

Use of MDMA and Marijuana among Arrestees in Taiwan - A Survey Based on Laboratory Test of Urine Specimens

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ABSTRACT

2,944 arrestees urine specimens submitted (during the period of September 2000 to February 2001) by law enforcement agencies in three cities and three counties in Taiwan were tested for methylenedioxyamphetamine (MDMA) and delta-9-tetrahydrocannabinol-9-carboxylic acid (THCA) to monitor the use of MDMA and marijuana among the sampled population. Adapted preliminary tests were fluorescence polarization immunoassay (FPIA, TDx) for amphetamine/methamphetamine (cutoff: 500 ng/mL d-amphetamine) and enzyme immunoassay for marijuana metabolites (cutoff: 50 ng/mL delta-9-tetrahydrocannabinol-9-carboxylic acid, THCA). GC/MS tests cutoffs for MDMA and THCA were 500 and 15 ng/mL, respectively.

Among the specimens tested, immunoassay positive rate for amphetamines was 61.7%, while confirmed positive rates for MDMA and THCA were 1.15% and 0.37%, respectively. All positive specimens came from the three cities, with Taipei City leading the positive rates of 2.49% for MDMA and 0.65% for THCA. The corresponding positive rates for specimens from Taichung City and Kaohsiung City were 1.26%, 0.42% and 0.60%, 0.36%, respectively. No specimen was found positive for both MDMA and THCA. All THCA and the majority of MDMA positive specimens (57%) tested negative for methamphetamine, suggesting that the majority of the marijuana and MDMA abuse population are different from those abusing methamphetamine. Results from this survey also indicate that MDMA and marijuana abuse are concentrated in the metropolitan areas of Taiwan.

Key words: drug testing, urine drug testing, MDMA(Ecstasy), marijuana, drug abuse

INTRODUCTION

Marijuana has long been the most popular drug among younger population in U.S. and European countries. Similarly, MDMA (also known as Ecstasy), a relatively new amphetamine "designer drug", has also become popular in Europe and U.S. Both drugs are placed in Schedule I in the U.S. controlled substance list⁽¹⁾. In Taiwan, marijuana and MDMA are classified as schedule 2 controlled drugs under the Statute for Narcotics Hazard Control⁽²⁾ list. There are also indications of increased abuse of these two drugs in recent years. Marijuana seizure (1.7 kg) was reported for the first time in the national drug abuse statistics^(3,4) in 1995. Seized quantities have increased to 74.0 kg in 2000 and 107 kg in 2001. The MDMA seizure (0.07 kg) was first reported later than marijuana, in the 1998 national drug abuse statistics^(3,4); the amount of seizure has since increased more rapidly to 44.7 kg in 2001^(3,4). Episodes of MDMA and marijuana abuse in public places (such as pubs and KTVs) where young people gather, have also been reported^(5,6). Laboratory tests of urine specimens collected by police officers from the youngsters appearing in these places indeed have confirmed the presence of these drugs. Positive findings of these two drugs in urine drug testing have been included in national statistics since 1998^(3,4). MDMA positive urine specimens reported in 1999, 2000, and 2001 were 1, 149 and 979,

respectively. The findings of marijuana cases have been fewer. Naturally, abuse of these drugs has become a concern of government agencies and the public in general.

Statistical information that may provide credible assessment to the extent of MDMA and marijuana abuse is currently lacking. In 1997, 1,585 urine specimens collected from Hualien, Taipei, Taichung and Kaohsiung was screened for marijuana; one positive was found⁽⁷⁾. Since MDMA was not a drug of concern at the time of the study, it was not included in that survey. The United Nations Office for Drug Control and Crime Prevention statistics projected⁽⁸⁾ a 0.5% annual abuse rate of marijuana for Taiwan.

With increasing number of foreign population (e.g., >300,000 foreign laborers) residing in Taiwan and a substantial local population traveling abroad, Taiwan will not be exempted from the abuse of new drugs that have high popularity in other countries. With this in mind, a survey aimed at assessing the trends and abuse rates of new drugs in our society was designed. Since the known positive rates of methamphetamine and morphine of these specimens could be used for direct comparison, this study adapted urine drug testing approach to assess the abuse rates of MDMA and marijuana among a specific population group -- arrestees.

