Abstract

Background

Dimethylamylamine (DMAA) is a stimulant component present in dietary and sport supplements. Safety is debatable. Given recreational drug user interest in DMAA, a netnographic study investigated displacement of DMAA into the realm of recreational drug use as shared by drug users on publically available drug web fora.

Methods

A systematic internet search was implemented on Google Insights for Search, Google and Yahoo by utilising precise key words; *'DMAA'*, *'Dimethylamylamine'*, *'Methylhexanamine'*, *'Methylhexaneamine'* ,and *'Geranamine'*, and in combination with the word *'forum'*. The search generated 1034 identified threads relative to recreational and sole use of DMAA for intoxication purposes. A cyclical analysis of textual data was conducted.

Results

Findings are illustrative of drug user curiosity relating to DMAA's potential uses as recreational drug. Oral use was common, and within advisable ranges. Due to its adrenergic effect DMAA is viewed as having low value for intoxication purposes, and better suited as workout and weight loss aid. Adverse sympathomimetic effects, tolerance and concerns around toxicity discouraged further experimentation.

Conclusions

Continued surveillance of drug user trend interest in sport supplements, monitoring of displacement trends and presence of DMAA in new psychoactive substances is warranted. Information can inform clinical and harm reduction responses.

Key Words

1,3-Dimethylamylamine; DMAA; Geranamine; sport supplement

Introduction

Dimethylamylamine (DMAA) known as *'methylhexanamine'* or 'methylhexaneamine' is a sympathomimetic component found in sports supplements (Armstrong, 2012; Monakhova et al 2014). The trade name *'Geranamine'* refers to geranium oil claimed as natural source of DMAA (Ping, Jun, & Qing, 1996), however studies to date are unable to confirm DMAA presence in geranium oil (Austin, Travis, Pace, & Lieberman, 2014). The compound was originally patented by Eli Lilly for use as nasal decongestant (Venhuis & de Kaste, 2012). DMAA is banned by the US Food and Drug Administration (FDA) (Dolan & Gatch, 2015) and by World Anti-Doping Agency in their 2010 Prohibited list (listed under its synonym *'methylhexaneamine'*). Emerging analogues on legislative controls have included '1,3-dimethylbutylamine' (DMBA) found in dietary supplements (Cohen, Travis, & Venhuis, 2014). More recently, DMAA has been identified in new psychoactive substances (NPS) (Zamengo, Frison, Bettin & Sciarrone, 2014), and in 2010 was reportedly attractive to drug users seeking as legal alternative to 3,4-methylenedioxymethamphetamine or 1- benzylpiperazine (BZP) (Gee, Jackson, & Easton, 2010; Gee et al., 2012).

DMAA's safety is debatable (Zhang, Woods, Breitbach, & Armstrong, 2012) given its vaso-constricting properties and cardiovascular effects (Austin et al., 2014). Recommended single 25mg doses of DMAA are reported to incur no significant untoward effect on blood pressure, resting heart rate or body temperature (Schilling, Hammond, Bloomer, Presley, & Yates, 2013). Sport supplements typically contain doses of 25-65mg (Venhuis & de Kaste, 2012). Zhang, Woods, Breitbach, & Armstrong (2012) have reported on supplements containing up to 285mg DMAA. Consequences of use include vascular toxicity, atrial fibrillation with rapid ventricular response, cardio myopathy, cardiac arrest, haemorrhagic stroke, proximal muscle weakness, impaired ambulation, generalised muscle atrophy and death. Cerebral hemorrhage has been reported on single dose ingestion with caffeine, phenethylamine, cannabis and alcohol (Gee et al., 2010:2012).

Displacement between enhancement drug use and recreational use for intoxication purposes has been observed in the case of gamma hydroxybutyrate (GHB) used initially by bodybuilders for increased muscle development, injury recovery and fat reduction, before entering the recreational party drug scene (Evans-Brown, McVeigh, Perkins, & Bellis, 2012). Given the potency of the internet in supporting retail of drugs and sharing of consumer information, we explored the displacement of DMAA into the realm of recreational use, as shared by drug users on publically available drug web fora.

Methods

The study was undertaken as part of a larger study investigating use of image and performance enhancement drugs. We utilised a simple, unobtrusive approach called *'netnography'* defined as a non-traditional form of ethnography which collects data in an efficient manner via online forums (Kozinets, 2010). This approach was chosen due to ease of access to anonymous experience reports posted by users active on drug fora, and was cognisant of the rapid evolvement of drug user trends. User generated raw data are also potentially more reliable and trustworthy than when collected via more obtrusive methods (Kozinets, 2010).

