ORIGINAL ARTICLE

Cardiac Enzyme Responses among Marijuana Smokers

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ABSTRACT

Aim: This study was carried out to determine the activity of aspartate aminotransferase (AST) and creatine kinase (CK) in marijuana smokers. **Materials and Methods:** Twenty confirmed marijuana smokers and 20 apparently non-smokers (control) between the ages of 20 and 40 years were selected for this study. The level of AST and CK were carried out by standard methods. **Results:** The level of AST (44.49 ± 5.18IU/L) in marijuana smokers was significantly increased when compared with the control (28.28 ± 6.12IU/L) ($P < 0.05$). Furthermore, the level of CK (295.84 ± 6.58 IU/L) in marijuana smokers was significantly increased when compared with the control (110.03 ± 11.80 IU/L) ($P < 0.05$)). **Conclusion:** The results obtained probably indicate that marijuana smokers are more likely to develop a cardiac problem. Hence, smoking of marijuana is not beneficial to health as it may be linked with myocardial infarction.

Key words: Cardiac enzyme, effect, marijuana, smoking

INTRODUCTION

Marijuana is the most commonly abused drug. It mainly acts on cannabinoid (CB) receptors. There are two types of CB receptors in humans: CB receptor type 1 (CB1) and CB receptor type 2 (CB2). CB1 receptor activation is pro-atherogenic, and CB2 receptor activation is largely anti-atherogenic. Marijuana use is also implicated as a trigger for myocardial infarction (MI) in patients with stable coronary artery disease (CAD).[1]

Marijuana is already legal in some states, and there is a push toward legalization in many more states. Physicians can, therefore, expect to encounter more patients who use or abuse marijuana. Therefore, physicians need to be aware of its effects on the cardiovascular system. Due to restrictions on manufacturing and distribution, there is a paucity of well-validated clinical studies describing the cardiovascular and other systemic effects of marijuana. Further, lacing and other chemicals present in marijuana are major confounding variables that may contribute to the untoward effects of marijuana.[2]

The active psychotropic component of marijuana is delta-9-tetrahydrocannabinol (THC) (Mechoulam and Gaoni, 2010). It mainly acts on CB1 and CB2 receptors. These are G-protein-coupled membrane-bound receptors and play a role in signal transduction through modulation of adenylate cyclase, mitogen-activated protein kinases (MAPK), and members of the nuclear factor kappa-light-chain-enhancer of activated B cells (NF-κB). Endogenous ligands such as anandamide and 2-arachidonoylglycerol also act on these receptors. There is a differential distribution of CB receptors in the human body. Major organ systems such as brain, heart, liver, and vascular smooth muscle cells (VSMCs) have CB1 receptors. CB2 receptors are mainly present in the immune cells. Both receptor types are present in cells in the atherosclerotic plaque-like macrophages and VSMCs.[3]

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CB modulates immune system, alters lipid metabolism, and affects endothelial cells and VSMCs (Singla *et al*., 2012). Inflammatory cytokines, oxidized low-density lipoprotein (LDL), and macrophages play key roles in pathogenesis of atherosclerosis. Furthermore, platelet-derived growth factor (PDGF), which causes proliferation and growth of VSMC, also contributes in atherosclerosis.[4]

In the endothelial cells, a CB1 receptor agonist activates MAPK and promotes reactive oxygen species (ROS) generation. It promotes endothelial injury and hence atherogenesis. CB2 receptor agonists attenuate inflammatory response to tumor necrosis factor-alpha and decrease expression of cell adhesion molecules, which are key steps in atherogenesis.[5]

In VSMCs, CB1 receptor agonism was shown to upregulate angiotensin 1 receptor, leading to increased ROS generation.[6] Further, CB1 receptor antagonism was shown to reduce PDGF-mediated proliferation and migration of human coronary artery smooth muscle cells. The same group of investigators showed that CB2 receptor agonists JWH-133 and HU-30 decreased tumor necrosis-factor-alpha-induced proliferation and migration of coronary smooth muscle cells.[5]

Oxidized LDL, which has been incriminated in the development of atherosclerosis, causes increased CB1 and CB2 receptor expression and increased endogenous CBs (anandamide and 2-arachidonoylglycerol) production. This results in increased lipid accumulation in macrophages. Exogenous synthetic CB was shown to increase macrophage lipid accumulation, and prior treatment with CB1 receptor antagonist was shown to decrease this effect.[3]

In humans, marijuana use causes tachycardia, peripheral vasodilation, postural hypotension, and elevation in both systolic and diastolic blood pressures in supine position. Tachycardia is believed to be a result of increased sympathetic nervous system activity after marijuana use.[7] Other proposed mechanisms for this effect are the inhibition of parasympathetic innervation to the heart and reflex tachycardia from vasodilation. Elevated norepinephrine levels and augmentation of left ventricular function was observed after marijuana use.[8]

