A Comparative Study of Self-Report, Urinalysis and Hair Analysis in the Detection of Methamphetamine in Yaba Users

Anongphan Junkuy MS*,
Apinun Aramrattana MD, PhD**, Pongruk Sribanditmongkol MD, PhD*

** Department of Forensic Medicine, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand*
*** Department of Family Medicine, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand*

Background: *Three diagnostic methods have dominated drug-abuse research: self-report, urinalysis and hair analysis. Previous studies have compared detection rates for various drugs, but none has focused a three-pronged concordance study on the use of methamphetamine (MA).*
Objective: *To determine and compare the rates of MA detection in urine and hair of subjects who reported consuming MA in the form of Yaba.*
Material and Method: *Self-reports of Yaba use, as well as biological specimens for chemical analyses, were collected from paid volunteers participating in a larger project studying risk-taking behavior of young adults in northern Thailand. All subjects in the present study reported using Yaba within 90 days of enrollment. Hair analysis for MA followed a validated protocol that coupled solid phase microextraction (SPME) with gas chromatography-mass spectrometry (GC-MS). Preliminary urinalysis was by means of REMEDi-HS. Positive urine was confirmed for MA by the SPME/GC-MS protocol.*
Results: *The MA detection rate by hair analysis (34.3%, n = 172) was significantly higher than by urinalysis (19.1%, n = 96) ($p<0.01$; McNemar's test). All subjects with MA-positive urine samples reported using Yaba within 30 days of testing, while hair analysis gave positive results for self-reports up to 90 days. Urinalysis showed greater concordance with self-report than hair analysis if testing occurred within seven days of most recent admitted Yaba use. The reverse was true after 14 days. Agreement of laboratory findings with self-reports increased if test results for the two biological matrices were combined. There was no strong agreement between hair analysis and urinalysis for subjects reporting most recent use within 30 days of testing (kappa = 0.131; 95% CI = 0.022-0.240).*
Conclusion: *For the Yaba users in the present study, urinalysis for MA significantly detected more positives than hair analysis if the most recent use reportedly occurred within seven days of testing. Hair analysis yielded better results after an interval of 14 days, with its window of detection extending up to three months. There were no urine positive samples for reported use after 30 days. Combining urinalysis and hair analysis increased the probability of detecting recent MA use. Both urinalysis and hair analysis significantly under-detected MA in the biological samples collected. The combined detection rate was 44.4%. This discrepancy might have resulted from over-reporting of Yaba use due to social/psychological factors and/or insufficient MA consumption causing test results to fall below cutoff levels.*

Keywords: *Yaba abuse, Methamphetamine (MA), Hair analysis, Self-report, Under-detection, Over-report*

J Med Assoc Thai 2014; 97 (7): 776-84
Full text. e-Journal: *http://www.jmatonline.com*

The illicit use of methamphetamine (MA) is a serious problem for Asian countries in general, and for Thailand in particular. In 2000, the United Nations Office for Drug Control and Crime Prevention (UNODC) echoed the Office of the Narcotics Control Board of Thailand in reporting that the "use of methamphetamine already exceeds that of the opiates, the traditional substance of abuse in the region"[1]. During the ensuing decade, UNODC repeatedly confirmed the drug's dominant position[2,3]. In Thailand, MA is usually consumed by smoking an illegally manufactured tablet known as "Yaba" (crazy drug). Chemical analyses of Yaba pills seized by Thai authorities between 2005 and 2006 revealed "active" ingredients of 15 to 30% MA and 60 to 70% caffeine[2]. These figures are in general agreement with assays of Yaba pills seized a few years earlier, although Thai police have reported finding Yaba tablets containing as little as 4% MA[4,5].

MA users self-administer the drug in a variety of ways, but when MA is consumed as Yaba, it usually

Correspondence to:
Sribanditmongkol P, Department of Forensic Medicine, Faculty of Medicine, Chiang Mai University, Chiang Mai 50200, Thailand.
Phone: 053-945-431-4, Fax: 053-945-435
E-mail: psriband@yahoo.com, vpp@cmu.ac.th

is by means of either smoking or oral ingestion. The method of consumption does not affect the drug's ultimate metabolic disposition. MA is rapidly absorbed and converted to amphetamine in the liver. However, certain chemical characteristics of the drug do affect its distribution in the body and its rate of excretion. Because of its basicity (pKA = 10.1), relatively high lipophilicity and low plasma-protein binding (10-20%), MA readily crosses cell membranes and incorporates into hair. Hair normally grows at a rate of 1 cm per month, so that 3 cm of hair collected from the root end may provide a 90-day profile of MA use. Low plasma-protein binding also facilitates urinary excretion, although alkaline urine retards the drug's elimination and acidic urine accelerates it. Typically, urinalysis is considered a reliable means of MA detection during a period ranging from two to four days after ingestion[6-8].

