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Acute administration of aqueous extract of *Garcinia kola* on daily blood glucose level and selected biochemical indices in longevity wistar albino rats

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Abstract

This study evaluated the effects of acute administration of aqueous extract of *Garcinia kola* on daily blood glucose level and selected biochemical indices in wistar albino Rats in connection with human health. The serum liver enzymes ALT and ALP increased significantly ($p<0.05$) in the test animals in groups two and three, while AST also increased, though not significantly ($p<0.05$). ALT increased from 35.38 ± 1.35 U/L in control group (group one) to 47.25 ± 1.71 U/L in group three, while AST and ALP increased from 36.75 ± 2.50 U/L to 38.25 ± 4.79 U/L and 27.46 ± 4.57 U/L to 40.14 ± 7.26 U/L respectively. Blood glucose level decreased on daily basis after administration of aqueous extract of *Garcinia kola*. The results showed that daily consumption of *Garcinia kola* induced hypoglycaemic effect and hepatic damage in Wistar albino rats as observed in groups two and three. This invariably implies that the longevity of human beings is guaranteed if adequately consumed and life expectancy in Nigeria positively influenced.

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Introduction

Herbal medicine has been used as an antidiabetic therapy alone, along with insulin or other synthetic oral hypoglycaemic agents (Rajan *et al.,* 2010). The use of synthetic agents, on the other hand, has shown several undesirable side effects and has failed to correct the fundamental biochemical lesion and diabetic complications. One of such herbal practices that have shown promise in treatment of diabetes mellitus and its complications is the use of *Garcinia kola* seed.

Garcinia kola (Heckel) is commonly called bitter kola. It is an angiospermae, belonging to the family of Guttiferae. The bitter kola is a type of kola found in parts of Nigeria. Among the Yorubas, it is called 'Orogbo', the Igbos calls it 'Agbilu', 'Adi' or 'Aki ilu' while among the Hausas, this very popular nut is known as 'Namijin Gworo.' *Garcinia kola* is a highly valued ingredient in African ethnomedicine because of its varied and numerous uses which are social and medicinal; thus making the plant an essential component in folk medicine (Adesuyi *et al*., 2012). It is a wonderful agricultural produce with a wide range of applications in natural and orthodox medicine.

This nut (bitter kola) is served as refreshment, medicinally used for the treatment of abdominal pain, cough, laryngitis, liver disease, infections and erectile problems (Njume *et al.,* 2011). Traditionally, it is said that regular consumption of this nut lowers blood glucose levels and improves the complications of diabetes mellitus. The seed is chewed whole and one to three whole seeds may be taken a day. Phytochemical studies of the seeds revealed the presence of biflavonoids, xanthones, triterpenes, cycoartenols and benzophenones (Adaramoye *et al.,* 2005). Adesuyi *et al*., (2012) also reported the presence of Flavonoids, Phenol, Alkaloids, Saponin and Tannin in *Garcina kola*. Kolaviron, consisting of the main bioactive com-ponents: biflavanones and kolaflavanones is the predo-minant constituent of *G. kola*. Kolaviron components account for most of the seed's biological activities (Adaramoye and Adeyemi, 2006). The seeds have been proven to possess numerous physiological and pharmacological effects which include hepatoprotective effects; anti-inflammatory, antioxidant, antifertility effect, haematological effects and anticancer effect (Esimone *et al*., 2007). *Garcinia kola* is traditionally used by African medicinemen who believe that it has purgative, antiparasitic and antimicrobial properties. The seeds are used for bronchitis, throat infections, colic, head or chest colds, and cough. There is no doubt that in view of the efficacy of this agricultural produce, life expectancy of Nigeria would positively be influenced if the populace imbibes the habit of its normal consumption.

The blood sugar concentration or blood glucose level is the amount of glucose (sugar) present in the blood of a human or an animal. The body naturally tightly regulates blood glucose levels as a part of metabolic homeostasis. Glucose is the primary source of energy for the body's cells, and blood lipids (in the form of fats and oils) are primarily a compact energy store. Glucose is transported from the intestines or liver to body cells via the bloodstream, and is made available for cell's absorption via the hormone: insulin, produced by the body primarily in the pancreas. Glucose levels are usually low in the morning, before the first meal of the day (termed "the fasting level"), and rise after meals for an hour or two by a few millimolar.

