



HAEMATOLOGICAL EFFECTS OF ETHANOLIC LEAF, SEED AND FRUIT EXTRACTS OF *Datura metel* ON MALE ALBINO RATS



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Abstract: This study aimed at investigating the effects of ethanolic extracts of leaf, seed and fruit of *Datura metel* on some haematological parameters in male albino rats. Thirty-five male albino rats were used in this study and were randomly placed into seven groups with five rats in each group. The extracts were administered accordingly to Groups 2 to 7 through gavage intubation. At the end of the administration of the extracts, blood was collected by cardiac puncture from each animal and haematological auto-analyzer (Abacus 380) was used for the haematological analysis. The result showed a non-significant ($p > 0.05$) decrease of white blood cells (WBC) count in Groups 3 and 5 administered high dose (600 mg/kg bw) of leaf extract and high dose of seed extract respectively compared with the normal control (Group 1), while there was a non-significant increase of WBC count in the groups administered low dose (300 mg/kg bw) of leaf extract (Group 2), low dose of seed extract (Group 4), low dose of fruit extract (Group 6) and high dose of fruit extract (Group 7) compared with the normal control. Results of red blood cell (RBC) count, packed cell volume (PCV) and haemoglobin (Hb) concentration showed a significant decrease ($p < 0.05$) of these parameter in Group 5 administered high dose (600 mg/kg bw) of seed extract and a non-significant decrease in Group 3 administered high dose (600 mg/kg bw) of leaf extract compared with the normal control. RBC, PCV and Hb levels increased in Groups 2, 4, 6 and 7 compared with the normal control. This means that low doses (300 mg/kg bw) of ethanolic leaf, seed and fruit extracts, and high dose (600 mg/kg bw) of fruit extract of *Datura metel* improved the haematological parameters analysed and may be good for boosting blood composition, but high doses (600 mg/kg) of ethanolic leaf and seed extracts posed an adverse effect on the animals. The high levels of RBC, PCV and Hb of Groups 2, 4, 6 and 7 animals when compared with the normal control show that administrations of low doses of the various extracts and high dose of the fruit extract improves haemoglobin synthesis, erythropoiesis, blood composition and could possibly improve the index of immune function.

Keywords: Anaemia, blood, *datura metel*, haematology, haemopoiesis, immune function

Introduction

Plants have a very great potential for the treatment and management of certain diseases. A large number of plants have been used by tribal and folklore: in many countries for the treatment of different diseased conditions. The medicinal value of plants lies in their bioactive phytochemical constituents that produce definite physiological actions on human body (Akinmoladun *et al.*, 2007) and other animals. These chemical constituents include flavonoids, alkaloids, essential oils, saponins, terpenoids, tannins, and phenolic compounds. Many medicinal plants contain some chemical constituents that could cause harmful effects to human if taken in large quantities. Alkaloids occurring in a large amount could make these plants poisonous. The World Health Organization has recognized the importance of traditional medicine and has created strategies, guidelines and standards for botanical medicines. Over the past decade, there has been a resurgence of interest in the investigation of natural materials as a source of potential drug substance (Manas *et al.*, 2012; Imo and Uhegbu, 2015). In recent times, developed countries are turning to the use of traditional medicinal systems that involve the use of herbal drugs and remedies and according to the World Health Organization (WHO), almost 65% of the world's population has incorporated the value of plants as a methodology of medicinal agents into their primary modality of health care (Manas *et al.*, 2012; Imo and Uhegbu, 2015).

Datura metel L. belong to the plant family Solanaceae. Its common names are: Thorn apple, Devil's apple, Jimson weed and Angel's trumpet. Its indigenous names in

Nigeria include: Igbo –Myaramuo; Hausa – Zakami; Yoruba – Apikan (Abdullahi *et al.*, 2003). It is native to Asia and Africa, widely cultivated and naturalized in tropic. In Nigeria, especially in the northern part, *Datura* is found growing as a weed in abandoned farmlands and or dumpsites, but it is sometimes cultivated. The leaves and seeds of the plant are used for several purposes and in several ways especially for its psychoactive activities (Kutama *et al.*, 2010). This makes the different parts of *Datura metel* to be abused by some youths who are more users and are prone to dangers of smoking and drug abuse. The extract of *Datura*, however, is a potent poison and its indiscriminate use may lead to delirium and acute poisoning that may lead to death. The active constituents in *Datura* include scopolamine, atropine, hyoscyamine, withanolides (lactones) and other tropanes. Recently, withanolide compounds have shown significant antitumor, cytotoxic, anti-inflammatory, antibacterial, hepatoprotective, sedative, cytostatic and immunosuppressive activity (Neeraj *et al.*, 2013).

