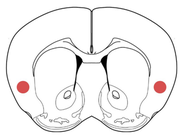
- **To examine the involvement of the Insular Cortex in adaptive feeding behaviors that engage post-ingestive and taste-reinforced feedback, we induced loss-of-function in Insular Cortex and executed a series of behavioral experiments in mice.**

Experimental Design & Methods

Subject: C57Bl/6 mice (n=19) that were single-housed for the tests.

Lesion IC

- Medial Insular Cortex (+0.85mm, ±3.25mm, -2.25mm)
- Ibotenic acid (IBO; **10 mg/ml in 0.1M PBS**, 200ul in total)



Adaptive Feeding

- 60% High Fat Diet (HFD) or High Sugar Diet (HSD): 4 days of chow diet followed by 3 days of HFD or HSD
- Body weight and food intake were measured daily.

Two Bottle Test

- Water vs. 10 mM Sucralose
- Water vs. 0.3 M Sucrose
- 0.3 M Sucrose vs. 10 mM Sucralose
- After the initial 24hr intake, bottle positions were switched for a subsequent 24 hr intake measurement.
- Body weight and liquid intake were measured daily.

Conditioned Taste Aversion

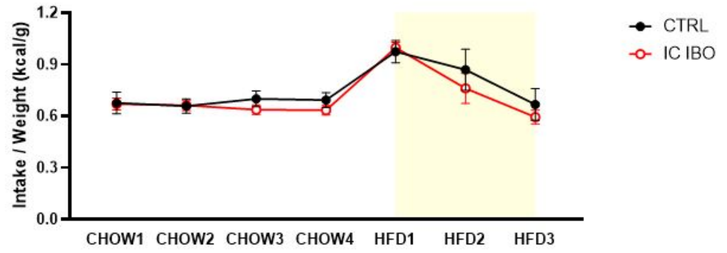
- Habituation to the testing bottle (water) under partial water deprivation in the homecage (2D).
- Acquisition: 30 minutes of 0.2 M NaCl solution intake followed by NaCl (control) or LiCl (180mg/kg) injection.
- Retention: 0.2 M NaCl intake (30 minutes) under ad lib water (RET1) or 24hr water deprivation (RET2).

Quinine Intake Test

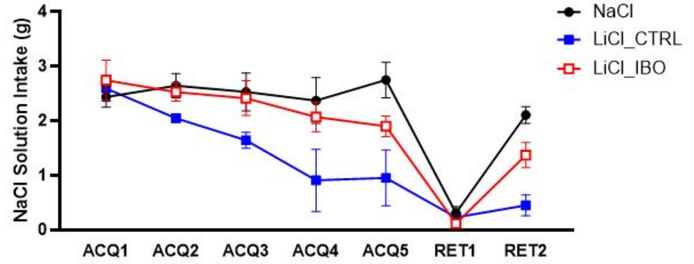
- 0.25 mM Quinine solution was given for 24hrs.
- Body weight and liquid intake were measured daily.

Results

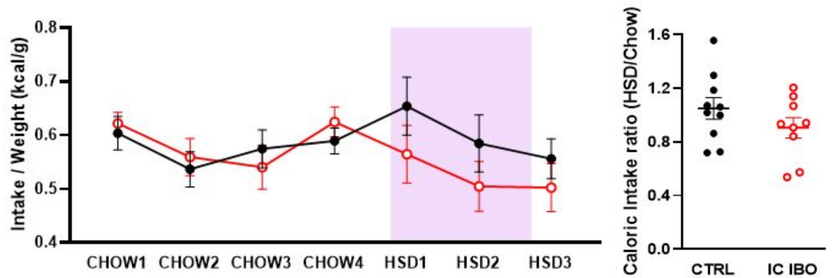
Adaptive Feeding: High Fat Diet (HFD)



Conditioned Taste Avoidance (CTA)

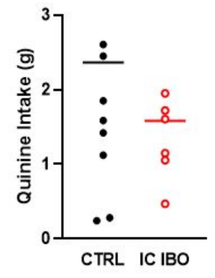


Adaptive Feeding: High Sugar Diet (HSD)



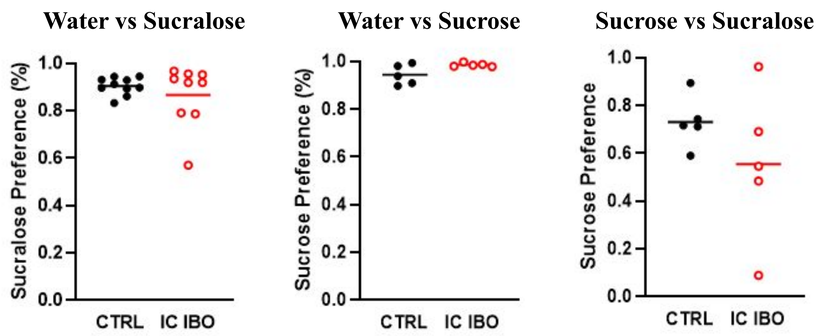
- **While the IC lesion did not affect the caloric intake in switching to the high fat diet, it led to a tendency of reduced intake when high sugar diet was given compared to controls.**

Quinine Intake Test



- **IC lesion attenuated the acquisition of conditioned taste aversion and its subsequent retention of NaCl tastant.**
- **However, it did not affect the natural avoidance of a bitter tastant, quinine.**

Two Bottle Tests (TBT)



- **IC lesion did not alter the sweet taste preference in two bottle tests with single sweetener, water vs. sucralose or sucrose.**
- **Interestingly, when both caloric sugar (sucrose) and non-caloric sweetener (sucralose) were available, IC lesion led to a tendency of reduced preference for caloric sugar.**

Conclusion & Future Directions

- **Conclusion:**
  - **Our results suggest that medial IC lesion does not affect the sweet tasting, but disrupts the post-ingestive signal from caloric sugar. Moreover, impaired CTA acquisition and retention indicates the integration of gustatory and visceral signals are interfered by IC lesion and thus, appropriate feeding decisions cannot be made.**
  - **Therefore, we concluded that the medial IC contributes to the dietary preferences and intake behaviors via mediating and integrating post-ingestive feedbacks.**
- **Future Directions:**
  - **The location and magnitude of lesion will be mapped by Nissl staining to ensure the intended loss-of-function in IC cells.**
  - **The sample size will be increased to enhance the statistical power.**
  - **Anatomical and functional connectivity of IC will be explored.**

References & Acknowledgements

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