Archives of Current Research International

20(7): 38-48, 2020; Article no.ACRI.62118
ISSN: 2454-7077

Assessment of Complete Blood Counts of *Cannabis sativa* Smokers in Ekpoma, Edo State, Nigeria

R. A. Amaechi[1*], I. O. Babatope[1], P. O. Abulele[1] and B. N. Obodo[1]

[1]Department of Medical Laboratory Science, Ambrose Alli University, Ekpoma, P.M.B. 14, Edo State, Nigeria.

Authors Contributions

This work was carried out in collaboration among all authors. Author RAA designed the study, supervised the work up, analysed data and prepared the manuscript draft. Author IOB performed Laboratory analysis and analysed data. Author POA conceived the study, source for literature materials, performed the Laboratory analysis and analysed data. Author BNO did literature search, performed statistical analysis and analysed data. All Authors read and approved the final manuscript.

Article Information

DOI: 10.9734/ACRI/2020/v20i730212
Editor(s):
(1) Dr. Faisal, Abdul Wali Khan University, Pakistan.
Reviewers:
(1) Muhammad Torequl Islam, Bangabandhu Sheikh Mujibur Rahman Science and Technology University, Bangladesh.
(2) Larisa Anghel, University of Medicine and Pharmacy, Grigore T. Popa, Romania.
Complete Peer review History: http://www.sdiarticle4.com/review-history/62118

Original Research Article

Received 24 August 2020
Accepted 31 October 2020
Published 07 December 2020

ABSTRACT

Smoking of *Cannabis sativa* (Marijuana), a known psychoactive substance may result in side effect on living cells of the system. The aim of this study is to assess the complete blood count of *Cannabis sativa* smokers and make comparison with non-smokers in Ekpoma, Edo State. A total of one hundred subjects were recruited for this study which consist of Fifty (50) *Cannabis sativa* smokers and fifty (50) non Smokers which served as control. A complete record of medical and smoking history was obtained for each subject, with the use of the questionnaire. The samples obtained were taken to the laboratory for analysis using Sysmex KX auto analyzer. The result showed that the levels of WBC, RBC, granulocytes, lymphocytes, monocytes, Haemoglobin, packed cell volume and platelet levels were significantly lower ($p<0.05$) in cannabis smokers as compared to the control. The MCV, MCH, MCHC, RDW, PDW and MPV values of cannabis smokers were significantly different ($p<0.05$) as compared to the control subjects. In conclusion, this study showed that haematological parameters of cannabis smokers differed significantly from non-smokers.

**Corresponding author: Email: roseyulunne@aauekpoma.edu.ng;*

Keywords: Marijuana; smokers; haematological parameters.

1. INTRODUCTION

Recently, it has become apparent that cannabis smoking has a negative impact on the haematological profile. However, carrying out this study would provide a valuable information regarding the relationship between smoking and the progression of haematogical disorders.

Cannabis could be described as a dry, shredded mixture of the flowers, stems, leaves, and seeds of the cannabis plant. The plant has three different species including: *Cannabis sativa, Cannabis indica, and Cannabis ruderalis. C. sativa* leaf is typically green, but brown if dried. All forms of cannabis contain delta-9-tetrahydrocannabinol (Δ9-THC) as the main psychoactive ingredient (Ashton, 1999). Recently, there seems to be an increase in the number of reports lending support to cannabis psychosis [1].

C. sativa (Marijuana) is an annual plant belonging to the family *cannabaceae* of the nettle order (urticales) it grows wild in warm and tropical climates throughout the world and is cultivated commercially. It is a known psychoactive substance, but for many years it was harvested primarily for its fiber [2]. Cannabis preparations have been used to relieve nausea, improve appetite and reduce pain for thousand years. *C. sativa* and *Nicotiana tobacum* (tobacco) are common drugs known today and the drugs have side effect on living cells of the system. Smoking leads to an appreciable rise in concentration of carboxyhaemoglobin which does not function in oxygen transport; an erythropoietin-mediated increase in erythropoiesis therefore occurs. Marijuana may increase factor vii activity, however, there are mixed results in terms of the effects of smoked marijuana on platelet function [3].

Presently, there is an increase in the use of marijuana by young able-bodied Nigerians, cutting across sex divisions [4]. There is paucity of information on the haematological 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 crystallize to form the basis of this study, which assessed the effect of marijuana usage on complete blood counts in smokers in order to elucidate possible deviations from the non-smokers. Alcohol and Drug Education shows that marijuana use can weaken the immune system and interrupt maturation of white blood cells. Therefore, marijuana users may be more vulnerable to illness [5].

Much research has focused on the effects of marijuana on the chemical transmitter acetylcholine that is, when THC is in a relatively small (dose) it decrease the turnover in acetylcholine, particularly in the hippocampus resulting in decrease in neurotransmitter activity (Marks et al., 2002). Cannabis has been shown to decrease intraocular pressure, although patients have experienced side effects regardless of whether the cannabis was administered orally through injection, or by smoking [4]. These side effects have included increase heart rate and psychological effects [4].

