p-ISSN: 0973-3558, e-ISSN: 0973-3566 DOI: 10.5958/0973-3566.2021.00003.1

Original Research Article

A Descriptive Study on Ecstasy-Related Deaths in a Tertiary Care Center in Goa

Ajith Antony, Sheryl Suares, André Victor Fernandes
Department of Forensic Medicine and Toxicology, Goa Medical College, Bambolim, Goa, India.

Article Info

Corresponding author: Dr. Sheryl Suares, Department of Forensic Medicine and Toxicology, Goa Medical College, Bambolim, Goa, India. Pin Code: 403202
Email: suares87sheryl@gmail.com

How to cite this article: Antony A, Suares S, Fernandes AV. A descriptive study on Ecstasy-related deaths in a tertiary care center in Goa**.** J Ind. Soc. Toxicolo 2021;17(1):13-18.

Received – **04 May 2021**
Accepted – **14 June 2021**

Abstract

Among the various drugs used for recreational purposes, Ecstasy or MDMA (3,4-Methylenedio xymethamphetamine) is believed to a relatively safe drug and has been abused by a wide spectrum of age groups, from teenagers to elderly. However, in Goa, with their ready availability in late-night "rave" parties (electronic dance music with drugs), the use of such drugs has shown an increased risk of fatality, especially if abused in conjunction with alcohol. The euphoria lasts longer and the sedative effects of alcohol is reduced, which causes the ill-informed drug abuser to consume larger doses of alcohol. This results in various complications ranging from severe dehydration and gastric erosions to multi organ failure, leading to death. The current study highlights the lethality of co-abusing MDMA with other substances while shedding light on the autopsy findings in ecstasy stackers.

Keywords: alcohol, drug abuse, ecstasy, MDMA, molly, stacking, substance abuse

Introduction

Conceived as a drug that would aid psychologists in conducting *talk therapy*, MDMA (abbreviation for 3,4-Methylenedioxymethamphe tamine) quickly gained notoriety as a drug of abuse under the street names of 'Ecstasy' and 'Molly'.[1] Owing to its socially catalyzing nature, *Ecstasy* aids in easier and uninhibited interactions along with a feeling of being high. Besides showing prospects for psychotherapy, the United States had also undertaken military research in its highly classified MK-ULTRA experimental program that studied MDMA's potential use as a mind control agent.[2]

Down the years, ecstasy has been socially labelled as a 'relatively safe' drug, and it found its place in a lifestyle that revolves around youngsters looking for cheap thrills in late night dance parties.[3] These events, also known as "rave parties" are a growing hub of such drugs of abuse that are even more potent, mentally unhealthy and potentially lethal than ecstasy.

As of 2018, about 12 metric tons of ecstasy has been seized worldwide.[4] The World Drug Report revealed that 61.3% of the treatment seekers from India reported use of opioids, 15.5% cannabis, 4.1% sedatives, 1.5% cocaine, 0.2% amphetamines and 0.9% solvents.[5] A survey conducted in United States reported a 95% prevalence of alcohol use in MDMA users.[6] China was once recognized as a drug-free nation for 3 decades from the 1950s to the 1980s.[7] However, this trend was not only broken in urban China, but also drugs like heroin are getting replaced by synthetic drugs like MDMA in the recent times, mainly due to the increased sexual benefits.[8]

Goa being an international tourist destination, the rave parties are mostly limited to the coastal line, and while the rise of more potent designer drugs have brought down the use of MDMA in the west, ecstasy still dominates the Goa nightlife and discothèques in the form of multi-colored pills. Besides, alcohol is available at cheaper rates compared to other states, which increases its abuse potential among local tourists. When used in conjunction with alcohol, the concentration of MDMA in the blood increases by 13 percent.[9] Furthermore, the sedative effects of alcohol is reduced, thereby increasing its intake capacity. Such increasing levels of alcohol can cause dehydration and poisoning resulting in the overdose of the same.

It is believed that more than the effects of ecstasy, it is the side effects of alcohol that often leads to death.

Although the reports on clinical studies are plenty, a study on autopsy findings of substance abusers, especially pertaining to that of designer drugs is scarce in Indian literature. Hence, the present study was undertaken with a primary objective to analyze patterns of MDMA poisoning in Goa and investigate the autopsy findings resulting from the concurrent consumption of MDMA with other substances of abuse, especially alcohol.

