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The role of *Moringa oleifera* aqueous roots extract on haemopoiesis in chicken

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A B S T R A C T

This study evaluates the haemopoietic effect of *Moringa oleifera* aqueous roots extract on chickens. Six hundred grams (600g) of fresh *Moringa oleifera* roots was collected, washed, air dried, pulverized and aqueous extracted. The aqueous roots extract was further subjected to chemical extraction with chloroform, ethyl acetate and n-butanol chemicals based on their order of polarity. The root extract also underwent qualitative chemical screening for identification of the various classes of active chemical constituents of the plant root material. It was found to contain carbohydrates, Saponins, cardiac glycosides, Terpenes, steroids, Flavonoids and alkaloids in various concentrations. The ethyl-acetate portion which has the highest level of concentration of the constituents and thus was used for sub-acute toxicity studies in chickens. In the sub-acute studies, haematological parameters showed that the extract stimulated significant increase in red blood cells (RBC), white blood cells (WBC), hemoglobin concentration (Hb) and packed cell volume (PCV). This haemopoietic activity of the extract is an indication that *M. oleifera* aqueous roots extract have the capability of preventing anaemia in chicken and boosting the immune system.

Keywords: Aqueous; Chicken, Haemopoiesis; *Moringa oleifera*; Root extract

1. Introduction

Moringa oleifera is fast growing, drought resistant tree, native to sub-Himalayan tracts of Northern India, but now distributed worldwide in the tropics and sub-tropics. *Moringa* is well known to the ancient world but only recently has it been rediscovered as a multipurpose tree with tremendous variety of potential uses (Fuglie, 1999). *Moringa oleifera* is widely used traditionally for nutritional and medicinal purposes against various disease conditions in Nigeria (Ahmadu, 2009; Furo and Ambali, 2012). Different parts of *Moringa oleifera* contain a profile of important minerals and are a good source of protein, vitamins, β carotene, aminoacids and various phenolics (Ola-Fadunsin and Ademola, 2013).

It is estimated that 80% of the world's population living in developing countries still rely on plants for health care (Saxena, 2003). Since over 80% of the world's populations use plants as their primary source of medication (Farnsworth, 1976), and in view of the fact that antibiotics are sometimes associated with adverse side effects to the host including hypersensitivity, immunosuppressive and allergic reactions (Ahmed et al., 1998), it is important to develop alternative antimicrobial drugs that are plant (herbal) based for the treatment of infectious diseases (Clark, 1996; Cordell, 2000) and immune stimulatory drugs to increase erythropoiesis and prevent anaemia which is common with most infectious diseases.

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Anaemia is an absolute decrease in the red cell mass as measured by red blood cell (RBC) count, haemoglobin concentration (Hb) and packed cell volume (PCV). Anaemia can develop from loss, destruction or lack of production of RBC. Anaemia can also be classified as regenerative or non-regenerative (Weiss and Wardrop, 2010; Greer et al., 2018). In a regenerative anaemia, the bone marrow responds appropriately to the decreased red cell mass by increasing RBC production and releasing reticulocytes while in a non-regenerative anaemia, the bone marrow responds inadequately to the increased need for RBC. Anaemia due to hemorrhage or hemolysis is usually regenerative while anaemia that is caused by decreased erythropoietin or an abnormality in the bone marrow is non-regenerative (Weiss and Wardrop, 2010; Greer et al., 2018) as other causes of anaemia are nutritional, diseases and parasitic (Greer et al., 2018).

The aim of the scientific study of *Moringa oleifera* was to investigate its phyto-chemical constituents, determine the toxicity effects and its haemopoietic effect on chickens.

2. Materials and Methods

2.1. Extract preparation

Six hundred grams (600g) of fresh roots was collected from the Botanical garden of the Department of Agriculture, University of Maiduguri. The roots were washed, air dried and pulverized. Aqueous extraction was carried out in the Chemistry Department, University of Maiduguri. The crude extracts of the roots were subjected to sequential fractionation using chloroform, ethyl-acetate and n-butanol chemicals based on their order of polarity as described by Motohashi et al. (2004).