Over the years, Cannabis remains the most widely used illicit drug worldwide due to its affordability and availability [6]. Besides, cannabis is a major controversial drug as there are numerous conflicting and controversial reports concerning its psychological and physiological effects [7]. Many reports have linked cannabis smoking to the development of psychosis [8]. Certain studies have also suggested that cannabis smoking is only a form of self-medication in people with psychotic symptoms rather than a causative factor in development of psychosis [9].

This study investigates the relationship between the complete blood count of *C. sativa* smokers and non smokers. The purpose of this study is to determine the effect of *C. sativa* on the complete blood count of smokers in Ekpoma, Edo State. If *C. sativa* lowers complete blood count, then smokers should be reduce intake. In the developing countries, like Nigeria, data available is scarce as well as reliable information of actual and potential health consequences, which could give input into health analysis of national developmental strategies. Therefore, this research is focused on the impact of *C. sativa* smoking on the haematological parameters (Total white cell count, Differential white count, haemoglobin concentration, platelet count, packed cell volume, red cell count, MCV, MCH and MCHC).

2. MATERIALS AND METHODS

2.1 Study Area

This study was carried out in Ekpoma, The Headquarter of Esan West Local Government area of Edo State. It is located at latitude 6^{o} 45^{l}N and longitude 6^{o} 08^{l}E. It is moderately populated with the peoples' occupation being farming and trading. The main sources of water in the locality are rainfall and well. The well is augmented by irrigation scheme provided by the Government for public use. University is situated in this region. It is usually cold at night and very hot during the day. It also has undulating topography (World Gazetter, 2007).

2.2 Study Population

A total of one hundred subjects were recruited for this study which consist of Fifty (50) *Cannabis sativa* smokers and fifty (50) non Smokers which served as control. The age ranges of the subjects and control were within 18-50 years

2.3 Research Design

This research was designed to evaluate white cell count, differential white count, haemoglobin concentration, platelet count, packed cell volume, MCV, MCH, MCHC, RDW, MPV and PDW in smokers of *Cannabis sativa* and make comparison with non smokers (control). This study was carried out within five (5) months October, 2018 to February, 2019. A complete record of medical history was obtained for each subject, including name, age, and gender with the use of the questionnaire. The samples obtained were taken to the laboratory for analysis. The results generated were further used to make comparisons with their control counterparts.

2.4 Inclusion Criteria

Apparently healthy *Cannabis sativa* smokers within the age range 18-50 years were included in this study. Also apparently healthy non *Cannabis sativa* smokers within the age range of 18-50 years were included as the control subjects.

2.5 Exclusion Criteria

Other smokers such as cigarette smokers and subjects above the age range of 18-50 years were excluded in this study.

2.6 Sample Collection

Five milliliters (5 mls) of bood samples was collected by vene-puncture into an accurately labelled 5ml EDTA container for both subject and control. The collected blood sample was mixed properly in order to avoid clotting of the samples, the samples container would be labeled properly with the date of collection name of subject. The laboratory analysis was carried out for total white cell count, differential white cell count, packed cell volume (PCV), Haemoglobin concentration (Hb), platelets count, MCV, MCH, MCHC, RDW, MPV and PDW

2.7 Sample Analysis

2.7.1 Automation procedure

This was carried out using the Sysmex KX. Five milliliters (5 mls) of venous blood was collected from the subjects in a sequestrated (EDTA) container and mixed properly to avoid clothing for haematological investigations, namely: full blood count, and platelet count (using KX-21 Haematology Analyser) (Sysmex, 2004).

2.8 Statistical Analysis

The Mean and standard deviation of the results obtained were calculated. Student's t- test and ANOVA (LSD) was used for the analysis using SPSS package version 21. Values with $p<0.05$ was considered statistically significant in this study.

3. RESULTS

The results of this study are presented in this chapter and comparisons were made between the control and the subjects-cannabis smokers in Ekpoma, Edo State. Socio demographic profiles and the smoking history of the subjects were also presented.

Fifty (50) questionnaires were distributed to respondents. These respondents were cannabis smokers in Ekpoma, Edo State. All questionnaires were returned in good order and analyzed. Table 1 revealed the socio-demographic characteristics of the respondents. Age is categorized into four year age groups from 16 -20; 21 - 25; 26 – 30 and 31 years and above. Majority of the respondents were within ages 21 - 25 years; 20 (40%), this is followed by 26 – 30, 15(30%), 31 years and above-8(16%), and 16– 20;7(14%). As it relates to gender, males 31(62%) were higher than females 19(38%). Regarding marital status, majority is

single 27 (54%), 19(38%) were married and 4 (18%) were divorced. Also, regarding ethnicity, the cannabis smokers are Esan, Benin, and Etsako having frequency of 19 (38%), 15 (30%) and 16 (32%) respectively. Regarding years of religion, most of the respondents are Christians 26 (52%); 8 (16%) are traditionalist while 18 (36%) are Muslims. Concerning education, most of the respondents have tertiary education 25 (50%), 19 (38%) had secondary, while 6 (12%) had primary education.

