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IMPACT OF GARCINIA KOLA SEED CONSUMPTION ON LIPID PROFILE AND ENZYMATIC ACTIVITIES IN HEALTHY INDIVIDUALS

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Abstract: Garcinia kola seed (G. kola seed) was investigated for its ability to exert an influence on serum lipid profile and activities of some hepatic marker enzymes of healthy human subjects. Different groups of healthy human subjects were fed with G. kola seed (20g) along with Eva premium table water (250ml), and 250ml Eva premium table water alone respectively, for 10 days. Results obtained showed that feeding human subjects with G. kola seed and water produced a significant increase ($p < 0.05$) in serum total cholesterol and HDL cholesterol concentrations, and a significant decrease ($p < 0.05$) in serum aspartate aminotransferase (AST) and alkaline phosphatase (ALP) activities. In the group of human subjects fed only water, none of the serum lipids and enzymes investigated was found to be significantly affected ($p > 0.05$). This investigation therefore shows that G. kola seed may have a beneficial effect, as evidenced by its ability to raise HDL cholesterol concentration, and a protective effect on liver function, as evidenced by its ability to produce a reduction in activities of serum AST and ALP.

Keywords: Garcinia kola seed, Serum lipids, Hepatic marker enzymes, Human subjects.

INTRODUCTION

The use of medicinal plants in managing patients with hyperlipidemia and various other disorders is currently on the increase (Akah *et al*., 2002; Anselm Adodo, 2002). Many plants are also in current use as supplements. Sometimes the aim is to lower blood concentrations or activities of some markers of disease states in order to improve health conditions (Akpanabiatu *et al*., 2006; Udenze *et al*., 2012). An example may be found in the use of *Garcinia kola* seed (hereafter referred to as *G. kola* seed) to lower blood glucose concentration in diabetic animals (Udenze *et al*., 2012). *G. kola* plant is a fruit-bearing plant that belongs to the family Guttiferae. The plant is found mainly in the tropical rain forest region of Central and West Africa (Uko *et al*., 2001; Agada and Braide, 2009). Traditionally it is claimed that every part of the plant is of medicinal importance. *G. kola* seed otherwise called "bitter kola" because of its bitter taste has been shown to possess anti-inflammatory, antidiabetic, antioxidant and antihepatotoxic activities (Iwu *et al*., 1990; Adegoke *et al*., 1998; Adegboye *et al*., 2008; Eminedoki *et al*., 2010; Udenze *et al*., 2012).

Phytochemical studies have shown that *G. kola* seed contains a variety of phytochemicals including flavonoids, saponins, tannins and cardiac glycosides (Adegboye *et al*., 2008; Adeyusi *et al*., 2012). The flavonoid component has been shown to be responsible for most of the biological activities of *G. kola* seed, including its ability to lower blood cholesterol concentration in hypercholesterolemic animals (Adaramaye *et al*., 2005).

In view of the possibility of *G. kola* seed to exert an influence on blood cholesterol concentration, and the fact that traditional medicine practitioners often prescribe and administer herbal preparations to patients without regard to possible adverse effects, this study was undertaken to investigate the effect of *G. kola* seed on serum lipid profile and activities of some marker enzymes of hepatic function of healthy human subjects.

MATERIAL AND METHODS

PLANT MATERIAL: Fresh *G. kola* seeds were purchased from the local market in Port Harcourt, Nigeria during December, 2014. The outer testa of each seed was peeled off before it was ingested.

STUDY PARTICIPANTS: Twenty (20) healthy human subjects were recruited for this study. The study protocol was carefully explained to each subject and consent was given to participate in the study. The subjects consisted of 12 males and 8 females aged 28 to 45 years, with body mass index (BMI) ranging from 21.5 to 27.5kgm^{-2}. None of the subjects was hyperlipidemic and none ingested any medicine or alcoholic beverage before and during the duration of the study.

STUDY DESIGN: The participants fasted overnight and were divided into 2 groups, each group consisting of 10 persons.

Group I participants were given to drink first thing in the morning for 10 days 250ml Eva premium table water (produced by Nigerian Bottling Company). Each participant was asked to eat 2 hours after taking the water.

