International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 5 Issue 6, September-October 2021 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

Medicinal Effects of Solanum Aethiopicum Leaf Ethanolic Extracts on Renal and Hepatic Function of Wistar Rats

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ABSTRACT

The effect of Solanum aethiopicum leaf extracts on, hepatic and renal function was studied. Twenty-five wistar albino rats were divided into five groups of five rats each. Apart from the control group, the experimental groups were given compounded feed of ground Solanum aethiopicum leaf and normal (pelletized) rats feed. Results obtained for hepatic and renal function revealed significance effect ($p<0.05$) on some of the parameters investigated in test rats against those of the control. This study has shown the effect of Solanum aethiopicum leaf extract on hepatic and renal function.

KEYWORDS: *Leaf, "Nkpuruofe, Afufa", Renal Function, Solanum aethiopicum*

How to cite this paper: Eze, H. C | Okoli Ik | Ajogwu Tobechukwu Maximilian | Okafor, Onyedika Ifeanyi | Ozor, Chinwendu Njideka "Medicinal Effects of Solanum Aethiopicum Leaf Ethanolic Extracts on Renal and Hepatic Function of Wistar Rats" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-5 | Issue-6, October 2021, pp.961-965, URL: www.ijtsrd.com/papers/ijtsrd46339.pdf

IJTSRD46339

1. INTRODUCTION

Leaves and vegetables are important to the body [1-4]. Aside their nutritional roles in complimenting staple foods to form balanced diets; they also influence biochemical parameters in the body [5-6]. Such influence when positive helps the body to fight many disease conditions [7-8]. Different authors [9-10], have noted that consumption of fruits and vegetables help to prevent diseases such as cancer, ulcers, etc; and as well remedy disease conditions such as gastrointestinal disease, malaria, hepatitis, pile, liver cirrhosis, etc, [6,11-15]. Studies have shown that these fruits and vegetables are able to play these vital roles due to the presence of chemical constituents found in them, which are bioactive in nature [15-17]. These bioactive compounds are termed phytochemicals. Among such chemicals are tannins, alkaloids, phytates, phenols, saponins, flavonoids, steroids, etc [18].

Solanum aethiopicum leaf specie of eggplant or garden egg is among such fruits with some of the above named phytochemicals, which are useful to the body [19-22]. The consumption of *Solanun aethiopicum* leaf is spread throughout the African continent. The fruit is served during ceremonies alongside with kola or sometimes in place of kola. The fruit and the leafy part of parent plant are used in the preparation of delicacy such as African salad, yam and stew, etc. Medicinally, the fruit or the leafy part of the plant are effective against constipation, ulcers, tooth ache and the leaf part is sometimes used as snake bite remedy [6]. The leafy part of *Solanum aethiopicum* is also applied to areas of skin disease, infections and sores [23].

Although the plant is seasonal, it is grown in all parts of Nigeria. It is described with different names by the existing ethnic groups in Nigeria for instance, The Igbos of South-eastern Nigeria call the fruit "Aṅara"

"Afufa" or "Mkpuruofe", the Yorubas of South-western Nigeria call it "Igbagba" while the Hausas of the Northern Nigeria call it "Dauta". With the rate at which the fruit of this plant is being consumed within Nigeria, there is need to look at its possible effect on some biochemical parameters.

The present study investigated the effect of *Solanum aethiopicum* leaf on hepatic and renal function.

2. Materials and Methods

2.1. Plant Material Collection, Identification and Preparation

Collection, authentication and processing of plant material: fresh leaves of *Solanum aethiopicum* were collected from the Agric farm of Faculty of Agricultural Sciences of the University of Nigeria, Nsukka. Plant materials were identified by Dr. Ugwuozor, a taxonomist of Botany Department of University of Nigeria, Nsukka. Taxonomic identity of plants was achieved (No:1120) respectively by deposited voucher specimen and use of documented literature from Dalziel (2016) in the herbarium unit of Department of Botany, University of Nigeria, Nsukka.