Table 2 presented the smoking history of the cannabis smokers. The result showed that majority of the cannabis smokers started smoking within the age 19-21 years 26 (52%), followed by 15-18 years 14 (28%) and then 22 years and above 10 (20%). Regarding the type of cigarette, 26 (52%) affirmed using cannabis, 15 (30%) and 9 (18%) affirmed to using roll up. Also, 21 (42%) agreed to have smoked for 1-3 years, 15 (30%) agreed to less than 1 year while 14 (28%) agreed to greater than 3 years. Concerning the number of wraps of cannabis per day, 33 (66%) was accrued to 3-5 wraps, 10 (20%) to 6-8wraps, 4 (8%) to 8-10 wraps and 3 (6%) to greater than 10 wraps. Also, as regards cannabis smoked per week, 23 (46%) agreed to 1-2 days, 17 (34%), 10 (20%) agreed to everyday. Also, 26 (52%) of the cannabis smokers agreed that they smoke after 1 hour of waking up, 12 (24%) agreed to within 5 minutes and 6-30 minutes. As regards smoking when critically ill, 30 (60%) of the respondents reported negatively while 20 (40%) responded positively. On quitting smoking, 26 (52%) agreed to have quit smoking in the past while 24 (48%) did not agree. On allergy, 34 (68%) responded not to have had allergy while 16 (32%) responded to the affirmative. Also, 10 (20%) of the respondents agreed to have underlying illness while 40 (80%) responded negatively.

The results in Table 3 presented the haematological parameters levels of cannabis smokers and control. The result showed that the levels of WBC were significantly lower ($p<0.05$) in cannabis smokers (3.88± 1.99 $10^{12/}$L) as compared to the control (6.51± 1.43 $10^{12/}$L). The levels of lymphocytes were significantly higher ($p<0.05$) in cannabis smokers (57.54 ± 7.90 g/dl) as compared to the control (36.60± 11.74 g/dl). The monocytes levels were significantly higher ($p<0.05$) in cannabis smokers (8.84±4.15 g/dl) as compared to the control (6.27± 1.27 g/dl). The granulocytes levels were significantly lower ($p<0.05$) in cannabis smokers (26.28± 8.01g/dl) as compared to the control (58.38± 10.04 g/dl).

Table 1. Socio-demographic characteristics of the study population

Variables		Frequency (N= 50)	Percentages (%)
Age (Years)	16– 20	7	14
	21 – 25	20	40
	26 – 30	15	30
	31& above	8	16
	TOTAL	50	100
Gender	Male	31	62
	Female	19	38
	TOTAL	50	100
Marital Status	Single	27	54
	Married	19	38
	Divorced	4	8
	TOTAL	50	100
Ethnicity	Benin	15	30
	Esan	19	38
	Etsako	16	32
	TOTAL	50	100
Religion	Christian	26	52
	Traditional	8	16
	Muslim	18	36
	TOTAL	50	100
Education	Primary	6	12
	Secondary	19	38
	Tertiary	25	50
	TOTAL	50	100

Table 2. Smoking history of the cannabis smokers /questionnaire

Variables		Frequency (N= 50)	Percentages (%)
At what age did you start smoking?	15-18	14	28
	19-21	26	52
	22 and above	10	20
	TOTAL	50	100
What type of cigarette do you smoke?	Cannabis	26	52
	Cigarette	15	30
	Roll up	9	18
	TOTAL	50	100
How long have you been smoking cannabis?	< 1 year	15	30
	1-3 years	21	42
	> 3years	14	28
	TOTAL	50	100
How many wraps of cannabis do you smoke per day?	3-5	33	66
	6-8	10	20
	8-10	4	8
	>10	3	6
	TOTAL	50	100
How many days a week do you smoke cannabis?	1-2 days	23	46
	3-4 days	17	34
	Everyday	10	20
	TOTAL	50	100
How soon after you wake up do you smoke your first cannabis?	Within 5 mins	12	24
	6-30mins	12	24
	After 1 hour	26	52
	TOTAL	50	100
Do you smoke cannabis when critically ill?	Yes	20	40
	No	30	60
	TOTAL	50	100
Did you at any time in the past quit smoking?	Yes	26	52
	No	24	48
	TOTAL	50	100
Do you have any allergy?	Yes	16	32
	No	34	68
	TOTAL	50	100
Do you have any underlying illness?	Yes	10	20
	No	40	80
	TOTAL	50	100

RBC levels were lower significantly ($p<0.05$) in cannabis smokers (3.27± 0.84 $10^{12/}$L) as compared to the control (5.03± 0.59 $10^{12/}$L). Haemoglobin levels were significantly lower ($p<0.05$) in cannabis smokers (12.79 ± 2.23g/dl) as compared to the control (14.24± 1.65 g/dl). Packed cell volume was significantly lower ($p<0.05$) in cannabis smokers (38.42± 6.29%) as compared to the control (43.43± 4.81%). MCV, MCH, MCHC, RDW and PDW values of cannabis smokers were significantly different ($p<0.05$) as compared to the control subjects. Platelet values were significantly lower ($p<0.05$) in cannabis smokers (206.18± 52.01 $10^{12/}$L) as compared to the control (266.44± 57.07 $10^{12/}$L). MPV values of cannabis smokers were not significantly different ($p>0.05$) when compared to the control.