The study of drug abuse requires accurate means of detecting illicit substances in human subjects. Since the mid-1990s, three diagnostic methods have dominated drug-abuse research. They are self-report, urinalysis and hair analysis[9]. As these methods have evolved in accuracy and precision, and as their diagnostic limitations have become better understood, researchers have attempted to compare the detection capabilities of the three techniques for various drugs under various conditions. Despite the widespread abuse of MA, there has been little interest in undertaking correlation studies of MA detection and use[10]. However, a few concordance studies have included MA as a self-reported item and as a target analyte for both hair testing and urinalysis. In these studies, the comparative detection results for MA were inconclusive. Procedures for eliciting the self-reported use of MA were either incapable of accessing the required information, or chemical detection rates for MA were too low to formulate statistically meaningful conclusions[11-15]. To date there has been no reported attempt to focus a three-pronged concordance study of self-report, urinalysis and hair analysis specifically on MA use. To help fill this void, the present study attempted to determine and compare the rate of MA detection in the urine and hair of subjects who reported using MA in the form of Yaba.

Material and Method

Data collection

The present study made use of data derived from self-reports, urinalyses and hair analyses. The self-reports, as well as the biological specimens for chemical analyses, were collected from research volunteers between April 2005 and January 2006, at the time of the subjects' enrollment in the wider research program conducted by Sherman et al[16]. This larger study attempted to evaluate the effects of peer network intervention on the risk-taking behavior of young adult Yaba users in Chiang Mai Province in northern Thailand. Research volunteers completed informed consent procedures and signed consent forms. Research protocols were reviewed and approved by the Institutional Review Board (IRB) of John Hopkins Bloomberg School of Public Health (USA), the Human Experimentation Committee of the Research Institute for Health Sciences of Chiang Mai University, and the IRB of the Ministry of Public Health of Thailand.

Subjects

The Sherman et al enrolled two types of volunteers, an "index" group and a "network" group[16]. The index group consisted of males and females between 18 and 25 years of age who fulfilled three basic requirements, (1) reported using Yaba at least three times during the three months prior to enrollment, (2) reported engaging in sex at least three times during the prior three months, and (3) succeeded in enrolling one member from their sex and/or drug network who belonged to their same age group and who satisfied the index-group requirement for indulging in either sex or Yaba. Details of recruiting the index group were not published, although the authors implied that recruitment relied on contacts established by members of the research team during previous work on MA-related issues in the Chiang Mai region[17]. The index group and the network group both received modest monetary payments for their participation. The present study drew its subjects only from the index group of the larger research project, thereby ensuring that the sample population consisted entirely of admitted Yaba users. Not all index group members were included, as some individuals failed to provide sufficient data on their Yaba use. The final sample (n = 502) represented 97% of the index group.

Self-report

Trained Thai interviewers individually questioned subjects about the history of their Yaba consumption. Subjects were guaranteed anonymity. According to Sherman et al, "the research took place in an unmarked building and the Thai research team worked closely with the police to ensure participant safety. Research was guided by an active community

advisory board to provide advice to ensure respondents safety and trust"[16].

Chemicals

Methamphetamine (MA) hydrochloride was supplied by Alltech (USA). Analytical grade benzaldehyde and acetone were obtained from B.D.H. (UK). Potassium carbonate (K_2CO_3) and methanol were acquired from Fisher Scientific (UK). Hydrochloric acid (HCl) was obtained from Merck (Germany). Proprietary reagents of the REMEDi-HS drug-profiling system (Bio-Rad Laboratories, Germany) were purchased from company suppliers in Bangkok.

Hair analysis

Hair analysis for MA employed an in-house validated protocol that coupled automated solid phase microextraction (SPME) with gas chromatography-mass spectrometry (GC-MS)[18]. Hair specimens were cut from the vertex posterior region of the scalp with root ends marked and kept in a clean plastic bag. Each sample was transected into 3-cm lengths from the root end, approximately corresponding to drug use over the prior three months. The specimens were washed four times by vortexing for one minute. The first three washings were with 5 mL of distilled water and the final washing with 5 mL of acetone. The hair was then dried at 50°C and cut into pieces of approximately 1 mm in length. Twenty milligrams of each hair sample was extracted with 200 µL of 1 M HCl in a closed headspace vial at 60°C for one hour. After cooling to room temperature, 150 µL of benzaldehyde (104 µg/mL) was added to the vial as an internal standard. Next, the extract was pipetted into a new 10 mL vial containing 1,650 µL of 1 M K_2CO_3, making the final volume 2 mL. The vial was then rapidly sealed.

