

Research Article

Phytochemical Screening and Effect of *Musa paradisiaca* Stem Extrude on Rat Haematological Parameters

^{1,2}Paul C. Onyenekwe, ²Omoaruemike E. Okereke and ¹Sikiru O. Owolewa

¹Department of Biochemistry and Molecular Biology, Nasarawa State University, PMB 1022, Keffi, Nigeria

²Biotechnology Advanced Laboratory, Sheda Science and Technology Complex, PMB 186, Garki Abuja, Nigeria

Abstract: This study was carried out to investigate the phytochemical composition and effect of various concentrations of *Musa paradisiaca* stem extrude on haematological parameters in Albino Wistar rats. Twenty rats (62-121 g) were randomly assigned into 5 groups of 4 rats each. Group 1 the control group, were given ordinary water while the test groups 2, 3, 4 and 5 were given 25, 50, 75 and 100% of the aqueous extract, respectively without water for 28 days. Rats were sacrificed and blood samples were collected by cardiac puncture then used for the haematological studies. Phytochemical tests were carried out using standard laboratory techniques. The results of the study show the presence of tannins and glycosides in abundance in the stem extrude while saponins, flavonoids, alkaloids, polyphenols and reducing sugars were present in moderate amounts but phlobatannins was absent. There was a significant ($p>0.05$) increase in rat RBC, PCV, Hb and WBC counts at concentrations of 75 and 100% when compared with the control and a significant ($p>0.05$) decrease in MCH and MCHC. The levels of MCV were not significantly altered at all extract concentrations. It can therefore be concluded that *Musa paradisiaca* stem extrude has a haematopoietic and immunomodulatory effect consistent with its ethnomedicinal use.

Keywords: Ethnomedicinal, haematological parameters, haematopoietic, immunomodulatory, *Musa paradisiaca*, phytochemical screening

INTRODUCTION

Musa paradisiaca (family-Musaceae), also known as plantain is a tropical plant that is native to India. It is extensively cultivated in the tropics and is a staple crop for over 70 million people of the sub-Saharan Africa. It is usually cultivated for its carbohydrate content and can be consumed as an unripe fruit or when ripe (Ahenkora *et al.*, 1997). Each stem normally produces a single, sterile, male banana flower, also known as the *banana heart*. The female flowers appear further up the stem and produce the actual fruit without fertilization. Bananas are one of the most popular fruits on the world market. It is well known that fruits like banana contain various antioxidants, such as vitamin C, vitamin E and β -carotene (Kanazawa and Sakakibara, 2000). Various parts of the plant such as the leaves, roots and flowers have been used for medicinal purposes. For example, the fruit is consumed as food. Again, the leaf juice is used in the treatment of fresh wounds, cuts and insect bites while the leaves act as an abortifacient. The sap of the plant is used as a remedy for diarrhoea, dysentery, hysteria and epilepsy. A cold infusion of the root is used to treat venereal diseases and anaemia. In

addition, the fruit has been reportedly used as antiscorbutic, aphrodisiac and diuretic (Salawu *et al.*, 2010). Along with other fruits and vegetables, consumption of bananas is associated with a reduced risk of colorectal cancer (Deneo-Pellegrini *et al.*, 1996), renal cell carcinoma (Rashidkhani *et al.*, 2005) and breast cancer in women (Zhang *et al.*, 2009). Banana stem extract from the Musaceae family had been suggested to be a useful agent in the treatment of patients with hyperoxaluric urolithiasis (Poonguzhali and Chegu, 1994), kidney stones and high blood pressure. Oral administration of chloroform extract of the *Musa sapientum* flowers had been found to cause a significant reduction in blood glucose and glycosylated haemoglobin; increase in total haemoglobin and prevents decrease in body weight (Pari and Uma-Maheswari, 1999). This study was designed to evaluate the effects of *Musa paradisiaca* Stem Extrude on haematological indices in rats.

