

Effect of Marijuana Smoking on Some Hematological Parameters of Smokers

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Abstract: The study investigated the effect of marijuana smoking on some Hematological characteristics of smokers in comparison to non smokers. Blood samples were collected from twenty four, randomly selected Nigerian male voluntary marijuana smokers (test) and sixteen voluntary male non-smokers (control). The completely randomized design study revealed no significant ($p > 0.05$) difference in the Hematological parameters between the test and control subjects. Though within normal range, the values observed for total leucocytes, neutrophil, lymphocyte, monocyte and platelet counts, were marginally lower in the test subjects, while values observed for PCV, hemoglobin and eosinophil were marginally higher. Occurrence of low lymphocyte count was specifically observed in 12.5% of test subjects while occurrence of high eosinophil count was specifically observed in 4.2% of test subjects. Cannabinoid, the psychoactive substance contained in marijuana, could have an inhibitory effect on T and B lymphocytes and consequently reduce the humoral and cell mediated immune responses in Marijuana users. Marijuana smoking seemed to result in inflammatory, allergic reactions leading to eosinophilia. Its usage however did not seem to confer physiological stress as the neutrophil : lymphocyte ratio did not differ between the test and control subjects.

Key words: Marijuana smoking • Hematological parameters • smokers • non-smokers

INTRODUCTION

The hemp plant (*Cannabis sativa*) has been very popular all over the world. According to Ebuechi [1] marijuana is a green or grey mixture of dried shredded flowers and leaves of the hemp plant. Pillard [2] reported that the resin covered flower top of the female plant and their adjacent leaves are considered to have the highest concentration of cannabinoid, which remains the most typical component of marijuana, with the active ingredient being (THC) Delta-9-tetrahydrocannabinol [3]. Apart from the therapeutic effect of marijuana and THC, which include lowering of internal eye pressure in persons suffering from glaucoma and alleviating nausea and vomiting, caused by chemotherapeutic drugs used to treat cancer patients and those afflicted with Acquired Immune Deficiency Syndrome (AIDS), the fibre of the plant is used for making ropes, hats, sacks and from its seed is the oil, used for soap production, hair cream and other products. The most contentious use of the plant is

for its psychoactive or narcotic properties due to the substance, cannabinoid, which occurs only in the species. According to Graham [4] the possibility of serious harm from acute overdose or of more subtle damage as a result of prolonged misuse of the drug is thrust to the back of the minds of those who propose freedom of its use. On the other hand, it is exaggerated by those who disapprove of the use of the drug, not necessarily on the ground of its toxicity. Susceptibility to cannabis is individual and dose dependent [5] thus while an experienced smoker ordinarily enjoyed cannabis, an inexperienced smoker could suffer dizziness, tachycardia, tremor, transient muscular rigidity becoming stupous and disoriented in a few hours. Marijuana smoking have been reported to significantly affect the blood chemistry and may also affect neural functions [1].

Isabell and Hagerup [6] reported that Cigarette and not pipe or cigar smoking resulted in increased packed cell volume (PCV) in male smokers and Hemoglobin (Hb) levels in female smokers. Polymorphonuclear neutrophils

are very important in the body's acute inflammatory process, while lymphocytes, monocytes and macrophages all as mononuclear phagocytic cells, are indispensable in the body immune system and chronic inflammatory response [7]. Eosinophils respond to chemotactic substances produced by mast cell when induced by the presence of persistent antigen-antibody complexes such as occur in chronic parasitic, dermatological and allergic conditions while Basophils, whose granules contain a number of preformed mediators of the inflammatory response including histamine and chondroitin sulphate, also stimulate leukotriene and other mediators upon stimulation [8].

Interaction with marijuana users revealed a continuous increase in its use by young, able-bodied Nigerians, cutting across sex divisions. Reasons proffered include frustrations, on account of current and consistent difficult economic situation in the country. The paucity of information on the Hematological status of marijuana users in this part of the country, the importance on blood constituents individually or collectively, to healthy living and the reality of the poor status of our country's economy for some time to come, with the government not succeeding in alleviating the situation effectively all crystallise to form the basis of this study, which seeks to investigate the effect of marijuana usage on some Hematological parameters in smokers in order to elucidate possible deviations from the non smokers.

