

Testing for Cannabis Impairment in Drivers: Chemical and/or Behavioral Tests

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Cannabis

- The characteristics for the absorption, distribution and elimination of delta-9-tetrahydrocannabinol (THC), the primary psychoactive substance in marijuana, is very different from alcohol
- Route of ingestion makes a big difference
 - Smoked/Vaporized
 - Eaten (candy, chocolates, brownies, etc.)

Cannabis Smoked or Vaporized

- Absorption:
 - Rapid transfer from air to blood in lungs
 - Peak THC level reached within minutes of smoking cessation
 - Declines by 80% - 90% within 30 minutes
 - Low levels after one – two hours

Cannabis Smoked or Vaporized

- Metabolism
 - Primarily in the blood
 - Blood THC levels decline exponentially
 - Fairly large individual differences

Cannabis

- THC is fat soluble (stored in fatty tissues in the body)
- THC can be released back into the blood long after ingestion (up to 30 days post ingestion)
 - Low levels of THC may not indicate impairment (or even recent use)

Edible THC

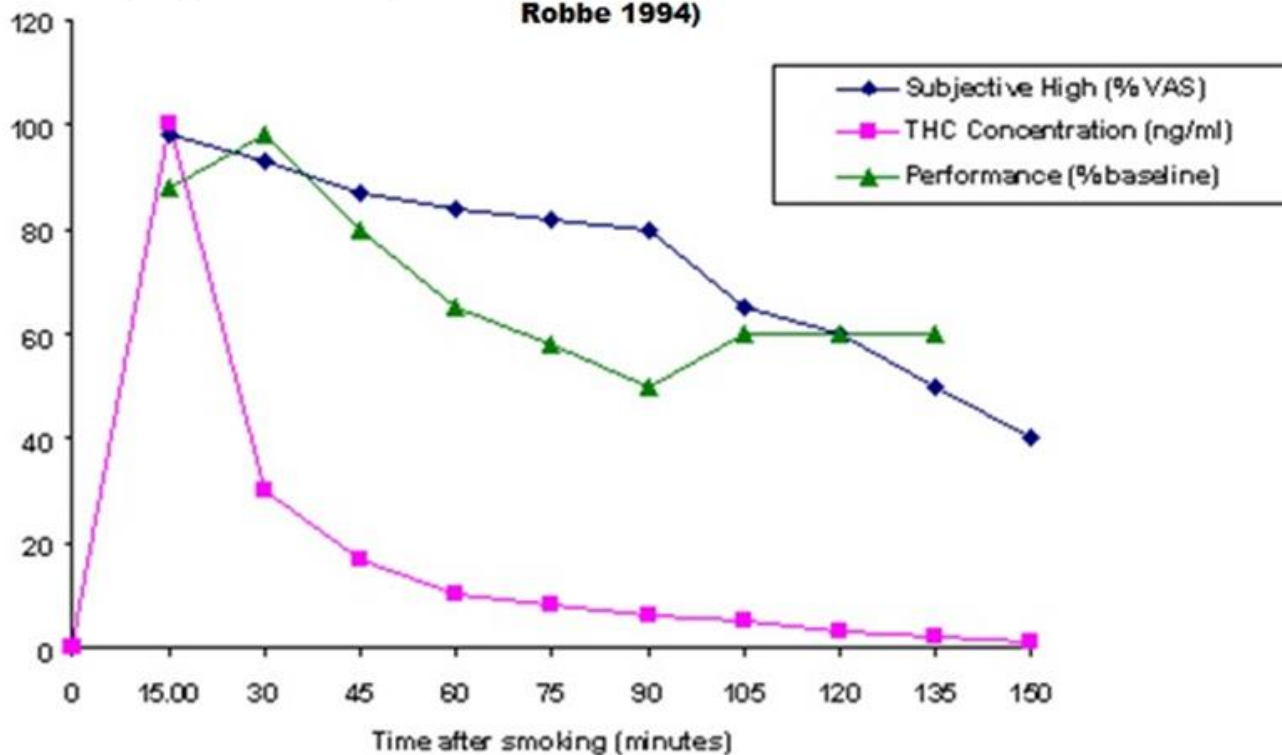
- Similar to alcohol, THC is absorbed in gastrointestinal tract
- THC may not appear in blood for up to twenty minutes
- Peak THC level lower than when smoked
 - Same quantity smoked or eaten will produce different blood levels

