



Choline and Sleep: Can Nutritional Supplementation Improve Sleep?

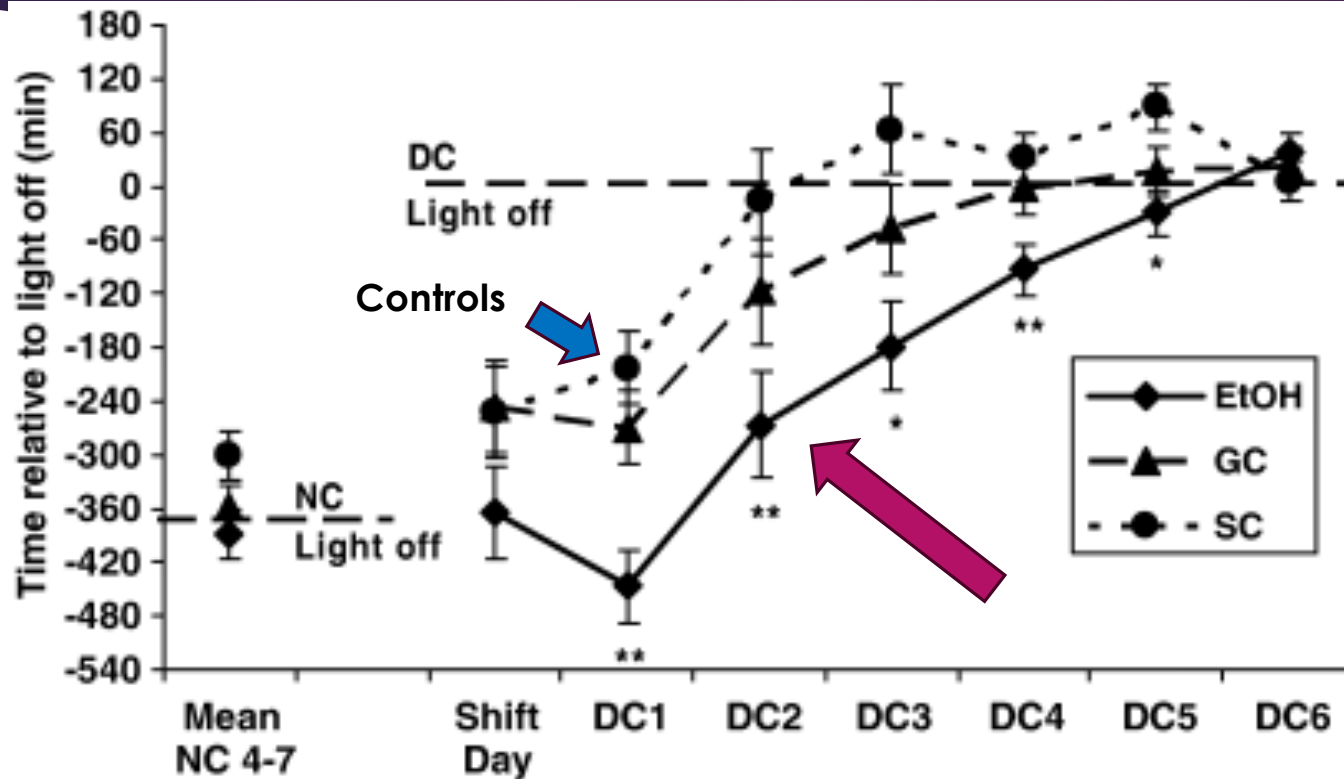
JENNIFER THOMAS
CENTER FOR BEHAVIORAL TERATOLOGY
SAN DIEGO STATE UNIVERSITY
APRIL 18, 2026

Animals with prenatal alcohol exposure took longer to fall asleep and spent less time asleep (Ispiroglu et al., 2019)

Additionally, these sleep-wake changes persist into adulthood (Volin & Kubin, 2012)




Developmental alcohol may alter regulation of circadian rhythm



Rats exposed to alcohol during development take longer to adjust to changes in light/dark cycle

Sakata-Haga et al, 2006

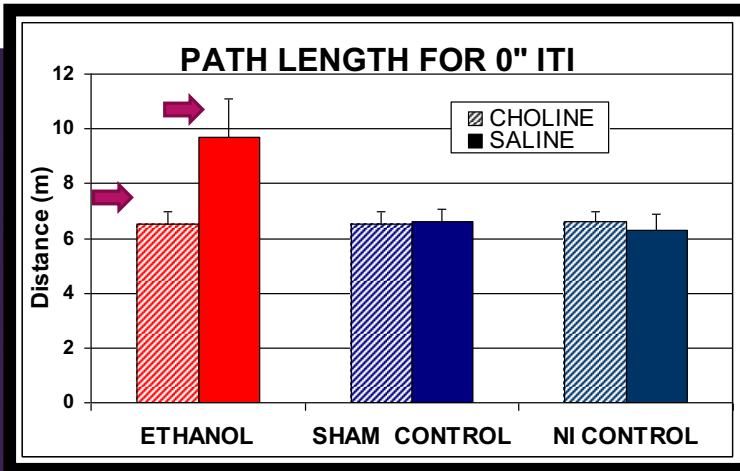


What can we do to
improve sleep quality in
subjects exposed to
alcohol prenatally?

