



Effect of the *Garcinia kola* Seed on Glycemia, Creatininemia and Aminotransferases in Adult Subjects

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Authors' contributions

This work was carried out in collaboration among all authors. Author MG designed the study, supervised the data collection, interpreted the data and validated the manuscript. Author TS did the data collection, data processing and analysis and wrote the manuscript draft. Authors GD and SZ collected the data and wrote the manuscript draft. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJBCRR/2020/v29i230169

Editor(s):

(1) Dr. Enrico Sanjust, University of Cagliari, Italy.

Reviewers:

(1) Dennis, Amaechi, Veritas University, Nigeria.

(2) Maria Bintang, IPB University (Bogor Agricultural University), Indonesia.

(3) Syed Mubashar Sabir, University of Poonch, Pakistan.

Complete Peer review History: <http://www.sdiarticle4.com/review-history/55202>

Received 28 December 2019

Accepted 05 March 2020

Published 24 March 2020

Original Research Article

ABSTRACT

Background: The administration of extracts of *Garcinia kola* seed to experimental rats has a hypoglycemic and hepatoprotective effect.

Objective: Assess the effect of daily consumption of *Garcinia kola* seed on glycemia, creatinine and serum aminotransferases among adult subjects.

Methods: We carried out an intervention study based on quasi-experimental approach during three months i.e. from May 1 to July 30, 2019. A sample consisting of 40 adult subjects (18 men, 22 women) had participated to the study after their written consent and approval by the institutional ethics committee. After the baseline testing which consists of fasting glycemia, creatininemia, alanine aminotransferase (ALAT) and aspartate aminotransferase (ASAT), each subject consumed one *Garcinia kola* seed per day during 90 days. Then, every 30 days, the same testing was performed. Glycemia was determined by endpoint colometric method for assaying enzyme using glucose oxidase; creatinine by colometric kinetic assay using the JAFFE reagent; and

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aminotransferases by UV enzyme kinetics. Student's t test helped compare the mean values of the parameters determined at the beginning and at the end of the experiment at the threshold of 5%.

Results: The mean values at the beginning and at the end of the experiment were glycemia in g/L (0.81 ± 0.20 vs 0.84 ± 0.14), creatininemia in mg/L (9.36 ± 2.44 vs 8.01 ± 2.15), ALAT in UI/L (27.19 ± 15.77 vs 25.60 ± 12.45) and ASAT in UI/L (28.46 ± 11.52 vs 23.30 ± 8.48). A significant decrease of creatininemia and ASAT was observed ($p = .010$ and $.025$ respectively).

Conclusion: The consumption of the *Garcinia kola* seed has a nephroprotective and hepatoprotective effect.

Keywords: Aminotransferases; creatinine; *Garcinia kola*; glycemia.

1. INTRODUCTION

The medicinal plants play a prominent role in the treatment of many diseases among the human beings. According to the World Health Organization, 80% of the populations of the low income countries engage in the use of plants for primary health care [1].

Garcinia kola is a tree that grows in the tropical forests; its seeds are highly valued for their many medicinal properties [2]. The plant extracts are used in the treatment of laryngitis, cough and liver diseases [3]. The phytochemical study of the *Garcinia kola* seed highlighted the presence of flavonoids, alkaloids, sterols, phenols and tannic acids [4].

Several biological effects were reported in various research works related to extracts of *Garcinia kola* seed on experimental animals and in cells in culture: chemoprotective [5], antioxidant, anti-inflammatory [6,7], anti-atherogenic [8] and hepatoprotective [9,10] action. Azu et al. [11] found out that the extracts of *Garcinia kola* seed have a hypoglycemic effect in normoglycemic and diabetic alloxan-induced rats. The administration of *Garcinia kola* extracts to rats has no hepatic adverse effect [12].

Despite the use of a wide range of synthetic antidiabetic drugs, diabetic patients are less and less balanced as regards their diabetes; this demonstrates that those drugs are not effective. Some patients become resistant to them and others do not respond to those treatments. Likewise, the long-term use of those drugs, the cost of which remains high, is not free of adverse effects especially in the liver and the kidney. There is renewed interest in dietary supplements and plants for the treatment of diabetes mellitus.

This study aimed to assess the effect of daily consumption of *Garcinia kola* seed on glycemia, creatinine and serum aminotransferases in adult subjects.

