

ACUTE EFFECTS OF CONCENTRATED CANNABIS ON BALANCE AND MOVEMENT SPEED: SMARTPHONE-BASED MOBILE ASSESSMENT

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Background

- As of 2018, 63% and 21% of the U.S. population lives in a state with legal access to medical and recreational cannabis, respectively.
- Sales of concentrates with tetrahydrocannabinol (THC) potencies up to 90%, (often inhaled by “dabbing” or vaping) have increased.
- Investigating direct cannabis use effects within the university setting are still currently limited.
- The acute effects of concentrated cannabis on motor function have not been described, nor has the impact of concentrates on common public health concerns and safety.

Objective: To assess general and driving-related neuromotor function under the acute influence of cannabis concentrates.

Materials & Methods

Participants

- **Recruitment:** locally mailed flyers and online advertising
- **Inclusion Criteria:** Currently using cannabis (70-90% THC)
- **Characteristics:** Experienced users (N=44; F:18, M: 26); Age: 29±11 yrs; Dabbing Freq: 19±2 days/month; Avg THC: 80±2%.

Study Design

- **Mobile Laboratory visit:** completed at or near participant's home
- **Motor Battery Sessions:** Immediately before (**Pre-Use**), Immediately after (**Post-Use**), & 1-hour after (**1-Hr. Post-Use**) self-administration of 70-90% concentrate in home:



- **Motor Battery Tasks:** Measured by Smartphone with accelerometer (*Sensor Data Application*)

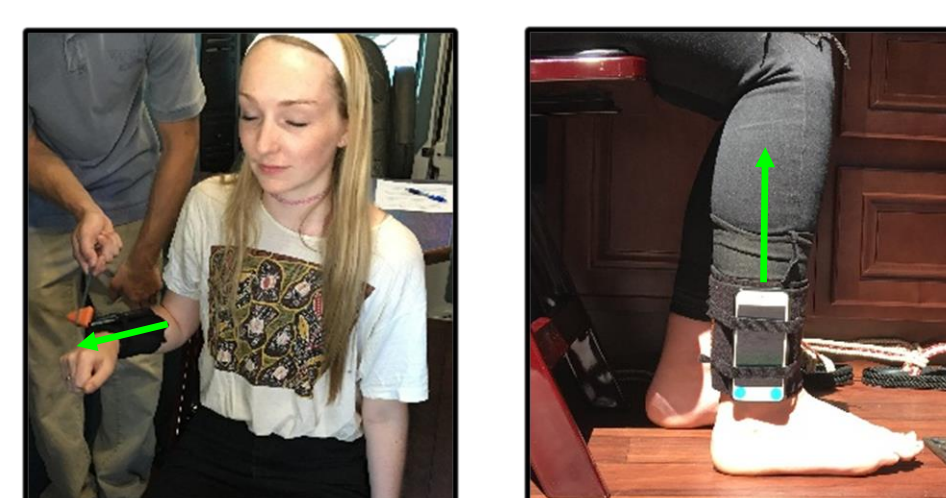
❖ Standing Postural Sway

- Standard deviation (SD) of acceleration measured
- Total of anterior/posterior & medial/lateral SD analyzed
- Conditions: Eyes open, closed, or head back (30 sec)
- Measure of balance



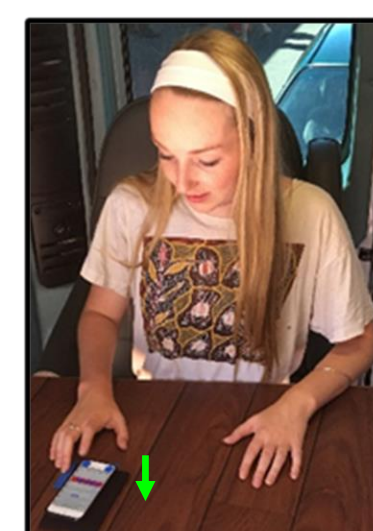
❖ Arm Punch & Leg Withdrawal

- Peak Acceleration measured
- 10 repetitions of each task completed
- Measure of speed



❖ Finger Tapping

- Finger tap rate (20 sec) calculated
- Measure of general neuromotor function



Statistical Approach

Repeated measures ANOVA (sessions: Pre, Post, 1-Hr) completed for each outcome measure with pairwise follow-up comparisons.