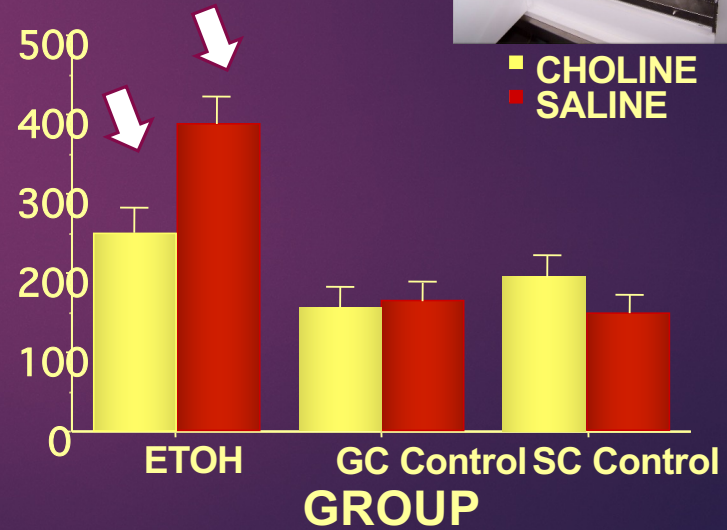
Choline



- Important for brain development
 - Pre/peri-natal choline deficiency
 - Disrupt development
 - Lead to neural tube defects
 - Behavioral and Cognitive deficits
 - Pre/peri-natal choline supplementation
 - Long-term changes in CNS structure/function
 - Leads to long-lasting enhancements in cognitive functioning



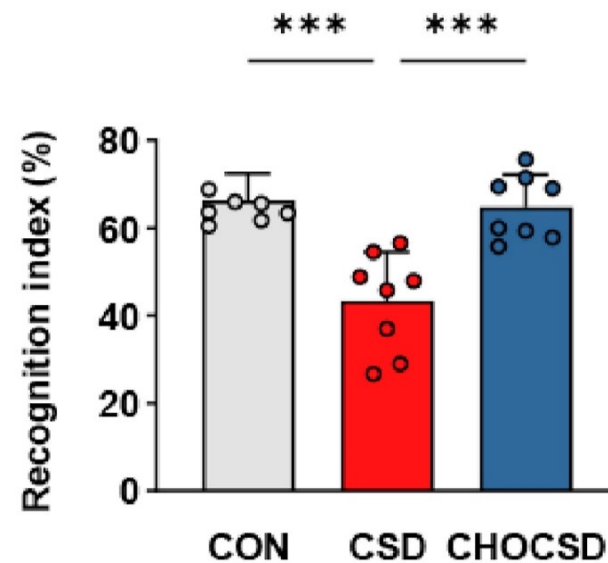
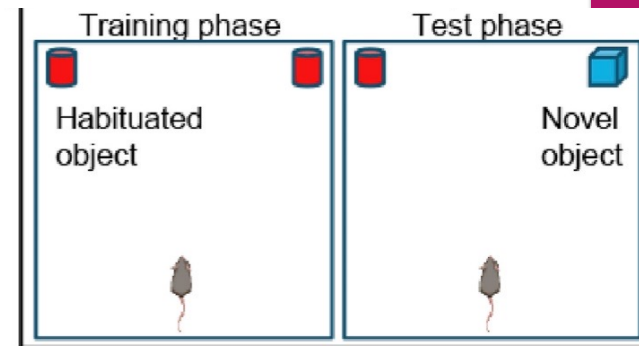
Choline supplementation AFTER ALCOHOL EXPOSURE attenuates ethanol's adverse effects on behavioral development





Why might choline
improve sleep?

Pre- and early postnatal choline can reduce the severity cognitive deficits associated with chronic sleep deprivation



Acetylcholine and its Role in Sleep

- ▶ Plays a role in sleep-wake modulation
- ▶ Low levels of choline are associated with poorer sleep





