The Characterization of ‘Legal Highs’ Available from Head Shops in Dublin

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Introduction

The past two years have seen an explosion in the number of head shops in Ireland, including Dublin. Since benzoylcgonine (BZP) was outlawed in March 2009 there has been a significant increase in the number of drugs with similar stimulant effects being legally sold as ‘bath salts’ or recently ‘legal highs’. In an attempt to fill the vacuum created by the BZP ban, new brands regularly appear and anecdotal reports suggest that the constituents of a given product may vary. Since ‘legal highs’ are mainly cathinone derivatives (methylethylcathinone, methylethylcathinone eutylate, methylethylcathinone isobutyrate and methylethylcathinone isobutyrate isomers), drug tests are unusual and reports often lack unbiased data on the drug.

These ‘legal highs’ are mainly cathinone derivatives (methylethylcathinone, methylethylcathinone eutylate, methylethylcathinone isobutyrate and methylethylcathinone isobutyrate isomers) which possess a similar chemical structure to amphetamines, and are usually sold either as capsules or in loose powder.

![Figure 1: Cathinone derivatives](image)

Preparation of mephedrone hydrochloride standard

A sample of product known to contain mephedrone was extracted from basic solution into ethyl acetate. The solvent was removed and the residue was purified by flash chromatography (ethyl acetate). Evaporation of the combined fractions containing mephedrone followed by addition of methanolic HCl, re-evaporation; tributylamine and acetic acid in vacuo afforded a white powder, fully characterized by mass spectrometry and NMR.

Quantification of mephedrone

Four samples which had been found to contain mephedrone (Dublin XXX, Breeze, The Business and Wild Cat), were subjected to quantitative analysis. Water (5 ml) was added to an accurately weighed amount of each sample (1 mg). Ammonia (50 µl) and toluene (5 ml) were then added and the mixture was rotated for 30 min. After centrifugation 1 ml of the upper layer was transferred to a vial for GC/MS analysis. Concentrations were determined from a standard curve prepared in the same manner.

Results and Discussion

All the samples (n = 18) were found to contain cathinone derivatives: mephedrone (28% of products), ephedrine (17%), methylone (22%), butylone (17%) and MDPV (22%), either in isolation or in combination. A substantial minority (19%) of the products tested also contained local anaesthetics, which may ease the pain associated with repeated cathinone insufflation and minimise the sensation associated with cocaine use. The results of the qualitative and quantitative analyses are displayed in Table 1 and 2.

![Figure 2: Drug identification poster](image)

![Figure 3: Appearance of known following mephedrone use](image)

As mentioned earlier, discolouration of the knee (“blue knees”), has been reported with mephedrone use, particularly with high doses.

Conclusion

We have successfully characterized some of the most popular legal highs available in Dublin head shops. These products were found to contain the cathinone derivatives mephedrone, methylethylcathinone, methylethylcathinone isobutyrate and Methylethylcathinone isobutyrate isomers, which were found in a number of samples. Mephedrone was present in just over one quarter of the samples analysed. This is of concern as media reports have linked this cathinone to several deaths.

Our work provides a foundation for further research into these drugs’ mechanisms of action, metabolism and toxicity. Such future work will be key to the management of hospitalizations associated with these drugs’ misuse.

References

2. Finnish Health Authority. Mephedrone is a psychoactive substance, internal memo, 26 Feb 2010.