



Toxicological Effects of Saponin Extract from the Root of Bitter Kola (*Garcinia kola*) on the Biochemical and Haematological Parameters of Albino Rat Tissues

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Abstract Toxicological assessment of any herbal medicine is to identify adverse effects and to determine limits of exposure level at which such effects occur. Assessment of haematological and biochemical parameters could be used to determine the extent of deleterious effect of foreign compound including plant extract on biological systems. *Garcinia kola* is a medicinal plant with immense benefits used in traditional medicine. The effect of administration of doses of saponin extract from the root of *Garcinia kola* on Alanine aminotransferase (ALT), Aspartate aminotransferase (AST), Alkaline Phosphatase (ALP), Acid Phosphatase (ACP), bilirubin, total protein, creatinine, urea, glucose, PCV, Hb, and WBC in rats was determined to ascertain the toxic effects on vital organs and haematological parameters. The exposure of rats at 100, 200 and 400mg/kg of saponin extract of the root of *Garcinia kola* did not alter haematological composition negatively since there was no significant difference in the PCV and haemoglobin levels but there was a significant increase in the concentration of the WBC. The exposure of the animals to the saponin extract of the root of *Garcinia kola* at all the doses when tested for the biochemical parameters such as protein, urea, electrolytes; AST, ALT and ALP did not show any significant difference in their serum levels when compared with the control animals, although there were little variations in the tissues which could be as a result of increased or decreased de-novo synthesis of the enzymes. This indicates that the saponin extract may not be harmful at the levels tested and could be safely used for all the biological activities it possesses at these doses (100mg/kg, 200mg/kg and 400mg/kg) respectively. Saponin extract from the root of *Garcinia kola* could be explored for the synthesis of novel drugs in improving health care delivery.

Keywords *Garcinia kola*, Saponin, Toxicological, Haematological, Biochemical.

Introduction

During the past decade, traditional systems of medicine have become a topic of global importance [1,2]. Plant-derived substances have recently become of great interest owing to their versatile applications. Medicinal plants are the richest bio-resource of drugs of traditional medicines, modern medicines, nutraceuticals, food supplements, folk medicines, pharmaceutical intermediates and chemical entities for synthetic drugs [3,4]. The World Health Organization, (WHO), estimated that 80% of the population of Africa depends on medicinal plants to satisfy their health care requirements [5]. However, poisoning of animals with plants is a common clinical phenomenon and some medicinal plants may produce adverse long-term effects such as hepatotoxicity [6] Scientific evaluation of medicinal plants is important to the discovery of novel drugs and also helps to assess toxicity risks associated with the use of either herbal preparations or conventional drugs of plant origin.

Garcinia kola (Heckel), an angiospermae, belonging to the family *Guttiferae*, is known in commerce as bitter cola. The various medicinal benefits of saponin extracts from the root of *Garcinia kola* has been reported at different



doses by [7, 8 9, 10]. There are concerns by certain medical personnel that herbal medicines may be harmful to vital organs such as liver and kidneys. However, there seems to be paucity of information on safety evaluations of medicinal plants unlike the therapeutic potentials.

Thus, there is need to study the effects of these plants, which have potential for therapeutic benefits, to ascertain their safety in animals. This study was designed to evaluate the toxicological effects of saponin from the root of *Garcinia kola* using biochemical and haematological indices.

Materials and Methods

Animals

Adult male albino rats (165-200g) were obtained from the Animal House Unit of Biochemistry Department, University of Ilorin, Kwara State, Nigeria. The animals were maintained in a well ventilated room under 12 h light: 12 h dark cycle and were acclimatized for 2weeks in the animal house of Biochemistry Department, Ekiti State University before the start of the experiment. Animals were allowed to freely feed on their standard pellet diet and water *ad libitum*.

Experimental Design

Twenty (20) albino rats were divided into 4 groups of 5 rats each and subjected to different doses of saponin extract. The experimental groups were:

Group A- Control group: Rats were fed with normal rat pellets and water.

