THE COMPARISON OF THE EFFECTS OF SOME MEDICINAL PLANTS ON HEAMATOLOGICAL PARAMETERS AND LIVER ENZYMES IN WISTAR RATS

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Abstract

This study was conducted to investigate the comparative effects of aqueous leaves extracts of some medicinal plants; *Vernonia amygdalina*, *Momordica charantia, Moringa oleifera, Jatropha curcas, Phyllantus amarus, and Rauvolfia vomitoria* on haematology and liver enzymes in male Wistar rats. Sixty-five (65) adult male Wistar rats were divided into 3 groups: control - 5 rats fed with pellet, test - 30 rats (5/leaf), and recovery - 30 rats (5/leaf) both received 0.3 ml of aqueous leaves extract of the medicinal for 21 days and the recovery group was allowed to recover for another 21 days without extract administration. Thereafter some biochemical parameters were evaluated. There was a significant increase ($p<0.05$) in packed cell volume and heamoglobin level when test and recovery groups were compared with the control group in all the medicinal plants under study with the exception of *Jatropha curcas* that has a non-significant decrease ($p>0.05$) in packed cell volume. The white blood cell decreased significantly ($p<0.05$) when test and recovery groups were compared to the control group in all the medicinal plants with the exception of *Jatropha curcas* which increased significantly ($p<0.05$). There was a significant increase ($p< 0.05$) in red blood cells when the test and recovery groups of the medicinal plants were compared to the control group. There was a significant increase ($p< 0.05$) in levels of ALP in *Phyllantus amarus* and *Moringa oleifera* when test and recovery groups were compared with the control group while there was a non-significant increase in *Jatropha curcas, Rauwolfia vomitoria,* and *Momordica charantia*. The level of ALP in *Vernonia amygdalina* decreased ($p< 0.05$) insignificantly. There was an insignificant increase ($p>0.05$) in the levels of AST in all the medicinal plants except for Momordica charantia, which increased significantly when the test and recovery groups were compared with the control group. There was an insignificant increase $p>0.05$) in ALT levels in Jatropha curcas, *Rauwolfia vomitoria*, and *Momordica charantia* when test and recovery groups were compared with the control group while there was a non-significant decrease in *Phyllantus amarus, Moringa oleifera*, and *Vernonia amygdalina*. The results of this study show that the aqueous leaf extract of all medicinal plants possesses anti-anemic and heamopoietic activities. This may be attributed to their phytochemicals and minerals content. The current study also suggests that oral administration of the aqueous leaf extract of most medicinal plants are not relatively safe on hepatocytes and did have a deleterious effect on the liver at the dosage investigated.

Key Words: medicinal plants, haematology, liver enzymes, male Wistar rats.

Introduction

The use of medicinal plants as an alternative treatment to manage and cure many diseases has been a common practice in both developing and developed countries (Dutra *et al*., 2016). The modern use of medicinal plants is now high and this is due to the fact they are cheap, potent, readily available, and have little or no side effects (Usifoh and Udezi, 2013). In many African communities, traditional medicine that involves medicinal plants' use in treating diseases and infections makes up a major aspect of their healthcare system. Plants contain bioactive compounds which are also known as phytochemicals, which are secondary metabolites found in different plant parts. These metabolites form the plant defense system and are also responsible for the coloration of the plant; in the body system these compounds have a physiological function that may either be toxic or therapeutic, these compounds include; flavonoids, phenols, glycoside, saponin, steroids, alkaloid, etc. (Tungmunnithum *et al*., 2018). Different studies carried out on the pharmacological effect of medicinal plants showed that medicinal plants extract have; anti-microbial activity (Anyanwu and Okoye, 2017), hepato-protective activity (Farkhondeh *et al*., 2019) nephroprotective activity (Bahmani *et al*., 2016), gastro-protective activity (Delfan *et al*., 2015), anti-diabetic activities (Al-Snafi *et al*., 2019). Hematological parameters are useful indices that can be employed to assess the toxic potentials of plant extracts in living systems. They can also be used to explain blood-relating functions of chemical compounds/plant extract (Sunmonu and Oloyede, 2010; Olusola and Oluwatosin, 2015). The hematological system is responsible for the well-being of intact organisms, changes in the hematological

