



'Legal highs' - Analysis of tablets and capsules containing piperazines

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Introduction

The use of 'legal highs' or 'party pills' has exploded over the last two years, in the media as well as on the high street. The 'new', popular ingredient in the tablets and capsules sold in numerous online shops, is a group of synthetic drugs called piperazines. The majority of products usually sold in such outlets are of a herbal nature and have been in existence for a decade.¹ Piperazines, although not herbal, are being sold in online shops due to their psychoactive properties, legal status and perceived safety compared with illicit drugs.

Benzylpiperazine (BZP) is the most common derivative and is a labelled ingredient in a wide number of products on sale across the internet¹ (figure 1 and 2). They have become increasingly popular over the last two years due to their amphetamine-like effects and legal status.^{2,3} Piperazine itself (figure 3) was originally used as an anthelmintic agent to treat round worm and is still used today in medicine as a worming agent⁴. Derivatives were further investigated in the 1970's but trials were stopped when it was discovered that benzyl derivatives had stimulant properties with abuse potential. Today, benzyl and phenyl derivatives such as those in figure 3 are seen alone or combined with BZP or other piperazine derivatives, in tablets and capsules sold as 'party pills' or 'harm reduction solutions' (figure 2) for use on the dance scene.^{5,6}

Figure 1 Examples of 'legal highs' containing piperazines available from SpiritualHighs.



Tablets and capsules analysed in this study were all bought directly from internet sites selling 'party pills', 'herbal highs', 'legal highs', 'herbal ecstasy' or directly promoting piperazines. Our aim was to identify active drugs contained in the tablets and capsules, their quantities and to determine how well the actual contents matched the listed ingredients.

Figure 2 Examples of tablets and capsules purchased on the internet and containing piperazines.

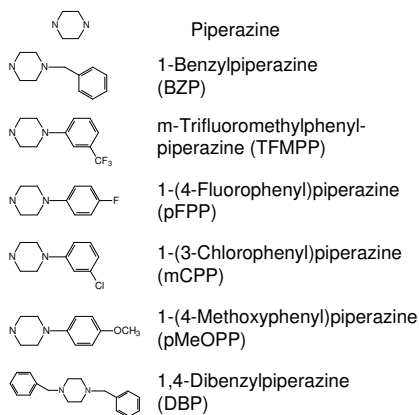


Figure 3 Piperazine and six piperazine derivatives seen in tablets and capsules.

Materials and Methods

26 different tablets and capsules were purchased from three different internet suppliers; Spiritual High (5), Everybody Does It (12) and Wicked Highs (8). One tablet was supplied by a clinician from a hospital admission. 11 piperazine derivative standards were purchased from Sigma-Aldrich. A Shimadzu QP2010 gas chromatograph and mass spectrometer with an HP5MS column (30m x 0.25mm, 0.50µm) was used for screening and quantitation.

Screening – Tablets were ground to a homogenous powder and a proportion of this was analysed. Alternatively, the whole tablet or capsule contents was taken for analysis. Samples were suspended in methanol (10mL), mixed and centrifuged at 3000rpm. 50µL of methanoic sample was combined with 100µL of 100mg/L internal standard solution (quinoline, pyribenzamine and flurazepam) and mixed with 1mL MTBE. 1µL was injected onto the GC-MS system at 225°C with a 10:1 split. The temperature was held at 80°C for 4 minutes and then ramped at 40°C/min until 290°C, and held for 10.75minutes. Samples were diluted and analysis repeated if necessary.

Quantitation – The major ingredients, BZP and TFMPP, were measured in those tablets/capsules that contained them. All samples were prepared using the same method as the screen

stated above (diluted if necessary), using quinoline as an internal standard. A SIM GCMS method was used scanning for the following ions: BZP 134m/z, TFMPP 188m/z and internal standard 129m/z.

