RELIABILITY OF CHEMICAL IDENTIFICATION FOR LAW ENFORCEMENT AGENCIES: A FORENSIC PERSPECTIVE

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ABSTRACT

It is now greatly understood and believed that drugs are related to crimes in multiple ways. Just as direct use, possession, manufacture, or distribution of drugs constitutes crime, the same having a potential for abuse has nevertheless a direct effect on the user's behaviour along with generation of violence and other illegal activity in connection with drug trafficking. With an ever increasing menace of substance abuse among the population, the present study is therefore aimed to introduce forensic toxicology's role in the analysis. Forensic analysis of drugs can, not only yield the general composition and percentage of the illicit substance, but also help in establishing eventual links (Of physical and chemical nature) between different samples. In the long run the analysis may help the investigators to pursue legal action against individual (s) suspected of a drug related crimes where the challenging goal is to determine the identity of the illegal drug for its constituents. It is only by virtue of the results of the analysis that make law enforcement agencies pursue criminal charges against the offenders and accordingly the courts to determine the appropriate sentencing.

KEYWORDS

Death, Drugs of Abuse, Crime, Tests, Forensic Toxicology.


INTRODUCTION

Sooner or later the inception of human race, the birth mark of drug abuse has started. In simpler words drug abuse equals the history of mankind on this planet as for as time period of both is taken into account. More often proper/prescribed drug usage does not constitute an evil for these may have medical blessings for treating many of the diseases. However once a dependence on these items is felt it then becomes a phenomenon of drug abuse which have great repercussions on the society to which an addict belongs.[1] However, over the past few decades, the use of illegal drugs has spread at an unprecedented rate and has reached every part of the world in epidemic conditions affecting all the spheres. According to 2005 report published by United Nations Office on Drugs and Crime (UNODC), some 200 million people, or 5 percent of the total world's population aged 15 - 64 have used drugs at least once in the last 12 months, a whopping implication of 15 million people more than the 2004 estimate. Another report of UNODC published in 2009 estimated that 149 to 272 million people (About 3.3% to 6.1%) of the population aged 15-64 used illicit substances at least once in the preceding year. About half those numbers are estimated to have been current drug users that are, having used illicit drugs at least once during the past month prior to the date of assessment. While the total number of illicit drug users has increased since the late 1990s, the prevalence rates have remained largely stable, as has the number of problem drug users which is estimated at between 15 and 39 million. It simply suggests that no nation has been immune to the devastating effects of drug abuse.[2,3]

In order to call a drug illegal the essentiality lies in its consequences of conquering a subject where addiction, habitation or a marked change in consciousness are its common elements. Other feature of illegal drugs is their limited or no medical use and is accordingly listed in the controlled substances act.[4] Forensic analysis of drugs may help the investigators to pursue legal action against individual (s) suspected of a drug related crimes where the challenging goal is to determine the identity of the illegal drug for its constituents. It is only by virtue of the results of the analysis that make law enforcement agencies pursue criminal charges against the offenders and accordingly the court to determine appropriate sentencing. Forensic toxicology a specialized branch of toxicology primarily focuses on the medico-legal and non-medical aspects of the harmful effects of chemicals and poisons on the human body. In order to divide the labour among toxicologist's three major sub disciplines of forensic toxicology were created which comprise human performance testing in the workplace, post-mortem, and forensic drug testing. Each of the divisions has an essential role to play for the work involves cases related to criminal justice delivery system. Work area of the above mentioned three disciplines is targeted in such a way wherein human performance testing is focused to study the mental or physical effects of drugs that may impair judgment or coordination; post-mortem toxicology is directed to toxicological analysis in death related circumstances for the determination of the cause of death. Likewise, forensic drug testing is used most often in the workplace, the military, and the emergency department. In short, toxicological analyses of forensic autopsies form an indispensable part not only in the diagnosis of the cause of death, but also in the detection of illicit drugs thereby help in investigating the background of unnatural deaths which include homicide, suicide and accidental casualties, as well as unexpected sudden deaths.[5-7]
Consequences of Drug Abuse