Results

1 Impaired balance with eyes closed immediately after concentrate use

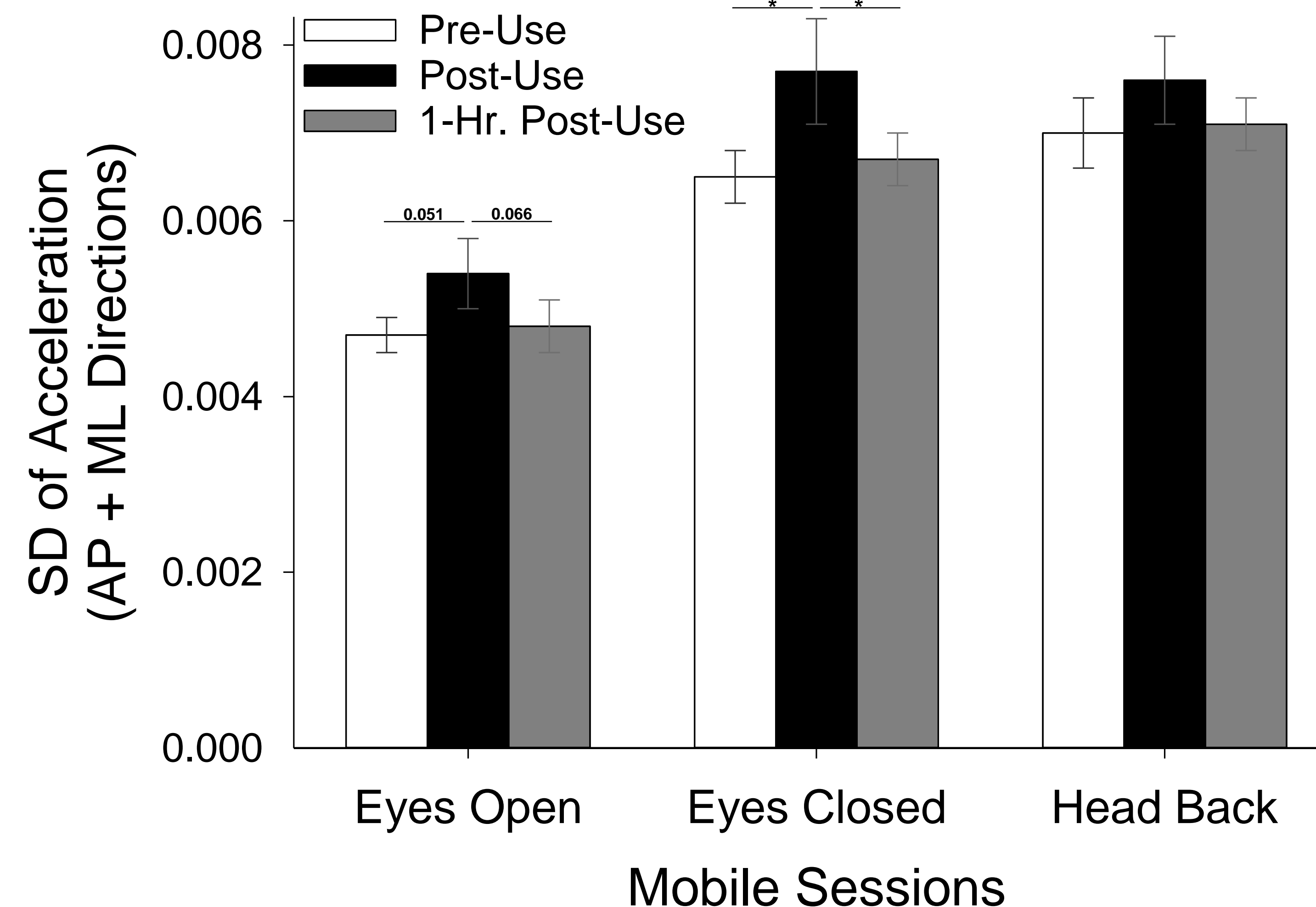


Figure 1. Standard deviation (\pm SEM) of total anterior/posterior (AP) and medial/lateral (ML) acceleration in eyes open, closed, and head back conditions, before (Pre-Use), after (Post-Use) and 1-Hr. after (1-Hr. Post-Use) concentrated cannabis use. $P_s < 0.01$ for eyes open vs. closed within sessions (Pre, Post, and 1 Hr.). Quadratic effects within eyes open ($P = 0.037$), and closed ($P = 0.005$) conditions. P value or $*$ $P < 0.05$ denotes between session effects.