MATERIALS AND METHODS

Twenty-four Nigerian male voluntary marijuana smokers (test) and sixteen male non-smokers (control) around Amuwo-Odofin area of Lagos State were randomly selected without any financial gratification for this study. Evidence of marijuana smoking was confirmed at a smoking joint where volunteers, certified by colleagues

as smokers for at least two years, were recruited. The control subjects had never smoked marijuana in any form nor cigarette in their life. Both the test and the control subjects were within 25-30 years age range. All participants voluntarily submitted written informed consent before the commencement of the study. Four (4) milliliter of blood was collected from the cephalic vein, a prominent vein in the cubital fossa of both test and control subjects in a fasting condition between 8 am and 10 am daily into sample bottles, which contained Dipotassium salt of Ethylene Diamine Tetra Acetic Acid (EDTA) at a concentration of $2 \mu\text{g mL}^{-1}$ of blood. Gentle mixing was done immediately to ensure complete anticoagulation of the blood. Hematological parameters studied according to the methods of Dacie and Lewis [9] included Hemoglobin (Hb), total leucocyte count (TLC) and differential leucocyte counts, Packed cell volume (PCV), red blood cells (RBC) and platelets.

Statistical analysis: The data collected was subjected to analysis of variance (ANOVA) using the General Linear Model [10]. Means, where significant were separated by Students' t-Test [10].

RESULTS

The effects of marijuana smoking on the Hematological parameters of the test subjects are shown in Table 1. There was no significant ($p > 0.05$) difference between the two subject groups in any of the Hematological parameters studied. However the PCV, the Hb and the eosinophil differential counts were marginally higher in the test than the control subjects, while TLC, neutrophils, lymphocytes, monocytes and the platelets counts were marginally lower. The neutrophil: lymphocyte ratios were equal between the two subject groups. Table 2 shows the frequency of occurrence of different

Table 1: Some Hematological Parameters of marijuana smokers and non-smokers

Blood characteristics	Smokers	Non-smokers	Mean	SED	P-value
Hemoglobin Hb (g/100mL)	12.16	12.10	12.14	0.690	0.93
TLC ($\times 10^9$)	5.20	5.45	5.30	0.159	0.13
Neutrophil (%)	55.96	59.88	57.25	2.150	0.08
Lymphocyte (%)	33.13	34.56	33.70	0.600	0.17
Eosinophil (%)	3.54	3.25	3.43	0.440	0.51
Monocyte (%)	4.54	4.56	4.55	0.580	0.97
Neu/Lymph ratio	1.78	1.77	1.78	0.120	0.96
PCV (%)	40.00	39.00	39.50	0.800	0.06
Platelet	250.00	253.00	252.00	4.100	0.09
n	24.00	16.00	40.00		

TLC - Total leucocyte count, PCV - Packed cell volume, SED - Standard error or of difference, n - Number sampled

Table 2: Frequency of occurrence of different levels of Hemoglobin and white blood cell (%)

Parameter	Frequency of occurrence					
	High level		Normal level		Low level	
	Smokers	Non-smokers	Smokers	Non-smokers	Smokers	Non-users
Hemoglobin	(>18 g dL ⁻¹)		(10-18 g dL ⁻¹)		(<10 g dL ⁻¹)	
	0	0	75	75	25	25
Total leucocytes	(>11.0 x 10 ⁹ /l)		(4.0-10.0 x 10 ⁹ /l)		(<4.0 x 10 ⁹ /l)	
	0	0	87.5	100	12.5	0