indices may occur due to other systemic disease conditions (Isaiah *et al*., 2012). The hematological evaluation is a reliable indicator of an organism's health. The blood is a major vehicle for the transport of most pharmacological substances in the human and animal systems, and as such, any alteration in the integrity of blood cells may lead to serious health problems. It also works well as a pathological mirror for the whole body. Heamatological indices are important in identifying certain compounds' immuno-toxic potential in immuno-toxicology, metabolic physiology, and pharmaceutical biology. Hematological and hepatological evaluations are crucial in identifying the body's functioning status after exposure to certain substances including medicinal plants. As a result of this, the effect of aqueous leaf extract of some medicinal plants on selected heamatological indices and liver enzymes in adult male Wistar rats will be evaluated in this study.

Materials and Methodology

Materials

The following were used for the experiment:
Sixty-five adult male Wistar rats, the leaves of *Vernonia amygdalina*, *Momordica charantia*, *Moringa oleifera*, *Jatropha curcas*, *Phyllantus amarus*, *and Rauvolfia vomitoria*, Weighing Scale, Rat restrainer (RTV180)

Collection of Plants Materials

The fresh leaves of all the medicinal plants used mentioned above were purchased from Falawo market, Sagamu, Ogun obtained in January 2022, and were authenticated by Federal Research Institute, Ibadan where samples were deposited at the Institute's herbarium.

Preparation of Aqueous Leaf Extract

The method of Mukhallad *et al.* (2009) was modified for the aqueous extraction. The leaves were air dried by spreading under the shade at room temperature with no direct exposure to sunlight and constantly turned over for 14 days to avoid mold formation till they were crispy to the touch, while still maintaining their green color. After which, the leaves were grounded to powder form using a mechanical grinding machine.
A sixty-gram powder leaves of each medicinal plant were dissolved in 300 ml of distilled water in a plastic bottle and left for 24 hours. It was then filtered using a white sieve cloth, and the dissolved aqueous leaf extract was collected into an empty plastic. The residue was dried and reweighed to 47g which was finally deducted (60g - 47g=13g); this implied that 13g of the leaf dissolved in 300m. The aqueous extract was then refrigerated till it was needed.

Experimental Animals

Sixty-five (65) adult male Wistar rats weighing between 180-200g were obtained from the animal house, Faculty of Basics Medical Sciences, Olabisi Onabanjo University, Ogun State, Nigeria. The rats were kept in thirteen different cages (5 per cage) and allowed to acclimate to their environment for 14 days before extract administration. They were all fed with rat chows.

Administration of Aqueous Leaf Extract

The administration was done orally by giving 0.3ml of each extract to different adult male Wistar rats using an oral cannula for 21 days.

Experimental Analysis

Sixty-five (65) adult male Wistar rats in total were used in the experiment. The rats were divided into 3 broad groups and kept in different cages:
Group 1: 5 rats in the control group received feed and water only.
Group 2: 30 rats (five rats per leaf) in the test group received 0.3ml of an aqueous leaf extract from the medicinal plants for 21 days.
Group 3: 30 rats (five rats per leaf) in the recovery group received 0.3ml of aqueous leaf extract of the medicinal for 21 days and were allowed to recover for another 21 days without extract administration.

Collection of Blood Samples

After 21 days of administration of aqueous leaves extract of the medicinal plants, the capillary tube was used to puncture the eye of each test group rat to collect blood into test tubes. The blood sample was shaken thoroughly to avoid clotting. After then, each blood was centrifuged at a speed of 800D, and then the serum was collected into plain bottles with a micropipette.

Hematological Analysis

A full blood count was conducted on the whole blood collected into EDTA bottles for immediate analysis using the SFRI 19-parameter heamatology analyzer (SFRI medical diagnostics, France). White blood cell count (WBC), red blood cell count (RBC), hemoglobin concentration (HB), and packed cell volume (PCV) were determined (Dacie and Lewis, 1991).