In the first stage, a systematic internet search was conducted on Google Insights for Search, Google and Yahoo by utilising key search terms; *'DMAA', 'Dimethylamylamine', 'Methylhexanamine', 'Methylhexaneamine'*, and *'Geranamine',* and in combination with the word *'forum'*. Collective searches generated 254,860 results. The first 20 hits of each of these five search combinations were scrutinised, with inclusion criteria relating to drug user fora activity, use of DMAA on its own, and use for intoxication purposes as opposed to sport or weight loss supplementation. Sampling was grounded in Kozinets (2010) criteria relating to scale, interactivity and heterogeneity.

In the second stage, following application of exclusion criteria, 4 websites hosting forum activity remained. These were then searched internally using the websites internal search

engine for the terms: *'DMAA', 'Dimethylamylamine', 'Methylhexanamine', 'Methylhexaneamine',* and *'Geranamine'.* This search ran until no more data could be found, and generated 1034 identified threads relative to sole use of DMAA for intoxication purposes. The third stage applied removal of duplicates with a total of 66 discussion threads and 16 user trip reports remaining for analysis. A total of 169 distinct fora user pseudonyms were recorded.

Insert Table 1 about here

The data were transported to a Word document, and produced 28,688 words for analysis. Both authors read and re-read the document in order to become familiar with recurrent DMAA experiences. Data were thematically analysed by dividing the data set into meaningful data units. Open, axial and selective coding were used to identify sub and main categories. Pattern based auto coding was assisted by NVivo and stored in thematic *'nodes'.* The five abstracted themes were systematically reviewed, refined, verified and checked for distinction and internal coherence by both authors, by virtue of close and frequent consultation with the original dataset.

In adherence to ethical protocols, we upheld discrete observational status during collection and analysis of data and did not make any attempt at personal contact or interaction with the target population. Further anonymity was ensured by removal of screen pseudonyms and report URLs.

Results

Products and Sourcing

DMAA's attractiveness centered on user curiosity, its low price and widespread availability online. Sourcing of products occurred mainly online, with common products consisting of sports supplements containing caffeine and DMAA, new generation legal party pills and '*research chemicals'*. Some users described ordering 'research chemicals' in preference to purchasing DMAA containing supplements. Packages originated from Israel, China and the United Kingdom. User discussions centered on community awareness of potential for contamination and inconsistent purity.

'It's all from dodgy Chinese labs… not made for consumption*'*.

Administration

Users generally appeared informed and aware of the recommended dose in sports supplements (20-50mg). Postings illustrated how product labelling advised *'do not use more than 25mg'.* Dosage consumed ranged from 25mg to 75mg. Some users described using encapsulation machines and packing 60mg capsules in order to calculate correct amounts. Fora discussions advised that 50mg was optimal for a 'recreational stimulation and mood-*lift'*, and as mild '*pick me up'*. Warnings around negative experiences and adverse consequences were exchanged with regard to toxicity on consumption of over 100mg.

Oral use was preferred to insufflation due to intense burning of the nasal cavities. Powder was commonly dissolved in soft drinks and caffeine drinks. 'B*ombing with cigarette paper'* was also described. Discussions around optimal oral route of administration also centred on awareness of loss of potency when smoked and potential for incineration of vapours in mid-air.

'Don't smoke it, it produces way too much smoke and it's not pure'.

Adrenaline Rush

In general, use of DMAA for recreational purposes was not described as favourable or pleasurable and often compared to *'bad caffeine or ephedrine'*.

> *'It was almost entirely adrenergic, there wasn't any euphoria, mood lift, or sense of* wellbeing. Just a highly uncomfortable feeling similar to an adrenaline rush, that lasted *for 5 hours.'*

Some users described increased physical activity responses and irritation/agitation in response to music. Mood was described as ranging between happiness and anger.

> *'I feel happy, but it's a form of rage and happiness. I feel no feelings of anxiety at this* point, I have an intense will to cause pain to myself. Pain seems to be a strange perverse pleasure.*'*

Some users described feelings of dissociation, hallucination and synaesthesia (i.e. colour changes, wall patterns). Favourable comments were made with regard to sexual enhancement in comparison to the anticlimactic properties of cocaine.

> *'DMAA made my body tingle and enhanced my mood but not too much stimulation. Made sex feel amazing.'*

Some discussion centred on concurrent use of DMAA with party drugs for mild stimulant properties to manage the *'MDMA ecstasy roll'*.

Disappointing Recreational Value

Majority of fora members described DMAA as having a '*low recreational value'*, with many comments indicating its limitations outside of the realm of sport supplementation.

> *'DMAA is not a "high" and nor does it have any* recreational value. They said "it mimics amphetamines and ecstasy. *Wrong.'*

Combinations of DMAA and caffeine were however described as useful as a mild daily 'utility, like *caffeine for general pick me up'*.