() Figure represents standard value for each level

Table 3: Frequency (%) of Various WBC (Leucocytes) types at different levels

Parameter	Frequency of occurrence					
	High level		Normal level		Low level	
	Smokers	Non-smokers	Smokers	Non-smokers	Smokers	Non-users
Neutrophils	0.0	0.0	100.0	100.0	0.0	0.0
Eosinophils	4.2	0.0	95.8	100.0	0.0	0.0
Monocytes	12.5	12.5	87.5	87.5	0.0	0.0
Basophils	0.0	0.0	100.0	100.0	0.0	0.0
Lymphocytes	0.0	0.0	87.5	100.0	12.5	0.0

WBC - White blood cells

levels of Hb and TLC in the test and control subjects. Hb level was normal in 75% of both the test and the control subjects. Hb was at lower level than normal in 25% of both the test and the control subjects. TLC was lower in 12.5% of the test subjects while none of the control subjects manifested any deviation from the normal leucocyte level. The frequencies of occurrence of different levels of the various WBC types in test and control subjects are shown in Table 3. Eosinophil and Lymphocyte counts were respectively higher than the normal level in 4.2% and lower than the normal level in 12.5% of the test subjects but no deviation from normal was observed in the control subjects for these two differential counts. Monocyte differential count was higher than the normal level in 12.5% of both the test and the control subjects. The Neutrophil: lymphocyte ratio did not differ between smokers and non-smokers (Table 1).

DISCUSSION

The non-significant difference in the Hematological values between smokers and non-smokers of cannabis is in line with the report of Isager and Hagerup [11] who found no effect of pipe and cigar smoking on Hematological values. It is also in agreement with Beacofield *et al.* [12] that Hemoglobin and PCV in the blood of ten native volunteers, who smoked cannabis containing 10 mg cannabinoid remained within the normal range. Our result is further reinforced by the report of Beacofield *et al.* [12] that there was no significant difference between smokers and non-smokers

in chest x-ray, blood parameters and alveolar debris. The marginally higher value observed for PCV in marijuana smokers in this study, agrees with Isabell and Hagerup [6] on cigarette smokers where PCV was increased as a result of smoking. This was explained by the increase in carbon monoxide level in the blood of smokers [13], which according to Kjeldsen [14] induced erythrocytosis in the rat. The marginally lower value observed in TLC of smokers in this study, though within the normal TLC range according to Govan *et al.* [7] is in line with the report of Brent-Moore [15] that induced peripheral blood leucopenia was caused by a single oral dose of 23-30 mg of cannabinoid per kg weight in rats. Possible complications arising from additional inflammatory agent, which might complicate the bronchitis experienced generally in smokers, could thus be implicated with reduced TLC.

The occurrence of higher eosinophil count than the normal in 4.2% of the smokers, while the values in all non-smokers studied were normal, can be explained by the observation of Brent-Moore *et al.* [15] that cannabis plants are contaminated with a range of fungal spore organisms, which cause secondary eosinophilic pneumonia. According to Rubin and Faber [8] apart from circulating in the blood, eosinophils are also found in tissues near points of external environmental contact and in inflammatory cellular infiltrates. They exhibit specialized function in certain disorders and are conspicuously active in their protection against foreign substances like smoke and cannabinoids. The eosinophilia manifestation in the 4.2% of smokers, could be as a result of individual

response since susceptibility is individual dependent [5]. Such individual resistance could be on account of nutritional status as well as dose and chronicity effect. The occurrence of low level of lymphocyte in 12.5% of the smokers is in line with the report of Nahas *et al.* [16] that cannabinoids inhibited both T and B-lymphocytes in mice, through the blocking of amino acid uptake into the stimulated lymphocytes. Nahas *et al.* [16] and Gupta *et al.* [17] from their results in separate experiments and contrary to Silverton and Lessin [18] suggested that the low level of lymphocyte counts in chronic cannabis smokers, would predispose them to overwhelming infection, cold, influenza or cancer.

The fact that the Neutrophil: Lymphocyte ratio did not differ between smokers and non-smokers of marijuana suggest that marijuana smoking did not seem to inflict conspicuous physiological stress on the smokers. This is in line with report of Granville-Grossman [19] and Rang *et al.* [20].