Group B- D Rats were fed with normal rat pellets and water with 100, 200 and 400mg/kg of saponin extract respectively.

The rats were fed for three weeks (21days) and were sacrificed by cervical dislocation.

Assessment of toxicological effects of saponin

The toxicological effects of saponin were assessed by evaluating its effect on some marker enzymes (AST, ALT, ALP, and ACP) of the vital organs like heart, liver and kidney [11]. Its effect on haematological parameters (PCV, WBC, and Hb), some important electrolytes like sodium and potassium, some metabolites like total protein, urea and glucose were also assessed. Protein concentration was estimated using the biuret method and glucose by glucose oxidase method earlier described.

Statistical Analysis

Quantitative data were recorded as means and standard deviation. Comparison of means was performed using of Variance (ANOVA) and Duncan multiple range test, Statistical significance among parameters was considered at $p < 0.05$.

Results

Table 1: Effect of Saponin extract from the root of *Garcinia kola* on PCV, Hb and WBC in the serum of albino rats

Group	PCV (%)	Hb (g/dl)	WBC ($\times 10^3$ cells mm^3)
Control	40.50 \pm 1.04 ^a	10.05 \pm 1.45 ^a	2.65 \pm 0.46 ^a
Saponin(100mg/kg)	40.00 \pm 1.19 ^a	9.91 \pm 0.41 ^a	13.00 \pm 0.15 ^b
Saponin(200mg/kg)	39.50 \pm 1.27 ^a	9.74 \pm 1.35 ^a	8.40 \pm 0.05 ^c
Sap (400mg/kg)	41.75 \pm 0.97 ^a	11.08 \pm 0.35 ^a	9.30 \pm 0.17 ^c

Results are mean of 5 determinations \pm SD. Using Analysis of Variance (ANOVA) and Duncan multiple range test, means with different alphabetical superscripts for the same parameter are significant different with respect to each other ($P < 0.05$).



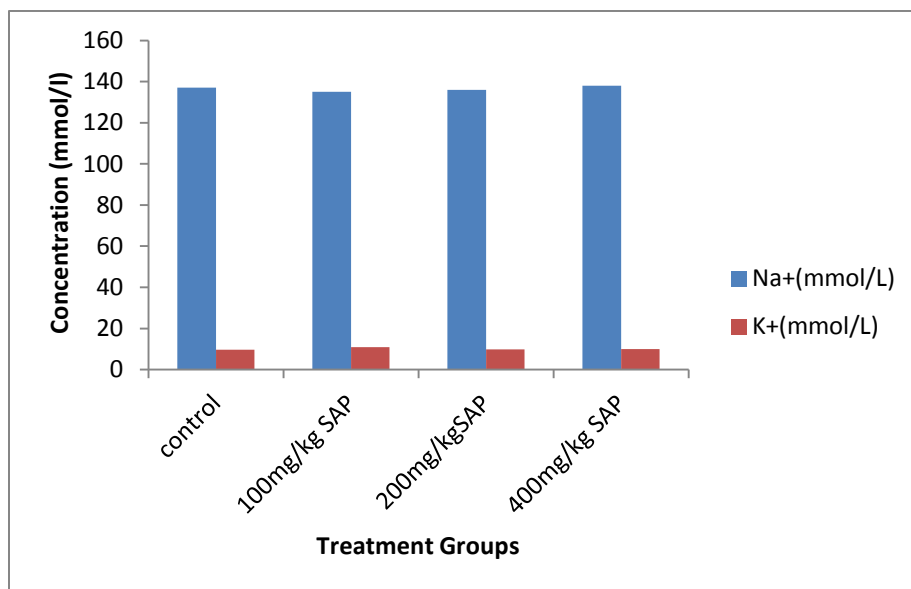


Figure 1: Effect of Saponin extract from the root of *Garcinia kola* on Serum Na⁺, K⁺ of albino rats
 Results are mean of 5 determinations ± SD. Using Analysis of Variance (ANOVA) and Duncan multiple range test, means

Within the same parameters are not significant different with respect to each other (P<0.05).

