K45 Cannabinoids in Exhaled Breath Following Controlled Administration of Cannabis

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The goal of this presentation is to offer a greater understanding of the applicability and relevance of measuring cannabinoids in breath following controlled smoked cannabis. The hypothesis is that the detection window of cannabinoids in breath will be several hours. This would be an appropriate timeframe for detecting driving under the influence of drugs, as this is similar to the window of acute drug impairment.

This presentation will impact the forensic science community by supporting the application of cannabinoid breath testing, particularly in the drugged driving field.

Methods: Breath specimens were collected using SensAbues (Huddinge) devices prior to and following *ad libitum* smoking of a single 6.8% Δ^9-tetrahydrocannabinol (THC) cigarette for 10 min in occasional and chronic cannabis users. This study was Institutional Review Board- (IRB) approved and written informed consent was obtained from participants. Breath specimens were collected during a 3 min period at -18, -1, 0.5, 1, 2, 3, 4, 5, 6, 8, 10.5, 13.5, and 21 hr post-smoking. Sample preparation involved a 20 min methanolic extraction, followed by solid phase extraction on polymeric SSTHC columns (UCT). THC, 11-nor-9-carboxy-THC (THCCOOH), and cannabinol (CBN) were quantified by Liquid Chromatography with Tandem Mass Spectrometry (LC/MS/MS) similar to a method proposed by Beck *et al*. with minor modifications.[1] Limits of Quantification (LOQs) were 50pg/pad for THC and CBN and 100pg/pad for THCCOOH. Linearity extended to 10,000pg/pad for all analytes. Extraction efficiencies for THC, THCCOOH and CBN were 33.8 34.6%, 58.1-63.0%, and 67.1-73.5% across the linear range. Matrix effects ranged from -34.6 to 12.3%. Extraction efficiencies and matrix effects were similar for matched deuterated internal standards. To date, breath specimens from one occasional and five chronic smokers were tested.

Results: Following controlled administration of THC, breath pads were positive only for THC; CBN and THCCOOH were not detected in any specimen at the method's LOQs. Breath pads were positive only at the 0.5, 1, and 2 hr post-smoking collections. Following cannabis smoking, dry mouth frequently occurred, making the collection of oral fluid difficult. As oral fluid collections occurred just prior to breath collection, breath collection times were delayed early in the time line due to prolonged oral fluid collection times. Mean (range) times for breath collection were 0.9 (0.78-0.98), 1.4 (1.30-1.45), and 2.4 hr (2.25-2.58) post-smoking. All but one participant had detectable THC in breath at 0.9 hr with a median (range, n) THC breath concentration of 147.0pg/pad (117-409, n=5). At 1.4 hr post-smoking, all but one participant had THC-positive breath with a median concentration of 122.2pg/pad (71.4-209, n=5). Only three participants still had detectable THC in breath at 2.4 hr post-smoking with a median concentration of 67.6pg/pad (54.0-86.3, n=3). For two participants, only one breath collection was positive for THC: 109pg/pad at 1.37 hr and 118pg/pad at 0.9 hr. Participants with multiple positive specimens (n=4) showed decreasing THC breath concentrations over time. In all participants, once breath specimens were negative for THC, they remained negative for the duration of the study.

Conclusions: The cannabinoid detection window in breath was short, ranging from 0.9 – 2.4 hr after cannabis smoking. Only parent THC was present; CBN and THCCOOH were not detected. Breath is an alternative matrix to oral fluid for a short cannabis detection window. Future research should determine if THC is present in breath during sustained cannabis abstinence in chronic daily cannabis smokers. During prolonged abstinence after chronic daily cannabis smoking, large THC body stores were slowly eliminated in the blood, plasma, urine, oral fluid, and sweat. The low THC concentrations in breath after cannabis smoking suggest that prolonged excretion will not occur. These data support the suitability of cannabinoid breath testing in the field of forensic science, particularly in the drugged driving field.

Reference:

1. Beck, O, Sandqvist, S, Dubbelboer, I and Franck, J. (2011) "Detection of Δ9-Tetrahydrocannabinol in Exhaled Breath Collected from Cannabis Users." J Anal Tox (35): 541-544.

Breath, Cannabinoids, THC

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