Liver Enzyme Assay

Randox^{TM} diagnostic kits, (Randox Laboratories Limited, UK) were used for the quantification of liver enzymes. These included aspartate aminotransferase, alanine aminotransferase, and alkaline phosphatase.

Table 1: Effect of the medicinal plants on packed cell volume (%) in male Wistar rats

Groups	Control (Mean ±SEM)	Test (Mean ±SEM)	Recovery (Mean± SEM)	SIG
Jatropha curcas	43.00 ± 0.55	35.20 ± 8.87	54. 30 ± 1.65	0.070
Phyllantus amarus		45.00 ± 1.55	57.00 ± 3.39	0.001*
Rauwolfia vomitoria		46.00 ± 1.05	56.5 ± 0.65	0.000*
Momordica charantia		46.00 ± 2.40	52.80 ± 1.65	0.003*
Moringa oleifera		44.60 ± 2.07	53.4 ± 2.07	0.000*
Vernonia amygdalina		44.20 ± 0.80	55.40 ± 1.57	0.000*

*Significant at $p < 0.05$

There was a significant increase ($p<0.05$) in packed cell volume when test and recovery groups were compared with the control group in all the medicinal plants under study with the exception of *Jatropha curcas* that has a non-significant decrease ($p>0.05$).

Table 2: Effect of the medicinal plants on hemoglobin level (g/dL) in male Wistar rats

Groups	Control (Mean ±SEM)	Test(Mean ±SEM)	Recovery (Mean ±SEM)	SIG
Jatropha curcas	14.32 ± 0.18	14.63 ± 0.49	18.04 ± 0.54	0.000*
Phyllantus amarus		14.96 ± 0.50	18.96 ± 1.11	0.001*
Rauwolfia vomitoria		15.30 ± 0.34	18.73 ± 0.28	0.001*
Momordica charantia		14.84 ± 0.79	17.58 ± 0.56	0.003*
Moringa oleifera		14.84 ± 0.31	17.82 ± 0.35	0.000*
Vernonia amygdalina		14.70 ± 0.26	18.52 ± 0.56	0.000*

*Significant at $p < 0.05$

The hemoglobin level increased significantly ($p< 0.05$) in all the medicinal plants when test and recovery groups were compared with the control group.

Table 3: Effect of the medicinal plants on white blood cell (per mm^3) in male Wistar rats

Groups	Control(Mean ±SEM)	Test (Mean ±SEM)	Recovery (Mean ±SEM)	SIG
Jatropha curcas	8120.00 ± 1168.50	9575.00 ± 614.24	2580.00 ± 1120.89	0.002*
Phyllantus amarus		7300.00 ± 517.68	2675 ± 1138.26	0.006*
Rauwolfia vomitoria		5300.00 ± 565.69	2025.0 ± 481.97	0.001*
Momordica charantia		5540.00 ± 798.49	3900.00±890.50	0.029*
Moringa oleifera		7780.00 ± 1016.56	1640.00 ± 373.63	0.000*
Vernonia amygdalina		6520.00 ± 1501.80	1440.00 ± 163.09	0.003*

Significant difference (*$p< 0.05$)

The white blood cell decreased significantly ($p<0.05$) when test and recovery groups were compared to control group in all the medicinal plants with the exception of *Jatropha curcas* that increased significantly ($p<0.05$).

Table 4: Effect of the medicinal plants on red blood cell (x 10^6 µL) in male Wistar rats

Groups	Control(Mean ±SEM)	Test (Mean ±SEM)	Recovery (Mean ±SEM)	SIG
Jatropha curcas	4.06 ± 0-77	4.25 ± 0.13	5.30 ± 0.11	0.000*
Phyllantus amarus		4.40 ± 0.25	5.58 ± 0.26	0.001*
Rauwolfia vomitoria		4.40 ± 0.12	5.38 ± 0.4	0.000*
Momordica charantia		4.36 ± 0.33	5.10 ± 0.13	0.013*
Moringa oleifera		4.08 ± 0.09	5.18 ± 0.05	0.000*
Vernonia amygdalina		4.26 ± 0.17	5.38 ± 0.10	0.000*

Significant difference (*$p< 0.05$)

There was a significant increase ($p< 0.05$) in red blood cell when test and recovery groups of the medicinal plants were compared to the control group.

