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Phytochemical Constituents, Haematological Activities and GC-MS Analysis of Isolated Oil of Rosary Pea (*Abrus precatorius*) in Wistar Rat Fed with High Lipid Diet

Osaro Iyekowa* and Opara V Ndubuisi
Department of Chemistry, Faculty of Physical Sciences, University of Benin, P.M.B. 1154, Benin City, Nigeria.
Email addresses: osaro.iyekowa@uniben.edu; oparavictorndubuisi@gmail.com
**Corresponding author*
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Abstract

The study is aimed at investigating the phytochemical constituents and haematological activities of the isolated oil in Wistar rat fed with high lipid diet. Powdered leaves of *Abrus precatorious* were extracted and phytochemical screening was done according to prescribed standard methods, while vacuum liquid chromatography (VLC) was adopted for oil isolation of the crude extract and characterized by gas chromatography-mass spectrometry (GC-MS). Thirty adult Wistar rats were randomly arranged into six groups (A, B, C, D, E and F) and treated under certain conditions. Haematological analyses were performed according to standard procedures. Saponins, alkaloids, terpenoids, flavonoids and glycosides were present. Oil constituents like octadecanoic acid (stearic acid) (35.30%), a saturated fatty acid was among the components detected in the isolated brown oil. There was a significant decrease ($p < 0.05$) in the levels of white blood cells (WBC) among the experimental groups (D and E), while mean corpsular haemoglobin (MCH) increased significantly ($p < 0.05$) with experimental group E (receiving high dose of the extract). This study indicated that methanol extract of *A. precatorius* can offer protection against blockage or plaques caused by high lipid diet.

Keywords: *Abrus precatorius,* phytochemicals, histology, haematology

Introduction

Phytotherapy, the use of plants-derived medications in the treatment and prevention of disease is one of the traditional practices in the world from antiquity. The active ingredients from these medicinal plants are used essentially for the treatment and management of mild and chronic ailments (Gnanavel and Saral 2013). Plants are known to provide a source of inspiration for novel lead candidates or drug precursors, and this is sequel to the fact that medicinal constituents derived from plants have made large contributions to human health and well-being (Iwu et al. 1999). Plants have been used by human beings to treat wide range of ailments for thousands of years (Sofowora 1982). According to the World Health Organization, most of the world populations to date still rely on traditional medicines for their psychological and physical health requirements (Rabe and Van-Stoden 2000), since they cannot afford the products of Western pharmaceutical industries (Salie et al. 1996) and lack of healthcare facilities. In developed and developing countries herbal medicines are in great demands and a source of primary health care owing to their attributes wide range of biological and medicinal activities, high safety margins and

lower costs. Herbal molecules are safe and would overcome the resistance produced by the pathogens as they exist in a combined form or in a pooled form of more than one molecule in the protoplasm of the plant cell (Lai and Roy 2004). Majority of the people in the rural areas in Nigeria and generally Africa use medicinal plants ranging from chewing sticks, decoction and syrups of plants *Afromonium melegueta*, ginger, bitter kola, to treat cough related infection (Iyekowa et al. 2011).

