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Drug detection tests and the important factors and effects of the development of addiction

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ABSTRACT

Drug addiction is a serious issue. A lot of psychopathic drugs are in use, but mainly methamphetamine. Addiction is a problem not only for the addicted person but also affected family and the entire society. Addicted persons lose control of their actions and so commit different crimes such as stealing, raping and killing. They may end up committing suicide. In this review article, we analyze the causes of addiction, absorption of methamphetamine into the body, its effects on cells and the analytical tool to detect the chemicals.

1. Introduction

The misuse of methamphetamine is now a global health problem. The euphoric effects of this highly addictive substance are comparable to those of cocaine and other stimulants. Sniffing, snorting and smoking are all methods of ingesting marijuana, which may have both short- and long-term health repercussions on those who are addicted. In recent years, the usage of precursor chemicals, including methylamine, ephedrine and pseudoephedrine, and the infrastructure needed to manufacture methamphetamine have skyrocketed, contributing to a spike in the drug's misuse (Richards and Laurin, 2021). Healthy brain activity is supported by the presence of three key neurotransmitters such as, dopamine, serotonin and norepinephrine. Neurotransmitters such as dopamine are overproduced and transported into synapses cavities in the mind upon methamphetamine use. Methamphetamine also prevents the reserve cells from absorbing dopamine. Toxicological tests rely on the presence of methamphetamine and isomer forms in the blood circulation (Shah et al., 2013). In this review, we outline the effect of sleep on drug use, family problem associated drug abuse, social networks in drug abuse, preclinical models of drug abusers, oxidative stress were discussed in this review. Furthermore, this review discusses the advantages of monoclonal antibodies over the polyclonal antibodies used against illicit drugs. We discussed the application of metabolomics in forensic field, biological evidence, factors influencing post-mortem protein degradation.

2. The effect of sleep on adolescents' likelihood of increased drug use

In the stage of puberty, the stage of delayed sleep begins and continues until adolescents reach the age of 20 years, after which they begin to try to sleep early until the end of their life (Randler, 2008; Roenneberg et al., 2004). Many adolescents suffer from sleep disorders due to social, recreational and academic stresses. Sleep disorders cause many exacerbating problems, including severe depression, which negatively affected the lives of adolescents and increase the chances of drug addiction (McKnight-Eily et al., 2011). The normal sleeping hours to meet the needs of refreshment for adolescents is 8 to 10 h a day, but analyses indicate

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that 71% of secondary school students sleep less than 8 h and 44% of secondary school students sleep less than 6 h in a day (Basch et al., 2014). Inadequate sleep disturbances in daily life and adolescents who suffer from lack of sleep are frequently exposed to consumption of prohibited substances such as caffeine, nicotine, alcohol and illegal drugs (Sivertsen et al., 2015), engage in risky behaviours including driving under the influence of alcohol which may cause accidents, and experience emotional and psychological problems that may lead to suicide attempts (McKnight-Eily et al., 2011; Thomas et al., 2015; Wheaton et al., 2016).

Studies conducted on adolescents indicate that short sleep and excessive sleep at the end of the week may pose a great risk of drug and alcohol abuse in the future (Pasch et al., 2012; Roberts et al., 2011). Studies conducted on 12,154 adolescents in American secondary schools indicated that lack of sleep among adolescents in the evening is linked to increased drug use (Johansson et al., 2016). Hasler et al. (2015) found that 63% of adolescents who sleep less than 8 h daily are more likely to be involved in drug abuse.

3. The effect of family problems on maternal drug abuse

Roenneberg et al. (2004) have been found that men are more exposed to illegal substances than women, but women have greater and more dangerous clinical outcomes than men due to several psychological, and behavioural differences than men and independent factors such as, pregnancy and parenthood (Randler, 2008). The involvement of mothers in drug abuse makes them more vulnerable to family violence and other problems and less socially supportive (McKnight-Eily et al., 2011; Basch et al., 2014). A study on 150 mothers has been exposed to violence from an intimate partner revealed that they were less attached to their children and were more likely to abuse drugs (Thomas et al., 2015). This may be because mothers who suffer from domestic violence have increased negative emotional states, which negatively affects their relationship with their children and with society in general and raises their risk of drug abuse and addiction (Wheaton et al., 2016).