MATERIALS AND METHODS

I. Source of Specimen

Urine specimens routinely submitted to and tested by

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local health bureaus were adapted in this survey to facilitate direct comparisons of positive rates reported for MDMA, marijuana, and methamphetamine. Specimens included for this survey came from three major cities (Taipei, Taichung and Kaohsiung) and three counties (Taichung, Tainan, and Kaohsiung) in the northern, central and southern parts of Taiwan. These specimens represent areas of metropolitan characteristics and their more rural counterparts. A total of 2,944 specimens, approximately 1,000 specimens from each of the northern, central, and southern parts of Taiwan, were included in this survey.

Most specimens were submitted by local police bureaus, while a smaller portion came from regional prosecutors' offices. Specimens included in this study were submitted during the period of September 2000 to February 2001.

II. Testing Methods

The 2,944 specimens submitted for routine amphetamines and opiates testing were screened for amphetamines with fluorescence polarization immunoassay method (TDx) with cut-off value of 500 ng/mL. Since the TDx methodology has significant cross reactivity to MDMA (84% at 1 $\mu\text{g/mL}$ and 21% at 10 $\mu\text{g/mL}$)⁽⁹⁾, this method was used for MDMA screening. These same specimens were screened for the presence of marijuana metabolites using enzyme immunoassay methodology (Beckman or DRI)^(10,11) in three laboratories (cut-off: 50 ng/mL delta-9-tetrahydrocannabinol-9-carboxylic acid, THCA).

Specimens tested positive were then confirmed in three laboratories (located in Taipei, Taichung, and Kaohsiung), using cutoff values of 500 and 15 ng/mL for MDMA and THCA. Confirmatory test procedures for MDMA and THCA included solid-phase extraction and chemical derivatization prior to GC/MS analysis. Two laboratories adapted selected ion monitoring methodologies using HP-5890GC/5972MSD systems (Hewlett-Packard, Palo Alto, Ca). The third laboratory adapted selected ion monitoring methodologies using a Thermal Quest Finnigan voyager-GC 800 Top (Thermo Finnigan, Waltham, Ma). Deuterated MDMA and THCA were used as the internal standards for quantitation. Two laboratories used HFBA (Heptafluorobutyric anhydride) as the derivatizing reagent; ions used for quantitation were m/z 254 for MDMA and m/z 258 for MDMA- d_5 . Other ions used for identification were m/z 162 and m/z 210 for MDMA and m/z 213 for MDMA- d_5 . One laboratory used PFPA (Pentafluoropropionic anhydride) as the derivatizing reagent, ions used for quantitation was m/z 204 for MDMA and m/z 208 for MDMA- d_5 . Other ions used for identification were m/z 162 and m/z 135 for MDMA and m/z 164 for MDMA- d_5 . All three laboratories used MSTFA (N-Methyl-N-(trimethylsilyl)-trifluoroacetamide) as the derivatizing reagent for THCA analysis. The quantitation ions used were m/z 371 for THCA and m/z 380 for THCA- d_9 . Other ions used for identification were m/z 473 and m/z 488 for THCA and m/z 479 for THCA- d_9 . The cut-off values adapted for the confirmatory tests of THCA and MDMA were 15 and 500 ng/mL, respec-

tively. The detection limit ranges for THCA and MDMA reported by the participating laboratories were 5-6 and 80-150 ng/mL, respectively.

III. Quality Control

Quality control samples were included in the GC/MS analysis process. Concentration of control samples used were 0, 200, 600 and 1000 ng/mL for MDMA and 0, 6, 18 and 50 ng/mL for THCA. Acceptable quantitation results of these controls were $\leq 20\%$ variation.

Furthermore, a total of 48 blind quality control samples (BQCs) containing MDMA were prepared at our laboratory and used as external quality control samples. Cerilliant (\pm)MDMA standard was used for the preparation of these BQCs with the targeted concentration act at 900 ng/mL. Immunoassay kits produced by Taiwan Bio-Pharm Inc. were used to validate these BQCs. These BQCs were sent to local health bureaus (or their commissioned hospital testing labs) then transferred into the same type of containers for submission (along with test specimens) to the three testing laboratories.

