Effect of Marijuana on Some Cardiac Biomarkers among Smokers in Southwest Nigeria

Abstract

Background: Marijuana is the oldest and one of the most widely used illicit drugs, the clinical and pharmacological effects of cannabinoids have been recently studied, with much still unknown about the physiologic and pathologic effects. This study aimed to evaluate its cardiovascular effect using some cardiac makers among smokers in Nigeria.

Methods: The study was a comparative design conducted among eighty-eight test and control subjects. Venous blood was collected for AST, LDH and CK-MB. Biodata was obtained via questionnaires with anthropometric and blood pressure measures. Data were analyzed using SPSS version 21 and a significant level was taken at $p<0.05$.

Results: There was a decrease in systolic and diastolic blood pressure of subjects who use marijuana as observed from earlier studies. There was a significant increase in the levels of these enzymes in marijuana users as compared to non-smokers.

Conclusion: The increase in these cardiac bio-markers, though heralds the pathologic effect of the use of marijuana on the heart, will be most convincing to assay more cardiac markers such as troponin T to buttress these findings.

Keywords: Marijuana, Cardiac biomarkers, Smokers, Nigeria

Introduction

Marijuana, also known as cannabis, is found in many tropical areas in the world and due to its effect on the brain[1], it is generally regarded as a substance of abuse; hence it is unlawful to possess, supply or use.[2] This makes it difficult to obtain precise data about the extent of its use.

Studies suggest that over 3.3 million people used cannabis yearly.[1,3] A New Zealand birth cohort discovered that by the age 21, nearly 70% has used cannabis.[4] Africa is confirmed to have the largest production area, transit territory and consumer market. South Africa is probably the world's leading producer of marijuana as well as Nigeria.[5] The cannabis produced in Nigeria feeds its large domestic market (an estimated 10.6 million cannabis users in 2018) and there is evidence of trafficking to other countries in Africa too. In the past decade, a number of countries outside of Africa also have mentioned Nigeria as a source country of cannabis.[6]

Apart from the therapeutic[7] effect of marijuana from its active ingredient Δ^9–tetrahydrocannabinol (THC), the involvement of the endocannabinoid system in

cardiovascular pathology has also been alluded to. One of the most consistent effects of cannabis intoxication is an increased heart rate. According to the American Heart Association, marijuana use is scientifically linked to an increased risk of cardiovascular diseases, as well as heart attacks and strokes. while may be helpful for some other medical conditions, it does not appear to have any well-documented benefits for the prevention or treatment of cardiovascular diseases (CVD). In fact, the chemicals in cannabis have been linked to an increased risk of heart attacks, heart failure and atrial fibrillation in observational studies.[7,8]

The presence and action of CBI (cannabinoid receptors) in arterial tissue were well described. Marijuana is derived from the hemp plant Cannabis sativa, with the biologically active ingredient being a group of cannabinoids and the main psychoactive constituent being 9-tetrahydrocannabinol (THC).[2] The THC ligand binds to multiple receptors with especially high selectivity for the Cannabinoid 1 and 2 receptors (CB1 and CB2, respectively). CB1 receptors are mainly located in the cardiovascular system (CVS), the central nervous system (CNS), and peripheral vasculature while CB2 receptors are mainly expressed in immune cells.[9]

THC causes an acute, dose-dependent increase in blood pressure (BP) and heart rate (HR). Cannabinoid signaling is involved with regulation of the microvasculature and causes direct activation of vascular cannabinoid CB1 receptors by binding to it.[10] There is evidence to suggest that increased frequency of marijuana use increases the risk of cardiac arrhythmias and myocardial infarction (MI).[8] Furthermore, chronic THC use has been associated with increased angina frequency, likely due to a decrease in the angina threshold, diminished sympathetic and parasympathetic nervous system signal transduction, serum aldosterone increases, central and peripheral vasoconstriction, and hypertension.[8,9]
Although cannabinoids are the oldest and most widely used illicit drugs, the clinical and pharmacological effects of cannabinoids have only been recently studied, with much still unknown about the physiologic and pathologic effects of marijuana[10] and with these cardiovascular effects in cannabis smokers, one would not cease to wonder how biochemical markers of cardiac pathologies in these groups of consumers will look like.

Methodology

Study Design

The study was a cross-sectional comparative design conducted among Forty-four (44) Nigerian male marijuana smokers and forty-four (44) male non-smokers (control) in Osogbo, Osun State Nigeria.

Study procedure

Subjects were randomly selected with voluntary participation after giving their informed consent. Evidence of marijuana smoking was confirmed at smoking joints (special locations), where volunteers attested as smokers for at least two years. The control subjects had never smoked marijuana or cigarettes. Both the test and the control subjects were within 20 - 35

years old. Biodata was obtained through interviewer-administered questionnaires. Blood pressure was measured and anthropometric parameters were obtained.

Five (5) mls of blood was collected from both test and control subjects into lithium heparinized bottle for cardiac markers. Creatinine kinase MB fraction (CK –MB) was determined using the immuno-inhibition method. Lactate dehydrogenase (LD) and Aspartate aminotransferase (AST) were determined using enzymatic UV Kinetic methods.