MATERIALS AND METHODS

Experimental animals: Albino Wistar rats (weighing between 62-121 g) were used for this study. They were

Corresponding Author: Okereke Omoaruemike Ebele, Biotechnology Advanced Laboratory, Sheda Science and Technology Complex, PMB 186, Garki Abuja, Nigeria

This work is licensed under a Creative Commons Attribution 4.0 International License (URL: <http://creativecommons.org/licenses/by/4.0/>).

obtained from the animal house of National Veterinary Research Institute (NVRI) Vom, Jos and housed at room temperature for 14 days before the commencement of the experiment.

Experimental plant: Matured banana stem was obtained from Professor P.C Onyenekwe garden in Abuja, the capital city of Nigeria.

Preparation of plant extract: The banana stem was washed free of debris. It was sliced and mashed with mortar and pestle to press out the juice. One hundred mL of the pure extract was used to make 100% (v/v) while 75% (v/v) was made by measuring 75 mL of the extract and made up to 100 mL with distilled water in a volumetric flask, 50% (v/v) was made with 50 mL of the extract made up to 100 mL with water while 25% (v/v) was made with 25 mL of the extract made up to 100 mL with water in a volumetric flask.

Experimental protocol: Twenty albino Wistar rats were randomly assigned into 5 groups of 4 rats each. Group 1 the control group was given ordinary water while groups 2, 3, 4 and 5 were the test groups were given 25, 50, 75 and 100%, respectively of the aqueous extract respectively without water for 28 days (4 weeks). All the animals were fed on normal rat chow. The weight of the rats in each group was determined and documented weekly.

Collection of blood samples: Rats were sacrificed using chloroform anaesthesia. Blood samples were collected by cardiac puncture into EDTA capped bottles with the aid of a 2 mL syringe. The blood samples were then used for the experiments.

Phytochemical screening of the plant extract: The different phytochemical tests were carried out using standard laboratory techniques. Alkaloids, glycosides (Salkowski test) and Saponins (Frothing test) were identified with the method of Sofowora (1984). The method of Trease and Evans (1986) was adopted to test for the presence of anthraquinones, phlobatannins, flavonoids and tannins.

Determination of haematological parameters: Red Blood Cell (RBC), Packed Cell Volume (PCV), White Blood Cell (WBC), Haemoglobin (Hb), Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH) and Mean Corpuscular Haemoglobin Concentration (MCHC) were estimated using an automated Haematological Analyzer, SYSMEX-KX21 (SYSMEX Corporation, Japan).

RESULTS AND DISCUSSION

The result of phytochemical screening of water-stem extract of *Musa paradisiaca* is shown in Table 1.

Table 1: Photochemical Screening of *Musa paradisiaca* water-stem extrude

| Chemical constituent | Score indication |
|----------------------|------------------|
| Alkaloids | + |
| Glycosides | ++ |
| Saponins | + |
| Tannins | ++ |
| Flavonoids | + |
| Polyphenols | + |
| Phlobatannins | - |
| Reducing sugars | + |

++: Present in abundance; +: Present; -: Absent

The results show that the stem extrudes of *Musa paradisiaca* contains tannins and glycosides in abundance. Alkaloids, saponins, flavonoids, polyphenols and reducing sugars were present in moderate quantities while phlobatannins were absent. Phytochemicals are known to occur in various parts of plants with diverse functions which include provision of strength to plants, attraction of insects for pollination and feeding, defence against predators, provision of colour, while some are simply waste products (Ibegbulem *et al.*, 2003). When ingested by animals these secondary metabolites exhibit varied biochemical and pharmacological actions (Amadi *et al.*, 2006). The presence of tannins in diets for livestock have been reported to have anti-nutritional and toxic effects including reduced feed intake, growth, feed efficiency and net metabolizable energy (Acamovic and Brooker, 2005). However, the results in this research showed that tannins did not impair the growth performance of the albino Wistar rats (Table 2). A general increase in physical activities, food and water intake were observed for all the animals during the feeding experiment. The increased weight could be due to increased feed intake observed all through the experimental period which suggests that the rats accumulated calories from the normal rat diet.