Group II participants were fed 2 *G. kola* seeds plus 250ml Eva premium table water first thing in the morning for 10 days. On each day the participants were asked to eat 2 hours after consuming the test material.

BLOOD TEST: Blood was collected from the participants before feeding with test material on the 1st day and 2 hours after feeding on the 10th day. The blood samples thus collected were transferred into labeled tubes without anticoagulant. The blood was allowed to clot at room temperature and then centrifuged at 1500 x g for 10 minutes to obtain clear serum. Serum triglycerides concentration was measured using assay kit from Agappe Diagnostics, India, while serum total cholesterol and HDL cholesterol concentrations were determined using assay kit from Randox Laboratories, UK. Serum HDL cholesterol concentration was calculated using the expression:

$$\underset{(mmol/L)}{LDL\ Cholesterol} = \underset{(mmol/L)}{Total\ Cholesterol} - \frac{Triglycerides\ (mmol/L)}{2.2} - \underset{(mmol/L)}{HDL\ Cholesterol}$$

Serum alanine aminotransferase (ALT) and aspartate aminotransferase (AST) activities were determined using kits of Randox Laboratories, UK, while the activity of serum alkaline phosphatase (ALP) was determined using kit from Quimica Clinica, Spain.

STATISTICAL ANALYSIS: All values were expressed as mean ± standard error of mean (SEM) and statistically analyzed using student T-distribution test. Differences were considered significant at $p < 0.05$.

RESULTS

The effect of *G. kola* seed on serum lipid profile of the study participants is shown in Table 1. In the participants fed water alone, the concentrations of total cholesterol, triglycerides, HDL cholesterol and LDL cholesterol measured on the 1st and 10th days were found to vary nonsignificantly ($p > 0.05$). However, in participants fed 20g *G. kola* seed plus 250ml water, the total cholesterol concentration measured on the 10th day increased significantly ($p < 0.05$) to 4.42 ± 0.14mmol/L as compared to the value (4.06 ± 0.016mmol/L) measured at the beginning of the study. The increase in total cholesterol

concentration could be as a result of 15.5% increase in the mean HDL cholesterol concentration (Table 2).

In Table 3, serum activities of aspartate aminotransferase (AST) and alkaline phosphatase (ALP) were found to decrease significantly ($p < 0.05$) in human subjects fed 20g *G. kola* seed and 250ml water each day for 10 days. In subjects fed only water, serum activities of all three enzymes examined were found to show non-significant changes ($p > 0.05$).

Table 1: Effect of *G. kola* seed on Serum Lipid Profile of Human Subjects

Group Fed with	**Day**	**Serum Concentrations (mmol/L)**			
		TC	**TG**	**HDL**	**LDL**
Water alone	0 10	4.03 ± 0.05 3.98 ± 0.06	1.16 ± 0.06 1.19 ± 0.07	0.62 ± 0.05 0.65 ± 0.04	3.69 ± 0.06 3.79 ± 0.07
G. kola seed plus water	0 10	4.06 ± 0.16* 4.42 ± 0.14*	1.70 ± 0.08 1.64 ± 0.10	0.71 ± 0.04# 0.82 ± 0.04#	3.79 ± 0.07 3.74 ± 0.08

All values are expressed as mean ± SEM for 10 human subjects. Group means were compared for significant differences using student T-distribution test. * and # = statistically significant difference ($p < 0.05$)

TC = Total Cholesterol; TG = Triglycerides

HDL = High Density Lipoprotein Cholesterol

LDL = Low Density Lipoprotein Cholesterol

Table 2: Percentage change in cholesterol concentrations before and after *G. kola* seed feeding

Parameter	**Concentrations (mmol/L)**		**Mean Percentage Change**	**P-value**
	TC	**TG**		
Total Cholesterol HDL Cholesterol LDL Cholesterol	4.06 ± 0.16 0.77 ± 0.04 3.79 ± 0.07	4.42 ± 0.14 0.82 ± 0.04 3.74 ± 0.08	+8.9 +15.5 -1.3	2.4914 (Sig) 3.9728(Sig) 0.6061 (NS)

All values are expressed as mean ± SEM for 10 human subjects. SIG = Statistically Significant Difference ($p < 0.05$)

NS = Statistically Non-significant Difference ($p > 0.05$).

