



EFFECTS OF ABRUS PRECATORIUS AQUEOUS LEAVES EXTRACT ON SOME HEMATOLOGICAL PARAMETERS IN NORMAL AND DIABETIC RATS

WAKAWA HY¹, ADEJO EO, Prof. Dr. FASIHUDDIN BA².

¹Department of Biochemistry, FSTS/FRST Universiti Malaysia Sarawak, Kuching, 94300 Kota Samarahan

²Department of Chemistry, FSTS/FRST Universiti Malaysia Sarawak, Kuching, 94300 Kota Samarahan
Corresponding author: Ntawa1hen@yahoo.com



WAKAWA HY

ABSTRACT

This study was designed to appraise the effects of *Abrus precatorius* aqueous leaves extract in Normal (non-diabetic) and diabetic albino rats on some hematological parameters including red blood cells, hemoglobin, packed cell volume, white blood cells, mean corpuscular hemoglobin, mean corpuscular volume, mean corpuscular hemoglobin concentration and platelets. Diabetic was induced by a single dose of intraperitoneal injection of 150mg/kg bwt of alloxan, and 100-, 200-, and 400mg/kg bwt of aqueous leaves extract of *Abrus precatorius* was administered orally via GIT Tube to the separate groups of rats for 21 days. A significant decrease ($p < 0.05$) was observed in the levels of red blood cells, hemoglobin, packed cell volume and platelets in diabetic group and both the groups treated with 200- and 400mg/kg bwt of the extract in the diabetic and normal models respectively, while a significantly increased was observed in the levels of red blood cells, hemoglobin, packed cell volume in the 200- and 400mg/kg bwt in diabetic treated groups.

Keywords: *Abrus precatorius*, hematology, rats, diabetes, alloxan

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INTRODUCTION

In recent times, efforts by many researchers have been directed towards the provision of empirical proof to back the use of tropical plants in trado-medicinal practice (Maiti et al 2009, Wakawa and Musa 2013), thus focus on medicinal plant research has increased worldwide, and evidence abounds in the immense potentials of medicinal plants used in various traditional systems. Various medicinal plants have been studied using different scientific approaches and results from these studies have revealed the potentials of medicinal plants in the area of pharmacology (Auddy et al 2003, Fatahi et al 2003, Wakawa and Musa 2013) These medicinal plant are of great importance to the health of the individuals and communities, and to larger extend the nutritional benefits derived from these plants since they are commonly used as vegetables.

These plants contains thousands of phytochemicals and allelochemicals (Rosenthal et al 1979) which constitute anti-nutritional or beneficial factors to the consumers. It was observed by researchers that the medicinal value of these plants/medicinal plants lies in some chemical substances that produces a definite physiological action on the human body in combating diseases..

Many of such diseases such as diabetes mellitus have received great attention both in modern and traditional medicine. Diabetes is a chronic metabolic disorder that is characterized by abnormally high blood glucose level and the excretion of excess glucose in urine (Ghosh et al 2004).

Diabetes is the most common endocrine disorder which is currently affecting approximately 3% of the population worldwide (Skyler 2004) and the number of people with diabetes is increasing due to population growth, aging and increasing prevalence of obesity and physical inactivity (Sarah et al 2004, Nasir et al 2006). According to recent estimates, approximately by the year 2030, 7.8% of the adult population, is expected to have diabetes (Ramachandran et al 2010). Some reasons like stress, rapid development of cities, substantial increase in purchase power, lifestyle ease and metro life have lead to health issues and higher number of people suffering from these diseases (Reetesh et al 2011).