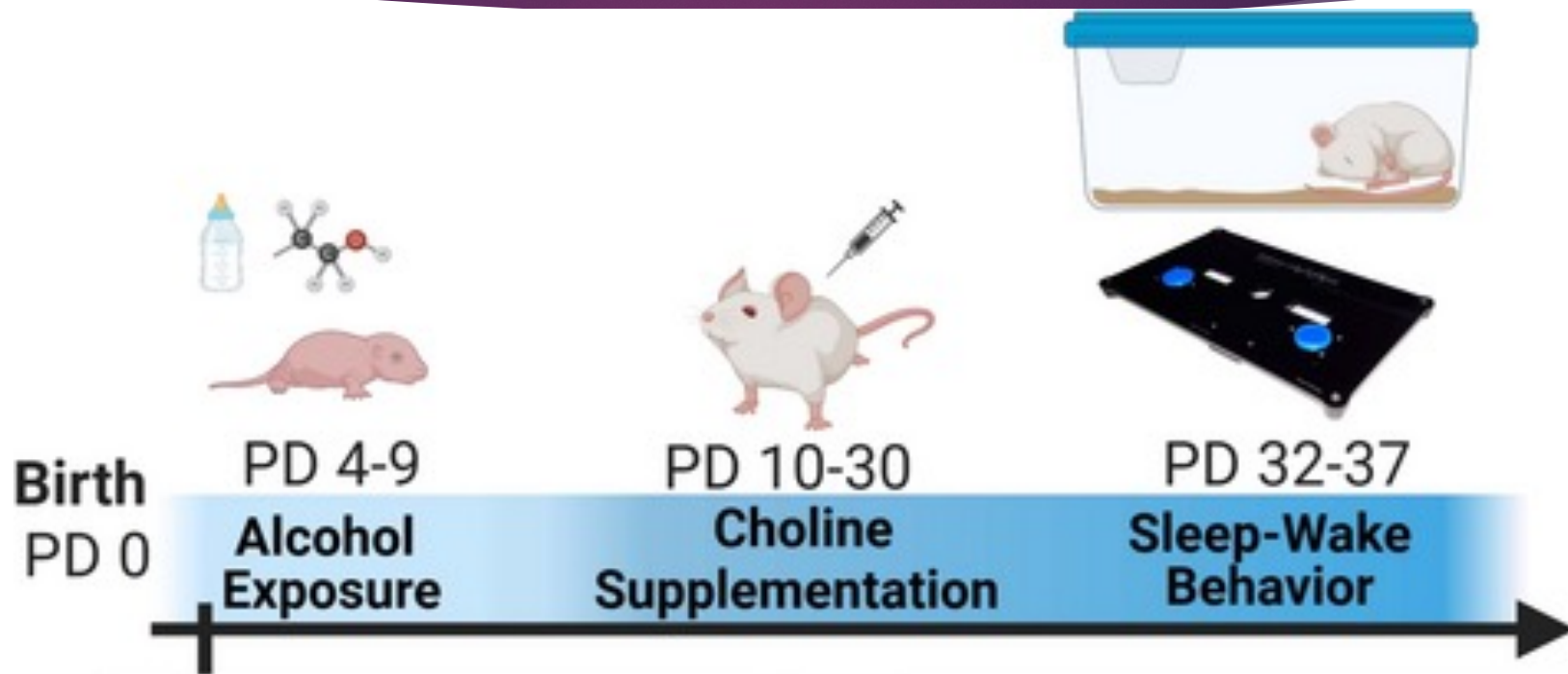
Can choline
supplementation improve
sleep quality?

Sleep-Wake Behaviors

- Cages are placed on top of the PiezoSleep system, which has a sensor that can detect pressure changes such as movement and breathing rate
- Sleep parameters and circadian rhythms can be monitored

