



K42 Cannabinoids in 113 Driving Under the Influence of Drugs (DUID) Forensic Toxicology Cases

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After attending this presentation, attendees will understand the ranges of concentrations at which cannabinoids are often detected in DUID cases.

This presentation will impact the forensic science community by providing valuable information on cannabinoid incidence among drivers and by offering blood reference concentrations of common cannabinoids in DUID case investigations.

The Forensic Laboratory Division of the Office of the Chief Medical Examiner performs DUID and other human performance forensic toxicology cases investigations on behalf of 14 law enforcement agencies routinely operating within the City and County of San Francisco. Specifically for cannabinoids, commercially available Enzyme Linked Immunosorbent Assay (ELISA) kits by Venture Labs, Inc. are employed to screen blood and urine. The ELISA cannabinoid cutoffs used for blood and urine are 5 ng/mL and 50ng/mL, respectively. Following a positive ELISA, confirmation and/or quantitation takes place on a new specimen aliquot by Gas Chromatography/Mass Spectrometry (GC/MS) with a limit of quantitation of 1ng/mL for Δ^9 -tetrahydrocannabinol (THC) and 5ng/mL for 11-hydroxy- Δ^9 -tetrahydrocannabinol (THC-OH) and 11-nor-9-carboxy- Δ^9 -tetrahydrocannabinol (THC-COOH) for both blood and urine. The deuterated compounds THC- d_3 and THCCOOH- d_3 are used as internal standards. For THC- d_3 , the target (underlined) and qualifier ions are 389 and 374. For THCCOOH- d_3 , the target (underlined) and two qualifier ions are 374, 476, and 491. For THC, the target (underlined) and qualifier ions are 386 and 371. For THC-OH, the target (underlined) and two qualifier ions are 371, 459, and 474.

Between July 1, 2010, and June 30, 2011, the Division performed toxicologic evaluations in 919 DUID cases including the cannabinoid protocol described above. Cannabinoids were consequently reported in 113 of the 919 cases (12.3%). Five of these cases involved urinalysis and 108 involved blood analysis.

Drivers averaged 29.7 years of age (range: 14 – 68 years) and were predominantly male (n=100; 88%) which represents a higher proportion of male drivers as compared to the overall sex distribution of drivers whose toxicology was performed by this Division during the same time period (750 males, 82%; 169 females, 18%).

Among all 108 blood DUID cases, mean concentrations and associated ranges in ng/mL for THC, THC-OH, and THC-COOH were 5 (1 – 33), 9 (5 – 14) and 52 (5 – 320), respectively.

In 64 of the 108 cases involving blood evidence, ethanol was also found at a mean concentration of 0.13% (w/v) which ranged from 0.01 – 0.38% (w/v). In four of these 64 ethanol-cannabis cases, additional drugs were also detected (diazepam/nordiazepam in two cases, alprazolam in one case, methadone in one case, and MDMA/MDA in one case). In the 64 cases where ethanol was reported in addition to cannabinoids, mean concentrations and associated ranges in ng/mL for THC, THC-OH, and THC-COOH were 4 (1 – 23), 9 (8 – 12), and 44 (5 – 150), respectively.

Cannabinoids were reported in combination with drugs other than ethanol in 15 cases. In those 15 cases, drugs found in addition to cannabinoids were codeine (four cases), cocaine/benzoylecgonine (three cases), methamphetamine/amphetamine (three cases), MDMA (three cases), oxycodone (two cases), alprazolam (two cases), methadone (one case), and hydrocodone (one case). In these 15 cases where cannabinoids were found in combination with drugs other than alcohol, mean concentrations and associated ranges in ng/mL for THC, THC-OH, and THC-COOH were 7 (1 – 33), 8 (7 – 10), and 65 (13 – 290), respectively.

Cannabinoids were the only compounds reported in 29 of the 108 blood DUID cases. In these 29 cases, mean concentrations and associated ranges in ng/mL for THC, THC-OH, and THC-COOH were 7 (1 – 26), 8 (5 – 14), and 62 (6 – 320), respectively.

In the five cases involving urinalysis, THC-COOH was the only cannabinoid confirmed present. Only in one of the five urinalysis cases, cannabinoids were the only compounds reported. Cocaine/benzoylecgonine, cocaethylene, and codeine were each confirmed present in two urinalysis cases, whereas morphine, phencyclidine, carisoprodol, meprobamate, promethazine, norpromethazine, and levamisole were each confirmed present in one urinalysis case. Per professional guidelines, drug concentrations are not measured/reported in urine specimens.

This study offers a significant insight into the blood cannabinoid concentrations of drivers involved in DUID investigations in San Francisco. The reported mean concentrations suggest that drivers who concurrently consume ethanol with cannabis have on average lower THC blood concentrations than drivers who use cannabis by itself or with drugs other than ethanol and one may infer these drivers may be changing their cannabis use patterns (i.e., consuming lower cannabis doses and/or extending the waiting times before drinking) when they combine cannabis with alcohol. This type of epidemiological data provides reference concentrations for forensic toxicologists, law enforcement agents, and attorneys who are required to evaluate cannabinoid concentrations in human performance toxicologic specimens when involved in DUID investigations.



Toxicology Section - 2013

Cannabinoids, Toxicology, DUID