2.2. Birds and experimental design

Fifty black Hacco cockerels were procured and acclimatized for two weeks in well ventilated room, fed with vital standard chick mash, and water was given *adlibitum*. The chicks were divided in to five groups (A – E) each for sub-acute studies. Group A served as the control group, while groups B, C, D and E were orally administered with ethyl-acetate graded fractions of 100, 200, 300 and 400mg/kg doses of the root extract daily for 28 days while the control group was given normal saline.

2.3. Hematology

Five milliliters of blood were collected daily for haematological assay like red blood cell (RBC) counts, white blood cell counts (WBC), haemoglobin concentration (Hb), packed cell volume (PVC) and Platelets counts. Analysis of the collected blood samples were carried out as described by Drury and Wallington (1979) and Trease and Evans (1989, 1997). The blood samples collected were analyzed to ascertain the effects of the administered graded doses of ethyl acetate root extract with the control group with regards to the chicken's RBC, WBC, HB, PVC, and Platelets counts.

2.4. Statistical analysis

Results were entered in Microsoft office Excel version 2014. Data were analyzed using descriptive statistics that was conducted using means (Standard deviation) and presented in charts. Analysis of variance was used to test the variations between the means.

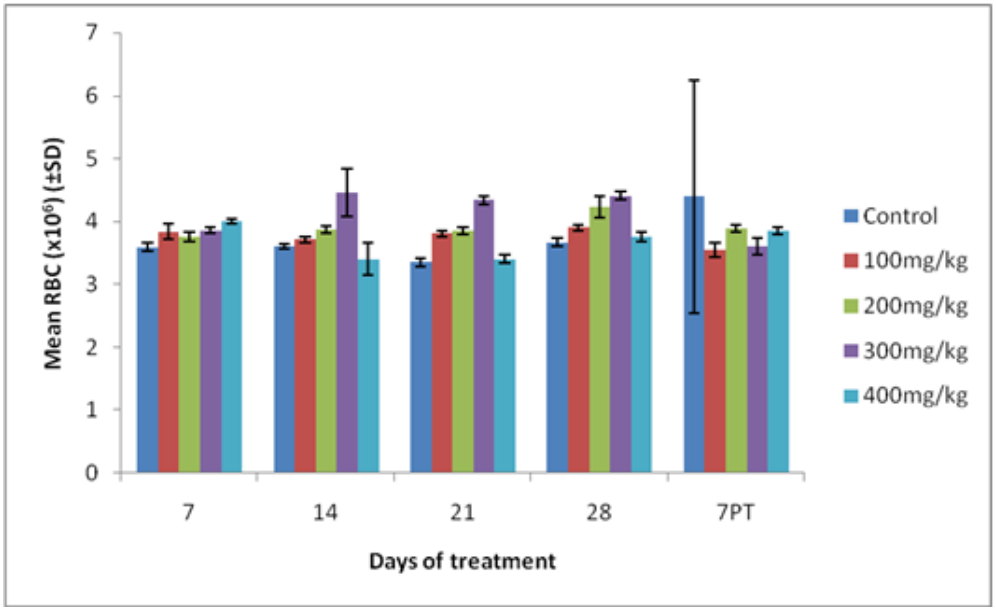

Figure 1: Effect of prolonged administration of varying doses of ethyl acetate soluble fraction of the aqueous extract of *Moringa oleifera* root on erythrocyte count in chickens.

Key: Pt = post treatment.