Abrus precatorius, commonly known as Rosary pea, crab's eye, Indian liquorice, is indigenous to India and is commonly found in other tropical and subtropical regions. In Nigeria, in Yoruba, it is called "ojuologbo", Hausa, "idon zakara", Ibo, "anya nnunu" and in Bini, "aruo-ovbieden". *Abrus precatorius* is a woody twinning plant of the Fabaceae family, with characteristic red and black seeds. The plant produces short brownish pods, which curl back on opening to reveal pendulous red and black seeds (Merlin et al. 2009). All parts of the plant: the seeds, roots and leaves are used for medicinal purposes in tropical regions (Yadava and Reddy 2002). Other reports indicated that the plant is used to treat scratches, sores and wounds caused by dogs, cats and mice (Chinnappan and Rathinam 2011). In Nigeria, the Ibos use the decoction of the seeds to cure a wide range of ailments such as cough, diarrhoea, hypertension, and ulcer (Nwodo and Alumanah 1991). The roots and leaves contain glycyrrhizin, the principal constituent of liquorice, and are used as substitutes for liquorice in coughs and catarrhal infections; hence the plant is also known as Indian liquorice (Gnanavel and Saral 2013). Its root is also chewed as a snake bite remedy, and hot water extract of fresh root is administered orally as an anti-malarial and anti-convulsant (Adesina 1982). Hot water extract of dried leaves and roots are used for the treatment of eye diseases. Leaves crushed with oil are used as a poultice and as anti-inflammatory agent (Anam 2001). The leaves have also been used as food; they are commonly chewed or sucked to obtain their sweet taste (Kennelly et al. 1996). The fixed oil extracted from seeds is said to promote the growth of human hair (Acharya and Roy 2013) and shows antimicrobial potency (Adelowotan et al. 2008).

It is also reportedly boiled with food, for example, cereal pulp, as a sweetener and even as a vegetable. According to Adedapo et al. (2007), fresh leaves have been reportedly pressed on the gum for treatment of sores in the mouth.

Scientifically, the seed extract of *Abrus precatorius* has been shown to possess antifertility effects (Rao 2007); high inhibitory activity against *Staphylococcus pneumonia* which are implicated for cough related infections (Iyekowa et al. 2011) and dose-dependent bronchodilator activity, of the methanol extract justify the use of the plant in the treatment of asthma (Mensah et al. 2011). The roots are very rich in abrasine, precool, precasine and isoflavonoids, while the leaves contain abrin, abruslactone A, abrusoside A, abrusoside C, abrusoside D, abrusoside, arabinose and choline (Paul et al. 2013). This research was thus, conducted to screen the phytochemical constituents of the methanol extract of *A. precatorius*, characterize the isolated oil using GC-MS and conduct the histological and haematological studies in Wistar rats fed with high lipid diet.

Materials and Methods

Collection of plant samples

The fresh leaves of *A. precatorius* were collected from Forestry and Wild life garden, Department of Forestry and Wild life, Faculty of Agriculture, University of Benin, Benin City, Edo State, Nigeria. The plant was identified and authenticated with herbarium voucher number (UBHm 0209) deposited in the Department of Plant Biology and Biotechnology, University of Benin, Benin City, Nigeria.

Extraction of plant samples

The *Abrus precatorious* leaves were air dried in a ventilated room for 28 days. The dried plant sample was ground into fine powder using a blender. Three hundred and forty grams (340 g) of the powdered leaves

were extracted using methanol (BDH, England) in a Soxhlet extractor for 8 hours. The crude extract recovered was dried with Na_2SO_4 (Vickers, England) and then concentrated in a rotary evaporator (RE, 200) to afford a syrupy consistency.

Phytochemical screening

Phytochemical screening was done to identify the presence of phyto constituents like alkaloids, glycosides, steroids, flavonoids, saponins and eugenols by using standard procedures by Sofowora (1982) and Trease and Evans (1989).

Isolation of oil

Fifty grams (50 g) of the crude methanol extract were partitioned with 150 mL of methanol: ethylacetate and hexane mixture (ratio: 1:1:1) and shaken vigorously in a separatory funnel. The upper organic fraction was separated, concentrated and then subjected to vacuum liquid chromatography (VLC), using silica gel (particle size: 200-425 mesh) as the solid phase and methanol, ethylacetate and hexane mixture ratio was used as the mobile phase. A brownish yellow oily phase obtained was dried over Na_2SO_4 and concentrated to recover the oil fraction.

GC-MS analysis

The analysis was carried out on a gas chromatograph-mass spectrometer (GC-MS, QP2010 Plus, Shimadzu, Japan) filled with an HP-5 MS (5% phenysiloxane) column at a temperature programmed at 70 °C (2 minutes) increase at 10 °C /min to 280 °C and held for 7 minutes. The carrier gas was nitrogen and flow rate, 1.80 mL/min.