Table 5: Effect of the medicinal plants on ALP (U/L) in male Wistar rats

Groups	Control(Mean ±SD)	Test (Mean ±SD)	Recovery (Mean ±SD)	SIG
Jatropha curcas	200.75 ± 106.60	337.15 ± 243.97	268.95 ± 191.5	0.285
Phyllantus amarus		436.70 ± 105.75	318.73 ± 159.64	0.008*
Rauwolfia vomitoria		300.85 ± 95. 45	250.80 ± 109.01	0.156
Momordica charantia		638.55 ± 98.37	419. 65 ± 196.11	0.308
Moringa oleifera		409.20 ± 172.97	304.98 ± 174.41	0.05*
Vernonia amygdalina		121.00 ± 83.79	160.86 ± 97.54	0.425

Significant difference (*$p< 0.05$)

There was significant increase ($p< 0.05$) in levels of ALP in *Phyllantus amarus* and *Moringa oleifera* when test and recovery groups were compared with the control group while there was a non-significant increase in *Jatropha curcas*, *Rauwolfia vomitoria*, and *Momordica charantia*. The level of ALP in *Vernonia amygdalina* decreased ($p< 0.05$) insignificantly.

Table 6: Effect of the medicinal plants on ALT (U/L) in male Wistar rats

Groups	Control(Mean ±SD)	Test (Mean ±SD)	Recovery (Mean ±SD)	SIG
Jatropha curcas	8.73 ± 0.85	20.95 ± 6.17	8.11 ± 0.83	0.36
Phyllantus amarus		7.05 ± 0.42	8.24 ± 0.62	0.88
Rauwolfia vomitoria		13.62 ± 0.55	9.44 ± 0.92	0.58
Momordica charantia		9.78 ± 0.76	8.15 ± 0.11	0.63
Moringa oleifera		8.38 ± 0.85	8.51 ± 0.72	0.51
Vernonia amygdalina		8.41 ± 0.56	8.14 ± 0.65	0.68

Significant difference (*p< 0.05)

There was an insignificant increase p>0.05) in ALT levels in Jatropha curcas, *Rauwolfia vomitoria* and *Momordica charantia* when test and recovery groups were compared with control group while there was a non-significant decrease in *Phyllantus amarus, Moringa oleifera* and *Vernonia amygdalina.*

Table 7: Effect of the medicinal plants on AST (U/L) in male Wistar rats

Groups	Control(Mean ±SD)	Test (Mean ±SD)	Recovery (Mean ±SD)	SIG
Jatropha curcas	5.26 ± 0.98	13.67 ± 0.31	9.43 ± 0.55	0.63
Phyllantus amarus		8.38 ± 0.42	6.83 ± 0.44	0.80
Rauwolfia vomitoria		8.43 ± 0.83	6.65 ± 0.23	0.61
Momordica charantia		51.33 ± 3.13	28.29 ± 1.79	0.02*
Moringa olie1fera		15.63 ± 2.63	10.44 ± 0.82	0.39
Vernonia amygdalina		11.88 ± 1.89	8.56 ± 1.13	0.68

Significant difference (*p< 0.05)

There was an insignificant increase (p>0.05) in the levels of AST in all the medicinal plants with the exception of *Momordica charantia* which increased significantly when test and recovery groups were compared with the control group.