From time immemorial based on folk medicine, diabetes has been treated with medicinal plants or their extracts (Akhtar and Ali 1984) and complications are far less common and less severe in people who have well controlled blood sugar levels (Umar et al 2010)

A. precatarius Linn, is one of the medicinal plants that have received attention both in treatment of many diseases and use as a vegetable and artifacts in many cultures, and is widely found in Africa, India and many other parts of the world. The leaves has a characteristics sweet taste and have been employed as sweetener in foods and certain medicines. It is shown to protect the liver against CCl_4 induced liver damage in rats (Wakawa and Frankline 2015), and also reported to exhibit anti-HIV (Hirabayashi et al.1991), anti-tumo, immunomodulatory (Yoshida et al. 2006), anti-ulcerative and anti-inflammatory properties among other uses.

Materials and Methods

Chemicals

Diagnostic kits for serum glucose test strips and EDTA K3 containers were purchased from Randox Laboratories Ltd, while automated blood analyzer Cell-Dyn, Abbott, US at (Peace hospital Jimeta Yola, Adamawa state) was used for the determination of hematological parameters, and other chemicals and solvents were of highest grade commercially available.

Abrus precatarius leaves

Freshly harvested leaves of *A. precatarius* was used for the preparation of the crude extract. It was collected from an uncultivated farm land in Girei LGA of Adamawa State-Nigeria. It was authenticated in the plant science department of Modibbo Adama University of Technology Yola and given a voucher specimen number WH/APL015/10, it was dried under room temperature.

Drug preparation

The freshly dried leaves of *A. precatarius* was grounded into fine powdered form using laboratory mortar and pestle and electric blender. 150mg of the powdered leaf was weighed into a beaker and mixed with distilled water almost three time the quantity and allow to stand for 2days with continues shacking at time interval for the first 12hrs. The mixture was then filtered using Whatman filter paper No.4 and the filtrate was concentrated using water bath a 40°C . It was then stored under frozen condition until use.

Breeding of Animals

A total number of thirty-six (36) male albino rats weighing between 90 and 120 g body mass were purchased from the animal farm, National Veterinary Research Institute Vom, Jos Plateau state, Nigeria. They were housed in cages at room temperature under 12/12 night/dark and were fed with pelleted standard laboratory feed (Vital Feeds, Grand cereals and oil mills Jos) and water *ad libitum*. They were allowed to stay for 7days to acclimatize before the commencement of the work.

Experimental protocol

The rats were randomly divided into five (5) groups of four (4) rats per group and were given the extract as follows

- | | |
|---------------------|--|
| Group 1: | Normal Control (diet/wate) |
| Group 2: | Rats were given single dose of 150mg/kg bwt alloxan +diet/water |
| Group 3: (treated). | Rats were given 100mg/kg b.wt. Leaf extract + 150mg/kg bwt alloxan +diet/water |
| Group 4: (treated). | Rats were given 200mg/kg b.wt. Leaf extract + 150mg/kg bwt alloxan +diet/water |

Group 5: (treated). Rats were given 400mg/kg b.wt. Leaf extract + 150mg/kg bwt alloxan +diet/water

The 150mg/kg bwt alloxan was administered intraperitoneally to induce diabetes (Akhtar *et al.*, 2002)

Blood Collection

Blood samples was collected through cardiac puncture from rats anesthetized with chloroform into EDTA (ethylenediaminetetraacetic acid) K3 containers, for hematological parameters estimation. Hematological parameters such as PCV, Hemoglobin concentration, white blood cell count and Red blood cell was analyzed using Hematological analyzer Cell-Dyn, Abbott, USA (at Peace hospital Jimeta Yola, Adamawa state)

Statistical analysis

All the data generated from the study was subjected to statistical analysis and the result was expressed as Mean + SEM. Student t-test was used to determine the statistical difference between 2 mean values at 95% level of confidence ($p < 0.05$).