The results in Table 4 presented the haematological parameters levels of male cannabis smokers and male control. The result showed that the levels of WBC were significantly lower ($p<0.05$) in male cannabis smokers (3.50± 0.83 $10^{12/}$L) as compared to the male control (6.62± 1.42 $10^{12/}$L). The levels of lymphocytes were significantly higher ($p<0.05$) in male cannabis smokers (58.16 ± 7.52 g/dl) as compared to the male control (38.83± 14.54 g/dl). The monocytes levels were significantly higher ($p<0.05$) in male cannabis smokers (9.35 ±4.28 g/dl) as compared to the male

control (6.46± 1.30 g/dl). The granulocytes levels were significantly lower (p<0.05) in male cannabis smokers (25.76± 7.95g/dl) as compared to the male control (57.37± 10.82 g/dl). RBC levels were lower significantly (p<0.05) in male cannabis smokers (3.23± 0.89 $10^{12/}$L) as compared to the male control (5.07± 0.68 $10^{12/}$L). Haemoglobin levels were significantly lower (p<0.05) in male cannabis smokers (12.91 ± 2.28g/dl) as compared to the male control (15.60± 1.65 g/dl). Packed cell volume was significantly lower (p<0.05) in male cannabis smokers (38.74± 6.54%) as compared to the male control (47.69± 2.54%). MCV, MCH, MCHC, RDW and PDW values of male cannabis smokers were significantly different (p<0.05) as compared to the control subjects. Platelet values were significantly lower (p<0.05) in cannabis smokers (211.26± 56.90 $10^{12/}$L) as compared to the control (248.40± 57.61 $10^{12/}$L). MPV values were not significantly different (p<0.05) when male subjects was compared with the male control.

The results in Table 5 presented the haematological parameters levels of female cannabis smokers and female control. The result showed that the levels of WBC were significantly lower (p<0.05) in female cannabis smokers (4.49± 1.44 $10^{12/}$L) as compared to the female control (6.39± 1.47 $10^{12/}$L). The levels of lymphocytes were significantly higher (p<0.05) in female cannabis smokers (56.55 ± 8.60 g/dl) as compared to the female control (34.38± 7.73 g/dl). The monocytes levels were significantly higher (p<0.05) in female cannabis smokers (8.01 ±3.90 g/dl) as compared to the female control (6.08± 1.24 g/dl). The granulocytes levels were significantly lower (p<0.05) in female cannabis smokers (27.13± 8.27g/dl) as compared to the female control (59.40± 9.30 g/dl). RBC levels were lower significantly (p<0.05) in female cannabis smokers (3.34± 0.76 $10^{12/}$L) as compared to the female control (4.99± 0.50 $10^{12/}$L). Haemoglobin levels were not significantly different (p>0.05) when female cannabis smokers (12.61 ± 2.20g/dl) was compared to the female control (12.89± 1.01 g/dl). Packed cell volume was not significantly different (p>0.05) when female cannabis smokers (37.89± 5.99%) was compared to the female control (39.18± 1.77%). MCV, MCH and RDW values of female cannabis smokers were significantly different (p<0.05) as compared to the female control subjects. Platelet values were significantly lower (p<0.05) in female cannabis smokers (197.90± 43.02 $10^{12/}$L) as compared to the female control (284.48 ± 51.51 $10^{12/}$L). MPV, MCHC, MPV and PDW values were not significantly different (p<0.05) when male subjects was compared with the male control.

Table 3. Haematological parameters of cannabis smokers and control

Parameters	Control (n=50)	Subjects (n=50)	t value	P value
WBC ($10^{12/}$L)	6.51±1.43	3.88±1.99	9.971	0.000
LYM (g/dl)	36.60±11.74	57.54±7.90	10.464	0.000
MON (g/dl)	6.27±1.27	8.84±4.15	4.188	0.000
GRA (g/dl)	58.38±10.04	26.28±8.01	17.671	0.000
RBC ($10^{12/}$L)	5.03±0.59	3.27±0.84	12.119	0.000
HGB (g/dl)	14.24±1.65	12.79±2.23	3.694	0.000
HCT (%)	43.43±4.81	38.42±6.29	4.475	0.000
MCV (fL)	82.83±9.66	126.17±35.69	8.290	0.000
MCH (pg/cell)	27.64±2.92	42.78±12.04	8.643	0.000
MCHC (g/dl)	33.72±1.24	32.81±2.06	2.665	0.009
RDW (%)	14.59±2.62	12.43±2.57	4.157	0.000
PLT ($10^{12/}$L)	266.44±57.07	206.18±52.01	5.519	0.000
MPV (fL)	8.95±0.63	8.83±2.07	0.386	0.700
PDW (%)	14.27±0.88	11.71±4.04	4.371	0.000

Key: N=Sample Size; P<0.05= Significant; p>0.05=Not Significant

WBC= White blood cell count; LYM=Lymphocytes; MON= Monocytes; GRA; Granulocytes; RBC=Red blood cell count; HGB= Haemoglobin; HCT=Haematocrit; MCV= Mean Cell volume; MCH= Mean Cell Haemoglobin; MCHC= Mean cell Haemoglobin concentration; RDW= Red Cell Distribution Width; PLT= Platelet Count; MPV=Mean Platelet Volume; PDW= Platelet Distribution Width