Discussion

Human and animal hematological profiles are important indicators of an individual's physiological state (Khan and Zafar, 2015). The evaluation of a full blood count (FBC) is usually included in hematology. Counts that are abnormally high or low can indicate the presence of a variety of diseases, conditions, or toxicity (West and Haines, 2012). In this study, there was a significant increase (p<0.05) in red blood cells when test and recovery groups of the medicinal plants were compared to the control group and this may be due to the fact that many of the medicinal plants contain erythropoietin-like agents which are responsible for the increased production of erythrocytes (Suzanne *et al*., 2014). The values of packed cell volume and, hemoglobin count also increase in this study and this may be due to the ability of these plants to reduce the action of the ROS and increase the request for iron (Suzanne *et al*., 2014). Bioactive compounds identified in a previous study showed that most medicinal plants contained alkaloids, coumarins, flavonoids, phenolic compounds, saponins, steroids, tannins, terpenoids, and triterpenoids (Verma *et al.,* 2014) and these compounds have the ability to stimulate the growth of early and old erythroid progenitor cells in the presence of erythropoietin thereby having a positive effect on the RBC and its component. Also in this study, there was a significant reduction (p<0.05) in the WBC count after administration of the medicinal plants with the exception of *Jatropha curcas* which increased significantly (p<0.05) and this plant's aqueous leaf extract may have the immune boosting effect, anti-inflammatory property and so has vital effects on inflammatory processes of some pathological states such as bacterial infection, malaria, and liver diseases (Ugochukwu, 2012). Such effects may also be due to an increase in vascular permeability (Ladokun *et al*., 2015). White blood cells (WBCs), or leukocytes, are one of three types of blood cells (the other two include platelets and erythrocytes that make up about 45% of whole blood (55% is plasma) (Pritchett and Reddy, 2015). In the present study, there was significant increase (p<0.05) in levels of ALP in *Phyllantus amarus* and *Moringa oleifera* when test and recovery groups were compared with the control group while there was an insignificant increase (p>0.05) in *Jatropha curcas, Rauvolfia vomitoria,* and *Momordica charantia*. The level of ALP in *Vernonia amygdalina* decreased insignificantly (p>0.05). The increased liver enzyme activities in most of the medicinal plants significantly show liver hepatocyte necrosis and cholestasis, and the high level of transaminases causes inflammation or hepatocellular disorders (Ali *et al*., 2005, Lavanaya *et al*., 2011). Liver damage is manifested by increases in serum ALP, ALP, and AST levels. It can be observed that the changes in the three enzyme levels are consistent to indicate liver damage. Although the increase was significant in ALP in nearly all of the medicinal plants, the significant reduction (p<0.05) in the levels of alkaline phosphatase (ALP) in *Vernonia amygdalina*, as observed in this present study, could be an indication of good effects of its aqueous leaf extract on both liver and bone; since the two main sources of ALP are liver and bone. In our study, there was an insignificant increase (p>0.05) in ALT levels in *Jatropha curcas, Rauvolfia vomitoria,* and *Momordica charantia* when test and recovery groups were compared with the control group while there was an insignificant

decrease ($p>0.05$) in *Phyllantus amarus*, *Moringa oleifera*, and *Vernonia amygdalina*. Most of these findings were in agreement with the observations of Nwanjo (2007) and Ibrahim *et al*. (2016) when they reported insignificant increases in AST and ALT levels in serum to indicate non-hepatotoxic effects of the *Phyllanthus nisruri* leaf extract and tuber extracts of M. psuedopetalosa, respectively. In our study, there was an insignificant increase ($p>0.05$) in the levels of AST in all the medicinal plants with the exception of *Momordica charantia* which increased significantly ($p<0.05$) when test and recovery groups were compared with the control group. It has been reported previously that ALT, AST, and ALP levels insignificantly increased after treating Wistar rats with a 500mg/kg oral dose of Senecio aureus extract (Osuigwe and Margret, 2017). On the contrary, El-Desouky (2014) reported that oral administration of ethanolic *Ziziphus mauritiana* leaf extracts resulted in a significant decrease in the level of ALT and AST enzymes in the serum of γ-irradiated rats. The same observations were obtained in rats administered *Anthyllis henoniana* ethyl acetate flower extract (Ben Younes *et al.*, 2018). By contrast, rats treated with ethanolic leaf extract of *Sorghum bicolor* showed extremely significant ($P<0.05$) elevated levels of AST, ALT, and ALP, which indicated intra-hepatic cell damage due to the extract administration (Ogunka-Nnoka *et al*., 2012).

Conclusion

The results of this study show that the aqueous leaf extract of all medicinal plants possesses anti-anemic and hemopoietic activities. This may be attributed to their phytochemicals and minerals content. The current study also suggests that oral administration of the aqueous leaf extract of most medicinal plants is not relatively safe on hepatocytes and did have a deleterious effect on the liver at the dosage investigated.

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