K16 Patterns of Natural Cannabinoids in Hair

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Learning Overview: After attending this presentation, attendees will understand the patterns in the relative abundances of Cannabidiol (CBD), Cannabinol (CBN), Tetrahydrocannabinol (THC), Tetrahydrocannabivarin (THCV), and carboxy-THC found in hair samples.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by demonstrating the types of patterns and the variance in the patterns seen in the results of a large population of samples containing detectable levels of cannabinoids

The cannabinoids THC, THCV, CBD, CBN, and (-)-11-nor-9-carboxy-Δ-9-Tetrahydrocannabinol (C-THC) were determined in over 4,700 workplace hair samples. Confirmation of C-THC was by a previously published Gas Chromatography/Tandem Mass Spectrometry (GC/MS/MS) method.[1] Confirmation of THC, THCV, CBN, and CBD was by Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS) on an AB SCIEX™ QTRAP 6500+ LC/MS/MS with binary Shimadzu® LC-30AD pumps and a Leap PALHTC-xt autosampler system with Dynamic Load and Wash (DLW) washing. DLW wash 1 was 0.1% formic acid in H_2O. DLW wash 2 was CH_3CN:isopropanol:acetone (60:30:10). Chromatographic separation was accomplished using a 3.0mm x 50mm Phenomenex® Kinetex® 1.7µm C18 100 Å 150mm x 2.1mm. The mobile phases were 0.1% formic acid in water and 0.1% formic acid in methanol. The method employed a gradient elution with a variable flow rate over 4.1 minutes.

The range of measured THC levels in the samples was from <Limit Of Detection (LOD) (5pg/mg) to 47,808pg/mg hair (note that some of these measured values were higher than the 5,000pg/mg upper limit of the assay). There was a wide variability in the relationship between parent THC and the metabolite C-THC. This variation is exemplified by two sets of samples with contrasting results. Among 79 samples that contained no THC above LOD, the C-THC ranged from 0.034–10pg/mg in hair. On the other hand, another set of 23 samples containing 10,000–47,808pg/mg THC in hair contained 0.2–21.9pg/mg C-THC in hair, not so very different from the C-THC range in the other set with no THC. These highly varying amounts of C-THC relative to THC are supported by other smaller studies.[2-4]

Only 26% of the samples contained THCV detectable by the method. The average THCV content when present was 1.77% of THC (SD 1.62, Median 1.38).

In THC-positive samples, 23% of samples contained less than 1% CBD, another 29% contained from 1% to 5% CBD, and 37% contained from 5% to 50% CBD. The roughly 11% of samples containing CBD at 50% or higher of the THC content likely consumed CBD and THC products, or a very few may have used only CBD products that contained THC.

Causes for the variabilities of parent and metabolite seen in these studies may be due to plant composition, storage, mode of use (oral, smoking, vaping), body weight, body fat composition, liver enzyme profile, or hair hygiene procedures. Still, the presence of C-THC remains the only definitive indicator of ingestion.

Reference(s):

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Cannabinoids, Hair, LC/MS/MS

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