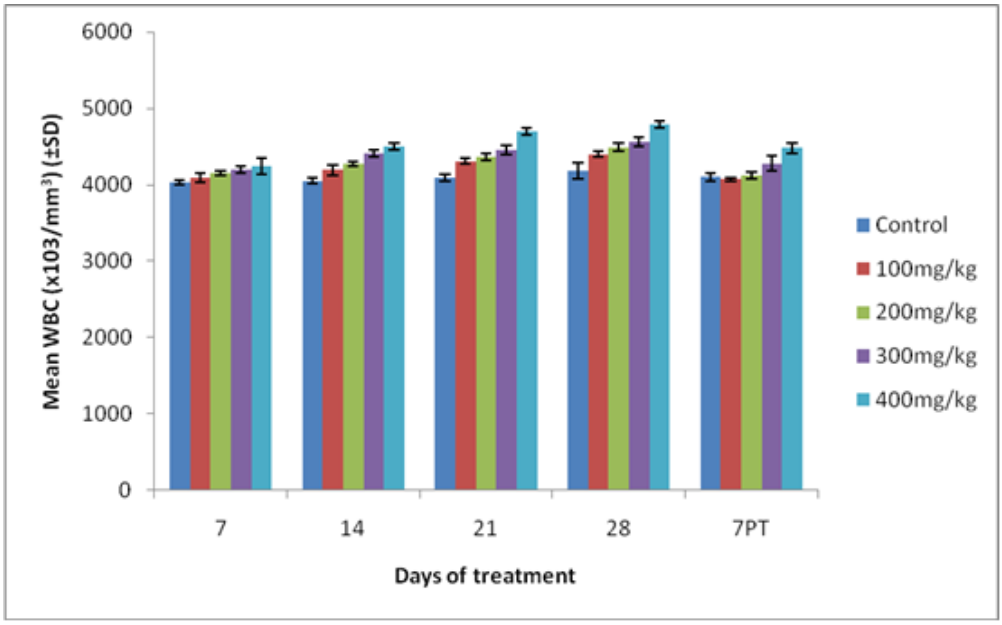

Figure 2: Effect of prolonged administration of varying doses of ethyl acetate soluble fraction of the aqueous extract of *Moringa oleifera* root on white blood cell (WBC) count in chickens.

Key: Pt = post treatment.