Sourcing of animals

Thirty (30) Wistar rats (151–286 g) of either sex, were purchased from the Anatomy Animal House, Anatomy Department, Faculty of Basic Medical Science, University of Benin. The Wistar rats were kept in clean cages and allowed to acclimatize. They were fed with standard pellet diet and had free access to water for six (6) weeks. The animals were kept under standard conditions of 12 hours-day and 12 hours–cycle. The experimental animals were handled using the standard protocols of handling experimental animals throughout the period of study (Takem et al. 2014).

Acute toxicity test

The acute toxicity in Wistar rats (n = 30) was estimated using a modified method described by Lorke (1983). Five animals per group received oral administration of 10, 100, 1000 5000 mg/kg and 10,000 mg/kg of methanol extract of *A. precatorius*. The control group received distilled water orally. Animals were observed for 24 hours for death and other toxic signs/symptoms. Those that survived were used for the experiment.

Experimental protocol

The Wistar rats were re-grouped after toxicity test into six (6) labelled groups of 5 rats each as follows:

Group A–Negative control (NC)–received feed and water only;

Group B–Positive control (PC)–received feed and water, lipid diet and atrovastacine drug;

Group C–Hyperlipidaemia untreated (HL)–received feed, water and lipid diet only;

Group D–Hyperlipidaemia low dose (HDL)–received feed, water, lipid diet and low dose of the extract;

Group E–Hyperlipidaemia high dose (HDD)–received feed, water, lipid diet and high dose of the extract;

Group F–received extract only (Ext)-received feed, water and extract only.

The procedures for feeding the animals with high lipid diet and treatment with the methanol extract of *Abrus precatorious* leaves were obtained from the Department of Anatomy, Faculty of Basic Medicine, University of Benin, Benin City, Nigeria.

Haematological analysis

Red blood cell (RBC) count: This was done using standard method as described by Cheesbrough (2005). About 20 µL of the blood sample was mixed with EDTA and diluted with 4.0 mL isotonic fluid into a tube which was continuously mixed for 2–3 minutes and the isotonic diluting fluid did not lyse. With the aid of the Haemacytometer, the

RBCs were counted from appropriate squares on the chamber under an electronic microscope.

***Haematocrit, packed cell volume (PCV) assay*:** The procedure was carried out using standard technique as described by Ochei and Kolhatkar (2008). The Capillary tube was heparinized and filled with blood by capillary action. An open end of the capillary tube was sealed with a plasticine and then centrifuged using micro haematocrit centrifuge for 5 minutes at 12000 rpm (revolutions per minute). The result was read using a special Haematocrit (HTC) reader device.

Mean corpulscular haemoglobin (MCH), mean corpscular volume (MCV) and mean corpscular haemoglobin concentration (MCHC): MCH, MCV and MCHC as red blood cell indices were calculated from the haemoglobin concentration (HC) and RBC count. MCH is expressed in picogram/cell. MCH is a red blood cell indices calculated from the haemoglobin concentration (HC) and RBC count and expressed in picogram/cell.

***Haemoglobin concentration determination using modified Drabkin's method*:** Haemoglobin concentration was determined by the method described by Dacie and Lewis (1991). Whole blood was diluted in a solution contain potassium ferricyanide and potassium cyanide. Haemoglobin was oxidized by the action of potassium ferricyanide to form methemoglobin (haemoglobin, Hi). Potassium cyanide provides cyanide ions to form cyanomethemoglobin (HiCN). The solution was measured spectrophotometrically and compared to haemoglobin standards. The procedure is also applicable in diagnosing and monitoring therapy in cases of haemoglobin deficiency anaemia.

