

## Evaluation of Hypoglycemic and Antioxidative Properties of Aqueous Extract of *Garcinia kola* Seeds in Wistar Rats

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**Abstract:** The effects of aqueous extract of *Garcinia kola* seed on glucose, superoxide dismutase catalase and malondialdehyde of normal rats were investigated. Oral administration of aqueous seed extract of *Garcinia kola* at a concentration of 200 mg kg<sup>-1</sup> body weight over a period of 21 days, significantly ( $p < 0.05$ ) decreased the levels of blood glucose, increased the activity of superoxide dismutase ( $p < 0.05$ ) and that of malondialdehyde ( $p < 0.05$ ). The treatment however had no significant effect ( $p > 0.05$ ) on the activity of catalase. The elicitation of these effects by the plant is a reflection of its hypoglycemic and antioxidative properties.

**Key words:** *Garcinia kola* seeds, catalase, MDA, SOD, aqueous extract, lipid peroxidation

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### INTRODUCTION

Historically, plants have provided a source of inspiration for novel drug compounds as plant derived medicines have made large contributions to human health and well being. Medicinal plants which produce and accumulate constituents have medical properties (Babalola *et al.*, 2001). *Garcinia kola* belongs to the family Guttiferae. It is an evergreen tree which can grow up to 30 m high but usually up to about 12-15 m.

*Garcinia kola* is popular among the people of Nigeria because of its ability to cause nervous alertness and induce insomnia. It is chewed extensively in Southern Nigeria as a masticatory and it is readily served to visitors, especially among the Igbo tribe in Eastern Nigeria as a sign of peace and acceptance of visitors. Traditionally in Africa, the seed is used for the treatment of bronchitis, throat infections and as an antipurgative and antiparasitic (Iwu, 1993).

*Garcinia kola* stem bark has been shown to contain a complex mixture of phenolic compounds such as biflavonoids, xanthenes and benzophenone (Iwu and Igboko, 1982) which have antimicrobial activity as kolanone (Hussain *et al.*, 1982), kolaflavanone and garcinia flavanone (Iwu, 1993). The plant nut contains a high proportion of tannins and guttiferin. *Garcinia kola* is reported to have a protective effect against variety of experimental hepatotoxins (Iwu, 1985; Akintonwa and Essien, 1990). However, some histological alteration in the liver, kidney and deudenum of rats fed diets containing

10% *Garcinia kola* nut have been reported (Braide and Grill, 1990). Because of the extensive consumption of *Garcinia kola* in Nigeria, this study was conducted to evaluate its antioxidant and hypoglycemic effects using Wistar rats as experimental models.

### MATERIALS AND METHODS

Ten albino rats of Wistar strain, weighing between 120-200 g were obtained from local breeders at Aduwawa cattle market, Benin city. The animals were kept in standard cages in the animal house and allowed to acclimatize to the new environment for a period of 1 week after which they were randomized into 2 groups (control and test) of five rats each. The rats were fed on guinea growers mash (from Ewu feeds, Edo state) and allowed free access to water in standard cans throughout the duration of the research.

*Garcinia kola* (bitter kola) nuts were purchased from New Benin market in Edo state and the taxonomic identification established in the Department of Botany, University of Benin. The nuts were chopped into pieces, air-dried and ground into fine powder. About 100 g of the powder was soaked in 400 mL distilled water and allowed to stand for 3 days with occasional stirring, using a magnetic stirrer to ensure proper mixture of the vessel content. The content was then filtered, using a sintered funnel and the filtrate concentrated, using a rotary evaporator. Prior to treatment, blood samples were collected from the animals for determination of the basal

values of the parameters in consideration. The concentrated extract was then weighed and administered to the test animals, orally at a dose of 200 mg kg<sup>-1</sup> body weight each day. The control animals were equally given equivalent amount of distilled water via the same route. The treatment period lasted for 3 weeks (21 days) after which blood samples were collected for final analysis, using the Spectrophotometry method.

