Traumatic Brain Injury and Ethanol Effect on Mitochondrial Bioenergetics and Behavior in the Retrosplenial Cortex of Female Rats

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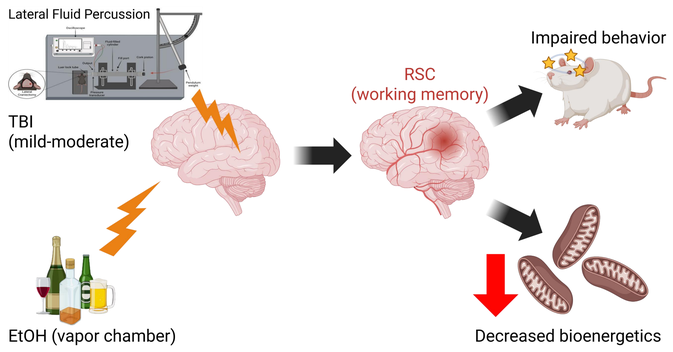
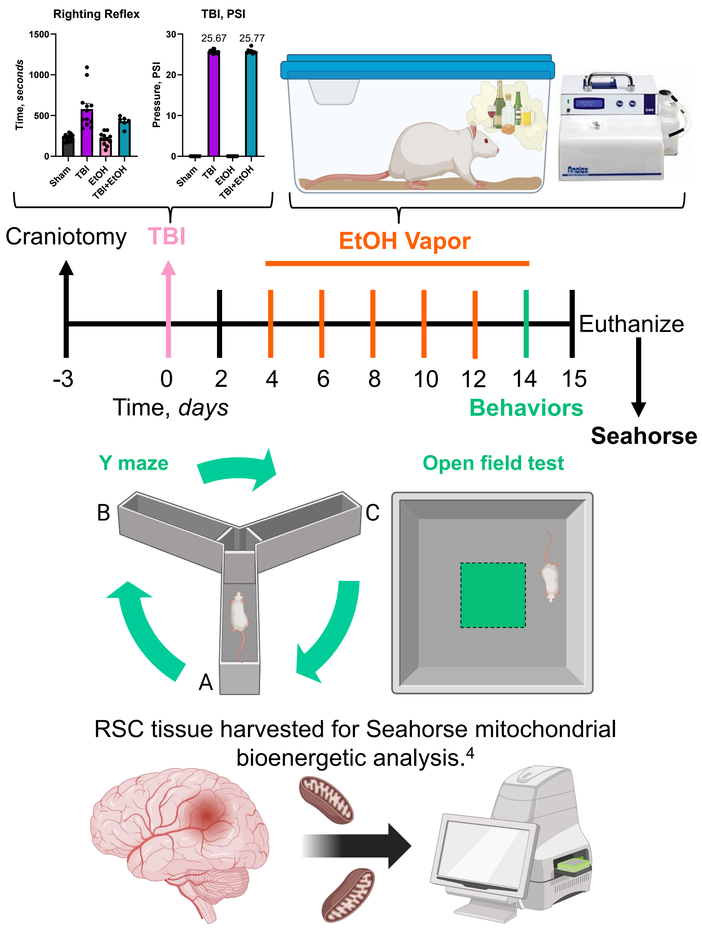
INTRODUCTION

- According to the CDC, there are approximately **586 traumatic brain injury (TBI) hospitalizations per day** (as of 2020). This does not include unreported injury.
- A study found that **30–50% TBI victims were intoxicated** at the time of injury. [1]
- Recovery is dependent on optimal mitochondrial function to mitigate damage.
- This study evaluates the impacts of TBI, sub-chronic ethanol (EtOH) vapor exposure, or both on mitochondrial bioenergetics and behavior in the retrosplenial cortex (RSC).



METHODS

Adult female Wistar rats were assigned to receive Sham or TBI procedure +/- EtOH (4 groups of n = 6 to 8).[2,3]



WEIGHT CHANGES

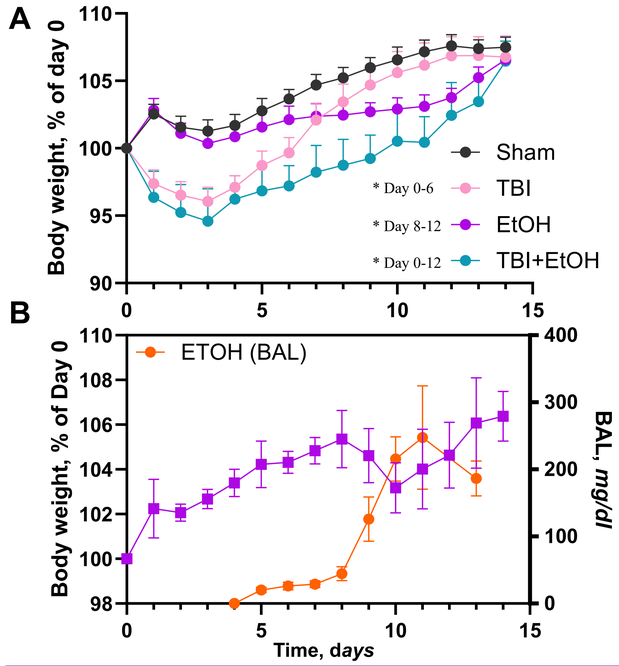


Figure 1: TBI and Intoxicating Levels of EtOH Induce Transient Weight Loss. Changes in body weight percentage (**A**) as a percentage of Day 0 weight. TBI group demonstrated up to ~5% loss ($p < 0.05$) during the first six days post-injury while the EtOH group experienced up to ~4% loss ($p < 0.05$) on days 8-12. TBI+EtOH experience transient weight loss of up to ~6% ($p < 0.05$) for the first 12 days. Body weight percentage of EtOH group compared to blood alcohol level (**B**) indicates that the EtOH group experienced peak weight loss when reaching the target BAL of 200 mg/dL.

