

# Age- and sex-related differences in blood-amphetamine concentrations in DUID suspects and reflections on drug-related impairment

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ALAN WAYNE JONES

Department of Forensic Chemistry, Artillerigatan 12, Linköping 581 33, Sweden

**AIMS:** New legislation for driving under the influence of drugs (DUID) in Sweden stipulated zero-concentration limits in blood for controlled scheduled substances. The present study focused on DUID suspects (N = 300) apprehended in Sweden with amphetamine as the only psychoactive drug present in venous blood. The drug concentrations were evaluated as a function of the person's age and gender and in a smaller retrospective material (N = 70) the relationship between blood-amphetamine concentration and clinical signs of drug-related impairment were evaluated.

**METHODS:** All blood samples were subjected to a broad toxicological screening analysis by immunoassay methods (EMIT/CEDIA) and positive results were verified by gas chromatography-mass spectrometry (GC-MS) with deuterium labeled internal standards. The limit of quantitation (LOQ) for measuring amphetamine in blood was 0.03 mg/L.

**RESULTS:** This case series consisted of 246 men (82%) and 54 women (18%) and the mean age ( $\pm$  SD) of the men was  $37.1 \pm 8.7$  y and  $35.5 \pm 7.1$  y for the women ( $p > 0.05$ ). The frequency distribution of the concentrations of amphetamine in blood was positively skewed with mean, median, lowest and highest values of 1.0 mg/L, 0.9 mg/L, 0.04 mg/L and 7.1 mg/L, respectively. The women had a slightly higher blood-amphetamine concentration than the men, 1.1 mg/L (median 1.0 mg/L) and 0.97 mg/L (median 0.80 mg/L), respectively ( $P > 0.05$ ). There was a weak but statistically significant association between blood-amphetamine concentration and the age of DUID suspect ( $r = 0.18$ ,  $p < 0.01$ ). When amphetamine concentrations in blood were subdivided into 7 age groups a linear trend was evident as shown by ANOVA and correlation-regression analysis ( $p < 0.01$ ). The primary signs of drug influence noted by the police officers who apprehended the drivers including bloodshot and glazed eyes, enlarged pupils, fatigue and spontaneous jaw movements. However, the results of a clinical examination made by a physician about 1 hour after driving failed to show any association between the concentration of amphetamine in blood and the conclusion that the person was under the influence of drugs or not.

**CONCLUSIONS:** The introduction of a zero blood-concentration DUID law for scheduled drugs has resulted in a 10-fold increase in the number of blood samples being submitted by the police authorities for toxicological analysis. In about 85% of these cases one or more banned substances are identified. Statistics show that amphetamine is the foremost drug of abuse in Sweden and this central stimulant has maintained this position for several decades. Interpreting the concentration of a psychoactive substance in blood in relation to the effects on performance and behavior is complicated by the development of tolerance. Moreover, many DUID suspects combine different classes of drugs, which tends to complicate further the relationship between concentration of a specific drug in blood and effects on the individual. The lack of a quantitative relationship between the concentration of amphetamine in blood and clinical manifestations of impairment speak against the notion of introducing concentration per se limits or graded penalties depending on the level detected. Zero-concentration limits or LOQ-limits are a much more pragmatic way to enforce DUID laws.

**KEYWORDS:** *Amphetamine, Concentration, Blood, Drivers, DUID, Impairment, Zero-limits.*

**Corresponding author:** [wayne.jones@rmv.se](mailto:wayne.jones@rmv.se)