4. The role of social networks in drug abuse

Social networks have a significant role in drug circulation, as they enable drug dealers and users to access one another without exposing their identities by using an electronic wallet to pay for these banned products (Randler, 2008). Social networks use unregulated means of payment, so users and addicts can easily purchase drugs at very low prices and without the risk of prosecution. For example, cannabis is a narcotic drug with an ancient history of abuse. With the advancement of technologies and with the ubiquitousness of social networks, it has become very easy to sell by highlighting its herbal qualities under pseudonyms in order to promote the product in international level (Roenneberg et al., 2004; McKnight-Eily et al., 2011; Basch et al., 2014). Approximately 111 countries reported the occurrence of illegal drugs from 2008 to 2017 and are very dangerous to promote narcotics using social networks (Sivertsen et al., 2015; McKnight-Eily et al., 2011). The available legal actions failed to detect or remove narcotics in various countries (Thomas et al., 2015; Wheaton et al., 2016). The problem is exacerbated by the existence of applications dedicated to the promotion and sale of drugs (Pasch et al., 2012; Roberts et al., 2009).

5. The effect of isolation and social interaction

Isolation and loneliness have detrimental effects on the mind and body and thus, induce drug abuse (Randler, 2008). Most drug users suffer from social isolation, which entices them to use drugs further until they become addicted to them. According to McKnight-Eily et al. (2011), isolation is one of the most important contributions in drug abuse. Social interaction plays a very important role in reducing the risk of drug abuse. The increased positive approach reduced the drug use among individuals (Basch et al., 2014). However social interaction between few sections of drug addicts promoted drug usage. The increases in drug use by adolescents are based on international social networks among drug addicts (Sivertsen et al., 2015).

6. Emotional states of preclinical models of drug abusers

Drug addiction is a chronic relapsing disorder that results from three main characteristics of individuals. These include, the compulsion to search for and use drugs, excessive consumption of drugs leading to lack of control over their use and and negative emotions after stopping drug use (Randler, 2008; Roenneberg et al., 2004). Self-reports play an important role in registering the emotional response of addicts (McKnight-Eily et al., 2011). They show that emotional states, whether negative or positive, are very prominent factors of the relapse of people into drug addiction (Basch et al., 2014; Sivertsen et al., 2015). In particular, positive past memories of drug use have been reported to be very strong motivators of drug-seeking individuals (Basch et al., 2014). Conversely, drug use is often a means of avoidingormitigating negative memories (Sivertsen et al., 2015; McKnight-Eily et al., 2011). Data and hypothesis from preclinical experiments on drug-addicted humans, which showed similar results on drug-addicted animals (Wheaton et al., 2016; Pasch et al., 2012). The results revealed negative symptoms when the drugs were withdrawn and the symptoms such as, depression, dysarthria, insomnia, irritability and paranoia were observed (Roberts et al., 2009; Hasler et al., 2015). On the contrary, positive symptoms observed after ingestion of psychostimulants included increased confidence, euphoria and alertness (Phillips et al., 2014).

7. Dopaminergic neurotoxicity pathways of antipsychotics, methamphetamine and levodopa

Monoaminergic neurotransmission is of enormous clinical importance because it has been implicated in the pathophysiology of a variety of diseases and because it underpins the mechanism of action of the majority of medicines that affect the central nervous system. After the repeated introduction of a specific medication, the response to the initial dose is delayed and a higher dose is needed to produce the previous effect. This phenomenon is called "developing tolerance to medicication. The steps leading to the development of such tolerance may be more important to the therapeutic effects of medicines than any immediate impact (Strowbridge, 2009).

Ergot derivatives are dopamine agonists that are non-selective for serotonin and used to treat depression. D2 and D3 receptors are both relatively selective for pramipexole and ropinirole, respectively, which are the current first-line medications for the treatment of depression. The activation of presynaptic inhibitory autoreceptors also causes the cholinergic neuron to hyperpolarise, which prevents the release of dopamine from cells. It is believed that D2 agonists have neuroprotective qualities, as they reduce dopamine rush and turnover in the brain. In Parkinson's disease, it is probable that selegiline and rasagiline would be beneficial by improving the availability of dopamine and minimizing the formation of free radicals during the oxidation of dopamine by MAO-B6 (Mustafa et al., 2020).