Table 4. Haematological parameters of male cannabis smokers and male control

Parameters	Male Control (n=25)	Male Subjects (n=31)	t value	P value
WBC ($10^{12/}$L)	6.62±1.42	3.50±0.83	10.278	0.000
LYM (g/dl)	38.83±14.54	58.16±7.52	6.422	0.000
MON (g/dl)	6.46±1.30	9.35±4.28	3.250	0.002
GRA (g/dl)	57.37±10.82	25.76±7.95	12.597	0.000
RBC ($10^{12/}$L)	5.07±0.68	3.23±0.89	8.508	0.000
HGB (g/dl)	15.60±0.84	12.91±2.28	5.586	0.000
HCT (%)	47.69±2.54	38.74±6.54	6.448	0.000
MCV (fL)	82.70±8.98	129.83±37.27	6.169	0.000
MCH (pg/cell)	28.20±2.14	43.44±12.52	6.007	0.000
MCHC (g/dl)	34.05±1.12	33.06±1.67	2.550	0.014
RDW (%)	14.96±3.33	12.83±2.49	2.738	0.008
PLT ($10^{12/}$L)	248.40±57.61	211.26±56.90	2.415	0.019
MPV (fL)	8.94±0.69	8.96±2.23	0.044	0.965
PDW (%)	14.43±0.83	10.43±3.06	6.340	0.000

Key: N=Sample Size
P<0.05= Significant
p>0.05=Not Significant
WBC= White blood cell count; LYM=Lymphocytes; MON= Monocytes; GRA; Granulocytes; RBC=Red blood cell count; HGB= Heamoglobin; HCT=Hematocrit; MCV= Mean Cell volume; MCH= Mean cell heamoglobin; MCHC= Mean cell heamoglobin concentration; RDW= red cell distribution width; PLT= Platelet Count; MPV=mean platelet volume; PDW= Platelet Distribution Width

Table 5. Haematological parameters of female cannabis smokers and female control

PARAMETERS	Female Control (n=25)	Female Subjects (n=19)	t value	P value
WBC ($10^{12/}$L)	6.39±1.47	4.49±1.44	4.281	0.000
LYM (g/dl)	34.38±7.73	56.55±8.60	8.978	0.000
MON (g/dl)	6.08±1.24	8.01±3.90	2.335	0.024
GRA (g/dl)	59.40±9.30	27.13±8.27	11.948	0.000
RBC ($10^{12/}$L)	4.99±0.50	3.34±0.76	8.673	0.000
HGB (g/dl)	12.89±1.01	12.61±2.20	0.567	0.574
HCT (%)	39.18±1.77	37.89±5.99	1.016	0.315
MCV (fL)	82.95±10.49	120.21±33.04	5.314	0.000
MCH (pg/cell)	27.07±3.50	41.71±11.47	6.040	0.000
MCHC (g/dl)	33.38±1.29	32.41±2.58	1.644	0.108
RDW (%)	14.22±1.61	11.78±2.63	3.786	0.000
PLT ($10^{12/}$L)	284.48±51.51	197.90±43.02	5.920	0.000
MPV (fL)	8.95±0.57	8.61±1.80	0.894	0.377
PDW (%)	14.10±0.90	13.80±4.64	0.321	0.750

Key: N=Sample Size
P<0.05= Significant
p>0.05=Not Significant
WBC= White blood cell count; LYM=Lymphocytes; MON= Monocytes; GRA; Granulocytes; RBC=Red blood Cell Count; HGB= Haemoglobin; HCT=Haematocrit; MCV= Mean Cell volume; MCH= Mean Cell Haemoglobin; MCHC= Mean Cell Haemoglobin Concentration; RDW= Red Cell Distribution Width; PLT= Platelet Count; MPV=Mean Platelet Volume; PDW= Platelet Distribution Width

The results in Table 6 presented the haematological parameters levels of male and female cannabis smokers. The result showed that the levels of WBC were significantly lower ($p<0.05$) in male cannabis smokers (3.50± 0.83 $10^{12/}$L) as compared to the female smokers (4.49 ± 1.44 $10^{12/}$L). The levels of lymphocytes were not significantly different ($p>0.05$) when male cannabis smokers (58.16 ± 7.52 g/dl) was compared to the female smokers (56.55± 8.60 g/dl). The monocytes levels was not significantly different ($p>0.05$) when male cannabis smokers (9.35 ± 4.28 g/dl) was compared to the female smokers (8.01± 3.90 g/dl). The granulocytes levels were not significantly different ($p>0.05$) when male cannabis smokers (27.13± 8.27g/dl)

was compared to the female subjects (25.76± 7.95g/dl). RBC levels were not significantly different (p>0.05) when male cannabis smokers (3.23± 0.89 $10^{12/}$L) was compared to the female smokers (3.34± 0.76 $10^{12/}$L). Haemoglobin levels were not significantly different (p>0.05) when male cannabis smokers (12.91 ± 2.28g/dl) was compared to the female smokers (12.61± 2.20 g/dl). Packed cell volume was not significantly different (p>0.05) when male cannabis smokers (38.74± 6.54%) was compared to the female smokers (37.89± 5.99%). MCV, MCH, MCHC, RDW and Platelet values of male cannabis smokers were not significantly different (p>0.05) as compared to the female smokers. PDW values were significantly different (p<0.05) when male smokers (10.43± 3.06%) was compared with the female smokers (13.80± 4.64%).