## RESULTS AND DISCUSSION

Cells maintain a variety of defenses against oxygen toxicity. Among these are an array of enzymes that have evolved to deal with oxidative stress including Superoxide Dismutase (SOD), catalase and malondialdehyde. Catalase works closely with superoxide dismutase to prevent free radical damage to the body. SOD converts the dangerous superoxide radical to hydrogen peroxide which catalase converts to harmless water and oxygen. Reactive oxygen species degrade polyunsaturated lipids, forming malondialdehyde (Pryor and Stanley, 1975). This compound is a reactive aldehyde and is one of the many reactive electrophile species that cause toxic stress in cells and form covalent protein adducts referred to as Advanced Lipoxidation End products (ALE) in analogy to Advanced Glycation End products (AGE) (Farmer and Davoine, 2007). The production of this aldehyde is used as a biomarker to measure the level of oxidative stress in an organism (Moore and Robert, 1998; Del Rio *et al.*, 2005). Oral administration of aqueous seed extract of *Garcinia kola* for a period of 21 days at a dose of 200 mg kg<sup>-1</sup> body weight to normal rats, significantly (p<0.05) reduced the blood glucose level of the experimental animals (Table 1). The reduction in glucose concentration after the period of treatment is indicative that the plant has possible hypoglycemic properties. This is however in accordance with the findings of Tita *et al.* (2001) which shows that the biflavonoids complex from *Garcinia kola* have antidiabetic properties. Also, Iwu (2003) reported that the seed of *Garcinia kola* has anti-diabetic properties. Thus, it is suggestive of the confirmation of its glucose lowering effect or property.

The treatment also caused a significant (p<0.05) increase in the activity of SOD (Table 2). This can be observed in the result when the final and the initial values for the test animals are compared. The increase in SOD activity after the period of treatment is suggestive of the ability of *Garcinia kola* to boost, the production of the antioxidant SOD within the system of the experimental animals. This is in agreement with the earlier findings of Adaramoye *et al.* (2005) which showed that the seeds of *Garcinia kola* possess antilipoperoxidative effect. This is a likely proof of its antioxidative properties which has high inhibition of lipid peroxidation. This may further be

Table 1: Effect of Aqueous seed extract of *Garcinia kola* on blood glucose of normal rats

Days	Control (mg dL <sup>-1</sup> )	Test (mg dL <sup>-1</sup> )
0 (baseline)	103.91±13.77	127.25±20.42
21	122.75±11.98	105.97±18.12*

Glucose concentrations are expressed as means±SEM, n = 5, \*p<0.05 compared to baseline

Table 2: Effect of Aqueous seed extract of *Garcinia kola* on SOD, catalase and MDA activities of normal rats

Parameters	Control		Test	
	Initial activity (U L <sup>-1</sup> )	Final activity (U L <sup>-1</sup> )	Initial activity (U L <sup>-1</sup> )	Final activity (U L <sup>-1</sup> )
Superoxide Dismutase (SOD)	1.635±0.17	1.788±0.18	1.366±0.15	1.721±0.07*
Catalase	0.655±0.11	0.574±0.12	0.291±0.05	0.265±0.05**
Malondialdehyde (MDA)	1.045±0.14	1.279±0.16	0.541±0.10	0.328±0.10***

Activities are expressed as means±SEM, n = 5, \*p<0.05, \*\*p>0.05, \*\*\*p<0.05 compared to initial activity

strengthened by the result obtained for MDA (lipid peroxidation) analysis (Table 2) where the values for the test is significantly (p<0.05) reduced compared with the initial values.

The treatment which caused a decrease in the levels of MDA is in accordance with the findings of (Wegwu and Didia, 2007) which suggests that the seed may possess the natural antioxidants, necessary for protection against free radical damage induced by carbon tetrachloride in rat liver since, marked decrease in the levels of lipid peroxides was recorded in rats pretreated with *Garcinia kola* seeds. MDA is a product of lipid peroxidation (Raghavendran *et al.*, 2004).

An increase in the liver MDA levels is an indication of elevated level of lipid peroxidation (Trible *et al.*, 1987). Extensive lipid peroxidation leads to disorganization of membrane by peroxidation of unsaturated fatty acids which also alters the ratio of polyunsaturated to other fatty acids. This would lead to a decrease in the membrane fluidity and the death of the cell (Raghavendran *et al.*, 2004). From the result of the investigation, *Garcinia kola* seed has the potential to prevent this cell death due to lipid peroxidation by inhibiting the lipid peroxidation process. The treatment however, caused no significant (p>0.05) effect in the activity of catalase. This may not be conclusive as the plant has been shown to have antioxidative properties as stated previous. However, more specific research may still be done to ascertain its actual effect on the activity of catalase.

