Research Journal of Chemical Sciences _____ ISSN 2231-606X
Vol. **4(3),** 1-4, March **(2014)** *Res. J. Chem. Sci.*

Effect of Ripe Plantain (*Musa paradisiaca*) Peel based Diet on some Enzymes of the Liver, Heart and Kidney of Albino Rats

Idoko A.S.[1] and Oladiji A.T.[2]
[1]Department of Biochemistry, Federal University Dutsinma, Katsina state, NIGERIA
[2]Department of Biochemistry, University of Ilorin, Ilorin, NIGERIA

Available online at: www.isca.in, www.isca.me
Received 24th December 2013, revised 25th February 2014, accepted 16th March 2014

Abstract

To study the liver, heart and kidney functions of rats fed ripe plantain peel supplemented diet, the activities of alkaline phosphatase (ALP), alanine aminotransaminase (ALT), aspartate aminotransaminase (AST), gamma glutamyl transferase (GGT) were determined. In this study, twelve (12) weanling albino rats, of 28 days old with mean weights of 37-38g were randomly assigned into two (2) dietary treatment groups of 6 animals each which were equalized for body weight. One diet (the control) had 0% inclusion level of plantain peel while the other diet (the test diet) had 50% inclusion level of plantain peel. On the forty- second day from the commencement of the experiment, the animals were sacrificed, and the serum and organs taken from them were subjected to enzyme assay. Compared to the control, the result obtained showed that there was no significant ($p<0.05$) difference in the levels of these enzymes in the serum and studied tissues of rats fed ripe plantain peel as animal feed supplement. Consequent upon that, we assert that the use of ripe plantain peel as animal feed supplement is safe and should be promoted to make the cost of animal production cheaper.

Keywords: Animal feed, liver, heart and kidney functions, plantain peel, supplement.

Introduction

Plantain is undoubtedly one of the oldest cultivated fruits in west and central Africa. In Nigeria, plantain production is becoming a significant economic activity for income generation for both large scale and small holder farmers, especially for those who produce them within their home compounds or gardens[1]. Known as ogede agbagba, ayaba and Ogadejioke in Yoruba, Hausa and Igbo languages respectively, plantain is a crop in the genus *Musa*, and all the members of the genus *Musa* are indigenous to the tropical regions of Southeast Asia and Oceania, including the Indonesia, Malaysia, Brunei and the Philippines and Northern Australia[2]. It is a tall, robust herb, and the plant portion above the ground is a false stem (pseudostem) consisting of concentrically formed leaves, from the centre of which develops the inflorescence stalk. The rhizome or true stem is underground. Near the tip of the flower stalk are several groups of sterile male flowers subtended by brilliant purple bracts. The lower female flower clusters on the same stalk and give rise to the fruit. The single fruits are called fingers; a single group of 8-12 fingers is termed a hand[3]. Plantain and banana are major sources of food in many regions throughout the world. Total world production of these crops is estimated to be over 76 million metric tons, out of which an estimated 12 million metric tons are produced in Africa annually. Most of these are consumed or traded locally[4].

The whole plant as well as specific parts (Flowers, banana bracts, ripe, unripe fruits, leaves and stems) of plant extract and its active constituents have been used for the treatment of large number of human ailments. Traditionally the plant has been used for different purposes such as abscess, alopecia (female), burns, cancer, cataplasm, diabetes, diarrhea, dog bites, snake bite, dysentery, dyspepsia, fracture, gangrene, hematuria, emiplegia, hemoptysis, hemorrhage, hypertension, lizard bites, marasmus, migrain, ringworm, shingles, smallpox, syphilis, tuberculosis, tumor, uremia, otalgia, psoriasis, urticaria, warts and wounds[5]. Similarly, the pulp has antiulcer, wound healing, hair growth promoting, analgesic, antioxidant property and hepatoprotective activities[6].