The results in Table 7 presented the haematological parameters levels of cannabis smokers according to their age ranges. The result showed that the levels of WBC, lymphocytes, monocytes, granulocytes, RBC, haemoglobin levels, HCT, MCV, MCHC, MCH, RDW, platelet count, and MPV were not significantly different (p>0.05) across the age groups of cannabis smokers. The levels of PDW were significantly lower in cannabis smokers within 31 years and above (8.76± 3.44%) as compared to 16-20 years (10.01± 2.47%), 21-25 years (13.59± 4.54%), and 26-30 years (11.56± 3.06%).

4. DISCUSSION

This study has clearly demonstrated the effects of cannabis smoking on some haematological parameters of smokers and this cannot be overemphasized as there was a significant difference in some of the parameters between cannabis smokers and that of the non-smokers. There is abundant evidence that haematological values vary considerably between this two study groups; therefore it becomes necessary to carry out this study.

The results obtained in this study showed that the total white blood cell count was significantly lower in cannabis smokers as compared to the control subjects. This is in concordance with the studies of Klein, et al. [10]; Oseni, et al., [11]; El-shahat, [12]; but contrary to the finding by Amna and Nabiala [13] who found no changes between smokers and non-smokers. The lower value observed in total white cell count of cannabis smokers is also in line with the report of Brent-Moore [14] that induced peripheral blood leukopoenia was caused by a single oral dose of 23-30 mg of cannabinoid per kg weight. Possible complications arising from additional inflammatory agent, which might complicate the bronchitis experienced generally in smokers, could thus be implicated with reduced total leukocyte count. In the present study, reduction of the count of total white blood cells in cannabis smokers confirm the disturbances in the immune

Table 6. Comparism of haematological parameters of male and female cannabis smokers

PARAMETERS	Male subjects (n=31)	Female Subjects (n=19)	t value	P value
WBC ($10^{12/}$L)	3.50±0.83	4.49±1.44	3.074	0.003
LYM (g/dl)	58.16±7.52	56.55±8.60	0.694	0.491
MON (g/dl)	9.35±4.28	8.01±3.90	1.108	0.273
GRA (g/dl)	25.76±7.95	27.13±8.27	0.584	0.562
RBC ($10^{12/}$L)	3.23±0.89	3.34±0.76	0.425	0.673
HGB (g/dl)	12.91±2.28	12.61±2.20	0.451	0.654
HCT (%)	38.74±6.54	37.89±5.99	0.459	0.649
MCV (fL)	129.83±37.27	120.21±33.04	0.923	0.600
MCH (pg/cell)	43.44±12.52	41.71±11.47	0.489	0.627
MCHC (g/dl)	33.06±1.67	32.41±2.58	1.081	0.285
RDW (%)	12.83±2.49	11.78±2.63	1.405	0.166
PLT ($10^{12/}$L)	211.26±56.90	197.90±43.02	0.880	0.383
MPV (fL)	8.96±2.23	8.61±1.80	0.584	0.562
PDW (%)	10.43±3.06	13.80±4.64	3.103	0.003

Key: N=Sample Size
P<0.05= Significant
p>0.05=Not Significant
WBC= White blood cell count; LYM=Lymphocytes; MON= Monocytes; GRA; Granulocytes; RBC=Red blood cell count; HGB= Haemoglobin; HCT=Haematocrit; MCV= Mean Cell volume; MCH= Mean Cell Hemoglobin; *MCHC= Mean Cell Hemoglobin Concentration; RDW= Red Cell Distribution Width; PLT= Platelet Count; MPV=Mean Platelet Volume; PDW= Platelet Distribution Width*

