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Timely Dosage Dependent Ethanolic Extract of *Mangifera Indica* Promotes Blood Cells Development and Weight Gain

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Abstract

The effects of ethanolic extract of *Mangifera indica* stem bark were investigated on blood cells. A total of twenty albino male and female rats were used for the study. The experimental groups were administered with low, medium and high dosages for the period of 14 days. The red blood cells count was increased at high dose of the extract than the control without the extract and was significant ($P<0.05$). At the medium dose there was low red blood cell counts which was significant compared with control ($P<0.05$). Same results were obtained with PCV at high dose ($P<0.05$) haemoglobin concentration and white cell counts. However, platelet counts were reduced at high dose of the extract and raised at medium dosage. The body weight of the rats was increased at 7 and 14 days of the administration of the extract. It is confirmed from the study that the extract regulates blood cells parameters and particularly promotes RBC, PCV; Hb levels at high dosages but platelets at low dosages respectively and hence could be used in the treatment of anaemia and weight loss.

Keywords

Mangifera indica; Hb; PCV; RBC; Platelet; Weight gain

Introduction

Certain plants provide preventive, protective, immunostimulative and therapeutic properties; these attributes are strong indications of the roles of plants in the health of man. The World Health Organization showed that of the 119 plants derived pharmaceutical drugs, 74% are used in the modern medical practice, and about 80% of the world population depends on the herbal remedies for their primary health care, [1,2] (*Mangifera indica* is in the family, Anacardiaceae [3,4]. The plants are indigenous in Indonesia but are found in the tropics and subtropics including Nigeria. They are of wide varieties and sizes and sweet when ripped. All parts of the plants seem to be endowed with medicinal properties i.e. the roots, leave, bark fruits etc. and are used in the treatment of asthma, cough, diarrhoea, dysentery, jaundice, pain, malaria, anaemia [1] and diabetes [5]. Its oil from the bark is effective in the treatment of sore throat [6] while the alcoholic extract has immunomodulation and immune-stimulatory properties. The phytochemical screening of the plants showed the following contents; saponin, tannins, phlobatannin, anthraquinones, flavonoids and cardiac glycosides [6]. In view of its speculative roles in arrest of anaemia, the research was carried out for confirmation of its related roles in blood cells development and its parameters. Blood cells developed from same haematopoietic stem cells. The red blood cells which specialize in oxygen transport in association with haemoglobin are the most numerous; 5.2 million in males and 4.7 million in females [7].

Deficiency of these cells leads to anaemia and lack of basic nutrients e.g. iron, vitamin B12, folic acid protein, hormones and other trace elements will cause structural anomalies e.g. microcytes, macrocytes spherocytes, acanthocytes and related anaemia. The white blood cells also called leucocytes are for the body defence and immunity. Mainly they are classified base on the granule contents; granulocytes e.g. neutrophils, eosinophil's and basophils and agranulocytes; the lymphocytes. The latter which is involved in cell-cell and humoral immunity as in the case of HIV/AIDS and CD4 [8]. The leucocytes are with varied structures and count and also varied with age, sex and diseases [9]. The counts also varied from 4500 to 1 million and may increase or decrease as in Leukocytosis and Leukocytopenia (Gannong, 2011).

Platelet is another blood cell also called thrombocyte; it is the smallest of blood cells with diameter of 1-2 um. Its functions depend on its structural arrangement or cytoskeleton and the presence of granules, dense and alpha granules. These relate to its adhesion, aggregation and procoagulant activities, growth factor and platelet factor 4 (PF4) and the coagulation pathways. These properties enhance the prevention of haemorrhage or bleeding by the platelets. It is also involved in growth development as in wound healing with its derived growth factor (platelets derive (growth factor, PDGF) [9].

Materials and Methods

Collection and identification of the plant materials

Fresh stem bark of mango tree; *Mangifera indica* were collected from Ikono Local Government Area of Akwa Ibom State Nigeria. The identification as stem bark from the mango tree was done by a Senior Technologist in the Department of Pharmacognosy and Natural Medicine, Faculty of Pharmacy, University of Uyo.

Preparation of extract: Stem barks of *Mangifera indica* were cut into small pieces, sundried for two weeks. The dried barks were pulverized with mortar and pestle into powder form. 900 g of the powder was dissolved in 1 litre of 50% ethanolic solvent for 24 hrs. It was filtered and the filtrate evaporated to dryness at 45°C in water bath to obtain the extract.

