

## Methylenedioxypropylamphetamine (MDPV) in Finland

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### Abstract

**Aim:** Since 2008, a new designer drug, 3,4-methylenedioxypropylamphetamine (MDPV), emerged among illicit drug users in Finland. In this study, we report the incidence and impact of MDPV among drivers suspected of driving under the influence of drugs (DUID) in year 2010. We also report the prevalence of MDPV in medico-legal autopsy cases in Finland in year 2010.

**Methods:** The LCMS method for the determination of MDPV from blood of DUID suspects and the GCMS method used in the post-mortem investigations are described. In MDPV positive cases from DUID suspects, the drug and alcohol concentrations were compared with the data from the clinical examination carried out while the suspect was under arrest. The information on psychomotor impairment was used together with the concentration of MDPV and possible other positive drug findings to evaluate the significance of the presence of MDPV.

**Results and Discussion:** In 2010, approximately 5.3 % of all confirmed DUID cases (excluding alcohol-only cases) were positive for MDPV. In 6 % of such cases, where a clinical examination was performed, moderate or greater functional impairment was observed. MDPV was the most abundant designer drug in drug seizures by the police in 2010. Post-mortem toxicology was performed in approximately 7000 cases in year 2010, comprising 14 % of all deaths. MDPV was found in 13 deceased, all of them being drug abusers. However, MDPV was not the sole cause of death in any of these cases. Based on our findings the incidence of MDPV in Finland is exceptional.

### 1. Introduction

MDPV (Fig. 1) is a relatively new abused “designer drug”, with stimulant effects similar to cocaine and amphetamine. It has no medical use, but is said to have exceptionally high addiction potential and high risk of psychosis. At higher doses some users report unpleasant and noticeable “come-down” effects [1].

Standard immunological screening procedures fail to detect MDPV. Due to the striking publicity associated with MDPV, including fatal overdoses in year 2009 and the fact that MDPV was connected to some severe crimes, the substance has been scheduled in Finland as an illicit drug by a special law that came into force in June 2010.

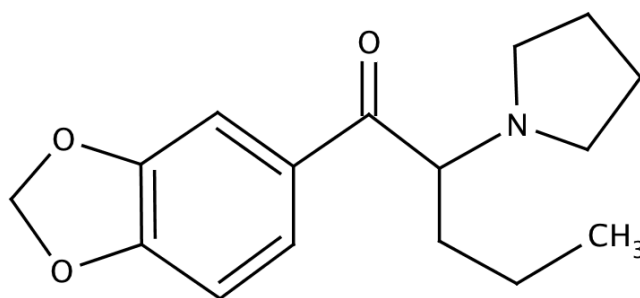


Fig. 1. 1-(3,4-Methylenedioxyphenyl)-2-pyrrolidinylpentan-1-one (methylenedioxypropylone, MDPV).

## 2. Materials and Methods

### 2.1. LC-MS/MS method used in the analysis of DUID cases

After qualitative multi-target screening with LC-MS/MS of selected samples, all positive MDPV findings from suspected DUID cases were confirmed by an LC-MS/MS method. The system consisted of a LC-system and a triple quadrupole mass spectrometer with Turbo Ion Spray. Multiple reaction monitoring (MRM) was created for the analyte and internal standard (MDPV  $m/z$  276/126 and  $m/z$  276/135, MDEA-d5  $m/z$  213/163) in positive ion mode. By LC-MS/MS, the limit of quantification (LOQ) for MDPV in serum was 0.011 mg/L.

### 2.2 GCMS method used in post-mortem investigations

Simultaneous analysis of MDPV together with amphetamines in blood was carried out by electron ionization (EI) GC-MS in the selected ion monitoring (SIM) mode following liquid-liquid extraction with toluene and derivatization with heptafluorobutyric acid anhydride. All MDPV findings were confirmed by positive chemical ionization (PCI) GC-MS in SIM mode. PCI-GCMS allowed the protonated molecule  $M+H^+$   $m/z$  276 to be used as a target ion with three abundant fragments as qualifier ions. By EI-GC-MS, the LOQ for MDPV was 0.020 mg/L.