2.2. Experimental Animals and Design

Twenty- five male albino rats of wistar strain weighing between 80-110g were obtained from the animal colony of Department of Biochemistry, University of Port Harcourt, River State, Nigeria. The animals were housed in a well-ventilated experimental animal house and were placed on pelletized commercial rat feed (Pfizer livestock Co. Ltd, Aba, Nigeria) and portable water *ad libitum.* They were left to acclimatize for five days. After acclimatization period, the rats were separated into five groups of five rats each. Their weights were equalised as nearly as possible. Aside the control groups, the remaining groups were given compounded feed and water for twenty eight days.

Treatments for the rats were as follows; Control group = Normal feed + portable water; Group Ia = 5% ground fruit sample + 95% pelletized feed + portable water, Group Ib = 10% ground fruit sample + 90% pelletized feed + portable water; Group Ic = 15% ground fruit sample + 85% pelletized feed + portable water; and Group Id = 20% ground fruit sample + 80% pelletized feed + portable water.

All the animals were treated according to NRC [24] guide for care and use of laboratory animals.

2.3. Blood Sample Collection

At the end of the treatment period, the rats were sacrificed by making incisions at their cervical regions with sterile blades after being put to sleep in a close container with help of chloroform. Their weights were also taken. Blood was collected by direct heart puncture with help of syringes into anticoagulant free tubes for haematology and anticoagulant free tubes renal and hepatic function studies.

2.4. Hepatic Function Test

The method of Write *et al*. [27] was used to determine alkaline phosphatase (ALP), alanine aminotransferase (ALT), and aspartate aminotransferase (AST) levels were determined using the methods of [28]. Total and conjugated bilirubin levels were assayed using [29] methods.

2.5. Renal Function Test

Creatinine, urea, and potassium ions were determined following strictly the instructions on their kits. Sodium ion, chloride and bicarbonate ions of renal function were done using the methods of [30], [31] and Forrester *et al.* [32] respectively.

3. Results

Hepatic function result (Table 2) showed that ALP (U/L) ranged from 32.10±2.03 to 32.75±1.06; AST (U/L) ranged from 60.04± 0.10 to 60.70±0.22; ALT (U/L) ranged from 35.71±0.10 to 37.60±0.04; total bilirubin (mg/dl) ranged from 0.40±0.04 to 0.45±0.09; direct bilirubin ranged from 0.27±0.01 to 0.29±0.05.

Table 3 renal function result revealed that creatinine (mg/dl) ranged from 0.60±0.01to 0.67±0.01; urea (mg/dl) ranged from 43.79± 1.09 to 45.51±1.20; K^+ (mEq/L) ranged from 6.80±0.10 to 8.37±0.29; Na^+ (mEq/L) ranged from 131.93±0.13 to 133.56±0.14; Cl^-(mEq/L)) ranged from 95.81±0.17 to 97.43±0.21 and HCO_3^-(mmol/L) from 28.11±0.09 to 29.62±0.18.

4. Discussion

The hepatic organ performs vital functions for healthy survival of the body [38]. Among such functions are detoxification of harmful substances, synthesis and storage of important molecules, secretion of bile into the intestine, etc [38-39]. Hepatic enzymes such as AST and ALT are used as markers of hepatocellular damage [40-42] though their specificity differs. Friday [43] noted that disease conditions such as obstruction jaundice, bone diseases, kidney diseases, metastatic carcinoma, etc. increase the levels of ALP in serum. The levels of ALP, AST, and ALT in test rats in the present study were insignificantly affected ($p>0.05$) against those of the control (Table 1). This could imply that the studied fruit did not induce hepatocellular injury in test rats. Bilirubin (both total and direct) levels were insignificantly affected ($p>0.05$) in test rats when compared to those of the control (Table 1). This could mean that diseases linked with effect on bilirubin in the body, may not be

possible with consumption of *Solanum aethiopicum* leaf. The kidney helps in maintaining homeostasis of the body by excreting waste products and reabsorption of important materials [44].