Tannins in plants have been shown to confer anti-diarrhoeic and anti-haemorrhagic properties on plants (Asquith and Butler, 1986). This is consistent with the traditional use of the sap of *Musa paradisiaca* for the treatment of diarrhoea, fresh wounds, cuts and insect bites. Saponins have been reported to have antifungal properties (Osugwu *et al.*, 2007) as well as serve as an expectorant and emulsifying agent (Edeoga *et al.*, 2003). Alkaloids, flavonoids and tannins have been known to show medicinal activity as well as exhibiting physiological activity (Sofowora, 1993). Flavonoids are known to have antioxidant effects and have been shown to inhibit the initiation, promotion and progression of tumors (Kim *et al.*, 1994). The presence of these phytochemicals in the sap of *Musa paradisiaca* confers medicinal properties on the plant and this explains the use of this plant for treatment of different ailments. The findings of this study is consistent with reports of the presence of these phytochemicals in various parts of the *Musa paradisiaca* plant as documented by Akpuaka

Table 2: The mean body weight of rats administered aqueous stem extract of *Musa paradisiaca*

| Week | Group 1 (control) | Group 2 (25%) | Group 3 (50%) | Group 4 (75%) | Group 5 (100%) |
|------|-------------------|---------------|---------------|---------------|----------------|
| 1 | 89.500±0.79 | 87.250±1.16 | 89.500±0.79 | 80.500±1.38 | 84.000±2.15 |
| 2 | 103.25±2.59 | 101.50±0.94 | 112.50±0.82 | 103.75±2.21 | 105.75±0.84 |
| 3 | 112.00±0.68 | 104.25±0.71 | 114.50±0.47 | 106.50±0.73 | 112.00±0.68 |
| 4 | 118.25±1.17 | 107.00±1.17 | 119.00±2.18 | 121.25±0.51 | 115.50±0.86 |

Values are mean±standard deviation of quadruplicates

Table 3: Haematological parameters in the different experimental groups of rats

| Parameters | Group 1 (control) | Group 2 (25%) | Group 3 (50%) | Group 4 (75%) | Group 5 (100%) |
|--|--------------------------|--------------------------|-------------------------|--------------------------|--------------------------|
| RBC (X10 ⁶ /mm ³) | 1.270±0.44 ^a | 1.600±0.78 ^a | 3.510±0.92 ^b | 7.550±2.22 ^b | 8.580±3.87 ^b |
| WBC (X10 ³ /mm ³) | 0.820±0.71 ^a | 0.250±0.11 ^a | 0.700±0.50 ^a | 7.600±0.82 ^b | 12.73±5.79 ^b |
| PCV (%) | 4.750±1.11 ^a | 6.030±2.31 ^a | 12.17±5.09 ^b | 31.86±5.53 ^b | 37.14±5.39 ^b |
| Hb (g/dL) | 4.900±0.60 ^a | 5.000±2.09 ^a | 14.70±2.38 ^b | 23.40±1.07 ^b | 24.60±1.43 ^b |
| MCV (fL) | 37.40±7.80 ^a | 37.69±7.04 ^a | 40.37±5.00 ^a | 42.20±3.19 ^a | 43.38±8.35 ^a |
| MCH (pg) | 38.58±1.01 ^a | 31.25±6.29 ^b | 31.88±4.97 ^b | 30.99±8.06 ^a | 28.67±5.26 ^b |
| MCHC (%) | 103.16±6.94 ^a | 82.92±21.76 ^a | 79.74±5.21 ^b | 73.45±15.85 ^b | 66.24±20.56 ^b |

^{a, b}: Values on the same row followed by different letters differ significantly (p<0.05); RBC: Red blood cell; WBC: White blood cell; PCV: Packed cell volume; Hb: Haemoglobin; MCV: Mean corpuscular volume; MCH: Mean corpuscular haemoglobin; MCHC: Mean corpuscular haemoglobin concentration

and Ezem (2011) and Akpabio *et al.* (2012). The assessment of haematological parameters could be used to reveal the deleterious effect of foreign compounds including plant extracts on the blood constituents of animals. They can also be used to determine possible alterations in the levels of biomolecules, metabolic products, haematology, normal functioning and histomorphology of the organs (Magalhaes *et al.*, 2008). Following the administration of the extract, there is a significant (p>0.05) increase in the level of RBC, PCV and Hb and a significant decrease in the levels of MCH and MCHC at extract concentrations of 50-100% while there is no significant change in the level of MCV at all concentrations of the extract when compared with the control as shown in Table 3.