Results

Of the 26 tablets and capsules screened, 23 contained one or more piperazine. 21 of the 23 piperazine-containing tablets/capsules contained BZP. Figure 4 shows these and other piperazines found in the samples. Additional ingredients seen with piperazine were nicotinamide in capsules (5) and caffeine in tablets (2). A chromatogram from a typical legal high pill is shown in figure 5.

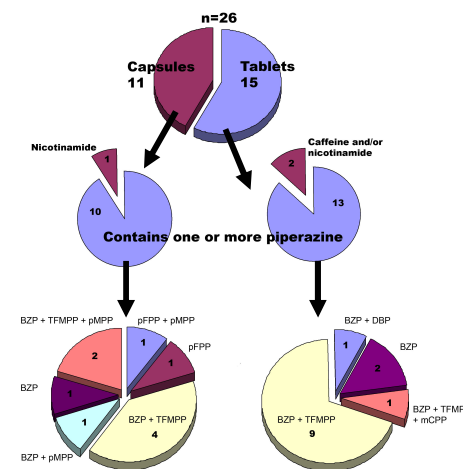


Figure 4 Pie charts to show results of tablet/capsule screens

Tablets and capsules came in a variety of packaging (figure 2) containing usually 2 or 3 capsules/tablets each. All samples containing one or more piperazine stated ingredients as "BZP, and other piperazine and piperine blends", "Cayenne pepper piperazine blend" or "Piperazine and piperine blend".

References

1. Legal party pill use in New Zealand: Prevalance of use, availability, health harms and 'gateway effects' of benzylpiperazine (BZP) and trifluorophenylmethylpiperazine (TFMPP). Massey University, 2006. 2. Gee P, Richardson S, Woltersdorf W, Morre G. Toxic effects of BZP-based herbal party pills in humans: a prospective study in Christchurch, New Zealand. N Z Med J. 2005 Dec 16;118(1227):U1784. 3. Michael H Baumann, Robert D Clark, Allison G Budzynski, John S Partilla, Bruce E Blough and Richard B Rothman. N-Substituted Piperazines Abused by Humans Mimic Molecular Mechanism of 3,4-Methylenedioxymethamphetamine (MDMA, or 'Ecstasy'). Neuropharmacology (2005) 30, 550-560. 4. www.erowid.org accessed 09 Nov 2006. 5. www.spiritualhigh.co.uk accessed 09 Nov 2006. 6. www.emcdda.europa.eu

Concentrations of BZP were stated on 10 samples. TFMPP was listed as an ingredient on 5 samples and concentrations given for 2 of these. Two samples stated other named piperazines (fluorophenylpiperazine and methylbenzylpiperazine respectively), but actually contained BZP with TFMPP, and BZP only, respectively. The 3 products that did not contain any piperazines were all sold as 'dietary' or 'herbal' supplements and contained caffeine and/or nicotinamide. However, their names gave the impression they may contain piperazine products e.g. 'Explode liquid ecstasy' available from 'London Underground', who also distribute piperazine products. They were also described as "mind broadening" ('DIONYSOS') and "trance and sensation" ('Explore energy booster').

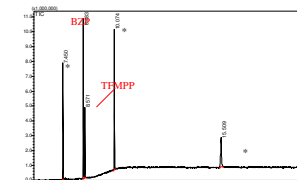


Figure 5 Chromatogram and tablet containing approximately equal amounts of BZP and TFMPP with internal standards*.

Quantitation of BZP and TFMPP in tablets and capsules (n=20) gave mean BZP of 65mg and TFMPP of 22mg. However, the range varied widely between 28-133mg BZP and 4-72mg TFMPP. Stated concentrations of BZP ranged from 105mg to 200mg, and TFMPP 50mg to 75mg.

Conclusions

This small study has shown that there is a wide variety of products available on the internet containing piperazines. The results show that not only do these tablets and capsules contain different/additional piperazines to those declared on the packaging, but the quantities contained are highly variable and unpredictable. It is clear that party pills, with their amphetamine-like effects, legal status and positive marketing are increasing their popularity and their growing use should not be ignored.