



Marijuana Testing and Impairment

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Background

The marijuana plant (*cannabis sativa*) contains over 500 chemical compounds, including over 100 cannabinoids.¹ The primary psychoactive substance in marijuana is delta-9-tetrahydrocannabinol (THC).² Marijuana is typically consumed by smoking or oral ingestion of plant material (leaves, flowers, seeds, stems) or extracts derived from plant materials. Marijuana has a variety of behavioral and physiological effects that are used for recreational and therapeutic purposes. As use of marijuana has increased and most states have passed laws providing for some limited use of marijuana, interest has developed in testing for impairment caused by marijuana use.

Physiology

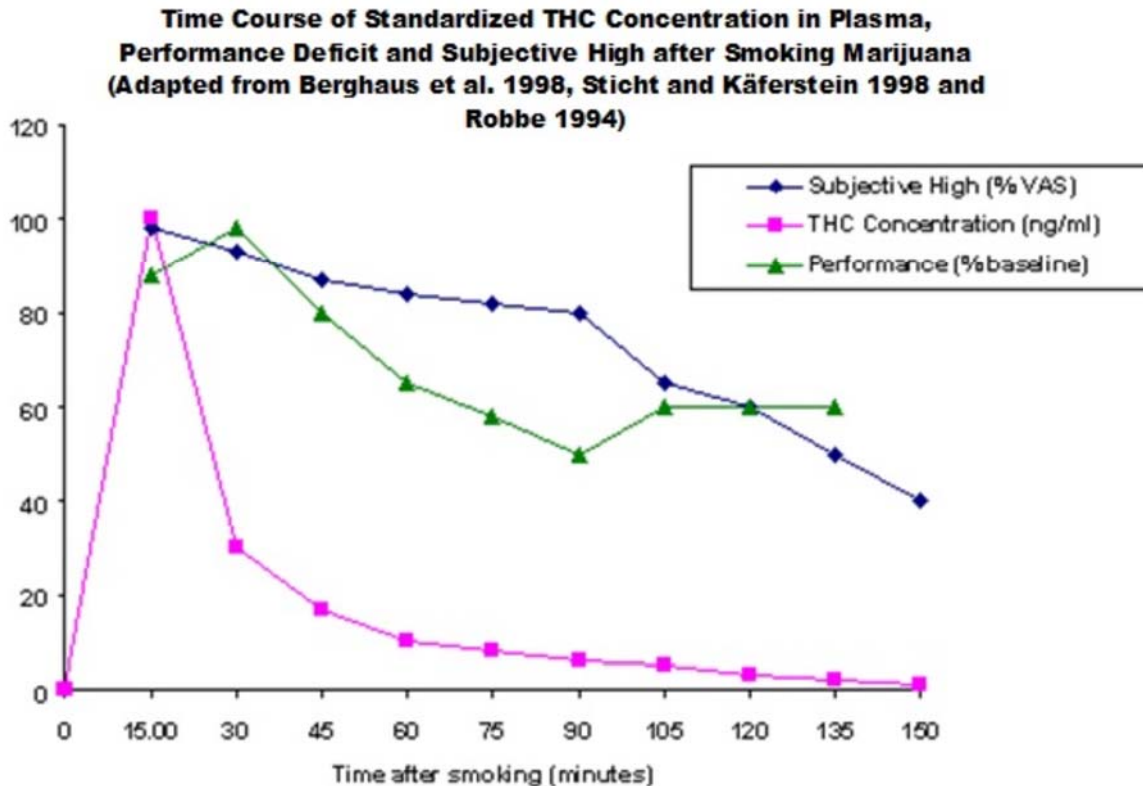
THC is fat-soluble, which means that it is stored in fatty tissues after ingestion and can be released back into the blood stream up to 30 days after ingestion.³ Although THC can be detected in the blood long after ingestion, the acute psychoactive effects of marijuana last for mere hours.⁴ After smoking marijuana, blood THC levels reach their peak at the end of smoking or immediately after cessation, depending on the rate and duration of inhalation. After peaking, THC level in the blood decrease dramatically even before the peak level of impairment is achieved (see Figure 1). After a few hours, very low THC levels are reached. Unlike marijuana, alcohol demonstrates well-documented linear relationships between blood levels and level of impairment. Impairment increases with rising alcohol concentration and declines with dropping alcohol concentration.⁵ Unlike alcohol, different people with the same THC blood level can have very different levels of impairment. A THC level of a few nanograms per milliliter can indicate recent use (within 1-3 hours) or chronic use without recent ingestion. Several studies have documented that blood concentrations of THC between 2-5 ng/mL can correlate with significant impairment.^{6,7,8,9,10,11} However low levels of THC >1ng/mL in chronic users do not correlate with impairment in all subjects.¹²