Determination of white blood cells (WBCs): The procedure adopted was the one prescribed by Neubauer Counting Chamber (Cheesbrough 2005). Whole blood was diluted 1:20 in a weak acid solution which haemolyzes (breaks down) the RBCs (not the nucleus of the nucleated red cells). This allowed the white cells to be counted microscopically using an improved neubauer ruled counting chamber and the number of WBCs per litre of blood calculated. Approximately 0.02 mL of well mixed EDTA-anticoagulated venous blood sample was added to 0.38 mL of diluted fluid and dispensed into a small container. One of the grids of the counting chamber was filled with re-mix of the diluted blood sample using a Pasteur pipette, with care taken not to overfill the area. The filled area was left undisturbed for two minutes to allow time for the white blood cells to settle, after which the underside of the chamber was dried and placed on the microscope stage and the cells in the four large squares of the chamber were squarely counted. The total number of cells counted was divided by 2 and the number obtained was then divided by 10 and multiplied by 109 to give the white cell count.

Statistical analysis

Statistical Analysis was carried out with a Statistical Software Packages, Microsoft Excel, 2010 and Statistical Package for Social Sciences (SPSS) version 20. Results were presented as mean ± standard error of mean (SEM). For comparison of means between the control and test groups, independent student t-test was used with confidence level of 95% for variables with normal statistical distribution. One way Analysis of Variance (ANOVA) was used to compare means among different groups and post-hoc test was carried out using Least Significant Difference (LSD). Values with $p \leq 0.05$ were taken to be significant.

Results and Discussion

Phytochemical screening of methanol extract of *A. precatorius*

The bioactive constituents such as saponins, phenolics, alkaloids and flavonoids were present among others. The results of the phytochemical screening of *A. precatorius* are shown in Table 1.

Table1: Phytochemical screening of methanol extract of *A. precatorius*

S/N	Phytochemical	Methanol extract
1.	Gycoside	+
2.	Saponins	+
3.	Flavonoids	+
4.	Phenolics	+
5.	Tannins	-
6.	Eugenols	+
7.	Steroids	+
8.	Terpenoids	+
9.	Alkaloids	+

Key: + = present - = absent.

The bioactive constituents are the major compounds on which plants derived their biological activities. The presence of alkaloids, flavonoids, saponins, glycosides, eugenol, steroid, terpenoids and phenolics in the methanol leaves extract of *Abrus precatorius* showed that the leaves of *Abrus precatorius* possess good phytochemical activities, which also contribute to their medicinal properties. From recent studies, saponins have been shown to possess pharmacological applications as anti-hyperlipidaemia (Wang et al. 2012), antimicrobial, antimalarial and anti-inflammatory activity (Bhatia et al. 2013).

GC-MS analysis

The GC-MS chromatograms of the isolated brownish yellow oil showed 18 peaks indicating from the search list of the chemical abstract service eighteen compounds. The chemical compounds identified in the oil fraction are presented in Table 2.

Table 2: GC-MS analysis results of isolated brownish yellow oil fraction

Peak No	Retention time (Rt) (minutes)	Name of compound	Area percent (%)
1	12.70	2- Undecenal	0.48
2	24.17	Hexadecanoic acid, methyl ester (palmitic methyl ester)	0.97
3	24.74	Hexadecanoic acid (palmitic acid)	2.44
4	26.04	9-Octadecenoic acid, methyl ester,	8.77
5	26.31	Methyl stearate (methyl octadecanoate)	9.03
6	27.00	Octadecanoic acid (stearic acid)	35.35
7	27.97	4-hydroxy methyl octadecanoate	2.68
8	28.09	6-hydroxy methyl-hexadecanoate	1.70
9	28.26	9-Octadecenoic acid (oleic acid)	2.34
10	28.47	Octadecanoic acid (stearic acid)	1.76
11	28.61	9-Octadecenoic acid (oleic acid)	1.01
12	28.90	9-Octadecenoic anhydride	2.54
13	29.11	Octadecanoic acid, 2-hydroxy-1-(hydroxymethyl)ethyl ester	2.05
14	29.31	15-Hydroxypentadecanoic acid	8.18
15	30.66	9-Octadecenoic acid (oleic acid)	1.80
16	30.96	Oleic anhydride	7.12
17	31.45	Octadecanoic acid, 2,3-dihydroxypropyl ester	7.88
18	31.80	4,22-Stigmastadiene-3-one	3.89
		Total	**100**

