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Male and female ecstasy users: Differences in patterns of use, sleep quality and mental health outcomes

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ABSTRACT

Background: Ecstasy users report a number of adverse effects following use including mood and sleep disturbances. The present study examined differences in characteristics of ecstasy use (amount, frequency of use, reported harm resulting from use) between males and females and assessed relationships between ecstasy use, sleep quality and mental health outcomes.
Methods: An online survey of 268 ecstasy users (54.1% male, 45.9% female) was conducted. Validated sleep instruments assessing sleep quality and excessive daytime sleepiness, as well as questionnaires regarding physical and mental health (measured using the short-form health survey 12 (SF-12) and details of drug use were included.
Results: Male ecstasy users reported taking larger amounts of ecstasy, but were not more frequent users compared to females. Female ecstasy users were more likely to report increased harm following ecstasy including: feelings of guilt and remorse; failing to do what was normally expected of them; and having been told by others to cut down their ecstasy use. There were interactions between amount and gender and frequency and gender in predicting use of sleep medication and daytime dysfunction. There was a positive correlation between poorer sleep quality and negative mood, although this relationship was not moderated by sex.
Conclusions: There is a significant association between sleep quality and mood disturbance in ecstasy users suggesting that these negative outcomes are co-morbid. These findings have implications for the treatment and advice given to ecstasy users who are experiencing sleep and/or mood related complaints.

1. Introduction

Sex differences have been reported in the physical and psychological responses to many psychoactive drugs including alcohol, cocaine and amphetamine (Becker et al., 2005; Holmila and Raitasalo, 2005; Lynch et al., 2002; Sell et al., 2000). Although ecstasy use is associated with adverse effects on mood (Parrott, 2001; Verheyden et al., 2002) and sleep quality (Ogeil et al., 2012a,b; Pirona and Morgan, 2010), relatively few studies have examined sex differences in ecstasy use in humans (see Allott and Redman, 2007). This is despite known sex differences in behavioural (Bubar et al., 2001; Palenicek et al., 2005) and neurotoxic (Koenig et al., 2005) responses to MDMA in animal models.

The number and nature of adverse effects following ecstasy use differ in males and females. For example, females are more likely to report thought disturbances and a fear of loss of body control (Liechti et al., 2001; Murphy et al., 2006). Females also report an increased number of adverse events following ecstasy use (Ter Bogt and Engels, 2005; Parsons et al., 2006) including depression, nausea, and headache (but see Verheyden et al., 2002). Interestingly, although females report more psychological symptoms associated with ecstasy use, males have greater physiological changes in heart rate and blood pressure following ecstasy (Liechti et al., 2001). These sex differences may arise because females may better recognise changes in mood (Allott and Redman, 2007) and are more likely to report such symptoms (Bedi and Redman, 2006), in contrast to male ecstasy users not being self-aware of drug effects (Parrott et al., 2006).

Alternatively, the experience of adverse effects may reflect sex differences related to how the drug is typically used by men and women. Patterns of ecstasy use have been found to predict some outcomes. Ogeil et al. (2011b) found that the amount of ecstasy used on a typical night out (as opposed to the frequency of ecstasy use) was associated with clinically significant decrements in sleep quality but not excessive daytime sleepiness, and that this effect was consistent between ecstasy-only users and polydrug users who

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also took ecstasy. However, gender differences were not examined in this study.

Increasing evidence suggests sex differences in neurochemical responses to ecstasy use, which may underlie the observed behavioural differences. Ecstasy has marked effects on biogenic amines, particularly serotonin (5-HT) and dopamine (DA; Green et al., 2009). Females have higher baseline 5-HT, 5-HIAA and tryptophan levels compared to males (Carlsson and Carlsson, 1988; Zhang et al., 1999), which affects their response to drugs of abuse. For example, Festa et al. (2004) found that the behavioural response to cocaine differed between male and female rats, likely mediated by differences in underlying monoamine levels as females have greater DA transporter availability and D2 receptor binding potential (Kaasinen et al., 2001; Lavalaye et al., 2000). Females, with their heightened 5-HT activity and transporter availability, may also be more susceptible to the consequences of the 5-HT releasing actions of MDMA (Staley et al., 2001; Cosgrove et al., 2007).

Alternatively, any sex differences in response to ecstasy may be due to variations in circulating hormone levels (Bubenakova et al., 2005), or to sex differences in the activation of the HPA axis following serotonin release (Broadbear et al., 2004). Zhou et al. (2003) demonstrated the potentiating effect of oestrogen on the hyperactivity response following MDMA (1, 2, 4 mg/kg) in ovariectomised female Sprague-Dawley rats, half of which received an oestrogen implant. Rats with the oestrogen implant showed a significantly greater hyperactivity response following MDMA (4 mg/kg).