RESULTS

Table 1: Effect of *Abrus precatorius* leaf extract on hematological parameters in diabetic rats

Parameters	Group1	Group 2	Group 3	Group 4	Group 5
WBC (x 10 ³ /μL)	15.73± 1.94	16.30 ± 1.30 ^a	14.03 ± 0.65	16.01 ± 1.06	16.45 ± 1.42 ^b
RBC (x 10 ⁶ /μL)	6.83 ± 0.40	4.32 ± 0.34 ^c	4.04 ± 0.64	5.02 ± 1.32 ^b	5.75 ± 1.42 ^b
HB (g/dL)	12.05 ± 0.50	7.48 ± 1.08 ^c	7.10±1.32 ^d	8.52±2.41 ^b	9.52 ± 2.41 ^b
PCV/HCT (%)	43.40 ± 2.36	30.25 ± 1.11 ^c	28.46 ± 0.32 ^d	33.07 ± 7.02 ^b	33.64 ± 2.17 ^b
MCV (Pg)	63.68 ± 2.00	81.60 ± 4.22 ^a	75.58 ± 4.21 ^d	60.93 ± 1.75	62.17 ± 3.93
MCH (fL)	17.70 ± 0.43	17.32 ± 0.56 ^c	20.03 ± 0.89 ^b	20.60 ± 0.77	18.60 ± 1.66 ^b
MCHC (%)	27.83 ± 0.55	21.22 ± 3.20 ^c	22.55 ± 1.19	25.10 ± 0.95 ^b	25.90 ± 1.06 ^b
PLATELET (x 0 ³ /μL)	460.25 ± 114.74	191.50 ± 55.85 ^c	307.00 ± 96.6 ^a	349.25 ± 58.95 ^a	366.67 ± 40.19 ^b

Results are Mean ± SEM (n= 4), ^asignificantly higher than group 1, ^bsignificantly higher than group 2. ^csignificantly lower than group 1. ^dsignificantly lower than group 2 ($p < 0.05$)

The result in Table 1 showed a relative decrease ($p < 0.05$) in the serum levels of red blood cells (RBC), hemoglobin (Hb), packed cell volume (PCV) and platelets in group 2 (diabetic group) to group 1 (control). However there was an observed relative increase ($p < 0.05$) in the groups 4 and 5 to group 2 and was observed to be dose dependent.

The result also show a significant increase ($p < 0.05$) in the level of white blood count (WBC) and MCV in group 2 (diabetic group) as compare to group 1 rats. However groups 3-5 showed a corresponding decrease in the level of MCV as compared to group 2, but there is no observed decrease in the levels of WBC.

Table 2: Effect of *Abrus precatorius* leaf extract on hematological parameters in Normal rats

Parameters	Group1	Group 2	Group 3	Group 4
WBC (x 10 ³ /μL)	15.73± 1.94	14.13 ± 2.07	15.46 ± 1.09	15.60 ± 0.56
RBC (x 10 ⁶ /μL)	6.83 ± 0.40	5.59 ± 0.62	4.91 ± 0.19 ^b	4.78 ± 0.48 ^b
HB (g/dL)	12.05 ± 0.50	9.70 ± 1.44 ^b	8.45 ± 0.91 ^b	6.80 ± 0.49 ^b
PCV/HCT (%)	43.40 ± 2.36	40.65 ± 4.88 ^b	39.68 ± 3.27 ^b	31.55 ± 2.23
MCV (Pg)	63.54 ± 2.00	72.72 ± 3.29 ^a	70.98 ± 2.78 ^a	69.00 ± 0.95 ^a
MCH (fL)	17.64 ± 0.43	17.35 ± 1.30 ^b	15.12 ± 0.83	14.23 ± 1.69 ^b
PLATELET (x 0 ³ /μL)	460.25 ± 14.74	455.13 ± 12.2	301.21 ± 11.4 ^b	296.75 ± 28.39 ^b

Results are Mean ± SEM (n= 4), ^asignificantly higher than group 1, ^bsignificantly lower than group 1. ($p < 0.05$)

The result in Table 1 showed a relative decrease ($p < 0.05$) in the serum levels of red blood cells (RBC), hemoglobin (Hb), packed cell volume (PCV) and platelets in groups 2 - 4 to group 1 (control). However there was an observed significant increase ($p < 0.05$) in the groups 4 and 5 as compared to group 2 which was observed to be dose dependent.