Table 2: Effect of Saponin extract from the root of *Garcinia kola* on urea, total protein and glucose in the serum of albino rats

Group	Urea (g/dl)	Total protein (g/dl)	Glucose (mg/dl)
Control	4.76±0.04 ^a	32.15±1.45 ^a	10.25±0.46 ^a
Saponin(100mg/kg)	4.45±0.19 ^a	31.91±0.41 ^a	8.19±0.15 ^b
Saponin(200mg/kg)	4.56±0.27 ^a	30.74±1.35 ^a	6.44±0.05 ^c
Sap (400mg/kg)	5.55±0.97 ^a	30.82±0.35 ^a	4.49±0.17 ^d

Results are mean of 5 determinations ± SD. Using Analysis of Variance (ANOVA) and Duncan multiple range test, means with different alphabetical superscripts for the same parameter are significant different with respect to each other (P<0.05).

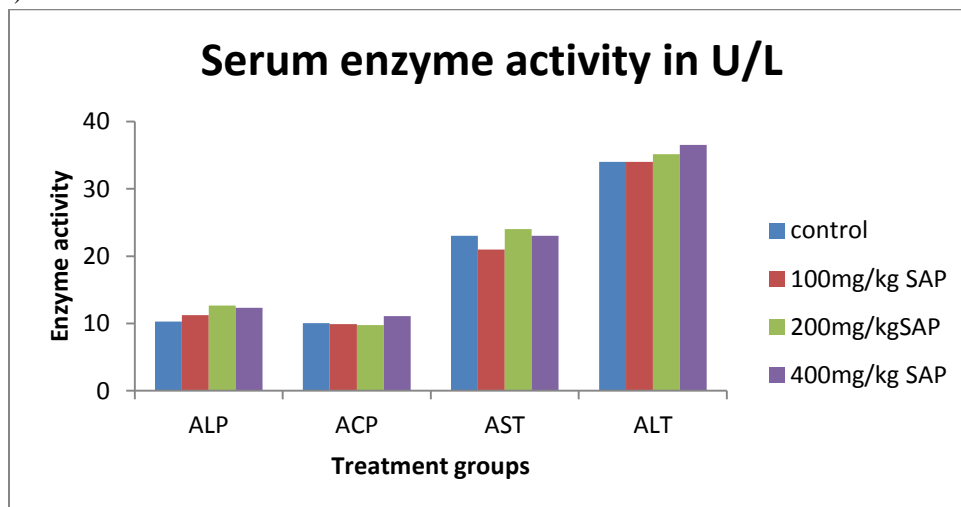


Figure 2: Effect of Saponin extract from the root of *Garcinia kola* on Serum ALT, AST, ALP and ACP
 Results are mean of 5 determinations ± SD. Using Analysis of Variance (ANOVA) and Duncan multiple range test, means Within the same parameters are not significant different with respect to each other (P<0.05).