2. MATERIALS AND METHODS

2.1 Plant Material

We used *Garcinia kola* seeds bought in different local markets of Benin. Those seeds were identified at the botany laboratory of the Faculty of Agricultural Sciences of the University of Parakou. To ensure their better conservation, they were stored in jute bags. Table 1 shows the phytochemical constituents of *Garcinia kola* seed.

Table 1. Phytochemical composition of *Garcinia kola* seed [4]

Phytochemical	Mean value
Tannin (%)	0.3467 ± 0.01155
Saponin (%)	0.6800 ± 0.00000
Phytic Acid (%)	0.5500 ± 0.01732
Phenol (%)	0.1633 ± 0.00577
Trypsin Inhibitor (Tu/g)	2.7367 ± 0.00577
Sterol (%)	0.0933 ± 0.00577
Flavonoid (%)	2.1300 ± 0.06083
Alkaloid (%)	0.4333 ± 0.01528
Oxalate (%)	0.4333 ± 0.01528
Caffeine (%)	0.6067 ± 0.01528
Hydrogen Cyanide (mg/kg)	1.3467 ± 0.01157

2.2 Type and Period of Study

This research work was an intervention study based on a quasi-experimental approach. The data were collected from May 1 to July 30, 2019, i.e. over a three-month period.

2.3 Study Population and Sampling

The study population consisted of adult subjects from both sexes, who volunteered to participate to the study by giving their written consent. We included subjects aged 18 to 60 years, who were living in Parakou during the data collection period and with normal baseline kidney and liver function test.

This study did not include subjects with chronic alcoholism suffering from a liver or renal disease, on any kind of therapy, as well as pregnant women.

This research work also excluded subjects who did not attend the experiment till the end or with a normal ongoing pregnancy after study initiation.

Through a systematic census of all the adult subjects who volunteered to participate to our study, we recruited 40 adult subjects (18 men and 22 women) whose mean age was 36.10 ± 12.52 years.

The subjects selected thereby underwent blood sample collection to measure glucose level, creatinemia as well as ASAT and ALAT serum aminotransferases.

2.4 Experiment

During the experiment, the study subjects kept their usual lifestyle. Each study subject consumed, by chewing it, one seed (20 grams) of *Garcinia kola* per day during three (3) months without any break. At the end of each month, glycemia, creatinemia and serum aminotransferases were measured.

For the present study, venous blood samples (4 mL) were collected in dry tubes and sodium fluoride heparin from subjects fasting for at least 8 hours. The blood samples collected thereby were centrifuged at 4000 revolutions per minute (rpm) during 5 minutes; then, serums and plasmas were decanted to perform the different measurements on the same day. Glycemia was measured by means of endpoint colometric assay using glucose oxidase; creatinemia by means of JAFFE kinetic colometric assay; and the activity of aminotransferases (ASAT and ALAT) was determined with UV kinetic assay using the reagents ELITech® kit (ELITech Clinical Systems, France) on the automated SELECTRA PROS ELITech Clinical Systems (Dieren, The Netherlands).

2.5 Data Processing and Analysis

The data were processed and analyzed using the software SPSS 25 (2018 version). Figs were generated with the software Microsoft Office Excel (2016 version). The monthly mean values of parameters of interest were compared using analysis of variance (ANOVA). Student's t test served to compare the mean values of the initial

parameters of the study with the ones of the end of the experiment. The significance level chosen was 5%.

2.6 Ethical Considerations

The research protocol of this study has been approved by the Local Ethics Committee for Biomedical Research of the University of Parakou (Decision No. 0191/CLERB-UP/P/SP/R/SA). The written consent of participants to this study was requested and obtained. All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

3. RESULTS AND DISCUSSION

3.1. Glycemic Outcome

At the end of the experiment, *Garcinia kola* did not modify significantly glycemia: $p = .68$ for female subjects (Fig. 1), $p = .46$ for male subjects (Fig. 2) and $p = .43$ for all the 40 study subjects (Fig. 3). Glycemia still meets common standards despite its fluctuating progression.

In the literature, there are no studies reporting the effect of the *Garcinia kola* seed on glycemia in the human being. By contrast, several research works conducted on experimental animals have showed a reduction in glycemia after administration of extracts of *Garcinia kola* seed [13-16]. This reduction of glycemia was attributed to kolaviron which is a biflavonoid i.e. one of the main phytochemical constituents of the *Garcinia kola* seed [17,18]. Many other phytochemical compounds such as saponin, tannic acids and glycosides found out in the *Garcinia kola* seed may have a hypoglycemic i.e. glucose-lowering effect [19, 20]. The hypotheses related to the mechanism of hypoglycemic action of *Garcinia kola* seed may be [21]: Decreased release of glucagon or increased secretion of insulin; direct activation of glycolysis in the peripheral tissues; increased intracellular penetration of glucose; decreased intestinal absorption of glucose. Other possible mechanisms were suggested: Inhibition of alpha amylase and alpha glycosidase impeding the digestion of carbohydrates into digestible monosaccharides; glucose-induced insulin secretion; and declined glycogenolysis [21].