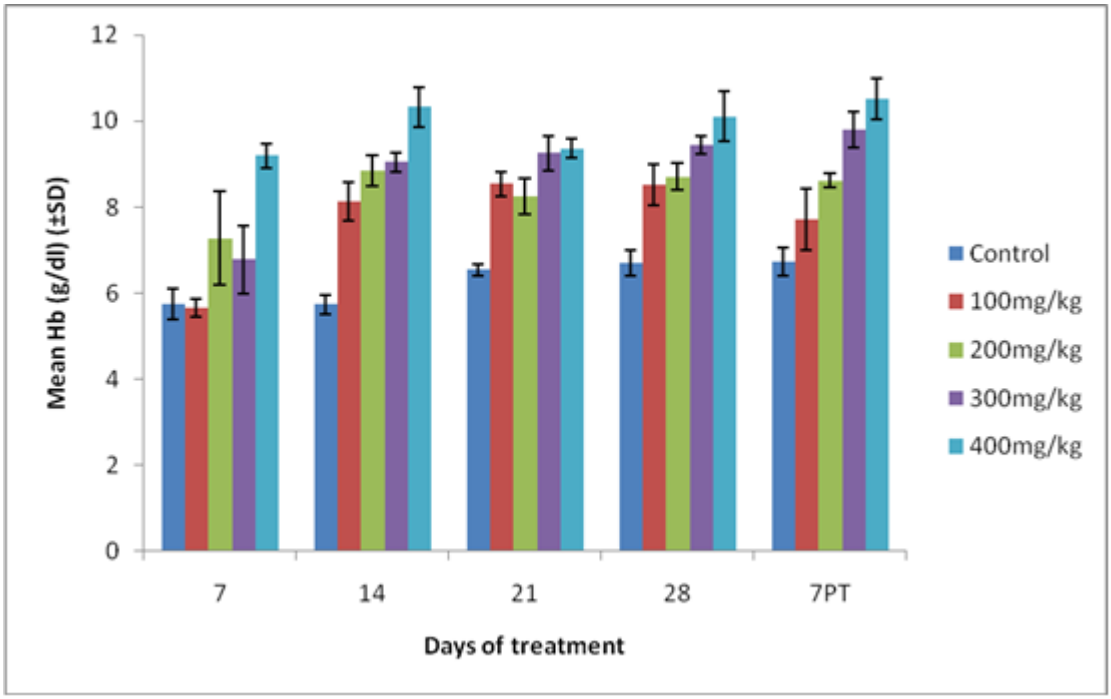

Figure 3: Effect of prolonged administration of varying doses of ethyl acetate soluble fraction of the aqueous extract of *Moringa oleifera* root on mean hemoglobin concentration (g/dl) in chickens.

Key: Pt = post treatment

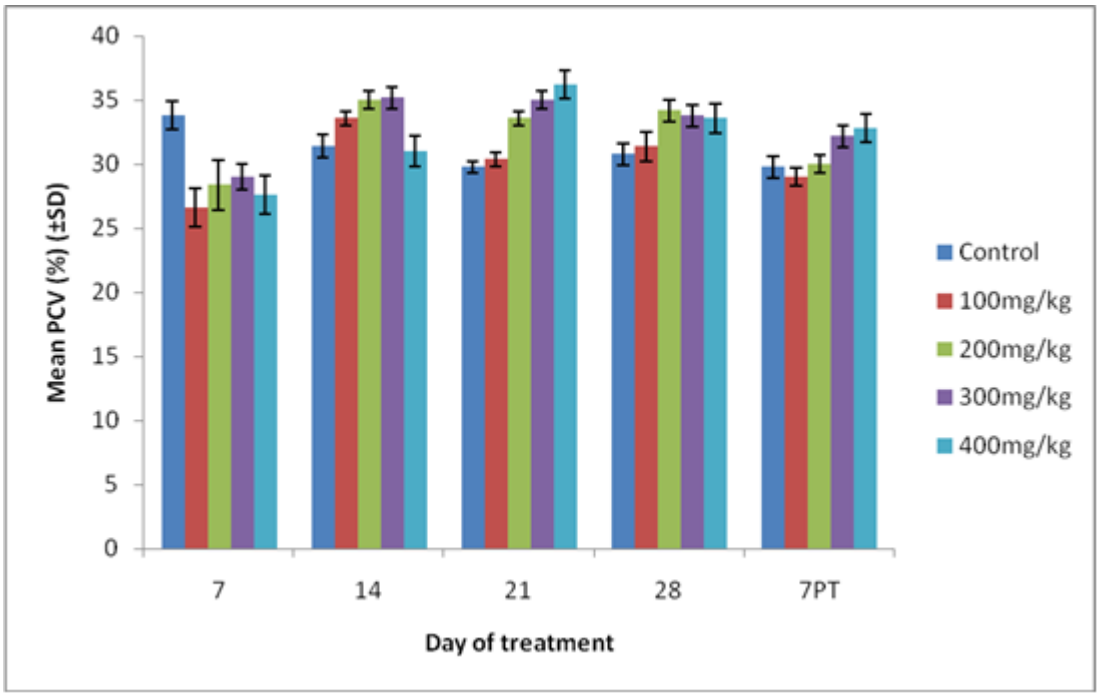

Figure 4: Effect of prolonged administration of varying doses of ethyl acetate soluble fraction of the aqueous extract of *Moringa oleifera* root on mean packed cell volume (%) in chickens.

Key: Pt= post treatment

3. Results

Our study showed that Moringa oleifera aqueous roots extract contains carbohydrates, saponins, cardiac glycosides, terpenes, steroids, flavonoids and alkaloids in different concentrations. In the sub-acute studies using ethyl-acetate fraction, the RBC of extract treated chickens increased during the first seven days of treatment. The percentage increase at day seven of treatment was 7.0%, 4.7%, 7.5% and 11.4% for groups treated with 100, 200, 300 and 400mg/kg respectively. From day fourteen of treatment, the RBCs continued to increase up to day 28. Observed percentage increase at day 28 were 6.3%, 15.2%, 20.2% and 20.5% in groups treated with 100, 200, 300 and 400mg/kg respectively (Figure 1).