Creatinine is a waste product formed in the muscle by metabolism of creatine [45]. Its retention in the blood is an evidence of kidney impairment [46]. Urea is the main end product of protein catabolism. It varies directly with protein intake. Reduce glomerular filtrate, leads to urea retention in the body, which ultimately results in disease condition of the kidney [47]. The creatinine and urea levels (Table 2) in the present study were insignificantly affected ($p>0.05$) in test groups when compared to the control. Retention of electrolyte ions in the body could lead to renal diseases [48-49]. K^+, Na^+, Cl^-, and HCO_3^- levels were insignificantly affected ($p>0.05$) in test groups against the control (Table 2). Their insignificant effect could be that the studied fruit did not influence the absorption or excretion of the ions.

5. Conclusion

The present study has shown the effect of *Solanum aethiopicum* leaf on hepatic and renal function. Conclusively, the observation made so far in the present study revealed a non-negative effect on the hepatic and renal function parameters of the rats used. The implication could be that humans that consume this fruit are exposed to the same effect

Table 1 Hepatic function of rats given *Solanum aethiopicum* leaf for 28 days

Groups	Control	Ia	Ib	Ic	Id
Parameters					
ALP (U/L)	**32.10±2.03**	**32.54±1.84**	**32.20±1.19**	**32.10±1.01**	**32.75±1.06**
AST(U/L)	60.04± 0.10	60.19±0.15	61.03± 0.05	60.70±0.22	61.08±0.77
ALT(U/L)	35.71±0.10	37.14±0.03	37.48±0.06	36.26±0.02	37.60±0.04
Total bilirubin(mg/dl)	0.40±0.04	0.43±0.01	0.44±0.02	0.45±0.09	0.44±0.01
Direct bilirubin(mg/dl)	0.27±0.01	0.29±0.08	0.29±0.03	0.29±0.07	0.29±0.05

Results are mean and standard deviation of five determinations

Table 2 Renal function of rats given *Solanum aethiopicum* fruit for 28 days

Groups	Control	I_a	I_b	I_c	I_d
Parameters Creatinine(mg/dl)	**0.60±0.01**	**0.63±0.03**	**0.58±0.05**	**0.67±0.01**	**0.66±0.08**
Urea (mg/dl)	43.79± 1.09	44.30± 1.00	44.31± 1.12	45.13±1.02	45.51±1.20
K^+ (mEq/L)	6.80±0.10	7.05±0.13	7.48±0.11	5.95±0.19	8.37±0.29
Na^+ (mEq/L)	131.93±0.13	132.12±0.81	133.56±0.14	132.89±0.31	133.02±0.15
Cl^-(mEq/L))	95.81±0.17	96.16±0.40	97.02±0.30	96.78±0.10	97.43±0.21
HCO_3^-(mmol/L)	28.11±0.09	29.17±0.04	29.54±0.01	29.30±0.12	29.62±0.18

Results are mean and standard deviation of five determinations.

References

[1] Tindal, H.D., 1965. Fruits and vegetables in West Africa 2nd edn., London: Oxford University Press. pp.105.

[2] Bingham, S., 1987. Nutrition; A consumer guide to good eating. Transworld Publishers, London.

[3] Olusanya J.O., 2008. Essentials of Food and Nutrition,1st edtion, Apex Book limited, Lagos. pp. 36-75.

[4] Nkafamiya, I. I., Oseameahon, S. A., Modibbo, U. U., Haggai, D., 2010, Vitamins and effect of soluble blanching on nutritional and anti-nutritional values of non-conventional leafy vegetables. Journal of Food Science 4(6), 335-341.

[5] Leung, W.T.W., Busson, F., Jardin, C., 1968. Food composition table for use in Africa (Rome, Italy FAO). pp.306.

[6] Sofowara, A., 1993. Medicinal plants and traditional medicine in Africa. Ibadan, Nigeria: Spectrum Books Ltd.

[7] Elujoba, A. A., Odeleye O. M., Ogunyemi C. M., 2005. Traditional medical development for medical and dental primary healthcare delivery system in Africa. African Traditional Complementary and Alternative Medicine 2(1), 41-46.

[8] Okigbo R.N., Mmeka E.C., 2006. An Appraisal of Phytomedicine in Africa. *KMITL* Sci. Tech. J. 6(2), 83-94.

[9] Stray F., 1998. The national guide to medicinal herbs and plants. Tiger Books International, London. Pp.12-16.