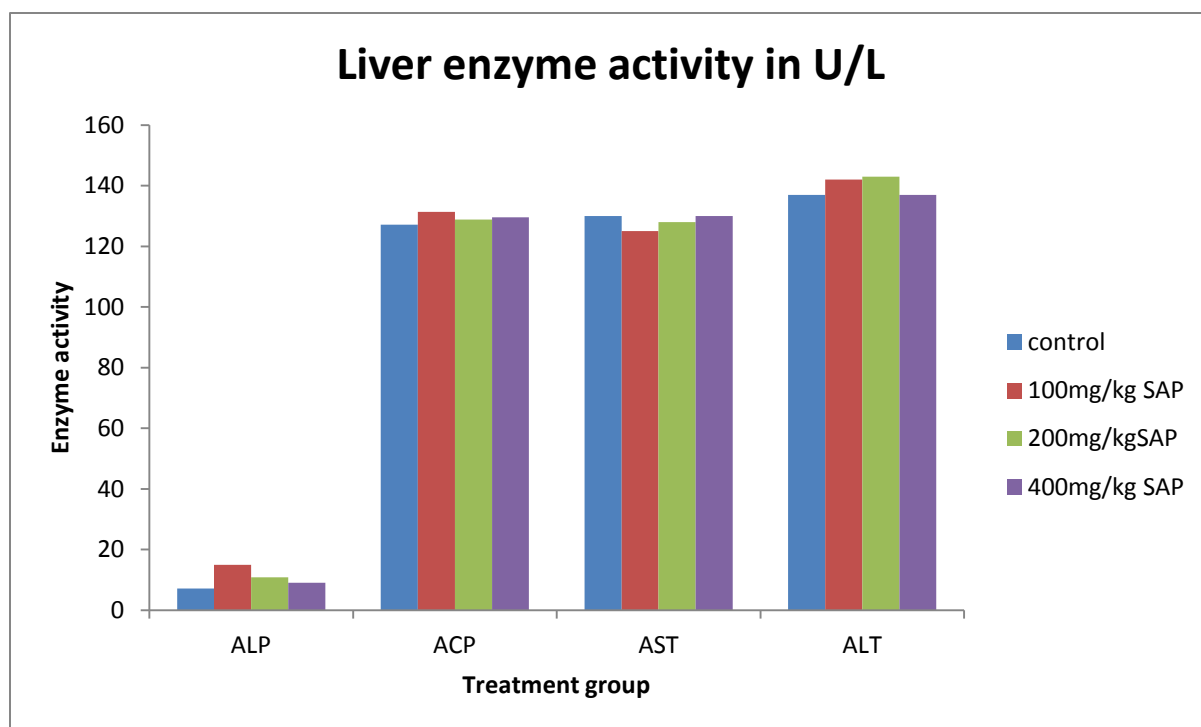


Figure 3: Effect of Saponin extract from the root of *Garcinia kola* on Liver ALT, AST, ALP and ACP
 Results are mean of 5 determinations ± SD. Using Analysis of Variance (ANOVA) and Duncan multiple range test, means within the same parameters are not significantly different with respect to each other (P<0.05).