Methodology

The present study is a record-based retrospective study in a tertiary care center in Goa, wherein hospital records of Medical Intensive Care Unit (MICU) and Psychiatry Department along with autopsy reports issued by the Department of Forensic Medicine and Toxicology were evaluated. The study duration is one year, spanning from January 2018 to December 2018.

The post-mortem memoranda with the Regional Forensic Science Laboratory (RFSL) reports or Randox^{TM} *Evidence Investigator* analysis (in the department) that detected MDMA (in the form of Methamphetamines) were taken into account. Cases of sudden collapse in rave parties where blood samples analyzed using Randox^{TM} *Evidence Investigator* (*Whole Blood — Drugs of Abuse Ultra)* kit, detected methamphetamine levels above 10 ng/mL were included. Apart from methamphetamine, the array also screens for other drugs of abuse such as Cannabis (in the form of Tetra Hydro Cannabinoids), Barbiturates, Benzodiaze pines, Benzoylecgonine/ Cocaine, Buprenorphine, Fentanyl, Dextromethorphan, Generic Opioids, Meprobamate, Methadone, Opiates, Oxycodones, Phencyclidine, Tramadol, Tricyclic Antidepressants and Zolpidem.

Furthermore, hospital records of Medical Intensive Care Unit (MICU) and psychiatry department were checked for admissions resulting from poisoning or drug overdose. Only the patients who had relevant history related to consumption of MDMA were included. Cases with provisional diagnosis of MDMA consumption based on strong clinical suspicion as well as Urine Drug Screen (UDS), which showed a positive result for 'methamphetamine', were taken into account.

Cases where UDS showed negative for methamphetamine were excluded. Again, cases where Randox^{TM} or RFSL reports did not point towards the presence of MDMA were excluded. The relevant data thus obtained, along with autopsy findings were then tabulated and analyzed.

Results

A total of 76 cases were admitted with history of MDMA consumption, out of which 6 patients (7.9%) succumbed to complications. Out of all the poisoning cases brought to the MICU, there were 42 admissions that showed urine screen test positive for MDMA or gave a positive history of consumption of the same. Remaining patients (n=34) were from the psychiatry wards. All six decedents had received their treatment at the MICU (Table 1).

Blood samples of all decedents (n=6) were analyzed using Randox^{TM}. Out of the six blood samples, only five (83.33%) turned positive for methamphetamine. All the samples (100%) returned a positive result for amphetamines, which is a metabolite of MDMA (Table 3). Three samples (50%) tested positive for tramadol, which is believed to be used as an additive in the MDMA tablets or as a cheap replacement for opioids by chronic abusers without immediate access to the same. Two cases (33%) tested positive each for cannabis and opioids. Opiates, benzodiazepines and methadone was present in one case (16.66%) each. Out of the fatal cases, all of them (100%) had consumed alcohol along with MDMA.

Viscera and blood samples were preserved for all the six cases, and the same was duly sealed and forwarded to RFSL for analysis. However, only three out of the six reports have come back from RFSL. All three reports detected the presence of alcohol, however only two had detected MDMA as methamphetamine and amphetamine (Table 4).

The autopsy findings are as summarized in Table 5. Cerebral edema, pulmonary edema and congestion of gastric mucosa were the most common findings present in all the decedents. Myocardial infarction was the least common, comprising of 33.33% of all cases.

Discussion

In less than half a century from its conception as a psychotherapeutic drug, the status of MDMA has taken a turn from a drug of use to that of abuse. Following this timeline, a study conducted in the

United States has shown that the number of MDMA users in the country has shot up from zero to nearly three million.[3] Although popularity of this designer drug is waning in the Western developed countries, with much potent congeners taking the limelight, MDMA abuse has grown rampantly in the Asian region. Drugs such as methamphetamine ("ice"), MDMA and ketamine are called the "new emerging synthetic drugs" in East Asian region, having spread quickly during the past decade.[10] In the present study too, we find maximum abuse of methamphetamine and amphetamine in fatalities.

A recent demographic study on MDMA addicts revealed that most of the MDMA addicts are well educated, with at least 66% having completed high school.[11] All of the decedents in the present study had graduated high school and many of them were employed in good companies. All the cases with known identities were also from financially well-off families.

