# The Effects of Crystal Methamphetamine Consumption on Creatine Kinase Concentration and Oxidative Stress Markers in Human Subjects

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## ABSTRACT

This study was designed to investigate the effect of crystal meth on the cardiovascular system. This research aims to study the relationship between methamphetamine consumption, creatine kinase levels, and oxidative stress indicators in a sample of individuals. By analyzing these factors, we can provide valuable insights into the health risks associated with this drug and develop effective treatment strategies for addicts.

The study was designed to examine the effect of methamphetamine on heart system , with a focus on cardiovascular disease. The study included a group of 50 addicted participants and 40 control participants. Tests were performed to determine creatine kinase levels and oxidative stress indicators.

Theresults showed a significant difference between addicts and healthy individuals. Creatine kinase levels in the addicted group were compared to the control group levels. The results also showed that the levels of total oxidants were higher in the control group  compared to the addict group .

The results indicate that methamphetamine consumption is associated with elevated creatine kinase levels, indicative of muscle tissue damage. Negative effects on the antioxidant system also promote oxidative stress, which increases the risk of chronic diseases.

**Keywords :** Methamphetamine ,addiction's , totaloxadant setouts , creatine kinase –MB

## INTRODUCTION

Drug use is exceptionally harmful, with approximately 3.1 million drug users affected, indicating that treatment is possible. Among these, only about one-sixth of drug users received treatment, a proportion that has remained largely unchanged in recent years. According to global health theory, nearly 45,000 people died from drug use in 2015. Of these deaths, 16,775 were directly related to tobacco use, making it a significant factor in drug-related deaths (Wdr, 2018).

Drug abuse is one of the most serious health, social and psychological problems facing the entire world and different societies, including our Arab and Islamic societies. According to estimates by global health institutions, there are about 800 million people who abuse or are addicted to drugs. Addiction to a drug means a strong and urgent desire that drives the addict to obtain the drug by any means and increase his dose from time to time, with difficulty or impossibility of quitting it, whether due to dependence (psychological addiction) or to the return of the body's tissues organically (Drug Dependency). The addict usually suffers from an internal compulsive driving force to abuse due to this psychological or organic dependence. Many political, economic and social factors have combined to make drugs a threat to the world (Abdul Rahman, 1985).

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abuse due to this psychological or organic dependence. Many political, economic and social factors have combined to make drugs a threat to the world (Abdul Rahman, 1985 ).

The harms of drugs are many and varied. It is scientifically proven that drug abuse harms the safety of the user's body and mind and that the person who abuses drugs is a burden and a danger to himself, his family, his group, morals, production, security, the interests of the state, and society as a whole. Rather, it has serious dangers as well. Loss of appetite for food, which leads to thinness, emaciation and general weakness accompanied by yellowing or blackening of the face of the user. It also causes a lack of activity and vitality and weak resistance to disease, which leads to dizziness and chronic headache accompanied by redness in the eyes. It also causes an imbalance and nervous coordination in the ears( Lotfi, 1993 )

Local irritation of the mucous membranes and bronchi as a result of the formation of carbon materials and their deposition In the bronchi, which results in chronic lung infections that may lead to pulmonary tuberculosis. Digestive system disorder which results in indigestion, excessive gas, bloating, fullness and overeating which usually ends in diarrhea. Liver damage and fibrosis, as opium, for example, breaks down liver cells and causes fibrosis and an increase in the sugar level, which causes the liver to be unable to rid the body of them.Erogenital inflammation and destruction and erosion of millions of nerve cells that make up the brain, which leads to memory loss, auditory, visual and intellectual hallucinations.(Abdul Rahman, 1993).

Drug use weakens physical and mental health and can lead to genetic addiction and behavioral disorders, which can ultimately result in dependence on substances, overdose, and suicide (Behave, 2006).

Heart disorders, pericardial heart disease, angina, high blood pressure, and rupture of the arteries. Methamphetamine is the largest drug threat across the globe, with health effects including neurotoxicity and cardiovascular disease( Sandau etal., 2020).

Methamphetamine is a stimulant that is of increasing concern in the medical community due to its adverse effects on physical and psychological health. Methamphetamine is used illegally as a psychoactive stimulant, which increases energy levels and focus, but it is also associated with serious health risks, including negative effects on the heart and central nervous system.

Methamphetamine also affects indicators of oxidative stress, like Total Oxidative Status (TOS) Atherosclerosis and other cardiovascular disorders are largely influenced by oxidative stress, which is indicated by elevated TOS levels (Zou et al., 2018).