Acute toxicity test (LD50)

The methods of Lorke were used in the test [10]. A total of 33 mice were used. The mice were divided into two phases for the test. In the first phase (9) mice were divided into 3 groups with 3 in each group and administered intra-peritoneally with 5000 mg/kg, 4500 mg/kg and 4000 mg/kg of the extract. Twenty four (24) mice were also administered intraperitoneally with 3000 mg/kg, 2000 mg/kg, and 1000 mg/kg 1000 mg/kg, 500 mg/kg, 400 mg/kg, 300 mg/kg, 200

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mg and 100 mg/kg dosages of the extract in the second phase of the test. Minimum dose, 300 mg/kg produced lethality and 200 mg/kg maximum dose that produced 0% mortality.

Lethal dosage was calculated from the maximum dose that had 0% lethality and minimum dose that has 100% lethality i.e. AB where A=maximum dosage that produced zero morality (0%).

B=minimum dosage that kill the mice $(100\%) lethality = \sqrt{AB}$

$\therefore\ LD_{50}\sqrt{200\times 300} = 244.95 mg/kg$

$= \%LD_0(244.95) = 10\% = 24.50 mg/kg - lowdose$

=20%= 48.99 mg/kg– medium dose

=30% = 73.49 mg/kg – high dose

Animals, grouping and extract administration: Twenty (20) adult male and female albino rats were used. They were kept in well ventilated Department of Pharmacology, University of Uyo, and animal house. The rats were fed with pellets and clean water. The rats were used for the studies based on the regulation of institute of animal ethical committee (IAEC) and the ethical standard of 1964 declaration of Helsinki were observed. The rats were randomly divided into four groups (4) with five (5) rats in each group, group 1 served as control were given low dose, group 3 medium dose and group 4 high dose of the extract in mg/kg as follows; 24.50 mg/kg, 48.99 mg/kg, 73.49 mg/kg, 10%, 20% and 30% of the LD50. The extract was administered for 14 days orally using cannula-by passing the oesophagus into the stomach [11-13].

Blood collection and analysis

Five (5 ml) of blood was collected into EDTA from the chloroform anaesthetized rats by cardiac puncture after 14 days administration of the rats. The blood was assayed for red blood cells, white blood cells, platelets, packed cell volume (PCV) mean corpuscular haemoglobin concentration (MCHC) mean corpuscular volume (MCV) and mean corpuscular haemoglobin using Mindray Analyser, BS-530.

Results

Red blood cells

The results showed increase in red blood cells count at high dose of the extract than control (P<0.05). But there was no significant difference between the control and low dose group (P>0.05) and the medium dose group showed a drastic reduction in the red cell count and significant as compared to control (P>0.05) (Figure 1).

Packed cell volume (PCV)

There was increase in the mean value of packed cell volume (PCV) at high dose of the extract than control (P<0.05) but at medium dose of the extract there was a significant decrease in the PCV as compared to control (P<0.05) (Figure 2).

Haemoglobin concentration

The haemoglobin concentration was increased at high dose of the extract as compared with the control and significant as compared with low and medium dosages P<0.05 (Figure 3).

Mean corpuscular volume

The mean corpuscular volume was raised at medial dose than control 65.19 + 2.59, 64.18 + 2.25, and then low dose and high dosages respectively, 64.19 + 0.82, 62.40 + 1.33.

White Blood Cell: There was slight increase of white blood cells count than that of control at high dose of the extract but was not significant (P>0.05). At low dose the count was reduced as compared to control and was significant as compared to medium and high dose P<0.05 (Figure 2). Specifically, neutrophil and lymphocytes were increased at high dose 26.73 than control, 22 + 0.30 and at low dose with lymphocyte, 73.90+ 3.39, 71.66+ 1.34 (Figure 4).

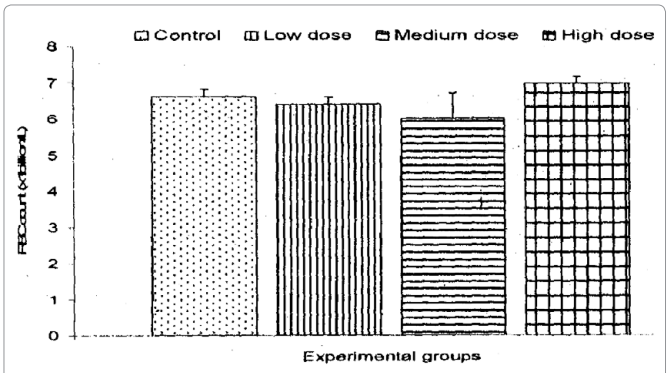

Figure 1: Comparison of red blood cell count in control, low. Medium and high doses of *M. indica* extract fed groups.