MDMA, like other drugs of abuse, exhibit the phenomenon of tolerance, leading to increase in dosage or co-consumption with other drugs of abuse. This is termed as "stacking" of MDMA, a popular form of substance abuse wherein MDMA tablets are taken in bulk (usually three or more), or in conjunction with alcohol, cannabis, ketamine, GHB, cocaine, etc.[12] If taken in conjunction with LSD, this is called *candyflipping*.[13] A study conducted by Parrott et al revealed that novice users take one tablet of Ecstasy (Molly) and regular users take about 2-3 tablets, whereas most experienced users take up to 10-25 tablets in a single session.[14] In the current study, decedents had preferred to stack MDMA with alcohol and cannabis.

There has also been reports of combining MDMA with Sildenafil® for enhanced sexual gratification,[15] especially in male homosexuals for receptive anal intercourse.[16] This particular method of stacking is dubbed as "Trail-Mix"[17] or *Sextasy*[18]. Most common places of abuse were nightclubs and disco halls. In the present study, there is only one case of 'sextasy' stacking, which turned out to be non-lethal.

A study conducted in England and Wales demonstrated that after removing confounding factors of concomitant drugs, there were only three deaths per year attributed solely to MDMA.[19] In the present study, death due to pure MDMA overdosing was not present. Neither were there any patients admitted with MDMA abuse alone. Among the 76 ecstasy stackers admitted (Table 1), 7.9% of the cases (n=6) died. Out of the remaining non-lethal cases (n=70), majority were in a critical condition (n=36) and brought to MICU. Small doses of MDMA stacked with cannabis, LSD, opioids or controlled amount of alcohol didn't prove to be lethal, however, over due course of chronic abuse, the patients suffered from severe psychiatric and psychomotor complications. Such patients were brought to the psychiatry department (n=34) as voluntary admissions or magistrate orders for deaddiction and rehabilitation purpose (Table 2).

However, stacking with alcohol has severe adverse effects on the body that can be fatal, if consumption of alcohol goes unchecked. Apart from reinforcing the addiction potential and serotonin depletion in the brain, stacking of alcohol with MDMA also causes dehydration, as well as slow removal of MDMA from the body, thereby creating a highly toxic buildup.[20] Furthermore, substantial free water intake combined with sodium loss from physical exertion in dance clubs increases the risk of the development of hyponatremia.[21] A recent study conducted in adolescent mice on the co-abuse of MDMA and alcohol revealed findings of exacerbated cardiac cellular stress and toxicity through augmented activation of cardiac sympathetic system.[22] In the present study too, we find that one-third of the decedents suffered from lethal cardiac pathology.

The sedative effects of alcohol are nullified by the stimulating effect of MDMA, causing the person to drink uncontrollably, hence resulting in devastating complications. Experiments have shown that the concentration of MDMA in the participants' blood increased by 13 percent after they drank alcohol[9]. Thus, the MDMA-alcohol combination induced longer lasting euphoria than MDMA or alcohol alone. Ultimately, this leads to a higher addictive potential as well as catastrophic chain of events through a down spiral of dehydration and disorientation, leading to death.

In the present study, we have found that it is not the use of MDMA alone, but its abuse in conjunction with alcohol that greatly enhances the mortality. Out of the six fatalities in the present study (Table 3), all the decedents (100%) had consumed alcohol along with MDMA, whereas only two (33.33%) had also stacked cannabis along with

ecstasy and alcohol. Another stacking habit prevalent here is the use of tramadol (50%) which is used as a substitute for opioids, since it a centrally acting opioid agonist. Moreover, tramadol is also used as an additive in MDMA tablets, or added as an adulterant in cases where MDMA is peddled in the form of white pills. These conclusions are based on results given by Randox^{TM} *Evidence Investigator*. Blood samples were sent to RFSL in all fatal cases; however, only three reports came back, with two showing the presence of MDMA (Table 4).

The autopsy findings (Table 5) in the fatalities were more or less consistent with the picture of alcohol overdose. Congestion and erosion of superficial layers of gastric mucosa and severe pulmonary edema were the hallmark findings, along with congestive changes of the brain. Another finding was myocardial infarction, with relatively normal coronary vessels. There was prominence of cerebral blood vessels and severe congestive features in half of the cases. Enlargement of lungs with rib markings on the surface and cerebral edema were mostly due to the action of alcohol.