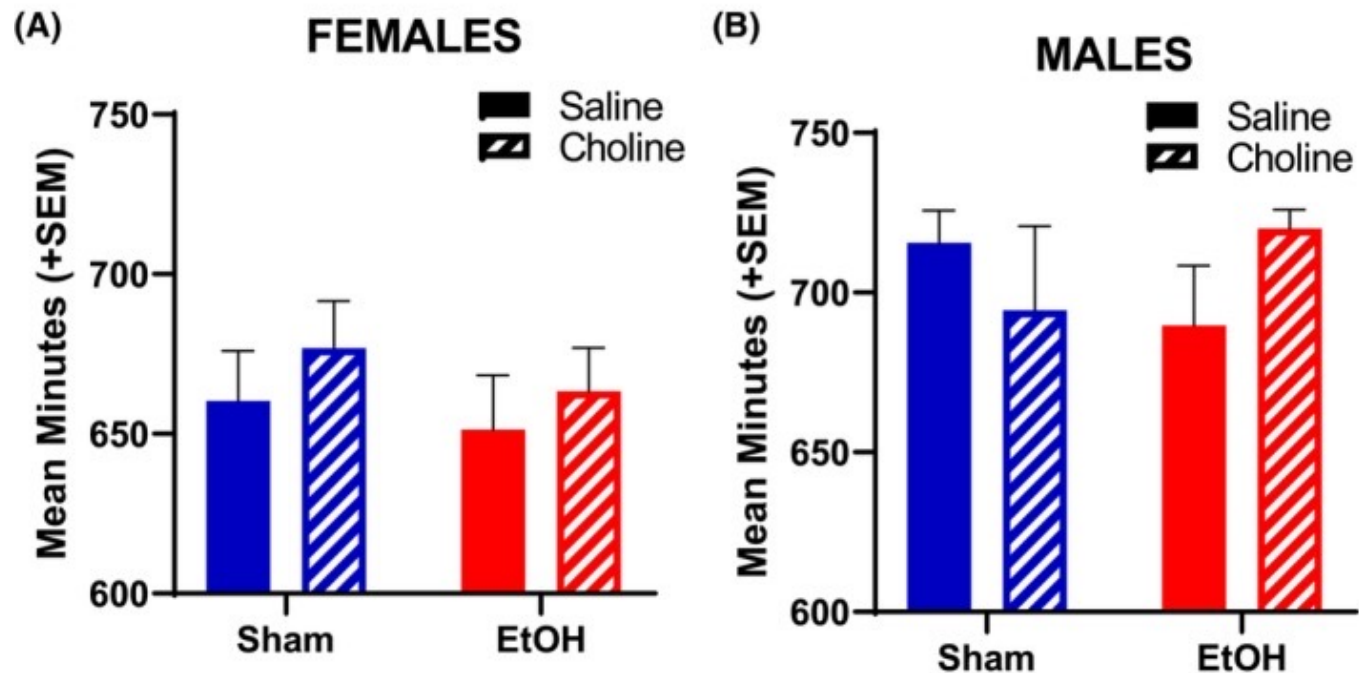


Design

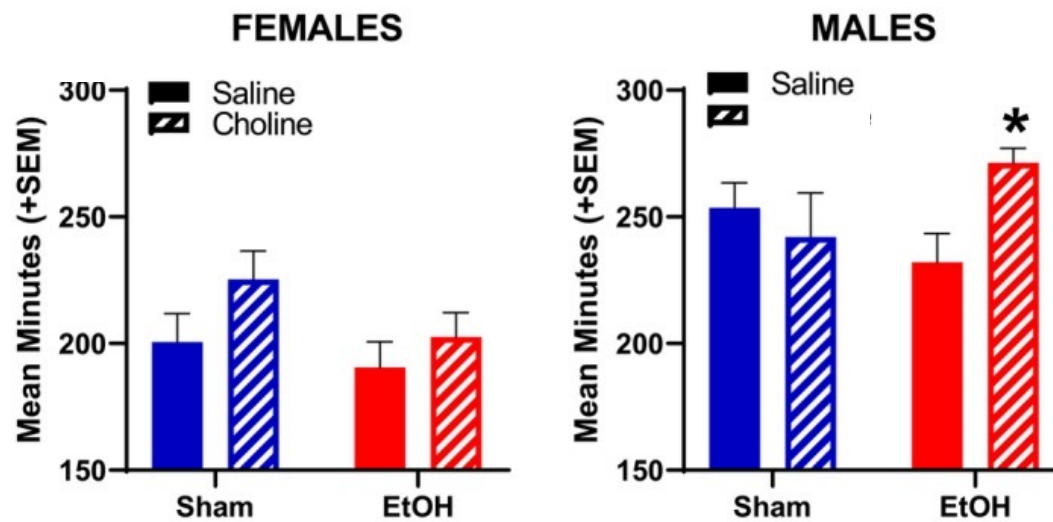


3rd Trimester alcohol exposure did not impact sleep duration across 24 hours

Sleep Duration: 24 Hours



Sleep Duration: Dark Cycle



Developmental alcohol reduced sleep during the dark cycle, an effect attenuated with postnatal choline supplementation

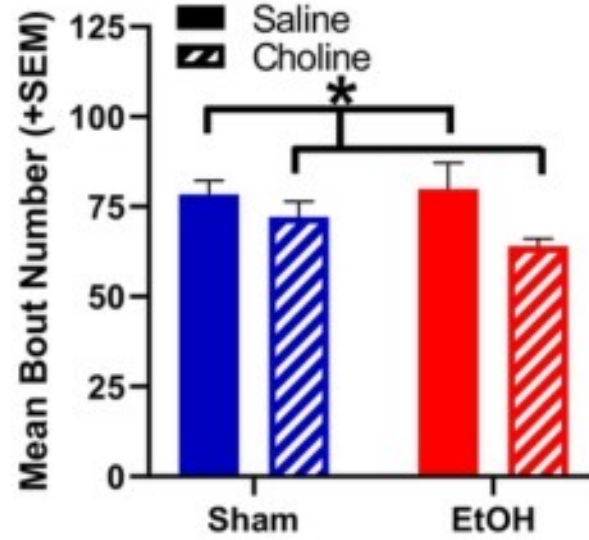
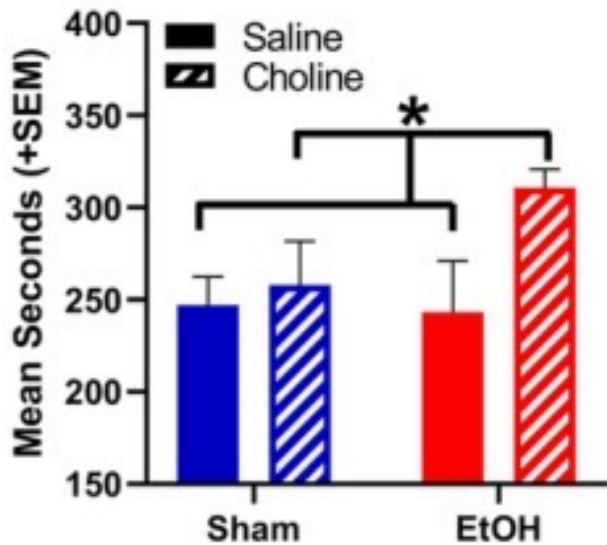
Light: Dark Cycle