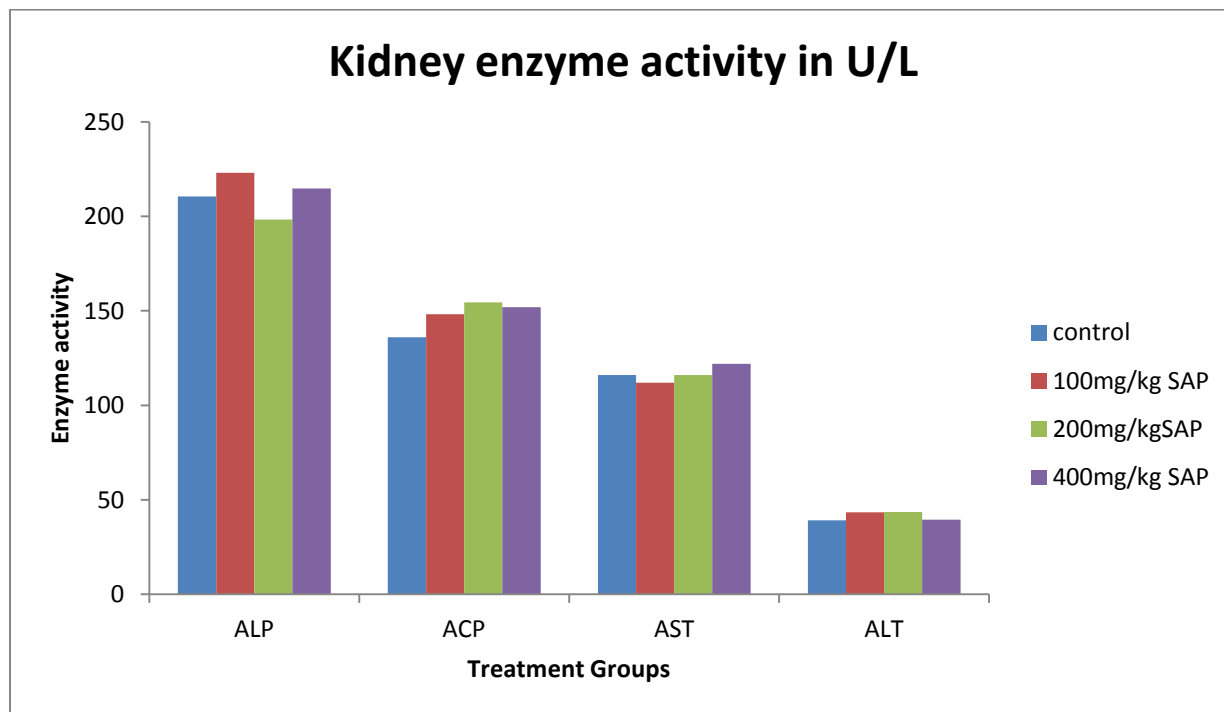


Figure 4: Effect of Saponin extract from the root of *Garcinia kola* on Kidney ALT, AST, ALP and ACP

Results are mean of 5 determinations \pm SD. Using Analysis of Variance (ANOVA) and Duncan multiple range test, means

Within the same parameters are not significant different with respect to each other ($P < 0.05$).

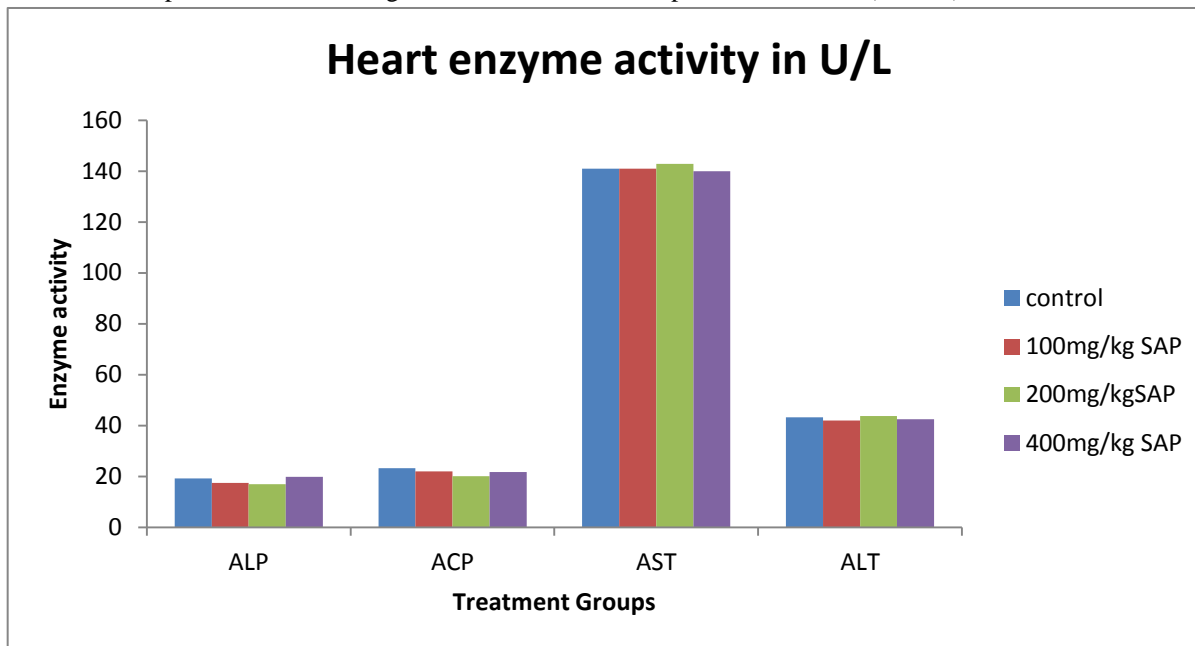


Figure 5: Effect of Saponin extract from the root of *Garcinia kola* on Heart ALT, AST, ALP and ACP