GC-MS analysis (Table 2) obtained indicated eighteen (18) components with compounds as n-hexadecanoic acid (retention time (Rt): 24.74, 2.44%), a saturated fatty acid; octadecanoic acid (Rt: 27.00, 35.35%), a saturated fatty acid (stearic acid) and a

cholesterol derivative, 4, 22-stigmastadiene-3-one (Rt: 31.80, 3.89%). The presence of this octadecanoic acid, a saturated acid suggests the plant oil has a potential for physiological activities. This corroborates the work of Oladimeji et al. (2016) who isolated oil from the leaves of *A. precatorius* with a potential for the treatment of cancer-related diseases, in addition to flavour and fragrance industry. More so, the presence of saturated fatty acids, (stearic acid), stearic acid ester (methyl stearate) and 4, 22-stigmastadiene-3-one, a cholesterol derivative, indicated that the oil fraction is a potential physiological agent. Doughari et al. (2009) and Doughari (2012) suggested that *A. precatorius* has rich medicinal properties which when explored will be of immense benefits to the pharmaceutical company and scientific community in general.

Haematological assays

The results of the effects of the haematological assays of the Wistar rats are presented in the charts.

Effects of methanol extract of *A. Precatorius* on the red blood cells (RBC) of adult Wistar rats

As observed in Figure 1, the RBCs showed that the differences in means are not statistically significant ($p < 0.05$) among the six groups. However, it was observed that the positive control showed a slight significant increase ($p < 0.05$) when compared to the negative control. There was a slight significant increase ($p < 0.05$) in the RBCs of the positive and negative control groups when compared to the groups fed with only extract, hyperlipidaemia untreated, hyperlipidaemia high dose and hyperlipidaemia high dose, respectively.

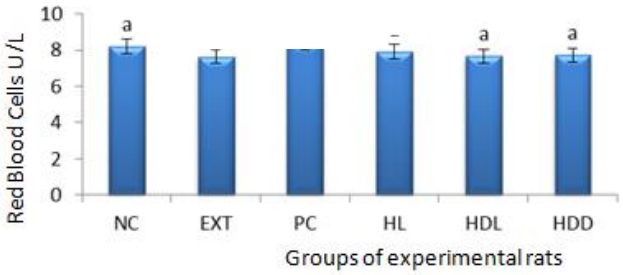

Figure 1: Effects of *Abrus Precatorius* on the red blood cells count activities of Wistar rats fed with high lipid diet.

Red blood cell indices are part of the haematological parameters that are useful in elucidating the etiology of anaemia. The administration of methanol extract of *Abrus precatorius* resulted in significant ($p < 0.05$) decrease of RBCs in the hyperlipidaemia high dose and hyperlipidaemia low dose when compared to the positive control and negative control. However, the atorvastatin induced some haematological changes in the positive control group. This often suggests the existence of complications of atherosclerosis. In addition, most medicinal plants with the presence of phytochemicals like alkaloids, flavonoids and tannins which are antioxidants help to increase the counts of erythrocytes and PCV (Okon et al. 2013). Similar findings were found from the toxic effects of orally administered aqueous extract of *Abrus precatorius* in mice and Wistar rats (Sunday et al. 2013). In their work, they found significant decrease in red blood cells (RBCs).