However, in a study in patients with CAD and angina, marijuana use was shown to decrease end diastolic volume, stroke index, and ejection fraction without causing any change in end systolic volume or cardiac index.[9] Chemical compounds in the *Cannabis* plant, including 400 different CBs such as THC, allow its drug to have various psychological and physiological effects on the human body.[10] Different plants of the genus *Cannabis* contain different and often unpredictable concentrations of THC and other CBs and hundreds of other molecules that have a pharmacological effect.[11]

Acute effects while under the influence can include euphoria and anxiety. Although some assert that Cannabidiol (CBD), another CB found in *Cannabis* in varying amounts, may alleviate the adverse effects of THC that some users experience. Little is known about CBD's effects on humans. The well-controlled studies with humans have a hard time showing that CBD can be distinguished from placebo or that it has any systematic effect on the adverse effects of *Cannabis*. When ingested orally, THC can produce stronger psychotropic effects than when inhaled. At doses exceeding the psychotropic threshold, users may experience adverse side effects such as anxiety and panic attacks that can result in increased heart rate and changes in blood pressure.[12]

The growing popularity of medical and recreational consumption of *Cannabis*, especially among the youth, raises immediate concerns regarding its safety and long-term effects. The cardiovascular effects of *Cannabis* are not well known. Cannabis consumption has been shown to cause arrhythmia including ventricular tachycardia as well as increases the risk of MI.It is a potential cause of sudden death. These effects appear to be compounded by cigarette smoking and precipitated by excessive physical activity, especially during the first few hours of consumption.[8]

Despite the considerable research in this field, the effects and benefits of *Cannabis* and its synthetic derivatives remain questionable even in the face of an increasingly tolerating attitude toward recreational consumption and promotion of therapeutic complications. More efforts are needed to increase awareness among the public, especially youth, about the cardiovascular risks associated with *Cannabis* use and disseminate the accumulated knowledge regarding its ill effects. Hence, the reason for this research on Cardiac Enzyme Responses among Marijuana Smokers.

MATERIALS AND METHODS

Twenty marijuana smokers (males) aged 20–40 years attending Federal Medical Centre Owerri were involved in this study. Furthermore, 20 apparently non-smokers aged 20–40 years were used as control. Their consent was obtained as well as ethical approval from the Ethical committee of the hospital.

Sample Collection

Five milliliters of blood sample were collected by standard venipuncture method[13] from each participant and were dispensed into dry bottle. This was centrifuged to get the serum for the analysis cardiac enzymes.

The serum cardiac enzymes were determined by spectrophotometric method: Creatine kinase (CK) (Lawrence, 1984) and aspartate aminotransferase (AST).[14]

Statistical Analysis

The values were expressed as mean ± standard deviation. The significant difference between the mean value of the control and experimental group was determined by one-way analysis of variance with *post hoc t*-test. $P < 0.05$ was considered as statistically significant.

RESULTS

Table 1 shows that the mean ± standard deviation of AST significantly increased in the test when compared with the control at $P < 0.05$. Furthermore, the level of CK was significantly increased in marijuana smokers when compared with the control at $P < 0.05$.

DISCUSSION

Marijuana is a psychoactive drug from the *Cannabis* plant used for medical or recreational purposes.[15] The main psychoactive part of *Cannabis* is THC, one of the 483 known compounds in the plant. It can be used by smoking, vaporizing, within food, or as an extract. However, it has mental and physical, such as creating a "high" feeling, a general change in perception, heightened mood, and an increase in appetite, the onset of effects is felt within minutes when smoked and about 30–60 min when cooked and eaten which last for 2–6 h.[16]

In this study, the level of AST was significantly increased in marijuana smokers when compared with the control. This is in agreement with the study carried out by Yakubu *et al*.[17] The increase in AST could be linked to damage of heart tissue.

AST is localized within the cells of liver, heart, skeletal muscle, kidneys, brain, and red blood cells. The enzyme is an important marker for monitoring liver cytolysis and MI. However, AST levels are influenced by various pathological conditions, such as acute pancreatitis, acute hemolytic anemia, severe burns, acute renal disease, musculoskeletal diseases, and trauma. Furthermore, the increase in AST could be linked with oxidative stress in which free radicals are released. This is in line with the work of Yakubu *et al*.[17]

Table 1: Mean prothrombin time and activated partial thromboplastin time in first, second, thirdtrimesters and non-pregnancy females (control)

Parameter	Test	Control	*P* value
AST (IU/L)	44.49±5.18*	28.28±6.12	*P*<0.05
CK-MB (IU/L)	295.84±6.58*	110.03±11.80	*P*<0.05

AST: Aspartate aminotransferase, CK: Creatine kinase, Key*Significantly increased when compared with the control at *P*<0.05

Furthermore, it was observed in this study that marijuana smokers have significantly higher CK levels compared with the levels in the control group. This is in consonant with the study carried out by Uboh,[18] who observed that marijuana smoking increases the activity of cardiac enzymes such as CK, AST, and lactate dehydrogenase. The results of the present study showed that the use of marijuana caused significant alterations in biochemical parameters of cardiac function.

CONCLUSION

The results of the present study indicated that the values of AST and CK were increased in marijuana smokers. This implies that marijuana smoking could be associated with MI.

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