The hair-sample solution was analyzed for MA using a SPME system designated MPS 2 (Gertsel, Germany), in line with a 6890N Series Gas Chromatograph and a 5973 Series Inert Mass Selective Detector (Agilent Technology, USA). SPME extraction was performed at 90°C with 65 µm polydimethylsiloxane/divinylbenzene (PDMS/DVB) fiber (Supelco, USA). GC utilized an HP-5MS column measuring 30 m x 0.25 mm x 0.25 µm (Agilent Technology, USA). The column temperature was held initially at 60°C for two minutes, then gradually increased by 20°C/minute to 250°C, and finally held at 250°C for one minute. The temperature of the injection port was set at 250°C. The splitless injection mode was used (purge flow 60 mL/minute, purge time 0.5 minute). Helium served as the carrier gas at a flow rate of 1.0 mL/min. Quadrupole, ion source and interface temperatures were set at 150, 230, and 280°C, respectively. Retention times for MA and benzaldehyde, the internal standard, were 6.90 minutes and 4.84 minutes, respectively. MS was conducted in the selected ion monitoring (SIM) mode, with the following results: m/z 58, 65, 91 (MA); m/z 77, 105, 106 (benzaldehyde). The underlined ions were used for quantitative assessment and the other two were used as qualifier ions. The MA standardization curve ranged from 0.5-10 ng/mg of hair with the correlation coefficient greater than 0.99. The accuracy and precision of the method were analyzed at concentrations of 1, 2.5, and 5 ng/mg of hair. Accuracy, as expressed in the relative recovery, was 93.50 to 103.50%. Precision, as expressed in the relative standard deviation, was 8.54 to 12.92%. The limit of detection (LOD) and limit of quantitation (LOQ) of MA was 0.3 ng/mg of hair and 0.5 ng/mg of hair, respectively. In the present study, 0.5 ng of MA/mg of hair was used as the cutoff level.

Urinalysis

Urine specimens measuring about 50 mL were collected in clean plastic bottles without preservative and kept at 4°C until analysis. Initial screening for MA was by means of the Rapid Emergency Drug Identification High-Sensitivity (REMEDi-HS) System (Bio-Rad Laboratories, Germany). At the time of specimen collection, REMEDi-HS was a widely used automated drug-profiling system for detecting drugs in urine and other bodily fluids[19,20]. Employing multicolumn extraction, REMEDi-HS coupled high performance liquid chromatography with computerized ultraviolet spectral-scanning detection. In the present study, urinalysis for MA followed the manufacturer's protocols for operating the system. Positive urine was confirmed for MA by SPME-GC-MS, using the same conditions as for hair analysis. The analyte sample was prepared in a 10 mL vial by adding 200 µL of urine to a mixture of 1650 µL of 1 M K_2CO_3 and 150 µL of benzaldehyde (104 µg/mL).

Statistical analysis

MA detection rates in urine and hair were compared using McNemar's test. The percent positive of MA in urine and number of Yaba tablets reportedly consumed were compared using Chi-square test. Agreement between urinalysis, hair analysis and self-report was determined by Kappa statistic.

Results

Hair and urine specimens were collected from 502 subjects between the ages of 18 and 25 years who reported using Yaba at least three times during the previous three months. About 75% of the subjects were male. Duration of Yaba use ranged from less than one month in males and females to 11 years in females and 12 years in males. The average duration of Yaba use was 4.94±2.40 years in males and 3.58±2.11 years in females. The mean time since most recent Yaba use was 15.12±16.14 days in males and 15.40±16.34 days in females (Table 1). Urinalysis for MA was positive in 96 cases (19.1%), with about 93% of this group reporting Yaba use within the previous seven days. All urine positive MA subjects reported using Yaba within the past 30 days. Of the 502 subjects, hair analysis was positive for MA in 172 cases (34.3%). This detection rate was significantly higher than that of urinalysis (p<0.001; McNemar's test). Of the hair positive subjects, 150 cases (87.2%) reported using Yaba within 30 days of testing. Of the 55 subjects who assessed their most recent Yaba use at 30 to 60 days before testing, 15 (27.3%) yielded MA positive hair. In the 60 to 90 day bracket for most recent use, seven of 14 cases (50%) tested positive for MA in hair (Table 2). Unlike urinalysis, which found MA positive samples only in subjects reporting Yaba use within 30 days, hair analysis gave MA positive results for subjects reporting their most recent Yaba use after 30 and 60 days.