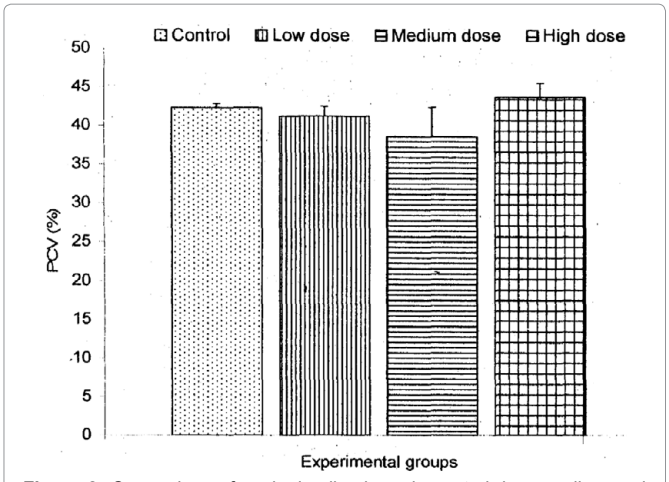

Figure 2: Comparison of packed cell volume in control, low, medium and high doses of *M. indica* extract fed groups.

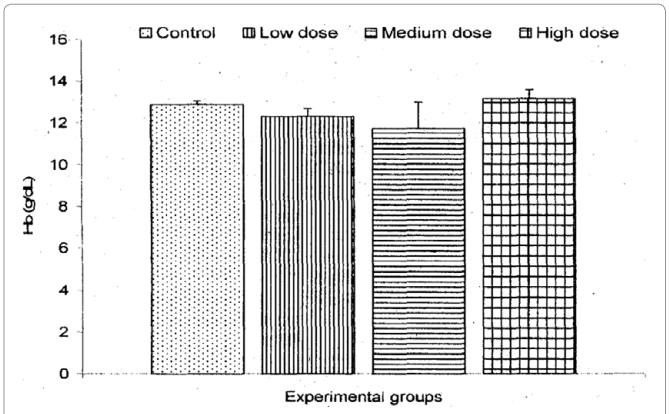

Figure 3: Comparison of haemoglobin concentration in control, low, medium and high doses of *M. indica* extract fed groups.

Mean corpuscular haemoglobin

Mean corpuscular haemoglobin was increased at medium dose of the extract than control, 19.73 + 0.42, and 19.19 + 0.25.

Mean Corpuscular Haemoglobin Concentration MCHC. The mean corpuscular haemoglobin concentration were within the range at low, medium and compared with control, 29.89 + 0.07, 30.35 + 0.65, 30.21 + 0.33, 30.50 + 0.27, but was slight lower at low dosage (Figures 5-7 and Table 1).

Discussion

Varied effects of ethanolic extract of *Mangifera indica* on the blood cells and its parameters have been unveiled in line with previous studies [14]; very significant of these effects is the boosting of blood cells development similar effects have been recorded with cotton seed extracts [11]. The increase observed in red blood cells count with high dosage of the extract means its haematinic potency. This potentiality has been compared with orthodox, drugs e.g. folic acid in our previous studies [11], though was not compared in the present study. We are pursuing the potency of this extract for drugs formulation: This shall increase the drugs availability for the treatment of red cell deficiency e.g. anaemia. It is found that effect of the extract on the red blood cells was dose dependent. Also the packed cell volume (PCV) was increased at high dose. This is the corresponding effect of raised red cell count in the study. Low packed cell volume is an indication of anaemia [7]. Also increase in haemoglobin concentration at the high dose of the extract shows its haematinic properties, haemoglobin binds with oxygen and transport such to the tissues. Increase in this protein concentration means increase availability of oxygen. Low haemoglobin means less oxygen presence in the tissue which

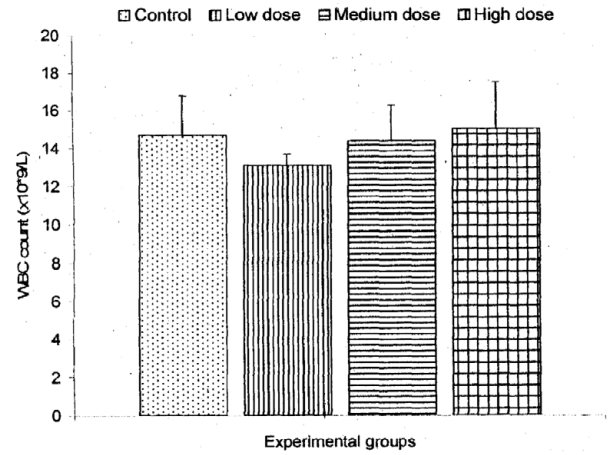

Figure 4: Comparison of total white blood cell count in control, low, medium and high doses of *M. indica* extract fed groups.