Blood sugar levels outside the normal range may be an indicator of a medical condition. A persistently high level is referred to as hyperglycaemia; low levels are referred to as hypoglycaemia. Diabetes mellitus is characterized by persistent hyperglycaemia from any of several causes, and is the most prominent disease related to failure of blood sugar regulation. Intake of alcohol causes an initial surge in blood

sugar, and later tends to cause levels to fall. Also, certain drugs can increase or decrease glucose levels, which can shorten or increase the life span of the affected individual.

This study was motivated because It became necessary (as no previous work has been done in this exact form) to evaluate the effects of acute administration of aqueous extract of *Garcinia kola* on daily blood glucose level and selected biochemical indices in wistar albino Rats. This will help to justify or not justify the use of *Garcinia kola* in folkshore medicine and to create the public awareness of the possible hypoglycaemic effect of *Garcinia kola*.

The aim of the present study is to evaluate the effects of acute administration of aqueous extract of *Garcinia kola* on daily blood glucose level as it related the life span of human beings and selected biochemical indices in wistar albino Rats.

Materials and methods

ACCU-CHEK active (glucometer)

ACCU-CHEK Active was bought from Roche Diagnostics GmbH, 68298 Mannheim, Germany.

Plant material and extraction

Garcinia kola was bought at Uturu, Abia State, Nigeria. It was identified at the Department of Plant Science and Biotechnology, Abia State University, Uturu and voucher specimen deposited at the herbarium of Plant Science and Biotechnology department. The plant material was sun-dried. The dried *Garcinia kola* was milled to a powder. 40g of the powder was extracted with 300ml of water by cold maceration for 48 hours and filtered. The concentration of the filtrate was determined.

Experimental design

Twelve male albino rats aged 8 weeks (between 180g-210g body weight) were used in this study. The animals were randomly placed into three (3) groups with four (4) rats in each group. Group 1 served as the control group (it received a placebo of normal saline). Group 2 received aqueous extract of *Garcinia kola* (450 mg/kg b.w.). Group 3 received aqueous extract of *Garcinia kola* (900 mg/kg b.w.).

Groups 2 and 3 animals received aqueous extract of *Garcinia kola* every 24 hours for five consecutive days. After the first day of administration of the aqueous extract of *Garcinia kola*, the blood glucose level of all the animals were read daily for five consecutive days.

The normal saline and plant extract were administered through oral route using gavage intubation. All animals were allowed free access to food and water ad libitum throughout the study.

Method for determination of blood glucose level

ACCU-CHEK Active (glucometer) test strips for quantitative blood glucose level was used. Blood was collected daily from the rats through tail puncture. It was placed on the test strip and slotted in the ACCU-CHEK Active and blood glucose level read on the meter.

Blood collection for biochemical indices

At the end of the experiment, the animals were anaesthetized with chloroform and sacrificed. Blood was collected by cardiac puncture and blood samples from each animal collected into dry test tubes. The blood sample was allowed to stand for about 15 minutes to clot and further spun in a centrifuge. Serum was separated from the clot with Pasteur pipette into sterile sample test tubes for the measurement of liver enzymes.

Biochemical analysis

The serum aspartate transaminase (AST) and alanine transaminase (ALT) were determined as described by Reitman and Frankel (1957) using Randox Diagnostic kit. Alkaline phosphatase (ALP) was determined as described by Tietz *et al.,* (1983) also using Randox Diagnostic kits.

Statistical analysis

Statistical analysis were carried out with the use of standard student T distribution test and mean was compared for significance at $p<0.05$.

Results

The results of the study are presented in the tables below, according to the parameters investigated.

Table 1. Result of daily blood glucose level (mg/dl).

DAYS	*GROUP 1*	*GROUP 2*	*GROUP 3*
DAY 1	82.00 ± 5.48[a]	77.50 ± 8.54[a]	77.00 ± 6.98[a]
DAY 2	78.00 ± 6.78[a]	51.00 ± 18.02[b]	50.25 ± 9.74[b]
DAY 3	73.75 ± 11.79[a]	44.00 ± 12.08[b]	41.50 ± 5.97[b]
DAY 4	71.00 ± 6.78[a]	38.50 ± 8.54[b]	34.25 ± 4.03[b]
DAY 5	72.25 ± 5.91[a]	30.75 ± 2.22[b]	21.00 ± 0.82[c]

Results represent mean ± standard deviation of group results obtained (n=4).