[10] Biswas T.K., Mukherjee B., 2003. Plant medicines of Indian origin for wound healing Activity. A Review. The International Journal of Lower Extermity Wounds 2(1), 25-39.

[11] Dalziel, J. M., 1937. The useful plants of West Tropical Africa (New York: Longman) 1st edn., pp. 433–435.

[12] Walker AR.P. (1978): The relationship between bowel cancer and fibre content in the diet.Am J clin. Nutr.31, S245-S251.

[13] World Health Organization, 1976. *African Traditional Medicine.* WHO: Afro-Tech. Rep.

[14] Bagchi, M., Milnes, M., Williams, C., Balmoori, J., Ye, X., Stohs, S., Bagchi, D. 1999. Acute and chronic stress-induced oxidative gastrointestinal injury in rats and the protective ability of a novel grape seed proanthocyanidin extract, Nutri. Res. 19**,** 1189–1199.

[15] Okwu, D.E., 2005. Phytochemical, vitamin and mineral contents of two Nigeria medicinal plants. International Journal of Molecular Medicine and Advance Sciences 1(4), 375-381.

[16] Duke, J.,1992. Handbook of biological active phytochemicals and their activities. CRC Press, BICA Ration (FL). pp. 99-131.

[17] Akubugwo, I. E., Obasi, N.A., Chinyere, G. C., Ugbogu, A. E., 2008. Mineral and phytochemical contents in leaves of Amaranthus hybridus L and Solanum nigrum L. subjected to different processing methods. African Journal of Biochemistry Research 2 (2), 040-044.

[18] Edeoga, H. O., Okwu, D. E., Mbaebie B. O., 2005. Phytochemical constituents of some Nigeria medicinal plants. Afr. J.Biotech. 4(7), 685-688.

[19] Jaeger, P.M.L., Hepper, F. N., 1986. A review of the genus *Solanum* in Africa, In: *Solanaceae:* biology and systematics (eds) W. G. D'Arcy . New York: Columbia University Press. pp. 41–55.

[20] Gbile, Z. O., Adesina, S. K., 1998. Nigerian *Solanum Species* of economic importance, Annals Missouri Bot. Garden. 75, 862-865.

[21] Bonsu, K. O., Fontem, D. A., Nkansah, G. O., Iroume, R. N., Owusu E. O., Schippers R. R., 2002. Diversity within the Gboma eggplant (*Solanum macrocarpon),* an indigenous vegetable from West Africa. Ghana J. Horticulture. 1, 50–58.

[22] Shalom, N. C., Abayomi, C. O., Okwuchukwu., K. E., Opeyemi., C. E., Olajumoke, K. A., Damilola I. D., 2011, Proximate and phytochemical analyses of *Solanum aethiopicum* L. and *Solanum macrocarpon* L. Fruits. Res.J.Chem.Sci. 1(3), 63-71.

[23] Oliver-Bever, B., 1989. Medicinal Plants in Tropical West African. Cambridge Unit. Cambridge. pp.70.

[24] NRC, 1985.National Research Council Guide for the care and use of laboratory animals. Publication no. 85-123(rev.).National Institute Health, Bethesda, M.D.

[25] Alexander, R. R., Griffith J. M., 1993a. Haematocrit, In: Basic Biochemical Methods, Bark Hill HM.1984: The Useful Methods, 2nd Ed. John Wiley and Sons Inc. New York, pp.186-187.

[26] Alexander, R. R., Griffith J. M., 1993b. Haemoglobin Determination by the Cyanomethamoglobin Method, In: 32 Duru y, Hepatic And Renal Function Basic Biochemical Methods, 2nd Ed., John Wiley and Sons Inc. New York, pp. 188-189.

[27] Write, P.J., Leathwood, P.D., Plummer D.T., 1972. Enzymes in rat urine. Alkaline phosphatase. Enzymology, 2, 31 – 427.

[28] Reitman, S., Frankel, S., 1957. Colorimetric method for the determination of serum transaminases. Am. J. Chis pathol. 28: 56-63.