CONCLUSIONS

The Hematological characteristics of cannabis smokers did not differ significantly from non-smokers. A decrease in lymphocyte counts in up to 12.5% of cannabis smokers is a pointer to the fact that cannabinoid inhibits T and B lymphocytes in man as it has been found in the rat. The most likely consequences are easy predispositions of cannabis smokers to preventable infections, consequent upon the possibility of reduced humoral and cell mediated immune responses. The occurrence of higher eosinophil counts in 4.2% of test subjects suggests an inflammatory, allergic reaction consequent upon the precipitated eosinophilia conspicuous in these subjects. Marijuana smoking did not however result in physiological stress in the test subjects.

REFERENCES

1. Ebuechi, A.O.T., A.I. Akinwande, O.O. Famuyiwa, E.O. Uzodinma, O.A. Adebayo, O.A. Onwumere, O.N. Masade and B. Aiyesimoju, 2005. Effect of Marijuana Smoking on Blood Chemistry and Serum Biogenic Aminos Concentrations in Humans. *Nigerian J. Health and Biomed. Sci.*, 1: 20-24.
2. Pillard, R.C., 1970. Marijuana, *N. Eng. J. Med.*, 283: 290-294.
3. Baczynsky, W.D., A.M. Zimmerman, 1983. Effects of delta-9-tetrahydro cannabinol, cannabinal and cannabidiol on the immune system in mice 1. *In vivo Investigation using the primary and secondary immune response. Pharmacology*, 26: 1-11.
4. Graham, J.D.P., 1973. The use of marijuana. *British Pharmacology*.
5. Isabell, H., 1971. *Pharmacological Review*, 23: 337-338.
6. Isabell, H. and I. Hagerup, 1971. Relationship between cigarette smoking and high PCV and Hb levels. *Scand. J. Hematol.*, 8: 241.
7. Govan, A.D.T., P.S. Macfarlane and R. Callander, 1995. In *Pathology Illustrated 4th Edition Churchill Livingston*, pp: 33-50.
8. Rubin, E. and J.L. Faber, 1998. In: *Pathology: The Respiratory System*, Travis, W.D., J.L. Farber and E. Rubin (Eds.) 3rd Edition, pp: 621.
9. Dacie, J.V. and S. Lewis, 1991. *Practical Hematology 8th Edition*.
10. SAS., 2002. *Statistical Analysis System. Users guide*. Cary. NC., USA.
11. Isager, H. and L. Hagerup, 1971. Relationship Between Cigarette Smoking and High Packed Cell Volume and Hemoglobin Levels. *Scand. J. Hematol.*, 8: 241-244.
12. Beacofield, R., J. Ginsburg and Rainsburg, 1973. Marijuana smoking Cardiovascular effects in man and possible mechanism. *N. Eng. J. Med.*, 287: 109-112.
13. Hubber, G., C. M'Carthy, M. Cutting Perrierra and R. Luardo, 1976. *Pharmacology of Canabis*.
14. Kjeldsen, K., 1969. Smoking and athero-sclerosis. *Munksgaard, Copenhagen*.
15. Brent-Moore, 2005. Marijuana Associated With Some Respiratory Symptoms as Tobacco. *J. General Internal Med.*, Pages.
16. Nahas, G.G., N. Socie-Foca, J.P. Armand and A. Morishuana, 1974. Inhibition of cellular immunity in marijuana smokers. *Sc.*, 153: 419-20.
17. Gupta, S., M.H. Grieco, J.D. Cushman, 1974. Impairment of rosette forming T. lymphocytes in chronic marijuana smokers. *N. Eng. J. Med.*, 291: 874-876.
18. Silverton, M.J. and P.N. Lessin, 1954. Normal Skin test response in marijuana users sciences, 185: 740-741.
19. Granville-Grossman, K., 1994. Psychiatric aspects of cannabis use. In *Recent advances in Clinical Psychiatry. Churchill-Livingstone London*, 3: 251-270.
20. Rang, H.P., M.M. Dale and R. J. M. 1996. *Pharmacology. 3rd Ed. Churchill-Livingstone London*, pp: 633-780.