2 Slowed arm movement speed

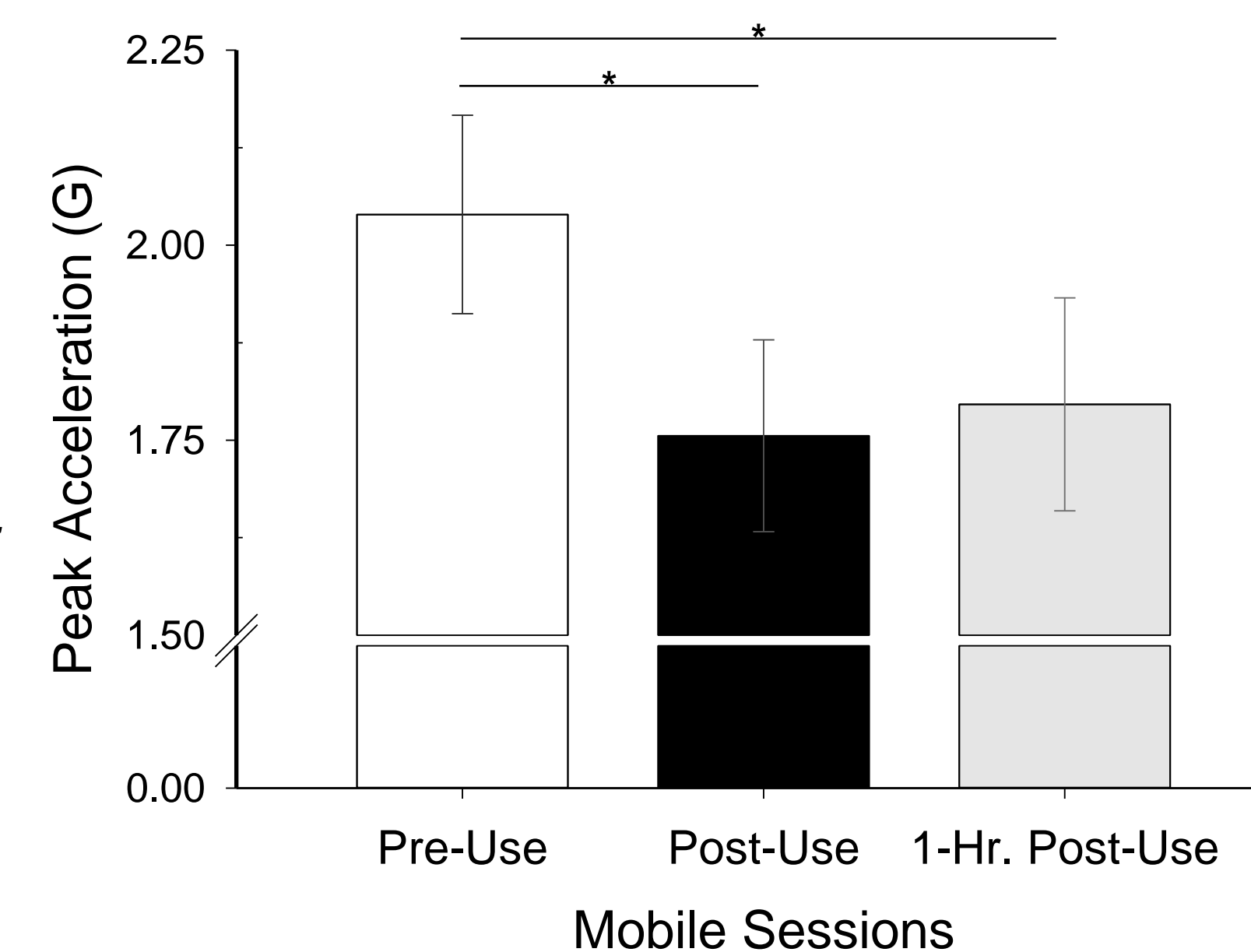


Figure 2. Average (\pm SEM) peak acceleration during punching before (Pre-Use), after (Post-Use) and 1-Hr. after (1-Hr. Post-Use) concentrated cannabis use. $*$ $P < 0.05$ denotes between session effects.