Mean in the same row, having different alphabet are statistically significant ($p<0.05$).

Table 2. Liver enzymes concentration (U/L).

Parameters	*Group 1*	*Group 2*	*Group 3*
ALT	33.25 ± 2.36[a]	45.00 ± 0.82[b]	47.25 ± 1.71[b]
AST	36.75 ± 2.50[a]	38.50 ± 5.57[a]	38.25 ± 4.79[a]
ALP	27.46 ± 4.57[a]	39.39 ± 9.82[b]	40.14 ± 7.26[b]

Results represent mean ± standard deviation of group serum results obtained (n=4).

Mean in the same row, having different alphabet are statistically significant ($p<0.05$).

Discussion

The result of this study showed significant decrease in daily blood glucose level. The decrease is believed to induce hypoglycaemic effect and was seen to be dose dependent. Flavonoids one of the major phytoconstituents of *Garcinia kola* seed have variously been implicated in the reduction of glucose levels in experimental animal models. However, it is noted that the hypoglycaemic effect of *Garcinia kola* powder is not only attributable to the flavonoid content alone, as other phytochemical compounds (saponin, tannins, glycosides) present in it have various hypoglycaemic effects (Lamba *et al.,* 2000). The possible mechanism of action of *Garcinia kola* seed could be that it decrease the release of glucagon or increase the secretion of insulin, stimulate directly glycolysis in peripheral tissues, increase glucose removal from blood or reduce glucose absorption from gastrointestinal tract (Marrif *et al.,* 1995).

If blood sugar levels drop too low, a potentially fatal condition called hypoglycaemia develops. Symptoms may include lethargy, impaired mental functioning; irritability; shaking, twitching, weakness in arm and leg muscles; pale complexion; sweating; paranoid or aggressive mentality and loss of consciousness. Some of these symptoms were observed in the rats in groups two and three. They were seen to have loss of consciousness, weakness and impaired mental functioning which invariably could affect the animal or human being's life span.

Mechanisms that restore satisfactory blood glucose levels after extreme hypoglycaemia must be quick and effective to prevent extremely serious consequences of insufficient glucose: confusion or unsteadiness and, in the extreme loss of consciousness and seizures. It is far more dangerous to have too little glucose in the blood than too much. In healthy individuals, blood glucose-regulating mechanisms are generally quite effective, as observed in the control group

(group one). Hypoglycaemic episodes can vary greatly between persons and from time to time, both in severity and swiftness of onset. For severe cases, prompt medical assistance is essential, as damage to brain and other tissues and even death will result from sufficiently low blood-glucose levels. If adequately employed, the life expectancy of our country Nigeria will be positively influenced against high incidence of mortality.

In animal studies, *Garcinia kola* increased the activities of the enzymes lactate dehydrogenase and glucose-6-phosphate dehydrogenase (Olajide and Adeyemi, 2011). In groups two and three, the aqueous extract of *Garcinia kola* caused elevation of the serum liver enzymes. ALT, AST and ALP increased in all the groups when compared with the control (group one). Elevated levels of serum enzymes are inductive of cellular leakage and loss of functional integrity of cell membrane in liver (Moore *et al*., 1985). The result of this study shows that despite the health benefit of *Garcinia kola* to human beings, it should not be consumed regularly: in excess quantity (on daily basis), except under some medical condition.

Conclusion

The study reviewed the efficacy of hypoglycaemic effects of acute administration of aqueous extract of *Garcinia kola* on daily blood glucose level and elevation of liver enzymes in wistar albino Rats as it related to human health. The hypoglycaemic effect was seen to be dose dependent. The effect observed could be attributable to the flavonoid content and other phytochemical compounds (saponin, tannins, glycosides) present in it *Garcinia kola*. However, the outcome could be beneficial to human health: by increasing the life expectancy if adequately consumed.

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