Ultra Running Impairs Attention: Associations with Affective Symptoms and Carb Intake

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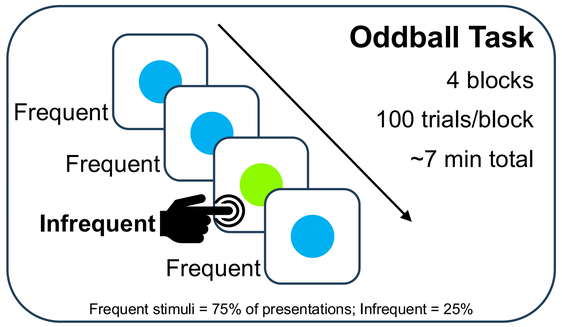
INTRODUCTION

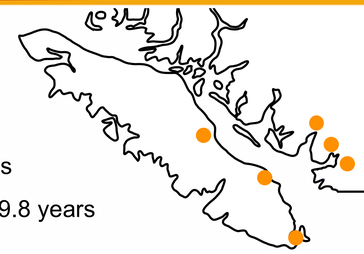
- An ultramarathon (ultra) is a running event longer than the classic marathon where athletes must remain attentive to challenging environmental conditions over long hours.
- Ultra running is known to cause physical and central fatigue and depletion of blood glucose, a shared energy source for muscles and the brain, yet its cognitive effects remain poorly understood.
- Carbohydrate (CHO) intake during prolonged exercise can improve performance, provide a central effect, and reduce low blood glucose—a condition associated with cognitive impairments.
- Endurance athletes are at a high risk for psychological distress (including depression, anxiety, and stress), which has been separately shown to negatively affect cognitive function.
- Portable electroencephalography (EEG) is a non-invasive way to measure brain activity in field settings, to better understand how the brain functions during cognitive processing.
- The P300 Event Related Potential (ERP) is a neural response seen in EEG data when an infrequent stimulus is presented, reflecting attention and working memory. Past studies suggest it can be separately affected by endurance exercise, affective symptoms, and low blood glucose.

Research Questions: How does a single-day ultra affect cognitive function, in the form of a marker of attention? Do pre-race affective symptoms and in-race CHO intake correlate with cognitive changes?

METHODS



6 ultras attended across lower BC



Participants

n = 76, 39 females

Age_{Mean} = 36.3 ± 9.8 years

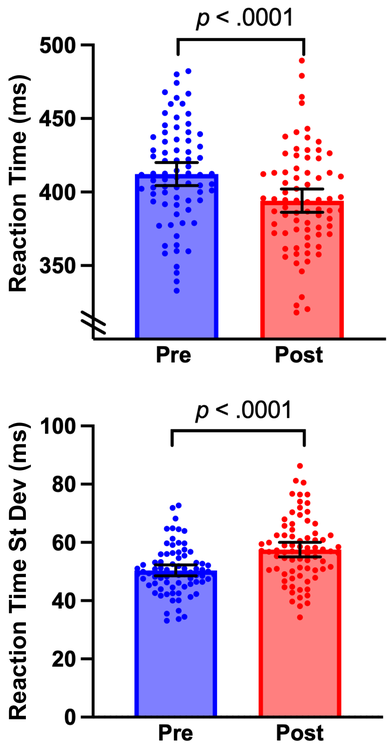
Running $Experience_{Mean}$ = 11.1 ± 8.5 years

Participants completed surveys, including the **DASS-21**, 7-14 days before the race →

← Participant **EEG** was assessed **pre**- and **post**-race using a visual **oddball task**

