

## 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 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 ( $p < 0.05$ ). Our 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:** Aqueous extract, catalase, *Garcinia kola* seeds, lipid peroxidation, MDA, SOD

### 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 (Hassain *et al.*, 1982), kolaflavanone and garcinia flavanone (Iwu, 1993). The plant nut contains a high proportion of tannins and guttiferin (Etkin, 1981). *Garcinia kola* is reported to have a protective effect

against variety of experimental hepatotoxins (Iwu, 1985; Akintowa 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). *Garcinia kola* contains potent natural antioxidants and may therefore be relevant in the preservation of lipid food products which are prone to oxidation and rancidity (Farombi *et al.*, 2003). Lipid peroxidation is a chain reaction providing a continuous supply of free radicals that initiate further peroxidation, whose products are cytotoxic (Cullis *et al.*, 1996). In addition, the plant possesses anti-hepatotoxic (Braide, 1991; Akintowa and Essien, 1990), antioxidant (Olatunde *et al.*, 2004), hypoglycemic (Iwu *et al.*, 1990; Odeigah *et al.*, 1999), and aphrodisiac properties (Ajibola and Satake, 1992). 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 of the department of Biochemistry, Igbinedion University, Okada, and allowed

to acclimatize to the new environment for a period of one week, after which they were randomized into two 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 work (December, 2010 to January, 2011).

*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. 100 g of the powder was soaked in 400ml 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 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 (S.O.D.), catalase and malondialdehyde. Catalase works closely with superoxide dismutase to prevent free radical damage to the body. S.O.D. 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-

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

Day	Control (mg/dL)	Test (mg/dL)
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±S.E.M n = 5; \*: p<0.05 compared to baseline

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 Roberts, 1998; Del *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 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.

Our treatment also caused a significant (p<0.05) increase in the activity of S.O.D. (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 S.O.D. activity after the period of treatment is suggestive of the ability of *Garcinia kola* to boost the production of the antioxidant S.O.D. 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 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. Our treatment which caused a decrease in the levels of MDA is in accordance with the findings of Mathew *et al.* (2007), which suggests that the seed may possess the natural antioxidants necessary for protection

Table 2: Effect of aqueous seed extract of *Garcinia kola* on S.O.D., Catalase and MDA Activities of normal rats

Parameter	Control		Test	
	Initial activity (U/L)	Final activity (U/L)	Initial activity (U/L)	Final activity (U/L)
Superoxide Dismutase (S.O.D)	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 (M D A)	1.045±0.14	1.279±0.16	0.541±0.10	0.328±0.10***

Activities are expressed as means±S.E.M; n = 5, \*: p<0.05; \*\*: p>0.05; \*\*\*: p<0.05 compared to initial activity

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 (Devaki *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 (Devaki *et al.*, 2004). From the result of our investigation, *Garcinia kola* seed has the potential to prevent this cell death due to lipid peroxidation by inhibiting the lipid peroxidation process. Our 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 above. However, more specific research may still be done to ascertain its actual effect on the activity of catalase. Thus, from our 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.

### CONCLUSION

Our research showed that the aqueous extract of *Garcinia kola* seeds caused a reduction in the concentration of glucose, an increase in the activity of superoxide dismutase, and a decrease in the levels of malondialdehyde of the experimental animals. These suggest the use of the plant as a hypoglycemic agent and as a remedy for oxidative stress or damage caused by free radicals in the body.

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