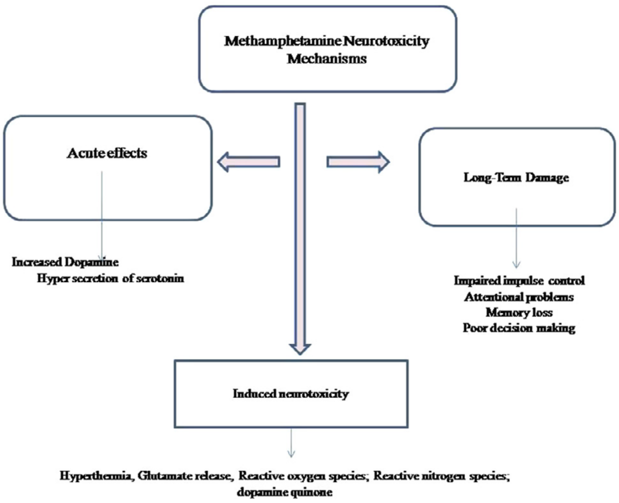

Fig. 1. Methamphetamine mediated neurotoxicity in addicts.

Abrupt withdrawal of levodopa may result in serious mental illness. The termination of levodopa, dopamine agonists and irreversible MAO inhibitors has been associated with the development of a clinical symptom comparable to that of neuroleptic malignant syndrome. Dopamine agonists caused behavioural addictions that may last for years after they stopped, as well as withdrawal syndrome marked by low mood, agitation and anxiety (Lauterbach et al., 2010).

8. Effects of cocaine and methamphetamine on saccular aneurysm formation and rupture

Amphetamine is a stimulant drug and develops an AMPH-induced psychosis and it involved in behaviour changes and it is administered to the individuals in several ways, including with cocaine and heroin, which are often used as psychoactive substances and contribute to the development of substance use disorder. Both medicines are played potential role in the development and progression of cerebral problems and to be related to the formation and rupture of lesions at an earlier stage. Thus, they increase the risk of intracranial bleeding. Intracranial aneurysms, which are located near the major cerebrovascular branches, are dangerous because they may burst and cause potentially fatal bleeding (Zhang et al., 2016).

According to Gamouras et al. (2000), the abnormal heart rhythm generated by cocaine use, in which the arterial wall is under maximum stress, is one of the causes of an elevated risk of aneurysm formation. Increased wall stress has been associated with temporary increases in heart rate, blood pressure, and vasospasm. Because cocaine interferes with the absorption of norepinephrine, it has been found to raise the levels of catecholamines in the synaptic cleft. Benzoylmethylecgonine, the chemical compound from which cocaine is made, is widely inhaled intranasal route as powder or smoked as hard drugs, and it quickly crosses the blood–brain barrier and enters the central nervous system, causing addiction. Neurotransmitter reuptake increases the sympathetic nervous system output, which causes hypertension. It also has neurotoxic implications on the brain function, such as aneurysm development and rupture (Park et al., 2019).

The physiological implications of cocaine have both acute and chronic vascular ramifications. Previous studies did not reveal the long-term functional consequences of cocaine and methamphetamine use, as well as the increased risk of developing and rupturing berry aneurysms. The combination of increased sympathetic activity with increases in fibrinogen, the von Willibrand factor and the endothelin-1 levels have been shown to induce vascular stress and worsen existing vessel damage in the near term. Thus, chronic cocaine users have increased endothelial damage, vasculitis and atherosclerosis of the arteries.