Table 7. Haematological parameters of cannabis smokers according to age

PARAMETERS	16-20 years (n=7)	21-25 years (n=20)	26-30 years (n=15)	31 &above (n=20)	F value	P value
WBC ($10^{12/}$L)	3.99±1.26	4.09±1.52	3.39±0.74	4.18±0.69	1.229	0.310
LYM (g/dl)	59.66±11.94	56.41±8.19	58.79±7.33	56.21±3.46	0.489	0.692
MON (g/dl)	11.04±3.58	8.46±3.62	8.95±4.74	7.68±4.74	0.923	0.692
GRA (g/dl)	21.39±5.22	26.81±7.89	26.73±8.35	28.40±9.35	1.109	0.355
RBC ($10^{12/}$L)	3.37±0.81	3.21±0.86	3.46±0.96	2.98±0.57	0.617	0.608
HGB (g/dl)	13.16±2.17	12.84±2.16	12.95±2.11	12.08±2.91	0.349	0.790
HCT (%)	39.43±6.53	38.30±6.17	38.87±6.39	37.00±7.19	0.213	0.887
MCV (fL)	121.44±38.96	128.41±30.63	124.90±45.52	127.11±29.72	0.071	0.975
MCH (pg/cell)	41.16±12.81	44.70±9.66	41.49±15.26	41.84±11.72	0.273	0.844
MCHC (g/dl)	33.03±0.62	33.23±1.01	32.37±3.00	32.40±2.72	0.619	0.606
RDW (%)	12.86±2.98	11.56±2.22	13.19±2.86	12.81±2.25	1.350	0.270
PLT ($10^{12/}$L)	172.29±16.98	209.65±56.21	221.93±53.78	197.63±50.01	1.610	0.200
MPV (fL)	9.93±2.03	8.07±1.48	8.90±2.45	9.74±2.20	2.114	0.111
PDW (%)	10.01±2.47	13.59±4.54	11.56±3.06	8.76±3.44	3.837	0.016

Key:
N=Sample Size
P<0.05= Significant
p>0.05=Not Significant
WBC= White blood cell count; LYM=Lymphocytes; MON= Monocytes; GRA; Granulocytes; RBC=Red Blood Cell Count; HGB= Haemoglobin; HCT=Haematocrit; MCV= Mean Cell volume; MCH= Mean cell hemoglobin; MCHC= Mean cell hemoglobin concentration; RDW= Red Cell Distribution Width; PLT= Platelet Count; MPV=Mean Platelet Volume; PDW= Platelet Distribution Width

system function and the immune response to the smoke inhalation. Also, the findings of this study is reinforced by the report by Klein, et al., [10] who found that a control group smoking a single marijuana cigarette every day for a year had a white-blood-cell count that was 39 percent lower than normal, thus damaging the immune system and making the user more susceptible to infection and sickness.

This study also observed significant higher values of lymphocytes in cannabis smokers as compared to the control subjects. However, this agrees with the findings by Amna and Nabiala [13]; El-shahat, [12] but not in line with the study of by Oseni, et al. [11] who recorded lower lymphocyte count.

In this study, the mean haemoglobin concentration obtained in cannabis smokers (test group) was significantly lower ($p<0.05$) than those obtained in non-smokers (control group). Also the mean packed cell volume obtained in the cannabis smokers was significantly lower ($p<0.05$) than those obtained in the control group. This finding is in agreement with the studies of El-shahat, [12] who recorded higher haemoglobin concentration and packed cell volume in the control group. However, this was not in agreement with the findings of Oseni, Victor & Oluwaranti, [11]; Amna & Nabiala [13]; where they recorded higher values of haemoglobin and packed cell volume attributing the rise to increase in the concentration of carboxyhaemoglobin as a result of smoking leading to an erythropoietin mediated increase.

The red blood cell count obtained in the cannabis smokers was significantly reduced as compared to the control group. Red cell distribution width was significantly reduced among cannabis smokers as compared to the control. This is not in line with the reports of El-shahat, [12] who obtained a higher red blood cell count in the test group. The non conformity with this study is also supported by the study of Isager & Hagerup, [15], who found no effect of pipe and cigar smoking on haematological values.

The results of this study also showed significant lower levels of packed cell volume in cannabis smokers as compared to the control. This observation is not in line with the study of Isabell & Hagerup, [16] where they reported increased PCV as a result of smoking. This was explained by the increase in carbon monoxide level in the blood of smokers which induced erythrocytosis [17] which has been suggested to result in the intrathorasic airway obstruction or pulmonary insufficiency leading to ventilation/perfusion imbalance that results in functional hypoxia or

hypoxaemia and arterial oxygen unsaturation; increasing the demand on bone marrow for RBC production observed as increased haemoglobin concentration to increase the oxygen carrying capacity of the blood [18].

This study also recorded significant lower levels of platelet count in cannabis smokers when compared to the control subjects. This is not in line with the study of Erikssen, et al., [19] who observed a small but statistically highly significant increase in platelet count in marijuana smokers. The difference in the results could be attributed to the different methods applied in the estimation of haematological parameters. Similar significant lower levels were recorded in MPV and PDW among cannabis smokers as compared to the control.

Mean corpuscular volume (MCV) which is the average volume of a single RBC showed a significant increase among cannabis smokers compared to control and low dose groups. In patients with anaemia, MCV measurement allows for classification as microcytic (MCV below normal range), normocytic (MCV within normal range) or macrocytic (MCV above normal range) [20]. It is plausible that smoking of cannabis had a macrocytic effect. Another index for diagnosing anemia is mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) [21]. There was significant increase in MCH among cannabis smokers as compared to the control. The MCHC were significantly reduced in cannabis smokers as compared to the control subjects. According to Rose & Bentley (2006), low MCHC is an indicator of hypochromia in early iron deficiency, and MCH level deceases as the hypochromia develops. This therefore suggests that the increased MCHC levels obtained in this study could be an indicator of hyperchromia and MCH levels increases as hyperchromia develops. However, significant variations in MCV, MCH and MCHC among cannabis smokers have been reported by Obembe, Omini, Okon, Okpo-ene & Ikpi, [22].