Data Analysis

The data generated were analyzed using SPSS version 21 and data were subjected to univariance and bivariance analysis using, students' T-Test. Statistical significance taken at $P<0.05$

Results

Table 1 shows the statistical comparison of the biophysical parameters and enzyme level between the smokers (test group) and non-smokers (control group). The mean age of the test subjects (26.66 + 0.48) was not significantly different ($p <0.05$) when compared to that of the control subjects with a mean value (25.43 + 0.50).

The difference between mean height (175.00 + 7.07), weight (71.61 + 6.87), BMI (Body mass Index) (23.52 + 2.54) in the test group when compared to that of the control (174.00 + 8.16), (71.48 + 6.02) and (23.82 + 2.32) was not significant at $p<0.05$.

There was a significant difference at $p<0.05$ of mean systolic blood pressure (SBP) (121.82 + 3.90), as well as the mean diastolic blood pressure (DBP) (67.73 + 4.75) in the test subjects as compared to that of the control subjects (123.86 + 4.90), (72.65 + 5.53).

The difference between the mean AST (13.32 + 6.12), LD (64.48 + 46.30), CK-MB (77.59 + 95.28) of the test group, when compared to AST (5.93 + 2.36), LD (17.18+ 15.22) CK-MB (48.57 +37.43) of the control group was statistically significant at $p< 0.05$.

Table 1: Comparison of the bio-parameters and enzyme levels between test and control subjects.

Parameters	**Test M+ SD**	**Control M+SD**	**P -Value**	**Statistical significance**
Age in years	26.66+0.48	25.43+ 0.50	0.88	Ns
Height (cm)	175.00+7.07	174.05 +8.16	0.59	N_s
Weight (kg)	71.61+6.87	71.48+6.02	0.10	N_s
BMI (kg/m^2)	23.52+2.54	23.82+2.32	0.10	N_s

Systolic blood pressure (mmHg)	121.821+3.90	123.86+ 4.92	0.05	S
Diastolic blood pressure (mmHg)	67.73+4.75	72.65+5.53	0.05	S
AST (U/L)	13.32+6.12	5.93+2.36	0.05	S
LDH (U/L)	64.48+46.30	17.18+15.22	0.02	S
CK-MB (U/L)	77.59+95.28	48.57+37.43	0.03	S

$p<0.05$ = Significant Ns = not Significant S = significant

Table 2: Relevance of co-smoking of marijuana with cigarette among subjects

Parameters	**Marijuana M+SD**	**Marijuana & Cigarette M+SD**	**p-Value**	**Statistical significance**
Age in years	26.74+0.45	26.58+ 0.50	0.84	N_S
Height (cm)	175.40+6.24	174.95 +8.00	0.14	N_s
Weight (kg)	70.09+6.17	73.29+7.35	1.57	N_s
BMI (kg/m^2)	22.96+2.31	24.14+2.69	1.57	N_s
SBP (mmHg)	121.741+3.87	122.38+ 4.36	0.52	N_s
DBP (mmHg)	67.83+4.21	68.10+0.51	0.20	N_s
Duration (Years)	11.87+0.34	1.71+0.46	1.27	N_s
AST (U/L)	13.00+6.00	13.67+6.40	0.36	N_s
LDH (U/L)	58.00+39.01	16.52+9.32	0.05	S
CK-MB (U/L)	102.74+123.60	57.67+49.80	1.56	N_S

Ns= not significant
$p<0.05$ = significant S- significant

Discussion

This study found a significant decrease in the systolic and diastolic blood pressure of the test subjects compared with that of the control. This is in consonant with another study where cannabis caused vasodilatation and modulation of the baroreceptors reflex in the control of SBP.[11] The reason for this decrease might be resulting from the vasodilatation effect of marijuana. However, a modest association between recent cannabis use and increased systolic blood pressure has been reported in another study where no association was detected between cannabis use and diastolic blood pressure levels.[12]

Aspartate aminotransferase, AST is an enzyme found in both the cytosol and mitochondria of most cells including the myocardium. Injuries to these cells cause the release of these enzymes into the plasma. This study found a significant increase in the level of AST in marijuana smokers when compared with that of the control (5.93+ 2.36). This increase though not cardiac-specific might not be unconnected with cardiac pathologies in this group of test subjects. However, the hepatoxicity effect of marijuana has also been documented alongside its cardiac effects.[13,14]

Lactate dehydrogenase, LDH, isoform is found in the myocardium. In acute myocardial infarction, serum activities rise within 12 to 24 hours and peak at 48 hours. There is a significant increase in the value of LDH in marijuana smokers when compared with the control group. However, there is a sharp disparity between marijuana smokers and smokers of both marijuana and cigarettes. This might be because the latter are passive smokers.

Creatine kinase MB fraction is a cardiac-specific enzyme. Pathologies of the heart usually result in an increased level of CK–MB. There is a significant increase in CK-MB level when compared with the control subjects. This is synonymous with elevated levels of CK-MB seen among cannabis addicts with cardiovascular collapse.[15] This increment might be a result of cardiac injuries.