Moreover, methamphetamine use has been connected to changes in lipid profiles, such as lower levels of HDL (high-density lipoprotein), which is protective to cardiovascular health (Sinha et al., 2020).

Creative kinasei measured clinically in blood tests as a sign of harm to CK-rich tissue in conditions such acute kidney injury, rhabdomyolysis (severe musele breakdown), muscular dystrophy, autoimmune myositis, and myocardial infarction (heart attack) (moghadam-KIA et al., 2016).

Creatine kinase-MB (CK-MB) levels are used to assess heart injury, such as in heart attacks, and to monitor the effectiveness of clot-dissolving medications. CK-MB levels rise and fall quickly with recovery. Creatine kinase is also used to identify muscle damage in conditions like heart attacks, rhabdomyolysis, and muscular dystrophy. Additionally, methamphetamine use is linked to serious cardiovascular issues due to its effects on the heart. (moghadam-KIA et al., 2016)

That a more useful representation of the oxidative equilibrium would be the oxidant-to-antioxidant ratio rather than each component separately. This is because a higher level of oxidant may only improve the disease state if it surpasses the antioxidants ability to neutralize excessive levels of molecular oxygen or its chemical derivatives, known as reactive oxygen species (ROS), such as hydrogen peroxide (HO), superoxide anions, or other molecules (02) Additionally, hydroxyl radicals (OH), a highly reactive intermediary in the metabolism of oxygen, are continuously created and eliminated (Kumar, 2011)

In this study, we will explore the effect of crystal meth consumption on creatine kinase levels and markers of oxidative stress, by analyzing data from a group of participants. We hope that the results of this study will contribute to providing valuable insights that contribute to addressing public health issues related to drugs, and help improve treatment and prevention strategies.This study was designed to evalute the effect of methamphetamine on the cardio vascular system.

## MATERIAL AND METHODS
### Study Design
The present study was designed to study the effect of methamphetamine on heart systeam in the body, specifically on the heart and blood vessels. Where the research took group of people detained in the department of drugs and psychological in waistprovinase and accused of using and consuming narcotic substances. A total of fiftyparticipants were taken, as the sample collection period extended from November, 2023 to March, 2024 inWasit province. On

the basis of laboratory examination and visual methods, are divided into two groups. The first group is people who abuse narcotic substances, precisely the methamphetamine drugs as abusers group. The second group is healthy and who do not use any kind of drug as a control group. The first group is methamphetamine addictions, and those who represent the focus of study and scientific research, and second group forty person as control groups.
1. Abusers group fifty person
2. Control group forty person

### Ethics Approval
This study was approved by the Ethics Committee of the Department of Biology, College of Science, University of Wasit, as did the Iraqi Ministry of Health. before they were included in the study tests.

### Two study groups have been investigated:
### Healthy Control group
Healthy control group consists of (40) apparently healthy of different ages ( 15-55 years), but all of them are chosen dependent on the next criteria:
**1-**The age and sex
**2-**They do not suffer from cardiovascular diseases and diseases in general .
**3-**No addicted to alcohol ,drug or cigarettes .

### Patients group
This study has included (50) Iraqi patents . Patients were selected from the Al.zahraaHospital( psychiatry unit forensic medicine unit). All subjects were mostly from ), this study extended from November, 2023 to June, 2024. The data were collected together with the subject's medical history.

### Criteria used for the diagnosis methamphetamine add action
1.Diagnosis through drug screening kit
2.Diagnosis by specialist doctors
3.Withdrawal symptoms such as anxiety, depression, tension or fatigue may appear when reducing or stopping the drug.
4.They have a strong desire to use the substance.

### Exclusion Criteria
People who use methamphetamine and other substances were excluded. People who suffer from psychological and mental illnesses were also excluded. People who are not residents of Wasit provinasewere excluded. People who did not show a positive result in the drug test were also excluded. People who abstained from using drugs were also excluded.

### Sample Collection
Samples of urine and blood were collected from people suspected of Taking methamphetamine drug from held in the department of narcotic drugs and psychotropic substances,4ml in the Gel tubes. The urine samples were placed in Blain Tubes. Began toconduct the test on urine samples. Where put the cassette for detecting thepresence of drugs in the urine. If the result is positive,then put the blood samples ofthe gel tubes in the centrifuge at a speed of 3000 rpm for 10 minutes, wherethe serum is extracted for the purpose of conducting ELISA tests .if the results is negative ,meaning that the person does not use type of drug, the sample ignored.