## 3. Results and Discussion

Of all the suspected DUID cases in 2010, a drug analysis was performed on 4532 samples of which 219 were found to contain MDPV. This represents approximately 5.3 % of all confirmed DUID cases ( $n=4084$ , excluding alcohol-only cases). In most cases MDPV was found together with other drugs, especially amphetamine (79 %) and benzodiazepines (76 %). A combination of MDPV, amphetamine and benzodiazepines were found in 63 % of the cases.

Of the MDPV positive drivers 89 % were male and 96 % were from Southern Finland (from former Province of Southern Finland). Over 90 % of the MDPV positive DUID suspects were aged between 18 and 50. In DUID samples MDPV was found at concentrations up to 8.4 mg/L with a median of 0.060 mg/L (Fig 2).

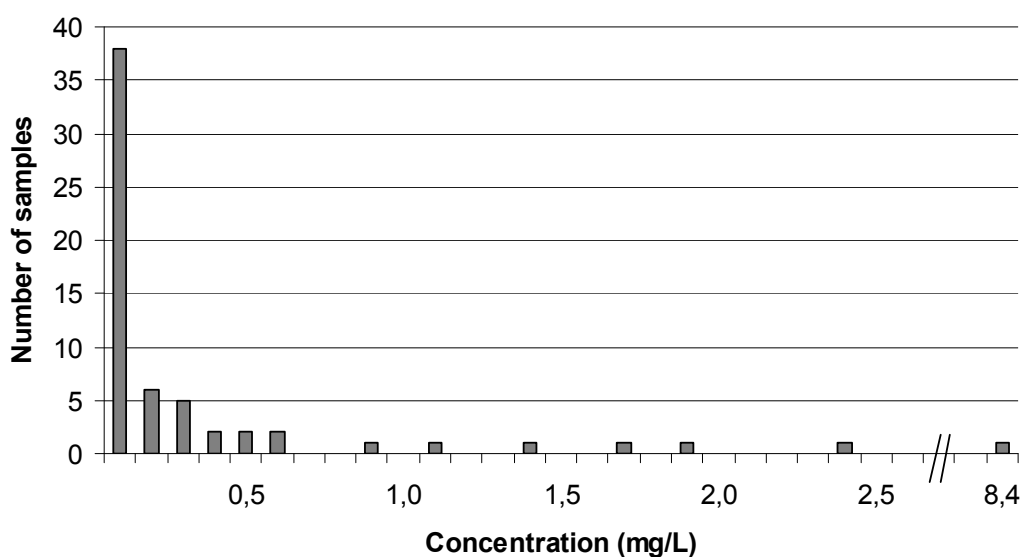


Fig. 2. Concentration of MDPV in Finnish DUID samples in August-December 2010.

In some DUID cases the suspect is given a psychomotor impairment test by a physician after the arrest. Of the MDPV positive cases where a clinical examination was performed functional impairment was found in 80 %, but only in 6 % the impairment was rated as moderate or greater.

In 2010, post-mortem toxicology was performed in 7105 cases comprising approximately 14 % of all deaths in Finland. In urine, MDPV was screened among hundreds of other drugs by liquid chromatography – time-of-flight mass spectrometry (LC-TOFMS) [3]. All positive LC-TOFMS findings as well as cases with suspected MDPV use were confirmed by a dedicated gas chromatography – mass spectrometry method [4] in blood and urine. MDPV was found in 13 deceased, all of them male and known drug abusers. The median (range) age of the victims was 38 years (20-47 years). The median (range) MDPV concentration in post-mortem blood was 0.13 mg/L (0.02-4.8 mg/L) based on the 8 samples for which a numeric value was obtained. MDPV was not the sole cause of death in any of these cases.

#### 4. Conclusion

In 2010, the incidence of MDPV in DUID cases (excluding alcohol-only cases) was approximately 5.3 %. MDPV was found in 13 deceased, but was not the cause of death in any of these cases. Since MDPV is so often found together with other drugs, it is difficult to determine whether the observed psychomotor impairment is caused by MDPV exclusively, or rather by the combined effect of several substances.

These results show that MDPV use is a significant problem among users of illegal drugs in Finland. Further studies are needed in order to gain more information on the pharmacology and toxicology of MDPV.

## 5. References

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