Effects of methanol extract of *A. Precatorius* on hematocrit concentrations, packed cell volume (PCV) of adult Wistar rats

Hematocrit (HCT) or packed cell volume (PVC) of all the groups were not significantly

different from each other. The positive control, hyperlipidaemia high dose, extract only and hyperlipidaemia untreated showed a significant increase ($p < 0.05$) in the HCT when compared to the Negative control group. However, the Hyperlipidaemia low dose decreased significantly ($p < 0.05$) in the HCT when compared to negative control and positive control.

The extract showed a significant increase ($p < 0.05$) in the hematocrit concentrations when compared to the negative control and positive control as seen in Figure 2. The mean difference of the treated groups extract, untreated group, treated groups and negative control were not statistical significant ($p < 0.05$) as observed in the hematocrit concentrations. However, the hyperlipidaemia low dose showed a significant decrease ($p < 0.05$) when compared to the hyperlipidaemia high dose. A significant increase ($p < 0.05$) was observed in the untreated group when compared to the negative and positive control groups of the hematocrit concentrations. The decrease in the PCV level observed in this study may be as a result of effects of the high lipid diet. Recent studies reported a decrease in red blood corpuscle counts and suggested the findings to the depression in erythropoiesis in the bone marrow and possibly anaemia which result from effects of the constituents of the high dose of *Commiphora molmol* present in both the ethanolic and ether extracts (Omer and Al-Dogmi 2018).

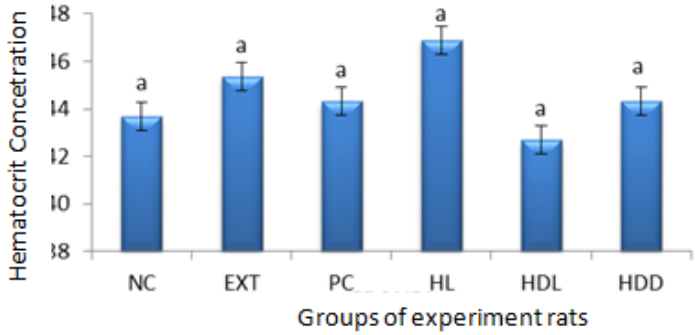

Figure 2: Effects of *Abrus Precatorius* on the hematocrit concentrations or packed cell volume (PCV) of Wistar rats fed with high lipid diet.

Effects of methanol extract of *A. Precatorius* on the mean corpuscular haemoglobin (MCH) of adult Wistar rats

There was a significant increase ($p < 0.05$) in MCH in the positive control group, hyperlipidaemia low dose and hyperlipidaemia untreated when compared to the negative control. However, the extract at high dose elevated MCH when compared to the positive control and extract at low dose.

The group fed with only extract showed a significant decrease ($p < 0.05$) in the MCH when compared with the rest of the groups as seen in Figure 3. This shows that the differences in mean of the six groups are not statistical significant ($p < 0.05$). There were non-significant decrease or increase ($p < 0.05$) between negative control, hyperlipidaemia low dose and positive control, respectively as observed in the MCH. From the findings of Adebayo et al. (2005), MCH only relate to individual red blood cells, and as such the result may not affect the inclusion of haemoglobin into the red blood cell or morphology of the red blood cells produced.

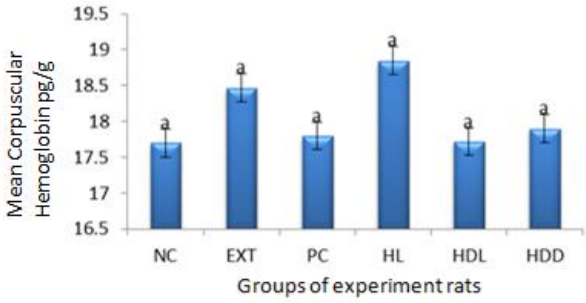

Figure 3: Effects of *Abrus precatorius* on the mean corpuscular haemaglobin activities of Wistar rats fed with high lipid diet.