### Statistical Analysis
The Statistical Packages of Social Sciences-SPSS (2019) program was used to detect the effect of difference groups (Abusers and control) in study parameters. T-test was used to significant compare between means. Chi-square test was used to significant compare between percentage (0.05 and 0.01 probability in this study( Bala,2016)

### RESULTS AND DISCUSSION
Effect of methamphetamine on the level serum creatine kanasesamong abusers and control group.
The results of the study indicated that there is a significant difference between addicts and healthy people. The CK-MB level for the "Abusers" group is 2.543, compared to the "Control" group at 0.654.

**Table 1:** Shows the concentration of Creatine Kinases –MB in blood serum(ng\ml).

| Group | Mean ±SE of Creatine Kinases -MB (n g\ml) |
|---|---|
| Abusers | 2.543 ±0.45 |
| Control | 0.654 ±0.26 |
| T-test | 1.118 ** |
| P-value | 0.0012 |
| ** (P≤0.01). | |

The creatine kinase was recorded a significant in increases between abusers categories and with control. The current study agreed with the study conducted by Abdullah et al.(2006) in New York, where studied the effect of amphetamine on rhabdomyolysis and concluded that amphetamine positively affects muscles, including cardiac muscles, and raises the level of creatine kinase. The current study also agreed with the study conducted by D'Anci et al.(2011) in the USA, where studied the effect of drugs use on cardiac muscles and concluded that drugs positively affect the heart muscles and raise the level of creatine kinase. This could explain the increase in the enzyme creatine kinase.

**Effect of methamphetamine on the level serum total oxidant stouts among abusers and control group.**
The results of the study indicated that there is a significant difference between addicts and healthy people. The Total oxidant setouts level for the "Abusers" group is 4.66, which is less than compared to the "Control" group at 5.78.

**Table 2:** Shows the concentration of total oxidant setouts in blood serum. (U\ ml).

| Group | Mean ±SE Total oxidant setouts (U\ml ) |
|---|---|
| Abusers | 4.66 ±0.31 |
| Control | 5.78 ±0.63 |
| T-test | 1.024 * |
| P-value | 0.0496 |
| * (P≤0.05),Significant. | |

Myocardial infarction (MI) is damage (necrosis) to heart muscle cells commonly known as a heart attack. Acute myocardial infarction (MI) occurs when blood flow to a coronary artery is reduced or stopped, causing damage to the heart muscle. MI is associated with a marked imbalance in oxidative stress following myocardial injury.The activites of the erythrocyte antioxidant enzymes GPx, CAT, and SOD were significantly decreased (-32%,-14% and -31%, respectively) in amphetamine users (Govitrapong etal .,2010).
Use of methamphetamine leads to increase in the end –products of the generation of free radicals from the metabolic processes that accompany the biotransformation of methamphetamine and a decrease in antioxidants .As a results, therapeutic intervention is required in order to reduce the negative effects of abusive use of methamphetamine (MazinFadhil et al .,2023).
Our study showed that TOS has a positive relationship with the cardiac enzyme CK_MB (t=1.118), (p =0.0012). This study is consistent with the study of Wijdan Mahmood et al., in 2024, where their study showed that TOS significantly positive relationship with CK –MB (r=0.2369), (p=0.038) had a significantly positive relationship.The activites of the erythrocyte antioxidant enzymes GPx, CAT, and SOD were significantly decreased (-32%,-14% and -31%, respectively) in amphetamine users (Govitrapong etal .,2010).
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Stimulant-dependent patients had significantly lower antioxidant capacity relative to controls, suggesting that they may be at greater risk for oxidative damage to the brain and other organs (Walker, J etal., 2014).

**CONCLUSION**
This study demonstrates that methamphetamine consumption significantly affects creatine kinase levels and oxidative stress markers in individuals. The results indicate elevated creatine kinase levels in the addicted group

compared to the control group, suggesting muscle tissue damage. Additionally, total oxidant levels were lower in the addicted group, reflecting the negative impact of chronic methamphetamine use on the antioxidant system. These findings highlight the health risks associated with methamphetamine use, underscoring the need for effective treatment strategies for addicts and addressing the health consequences of this drug. Increasing awareness of the dangers of methamphetamine and its effects on public health is crucial for improving prevention and treatment strategies in various communities.

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