Despite these medicinal importances of plantain, it is usually cultivated for food. Cultivated for its carbohydrate content, plantain fruit can be consumed as an unripe or ripe fruit[7]. The peels of the fleshy pulps are usually thrown away. The current farming practice is usually to burn these wastes or leave them to decompose. It is believed that if plantain peel could serve as a supplement in animal feed, it will go a long way in bringing the cost of livestock production to affordable level owing to the large quantities of plantain peels available in the regions where they are produced. However, before the use of the peels in the formulation of animal feeds, the possible effects of its ingestion ought to be investigated. The peels have been reported to have the potentials of replacing maize (corn starch) in the diet of snail[8], and the use of the peels as source of protein fraction in rats has been shown to support growth and proper organ development, and to have no deleterious effect on blood integrity of rat[9]. However, information on the effect of the peels on some enzymes of the liver and kidney of albino rats was scarcely available. The use of activities of enzymes such as alkaline phosphatase (ALP), glutamate oxaloacetate

transaminase (GOT), glutamate pyruvate transaminase (GPT) and gamma glutamyl transferase (GGT) in the diagnosis of diseases is well documented. The activities of these enzymes could give indications of progressive toxicity long before the actual manifestation of the toxic effects[10]. This research was conducted to ascertain the effect of the use of ripe plantain peel as a supplement in the diet on the enzymes of some vital organs of albino rats.

Material and Methods

Plantain Peel Preparation: Ripe peel of M. paradisiaca fruits were obtained from within Ilorin metropolis, Ilorin, Nigeria and screened to remove bad ones. The peels were washed with tap water to remove any dirt and were then cut into pieces and oven dried at 60^{o}C for 72 h to constant weight. The pieces were then pulverized using an electric blender and thereafter stored in polythene bag.

Chemicals and reagents: All the chemicals and reagents used in this study were of analytical grade and were kept under ideal laboratory condition.

Feed Formulation: The pulverized peels were mixed with other ingredients to formulate two experimental diets to replace casein at 0% and 50% inclusion levels detailed thus: i. Diet A (control): Diet based on 0% inclusion level of ripe plantain peel, ii. Diet B: (test): Diet based on 50% inclusion level of ripe plantain peel.

Table-1
Components of the formulated diets

	A(g/kg)	B(g/kg)
Corn starch	520	365
Casein	250	125
Plantain peel	-	280
Soybean oil	40	40
Rice bran	40	40
sucrose	100	100
Vit/min mix	50	50

Mineral mix (g/kg): $CoCl_2.6H_2O$ (0.001), $CuSO_4.5\ H_2O$ (0.07), $MgSO_4.2\ H_2O$ (0.178), Fe $SO_4.7\ H_2O$ (1.075), KI (0.033), KH_2PO_4 (15.559), Ca SO_4 (15.24), NaCl (5.573), $ZnCO_3$ (1.6), Mg $SO_4.7\ H_2O$ (2.292). Vitamin mix (g/kg): 6mg Thiamine hydrochloride; 7mg pyridoxine hydrochloride; 30mg nicotine acid,16mg pantothenate, 2mg folic acid, 0.2mg biotin, 0.01mg cynocobalamin, 4000 IU retinol palmitate, 100IU cholecalciferol, 50IU α- tocopherol acetate, 0.05mg menadine, 2gm choline chloride.

Management of Experimental Animals: Twelve (12) weanling albino rats, about 28 days old with mean weights of 37-38g were obtained from the small animal holding unit of the Department of Biochemistry, University of Ilorin. The rats were randomly assigned into two (2) dietary treatment groups of 6 animals each which were equalized for body weight. The rats in each group were housed together in standard plastic laboratory cages with stainless steel covers and were offered their respective experimental diets and water *ad libitum* after 24h fasting period. The rats in each group had unrestricted access to their respective diets and the experiment lasted six (6) weeks.

Collection and Treatment of Blood Samples: After 42 days, the animals were sacrificed by anaesthetizing them in a jar containing cotton wool soaked in diethylether and blood samples were collected from the rats through their jugular veins and put into plain sample bottles. The blood in the plain sample bottles was allowed to clot for 3 hours. The clotted blood samples were spun in a bench top centrifuge to obtain sera. The serum samples were thereafter separated into another set of plain sample tubes and stored in the refrigerator pending enzyme assay.

Preparation of Tissue Homogenate: The liver, heart and kidney of the animals were removed into a beaker containing ice cold 0.25 M sucrose solution. A portion of each of the isolated tissues was cut out, chopped into very small pieces and then homogenized using pre-cooled pestle and mortar in a bowl of ice cubes. The tissue homogenates were diluted using 0.25 M sucrose solution to the tune of 1 in 6 dilutions. The diluted homogenates were then stored at temperature of -8 ^{0}C until required for use.