Cannabis and Impairment

- After smoking peak impairment occurs at approximately 90 minutes
- Impairment typically last 2 – 3 hours
- Some effects 4 - 5 hours or longer

Time Course of THC Concentration In Plasma, Subjective High and Performance Impairment

Time Course of Standardized THC Concentration in Plasma, Performance Deficit and Subjective High after Smoking Marijuana
(Adapted from Berghaus et al. 1998, Sticht and Käferstein 1998 and Robbe 1994)



Other Considerations

- Typical amount of time after smoking when blood is drawn for a toxicological test for THC
 - DUID Arrest: 1.5 – 3.0 hours
 - Crash Involved Driver: 1.5 – 3.0 hours
 - Fatality: Unknown time after death
- Likely to find only low levels of THC in the blood
 - Washington State Study over a 10 year period some 80%+ of arrested drivers had THC levels lower than the 5 ng/ml per se level

Implications

- Poor correlation of THC concentration in the blood with impairment (except right after smoking)
 - High impairment not necessarily associated with high THC levels
- Setting per se levels for THC is problematic
 - Defendants are using the law to argue they were not impaired

Behavioral Tests for Cannabis Impairment

- Is it possible to develop a behavioral/cognitive test for cannabis impairment?
- Challenges to be overcome:
 - Individual differences
 - Degree of impairment
 - Awareness of impairment
 - Ability to compensate
 - Adaptation
 - Some evidence of reduced impairment with practice

Challenges

- In the criminal justice system
 - False positives must be kept to a minimum
 - False negatives are somewhat less important
- Most research study effects reported
 - In terms of group means
 - Not individual performance

Challenges

- Test (s) must be specific to Cannabis
 - Many of the impairments found in studies dosing subjects can also be seen from other drugs and for other reasons
- E.g., lane position variability can occur due to
- Alcohol
 - Sedatives
 - Fatigue
 - Illness

General versus Personalized Scoring

- Population variation in normal abilities
 - Psychomotor
 - Cognitive
 - Executive Functions
- Not a problem with an individualized scoring criteria
 - Every ones' normal capabilities serves as the base rate for gauging impairment
- Establishing a general scoring criterion may be quite difficult

Research Under Way to Develop a Behavioral Test for Cannabis Impairment

- Dosing study using well established behavioral and cognitive domains that have shown impairment, for example:
- *Inhibitory Processes* (ability to tune out irrelevant or distracting stimuli)
 - Reaction Time
 - Stop-Signal Task
 - Go/No-Go Task

Cannabis Impairment of Behavioral & Cognitive Domains

- *Eye-hand coordination* (process visual input and coordinate it with hand movement)
 - Critical Tracking Task
 - Pursuit Rotor Task
 - Stylus and Groove task

Cannabis Impairment of Behavioral & Cognitive Domains

- *General Motor Coordination* (coordinate whole body movement, balance, etc.)
 - One-Leg Stand
 - Body Sway
 - Finger-to-Nose test

Cannabis Impairment of Behavioral & Cognitive Domains

- *General Cognition/Working Memory* (information processing, attention, etc.)
 - Free Recall Task
 - Divided Attention Task
 - Time Production Task
 - Tonal preference Task

Cannabis Impairment of Behavioral & Cognitive Domains

- *Emotional Processing* (ability to recognize, classify and identify emotions)
 - Facial Emotional Recognition Task
 - Affect Matching
 - Identical Pairs Paradigm using emotional stimuli

Cannabis Impairment of Behavioral & Cognitive Domains

- Executive Function (planning, decision making)
 - Tower of London

Current Status

- Pilot testing underway

QUESTIONS?