In investigating the degree of agreement between laboratory results and self-reports of most recent Yaba use, we found that urinalysis showed greater concordance than hair analysis if the most recent use reportedly occurred within seven days of testing. Within the first three days, the degree of agreement between urinalysis and self-report was about 60 to 70%. The ratio of MA positives for hair analysis and urinalysis within seven days was less than 1 (Table 3). After 14 days, hair testing showed a higher degree of agreement with self-report than urinalysis (p<0.01; McNemar's test). The ratio of hair and urine MA positives was more than 1. Nonetheless, the degree of agreement between hair testing and self-report was less than 50%. However, the concordance of laboratory findings with self-reported use increased for all time intervals if test results for the two biological matrices were combined (Table 3). In the group who reported most recently using Yaba within 30 days of testing, the rate of MA detection in urine significantly increased with self-reports of increased Yaba consumption (Table 4). The MA detection rate in urine was 45% for subjects reporting use intensity of more than 30 tablets in the month before testing. However, there was no

Table 1. Demographic characteristics of subjects

Characteristic	Male (n = 380)	Female (n = 122)
Age (years)		
Mean (± SD)	19.63 (±1.92)	18.97 (±1.41)
Range	18-25	18-24
Duration of reported Yaba use (years)		
Mean (± SD)	4.94 (±2.40)	3.58 (±2.11)
Range	0.08-12	0.08-11
Duration of most recently reported Yaba use (days)		
Mean (± SD)	15.12 (±16.14)	15.40 (±16.34)
Range	1-81	1-87

Table 2. Methamphetamine (MA) detection in urine and hair of subjects reporting different periods of duration for most recent Yaba use

Duration of most recent Yaba use	n	Urine positive MA		Hair positive MA		p-value*
		n	%	n	%	
Less than 30 days	433	96	22.2	150	34.6	0.001
Between 30-60 days	55	0	0	15	27.3	-
More than 60 days	14	0	0	7	50.0	-
Total	502	96	19.1	172	34.3	0.001

* Compared between urine and hair positive results using McNemar's test

corresponding significant increase for hair analysis. The MA detection rate in hair ranged from about 30% for subjects who reported consuming less than three tablets to about 44% for those who reported using more than 30 tablets (Table 4). In addition, 30.5% of the subjects who reported using less than three tablets in the preceding month had MA positive hair specimens compared to only 14.3% with MA positive urine specimens. Although self-reports for use intensity did not greatly influence hair analysis findings for MA, the detection rate in hair was positive for about one third of the subjects. This was not significantly higher than the urine detection rate (Table 4). Self-reported use intensity was also investigated by quantification studies (Fig. 1). Although the median of MA level in hair was highest for the group who reported using more than 30 Yaba tablets within the preceding 30 days, there was no significant difference in the mean of MA concentration among those who reported consuming lesser amounts. In addition, there was no strong agreement between hair and urine results in the group reporting most recent Yaba use within 30 days of testing (kappa = 0.131; 95% CI = 0.022-0.240) (Table 5).

Discussion

Windows of detection

The results of the present study supported previous findings concerning the different windows of detection for urinalysis and hair analysis. A commonly

Table 3. MA detection in urine and hair for various self-reported time intervals of most recent Yaba use

Recent use	Number of subjects	% MA detection			Ratio of hair/urine MA positive
		Urine	Hair	Urine and/or hair	
≤1 day	28	71.4	46.4*	85.7	0.65
≤2 days	86	70.9	45.3**	79.1	0.64
≤3 days	119	61.3	43.7**	73.9	0.71
≤7 days	215	41.4	36.7**	58.1	0.89
≤14 days	325	29.5	35.1**	50.8	1.19
≤30 days	433	22.2	34.6**	46.4	1.56
≤60 days	488	19.7	33.8**	44.3	1.52
≤90 days	502	19.1	34.3**	44.4	1.55

* $p<0.05$, ** $p<0.01$ compared between percent positive of MA in urine and hair using McNemar's test

Table 4. MA detection in urine and hair of subjects reporting different intensities of Yaba use during preceding 30 days

Number of Yaba tablets reportedly consumed	n	Urine positive MA*		Hair positive MA		*p*-value[#]
		n	%	n	%	
<3	105	15	14.3	32	30.5	0.4062
3-10	142	25	17.6	48	33.8	0.2360
11-30	115	24	20.9	39	33.9	0.4129
>30	71	32	45.1	31	43.7	0.8872

* $p<0.01$ compared between percent positive of MA in urine and number of Yaba tablets reportedly consumed using Chi-square test

[#] Compared between percent urine positive and percent hair positive using McNemar's test

Table 5. Analysis of agreement between urine and hair tests in subjects reporting different time intervals for most recent Yaba use