Assays: ALT and AST activities were determined using the method described by Reitman and Frankel[11]. GGT activity was determined according to the methods of Szaz[12]. The method of Wright *et al.*[13] was used for evaluating the ALP activity.

Results and Discussion

The results of the proximate analysis of the formulated diets as presented in table 2 shows variation only in the ash content. Diet based on 50% inclusion level of ripe plantain peel had significantly ($p<0.05$) higher ash content than Diet based on 0% inclusion level of ripe plantain peel. The enzyme activities shown in tables 3, 4, 5 and 6 indicate that the levels of all the four enzymes – alkaline phosphatase (ALP), alanine aminotransaminase (ALT), aspartate aminotransaminase (AST), gamma glutamyl transferase (GGT) in the serum and studied tissues of rats fed Diet based on 50% inclusion level of ripe plantain peel did not differ significantly ($p<0.05$) from the levels obtained from the rats fed Diet based on 0% inclusion level of ripe plantain peel (control). For table 2, 3, 4, 5 and 6, results are means of 3 determinations ± S. E.M., Values along the same row with the same superscript are NOT significantly different ($P>0.05$), and are significantly different if the superscripts are different.

Table-2
Proximate Analysis of the Formulated Feed

Nutrient	A	B
Protein (%)	26.40±0.058[a]	24.90±0.058 [a]
Lipid (%)	4.20±0.058 [a]	5.30±0.058 [a]
Ash (%)	6.98±0.19 [a]	9.33±0.33[b]
Fibre (%)	2.36±0.30 [a]	3.25±0.006 [a]
Carbohydrate (%)	59.87±0.50 [a]	57.10±0.28 [a]

Table-3
Activity of ALP in Selected Tissues of Control and Test Rats

Tissue	Control (IU)	Test (IU)
Serum	631.67 ± 76.41 [a]	615.00± 63.84 [a]
Liver	5736.67 ± 308.42 [a]	5443.33± 351.77 [a]
Heart	5946.67 ± 253.92 [a]	5690.33± 276.07 [a]
Kidney	6514.67±114.17 [a]	6496.67±171.30 [a]

Table-4
Activity of AST in Selected Tissues of Control and Test Rats

Tissue	Control (IU)	Test (IU)
Serum	145.67 ± 12.73 [a]	151 ± 21.73 [a]
Liver	1326.67 ± 37.56 [a]	1323.33 ± 24.03 [a]
Heart	1506.67 ± 52.39 [a]	1490 ± 100.17 [a]
Kidney	816 ± 33.01 [a]	823.33 ± 20.28 [a]

Table-5
Activity of ALT in Selected Tissues of Control and Test Rats

Tissue	Control (IU)	Test (IU)
Serum	65.00±3.06 [a]	67.33±3.84 [a]
Liver	1100.67±61.53 [a]	1105.00±69.46 [a]
Heart	495.00±24.66 [a]	470.00±17.32 [a]
Kidney	550.00±26.46 [a]	543.33±17.64 [a]

Table-6
Activity of GGT in Liver and Serum of Control and Test Rats

Tissue	Control (IU)	Test (IU)
Serum	274.33±16.33 [a]	284.00±48.60 [a]
Liver	2227.33±36.37 [a]	2239.33±87.71 [a]

Discussion: The significantly higher ash content observed in diet B could be due to the relatively high content of minerals in the ripe plantain peel. Other ingredients were, however, comparable with the ingredients in the control diet. The observed non-significant difference between the rats fed diet B and the rats fed control diet in the levels of these enzymes could simply mean that the use of plantain peel as animal feed supplement does not cause obvious damage to the tissues studied (liver, heart and kidney). Aminotransferases (GOT and GPT) occupy a central position in the metabolism of amino acids as they help in retaining amino groups (to form new ones) during degradation of amino acids. They are also involved in the biochemical regulation of amino acid pool and in providing necessary intermediate for gluconeogenesis. GOT and GPT are useful biomarkers to predict possible toxicity in some organs such as liver cytolysis[14]. The membranes of liver cells can become permeable when damaged, allowing for escape of GOT and ALT into the bloodstream[15]. AST and ALP are not specific to the liver only but are also located in organs like heart, brain, kidney and skeletal muscle. Generally, increase in membrane permeability of the hepatocytes and cardiac cells will result in elevations of these transaminases in the serum[16] and decrease in the tissues. ALT is more liver specific enzyme for diagnostic use[17]. Gamma -glutamyl transferase (GGT) is expressed primarily in the liver, kidneys and other organs. Organ damage, especially damage to the liver, causes the release of this enzyme into the blood. Elevation of GGT levels is an indication of liver damage and has been associated with liver injury as well as pancreatic and myocardial disorders[18]. The finding is consistent with earlier report which showed that the use of the peels has no deleterious effect on the blood integrity of rats[9].