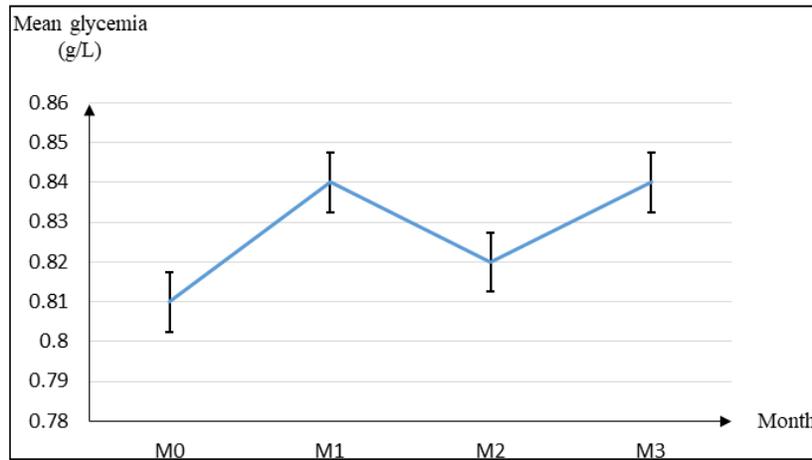


Fig. 1. Variations in the glycemia of the 22 female subjects during three months (M) of daily consumption of one seed of *Garcinia kola*, Parakou, 2019

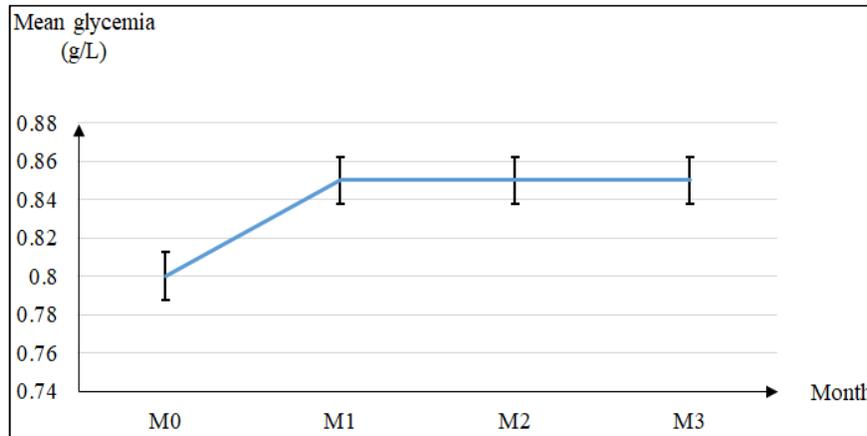


Fig. 2. Variations in the glycemia of the 18 male subjects during three months (M) of daily consumption of one seed of *Garcinia kola*, Parakou, 2019

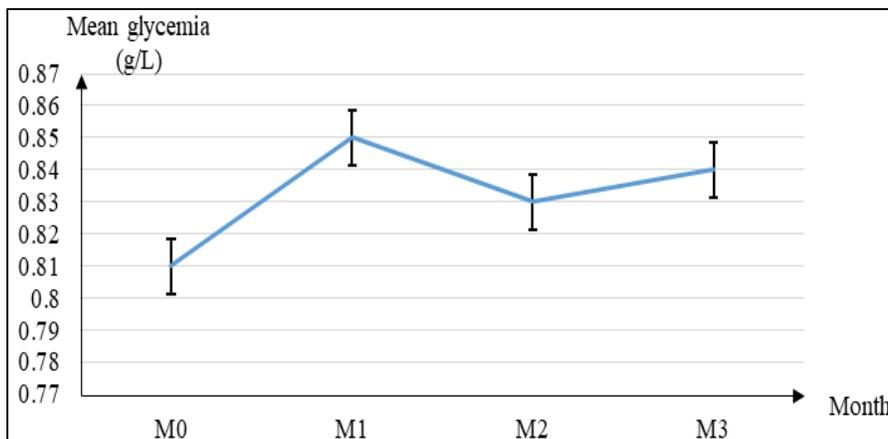


Fig. 3. Variations in the glycemia of the 40 subjects during three months (M) of daily consumption of one seed of *Garcinia kola*, Parakou, 2019

In this study, the absence of significant effect of *Garcinia kola* seed on glycemia may be due to study short duration, consumption of insufficient amount (one seed per day) or to intake schedule punctuated by meals.