3 Slowed finger tapping rate

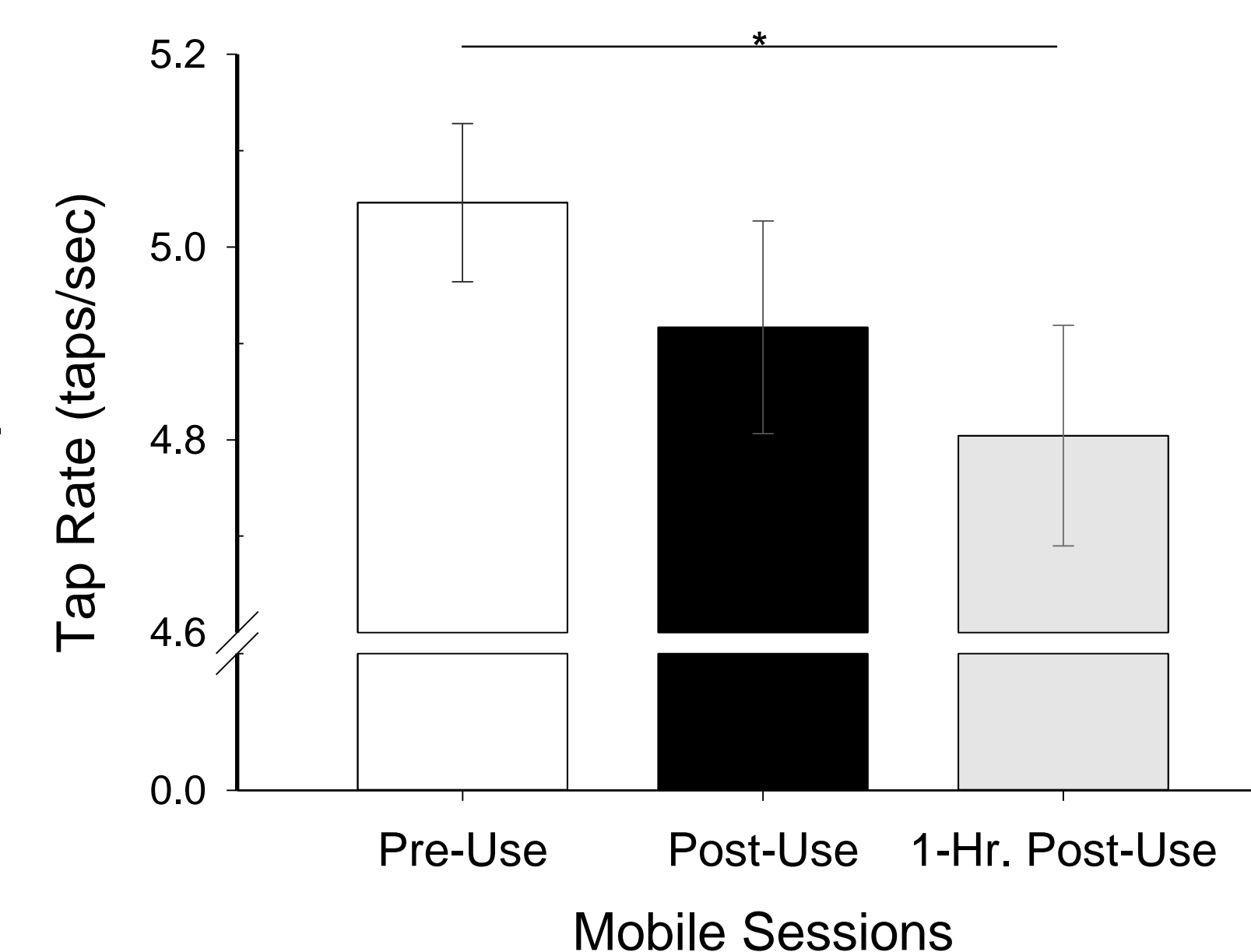


Figure 3. Average (\pm SEM) tap rate before (Pre-Use), after (Post-Use) and 1-Hr. after (1-Hr. Post-Use) concentrated cannabis use. $*$ $P < 0.05$ denotes between session effect.

Conclusions

Concentrated cannabis use affected three features of motor function:

- 1. Standing balance impaired immediately and recovered an hour later.** Impairment tends to be more consistent without visual feedback – implicating an effect on proprioceptive mechanisms.
- 2. Arm speed decreased immediately and remained slower for one hour.** The slowing did not occur during the leg withdrawal task (data not shown).
- 3. General neuromotor function (finger tapping rate) declined progressively within one hour.**

Summary:

- Postural stability, ballistic arm movements with large muscles, and rapid movements with small arm muscles are impaired with different time scales after concentrated cannabis use.
- Various features of motor and proprioceptive function affected.

Implications:

- Balance and movement speed tests indicate acute cannabis intoxication can be assessed.
- Rapid arm movements (as are often required during driving) are affected by cannabis.
- The ability of the brain to sustain repeated, rapid motor signals is affected by concentrated cannabis use.

These novel findings suggest a need for more definitive research on concentrated cannabis and motor function. Public health and safety goals: 1) Describe effects on driving ability, and 2) Define necessary components of mobile roadside tests of cannabis intoxication.

Limitations & Future Research

- **Observational product assignment:** Control over method of administration and dose reduced for greater external validity.
- **Novel motor tasks & analysis:** Data will be validated in a control group and other populations to determine relative impairment and application to driving and other activities.
- **Preliminary data:** Data collection ongoing for motor control, health behavior self-report, cognitive scores, and cannabinoid levels (e.g., THC, THC-COOH) in plasma to be analyzed together.

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Conflict of Interest Disclosure Statement

- Authors have no conflicts of interest to disclose regarding the present study.