White blood cell (WBC) increased significantly (P<0.001) from day 7 to 28. The percent increase at day 28 were 5.3%, 7.4%, 9.1% and 14.6% in groups treated with 100, 200, 300 and 400mg/kg of the extract respectively. After withdrawal of treatment, WBC values reduced and appear similar to those of the control group (Figure 2).

The mean hemoglobin concentration (Hb) increased from the control values of 5.66±0.22, 7.28±1.09, 6.78±0.79 and 9.20±0.28g/dl in groups treated with 100, 200, 300 and 400mg/kg to 8.52±0.48, 8.70±0.31, 9.44±0.22 and 10.10±0.58g/dl at 28 days of treatment (Figure 3).

The administration of *M. oleifera* ethyl acetate aqueous root extract decreased the PCV values of the treated chickens in the first 7 days of treatment; however, the PCV increased from day 14 to 28. The percent increase in PCV value at day 28 of treatment was 2.0%, 11.0%, 9.7% and 9.1% in groups treated with 100, 200, 300 and 400 mg/kg of the extract respectively (Figure 4). The PCV value of the control group was apparently not affected throughout the period of study.

4. Discussion

Natural substances of plant origin have been used and are being used throughout the world for human and animal health care. It is estimated that 80% of the world population living in developing countries still rely on plants for health care (Saxena, 2003). This is seen in the enormous potential uses of *M. oleifera* plant parts for nutritional and medicinal purposes by households and traditionally for the treatment of various ailments. The chemical compounds found in these various extracts of *M. oleifera* roots have medically important pharmacological properties. Cardiac glycosides are known to have therapeutic benefits as they exert physiological effects on the heart (Frantisek, 1991). Saponins have expectorant actions and may be useful in the management of inflammation of the upper respiratory tract. Saponins present in many plant parts are known to be cardiotonic in nature (Trease and Evans, 1989). Steroids are known to have stimulatory effect on bone marrow resulting in increased erythropoiesis (Shapiro and Greenfield, 1987). The erythropoietic activity observed in this study may be attributed to the presence of steroids in *Moringa oleifera* aqueous root extract.

The roots of *M. oleifera* contains carbohydrates, saponins, cardiac glycosides, terpenes, steroids, flavonoids and alkaloids that are pharmacologically active (Furo and Ambali, 2012). This appears to explains the application of the roots of *M. oleifera* as poultice and decoction traditionally. Flavonoids detected in *M. oleifera* roots could be said to substantiate the use of the products by traditional medicine healers who uses it to treat various disease conditions like edema, toothache, fever, common cold, diarrheoa and dental caries. The flavonoids act on bacteria by inhibiting its protein synthesis (Xu and Lee, 2001). The presence of alkaloids in *M. oleifera* aqueous root extract as an analgesic, anti-inflammatory and adaptogenic agent reported in previous study (Furo and Ambali, 2012) helps the host (man and animal) to develop resistance against disease and endurance against stress (Gupta, 1994). The use of extracts of herbs in place of the crude herbs has the benefit of improving quality and accurate dosage for better results. This will further revalidate the therapeutic benefits of herbs due to totality of constituents rather than one single molecule (Saxena, 2003).

Moringa oleifera stimulates erythropoiesis and boost cellular immune system, this could prevent anemia arising from erythropoietin related abnormalities, organs or nutritional deficiencies. This is supported by a study reported by (Furo and Ambali, 2011) that ethyl-acetate root extract of *M. oleifera* has a high safety margin through oral route and can stimulate erythropoiesis and immunostimulatory in chickens.

This study shows that *Moringa oleifera* aqueous roots extract has haemopoietic effect on chicken. We advise that *Moringa oleifera* should be used as feed additive in chickens since the plant has many beneficial properties, and it is readily available in the tropics.

Competing Interests

The authors have not declared any conflict of interests.

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