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

![Graph showing standard deviation (SD) of acceleration (AP + ML Directions) for eyes open, eyes closed, and head back conditions before and after concentrate use.]

2. Slowed arm movement speed

![Graph showing average peak acceleration during punching before and after concentrate use.]

3. Slowed finger tapping rate

![Graph showing average tap rate before and after concentrate use.]

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.