RESULTS AND DISCUSSION

Among the 2,944 specimens tested, 1,815 were screened positive (TDx Amphetamine/methamphetamine II; cutoff: 500 ng/mL d-amphetamine)⁽¹²⁾ for amphetamines by local health bureaus (Table 1). The number of specimens tested and those screened positive for amphetamines by the health bureaus are shown in the second and the fourth columns of Table 1. The positive rates for the preliminary test of amphetamines ranged from 48% to 74%. 34 were confirmed positive for MDMA and 11 for THCA by GC/MS, corresponding to positive rates of 1.15% and 0.37%, respectively (see the last two column in the last row of Table 1). No specimen was tested positive for both drugs. MDMA concentrations in the 34 positive specimens range from 765 ng/mL to 69,456 ng/mL with a median of 13,291 ng/mL (Figure 1). This concentration is similar to a literature report based on specimens collected from the Ecstasy users in a

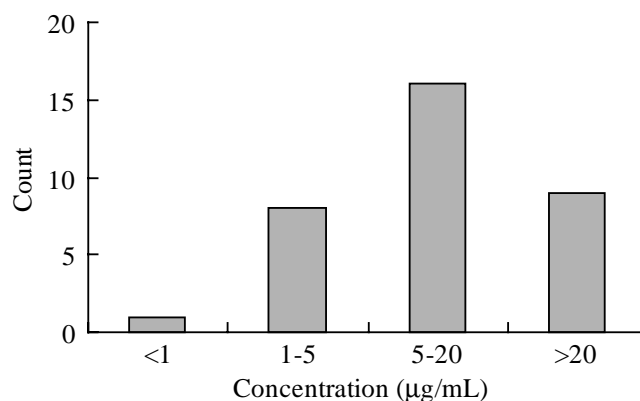


Figure 1. MDMA concentration range of positive specimens.

Switzerland rave party⁽⁶⁾. Additional 3 specimens were found to include MDMA with concentrations lower than the 500 ng/mL cutoff.

All of the 11 specimens screened THCA positive were confirmed by GC/MS to be positive. THCA concentrations range from 30 to 198 ng/mL with a median value of 84 ng/mL (Table 3). No specimen was found to contain THCA but below the 15 ng/mL cutoff concentration.

I. Distribution of Positive Specimens

When further analyzed for the distribution of the positive specimens, all MDMA and marijuana positive specimens were found to come from the three cities and none from the three counties included in this survey (Table 1). Taipei City leads in both the MDMA (2.49%) and marijuana (0.65%) positive rates. The corresponding positive rates are 1.26% and 0.42% for Taichung City and 0.60% and 0.36% for Kaohsiung City. The observed concentration of MDMA use in the metropolitan area is consistent with that reported by Hauschild (of the Interpol), who is responsible for monitoring the trend of MDMA use in the world⁽¹³⁾.

Among the 23 specimens tested positive for MDMA in Taipei City, 10 (43%) were positive for methamphetamine, suggesting the majority of those tested positive for MDMA did not use methamphetamine at the same time. Similarly, the 6 specimens tested positive for MDMA and the 2 specimens tested positive for marijuana in Taichung City were not among the 228 specimens tested positive for methamphetamine.

II. Alarming MDMA Positive Rates

This study represents the first laboratory test-based survey on the abuse of MDMA in Taiwan. The finding hereby presented is consistent with the 1999 epidemiology study conducted by Chou, in which MDMA was reported as the third most popular drugs (after amphetamines and glue) among younger population in Taiwan⁽¹⁴⁾.

The observed MDMA positive rate (2.49%) for Taipei City is alarming. Drugs containing MDMA are believed to come from European countries at this time⁽¹³⁾. As it gains further popularity, local manufacturing may be clandestinely developed. Closer monitoring of MDMA abuse and its illicit manufacturing activities is necessary.

III. Quality Control

The three laboratories conducting the GC/MS analysis have been certified and maintained good standing under the Department of Health's Drug of Abuse Testing Laboratory Certification Guidelines⁽¹⁵⁾. Blanks and open controls were included at least 10% in each analytical batch. Raw data were kept on in respective laboratories with copies sent along with test results to our laboratory at the completion of the project. Quality control results in all batch of analysis were within acceptable range.