This gives an indication that the plant extract contains phytochemicals that stimulate the formation or secretion of erythropoietin in the stem cells of the animals. Erythropoietin is a glycoprotein hormone which stimulates stem cells in the bone marrow to produce red blood cells (Ohlsson and Aher, 2009). A similar trend was observed when garlic (*Allium sativum*) extract was administered to rats as reported by Iranloye (2002). Since MCHC, MCH and MCV relate to individual red blood cells while Hb, RBC and PCV relate to the total population of red blood cells in the blood (Adebayo *et al.*, 2005), it could thus imply that though the extract may stimulate the production of red blood cells and haemoglobin, it could have an inhibitory effect on haemoglobin incorporation into red blood cells and a consequent reduction in oxygen exchange. WBC levels increased significantly at extract concentrations of 75 and 100% which shows that the extract of *Musa paradisiaca* has an immune boosting property similar to that reported for garlic (*Allium sativum*) by Iranloye (2002) and seed extract of *Citrus paradisi* Macfad (Adeneye, 2008). It has been reported in literature (Guyton and Hall, 2000; Ganong, 2001) that granulocyte-macrophage colony stimulating factor, macrophage colony stimulating factor, interleukins IL-

2, IL-4 and IL-5 regulate the proliferation, differentiation and maturation of committed stem cells responsible for the production of white blood cells. Since the extract of *Musa paradisiaca* increases WBC concentration, it may be that some components of the extract stimulated the production of these regulatory factors or increased the sensitivity of the committed stem cells (responsible for the production of white blood cells) to these factors.

CONCLUSION

It can be concluded from this study that the stem extrude of *Musa paradisiaca* contains phytochemicals which confer medicinal properties on the plant and could be responsible for its haematopoietic and immunomodulatory property.

REFERENCES

- Acamovic, T. and J.D. Brooker, 2005. Biochemistry of plant secondary metabolites and their effects in animals. *Proc. Nut. Soc.*, 4: 403-412.
- Adebayo, J.O., A.A. Adesokan, L.A. Olatunji, D.O. Burro and A.O. Soladoye, 2005. Effect of Ethanolic extract of *Bougainvillea spectabilis* leaves on haematological and serum lipid variables in rats. *Biochemistry*, 17: 45.
- Adeneye, A.A., 2008. Hematopoietic effect of methanol seed extract of *Citrus paradise* Mac fad (grape fruit) in Westar rats. *Biomed. Res.*, 19(1): 23-26.
- Ahenkora, K.M., A. Kye, K. Marfo and B. Banful, 1997. Nutritional composition of false horn Aponte pa plantain during ripening and processing. *Afr. Crop Sci. J.*, 5(2): 243-248.
- Akpabio, U.D., D.S. Udiong and A.E. Akpakpan, 2012. The Physicochemical characteristics of plantain (*Musa paradisiacal*) and banana (*Musa sapientum*) pseudo stem wastes. *Adv. Nat. Appl. Sci.*, 6(2): 167-172.