Interval of most recent use	Number of subjects	Kappa	95% CI	*p*-value
1 week	215	0.201	0.066-0.335	0.003
2 weeks	325	0.159	0.046-0.271	0.004
1 month	433	0.131	0.022-0.240	0.004
3 months	502	0.120	0.016-0.224	0.004

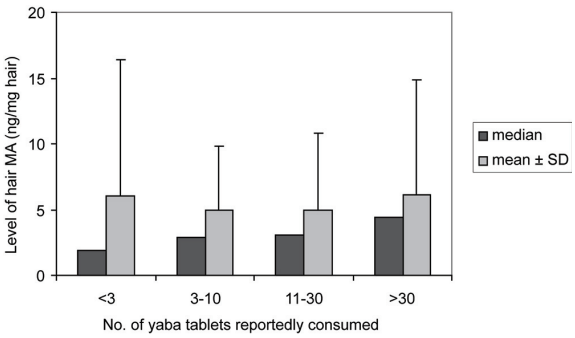

Fig. 1 MA level (median and mean ± SD of positive cases in each group) in hair of subjects reporting different intensities of Yaba use during preceding 30 days (n = 150).

used statistic is that urinalysis is most reliable in detecting drugs consumed within two to four days of testing, while hair analysis has a much longer analytical reach, extending into weeks or months, depending on the length of the hair specimen[8]. In the present study, the vast majority (93%) of urine positive specimens came from subjects who reported consuming Yaba within seven days of testing. If the most recent use reportedly occurred after 30 days, urine assays were negative. In contrast, hair analysis detected positive specimens for subjects who placed their most recent Yaba consumption in the two to three month period prior to testing.

Complementary nature of testing

The present study also supported the belief that hair analysis and urinalysis work well in tandem. To quote Kintz: "For practical purposes, the two tests complement each other. Urinalysis provide[s] short-term information of an individual's drug use, whereas long-term histories are accessible through hair analysis"[8]. Our findings indicated that urinalysis was more reliable than hair analysis in confirming self-reported Yaba use within seven days of testing, but the reverse was true after reported interval of 14 days. These findings strongly suggest that the two tests together provide more accurate chronology of drug use than either one individual. In addition, our study revealed still another aspect of the complementary nature of the two procedures. Even during the 14 days prior to testing, when urinalysis results more closely conformed to self-reported use than hair analysis, our findings indicated that detection rates increased when the results of the two tests were combined. Hair analysis, in effect, detected MA in some individuals who tested negative by urinalysis. Administering the two tests together apparently not only provides a fuller chronology of an individual's drug use but also increases the probability of detecting recent drug use.

Under-reporting, over-reporting, and under-detection

Studies of illicit drug use that compare self-report with laboratory testing often find that subjects under-report their drug consumption to avoid negative consequences. In the present study, complete denial of drug use was not an option. Enrollment in the study, and receiving its monetary rewards, was open only to subjects who admitted using Yaba at least three times during the previous three months. Yet various forms of under-reporting were possible, and Sherman et al, who gathered the self-report data upon which the present study is based, hypothesized that under-reporting may have occurred because their research took place in the wake of a severe crackdown on illicit drugs by the Thai government[16]. Participants, for example, could have under-reported their drug use by affirming recent abstinence from Yaba and declaring that their consumption was limited to the more distant past of two to three months. However, if this had been the case, urinalysis would have found positive results for subjects making such claims. Nevertheless, there were no positive urine results for those who reported deferring Yaba use for more than 30 days. Under-reporting may have occurred, but there is no objective evidence that it undermined the research findings.

A more likely scenario is that subjects over-reported their Yaba consumption. The self-report for MA use was 100%, but the combined detection rate of urinalysis and hair analysis was only 44.4%. Some degree of this discordance may have resulted from various technical issues, such as metabolic idiosyncrasy, melanin content and hygienic/cosmetic treatment of hair[7], but the size of the discrepancy suggests a reliability problem with the self-report data itself. Even if Yaba users were completely honest and had accurate long-term recall of their activities, their self-reports of drug use would still be inherently problematical, partly because the MA content of any given Yaba tablet is unknown. Yaba tablets generally contain 15 to 30% MA, but reported assays of MA purity have been as low as 4%[3-5]. It was possible that some self-reported Yaba users consumed tablets containing no MA at all. Such a situation would have led to unintentional over-reporting. Furthermore, the

communal nature of Yaba smoking renders estimates of individual consumption uncertain. A subject could have honestly reported smoking Yaba even if his or her participation had been extremely minimal. The dosage of MA consumed might have been so low that test results would have fallen below cutoff levels, resulting in analytical under-detection.