(A) FEMALES

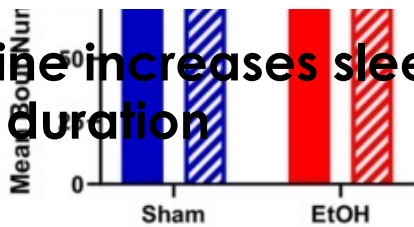
(B) MALES

MALES

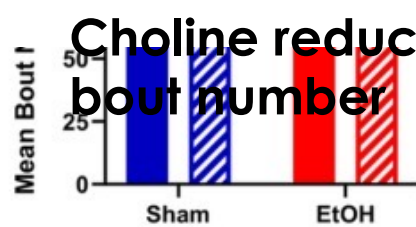
MALES



Choline increases sleep bout duration



Choline reduces sleep bout number

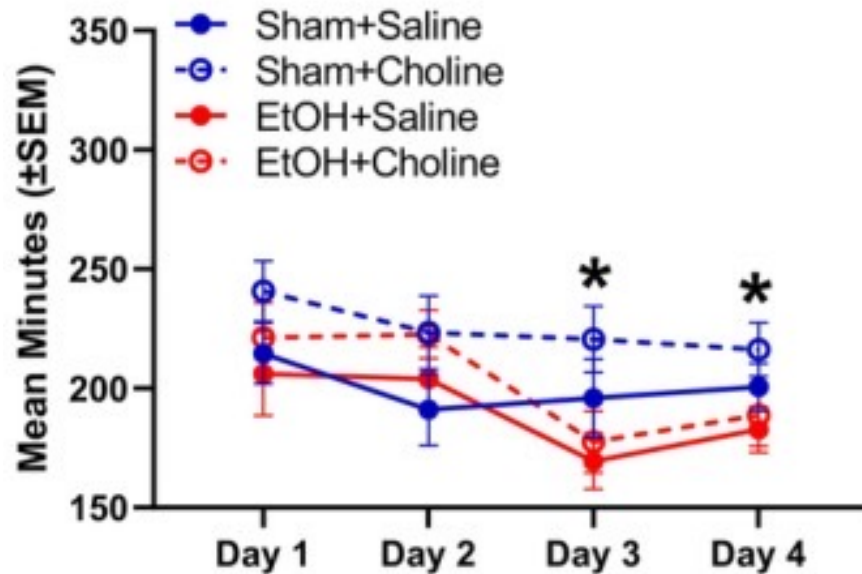


Choline reduced sleep fragmentation

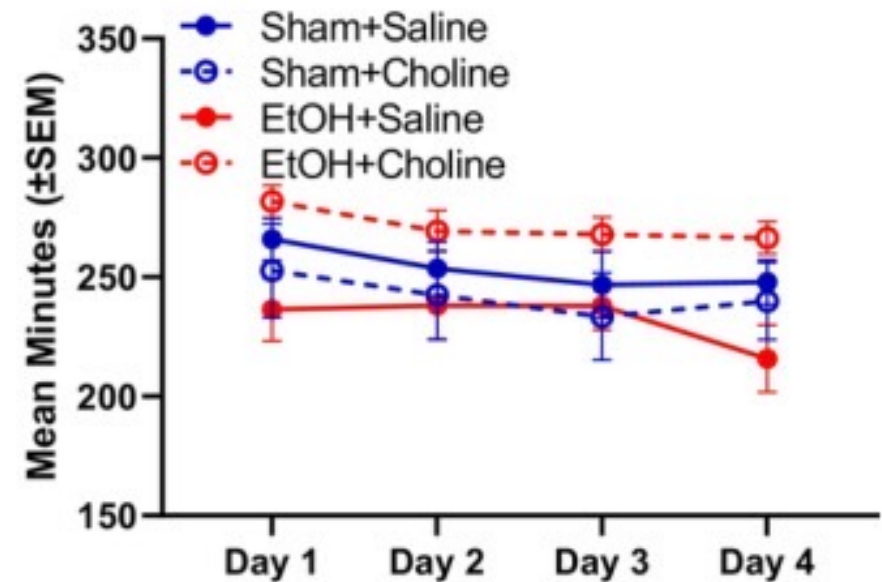
Developmental alcohol may also reduce sleep duration in females