BEHAVIORS

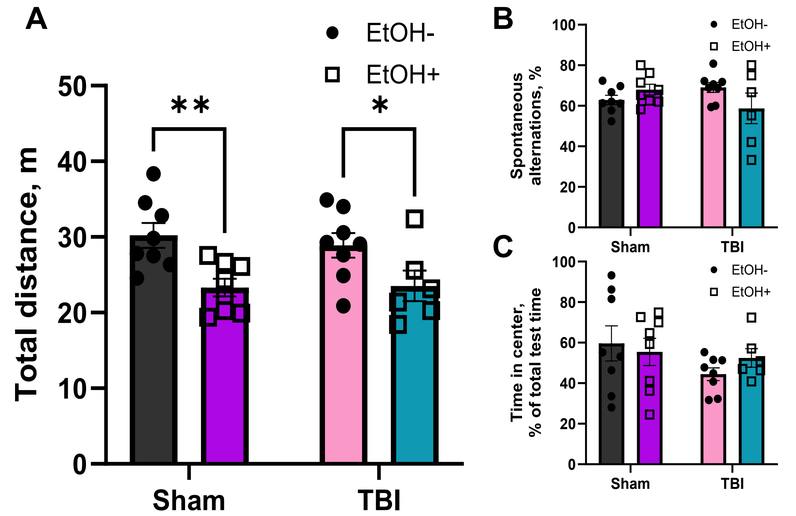


Figure 2: Decreased Y-Maze Distance Travelled Following EtOH Exposure. Distance traveled in Y-maze (**A**) was reduced in EtOH group ($p < 0.01$) and in TBI+EtOH group ($p < 0.05$). Frequency of Y-maze Spontaneous alternation (**B**). No significant changes in working memory in either group. Time spent in center of OFT (**C**). No significant changes in anxiety-like behavior in either groups.

SEAHORSE MITOCHONDRIAL ANALYSIS

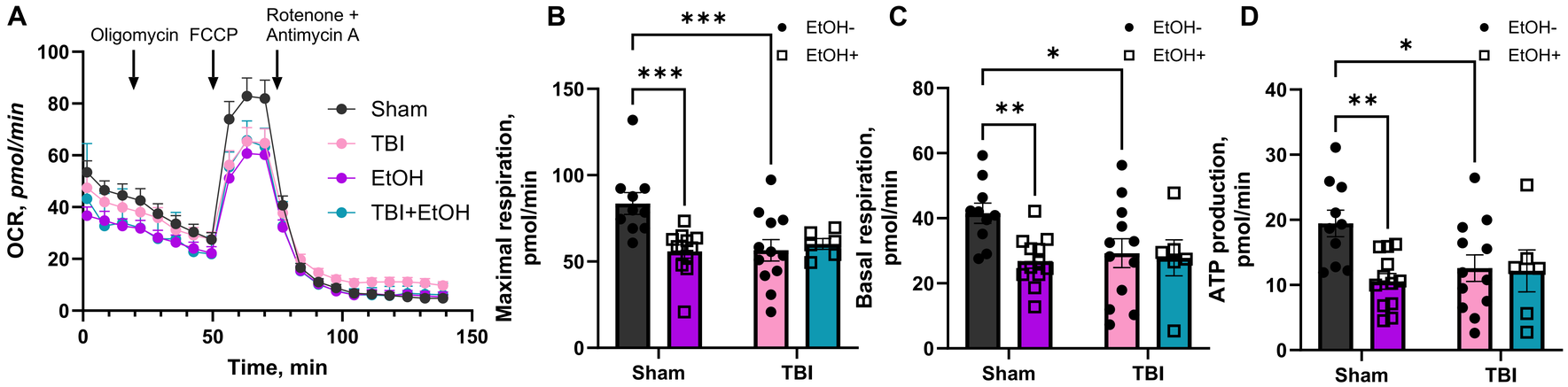


Figure 3: Seahorse Analysis of Mitochondrial Bioenergetics. Traces of oxygen consumption rate (**A**) recorded from coronal brain sections of the RSC tissue punch of Sham, TBI, EtOH, and TBI+EtOH groups. Maximum respiration (**B**) was reduced in TBI group by 32% ($p < 0.001$) and in EtOH group by 33% ($p < 0.001$). Basal respiration (**C**) was reduced in TBI group by 33% ($p < 0.01$) and EtOH group by 38% ($p < 0.05$). ATP Production (**D**) decreased in TBI group by 38% ($p < 0.01$) and in EtOH group by 47% ($p < 0.05$).

CONCLUSION

1. Transient **reductions in body weight** were observed following TBI and EtOH exposure indicating the negative physiological impact of each condition.
2. Preliminary evidence shows a **decrease in distance travelled in Y-Maze following EtOH exposure in females.** However, no measurable impairments in anxiety-like behavior or working memory were detected among the groups.
3. A **decrease in maximal and basal mitochondrial respiration as well as decreased ATP production** following TBI and EtOH indicate potential bioenergetic deficits through similar mechanisms.

Future Direction: Increase sample size to enhance statistical power and evaluate combined TBI and EtOH exposure effects relative to these conditions.

ACKNOWLEDGEMENTS

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