Laboratory Testing for Marijuana

The current marijuana laboratory testing environment includes a variety of methods for specimen screening and confirmation. An immunoassay test is typically used as an initial step to detect cannabinoids and other drugs in a specimen.¹³ Immunoassay tests are easy to conduct, cheap, and can check for multiple drugs simultaneously, however they also lack high specificity, are subject to cross-reactivity, and may produce false positive results. Positive immunoassay screening tests will trigger further confirmatory testing. The most common confirmatory laboratory techniques for detecting cannabinoids combine gas chromatograph with mass spectrometry (GC/MS). In some cases, liquid chromatography is combined with

mass spectrometry (LC/MS) and sometimes involves further ionization and a second pass through a mass spectrometer (LC/MS/MS). These advanced techniques allow highly specific detection and quantification of cannabinoid molecules in collected samples. Unfortunately, as mentioned above, detection of a specific concentration of a cannabinoid molecule in body samples correlates poorly with acute impairment.

Figure 1¹⁴



Several methods of specimen collection are currently available, including blood, oral fluid, sweat, hair, and urine testing.

Blood testing is considered the “gold standard,” however collecting a blood sample is an invasive procedure. Limitations of correlating THC levels with impairment are described above.

Oral fluid testing is increasingly used due to its minimally invasive nature. The oral fluid contains very high levels of THC for a short period of time after marijuana is smoked, which then rapidly decreases. Experimental studies have failed to show a linear relationship between THC levels in oral fluid and impairment.¹⁵ Passive smoke exposure can also lead to false positive oral fluid results.^{16,17,18} THC levels can be detectable in oral fluid for days,¹⁹ however higher levels are correlated with more recent use.^{20,21,22,23} Point of care oral fluid testing has been employed by law enforcement officers in Canada using the Drager DrugTest® 5000 device, where positive oral drug screening tests are used to justify performing a drug recognition evaluation or obtaining a blood sample for further testing.

Sweat and hair testing can provide information on prior marijuana use, however both are susceptible to contamination and provide no information about recent use or impairment.

Urine testing is well established and widely used due to its minimally invasive nature, however detection of THC or other cannabinoids in urine does not necessarily reflect recent use or impairment.

Breath testing is under development currently with several companies (e.g. Hound Labs, Cannabix) claiming to be able to detect THC in breath samples that would correlate with recent use. No marijuana breath test devices are currently commercially available.

Performance Testing for Marijuana Impairment

Given the challenges inherent in laboratory testing for marijuana impairment, there has been interest in performance testing to detect marijuana impairment. Law enforcement officers use standardized Field Sobriety Tests (FSTs) developed by the National Highway Traffic Safety Administration (NHTSA) and International Association of Chiefs of Police (IACP) to evaluate drug impairment among US drivers. The three most common FSTs include walk-and-turn, one-leg stand, and horizontal gaze nystagmus tests.²⁴ Some officers are trained as specialized “Drug Recognition Experts” to use a standardized 12-step “Drug Evaluation and Classification Program” that applies various medical, psychophysical, and observational measures to further categorize impairment based on drug class (e.g. stimulant, hallucinogen, marijuana). Standardized performance testing for marijuana impairment has been explored in occupational settings however is not widely used.²⁵

Cannabidiol (CBD)