Sleep Duration Across Days: Dark Cycle

FEMALES

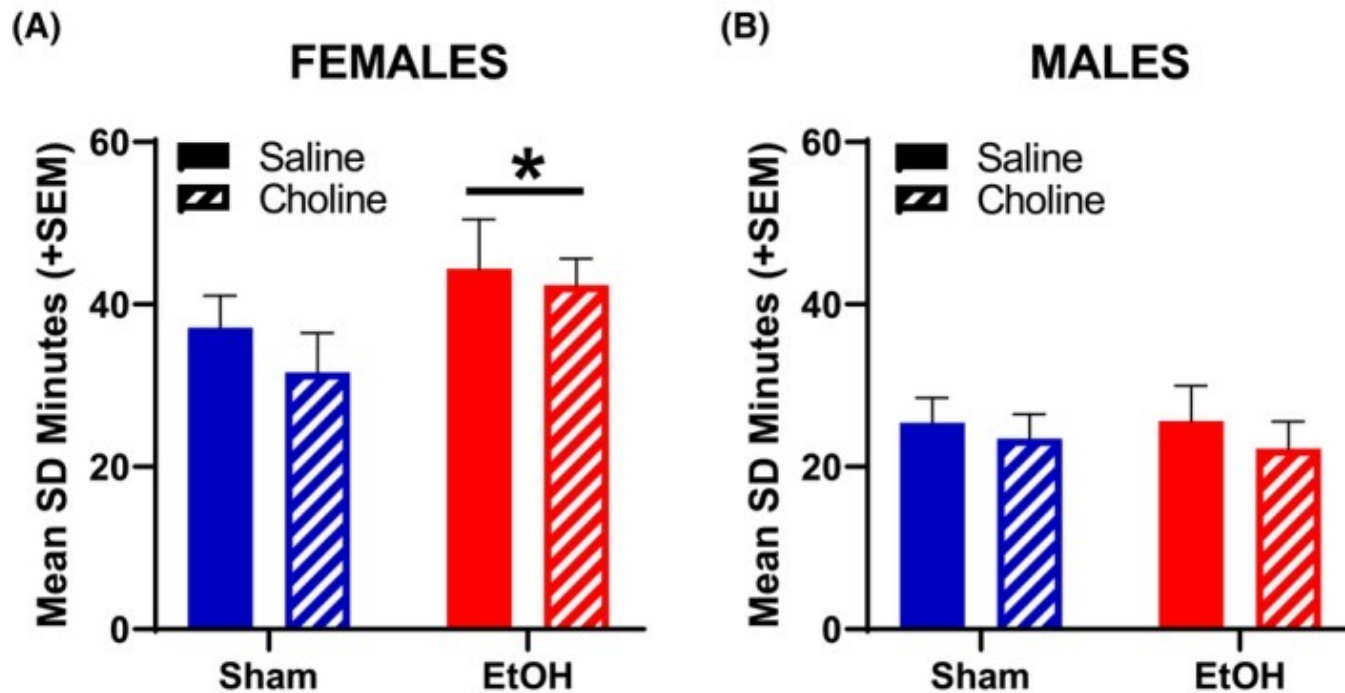


MALES

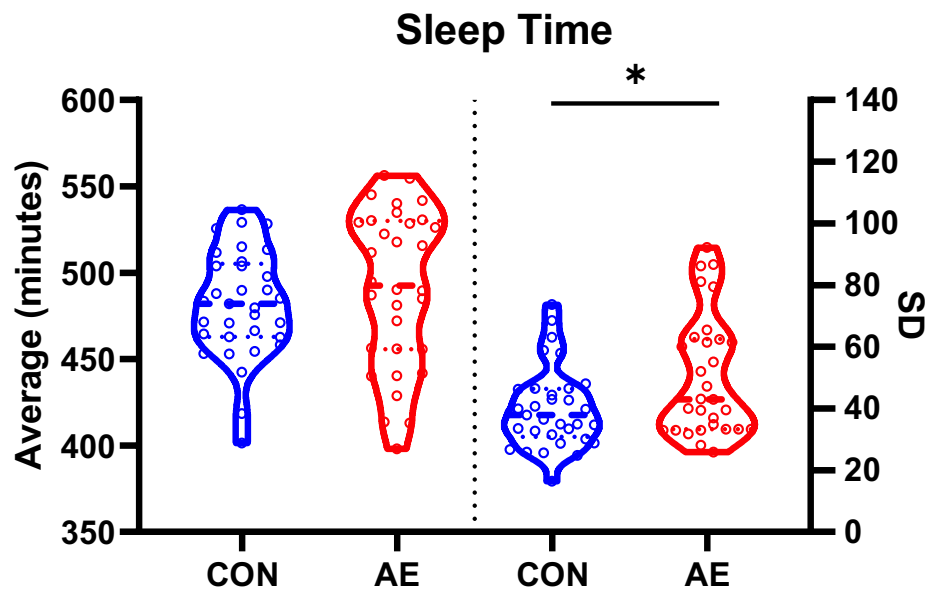


Developmental alcohol increased sleep variability

Sleep Variability: 24 Hours



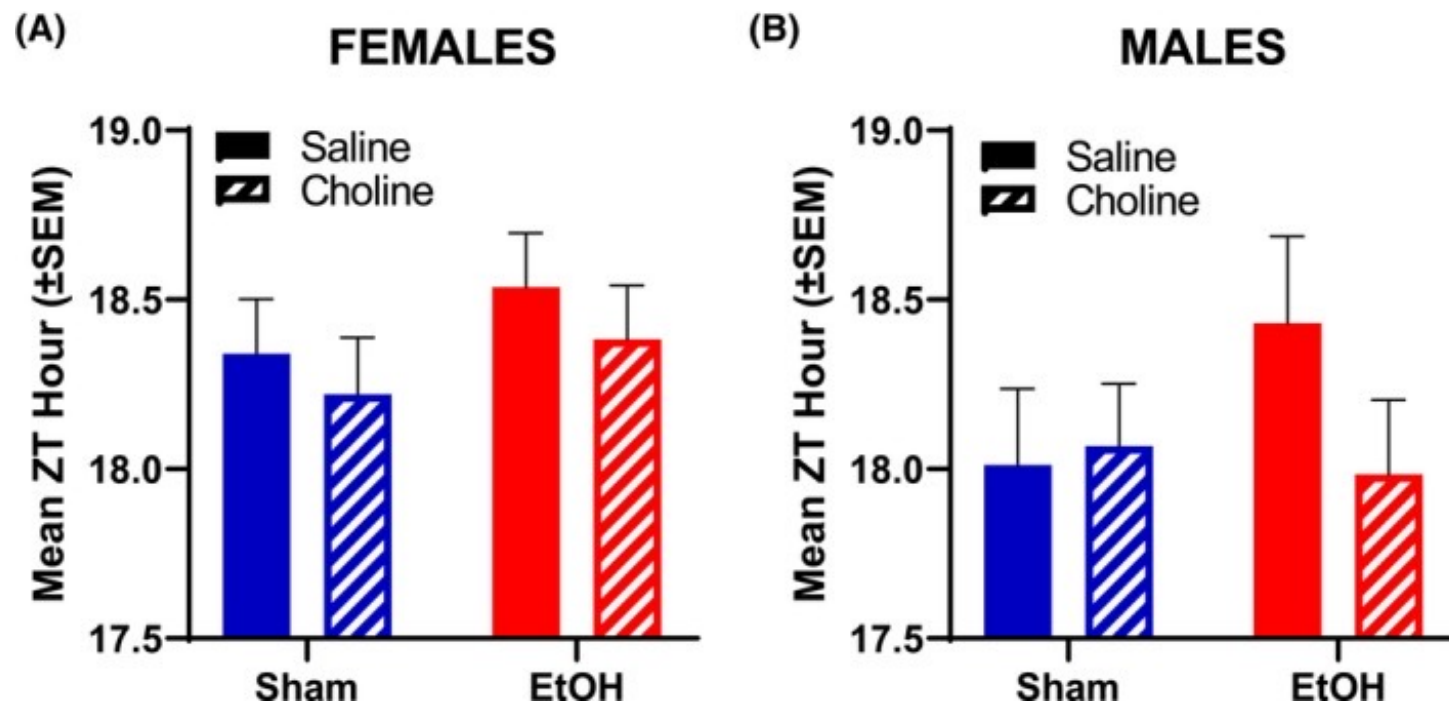
Night-to-night variability is increased in children with prenatal alcohol exposure



Inkelis, et al. 2025

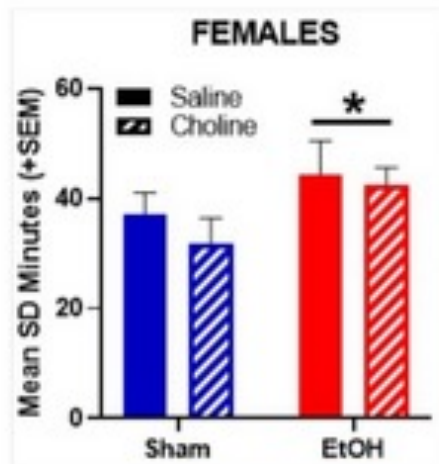
Could circadian rhythm be affected?

Acrophase



Ethanol Effects

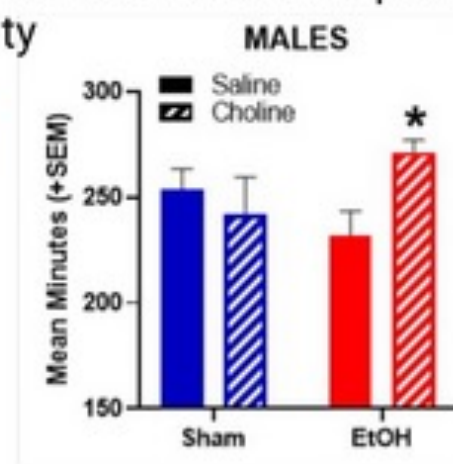
↑ -Sleep Variability
-Activity



Choline Effects

↑ -Sleep in EtOH-Exposed
-Bout Length in EtOH-Exposed

↓ -Sleep Fragmentation in EtOH-Exposed
-Bout Number in EtOH-Exposed
-Activity





What about alcohol
exposure during the first 2
trimesters?

WHAT ABOUT MATERNAL CHOLINE LEVELS?

Maternal
dietary
choline
levels
interact
with
prenatal
alcohol




Summary

- ▶ Developmental alcohol can alter sleep patterns in adolescent and adult offspring
 - ▶ Postnatal choline can modify sleep, including sleep in subjects exposed to prenatal alcohol, but may do so in a sex-dependent manner
 - ▶ Preliminary data suggest that maternal choline levels may impact the effects of prenatal alcohol on sleep
 - ▶ We are still at the beginning of this investigation...
-

