

THC New Use vs Old Use: Normalizing Results

Interpretation of Results

Urinary concentrations of THC are very difficult to interpret due to variables such as dosage of THC ingested, frequency of prior use, timing of urine collection relative to last exposure to marijuana, rate of release of stored cannabinoids in adipose tissue, and concentration of urine. Therefore the detection of THC metabolites in urine is only an indication of past marijuana uses and is not related to the degree of intoxication or impairment.

Interpretation of THC Semi quantitative Values:

| THC Result | Interpretation |
|---------------|--|
| > 150 units | High Dosage-Acute dosage probably within 3-10 days. |
| 100-150 units | Moderate Dosage-Ingestion occurred probably within 3-21 days. |
| 50-100 units | Low Dosage-Difficult to determine time of use as chronic habitual users can excrete THC values in this range for 21-30 days or longer. |
| < 50 units | Cannot rule out chronic users, passive inhalation, ingestion of low quantity, or dilute specimen. |

Semi-quantitative THC values are of little use when determining possible renewed marijuana use. A helpful method of answering this question is to normalize the cannabinoid concentration to the urine creatinine value of the sample. Random urine specimens contain varying amounts of creatinine depending on the concentration of the urine. This THC/creatinine ratio provides a means to eliminate the urine dilution problem when interpreting THC values. Therefore, in general, an increase of >50% in the THC/creatinine ratio above the previous sample is considered to indicate a new episode of drug exposure.

Formula needs to be used on each sample provided for individual. Once two samples have been provided and normalized, one will be able to better ascertain if marijuana use is new or old.

Normalization Formula:

$$\text{THC Value/Creatinine Level} \times 100 = \text{value}$$

Example A : *samples from same client on differing dates

Sample 1: Marijuana: negative at level of 20 ng/ml, Creatinine normal at 94 mg/dl

$$20/94 = 0.212 \times 100 = 21.2$$

Sample 2 : Marijuana negative at level 45 ng/ml, Creatinine normal at 53 mg/d

$$45/53 = 0.84 \times 100 = 84.9$$

Is normalized value from Sample 2 (84.9) an increase of greater than 50% from normalized value is Sample 1 (21.2)?

Answer: Yes. So, although sample 2 results were reported negative, new use of marijuana may be associated with results using normalized value formula.

Example B: samples taken from same client on differing dates

Sample 1: Marijuana: negative at level of 5 ng/ml, Creatinine normal at 82 mg/dl

$$5/82 = 0.0609 \times 100 = 6.09$$

Sample 2: Marijuana negative at level 19 ng/ml, Creatinine normal at 128 mg/dl

$$19/128 = 0.148 \times 100 = 14.8$$

Is normalized value from Sample 2 (14.8) an increase of greater than 50% from normalized value is Sample 1 (6.09)?

Answer: Yes. So, although sample 2 results were reported negative, new use of marijuana may be associated with results using normalized value formula

THC Normalized Study (for reference)

Urinary excretion profiles of 11-nor-9-carboxy- Δ^9 -tetrahydrocannabinol: a Δ^9 -THC-COOH to creatinine ratio study #2

Albert D. Fraser   ^{a, b} and David Worth ^a

^a Department of Pathology and Laboratory Medicine, Queen Elizabeth II Health Sciences Centre, 1278 Tower Road, Halifax, NS, Canada B3H 2Y9. ^b Dalhousie University, Halifax, NS, Canada Received 26 August 2002; Revised 15 November 2002; Accepted 15 November 2002. ; Available online 3 April 2003.

Abstract

Subjects with a history of chronic marijuana use were screened for cannabinoids in urine specimens with the EMIT[®] II Plus cannabinoids assay with a cut-off value of 50 ng/ml. All presumptively positive specimens were submitted for confirmatory analysis for the major urinary cannabinoid metabolite (Δ^9 -THC-COOH) by GC-MS with a cut-off value of 15 ng/ml. Creatinine was analyzed in each specimen as an index of dilution. Huestis and Cone [J. Anal. Toxicol. 22 (1998) 445] reported that serial monitoring of Δ^9 -THC-COOH to creatinine ratios in paired urine specimens collected at least 24 h apart could differentiate new drug use from residual Δ^9 -THC-COOH excretion. The best accuracy (85.4%) for predicting new marijuana use was a Δ^9 -THC-COOH/creatinine ratio ≥ 0.5 (dividing the Δ^9 -THC-COOH to creatinine ratio of specimen 2 by the specimen 1 ratio). In a previous study in this laboratory [J. Anal. Toxicol. 23 (1999) 531], urine specimens were collected from chronic marijuana users at least 24 h apart and dilute urine specimens (creatinine values $< 2.2 \mu\text{mol/l}$) were excluded from the data analysis. The objective of the present study was to determine whether creatinine corrected urine specimens positive for cannabinoids could differentiate new marijuana use from the excretion of residual Δ^9 -THC-COOH in chronic users of marijuana based on the Huestis 0.5 ratio. Urine specimens ($N=946$) were collected from 37 individuals with at least 48 h between collections. All urine specimens were included in the data review irrespective of creatinine concentration. The mean urinary Δ^9 -THC-COOH concentration was 302.4 ng/ml, mean Δ^9 -THC-COOH/creatinine ratio (ng/ml Δ^9 -THC-COOH/(mmol/l) creatinine) was 29.3 and the Huestis ratio calculation indicated new drug use in 83% of all sequentially paired urine specimens. The data were sub-divided into

three groups (A–C) based on the mean Δ^9 -THC-COOH/creatinine values. Interindividual Δ^9 -THC-COOH/creatinine mean values ranged from 2.2 to 13.8 in group A (264 specimens, $N=15$ subjects) where 80.7% of paired specimens indicated new drug use. In group B, mean Δ^9 -THC-COOH/creatinine values ranged from 15.3 to 37.8 in 444 specimens ($N=14$ subjects) and 83.3% of paired specimens indicated new drug use. In group C, individual mean Δ^9 -THC-COOH/creatinine values were >40.1 (41.3–132.5) in 238 urine specimens ($N=8$ subjects) and 85.3% of paired urine specimens indicated new marijuana use. Correcting Δ^9 -THC-COOH excretion for urinary dilution and comparing Δ^9 -THC-COOH/creatinine concentration ratios of sequentially paired specimens (collected at least 48 h apart) provided an objective indicator of new marijuana use in this population.