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Original Research

Chronic kola nut consumption and its effect on uric acid level and lipid profile

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ABSTRACT

Background: Kola nut, a caffeine rich nut is widely consumed in West African cultures as food, drug and beverages. Little is known about the health implications of kola nut consumption in humans. **Aim:** The present study therefore aimed at assessing the effects of chronic consumption of kola nut on uric acid and lipid profiles in humans. **Method:** Thirty chronic kola nut consumers with mean ± sd age of 55.3 ± 9.15 yrs and their age-matched non-kola nut consuming controls with mean ± sd age of 57.5 ± 7.85 yrs were recruited from Uburu in Ohozara Local Government Area (L.G.A) of Ebonyi State, Nigeria. Blood samples were collected for the measurements of uric acid and lipid profile. Assays were done by enzymatic colorimetric methods. **Result:** The chronic kola nut consumers had significantly ($p<0.001$) higher levels of uric acid, low-density lipoprotein (LDL), triglyceride (Tg) and total cholesterol when compared to their controls. On the contrary, kola nut consumers had significantly ($p<0.001$) lower high density lipoprotein (HDL) compared to the control. The incidence of hyperuricemia among kola nut consumers is 73.5% compared to 26.5% seen in control subjects. 95.5% of kola nut consumers had low HDL level and only 4.5% seen in control subjects. Logistic regression analysis indicated that the chronic kola nut consumers were at greater risk of hyperuricemia (OR = 11.66; 95% C.I., 3.38-40.22); abnormally low HDL (OR = 67.66; 95% C.I., 7.95-575.67); high Tg (OR = 30.0; 95% C.I., 1.81-4.97) and hypercholesterolemia (OR = 4.92; 95% C.I., 1.61-15.07) compared to the control. **Conclusion:** Chronic kola nut consumption raises the blood levels of uric acid, LDL, triglyceride and total cholesterol but lowers HDL level.

KEY WORDS: Kola nut; Uric acid; Lipid profile; Chronic consumption; Ebonyi state

INTRODUCTION

Kola nut is a bitter flavored, caffeine-containing nut of evergreen trees of the genus *Cola* and primarily of the species *Cola acuminata* and *Cola nitida* [1]. It contains theobromine (stimulant found in chocolate as well as in green tea), tannins, phenolics, phlobaphens, kola red, betaine, protein, starch, fat, thiamine, riboflavin, and niacin. Kola nut is consumed widely in Nigeria and many West African countries as part of traditional hospitality, cultural, and social ceremonies. Kola nut has been found to cause relaxation of smooth muscles [2] and one of its contents, caffeine is reported to combat fatigue by stimulating the central nervous system (CNS), heart, and muscles [3]. Other effects of kola nut include stimulation of gastric acid production, aiding of digestion, and improvement of the taste of food and acting as an appetite suppressant [4]. Kola nut and caffeine diets also cause decrease in food intake and body weight in mice [5]. The antioxidant and enzyme inhibition effects of kola nut are applied in folklore for the management/treatment of type-2 diabetes [6-7].

The biological effects of the kola nut extract have been attributed to its caffeine content [8, 2]. During pregnancy, maternal caffeine consumption is associated with an increased risk of foetal growth restriction [9-11] and increases the risk of miscarriage [12 -14]. Extract of *Cola nitida rubra* has been reported to reduce serum reproductive hormone concentrations and sperm count in male wistar rats [15]. Salahdeen et al [2] has shown that chronic consumption of kola nut and caffeine significantly decreased body weight, increased the mean arterial blood pressure and reduced the relaxation response to both acetylcholine and sodium nitroprusside in rat. Habitual chewing of kola nut can actually cause cardiac arrhythmias, based on clinical trials using rats [16].

Recent study by Nku et al, [17] shows that moderate consumption of kola nut increases serum cholesterol concentration in male Wister rats and may increase the risk of developing coronary heart disease while high consumption does the direct opposite and reduces the risk of coronary heart disease. Previous studies have also shown

that chronic administration kola nut extract in Wistar rat significantly decreased body weight and increased liver enzymes [17, 2]. Total plasma protein levels, creatinine, bilirubin, very low density lipoprotein (VLDL), low density lipoprotein (LDL) and total serum cholesterol levels were also significantly increased. However, urea was significantly reduced [18].