9. Oxidative stress mechanisms for masking methamphetamine-induced neurodegeneration

Oxidative stress plays a critical role in the link between mitochondrial dysfunction and the neurotoxic effects of methamphetamine. It has been stated that methamphetamine inhibited the Krebs cycle and the electron transport chain, resulting in neurotoxicity. In addition, methamphetamine may cause hyperthermia, which can increase the degree of peroxidation at the dopamine terminal and result in neurotoxicity (Albers and Sonsalla, 1995). The feeling of lightheadedness caused by methamphetamine may have an impact on the oxidation of norepinephrine in two ways: first, it can increase the rate at which dopamine is oxidized; and second, it can decrease the rate at which dopamine is oxidized. Free iron or other trivalents are believed to incite the autooxidation of dopamine. Methamphetamine may promote the release of the neurotransmitters such as serotonins, and norepinephrine. It involves in hyperthermic process increases the auto oxidation levels of dopaminergic (Kiyatkin and Sharma, 2019). The scheme of methamphetamine-mediated neurotoxicity in human was described (Fig. 1).

In the two aforementioned processes, methamphetamine depletes the glutathione levels, which results in a redox imbalance and the generation of reactive oxygen species. Methamphetamine may also cause oxidative stress via the activation of NADPH oxidase or the over activation of astrocytes, which are two different mechanisms. Oxidative stress and reactive oxygen species may trigger intracellular protein thiol oxidation, which can activate myosin light chain non-muscle protein kinase. The nervous system may be damaged if the astrocyte function or activity is aberrant. Methamphetamine-induced neurotoxicity is strongly linked to the Sigma-1 receptor. A new class of drugs called "Sigma-1 receptor antagonists" has been shown to lessen the cell damage, cerebrovascular overheating and psychological impairments associated with methamphetamine use (Sánchez-Fernández et al., 2017).

10. Examination of recently found contaminant profiles in methamphetamine seizures

Molecular fingerprints are used to utilize to analyze the resemblance between episodes and their source or a particular set of samples, as well as the probable synthesis techniques, circumstances and post-production alterations linked to the identities. Theoretically, at the macroeconomic scale, and methodologically at the micro level, an in-depth comparison of chemical fingerprints has become more useful. Because of these advancements, police and criminal investigators have been able to understand better illegal drug markets and identify traffickers, and to establish conspiracy ties between dealers and consumers at both the international and national levels (Tsujikawa et al., 2012).

Molecular techniques produce unique stable isotopic compositions of ephedrine, which can be utilized to monitor methamphetamine seizures. Isotopic variation is caused by a variety of enrichment factors that occur during the biological creation of raw materials for intermediates, as well as by the atomic separation that occurs throughout the synthetic processes. The chemical synthesis of ephedrine is the most reliable method of obtaining it, but it may also be derived from natural sources. A complete approach that includes the data obtained, in addition to the source equipment, is expected to tie up the criminal networks to one another (Stojanovska et al., 2013).

A chemometric technique and purity analysis with isotope fingerprints currently widely used method. According to Makino (2012), drug paraphernalia are disguised using a wide range of legally available substances and pharmaceuticals. The study also highlighted the importance of tracing the isotopes of primordial compounds to allow experts to identify seizures based on their real starting materials, which has resulted in complete characterization. Steady isotopes should be used to augment defect assessment in the future, as well as discovered novel methamphetamine profiles. These methodologies should be coupled with metabolomics approach (Makino, 2012).

11. Methamphetamine induced mortality

Methamphetamine's dopaminergic surge, like that of cocaine and other opiates, generates euphoria among individuals. Methamphetamine-induced blood pressure not only associated with stroke, but also involved in the formation of hemorrhages and involved in the release of large levels of dopamine in the brain. Several cardiovascular diseases, such as accelerated atherosclerosis, have been linked to methamphetamine consumption, including the experience of a heart attack at an early age. Post-mortem toxicology may be used to identify when illegal or prescribed medications, as well as other hazardous compounds, had a role in the victim's death. Toxicological tests may also reveal which banned drugs are more prevalent in certain places, which can help the investigators. ost-mortem samples may also shed light on major interpretative issues (Lebish et al., 1970).

12. Application of monoclonal antibodies in lateral flow immunochromatographic assays for detecting drugs of abuse

Lateral flow assays are widely conducted in early diagnostic and screening applications. In contrast to conventional high-performance liquid chromatography (HPLC), polymerase chain reaction (PCR), gas chromatography- mass spectrometry (GC–MS), flow assays can produce the results within short time. These tests are ideal for resource-constrained areas because they are reliable but simple and inexpensive.