Incentives existed, however, for intentional over-reporting. According to research among North American young adults (18-25 years of age), a strong predictor for over-reporting marijuana use was belonging to a network of friends who used marijuana[21]. Having a Yaba-using friend was one factor that helped make a subject eligible for the present study. Previous research found that 29% of the students (n = 1,725) attending three vocational colleges in northern Thailand reported using MA in the form of Yaba[22]. This finding lends credence to the assertion by Sherman et al[17] that young Thai adults in the Chiang Mai region lived in a social environment in which Yaba use was considered normative. In the same study[17], Sherman et al found that all Yaba users (n = 48) were introduced to the drug by friends or close acquaintances. If peer pressure so strongly encouraged actual Yaba use, it may also have encouraged over-reporting. It is also possible that subjects falsely reported Yaba use simply to receive the monetary payment that accompanied participation in the study. Consequently, our findings of MA under-detection by chemical analyses should be evaluated in the light of potential over-reporting of Yaba use by study participants.

Conclusion

For the reported Yaba users in the present study, urinalysis for MA had a significantly better detection rate than hair analysis if the most recent use reportedly occurred within seven days of testing. Hair analysis yielded better results after an interval of 14 days, with its window of detection extending up to three months. There were no urine positive samples for reported use after 30 days. Combining urinalysis and hair analysis increased the probability of detecting recent MA use. Both urinalysis and hair analysis significantly under-detected MA in the biological samples collected. The combined detection rate was 44.4%. This discrepancy may have resulted from over-reporting of Yaba use due to social/psychological factors and/or it may have resulted from laboratory under-detection because insufficient MA consumption, caused test results to fall below cutoff levels.

What is already known on this topic?

Previous researchers have determined that urinalysis and hair analysis often are complementary methods of drug detection; the former displays greater reliability in detecting recent drug use while the latter is more useful for compiling longer-term histories. Prior research has also found that users of illicit drugs typically under-report their drug consumption to avoid negative consequences.

What this study adds?

This study is the first to compare the reliability of self-report, urinalysis and hair analysis in assaying methamphetamine use in a sizeable population (n = 502). While the study confirmed prior findings regarding differing windows of detection for hair analysis and urinalysis, it presented new evidence that combining the two methods increased detection rates for even recent drug consumption. By analyzing the congruence of self-report, urinalysis and hair analysis data, the study also called attention to two often-neglected topics, (1) intentional over-reporting of drug use by study subjects, and (2) analytical under-detection caused by potential low purity in illicit drugs and/or low dosage consumption resulting from the method of ingestion.

Acknowledgement

The authors would like to express our appreciation to David D Celentano from Johns Hopkins University Bloomberg School of Public Health, Baltimore for his funding support. The assistance of Bangorn Sirirojn and Susan Sherman is appreciated, as is the help of Jeffrey Hess, who served as English language editor. The authors also wish to thank Mrs. Rochana Phuackchantuck from the Research Department of the Faculty of Medicine, Chiang Mai University, for her advice concerning statistics. The authors have no conflict of interest to report.

Funding source

This project was supported by a grant from the U.S. National Institutes of Health (1 R01 DA14702 to David D Celentano, Johns Hopkins University Bloomberg School of Public Health, Baltimore, Maryland.

Potential conflicts of interest

None.