## CONCLUSION

Thus from the findings, it is evident that *Garcinia kola* which is popularly chewed among Nigerians for its nervous alertness and induction of insomnia also possess hypoglycemic and antioxidative properties.

## REFERENCES

- Adaramoye, O.A., V.O. Nwaneri, K.C. Anyanwu, E.O. Farombi and G.O. Emerole, 2005. Possible anti-atherogenic effect of kolaviron (a *Garcinia kola* seed extract) in hypercholesterolaemic rats. Clin. Exp. Pharm. Physiol., 32: 40-46.
- Akintonwa, A. and A.R. Essien, 1990. Protective effects of *Garcinia kola* seed extract against paracetamol-induced hepatotoxicity in rats. J. Ethnopharmacol., 29: 207-211.
- Babalola, O.O., J.I. Anetor and F.A. Adeniyi, 2001. Amelioration of carbon tetrachloride-induced hepatotoxicity by terpenoid extract from leaves of *Vernonia amygdalina*. Afr. J. Med. Sci., 30: 91-93.
- Braide, V.B. and V. Grill, 1990. Histological alterations by a diet containing seeds of *Garcinia kola*: Effect on Liver, Kidney and Intestine in the rat. Gregenbaurs. Morphol. Hahrb., 136: 95-101.
- Del Rio, D., A.J. Stewart and N. Pellegrini, 2005. A review of recent studies on malondialdehyde as toxic molecule and biological marker of oxidative stress. Nutr. Metab. Cardiovas. Dis., 15: 316-328.
- Farmer, E.E. and C. Davoine, 2007. Reactive electrophile species. Curr. Opin. Plant Biol., 10: 380-386.
- Hussain, R.A., A.G. Owegby, P. Parimoo and P.G. Waterman, 1982. Kolanone, a novel polyisoprenylated benzophenone with antimicrobial properties from the fruit of *Garcinia kola*. Planta Med., 44: 78-81.
- Iwu, M., 2003. Handbook of African Medicinal Plants. CRC Press, Boca Raton, Florida.
- Iwu, M.M. and O. Igboko, 1982. Flavonoids of *Garcinia kola* seeds. J. Nat. Prod., 45: 650-651.
- Iwu, M.M., 1985. Antihepatotoxic constituents of *Garcinia kola* seeds. Experimentia, 41: 699-700.
- Iwu, M.M., 1993. Handbook of African Medicinal Plants. 1st Edn., CRC Press, Boca Raton, FL., ISBN-10: 084934266X, pp: 464.
- Moore, K. and I.J. Robert, 1998. Measurement of lipid peroxidation. Free Radical Res., 28: 659-671.
- Pryor, W.A. and J.P. Stanley, 1975. Letter: A suggested mechanism for the production of malonaldehyde during the autoxidation of polyunsaturated fatty acids. Nonenzymatic production of prostaglandin endoperoxides during autoxidation. J. Org. Chem., 40: 3615-3617.
- Raghavendran, H.R.B., A. Sathivel and T. Devaki, 2004. Hepatoprotective nature of seaweed alcoholic extract on acetaminophen induced hepatic oxidative stress. J. Health Sci., 50: 42-46.
- Tita, R.K., P.G. Odeigah, P.U. Agomo and E. Bassey, 2001. Some Properties of Medicinal Plants used by the Igbos of Nigeria. In: Triats, Tracts and Traces, Wolfgang Kreis (Ed.). Bioline International, Germany, pp: 209-210.
- Tribble, D.L., T.Y. Aw and D.P. Jones, 1987. The pathophysiological significance of lipid peroxidation in oxidative cell injury. Hepatology, 7: 377-386.
- Wegwu, M.O. and B.C. Didia, 2007. Hepatoprotective effects of *Garcinia kola* seed against hepatotoxicity induced by carbon tetrachloride in rats. BIOKEMISTRI, 19: 17-21.