3.2 Outcome of Serum Aminotransferases and Creatinine

At the end of the experiment, *Garcinia kola* reduced significantly creatininemia ($p = .007$) in male subjects (Fig. 4); ASAT ($p = .003$) and creatininemia ($p = .001$) in female subjects (Fig. 5); ASAT ($p = .025$) and creatininemia

($p = .010$) among the 40 subjects involved in the study (Table 2).

Fig. 6. Shows the significant decline of ASAT aminotransferase and creatininemia and stable evolution of ALAT in all the 40 subjects.

The reduction in ASAT activity ($p = 0.025$) was observed by Tamuno-Emine et al. [22] in a study carried out among human beings which showed a significant decrease in the serum activity of ASAT, and an absence of ALAT modification after the consumption of 20 grams of *Garcinia kola* seed during 10 days.

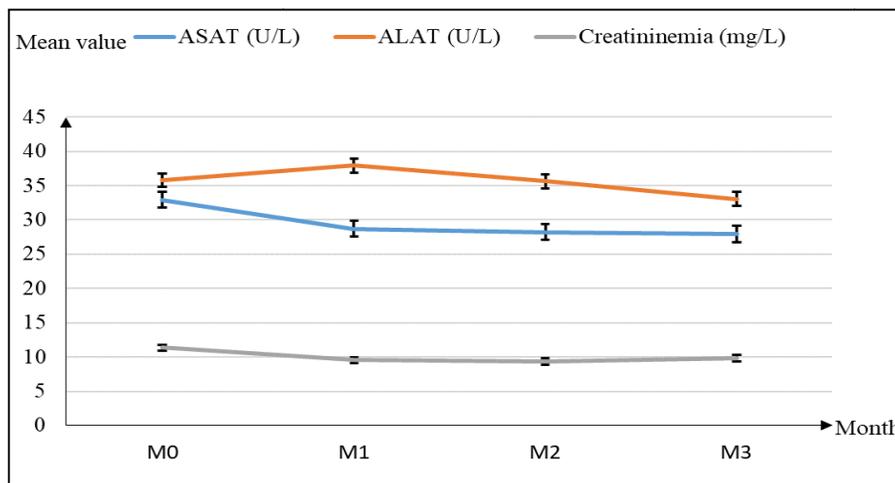


Fig. 4. Variations in mean values of aminotransferases and creatininemia of the 18 male subjects during three months (M) of daily consumption of one seed of *Garcinia kola*, Parakou, 2019

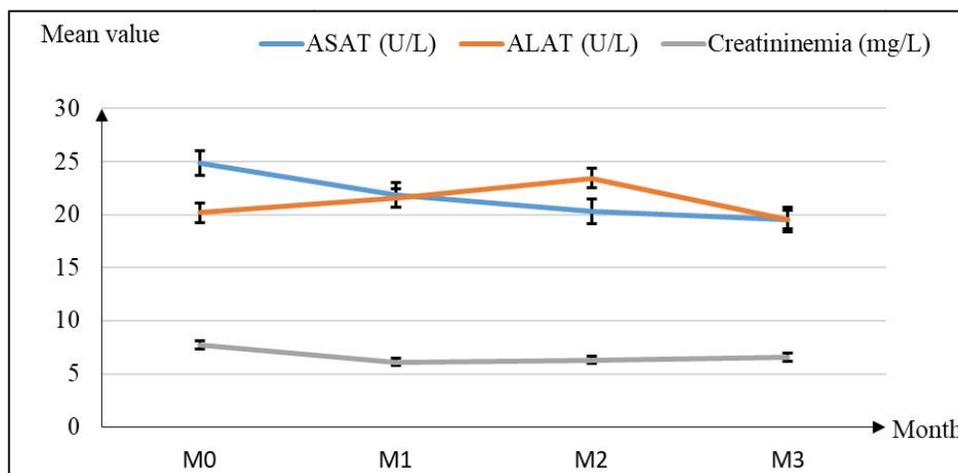


Fig. 5. Variations in mean values of aminotransferases and creatininemia of the 22 female subjects during three months (M) of daily consumption of one seed of *Garcinia kola*, Parakou, 2019