Datura metel is a medicinal plant widely used in phytomedicine to cure diseases such as asthma, cough, convulsion and insanity. Various parts of the plant (leaves, seeds, roots and fruits) are used for different purposes in medicine. Nuhu (2002) reported that *D. metel* contains tropane alkaloids and are used as sedative, anti-spasmodic and mydriatic agents. The whole plant, but especially the leaves and seed, have anaesthetic, hallucinogenic, anti-asthmatic, anti-spasmodic, anti-tussive, narcotic, bronchodilator, anodyne, hypnotic and mydriatic effects. Leaves are used as a local application for rheumatic swellings of the joints, lumbago, sciatica, neuralgia,

painful tumors, scabies, eczema, allergy and glandular inflammations, such as mumps; used externally for earache and smoked to relieve spasmodic asthma. Seeds are also used externally for piles (Yusuf *et al.*, 2009). Seeds, leaves and roots are used in insanity, fever with catarrh, diarrhea, skin diseases and cerebral complications (Khaton an Shaik, 2012).

Haematology is the branch of medical science that deals with the study, diagnosis, treatment, and prevention of diseases related to the blood. It involves treating diseases that affect the production of blood and its components, such as blood cells, haemoglobin, blood proteins, and the mechanism of coagulation. Common haematological parameters include white blood cell, Red blood cell, haemoglobin, packed cell volume and platelets.

The present study is aimed at investigating the effects of ethanolic extracts of leaf, seed and fruit of *Datura metel* on some haematological parameters in male albino rats. The results will help reveal the likely pharmacological/clinical effects of the plant parts on these parameters on consumers/users.

Materials and Methods

Plant material

The leaf, seed and fruit of *Datura metel* were harvested at Wapan-Nghaku (popularly known as T-junction), Wukari, Taraba State, Nigeria. The plant materials (leave, seed and leave) were rinsed and then sun-dried. The dried leaf, seed and fruit were milled to powder. Known weights of the powders were extracted with 70% ethanol by cold maceration for 48 h and filtered. The filtrates were evaporated to dryness and reconstituted in normal saline for the experiment.

Experimental animals

Thirty-five healthy male albino rats, aged 8 weeks were used in this study. The animals were purchased at Vom, Plateau State and kept in the Animal House, Department of Biochemistry, Faculty of Pure and Applied Sciences, Federal University Wukari, Taraba State. The animals were allowed to acclimatize for 7 days under standard laboratory conditions with free access to commercial rat feed and water.

Experimental design

The thirty-five male albino rats (between 65 – 84 g body weight) were randomly placed into seven (7) groups with five (5) rats in each group. Group 1 served as the normal control (it received a placebo of normal saline). Group 2 received leaf extract (300 mg/kg b.w.), while group 3 received leaf extract (600 mg/kg b.w.). Group 4 received seed extract (300 mg/kg b.w.), while group 5 received seed extract (600 mg/kg b.w.). Group 6 received fruit extract (300 mg/kg b.w.), while group 7 received fruit extract (600 mg/kg b.w.). The test animals (groups 2, 3, 4, 5, 6 and 7) received the leaf, seed and fruit extracts as stated above for seven consecutive days. The extracts were administered through oral route (using gavage intubation). All animals were allowed free access to feed and water *ad libitum* throughout the study.

Blood collection

After twenty-four hours of administration of the leaf, seed and fruit extracts of *Datura metel*, the animals were starved overnight, anaesthetized with chloroform and sacrificed. Blood was collected by cardiac puncture from

each animal into heparinized tubes for haematological analysis.

Biochemical analysis

Haematological parameters: Red blood cell, White blood cell, Haemoglobin and Packed Cell Volume were analysed using haematological auto-analyzer (Abacus 380).

Statistical analysis

Statistical analysis was carried out with the use of standard Student-T-distribution test: using Statistical Package for Social Sciences (SPSS) version 21 and group mean were compared for significance at $p \leq 0.05$.