Results are mean of 5 determinations \pm SD. Using Analysis of Variance (ANOVA) and Duncan multiple range test, means

Within the same parameters are not significant different with respect to each other ($P < 0.05$).

Discussion

Dependence on herbs as medicine in the treatment of diseases is common among a large proportion of the rural populace because of its availability and affordability [12]. This dependence on natural products has its merits, but care must be taken not to consume harmful plants or high dose of plant extracts that could have deleterious effects on vital organs of the body either in the short term or long term. Biochemical tests have immense benefits in the diagnosis and monitoring of liver diseases [13], while haematological assays are also useful in early detection of the effects of harmful xenobiotics. The present study was therefore initiated to investigate the effect of administering doses of saponin extract of the root of *Garcinia kola* on the biochemical and haematological indices of albino Wistar rats, to determine their safety in animals.

Rats treated with 100mg/kg, 200mg/kg and 400mg/kg of saponin extract of the root of *Garcinia kola* did not show the signs of toxicity during period of the experiment. In the study, saponin extract of the root of *Garcinia kola* did not produce any significant increase in the mean values of body weights of rats treated at all doses. The treatment of rats at 100, 200 and 400mg/kg of saponin extract of the root of *Garcinia kola* did not alter haematological composition negatively since there was no significant difference in the PCV and haemoglobin levels but there was a significant increase in the concentration of the WBC. The significant increase in WBC counts in the test animals suggests that the extract may have immunological properties, by stimulating increased production of white blood cells, thereby boosting the defence system of the animals. This could account for the ability of saponin extract of *Garcinia kola* to act against a broad spectrum of pathogenic microorganisms. Haematological changes such as anemia are often accompanied with bone marrow toxicity [14]. According to [15] anemia that results after administration of agent can be a result of lysis of blood cells. However no such anemia is observed after treatment with the saponin extracts suggesting that there is no lysis of blood cells. Analysis of blood parameters with respect to animal studies has a high relevance and predictive value for humans [16]. This indicates its safe usage in humans.



The exposure of the animals to the saponin extract of the root of *Garcinia kola* at all the doses when tested for the biochemical parameters such as protein, urea, electrolytes; AST, ALT and ALP do not show any significant difference in their serum levels when compared with the control animals, although there are little variations in the tissues which could be as a result of increased or decreased de-novo synthesis of the enzymes.

The normal values of the biochemical parameters *Viz* urea and electrolytes suggest that the extract do not produce any sort of disturbance in the renal function, as it has been found in case of *Garcinia kola* saponin extracts. Transaminases and alkaline phosphatases are good indices of liver, heart and kidney damage respectively [17]. The activities of aspartate transaminase, alanine transaminase, alkaline phosphatase and the levels of protein, urea, glucose, and electrolytes show that the function of the liver, heart and kidney are not affected by the oral supplementation of saponin extracts of the root of *Garcinia kola*.

Conclusion

The observation of the current study portrays that the oral administration of the saponin extract of the root of *Garcinia kola* did not cause any mortality nor altered the biochemical and haematological indices. This indicates that the saponin extract may not be harmful at the levels tested and could be safely used for all the biological activities it possesses at these doses (100mg/kg, 200mg/kg and 400mg/kg) respectively. Saponin extract from the root of *Garcinia kola* could be explored for the synthesis of novel drugs in improving health care delivery.

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