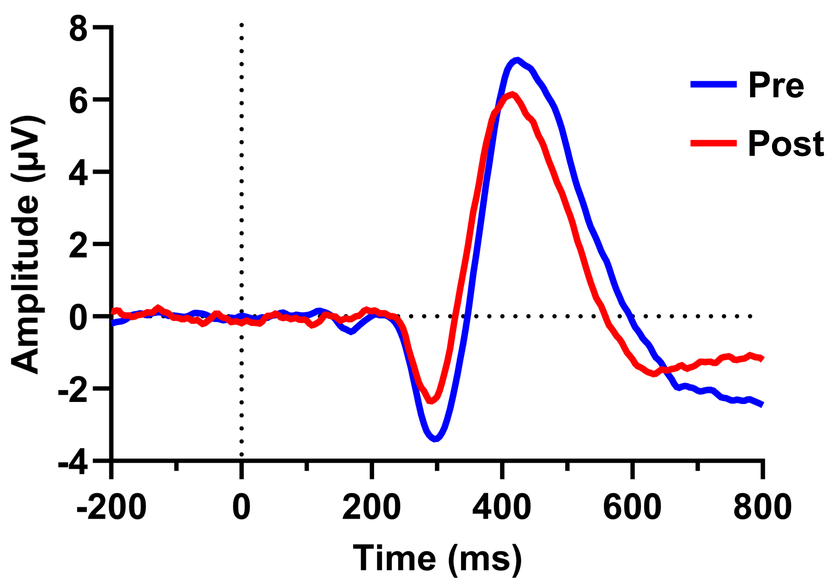
Participant **CHO intake** was tracked during the race using nutritional item wrappers →

RESULTS



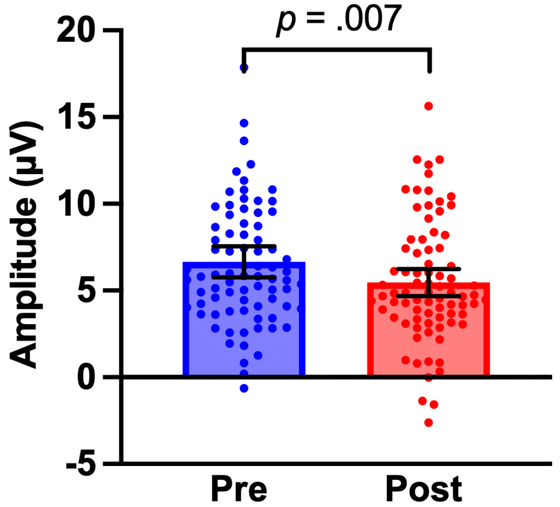
- ↓ Reaction Time (shorter)
- ↑ Reaction Time Variability

P300 Difference Waves

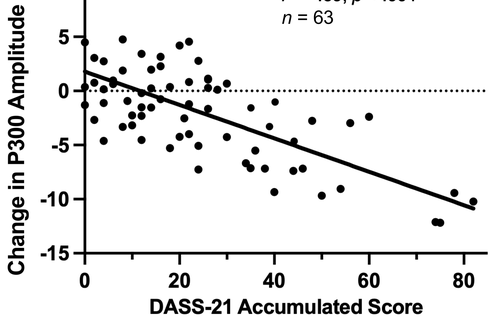


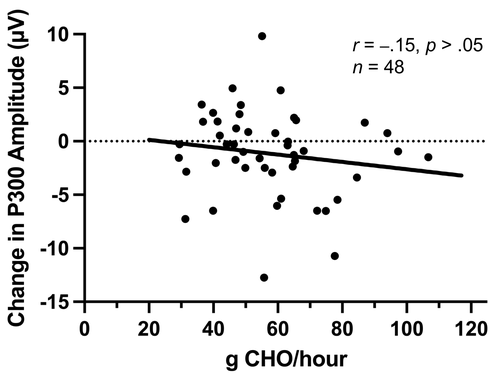
- Pre-race P300 > Post-race P300
- ↓ P300 Amplitude

P300 Amplitude



- (–) correlation between P300 amplitude changes and DASS-21 accumulated score
- **No** correlation between P300 amplitude changes and grams of CHO consumed/hour





CONCLUSIONS

- **P300 and Reaction Time Changes:** A reduction in P300 amplitude from pre- to post-race suggests that the stresses of ultra running impair attention and working memory updating. In combination with shorter and more variable reaction times, this pattern may indicate a shift toward quicker but less deliberate responding under prolonged fatigue.
- **In-race CHO Intake:** No detectable relationship with P300 amplitude changes is likely indicative of the complexities of neural energy supply and inconsistencies in self-reporting nutritional intake.
- **Pre-race Affective Symptoms:** A negative relationship with P300 amplitude changes indicates that higher psychological distress may predict greater attentional and working memory impairments.
- **Together:** A single-day ultramarathon disrupts attention and working memory, with mental health being a potential determinant of cognitive resilience during ultra running.

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March 18, 2026. This research was supported by the Jamie Cassels Undergraduate Research Awards, University of Victoria. Supervised by Dr. O.E. Krigolson.

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