Results and Discussion

The results of the analysis are presented in the Tables (Table 1 & 2). The haematological result of this study showed a non-significant ($p > 0.05$) decrease of white blood cells (WBC) count in groups three and five administered high dose (600 mg/kg bw) of leaf extract and seed extract respectively compared with the normal control (group one), while there was a non-significant increase of WBC count in the groups administered low dose (300 mg/kg bw) of leaf extract (group two), low dose of seed extract (group four), low dose of fruit extract (group six) and high dose of fruit extract (group seven) compared with the normal control. WBC is known as an index of an immune function (Imo *et al.*, 2013) as it helps to boost the immune system and fight against diseases. White blood cells are an important component of the host defence system, responsible for protection against bacteria, fungi, viruses, and invading parasites. White blood cells originate from pluripotent haemopoietic stem cells (Metcalf, 1993). Sometimes, rapid adjustment in the rates of production of white blood cells can occur in response to acute and chronic stress. It is believed also that consumption of green leafy vegetables could improve blood composition, which includes WBC. Though the increase and decrease of the WBC recorded in this study were not statistically significant ($p > 0.05$), result showed that administration of the high doses of the leaf and seed extracts reduced the WBC counts; this therefore could predispose the animal to poor immune state. It is possible that the high concentrations of chemical component (mostly the tropane alkaloids) of *Datura metel* leaf and seed adversely affected the haemopoietic stem cells, and therefore affected the production of WBC. The increase in WBC count in Groups 2, 4, 6 and 7 show that at low concentrations, these plant parts of *Datura metel* could improve the process of haemopoiesis, therefore leading to an increased production of WBC. This means that the immune index of Groups 2, 4, 6 and 7 could be better than that of Groups 3 and 5 when compared with the normal control animals. WBC count could rise due to response to allergies, parasitic infections, collagen diseases, and disease of the spleen and central nervous system. It is also possible that the increased WBC count may be due to the response of the animal to the extract administered.

Results of red blood cell (RBC) count, packed cell volume (PCV) and haemoglobin (Hb) concentration showed a significant decrease ($p < 0.05$) of these parameters in Group 5 administered high dose (600 mg/kg bw) of seed extract and a non-significant decrease in Group 3 administered high dose (600 mg/kg bw) of leaf extract compared with the normal control (Group 1) (Table 1).

Table 1: Concentrations of haematological parameters

Parameters	Group 1 (Normal control)	Group 2 (leaf: 300 mg/kg bw)	Group 3 (leaf: 600 mg/kg bw)	Group 4 (seed: 300 mg/kg bw)	Group 5 (seed: 600 mg/kg bw)	Group 6 (fruit: 300 mg/kg bw)	Group 7 (fruit: 600 mg/kg bw)
WBC ($\times 10^9/L$)	4.54 \pm 0.26 ^a	5.30 \pm 0.84 ^a	4.44 \pm 0.75 ^a	4.98 \pm 0.25 ^a	3.94 \pm 0.54 ^a	5.66 \pm 1.34 ^a	5.80 \pm 1.20 ^a
RBC ($\times 10^{12}/L$)	3.64 \pm 0.17 ^a	3.68 \pm 0.60 ^a	3.30 \pm 0.58 ^a	3.66 \pm 0.25 ^a	3.18 \pm 0.13 ^b	3.78 \pm 0.43 ^a	4.16 \pm 0.34 ^a
Hb (g/dl)	10.94 \pm 0.93 ^a	11.66 \pm 1.96 ^a	9.54 \pm 1.45 ^a	11.26 \pm 1.13 ^a	9.34 \pm 0.69 ^b	12.26 \pm 1.74 ^a	14.02 \pm 1.37 ^c
PCV (%)	32.80 \pm 2.77 ^a	35.00 \pm 5.83 ^a	28.60 \pm 4.34 ^a	33.80 \pm 3.35 ^a	28.00 \pm 2.00 ^b	36.80 \pm 5.26 ^a	40.00 \pm 3.39 ^c

Results represent mean \pm standard deviation of group results obtained (n=5); Mean in the same row, having different letters of the alphabet are statistically significant (p<0.05) compared with the normal control (group one); WBC= White blood cell, RBC= Red blood cell, Hb= Haemoglobin, PVC= Packed cell volume, %= percent and g/dl= grams per decilitre.