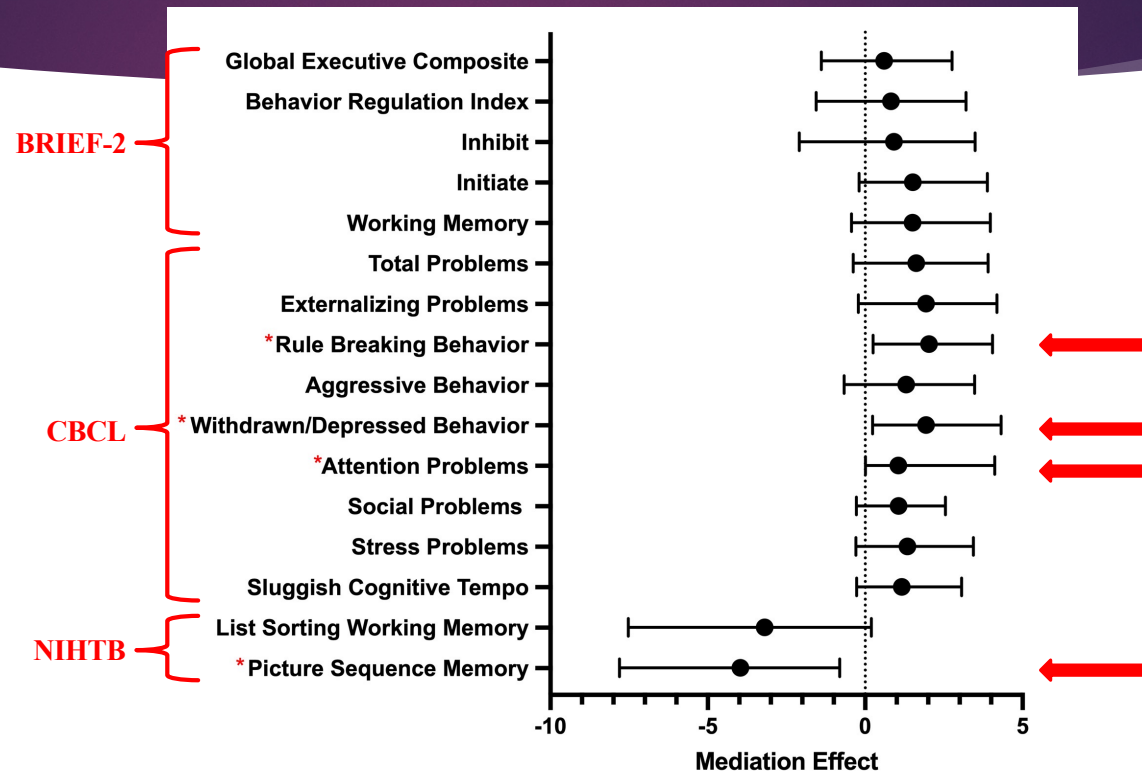


So stayed tuned....



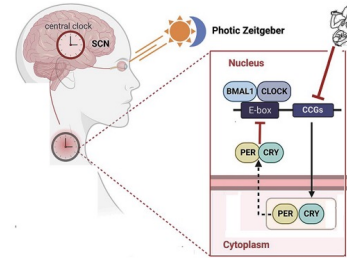
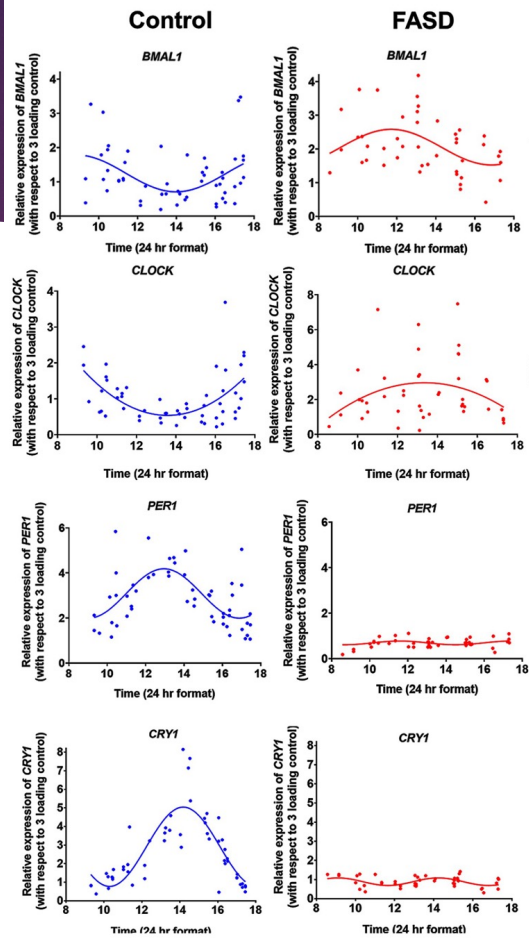
Can improving sleep
improve other cognitive
and behavioral domains?

Sleep Quality Mediates Behavioral Regulation



Inkelis et al, under review

Circadian changes in core clock genes in FASD children



Das et al. 2025



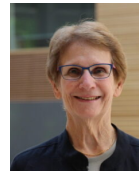
Supported by:

- NIAAA grants AA025425 and AA012446 to JDT
- CMCR to JDT
- TRDRP to JDT

Thank You!

Thomas Lab

- ▶ Dr. Jennifer Thomas
- ▶ Jessica Baker
- ▶ Jaclyn Hanson
- ▶ Cristina Rodriguez
- ▶ Sarah Inkelis
- ▶ Samirah Hussain
- ▶ Karen Thomas
- ▶ Brandonn Zamudio
- ▶ Annie Lei
- ▶ Ivette Gonzalez
- ▶ Bahar Sabouri
- ▶ Valery Quinonez
- ▶ Ilse Fleischer
- ▶ Karen Thomas
- ▶ Julia Steinberg
- ▶ Shadoe Neri-Dewitt
- ▶ Maya Rusnak
- ▶ Savanna Hampton



Breit Lab (West Chester University)

Taffe Lab (TSRI/UCSD, La Jolla, CA)

Roberto Lab (TSRI)

Christie Lab (University of Victoria)

Christina Chambers (UCSD)

Joanne Weinberg/ Tamara Bodnar (UBC)