13. Forensic toxicological hair analysis

Hair analysis can reveal information about a person's drug addiction history or drug toxicity. Hair provides a larger window for drug detection than do other biological samples. Following the intake of drugs, they are deposited in the hair via various mechanisms through blood circulation. Compared to the drug found in other biological samples such as saliva, blood and urine, the drug deposited in the hair is much more stable and can be detected after a longer period of time. Furthermore, by using sensitive analytical techniques, segmental analysis can depict multiple or single drug administration. LC-MS and GC–MS are the most commonly used analysis techniques because of their high sensitivity (Kintz, 2017).

14. Benzodiazepine detection and quantification

The use of psychotropic drugs, particularly benzodiazepines (BZDs), is prevalent in the treatment of mental ailments. Indeed, BZDs have been used to treat a variety of conditions, including insomnia, anxiety and seizure disorders, and as general anesthesia. Unfortunately, these drugs are available on the illegal street market, resulting in a high rate of their abuse among users. As a result, it has become critical to investigate BZDs in human biological systems. In forensic sciences, specimens of drug abuse are collected for investigation. Analytical methods are commonly used to detect and quantify BZDs. Among these methods nuclear magnetic resonance (NMR), chromatography (GC–MS, HPLC and thin layer chromatography (TLC)), immunoassays (ELISA, RIA, LFA, CEDEA and FPIA) and electro analytical methods (voltammetry and potentiometric) are widely used.

15. Drug testing services for drug users

Drug checking services provide drug users results of chemical analyses of drug samples while monitoring the unregulated drug market. Drug checking services appear to influence behavioural intentions and drug use behaviour, particularly when the results of such services are unexpected or reveal drugs of concern. Drug checking services have long been used to monitor drug markets in Europe and increasingly, in North America. Concerns about the contents of drugs and their negative health consequences facilitate the use of drug checking services (Maghsoudi et al., 2021). Many methods have been suggested to test the drugs from various sources and the reliable methods were described in Table 1.

16. Recent advancements in the direct electrochemical detection of illicit drugs

Over the last decade, the trafficking and use of illicit drugs have shown a consistent incremental trend, continuing to be a global challenge due to the consequences on society, health, criminality and the environment. The introduction of new products and illicit synthetic compounds to the market represents a new and challenging task for analytical chemistry, which is seeking rapid and accurate methods of detecting illicit substances in seized street samples, biological fluids and wastewater. In this context, electrochemical sensors have shown promising results as alternatives to standard chromatographic and spectroscopic methods. The electrochemistry methods detect primarily cannabinoids, cocaine, opioids, ecstasy and methamphetamine, as well as new psychoactive molecules that are widely distributed in recent times. Several strategies are described for analysis, the most notable of which is the direct electrochemical oxidation of the target for analysis. In large-scale sampling tests, the use of custom-made portable

Table 1
Analytical methods used for the detection of drugs.

Drug	Method of Analysis	References
Cocaine	*Biosensors*	De Rycke et al., 2020
Heroin	Electrochemical sensors	Ahmed et al., 2020
Heroin, cocaine, and cannabis	Chromo- and fluorogenic methods	Garrido et al., 2018
Heroin	THz-wave spectroscopy	Dobroiu et al., 2007
Cocaine	Biochemical analysis	Gjerde et al., 2015
Cannabis	One step ELISA method	Pujol et al., 2007
Heroin, cocaine, and cannabis	Eeal time (DART) time-of-flight mass spectrometry	Grange and Sopocool, 2011
Cocaine	Biosensors	Mao et al., 2019
Cocaine	Surfactant-mediated analysis	Parrilla et al., 2021
Heroin, cocaine, and cannabis	Desorption/ionization on porous silicon	Guinan et al., 2012
Cocaine	Trained honey bees	Schott et al.,2015
Cocaine	Methadone maintenance treatment	Wasserman et al., 1999

instruments with electrochemical detection methods adds value to the effectiveness of electrochemical sensors for detecting psychoactive substances (Cumba et al., 2015).