These changes in the level of some cardiac biomarkers (AST, LD, CK-MB), this is a pointer to the effect of marijuana use on the cardiac system, however studies in more cardiac-specific markers will need to be conducted to determine the specific effect of marijuana on the heart.

Conclusion

The study observed a decrease in systolic and diastolic blood pressure among marijuana smokers a significant increase in the level's cardiac bio-markers. This brings about the need to pay more attention to the pathologic effect of marijuana use on the heart rather than it widely echoed medicinal advantages. It will however be most convincing to assay more cardiac markers such as troponin T to buttress these findings.

Reference

1. Osborne GB, Fogel C. Understanding the motivations for recreational marijuana use among adult Canadians. Subst Use Misuse [Internet]. 2008 Feb [cited 2023 Sep 24];43(3–4):539–72. Available from: https://pubmed.ncbi.nlm.nih.gov/18365950/
2. Sharma P, Murthy P, Bharath MMS. Chemistry, Metabolism, and Toxicology of Cannabis: Clinical Implications. Iran J Psychiatry [Internet]. 2012 [cited 2023 Sep 24];7(4):149. Available from: /pmc/articles/PMC3570572/
3. Barnett JH, Werners U, Secher SM, Hill KE, Brazil R, Masson K, et al. Substance use in a population-based clinic sample of people with first-episode psychosis. The British Journal of Psychiatry [Internet]. 2007 Jun [cited 2023 Sep 24];190(6):515–20. Available from: https://www.cambridge.org/core/journals/the-british-journal-of-psychiatry/article/substance-use-in-a-populationbased-clinic-sample-of-people-with-firstepisode-psychosis/ACE0E09BA23E61AFCD0AA1E2D650CF58
4. Fergusson DM, Horwood LJ, Lynskey MT, Madden PAF. Early reactions to cannabis predict later dependence. Arch Gen Psychiatry. 2003 Oct 1;60(10):1033–9.
5. UNODC - Bulletin on Narcotics - 1972 Issue 2 - 002 [Internet]. [cited 2023 Sep 24]. Available from: https://www.unodc.org/unodc/en/data-and-analysis/bulletin/bulletin_1972-01-01_2_page003.html
6. Nelson EUE. Consumption, not decriminalization: How Nigerian drug dealers/users account for cannabis harms. International Journal of Drug Policy. 2022 Aug 1;106.
7. Yarnell S. The use of medicinal marijuana for posttraumatic stress disorder: A review of the current literature. Prim Care Companion J Clin Psychiatry. 2015;17(3).
8. Page RL, Allen LA, Kloner RA, Carriker CR, Martel C, Morris AA, et al. Medical Marijuana, Recreational Cannabis, and Cardiovascular Health: A Scientific Statement From the American Heart Association. Circulation. 2020 Sep 8;142(10):E131–52.
9. Subramaniam VN, Menezes AR, DeSchutter A, Lavie CJ. The Cardiovascular Effects of Marijuana: Are the Potential Adverse Effects Worth the High? Mo Med [Internet]. 2019 Mar 1 [cited 2023 Sep 24];116(2):146. Available from: /pmc/articles/PMC6461323/
10. Metabolic Syndrome and Cannabinoids – Nature's Breakthrough [Internet]. [cited 2023 Sep 24]. Available from: https://naturesbreakthrough.com/blogs/news/metabolic-syndrome-and-cannabinoids
11. Vallée A. Association between cannabis use and blood pressure levels according to comorbidities and socioeconomic status. Scientific Reports 2023 13:1 [Internet]. 2023 Feb 5 [cited 2023 Sep 24];13(1):1–13. Available from: https://www.nature.com/articles/s41598-022-22841-6
12. Alshaarawy O, Elbaz HA. Cannabis Use and Blood Pressure Levels: United States National Health and Nutrition Examination Survey, 2005–2012. J Hypertens [Internet]. 2016 Aug 1 [cited 2023 Sep 24];34(8):1507. Available from: /pmc/articles/PMC5237375/
13. Vázquez-Bourgon J, Ortiz-García de la Foz V, Suarez-Pereira I, Iruzubieta P, Arias-Loste MT, Setién-Suero E, et al. Data regarding the effect of cannabis consumption on liver function in the prospective PAFIP cohort of first episode psychosis. Data Brief. 2019 Dec 1;27.
14. Kaufmann R, Aqua K, Lombardo J, Lee M. Observed Impact of Long-Term Consumption of Oral Cannabidiol on Liver Function in Healthy Adults. Cannabis Cannabinoid Res. 2023 Feb 1;8(1):148–54.
15. Wayangankar SA, Dasari TW, Lozano PM, Beckman KJ. A Case of Critical Aortic Stenosis Masquerading as Acute Coronary Syndrome. Cardiol Res Pract [Internet]. 2010 [cited 2023 Sep 24];2010(1). Available from: /pmc/articles/PMC2913510/