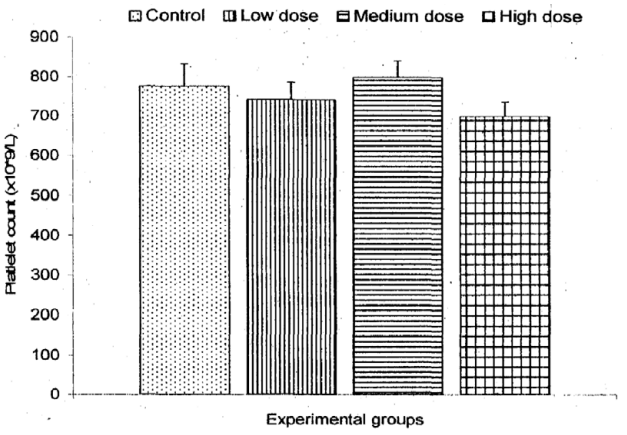

Figure 5: Comparison of platelet count in control, low, medium and high doses of *M. indica* extract fed groups.

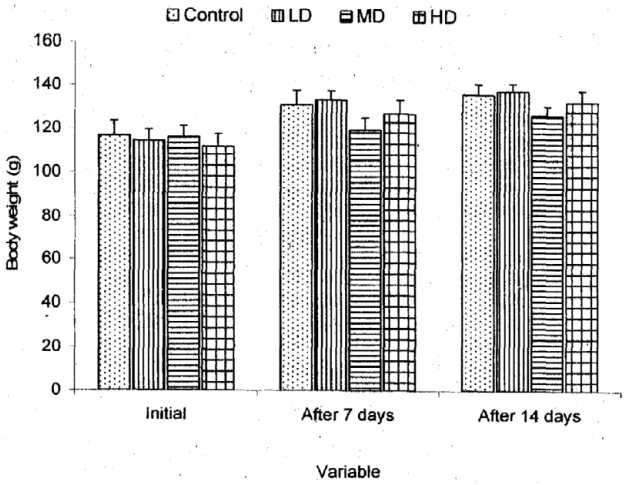

Figure 6: Comparison of initial body weight, body weights after 7 and 14 days in control and *M. indica* extract fed groups.

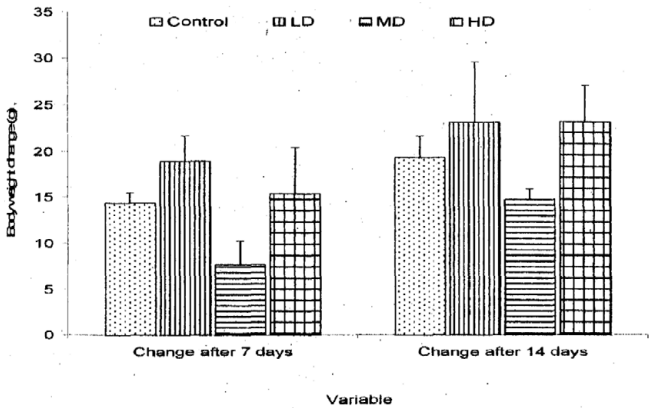

Figure 7: Comparison of change in body weights after 7 and 14 days in control and M. indica extract fed groups. Values are expressed as mean ± SEM, n=5. No significant differences among groups.

	MCV	MCH	MCHC	Neutrophils	Lymphocytes
	(fL)	(pg)	(g/dL)	(%)	(%)
Control	64.18	19.56	30.50	22.30	71.66
	2.25	0.53	0.27	1.05	1.34
Low dose	64.19	19.19	29.89	17.44	73.90
	0.82	0.25	0.07	1.97	3.39
Medium dose	65.19	19.73	30.35	20.54	72.34
	2.59	0.42	0.65	1.33	1.67
High dose	62.40	18.84	30.21	26.73	69.05
	1.33	0.24	0.33	4.39[a]	3.75

Table 1: Comparison of red blood cell indices, neutrophil and lymphocyte counts in control, low medium and high doses of *M indica* extract fed groups.

often leads to hypoxia which results in death (Gannong, 2013). The mean corpuscular volume which measures, volume of red cell per haemoglobin concentration the mean corpuscular haemoglobin and mean corpuscular haemoglobin concentration were all increased at medium and high dose respectively. These are all haematological parameters that relate haemoglobin with red blood cells [8]. The white cells; neutrophils and lymphocytes were increased at high dose of the extract. The extract is therefore useful in the treatment of Leukopenia, HIV/AIDS and leucophilia. The observed increase in weight of the rats after 14 days administration shows periodic dependent nutritional boosting of the extract. The extract could be used in treating weight loss related ailments e.g. HIV/AIDS, marasmus and Kwashiorkor.

Recommendation

The extract is highly recommended for use in the treatment of anaemia and weight loss but caution should be taken on platelet counts at high dose to avoid bleeding.

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