17. Controlled drug detection using chemiluminescence and electrochemiluminescence

Chemiluminescence and electrochemiluminescence are used for the determination of various controlled drugs (opioids, tranquilizers, stimulants and hallucinogens). Column methods (flow injection analysis, HPLC, capillary electrophoresis and microfluidic devices) and chemiluminescence and electrochemiluminescence reagents such as luminol,diaryloxalates, tris(2,2bipyridine) ruthenium(II), permanganate and mangane are widely used (Adcock et al., 2011).

18. Analysis of postmortem changes

Determining the time of death is essential information in investigations. Therefore, choosing an appropriate method is important to determine the postmortem interval (PMI). There are four stages, including, fresh stage, the early decomposition stage, the advanced decomposion stage and the skeletonization stage (Metcalfe, 2019). The best PMI markers are deemed to be state of rigor mortis and the presence of blowfly larvae (Metcalf, 2019). Rigor mortis is the stiffness of the muscles, which begins 2–6 h after death until 72 h after death, and the presence of the blowfly larvae leads to the development of maggots and then of the full blowfly (Metcalf, 2019). Post mortem interval method is used in the first two weeks of death depending on the environment, such as varying temperature, contaminated environment, sterile soil and ice (Metcalf, 2019). When the technique is done indoors, the amount of blowfly may be limited (Metcalf, 2019). For the early and advanced decomposition stage, investigations indicated that the PMI can be estimated in+/-2–5 days out of the 25 to 48 days of decomposition (Metcalf, 2019). The decomposition is affected by the biological and biochemical processes, so forensic entomology has established a tool for indicating the minimum PMI while considering a range of temperatures (Pechal et al., 2014).

19. Metabolomics applications in the forensic field

The metabolomic methodology is a valuable tool for the analysis of PMI (Szeremeta et al., 2021). Metabolic fingerprinting is the most inclusive metabolomic method. It involves measuring all metabolites appearing in the sample using several techniques such as NMR or mass spectrometry (MS) in combination with separation systems such as liquid chromatography (LC), GC or capillary chromatography (CC) (Szeremeta et al., 2021). Metabolic procedures show an alternative strategy for identifying biomarkers and for responding fast to new psychoactive substances, and they also help to diagnose drug abuse or overdose (Szeremeta et al., 2021). Szeremeta et al. (2021), reported various biochemical changes in the body after death, these include, enzymatic reactions, cellular autolysis and putrefaction, lack of circulating oxygen and the cessation of synthetic pathways. Therefore, these changes reveal that metabolomics can be used in investigations following death (Szeremeta et al., 2021). Metabolic profiling of post-mortal biological specimens may explain more intensely the pathogenesis of fatal disorders such ascardiovascular disease (Ussher et al., 2016), fatal cancers (Huang et al., 2019), diabetes mellitus (Newguard, 2017) and traumatic brain injury (Szeremeta et al., 2021). Therefore, changes in metabolic pathways help withestimating the PMI and the duration of changes, which are important information to prove it (Szeremeta et al., 2021). Moreover, the proper specimens or tissues for the analysis may be crucial for acquiring the needed metabolites present in a biological sample (Szeremeta et al., 2021). Recently, new studies have proposed polysaccharides, steroids, amino acids and others as potential biomarkers, allowing for the estimation of the time since death (Kang et al., 2012).

20. Biological evidence and its interpretation in forensics

Protein is more stable than DNA, which makes it an ideal tool of compromised samples using proteomic mass spectrometry. Proteomic samples in forensic science will tend to be solid substrates, such as hair or bone, or dried samples such as, body fluid or touch samples from skin or clothing (Parker et al., 2021). Most sample preparation method consisting of protein extraction, proteolytic digestion and sample cleanup (Parker et al., 2021). These three strategies are used to validate forensic protein. The first strategy is to validate the efficacy of the peptide spectral matching process in the shotgun proteomic dataset (Parker et al., 2021). The second strategy is to compare the observed peptide with the known standard. The third strategy is changes of protein due to environmental change. Therefore, the degradation of proteomic can standardize the PMI (Parker et al., 2021). For a longer time, span, changes in the bone proteome have been used to identify proteins that degrade at different rates over a period of months or years. This helps to establish algorithms with the use of data to predict PMIs (Parker et al., 2021; Procopio et al., 2019; Prieto-Bonete et al., 2019). Housekeeping globular proteins, such as glycolytic enzymes, have become flexible and thus, more subject to derivative chemical processes (Parker et al., 2019; Mizukami et al., 2020]. Variations in the profiles of proteins in fingermarks have also been used to estimate the post-deposition interval (Parker et al., 2021; Oonk et al., 2018). This method may be even more stable in bones left in aqueous environments (Parker et al., 2021; Mizukami et al., 2020). Moreover, one of the advantages of proteomics is that it is not dependent on the anatomical integrity (Parker et al., 2021; Procopio et al., 2019). Deamidation is known to occur at different rates depending on the amino acid, flanking protein sequences and protein flexibility (Parker et al., 2021; Ramsøe et al., 2021; Hao et al., 2011). These complex and variable chemical and environmental factors result in a high level of variance of deamidation at different time points, indicating that it is more of a preservation and exposure signal than an indicator of time (Robinson and Robinson, 2001).