Composition of these BQCs, submission rates, and test results are summarized in Table 2. Among the 48 MDMA-containing BQCs only 16 were sent to one of the three laboratories correctly. 15 were screened positive, with the

Table 1. Urine specimens tested by three certified laboratories

Specimen Source	No. of specimen	Sampling period	No. (%) screened positive		No. (%) confirmed positive	
			Amphetamines ^a	Marijuana ^b	MDMA	THCA
Taipei City	923	00/12-01/02	612 (66.3%)	6 (0.65%)	23 (2.49%)	6 (0.65%)
Taichung City	476	00/09-00/12	228 (47.9%)	2 (0.42%)	6 (1.26%)	2 (0.42%)
Taichung County	479	00/09-00/12	354 (73.9%)	0 (0%)	0 (0%)	0 (0%)
Kaohsiung City	839	00/10-01/02	489 (58.3%)	3 (0.36%)	5 (0.60%)	3 (0.36%)
Kaohsiung County/ Tainan County	227	00/10-01/02	132 (58.3%)	0 (0%)	0 (0%)	0 (0%)
Total	2,944	00/09-01/02	1,815 (61.7%)	11 (0.37%)	34 (1.15%)	11 (0.37%)

^a Preliminary tests for amphetamines were conducted by local health bureaus using TDx technology (cutoff: 500 ng/mL d-amphetamine).

^b Preliminary tests for marijuana metabolites were conducted by the three certified laboratories performing the confirmation tests (cutoff: 50 ng/mL THCA).

Table 2. Number of MDMA blind quality control samples and reported test results

	No. Prepared	No. Submitted	Test result	
			Preliminary	Confirmation
Northern area	16	0 ^a	—	—
Central region	16	16	15 positive	15 (mean = 895 ng/mL)
Southern region	16	0 ^a	—	—

^a 16 MDMA-containing BQCs were submitted but not marked as amphetamines positive, thus were not tested for MDMA by the commissioned laboratory.

Table 3. THCA concentrations of positive specimens

No.	1	2	3	4	5	6	7	8	9	10	11
Concentration (ng/mL)	30	115	88	60	43	94	79	91	84	60	198

GC/MS confirmation showing a mean concentration of 894.5 ng/mL. All together, there were 10 agencies or laboratories involved in this study, the first of this nature. A better specimens transmission processing scheme will be established for this kind of study in the future.

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台灣嫌疑犯濫用藥物MDMA及大麻評估 —尿檢陽性率調查

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摘 要

本項調查使用尿液檢體為衛生局於89年9月至90年2月間收驗者，計2944件，包括台北市923件，台中縣市955件、台南縣高雄縣市1,066件。使用免疫學分析方法（FPIA及EIA）初篩及GC/MS方法確認，檢測MDMA及大麻，初篩閾值MDMA為500 ng/mL，及大麻為50 ng/mL。GC/MS方法確認閾值MDMA為500 ng/mL，及大麻代謝物羧基四氫大麻酚為15 ng/mL。

尿液檢體中甲基安非他命陽性1,815件（陽性率61.7%），MDMA 34件（陽性率1.15%），大麻11件（陽性率0.37%）。分析地區性差異顯示台中縣、台南縣、高雄縣檢體均未檢出大麻或MDMA，而陽性檢體均來自台北市、台中市、高雄市都會區，台北市檢體陽性率又較台中市、高雄市為高；以台北市的MDMA 23件（2.49%）及大麻6件（0.65%）最多、台中市MDMA 6件（1.26%）及大麻2件（0.42%）次之，高雄市MDMA 5件（0.60%）及大麻3件（0.36%）再次之，但無檢體同時檢出大麻及MDMA。

台北市檢出安非他命檢體612件，陽性比率高達66%，但檢出MDMA 23件陽性檢體中，同時為安非他命陽性者則僅有10件，佔MDMA陽性檢體43%。台中市檢測出大麻2件及MDMA 6件檢體均為安非他命陰性檢體，推測使用甲基安非他命族群，與使用大麻及MDMA族群有所區隔。

關鍵詞：藥物篩檢，尿液篩檢，MDMA（快樂丸），大麻，藥物濫用