References

1. United Nations Office on Drugs and Crime (UNODC). The extent of drug abuse. In: UNODC World drug report 2000. Oxford: Oxford University Press; 2000: 69-79.
2. United Nations Office on Drugs and Crime (UNODC). Thailand. In: Patterns and trends of amphetamine-type stimulants (ATS) and other drugs of abuse in East Asia and the Pacific 2006. Bangkok: UNODC Regional Centre for Asia and the Pacific; 2007: 121-8.
3. United Nations Office on Drugs and Crime (UNODC). Amphetamine-type stimulants. In: UNODC World drug report 2010. Vienna: UNODC; 2010: 292-6.
4. Adam P, Natakankikul S, Sirithunyalug J, Aramrattana A. Physico-chemical profiles of methamphetamine tablets. Chiang Mai University Journal 2005; 4: 65-70.
5. Office of the Narcotics Control Board. ATS situation of Thailand. SMART Programme. Bangkok: United Nations Office on Drugs and Crime (UNODC); 2009.
6. Huestis MA, Cone EJ. Methamphetamine disposition in oral fluid, plasma, and urine. Ann N Y Acad Sci 2007; 1098: 104-21.
7. Pragst F, Balikova MA. State of the art in hair analysis for detection of drug and alcohol abuse. Clin Chim Acta 2006; 370: 17-49.
8. Kintz P. Value of the concept of minimal detectable dosage in human hair. Forensic Sci Int 2012; 218: 28-30.
9. Harrison L, Hughes A, editors. The validity of self-reported drug use: improving the accuracy of survey estimates. Proceedings of a meeting September 8-9, 1994. NIDA Res Monogr 1997; 167: 1-497.
10. Han E, Paulus MP, Wittmann M, Chung H, Song JM. Hair analysis and self-report of methamphetamine use by methamphetamine dependent individuals. J Chromatogr B Analyt Technol Biomed Life Sci 2011; 879: 541-7.
11. Cook RF, Bernstein AD, Andrews CM. Assessing drug use in the workplace: a comparison of self-report, urinalysis, and hair analysis. NIDA Res Monogr 1997; 167: 247-72.
12. Mieczkowski T, Newel R, Wraight B. Using hair analysis, urinalysis, and self-reports to estimate drug use in a sample of detained juveniles. Subst Use Misuse 1998; 33: 1547-67.
13. Mahl MA, Hirsch M, Sugg U. Verification of the drug history given by potential blood donors: results of drug screening that combines hair and urine analysis. Transfusion 2000; 40: 637-41.
14. Musshoff F, Driever F, Lachenmeier K, Lachenmeier DW, Banger M, Madea B. Results of hair analyses for drugs of abuse and comparison with self-reports and urine tests. Forensic Sci Int 2006; 156: 118-23.
15. Harrison LD, Martin SS, Enev T, Harrington D. Amphetamines. In: Harrison LD, Martin SS, Enev T, Harrington D, editors. Comparing drug testing and self-report of drug use among youths and young adults in the general population. Rockville, MD: Department Of Mental Health And Human Services; 2007: 95-9.
16. Sherman SG, Sutcliffe C, Srirojn B, Latkin CA, Aramratanna A, Celentano DD. Evaluation of a peer network intervention trial among young methamphetamine users in Chiang Mai, Thailand. Soc Sci Med 2009; 68: 69-79.
17. Sherman SG, German D, Sririojn B, Thompson N, Aramrattana A, Celentano DD. Initiation of methamphetamine use among young Thai drug users: a qualitative study. J Adolesc Health 2008; 42: 36-42.
18. Junkuy A, Pengwong M, Aramrattana A, Celentano D, Sribanditmongkol P. Validation and application of hair analysis for the detection of methamphetamine in Thai young adults. Asian Biomedicine. In press 2014.
19. Ohtsuji M, Lai JS, Binder SR, Kondo T, Takayasu T, Ohshima T. Use of REMEDi HS in emergency toxicology for a rapid estimate of drug concentrations in urine, serum, and gastric samples. J Forensic Sci 1996; 41: 881-6.
20. Lynch KL, Breaud AR, Vandenberghe H, Wu AH, Clarke W. Performance evaluation of three liquid chromatography mass spectrometry methods for broad spectrum drug screening. Clin Chim Acta 2010; 411: 1474-81.
21. Harrison LD, Martin SS, Enev T, Harrington D. Marijuana. In: Harrison LD, Martin SS, Enev T, Harrington D, editors. Comparing drug testing and self-report of drug use among youths and young adults in the general population. Rockville, MD: Department Of Mental Health And Human Services; 2007: 59-81.
22. Sattah MV, Supawitkul S, Dondero TJ, Kilmarx PH, Young NL, Mastro TD, et al. Prevalence of and risk factors for methamphetamine use in northern Thai youth: results of an audio-computer-assisted self-interviewing survey with urine testing. Addiction 2002; 97: 801-8.

เปรียบเทียบการตรวจพบเมทแอมเฟตามีนในปัสสาวะและในเส้นผมจากผู้ที่ยอมรับว่าเสพยาบ้า

อนงพันธ์ จันทร์กุย, อภินันท์ อร่ามรัตน์, พงษ์รักษ์ ศรีบัณฑิตมงคล

ภูมิหลัง: *การวินิจฉัยการเสพสารเสพติดที่ใช้กันอยู่เป็นหลัก มี 3 วิธีคือ การยอมรับว่าเสพ การตรวจสารเสพติดในปัสสาวะ และการตรวจสารเสพติดในเส้นผม มีการศึกษาเปรียบเทียบการตรวจพบสารเสพติดชนิดอื่น ๆ โดยทั้ง 3 วิธีนี้พร้อม ๆ กัน แต่ยังไม่มีการเปรียบเทียบการตรวจเมทแอมเฟตามีนในปัสสาวะ เส้นผม กับประวัติการยอมรับว่าเสพยาบ้า*