Conclusion

Ecstasy or MDMA is a relatively safe drug in terms of lethality. However, its potential to cause death increases along with "stacking", especially with alcohol. The simultaneous consumption of MDMA and alcohol produces more severe adverse effects than consuming either of them alone. Congestive and edematous changes in gastric mucosa, lungs and brain are the most common findings in such cases, which is neither diagnostic nor specific.

In cases of drug abuse (or poisoning, for that matter) the RFSL plays a major role in confirming the diagnosis of the pathologist or toxicologist concerned. Certain legislative and administrative measures must be taken to ensure that the RFSL functions in a more efficient manner, by arranging provisions for adequate equipment, staffing and/or funding. This would help in speedy resolution of cases in which the cause of death have been kept reserved or pending since years.

Last, but not the least, this study also calls for a stronger vigilance in tourist destinations from the side of the police force, since the footfall of psychedelic and designer drugs seems to be more in such destinations.

Limitations of the study:

"Candyflipping" (stacking ecstasy with LSD) is believed to be a prevalent practice in the region, with LSD "stamps" gaining popularity in the rave parties. However, extent of the same could not be assessed due to the unavailability of screening methods that detected LSD or its derivatives. Moreover, due to the variable nature in recording the provisional diagnosis on case sheets, or due to privacy reasons, not all consultants may have mentioned MDMA consumption in the space allotted for diagnosis. There are chances that such cases were inadvertently omitted from this study. It is also pertinent to note that the diagnosis made at the hospital is based on urine drug screen during the time of admission. Certain degree of error may be expected due to the delay between admission and testing. Hence, the epidemiological data presented in this study must not be used as an accurate generalization of the whole scenario, which might as well be an iceberg whose tip we have witnessed.

Conflicts of interest/Competing interests: None

References

1. Sessa B, Higbed L, Nutt D. A Review of 3,4-methylenedioxymethamphetamine (MDMA)-Assisted Psychotherapy. Front Psychiatry. 2019;10:138.
2. Karch S. A historical review of MDMA. The Open Forensic Science Journal. 2011;411:20-24
3. Stolaroff M. The secret chief revealed: conversations with a pioneer of the underground therapy movement. 2nd ed. Sarasota: Multidisciplinary Association for Psychedelic Studies; 2004
4. United Nations office on Drugs and Crime. [Internet] World Drug Report 2020; c2007-18 [updated 2020 Nov 30; cited 2020 Nov 30]. Available from: https://wdr.unodc.org/wdr2020/ index. html
5. Murthy P, Manjunatha N, Subodh BN, Chand PK, Benegal V. Substance use and addiction research in India. Indian J Psychiatry. 2010;52(Suppl 1):S189-S199.
6. Keyes KM, Martins SS, Hasin DS. Past 12 month and lifetime comorbidity and poly-drug use of ecstasy users among young adults in the United States: Results from the National Epidemiologic