Cannabidiol (CBD) is a cannabinoid constituent of the cannabis plant that has been approved by the US Food and Drug Administration (FDA) for the treatment of certain rare seizure disorders under the brand name Epidiolex®.²⁶ Other preparations of CBD suspended in oil, alcohol, or vaporization liquid are sold for the treatment of a variety of health conditions (anxiety, depression, acne, alleviating cancer-related symptoms, neuroprotective properties, heart health benefits, antipsychotic effects, substance abuse treatment, anti-tumor effects and diabetes prevention), and these non-Epidiolex® preparations are not regulated for quality and purity by the FDA. Pure CBD extract does not contain THC and therefore lacks the psychoactive effects of other forms of cannabis. Commercial laboratory testing for marijuana detects THC and its metabolites, so routine drug tests will not detect abnormalities in people who have used pure CBD. However, one study found that 43% of CBD products sold online contained higher levels of THC and other chemicals than advertised, which could lead to positive drug tests.²⁷ Between October 2017 and January 2018, 52 people were poisoned by CBD products in Utah that contained undisclosed synthetic cannabinoids (aka. Synthetic marijuana, K2, Spice).²⁸

Legality of Marijuana

Marijuana is listed by the United States Drug Enforcement Agency as a Schedule I substance, which is defined as a drug “with no currently accepted medical use and a high potential for abuse.”²⁹ Nonetheless, most states have passed laws legalizing marijuana for recreational and/or medicinal use. In 2013, the US Department of Justice issued the “Cole memorandum” stating that the federal government would not enforce federal marijuana prohibition in states that had legalized marijuana with few exceptions, however this memorandum was subsequently rescinded in January 2018.^{30,31} State laws regulating marijuana use among drivers vary significantly. Some states assume a “zero tolerance” policy in which any detectable level of THC +/- its metabolites in a driver’s blood is considered driving under the influence (DUI). Other states have established THC blood limits of 1, 2 or 5ng/mL to define DUI, and Colorado set a limit of

5ng/mL for DUI but acknowledges that lower levels may justify a DUI arrest if the officer makes a “reasonable inference” that the driver is impaired.³² The Drug Free Workplace Act of 1988 requires organizations receiving federal grants to maintain a “zero-tolerance” policy for illegal drugs in the workplace, which includes marijuana. Fire fighters who work in departments receiving federal grants are still subject to this legal requirement and may be drug-tested in accordance with “Drug Free Workplace” policies irrespective of state laws.

Marijuana/CBD Oil and Fire Fighters

Despite the increase in states allowing recreational marijuana use and still more states allowing medical marijuana use, it is still classified as a Schedule I substance by the federal government. Therefore, it’s use is still disqualifying for public safety positions. Fire departments in states with medical or recreation marijuana laws have put forth policies such as the following regarding its use:

“The manufacturing, distribution, use of, or being under the influence of controlled substances as defined by the federal Controlled Substance Act (21 U.S.C §812) is prohibited on and off duty. As used in this policy, controlled substances do not include medications lawfully prescribed for the employee’s use when taken as prescribed and where its use does not present a safety hazard or otherwise impact an employee’s performance or Department Operations. Marijuana is defined as a controlled substance for the purpose of this Agreement, regardless of whether or not the marijuana was prescribed, manufactured, or distributed for medical or recreational purposes. Employees who are considering the use of medical marijuana in connection with a disability should discuss with their supervisor other means of accommodating the disability in the workplace, as the Department will not agree to allow an employee to use medical marijuana as an accommodation.”

Conclusion

Marijuana and its derivatives have recently seen an increased societal acceptance in both the US and Canada however, their use remains disqualifying for public safety positions in the majority of jurisdictions. Current laboratory tests for marijuana do not clearly correlate with level of impairment. The current drug testing paradigm is based on detection of a drug present in a biological system rather than detecting occupationally significant impairment. Until the time when a more objective measure of marijuana impairment is available, employers will likely continue to use body sample cannabinoid tests as evidence of employee marijuana use.

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