5. CONCLUSION

This study showed that haematological parameters of cannabis smokers differed significantly from non-smokers. As it is evident in this study, cannabis smokers resulted in significant increase in lymphocytes, monocytes, , MCV, MCH while significant lower values were recorded for total while cell count, granulocytes, RBC, haemoglobin, packed cell volume MCHC, RDW, platelet count, MPV and PDW.

6. RECOMMENDATIONS

Based on the findings of the this study; the following are hereby recommended;

1. Continuous awareness programs should be created among youths in the study area on the dangers of cannabis smoking.
2. Individuals with anaemia or immune complications should not use *Cannabis sativa* in their food preparation on regular basis.
3. Further studies should be carried out to check the therapeutic use of cannabis in the treatment of diseases.

CONSENT AND ETHICAL APPROVAL

Ethical approval was obtained from the Management of Ambrose Alli University Health Research Ethic Committee; and informed consent was also sought from the subjects before collection of samples.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Thomas G. Adverse cardiovascular, cerebrovascular, and peripheral vascular effects of marijuana inhalation: What cardiologists need to know". American Journal of Cardiology. 2014;113(1):187–190.
2. Hall WD, Swift W. The policy implications of cannabis dependence. In: Roffman RA, Stephen RS, Editors. Cambridge University Press (UK). 2006;315-339.
3. Nathan PE. Substance use disorders in the DSM-IV. Journal of abnormal Psychology. 2001;100:356-361.
4. Helper RS, Petrus RJ. Experiences with administration of Marijuana to glaucoma patients. In Cohen S. & R.C. Stillman (Eds.), The therapeutic aspects of marijuana. New York: Plenum Press. 1996;63-75.
5. Leary T. Tarcher & Putnam, ed. Flashbacks. New York: GP Putnam's Sons. 1990;47-87.

6. Bauman A, Phongsavan P. Epidemiology of substance use in adolescence: Prevalence, trends and policy implications. Drug Alcohol Dependency. 1999;55:187-207.
7. Richardson G. Drugs across the spectrum, 7th ed. Cengage Learning. 2010;255.
8. Hall W, Degenhardt L. Cannabis use and the risk of developing psychotic disorder. World Psychiatry. 2008;7:68-71.
9. Abdelrahman SH, Mousa IM, Khojali SME, Ismail AA. Trypanocidal effect of Cannabis sativa on experimental camel trypansomosis. Research. Journal of Medicinal Plant. 2012;6:281-285.
10. Klein M, Akpa GN, Nwagu BI, Adeyinka IA, Bello UI. Sexual dimorphism, breed and age characteristics of rabbits in Zaria, Nigeria. Proceedings of the 16th Annual Conference of Animal Science Association of Nigeria. 2003;133-137.
11. Oseni BS, Victor AT, Oluwaranti FT. Effects of marijuana smoke on some haematological parameters of smokers. World Journal of Medical Science. 2006; 1(2):82-85.
12. EL-Shehat AT. Impact of marijuana smoking on liver and sex hormones: Correlation with oxidative stress. Nature and Science. 2011;9(12):76-87.
13. Amna HM, Nabiala ME. Effect of cannabis sativa on haematological indices in rats and men. Pakistan Journal of Nutrition. 2011;10(4):313-316.
14. Brent-Moore R. A literature review and meta-analyses of cannabis use and suicidality. Journal of Affective Disorders. 2005;195:63–74.
15. Isager TC, Hagerup U. Haematological and serum biochemical characteristics of rabbit bucks fed diets containing garcimiola kola seed meal. 1971;87-89. Proceedings of 37th Annual Conference of Nigerian Society for Animal Production.
16. Hagerup D. Cannabis exposure and risk of testicular cancer: A systematic review and meta-analysis. Cancer. 1971; 15(1):897.
17. Tashkin D. Effects of marijuana on the lung and its immune defenses. UCLA School of Medicine; 1997.
Retrieved 2016-06-23.
18. Rubin V, Comitas L. Ganja in Jamaica: A medical anthropological study of chronic marihuana use. The Hague: Mouton Publishers; 1975.
19. Erikssen J, Hellem A, Stormorken H. Chronic effect of smoking on platelet count and "platelet adhesiveness" in presumably healthy middle-aged men. Chest. 1994; 105(3):847-852.
20. Tonnesen H, Hejberg L, Fronbenious S, Anderson J. Erythrocyte mean cell volumecorrelation to drinking pattern in heavy alcoholic. Acta Medical Journal. 2006;219(5):515-518.
21. Archibong NA, Ofem EO, Nna VU, Bisiong EM, Johnson JI, Eno AE. Changes in haematological parameters following the administration of crude extract from *Tympanotonus fuscatus* (periwinkle) in rats. Australian Journal of Basic and Applied Sciences. 2014;8(10): 586-591.
22. Obembe AO, Omini GC, Okon UA, Okpo-ene AI, Ikpi DE. Hematological and Immunological Effect of *Cannabis sativa* on albino wistar rats. British Journal of Medicine & Medical Research. 2015;7(1): 52-60.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/62118