*'DMAA is a perfect example of "the right tool fo*r the right job." I sprinkle about 50mg of the powder in my morning coffee and I'm feeling right as rain, it wakes me up nicely and *gets me in the mood to start my busy day.'*

Other comments centred on its capacity to act as withdrawal support from methamphetamine and opiates.

'....when I withdraw I use DMAA and am outta withdrawal in 2-3 days no matter how *long the opiate binge.'*

Comedown Effects

DMAA was described by users as having little or no abuse potential. This was attributed to its mild stimulatory effect, and lack of user desire to re-dose. The DMAA adrenergic feeling appeared to recede slowly over time. Negative effects were described during and after comedown and included nervousness, agitation, hypothermic reactions, atrial fibrillation, vertigo, intense nausea, headaches, paranoia, leg pains and vomiting. Re-dosing of DMAA heightened these reported negative effects. All users reported fatigue and depression lasting several days.

*'I*t [user experience] involved panic attacks, blacking out, passing out, pissing myself, trying to bury myself , punching walls , about 14 hours of vomiting followed by 48 hours of sickness, nausea , depression and paranoia.*'*

Many users reported 'feeling poisoned in the purest sense*'* by DMAA and posted concerns around toxicity.

'DMAA is poison, do not consume! I felt like I was dying the next day -sweating, headache, vomiting, burping up a sulphur smell. Very nasty stuff!

Paranoia was described as deterring future use with one user commenting, DMAA *'has something* very *dark about it'.*

Discussion

The study aimed to investigate drug user curiosity and displacement of DMAA into recreational drug use for intoxication. We recognise that textual data collected may be confounded by self-report issues, potential for multiple screen pseudonyms, exclusion of recreational drug users who also use DMAA for sports/weight loss purposes, and lack of verification of DMAA in products used. Validity of the findings, despite the study's potential for unrepresentativeness of a wider drug using population, are however enhanced by verification of extensive similarities around sourcing of products containing DMAA, congruence around effects and outcomes, and user attributed value as recreational substance. Similar to Gee et al., (2010: 2012) in New Zealand, reference was made to legal *'party pills'* containing DMAA, and market shifts switching away from BZP (Wilkins, Sweetsur, & Parker, 2014).

DMAA was viewed as a mild stimulant, best confined to sports enhancement and weight management purposes and with low recreational value. Its stimulant effects were described as dose dependent and included elevated mood, intense energy, adrenaline rush and light euphoria. Dissociation, hallucination and drug induced synaesthesia were of minor recreational interest, with experiences complicated by increased physical energy, agitation and intentions to self-harm. Recreational doses appeared to adhere to recommended sports dosage (25-75mg) with users aware of negative adverse effects on consumption of over 100mg. Similar to Schilling et al., (2013), DMAA with caffeine as attractive as '*daily pick me up'*.

Oral use was preferred due to nasal burning and loss of potency when smoked. Relatively slow absorption was reported (see Perrenoud, Saugy, & Saudan, 2009). Positive experiences appeared confined to first time use. Users reported lack of desire to re-dose, and low concern for abuse potential given its weak effect and negative effects when receding and after comedown. We note that studies have observed DMAA's long half-life, with repeated doses within 24-36 hours and dosages of greater than 100-200mg increasing risk of adverse effects (Venhuis & de Kaste, 2012). Abuse liability of DMAA is reported to be similar to stimulants such as cocaine and methamphetamine (Dolan & Gatch, 2015). Adverse sympathomimetic symptoms reported by these users are similar to those described by

Gee et al., (2010: 2012) in New Zealand, and deterred follow-up or chronic use. Concerns for toxicity were evident.

Conclusion

The study whilst revealing DMAA's low reported attraction as recreational drug, highlights the need for continued surveillance of drug user interest in stimulant type lifestyle and sports supplements, and the monitoring of displacement trends. Findings are intended to inform policy makers and clinical, health and harm reduction practitioners.

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Tables

Table 1 Sites containing Trip Reports and Thread Discussions around recreational use of DMAA, and records remaining following application of exclusion criteria.

Website Link	Website name	Initial search result number of users reports/threads	Threads excluded	**User Discussion Threads After exclusion**	**User Trip Reports**	**Distinct pseudonyms per site recorded**
https://www.drugs-forum.com/forum/index.php	Drugs Forum	347	317	17	13	45
http://www.bluelight.org/vb/forum.php	Bluelight	552	512	39	1	107
http://www.legalhighsforum.com/	Legal highs Forum	80	69	9	2	16
http://www.hipforums.com	Hip Forums	18	17	1	0	1
http://www.psychonaut.com/	Psychonaut.com forums	28	28	0	0	0
http://forum.opiophile.org/forum.php	Opiophile	9	9	0	0	0
	Total	1034	952	**66**	**16**	**169**

***Conflict of Interest Statement**

No conflict of interest declared.