Conclusion

Having carried out a research into the effect of ripe plantain (*Musa paradisiaca*) peel based diet on some enzymes of the liver, heart and kidney of albino rats, we assert that the use of ripe plantain peel as animal feed supplement has no deleterious effects on the studied organs, may be safe and could make the cost of animal production cheaper.

References

1. Fakayode B.S., Rahji M.A.Y. Ayinde O. and Nnom G.O., An economic assessment of plantain production in Rivers State, Nigeria, *International Journal of Agricultural Economics & Rural Development,* **4(2) (2011)**

2. Randy C., Ploetz A., Jeff D. and Scot C.N., Banana and plantain – an overview with emphasis on the Pacific island cultivars, *Species Profiles for Pacific Island Agroforestry* (Traditional Tree nitiative), **(2007)**

3. Daniel N.L., Mc Graw-Hill Encyclopedia of food Agriculture and Nutrition, 125 **(1977)**

4. International Network for Improvement of Banana and Plantain (INIBAP), Networking Banana and Plantain, Montpellier, France, 24 **(2003)**

5. Alexandra P., Monica G., Ronald E.W. and Beatriz M.M., *Food chemistry,* **73(3)**, 327 **(2001)**

6. Sanjeev K., Chanchal K.M., Anil A., Asha R. and Nema R.K., Phytoconstituents and Pharmacological activities of Musa paradisiaca Linn, *Asian Journal of Biochemical and Pharmaceutical Research,* **4(2) (2012)**

7. Ahenkora K.M., Kye A., Marfo K. and Banful B., Nutritional composition of false horn Aponte pa plantain during ripening and processing, *Afr. Crop Sci. J*., **5(2),** 243-248 **(1997)**

8. Omole A.J., Ajasin F.O., Oluokun J.A. and Obi O.O., Performance characteristics of weaned rabbit fed plantain

peel as replacement for maize, *J. Nutr. Food*., **38,** 559-563 **(2008)**

9. Idoko A.S., Oladiji A.T. and Aska A., Growth and Hematological Parameters of Rats Fed Diets with or without Ripe Plantain Peel (*Musa paradisiaca*), *Journal of Environment, Technology & Sustainable Agriculture,* **2(1),** 82-86 **(2011)**

10. Hanley K.S., Schmidt E. and Schmidt F.M., Enzymes in Serum, their volume in diagnosis, 70-81, Charles Thomas, Springfield Illinois **(1986)**

11. Rietman S. and Frankel S., A Colorimetric Method for the Determination of Serum GOT and GPT, *Am. J. Clin. Pathol.,* **28,** 56-63 **(1957)**

12. Szaz G., A kinetic photometric method for serum Gamma glutamyl transpeptidase, *Clin. Chem*., **15,** 124-136 **(1976)**

13. Wright P.J., Healthwood P.D. and Pummer D.T., Enzyme in Rat.Urine: Alkaline Phosphate **(1972)**

14. Oladiji A.T., Abodunrin T.P. and Yakubu M.T., Toxicological evaluation of Tetracarpidium conophorum nut oil-based diet in rats, *Food and Chemical Toxicology,* **48,** 898–902 **(2010)**

15. Green R.M. and Flamm S., AGA Technical review on the evaluation of liver chemistry tests, *Gastroent*, **123**, 1367-1384 **(2002)**

16. Holnadel D.C., In: Kaplan, L.A., Pesce, A.J. (Eds.), Clinical Chemistry, Theory, Analysis and Correlations, Mosby, Princeton **(1989)**

17. Moss D.W. and Henderson A.R.. Enzymes, In: Tietz, N.W., (Ed.), Tietz Fundamental of Clinical Chemisty, 4th Edn, W.B Sounders Company Philadalphia, 283-335 **(1996)**

18. Dlab Biotechnology, Enzyme Immunoassay for the determination of the γ-glutamyl transferase enzyme in serum samples, Retrieved Sept 19 **(2012)**