Designer stimulants recently identified on black market

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Abstract

Recently, designer stimulants have become a great concern due to their availability on the market as bath salts, plant feeders etc. We have ordered several preparations over the Internet, and six substances were identified: mephedrone (methylenecathinone), flephedrone (fluoromethcathinone), fluoroamphetamine (2 isomeric compounds), methylamphetamine (3- or 4-substituted), and methylenedioxyxymethamphetamine.

Forensic urine samples (samples provided to our laboratory by local drug enforcement body for investigation) were also analyzed and many of them were found to contain these designer stimulants. Some metabolic products were tentatively identified for mephedrone, flephedrone and methylenedioxyxymethamphetamine. In these urine samples the parent drugs were always detectable.

Introduction

Following the designer steroids synthesized with the purpose of getting around the regulations of drug enforcement bodies, the designer stimulants have become a concern as well. Recently Perrenoud et al. reported the detection of 4-methyl-2-hexanamine, a stimulant analog of tuaminoheptane [1]. During 2009 we detected this compound, also known as 1,3-dimethylpentylamine or 1,3-dimethylamylamine, as a component of several so-called “social stimulants” which are available over-the-counter in Russia. However, at present the range of stimulants is much wider and includes various amphetamine and cathinone derivatives. They might be sold over the Internet as bath salts, scrubs or plant feeders and usually have a statement on the package “not for human consumption”. Nevertheless, recreational drug users do understand its intended mode of administration.

Most publications related to the identification of designer stimulants belonging to the cathinone class have appeared in 2009–2010 [2-6], indicating the increasing popularity of these “legal” (that is, not controlled) stimulants among the drug abusers.
Materials and Methods

Sample preparation

**Powders:** 5 mg of specimen were extracted with 1 ml of methanol in ultrasonic bath. Upon centrifugation, 5 μl of the solution were taken to dryness under nitrogen and reconstituted in 100 μl of ethyl acetate.

**Urine:** To 3 ml of urine 1 ml of carbonate buffer (3M, pH 10.1) and 2 g Na₂SO₄ were added followed by extraction with 5 ml of diethyl ether. Ethereal extract was taken to dryness under nitrogen and reconstituted in 100 μl of ethyl acetate.

Instrumental parameters

Samples were analyzed on an Agilent MSD 5973, under the conditions as follows.

- Electron ionization, 70 eV; fullscan data acquisition (m/z 50-500).
- Interface temperature: 280°C; ion source and quadrupole temperature: 230°C and 150°C.
- Column: Rxi-1ms, 12 m × 0.2 mm × 0.33 μm.
- Temperature program: 110°C (2 min), ramp 15°C/min to 300°C (4 min).
- Injection: split, 2 μl at 1:20.

Results and Discussion

In 2009 we have obtained through the Internet various “party powders”, “herbal highs” etc. and 6 compounds were identified as a result. The identification was done based on GC-MS electron ionization data and comparison to the literature available at the moment [2–4]. These include methylenedioxypyrovalerone (MDPV), 4-methylmethcathinone (mephedrone), fluoromethcathinone (flephedrone, either meta- or para-substituted), fluoroamphetamines (two isomers detected), and methylamphetamine (either meta- or para-substituted, i.e. not ortetamine). Several preparations occasionally contained other ingredients like horde-nine, caffeine and lidocaine or synthesis by-products.

During the last year we were also receiving forensic urine samples from a local drug enforcement body. These samples were collected from persons who were seized in a condition of presumptive drug intoxication. Each sample was analyzed, and some of them revealed the presence of the abovementioned drugs and/or their metabolites.

We have found that fluoroamphetamines, methylamphetamine and methylenedioxypyrovalerone might be monitored as parent drugs, though the latter is slightly metabolized to the products tentatively identified as MDPV-ketone and hydroxymethoxypyrovalerone (<5%). Flephedrone mostly has its β-oxo moiety reduced, with parent compound being less abundant.
but well detectable (<50%). Unlike flephedrone, mephedrone shows different metabolic pattern: its main metabolite is hydroxylated at the tolyl methyl group. N-desmethyl metabolites of both flephedrone and mephedrone are low (<5%). Our findings are in agreement with the published data [5]. The electron ionization mass spectra of the studied designer stimulants and their tentative metabolites are presented in Fig. 1.

Fig. 1. EI mass spectra of mephedrone (A1, MW=177), hydroxymephedrone (A2, MW=193), flephedrone (B1, MW=181), dihydroflephedrone (B2, MW=183), methylenedioxyprovalerone (C1, MW=275), oxo-metabolite (C2, MW=289), fluoroamphetamine (D, E: two isomers with identical mass spectra, MW=153) and methylamphetamine (F, MW=149; ortetamine elutes at 2.59 min under these conditions). ISTD (diphenylamine) retention time: 6.0 min.
Conclusion

The GC-MS screening of volatile compounds might be adapted to include these novel stimulants in urine, as they are structurally related to ephedrine- and amphetamine-like substances and will be extracted under the same conditions. As category S6 of the Prohibited List is open for “other substances with a similar chemical structure or similar biological effects”, these designer stimulants are to be considered as related compounds, administration of which may (or shall?) result in an adverse analytical finding. Therefore, antidoping laboratories are advised to update their screening procedures whenever possible.

References