วัตถุประสงค์: *เปรียบเทียบอัตราการตรวจพบเมทแอมเฟตามีนในปัสสาวะ กับในเส้นผม จากผู้ที่ยอมรับว่าเสพยาบ้ามา*

วัสดุและวิธีการ: *เก็บประวัติการเสพยาบ้า ปัสสาวะ และเส้นผม จากอาสาสมัครที่ร่วมในโครงการศึกษาพฤติกรรมเสี่ยงในเยาวชนภาคเหนือของไทย อาสาสมัครทุกคนยอมรับว่ามีการเสพยาบ้ามาภายใน 90 วัน เก็บเส้นผมจากหนังศีรษะด้านหลัง นำมาตรวจหาเมทแอมเฟตามีน ด้วยวิธี solid phase microextraction (SPME) gas chromatography-mass spectrometry (GC-MS) ตรวจคัดกรองหาเมทแอมเฟตามีนในปัสสาวะด้วยเครื่อง REMEDI-HS และทำการตรวจยืนยันด้วย SPME/GC-MS*

ผลการศึกษา: *จากอาสาสมัคร 502 คน ที่ยอมรับว่าเสพยาบ้ามาอย่างน้อย 3 ครั้ง ในช่วง 90 วันที่ผ่านมา ตรวจพบเมทแอมเฟตามีนในเส้นผมร้อยละ 34.3 ซึ่งสูงกว่าที่ตรวจพบในปัสสาวะ (ร้อยละ 19.1) อย่างมีนัยสำคัญทางสถิติ ($p<0.01$, McNemar's test) สามารถตรวจพบเมทแอมเฟตามีนในปัสสาวะในกลุ่มที่ยอมรับว่าเสพยาบ้าครั้งสุดท้ายในช่วง 30 วันที่ผ่านมา ขณะที่เมทแอมเฟตามีนตรวจพบในเส้นผมได้ในกลุ่มที่ยอมรับว่าเสพยาบ้าครั้งสุดท้ายอยู่ในช่วง 90 วัน การตรวจพบเมทแอมเฟตามีนในปัสสาวะสอดคล้องกับการยอมรับว่าเสพยาบ้าในช่วง 7 วันที่ผ่านมา แต่หากประวัติการเสพยาบ้าครั้งสุดท้ายนานกว่า 14 วันขึ้นไป การตรวจในเส้นผมจะมีความสอดคล้องกับประวัติการเสพมากกว่าการตรวจในปัสสาวะ หากทำการตรวจเมทแอมเฟตามีนทั้งในเส้นผมและปัสสาวะร่วมกันจะสัมพันธ์กับประวัติการยอมรับว่าเสพยาบ้ามากขึ้น การศึกษานี้ไม่พบความสัมพันธ์ระหว่างผลการตรวจพบเมทแอมเฟตามีนในเส้นผมกับในปัสสาวะ ในกลุ่มที่ยอมรับว่าเสพยาบ้ามาในช่วง 30 วัน (kappa = 0.131; 95% CI = 0.022-0.240)*

สรุป: *อัตราการตรวจพบเมทแอมเฟตามีนในปัสสาวะสูงกว่าในเส้นผมในผู้ที่ยอมรับว่าเสพยาบ้ามาในช่วง 7 วัน ในกรณีที่เสพยาบ้ามาเกินกว่า 14 วัน โอกาสที่ตรวจพบเมทแอมเฟตามีนในเส้นผมสูงกว่าในปัสสาวะ การตรวจพบเมทแอมเฟตามีนในเส้นผมอาจพบได้นานถึง 3 เดือนหลังการเสพครั้งสุดท้าย ในผู้ที่ยอมรับว่าเสพยาบ้ามานานกว่า 30 วันนั้น จะตรวจไม่พบเมทแอมเฟตามีนในปัสสาวะเลย การตรวจหาเมทแอมเฟตามีนทั้งในปัสสาวะและเส้นผมร่วมกันช่วยเพิ่มโอกาสในการตรวจยืนยันการเสพยาบ้ามา อัตราการตรวจพบเมทแอมเฟตามีนทั้งในปัสสาวะและในเส้นผมต่ำกว่าการยอมรับว่าเสพยาบ้ามา แม้ว่าทำการตรวจทั้งในปัสสาวะและเส้นผมร่วมกันจะตรวจพบเมทแอมเฟตามีนได้เพียงร้อยละ 44.4 ของผู้ที่ยอมรับว่าเสพยาบ้ามา ทั้งนี้อาจเกิดจากการรายงานเกินจริงของกลุ่มตัวอย่างที่ทำการศึกษาหรือจากการเสพยาบ้าในปริมาณที่ต่ำกว่าที่จะตรวจได้ด้วยวิธีการนี้*