Illicit drug abuse habit conquers an individual to a Drug addiction level that is characterized by a chronic, relapsing disease and a compelled urge for use of the desired product despite its known harmful consequences on him/her including neuro-chemical and molecular changes in the brain. Apart from these health consequences of drug abuse, roughly 2.8 million people are HIV positive by injecting drugs, an estimate of nearly one in five HIV injecting drug users. It has been observed that the consequences of excessive drug usage either acute or chronic result in death due to direct toxicity of the drug alone or its metabolite. Death can also be caused by a variety of indirect effects of drug abuse which include transmission or sharing mode of injectables that transfer infectious diseases, by way of suicides due to depression affecting the brain. Liver disease is also likely to account for considerable numbers of deaths among drug users, mainly due to Hepatitis C Virus (HCV) infection, and often worsened by heavy alcohol use. At a global level Hepatitis C prevalence among injecting drug users is estimated to be 50 percent implying a worldwide infection among 8.0 million injecting drug users by Hepatitis C Virus. However illicit drug related death statistics suggest the occurrence of 104,000 to 263,000 deaths each year that is equivalent to a range of 23.1 to 58.7 deaths per one million inhabitants per year. Over half of the deaths are estimated to be fatal overdose cases which requires further analysis for the appropriate cause of death.

Need of the Testing

The consequences of the drug abuse are numerous wherein medical, social, and legal problems arise. The trade in illegal drug has created a global black market economy that had put the public at a greater risk, not just from the substances that are distributed but from the crimes subsequently committed thereafter by all the stake holders which include users, traffickers and manufacturers. These crimes range from burglary, assault, fraud, and serious ones like homicide, abduction and human trafficking. Nowadays mass media reports suggest that prescription drug abuse has surpassed the illegal drugs as agents of lethal drug toxicity as well as deaths caused by illicit overdose in celebrities in recent past has added new dimensions to the already faced challenges. Therefore, testing of abused drugs is needed and it constitutes an important task in forensic toxicology and the related fields. It is generally performed either to confirm an acute drug effect (e.g. in drugged driving) or to monitor drug abstinence (e.g., in workplace drug testing). Drug analysis not only shall be able to determine the general composition and the percentage of the illicit substance, but can also aid in establishing eventual links (Of physical and chemical nature) between different samples. Therefore, forensic based studies in such like cases are vehemently sought particularly when a huge burden of case pendency lies in the courts of law. Forensic analysis of pharmaceutical preparations may also distinguish counterfeit medicines which are nowadays in great shares in the markets. Forensic analysis of drugs may help the investigators to pursue legal action against individual (s) suspected of a drug related crimes where the challenging goal is to determine the identity of the illegal drug for its constituents. Characterization of the samples can possibly differentiate a certain number of them and furthermore to classify them into groups in turn will allow identifying the source of production. The statistical interpretation of the results can be used to estimate the longevity of the production as well as help to know the extent of illicit drug distribution. This type of intelligent visualization can thus help in devising a strategic approach for dealing with illicit drugs market. Another approach that may appear very useful in criminal investigations aimed at searching illicit drug production and distribution is Drug Profiling. The approach is based on physical and chemical characterization of seized samples of drugs. Profiling can serve as a tool to relate different street drug seizures to a common source, to determine the origin of drug manufactured from natural sources or synthetic routes for synthetic drugs and to identify additives or impurities found in illicit drugs which may cause public health risks because of their inherent chemical or biological hazards. The above mentioned strategies can only be beneficial if toxicological laboratories are equipped with modern analytical gadgets. By virtue of the results of the analysis law enforcement agencies may be able to pursue criminal charges against the offenders and accordingly the court to determine the appropriate sentencing.

Biological Matrices used for Drug Detection

As already mentioned, that drug abuse is associated with numerous medical, social, and legal problems where forensic testing has a decisive role to play. In order to confirm the presence of relevant drugs of abuse in an individual, blood, urine and hair are most commonly used as biological matrices for the testing. Nowadays oral fluid (Saliva) as a testing matrix has become important tool in allowing on-site sample collection using dedicated collection devices for abused drug confirmation. In addition, sweat can also be used as a testing matrix.