[29] Jendrassik, L., Groff, P., 1938. Colorimetric method for measurement of Bilirubin. Biochem. J. 297, 81-89.

[30] Trinder, I., 1951. Analyst 76, 596.

[31] Skeggs, L.T., Hochstrasser, H.C., 1964.Clin. Chem.10, 918.

[32] Forrester, R.L., Watafe, L. J., Silverman, D.A., Pierre, K.J., 1976. Enzymatic method for the determination of CO2 in serum. Clin. Chem. 232-243.

[33] Balter, F.J., Silverton R.E., 1996. Introduction to medical laboratory technology, 8th edition, Butter Worth and Co Publisher Ltd, London. p.131.

[34] Guyton, A. C., Hall J.E., 2000. Textbook of medical physiology, 10th edition, W.B. Saunder Company, New York. Pp.523-753.

[35] Sliverd, C. E., 1983. Heamatology for medical technologies. Lea and Febiger, Philadelphia. Pp.240-245.

[36] Okeke, E.A., Ayalogu, A.O., Akaninwor, J.O., 2006. Effect of diets contaminated with crude petroleum product (Bonny light and Facados) on the hematological parameters of wistar albino rats. JNES.3 (3), 160-166.

[37] Duru, M.K.C., 2009. Physicochemical and biochemical studies on Otamiri River, Owerrri, Imo State. M.Sc thesis, Abia State University, Uturu. p. 34.

[38] Prince, C. P., Albert K. G., 1976. Biochemical assessment of liver function, in: Liver and Biliary diseases-pathophysiology, diagnosis and management (R. Wright, K.G. Albert, S. Karran and G. Millivard-Sadler, eds), Saunders Co. Ltd., London. pp. 381-416.

[39] Wurochekke, A.U., Anthony, A.E., Obidah, W., 2008. Biochemical effects on Liver and kidney of rats administered aqueous stem bark extract of *Xemenia americana*. *African* Journal of Biotechnology **7** (16), 2777-2780.

[40] Chatterjea, M. N., Shinde, R., 2002a. Uses of enzymes, in; Textbook of Medical Biochemistry, 5th edn., Jaypee Brothers, New Delhi. p.118.

[41] Nyblom, H., Berggeren, U., Balldin, J., Olsson, R., 2004. High AST/ALT ratio may indicate advanced alcoholic liver disease rather than heavy drinking. Alcohol Alcohol. 39(4), 336 – 339.

[42] Nyblom, H., Bjornsson, E., Simren, M., Aldenborng, F., Almer S., Olsson R., 2006. The AST/ALT ratio as an indicator of cirrhosis in patients with PBC. Liver Int. 26(7): 840 – 545.

[43] Friday, E.U., 2004. Clinical uses of enzymes, In: Conceptual Enzymology, Innolex Printers and Publishers, Calabar. pp. 190-212.

[44] Oh, M.S., 2006. Evaluation of renal function, water, electrolytes and acid-base balance. In: Mcpherson, R.A., Pincus, M.R., eds. Henry's Clinical diagnosis and Management by Laboratory Methods, 21 edition, Saunders Elsevier, Philadephia. Chap. 14.

[45] Ranjna, C., 1999. Practical clinical Biochemistry methods and interpretation, 2nd edn. pp.117.

[46] Pincus, M.R., Abraham, N.Z., 2006. Interpretation of Laboratory results in Mc-Pherson, R.A., Pincus, M.R eds. Henry's Clinical Diagnosis and Management by Laboratory Methods. 21st edition. Saunders Elsever, Philadelphia. pp. 1– 800. Chap. 8.

[47] Post, T., Burto, R., 2001. Clinical Physiology of Acid-Base and Electrolyte Disorders, 5th edition. New York. McGraw-Hill.

[48] Stevens, L. A., Levcy, A. S., 2005. Measurement of kidney function in medical clinics of North America, Signh, AK (Ed), W.B Saunders, Philadelphia, p. 457.

[49] Stevens, L. A., Coresh, J., Greens, T., Levey, A.S., 2006. Assessing Kidney function measured and estimated glomerular filtrate rate. The New England Journal of Medicine 354 (22), 2473-83.