Effects of methanol extract of *A. precatorius* on the mean corpuscular volume (MCV) of the adult Wistar rats

In Figure 4, there was a non-significant increase ($p < 0.05$) in the MCV of the negative control when compared to the positive control group. A non-significant difference ($p < 0.05$) was also observed in the MCV of the group fed with extract only when compared to the untreated group.

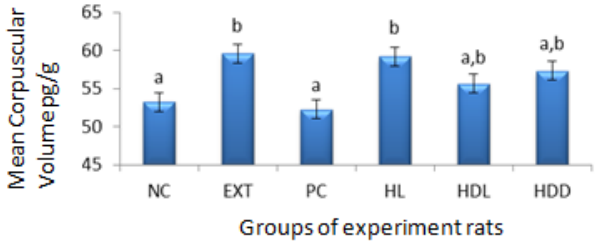

Figure 4: Effects of *Abrus precatorius* on the MCV activities of Wistar rats fed with high lipid diet.

The graded dose of the extract at high and low doses, the hyperlipidaemia untreated and the extract only group showed increased levels of MCV when compared with the negative control. This report was consistent with that earlier reported by Tion et al. (2018). The significant ($p < 0.05$) decrease in the MCV of the positive control group when compared to the negative control, extract only, hyperlipidaemia untreated and the graded dose of the extract at high and low doses may suggest that the hyperlipidaemia untreated group induces microcytic anaemia in the blood as a result of high levels of MCV.

Effects of methanol extract of *A. precatorius* on mean corpuscular haemoglobin concentrations (MCHC) of adult Wistar rats

The levels of MCHC activities of all the groups were the fairly the same except for the positive and negative control groups. In Figure 5, the MCHC showed that a non-statistical difference ($p < 0.05$) was observed in the negative control when compared to the positive control. There was a significant increase ($p < 0.05$) in the MCHC of the positive control when compared with the negative control. A statistical increase ($p < 0.05$) in the MCHC was observed in the negative and positive control when compared to the untreated group, extract, and the test groups treated with the extract at high and low doses, respectively. Values of MCHC

only relate to individual red blood cells, and from this study, since levels were less than the positive control group, the plant extract may not affect the oxygen-carrying capacity of each red blood cell, but may cause a reduction in the oxygen-carrying capacity of the whole blood occasion by the reduction of the entire population of RBCs in the blood (Malomo et al. 2002).

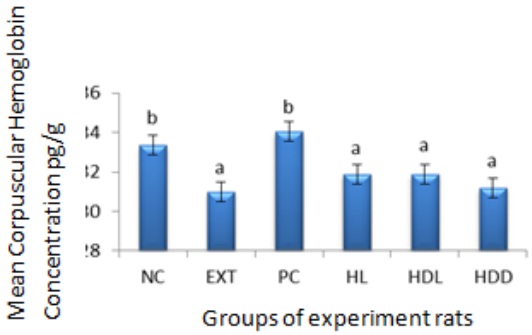

Figure 5: Effects of *Abrus precatorius* on the MCHC activities of Wistar rats fed with high lipid diet.

Effects of methanol extract of *A. precatorius* on the haemoglobin concentration of adult Wistar rats

In Figure 6, the haemoglobin concentrations showed that the differences in mean values were not statistically significant ($p < 0.05$) as observed from the six groups. The hyperlipidaemia untreated showed a slight significant increase ($p < 0.05$) when compared to the negative control and the treated groups. It was observed that there was a slight significant decrease ($p < 0.05$) in the haemoglobin concentration of the negative control when compared to the positive control group.

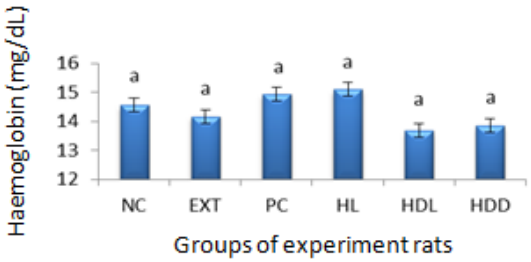

Figure 6: Effects of *Abrus precatorius* on the haemogblobin concentrations of Wistar rats fed with high lipid diet.