In human studies, females are more sensitive to amphetamine during the late follicular phase which is characterised by high oestrogen and low progesterone levels (Evans et al., 2002; Justice and De Wit, 2000; White et al., 2002). Oestrogen and progesterone levels may also affect the actions of ecstasy, including the increased activity seen in female rats following MDMA. This has broad ramifications for sex differences in response to ecstasy, given that oestrogen levels affect the distribution and number of 5-HT and DA receptors (Sumner and Fink, 1995; Zhou et al., 2002) as well as the levels of serotonin (SERT) and dopamine (DAT) transporters in the brain (Attali et al., 1997), the actions of which underlie important physiological and psychological functions.

Despite the evidence for sex differences in behavioural and physiological responses to ecstasy, there is uncertainty as to whether these translate into functional deficits (Allott and Redman, 2007). We examined differences in self-reported sleep quality between male and female ecstasy users and the relationship between poor sleep quality and mental health functioning. Specifically we examined: (a) sex differences in ecstasy use patterns with respect to the amount and frequency of ecstasy use, as well as perceived harm following use; (b) whether these differences were linked with a functional deficit with respect to sleep and mental health functioning; (c) which domains of sleep differ between male and female ecstasy users and (d) whether sex moderates the relationship between self-reported sleep quality and mental health outcomes in ecstasy users.

2. Method

2.1. Participants

268 ecstasy users were selected from a larger survey collected using convenience sampling investigating social drug use on sleep and mental health (Ogeil et al., 2011b). The majority of the sample lived in Australia (70%), with smaller proportions residing in the USA (17%) and the United Kingdom (5%). The results of the larger study demonstrated the utility of two factors, (a) the amount of ecstasy normally consumed on a typical night out and (b) various indices of self-harm in predicting poor sleep quality in ecstasy users (Ogeil et al., 2011b). In addition, the capacity for ecstasy, in the absence of other illicit drug use, to disrupt sleep was demonstrated, highlighting the need for further investigation into ecstasy users most at-risk of sleep deficits.

2.2. Materials

Ecstasy use was assessed using a series of items relating to the amount of ecstasy use, frequency of use and perceived harm (Ogeil et al., 2011b). Alcohol and cannabis use were assessed with the Alcohol Use Disorders Identification Test (AUDIT; Babor et al., 2001) and marijuana screening inventory (Alexander, 2003), respectively. Participants completed two measures of sleep; the Pittsburgh Sleep Quality Index (PSQI) and the Epworth Sleepiness Scale (ESS). The Short-form health survey-12 (SF-12) was completed as a measure of physical and mental health as it provides validated standardised physical (PCS) and mental health (MCS) components scores, each having a mean of 50 and a standard deviation of 10 in the population (Sanderson and Andrews, 2007).

The Pittsburgh Sleep Quality Index (PSQI) assesses sleep quality during the previous month. It contains 19 items and yields a Global Score (range 0–21), with higher scores indicating poorer sleep quality and scores of 5+ used as a clinical marker for sleep disturbance. The PSQI has seven subscales (scored 0–3) which are: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication and daytime dysfunction. The PSQI has good reliability and high internal consistency, with Chronbach's alpha of .83 (Buysse et al., 1989).

The Epworth Sleepiness Scale requires participants to rate their likelihood of dozing in eight situations using a 0–3 Likert-type scale (0 = would never doze; 3 = high chance of dozing) (Johns, 1991). The total score ranges from 0 to 24, with scores >10 used as a clinical measure of daytime dysfunction (Johns, 1991, 1992). The ESS has high levels of reliability and internal validity with Chronbach's alpha = .88 for clinical populations (Johns, 1992).

2.3. Procedure

The study was advertised on web-sites, in the "magazine BEAT" (Rob Furth Publishing) and on flyers placed in public places in Sydney and Melbourne. Prior to participation, an explanatory statement page, which included details about the study and links to resources regarding drug use was provided. Participation in the social questionnaire was limited to English-speaking people who were aged 18 or over and had used at least one of the drugs–alcohol, cannabis or ecstasy in their lives. All procedures were approved by the Monash University Human Research Ethics Committee. The questionnaire took approximately 30 min to complete.

3. Results

3.1. Participant characteristics

Demographic characteristics of male and female ecstasy users are provided in Table 1. There were no significant differences in age, employment or educational attainment in male and female ecstasy users using chi-square tests for differences in distributions. In addition, shift-work status and the experience of a significant life event that may have affected sleep did not differ between males and females.

3.2. Ecstasy use

Males and females were compared with respect to their pattern of ecstasy use using chi-square tests (see Table 2). While males used greater amounts of ecstasy, females were more likely to report