- Akpuaka, M.U. and S.N. Ezem, 2011. Preliminary photochemical screening of some Nigerian dermatological plants. *J. Basic Phys. Res.*, 2(1): 1-5.
- Amadi, B.A., C.O. Ibegbulem and A.C. Egbebu, 2006. Assessment of the effect of aqueous extract of *Asimina triloba* root on organ weights and liver function of albino rats. *Int. J. Nat. Appl. Sci.*, 2: 79-81.
- Asquith, T.N. and L.G. Butler, 1986. Interaction of condensed Tannins with selected proteins. *Photochemistry*, 25(7): 1591-1593.
- Deneo-Pellegrini, H., E. De Stefani, A. Ronco, M. Mendilaharsu and J.C. Carzoglio, 1996. Meat consumption and risk of cancer: A case control study from Uruguay. *Lung Cancer*, 14(2-3): 195-205.
- Edeoga, H.O., D.E. Okwu and B.O. Mbaebie, 2003. Mineral and nutritive value of some Nigerian medicinal plants. *J. Medi. Aroma. Plant Sci.*, 25: 689-694.
- Ganong, W.F., 2001. Review of Medical Physiology. 20th Edn., Lange Medical Books, McGraw Hill Companies Inc., New York, pp: 500-515.
- Guyton, A.C. and J.E. Hall, 2000. A Textbook of Medical Physiology. 10th Edn., W.B. Saunders Co., Philadelphia, pp: 382-401.
- Ibegbulem, C.O., E.O. Ayalogu and M.N. Uzoho, 2003. Photochemical, ant nutritional contents and hepatotoxicity of Zobo (*Hibiscus sabdariffa*) drink. *J. Agric. Food Sci.*, 1(1): 35-39.
- Iranloye, B.O., 2002. Effect of chronic garlic feeding on some haematological parameters. *Afr. J. Biomed. Res.*, 2002: 81-82.
- Kanazawa, K. and H. Sakakibara, 2000. High content of dopamine, a strong antioxidant, in Cavendish banana. *J. Agric. Food Chem.*, 48(3): 844-848.
- Kim, S.Y., J.H. Kim, S.K. Kim, M.J. Ohandy, M.Y. and Jung, 1994. Antioxidant activities of selected oriental herb extracts. *J. Am. Oil Chem. Soc.*, 71: 633-640.
- Magalhaes, P., H. Appell and J. Duarte, 2008. Involvement of advanced glycation end products in the pathogenesis of diabetes complication: The protective role of regular physical activity. *Eur. Rev. Aging Phys. Act.*, 5(1): 17-29.
- Ohlsson, A. and S.M. Aher, 2009. Early erythropoietin for preventing red blood cell transfusion in preterm and/or low birth weight infants. *J. Diet Suppl.*, 6(3): 227-251.
- Osuagwu, G.G.E., I.C. Okwulehie and J.O. Emenike, 2007. Photochemical and Mineral content of the leaves of four Nigerian *Pterocarpus* species. *Int. J. Mol. Med. Adv. Sci.*, 3(1): 6-11.
- Pari, L. and J. Uma-Maheswari, 1999. Hypoglycaemic effects of *Musa sapientum* L. in alloxan-induced diabetic rats. *J. Ethnopharmacol*, 68: 321-325.
- Poonguzhali, P.K. and H. Cheju, 1994. The influence of banana stems extract on urinary risk factors for stones in normal and hyperoxaluric rats. *Br. J. Urol.*, 74(1): 23-25.
- Rashidkhani, B., P. Lindblad and A. Wok, 2005. Fruits, vegetables and risk of renal cell carcinoma: A prospective study of Swedish women. *Int. J. Cancer*, 113(3): 451-455.
- Salawu, L., R.A. Bolarinwa, A.B. Adegunloye and H.A. Moraine, 2010. HBs Ag, anti-HCV, anti-HIV and VDRL in blood donors: Prevalence and trends in the last three and a half years in a tertiary health care facility in Ile-Ife, Nigeria. *Int. J. Med. Sci.*, 2(11): 335-341.
- Sofowora, A., 1984. Medicinal Plants and Traditional Medicine in Africa. Spectrum Books Ltd., Ibadan, John Wiley and Sons, NY, pp: 142-143.
- Sofowora, A., 1993. Medicinal Plants and Traditional Medicine in Africa. Spectrum Books Ltd., Ibadan, Nigeria, pp: 191-289.
- Trease, G.E. and W.C. Evans, 1986. Textbook of Pharmacognosy. 12th Edn., Bailliere Tindal, London, pp: 343-383.
- Zhang, L.Y., B. Gong, J.P. Tong, D.S. Fan, S.W. Chiang, D. Lou, D.S. Lam, G.H. Yam and C.P. Pang, 2009. A novel gamma D-crystalline mutation causes mild changes in protein properties but leads to congenital coralliform cataract. *Mol. Vis.*, 15: 1521-1529.