Table 2: Differential white blood cells (%)

Parameters	Group 1 (Normal control)	Group 2 (leaf: 300 mg/kg bw)	Group 3 (leaf: 600 mg/kg bw)	Group 4 (seed: 300 mg/kg bw)	Group 5 (seed: 600 mg/kg bw)	Group 6 (fruit: 300 mg/kg bw)	Group 7 (fruit: 600 mg/kg bw)
Lymphocyte	49.60 \pm 5.22	56.40 \pm 2.64	44.20 \pm 3.15	55.00 \pm 6.31	59.80 \pm 3.09	56.00 \pm 3.41	57.40 \pm 1.94
Neutrophil	49.20 \pm 5.29	42.80 \pm 2.85	55.40 \pm 3.22	43.60 \pm 6.44	38.60 \pm 3.19	43.00 \pm 3.63	40.60 \pm 1.33
Monocyte	0.80 \pm 0.20	0.80 \pm 0.37	0.40 \pm 0.24	1.20 \pm 0.49	1.40 \pm 0.40	0.80 \pm 0.58	1.20 \pm 0.37
Eosinophil	0.40 \pm 0.24	–	–	0.20 \pm 0.20	0.20 \pm 0.20	0.20 \pm 0.20	0.80 \pm 0.37
Basophil	–	–	–	–	–	–	–

Results represent mean \pm standard error of group results obtained (n=5); N - Neutrophil, L - Lymphocyte, M- Monocyte, E- Eosinophil, B- Basophil and %= percent.

Red blood cells are the animals' principal means of delivering oxygen (O_2) to the body tissues—via blood flow through the circulatory system. The cytoplasm of the red blood cells is rich in haemoglobin, an iron-containing biomolecule that can bind oxygen and is responsible for the red colour of the cells. Red blood cells are continuously produced in the red bone marrow through the process called erythropoiesis. The production of red blood cells is stimulated by the hormone erythropoietin (EPO), synthesized by the kidney. A decrease in the amount of red blood cell affects animals' immune system. The decreased RBC, PCV and Hb levels in Groups 3 and especially 5 is believed to be as a result of high contents of the secondary metabolites (mostly tropane alkaloids) contained in the leaf and seed of *Datura metel*. This reduction could affect the functionality of the animals and could result to a diseased condition. Some chemical constituent of the leaf and seed may have in high concentrations interfered with erythropoiesis and haemoglobin synthesis or have caused destruction of some haemoglobin, leading to low RBC, Hb and PCV. As a result of this, it is possible that serum protein synthesis in the liver will be suppressed and the bone marrow may not have enough proteins to synthesize red blood cell, thereby reducing the level of Hb and PCV. This condition results in anaemia. When haemoglobin levels fall below normal, the animal body may not actually function optimally. Besides, when the number of healthy red blood cells drop, a haemoglobin level also drops, a condition known as anemia. This reduction often results in a drop in oxygen delivery to cells.

When anaemia comes on slowly, the symptoms are often vague and may include: feeling tired, weakness, shortness of breath or poor ability to perform physical exercise (Janz *et al.*, 2013). These poor health conditions may have been experienced by the animals in Groups 3 and 5, unlike the animals administered the low doses of leaf extract, low dose of seed extracts, low dose of fruit and high dose of fruit extracts. Hb synthesis is normally increased by the consumption of plant foods due to their high content of minerals and vitamins (Morebise *et al.*, 2002) that may stimulate synthesis of globin component of Hb. The high levels of RBC, PCV and Hb in Groups 2, 4, 6 and 7 when compared with the normal control show that administrations of low doses of the various extracts and

high dose of the fruit extract improves haemoglobin synthesis, erythropoiesis and possible stimulation of the production of the hormone erythropoietin (EPO), thereby improving blood composition and improving the index of immune function.

Conclusion

The result of this study revealed that low doses (300 mg/kg bw) of ethanolic leaf, seed and fruit extracts, and high dose (600 mg/kg bw) of fruit extract of *Datura metel* improved the haematological parameters (WBC, RBC, PCV and Hb) analysed and may be good for boosting blood composition, but high doses (600 mg/kg) of ethanolic leaf and seed extracts posed an adverse effect on the animals, as it can decrease WBC, RBC, PCV and Hb levels, and may predispose animals to anaemia and poor immune function.

Conflict of Interest

The authors declare no conflict of interest.

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