Survey on Alcohol and Related Conditions. Drug and Alcohol Dependence. 2008; 97:139–149.
7. Michels I, Fang Y, ZhaoD, et al. Comparison of drug abuse in Germany and China. Acta Pharmacol Sin 2007;28:1505–1518.
8. Yang X, Xia G. Causes and Consequences of Drug Abuse: A Comparison Between Synthetic Drug and Heroin Users in Urban China. AIDS Educ Prev. 2019;31(1):1-16.
9. Hernández-López C, Farré M, Roset PN, Menoyo E, Pizarro N, et al. 3,4- Methylenedioxyme thamphetamine (ecstasy) and alcohol interactions in humans: Psychomotor performance, subjective effects and pharmacokinetics. J Pharmacol Exp Ther. 2002; 300:236–244.
10. Morales, B. International Society of Substance Use Prevention and Treatment Professionals. [Internet] Current situation of drug abuse and the models of treatment in china. Beijing: Brian Morales. 2015 December – [cited: 2020 Nov]. Available from: https://www.issup.net/node/2352
11. Yi S, Benshu X, Zhiqiang W, et al. An Analysis of 250 MDMA Addicts. Chinese Magazine of Drug Abuse Prevention and Treatment. 2004;5.
12. Pillay VV. Comprehensive Medical Toxicology. 2ed. Hyderabad: Paras Medical Publisher. 2008.p1078.
13. Schechter MD. 'Candyflipping': synergistic discriminative effect of LSD and MDMA. Eur J Pharmacol. 1998;341(2):131–4.
14. Parrott AC. Chronic tolerance to recreational MDMA (3,4-methylenedioxymethampheta mine) or Ecstasy. J Psychopharmacol. 2005;19(1):71-83.
15. Chan WL, Wood DM, Dargan PI. Significant Misuse of Sildenafil in London Nightclubs. Substance Use & Misuse. 2015;50(11):1390-1394.
16. Mansergh G, Shouse RL, Marks G, et al. Methamphetamine and sildenafil (Viagra) use are linked to unprotected receptive and insertive anal sex, respectively, in a sample of men who have sex with men. Sex Transm Infect. 2006;82(2):131-134.
17. Fisher DG, Malow R, Rosenberg R, Reynolds GL, Farrell N, Jaffe A. Recreational Viagra Use and Sexual Risk among Drug Abusing Men. Am J Infect Dis. 2006;2(2):107-114.
18. Breslau K. The 'sextasy' craze. Clubland's dangerous party mix: Viagra and ecstasy. Newsweek. 2002;139(22):30.
19. Schifano F, Oyefeso A, Webb L, Pollard M, Corkery J, Ghodse AH. Review of deaths related to taking ecstasy, England and Wales, 1997–2000. BMJ. (2003) 326:80–1.
20. Althobaiti YS, Sari Y. Alcohol Interactions with Psychostimulants: An Overview of Animal and Human Studies. J Addict Res Ther. 2016;7(3):281.
21. Nelson LS, et al. Goldfrank's Toxicological Emergencies.11 ed. New York: McGraw-Hill; 2006.p.1105-1106.
22. Navarro-Zaragoza J, Ros-Simó C, Milanés MV, Valverde O, Laorden ML. Binge ethanol and MDMA combination exacerbates toxic cardiac effects by inducing cellular stress. PloS one. 2015;10:e0141502.

Table 1: Hospital admission profile for MDMA abusers and case fatality rate (CFR)

S N	Ward	Admissions	Fatalities	CFR
1	MICU	42	6	**13.63%**
2	Psychiatry	34	0	**0%**
	Total	**76**	**6**	**7.9%**

Table 2: Stacking habits pertaining to MDMA consumption obtained from the history of non-lethal cases.

Sl. No.	Non-lethal stacking history	No. of cases
1	MDMA + Alcohol	27
2	MDMA + Alcohol + Cannabis	9
3	MDMA + Cannabis	33
4	MDMA + Sildenafil	1
	Total	70

Table 3: Analysis of all the blood samples screened using Randox^{TM} *Evidence Investigator*

Case	MAMP	AMPH	TRM	THC	OPDS	OPIAT	MDONE	BENZ-I
1	+	+	+	-	+	-	+	-
2	+	+	+	-	-	-	-	-
3	+	+	-	-	-	-	-	-
4	+	+	+	+	-	-	-	+
5	+	+	-	+	-	-	-	-
6	-	+	-	-	+	+	-	-
Total	5	6	3	2	2	1	1	1
%	**83.3**	**100**	**50**	**33.3**	**33.3**	**16.6**	**16.6**	**16.6**

MAMP: Methamphetamine, AMPH: Amphetamine, TRM: Tramadol, THC: Tetra Hydro Cannabinoids (Cannabis metabolite), OPDS: Opioids, OPIAT: Opiates, MDONE: Methadone, BENZ-I: Benzodiazepines

Table 4: Basic statistics pertaining to RFSL reports

Case No.	Viscera sent	Report received	Alcohol detected*	MDMA detected#
1	+	+	+	-
2	+	-	N/A	N/A
3	+	-	N/A	N/A
4	+	-	N/A	N/A
5	+	+	+	+
6	+	+	+	+
Total	6	3	3	2

* Both quantitative and qualitative analysis of alcohol is done by the RFSL. Since there is significant delay in conducting tests, the quantitative data has less significance.
# MDMA is detected either directly or in the form of metabolites: methamphetamines and/or amphetamine.

Table 5: Frequency of each autopsy finding noted in the fatal cases of MDMA stacking

S.N	Autopsy finding	Cases	Percentage
1	Congestion of gastric mucosa	6	100
2	Erosion of superficial layers of gastric mucosa	5	83.33
3	Pulmonary edema	6	100
4	Enlargement of lungs with rib markings	4	66.66%
5	Cerebral edema	6	100%
6	Cerebral congestion with prominent vessels	3	50%
7	Myocardial infarction	2	33.33%