Table 2. Mean value \pm standard deviation of aminotransferases and creatininemia of the 40 subjects during the three months of daily consumption of one seed of *Garcinia kola*, Parakou, 2019

	M ₀	M ₁	M ₂	M ₃	P*	P
ASAT (U/L)	28.46 \pm 11.52	24.92 \pm 11.07	23.88 \pm 10.89	23.30 \pm 8.48	0.128	0.025
ALAT (U/L)	27.19 \pm 15.77	28.93 \pm 15.48	28.93 \pm 14.01	25.60 \pm 12.45	0.691	0.618
Creatininemia (mg/L)	9.36 \pm 2.44	7.65 \pm 2.41	7.66 \pm 2.11	8.01 \pm 2.15	0.002	0.010

M (months); p* (ANOVA); p (comparison of values M₀ and M₃)

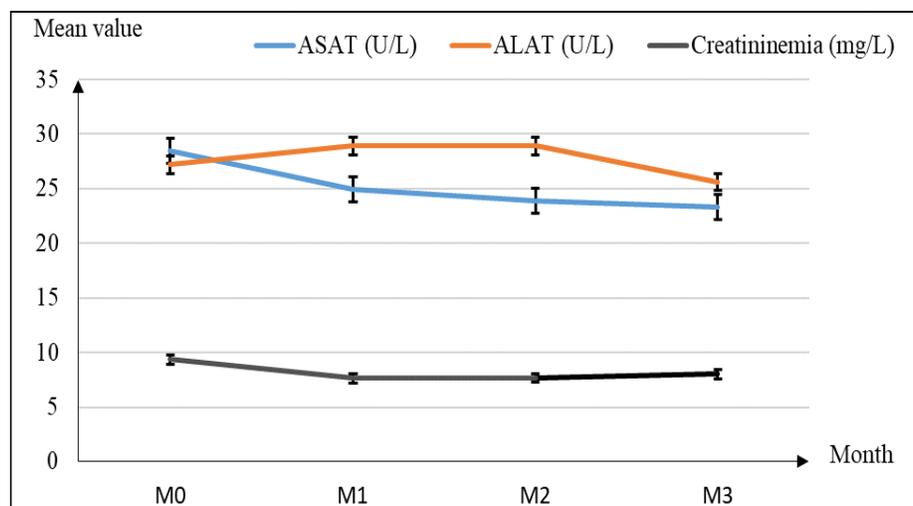


Fig. 6. Variations in mean values of aminotransferases and creatininemia of the 40 subjects during three months (M) of daily consumption of one seed of *Garcinia kola*, Parakou, 2019

In their study about the effect of acute consumption of *Garcinia kola* seed on liver enzymes, Biliaminu et al. [23] have reported by contrast an increased activity of ALAT and ASAT two hours after the consumption of 100 mg/kg of *Garcinia kola* seed in 28 apparently healthy subjects. Many authors [10,24-26] reported a decline in the activities of aminotransferases among rats fed with extracts of *Garcinia kola* seed. That decreased activity of serum aminotransferases may be due to the inhibition of their synthesis by alkaloids contained in the *Garcinia kola* seed [27]. Those different results show the hepatoprotective effect of the *Garcinia kola* seed which may be used in the prevention and management of liver diseases.

As in this study, many studies conducted on experimental animals highlighted a significant decline in creatininemia [26,28]. The different observations mentioned above may reflect the non-toxicity of *Garcinia kola* seed at the doses used and its beneficial effect on the renal function. Acute toxicity tests showed no adverse effects or mortality in mice at a dose of 2400

mg/kg, eight times the test dose in the study of Duzé et al. [14]. This confirms that *Garcinia kola* is safe to use, although biochemical studies for organ function and chronic treatment studies may be necessary to determine LD50 and thus confirm safety. However, *Garcinia kola* has been used for centuries as a food product in West and Central Africa.

4. CONCLUSION

The daily consumption of one seed (20 grams) of *Garcinia kola* during three (3) months without any breaks decrease creatinine rate and activity of serum aminotransferases and do not have a significance effect on glycemia.

Therefore, the *Garcinia kola* seed may be used in therapies due to its protective effects on the liver and kidney.

CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

ACKNOWLEDGMENTS

The authors are grateful to the volunteers who agreed to participate to this study. They also extend their gratitude to Mr. Sabi Alassane Orou Djara for his assistance concerning statistical analysis.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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