The result also show a significant increase ($p < 0.05$) in the level of MCV as compared to group 2, but

there is no observed change in the levels of WBC.

DISCUSSION

Diabetes is associated with abnormalities on hematological functions such as blood cell morphology and decreasing of red or/and white blood cells counts (Mansi, 2008). However, literature have shown that the administration of medicinal plants or drugs can alter the normal ranges of these hematological parameters. (Anand et al 2010).

Alloxan is a diabetogenic agent which induces diabetes by damaging the pancreatic β -cells leading to hyperglycemia. Alloxan has been reported to be a specific β -cytotoxic drug and acts by complexing with the metal ions in the islets (Akhtar et al 2011), thus the blood glucose level in this study was significantly increased in group 2 rats (table 1).

The levels of red blood cells, hemoglobin and packed cell volume, in group 2 (table 1) showed a relative decrease which may be attributed to the effect of diabetes in these rats.

A relative increase was observed in the level of RBC, PVC and Hb in groups D and E in table 1, this gives an indication that the plant extract may contain some phytochemicals that can stimulate the formation or secretion of hormone erythropoietin in the stem cells of the animals. The stimulation of this hormone enhances rapid synthesis of red blood cells which is supported by the improved level of MCH and MCHC as observed in table 1. These parameters are used mathematically to define the concentration of hemoglobin and to suggest the restoration of oxygen carrying capacity of the blood. Though, the mechanism of action of this plant is not well understood, however it may be attributed to the ability of plant extract to lower lipid peroxidation level that causes hemolysis of erythrocytes.

A relative decrease was observed in the level of RBC, PVC and Hb in groups B (table1) and, C and D (table 2), this gives an indication that the plant may have toxic effect on the parameters and that over a prolong exposure to this plant, the animal may be subjected to depression in erythropoiesis and possibly anaemia (Adedapo et al 2007). The possible anemic condition observed may be attributed to destruction of red blood cells and reduced rate of its release from the bone marrow to blood. Several studies have attributed this anemia to increase in lipid peroxidation of the erythrocyte cell membrane (Baskar *et al* 2006) and the alterations of these parameters are well known to cause anaemic condition in man.

The destruction of the RBC might be as a result of the abrin content of the plant, which consists of abrus agglutinin (a haemagglutinin), and toxic lectins abrin *a-d*, which are the five toxic glycoproteins found in the plant (Budavari 1989, Windholz 2004). It was observed that the effects of anaemia are greatly influenced by its severity, duration and rate of development (Taiwo and Anosa 1995, Macfarlane et al 2001).

There is no observed relative changes in the total WBC count, which may be attributed to the findings that toxic plants do not produce direct effect on the white blood cells, such as neutrophils, lymphocytes, eosinophils and monocytes (Swenson and Reece 1993). However it was observed that excessive ingestion of wide variety of plants or their products causes hypoproliferative or non-regenerative anaemia, this is a stem cell disorder characterized by reduced production of all blood components in the absence of primary disease process infiltrating the bone marrow or suppressing haemopoiesis (Olsen et al 1984). This shows that the plant should be used with caution since it has the ability to cause destruction of red blood cells leading to anaemia.

Platelets play a major role in the process of haemostasis. Interaction of the damaged vascular wall with circulating platelets and coagulation protein leads to haemostasis. The reduction of the level of platelets in table 2 might mean that haemostasis may be compromised which may lead to internal and external haemorrhage. Some plants produce toxic effects by causing extensive haemorrhages into tissues leading to severe blood loss (Mensah et al 2011).

CONCLUSION

Abrus precatorius is a medicinal plant used traditionally in Nigeria and other part of the world for the management of various diseases condition. Hence in this study it may be safe to conclude that the extract of the leaves has a potential toxic effects on the red blood cell parameters and care should be taken when consuming it.

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