Drug Detection

A two-step process of testing made globally a standard drug analysis process is employed for the detection of common drugs of abuse, irrespective of whether a case is in a clinical, forensic, sport, or workplace setting. The first step involves a systematic screening test followed by a confirmatory analysis test for the final determination of identity. Initially screening of samples is made to clear the doubts of suspicion for the detection a drug of abuse and is called as presumptive test, but is prone to certain downfalls. However, the screening tests for medical applications are directly needed and used for medical evaluation just for the beneficial use. The screening procedure for legal purposes eliminates all the negatives and positive results and is thus regarded as a presumptive test. The purpose of employing screening methods is to enable rapid routine analysis of multiple samples. Commonly employed presumptive tests include immunoassays which are not definitive and are subject to high rates of false negatives or false positives due to cross-reactivity or adulterants in the samples tested. Essentially immunoassays detect a range of (but not all) structurally related substances in one analytical process where the antibodies react with a more or less large number of structurally related substances or metabolites. Conformational analysis requires other methods/tests like chromatography or spectroscopy or the coupled ones for the accurate detection of drugs. Chromatographic techniques like liquid chromatography and gas chromatography/mass spectrometry) require sample preparation along with an extraction protocol followed by the detection of compound. Nuclear magnetic resonance (NMR) spectroscopy is another powerful technique that is also used for the detection of drugs...
of abuse. In order to improve the performance of the results it is advisable to use synergistic techniques for routine use for the analysis of drugs particularly in bio fluids. Liquid chromatography- nuclear magnetic resonance- mass spectrometry (LC-NMR-MS) is a hyphenated technique in which the rapid and ultra-sensitive screening capability of MS or the advanced information content of real-time MS/MS could be used to identify the peaks of interest in a complex mixture.[10-13]

**Quantitative Analysis**

Quantitative analysis of a drug is primarily focused to determine its concentration in the whole material, whereas impurity profiling determination involves the comparative analysis of minor components in the abused drugs and therefore an entirely separate sampling protocol is needed. It has been observed that sampling for quantitative analysis is strongly influenced by two factors: the distribution (Spatial) heterogeneity and the particle size of the original material. Therefore all the way the basic goal in sampling criteria for quantitative analysis is to maintain the average concentration of the drug in the material from its original seized state.[14,15]

**DISCUSSION AND CONCLUSION**

As the abuse of drugs in a society has dramatically increased its association with crime has therefore remained a debatable. Most often deaths due to drug abuse are grossly underestimated because of inadequate toxicological facilities. Owing to these inadequacies most of the crimes go undetected. It is not uncommon these days to hear reports of celebrities using a new type of drug, or sensationalized reports of other potent substances leading to extraordinary events. Emerging trends in drug usage and distribution claims had awaken the society, law enforcement agencies and the courts with panic and sensations. It is vehemently desirable to react with a reasoned and sophisticated toxicological analytical approach. The same very objective can be achieved by the establishment of sophisticated toxicological laboratories equipped with modern analytical gadgets.[14] Furthermore death related statistics by illicit drug usage (Mentioned in consequences of drug usage) clearly suggest that there is crucial need to develop and improve analytical methods to identify such drugs. Possibly the virtue will help in deciding the appropriate cause of death as well as a tool for law enforcement agencies to make them proficient for pursuing criminal charges against the offenders and accordingly the courts of law to disseminate justice by determining the appropriate sentencing.[17] Additionally laboratory results/reports form a power house of information both in technical and statistical perspectives that may help immensely in identifying new potential threats, health hazards, social and economic ramifications related to drugs, or new variants of drugs, manufacturing methods, new sources of drugs, availability, purity, cutting agents, new products and drug combinations.[18]

**ACKNOWLEDGEMENT**

The senior author (Sami Ullah) is thankful to UGC for providing financial assistance. Special and sincerely gracious thanks are due to Dr. Rakesh Kumar Garg, Professor & formed Head Department of Forensic Science Punjabi University Patiala for being an instrumental in providing informative knowledge and enlightening valuable suggestions. Mr. Hamid Ali Banday Dy. SP 12th Bn IRP is greatly acknowledged for his untiring cooperation in providing the literature.

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