There was a significant increase ($p < 0.05$) in the haemaglobin concentrations of the positive group when compared to the extract, hyperlipidaemia high dose and hyperlipidaemia low dose, respectively. It is known that secondary bioactive chemical substances in most medicinal plants that are anti-nutritive like saponins, glycosides, flavonoids and tannins cause haemolysis, nutritional mal-absorption and abnormal haematopoiesis (Al-Harbi et al. 1997). Thus, the decreased levels of haemoglobin concentrations (HC) in the experimental animals fed with extract of *A. precatorius* only, the low dose and high dose treatment groups may probably be as a result of the rapid blood haemolysis leading to haemolytic anaemia and reduction in levels of haemoglobin (Hb) which is a protein used by red blood cells for transport and distribution of oxygen to other cells of the body (Kumar et al. 2011).

Effects of methanol extract of *A. Precatorius* on total white blood cells (WBCs) of adult Wistar rats

As observed in Figure 7, the total white blood cells showed that the differences in mean values were not statistically significant ($p < 0.05$) among the groups. The negative control showed a significant increase ($p < 0.05$) when compared to the test groups. The treated groups (hyperlipidaemia low dose and hyperlipidaemia high dose) showed a slight significant decrease ($p < 0.05$) when compared with the positive control. Meanwhile, it was observed that hyperlipidaemia untreated showed a slight significant increase ($p < 0.05$) when compared to the positive control. There was a significant decrease ($p < 0.05$) in the total white blood cells of the positive control when compared with the negative control.

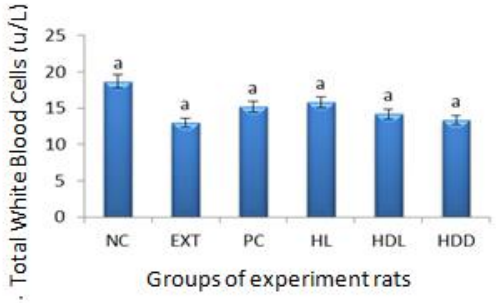

Figure 7: Effects of *Abrus precatorius* on the total WBC activities of Wistar rats fed with high lipid diet.

High white blood cell count indicates an increased production of white blood cells to fight infections, bone marrow disease or immune system disorder. The components of the white blood cells observed in this study were lymphocytes, monocytes, and granulocytes. The administration of methanol leaves extract of *A. precatorius* resulted in significant ($p < 0.05$) decrease of WBC levels when compared with the negative control. The results obtained from this study were higher than the values obtained by Omotoso (2017) and Tion et al. (2018) and slightly lower than the values obtained by Ogundeji et al. (2013). The treatment with the extract at high dose (hyperlipidaemia high dose) and low dose (hyperlipidaemia low dose) showed a slightly significant ($p < 0.05$) decrease in the WBCs when compared to the positive control group. Haematological parameters in the white blood cell indices were not significantly different from each other with respect to the WBC, lymphocytes, monocytes and granulocytes. This could be explained that the extract at graded doses and the atorvastatin induced no injuries in the blood vessels with similar activity. The atorvastatin drug was more potent than the extract doses on white blood indices.

Conclusion

The results obtained from this study showed that the graded doses of the extract increased blood flow in the aorta, induced no injuries in the blood vessels and improved the haematological parameters. The methanol leaves extract of *Abrus precatorius* enhanced the defensive mechanism of the body in hyperlipidaemia conditions of WBC and RBC indices. Therefore, from the histological study, it has been shown that the low dose of the extract was more potent than the high dose. These findings suggest that the plant is an important medicinal candidate for pharmaceutical purposes.

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Conflict of Interest

The authors declare no conflict of interest.

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