Table 3: Effect of *G. kola* seed on serum aspartate aminotransferase (AST), alanine aminotransferase (ALT) and alkaline phosphatase (ALP) activities of human subjects

Group Fed with	**Day**	**Serum Activities (iμ/L)**		
		AST	**ALT**	**ALP**

Water alone	0 10	9.13 ± 0.29 9.73 ± 0.32	8.20 ± 0.30 8.07 ± 0.25	25.67 ± 0.36 27.73 ± 0.96
G. kola seed plus water	0 10	9.00 ± 1.44# 7.40 ± 0.85#	7.93 ± 0.28 8.00 ± 0.26	31.00 ± 1.80* 27.00 ± 1.30*

All values are expressed as mean ± SEM for 10 human subjects. Group means were compared for significant differences using student T-distribution test. * and # = statistically significant difference ($p < 0.05$).

DISCUSSION

Studies have shown that hyperlipidemia is one of the major risk factors for some cardiovascular diseases such as atherosclerosis, and that cholesterol is the major lipid constituent of atherosclerotic plaque (Guttman, 1999; Ekpo *et al.*, 2007). Evidence from this study showed that *G. kola* seed feeding produced a significant increase ($p < 0.05$) in serum total cholesterol and HDL cholesterol concentrations. Similarly, in the study of Ibekwe *et al.* (2013), serum HDL cholesterol concentrations were found to be significantly elevated ($p < 0.05$) in rats fed *G. kola* seed diet relative to control.

Epidemiological and clinical studies show that cholesterol in HDL is inversely related to the incidence of coronary artery disease. The higher the serum HDL cholesterol concentration, the lower the incidence of coronary artery disease (Fletcher *et al.*, 2005). The fact that *G. kola* seed feeding caused a significant increase ($p < 0.05$) in serum HDL cholesterol concentration suggests that the kola seed may exhibit a protective role against coronary artery disease. The protective role of HDL cholesterol against coronary artery disease can be explained by its ability to counteract LDL cholesterol oxidation and to promote the reverse cholesterol transport pathway by inducing an efflux of excess accumulated cellular cholesterol (Yokozawa *et al.*, 2006).

Elevated serum LDL cholesterol and triglycerides concentrations may be risk factors related to atherosclerosis which causes thickening of the walls of blood vessels (Guttman, 1999; Ochei and Kolhatker, 2007). In this study, *G. kola* seed feeding for 10 days was found to produce a nonsignificant effect ($p > 0.05$) on serum LDL cholesterol and triglycerides concentrations. This observation indicates that *G. kola* seed may not promote atherosclerosis related to elevated serum LDL cholesterol and triglycerides concentrations.

Serum activities of aspartate aminotransferase (AST), alanine aminotransferase (ALT) and alkaline phosphatase (ALP) are markers of hepatic function. Alli Smith and Adanlawo (2012) reported that animals fed saponin from the root of *G. kola* had a significant rise ($p < 0.05$) in serum AST and ALP activities and a non-significant change ($p > 0.05$) in serum ALT activity. This observation is found to be inconsistent with the results of this study in which human subjects fed 20g *G. kola* seed had a significant decrease ($p < 0.05$) in serum AST and ALP activities, and a non-significant change ($p > 0.05$) in serum ALT activity (Table 3).

Serum AST and ALT activities could give indications of hepatic malfunctions. Serum ALP activity gives indications of both hepatic and bone malfunctions. An increase in serum activities of the three marker enzymes could be due to cellular leakage and loss of functional integrity of liver cells (Moore *et al*., 1985). The fact that *G. kola* seed feeding resulted in a decrease in the activities of serum AST and ALP indicated that the kola seed may have a protective effect on the liver.

CONCLUSION

Feeding human subjects with *G. kola* seed caused a significant increase in serum total cholesterol and HDL cholesterol concentrations, and a significant decrease in serum activities of AST and ALP. The raised serum HDL cholesterol concentration induced by *G. kola* seed suggested that the kola seed may exhibit a protective role against coronary artery disease, while the reduced serum AST and ALT activities showed that the kola seed may have a possible protective effect on liver function.

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