21. Factors of postmortem protein degradation

After death, due to the lack of oxygen and the irreversible biochemical, physical and physicochemical changes in the decomposed body, the anabolic production of metabolites ceases, enzymatic reactions are altered and cellular degradation advances (Donaldson and Lamont, 2013; Campobasso et al., 2001). Moreover, the postmortem changes occur over time in stages of degradation (Donaldson and Lamont, 2013; Shedge et al., 2020). However, a lot of variations occur due to the individual body itself (intrinsic factors) and the environment (extrinsic factors) (Donaldson and Lamont, 2013). A detailed understanding of the susceptibility of postmortem changes to such factors is important because these likely affect both the appearance of the changes and the rate of decay, and thus, either accelerate or reduce the progression of postmortem events (Donaldson and Lamont, 2013). Protein decomposes faster at higher temperature than low temperatures (Concheiro et al., 2018). Another factor is the body mass, which has aproportional effect on the postmortem thermal change and the muscle protein degradation after death (Donaldson and Lamont, 2013). A third factor is sex difference. Desmin is the only protein that shows a difference in the decomposition rate between men and women, decomposing much faster in women. A fourth factor is the cause of death. A fifth factor is the effect of exposure to insects and microorganisms. The conditions of surface exposure to the environment and colonization by insects and microorganisms are the most plausible influencing factors of postmortem protein degradation (Donaldson and Lamont, 2013).

22. Toxicology of opioids in postmortem

Hyper dose of opioids caused death among human population and the concentrations of opioids determined in postmortem specimens differ significantly depending on the type of synthetic opioid detected. Postmortem changes in drug concentrations can happen through postmortem redistribution from tissues with a higher concentration of the drugs to those with a lower concentration. Physicochemical and pharmacological properties of the analytes, such as their pKa, log P, volume of distribution and protein binding, may indicate the presence of drugs that have undergone this postmortem phenomenon (Concheiro et al., 2018).

23. Conclusions and future perspectives

Drug abuse is one of the serious problems and harm on safety and public health around the world in every year. Drug abuse affects the smooth functioning of various societies. An understanding of the severe drug abuse is very essential to develop government policies. In recent years, numerous attempts have been made to calculate the global burden of narcotics and lack of data leads to failure. Analysis of severe economic loss and associated government policies are useful to elucidate awareness among public. The societies required potential resources to give education, evidence-based prevention, interventions, treatment and rehabilitation. Cannabis, heroin and cocaine are widely used by the people and more than 4.5 million people undergo treatment every year. Drug abuse affects attention, perception, coordination, neurological functions which affect driving. Cannabis is one of the important drugs used by the drivers. Poverty and drug abuse are associated with various ways. The relationship between narcotic drugs and poverty were inversely correlated each other. Methamphetamine is a psychostimulant and is one of the addictive drugs. The increased number of industries for the production of methamphetamine leads to environmental and public health issue. The exposure to methamphetamine is highly neurotoxic and involved in neural damage. These physiological changes are associated with memory and attention deficits. Many analytical tools, including liquid chromatography methods and solid samples are used for the determination of methamphetamine from the human subjects. Hair, soil samples and urine test have been recommended for the determination of methamphetamine and help clinicians to detect the availability of methamphetamine. Artificial intelligence may be useful in diagnostic research and has several advances than traditional methods.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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