The rate of kola nut consumption in Eastern Nigeria has been on the increase in recent years. This is mainly because of the local belief that it cures catarrh, diabetes, cough and cold. Other reasons include its efficacy as a stimulant that helps students and drivers stay awake at night while studying and driving respectively, and its effect in aiding digestion. Despite the plethora of data on the effects of kola nut extract on some biological parameters in rats/mice, there is paucity of scientific reports on the adverse effects of its chronic consumption in humans. It is pertinent that we assess if chronic consumption of kola nut is actually beneficial or disadvantageous to human health by assessing some biological indices. The present study therefore assessed the effects of chronic consumption of kola nut on uric acid and lipid profiles in humans.

METHODOLOGY

Subjects and location: Thirty sex-matched chronic kola nut consumers aged 55.25 ± 9.15 years and mean ± sd BMI of 24.6 ± 1.86 were seen at Uburu community in Ohozara L.G.A of Ebonyi State, Nigeria. They were male and female indigenes of Uburu community in Ohozara whose occupation is to trade on kola nut. The people of Uburu community have a market where kola nut is popularly sold. High consumption of kola nut was seen among the "kola nut sellers". The test subjects (kola nut sellers) were also involved in farming which is a common occupation by the people of Uburu community and the entire Ebonyi State. The participants were selected among the "kola nut sellers" and are referred to as 'chronic kola nut consumers'. The participants consume between 1 to 4 kola nut seeds per day, at least 3 times a week and for a period of 1-8 years. Thirty age and sex-matched non-kola nut consumers aged 57.50 ± 7.85 years and mean ± sd BMI of 25.0 ± 4.47 were also recruited as control from the same community. Individuals above the age of 45 years and BMI greater than 25 kg/m^2 were excluded since these factors have shown to affect lipid profile and uric acid level. Both the control and test subjects had no history of arthritis, rheumatism, hypertension, obesity, diabetes amongst others. The test subjects (chronic kola nut consumers) were also non-smokers and non-caffeine users. The consent of all the subjects was sought after. Ethical approval for the study was granted by the Department of Medical Laboratory Science, Ebonyi State University, Nigeria. All procedures used in this study conformed to the guiding principles for research involving humans as recommended by the Declaration of Helsinki.

Sample collection and analysis: About 10 ml of venous blood was collected unto a plain container, spun and serum separated for the analysis of uric acid and lipid profile. Uric acid estimation and lipid profile were done using enzymatic colorimetric method by Randox (Crumlin, Co. Antrim, Northern Ireland).

Statistical analysis: Data were expressed as means and standard deviations for continuous variables and percentages for categorical variables. Comparative analysis between continuous variables was performed using independent sample t-test. 2-way cross-tab analysis was used to determine the incidence of the presence or absence of abnormal levels of study variables and their associations with kola nut consumption. Logistic regression was also used to compare the risk of developing abnormal levels of variables between the kola nut consumers and their non-kola nut consuming controls. Statistical significance was set at $P<0.05$. All statistics were performed using SPSS (Version 16.0).

RESULTS

In this study, we found that chronic kola nut consumers had significantly ($p < 0.001$) higher level of uric acid (mean ± sd, 7.89 ± 1.89 mg/dl) compared to their controls (mean ± sd, 5.98 ± 1.42 mg/dl). Chronic kola nut consumers also showed higher level of lipid profile ranging from TC (mean ± sd, 247 ± 22.63 vs. 206 ± 33.95), LDL (mean ± sd , 165.0 ± 17.27 vs. 116.48 ± 24.42 mg/dl) to Tg (mean ± sd , 172.06 ± 11.39 vs. 118.65 ± 22.16 mg/dl) when compared to their healthy controls. However, the mean ± sd HDL (35.31 ± 6.46 mg/dl) level for the chronic kola nut consumers was significantly ($p < 0.001$) lower when compared to that of control (mean ± sd 47.33 ± 11.10 mg/dl). See table 1. There is a positive and significant association between hyperuriceamia and chronic kola nut consumption. Chronic kola nut consumers are at greater risk of hperuriceamia compared to non-kola nut consumers. See table 2.

Table 1. Uric acid and lipid profiles of chronic kola nut consumers and their non-kola nut consuming controls.

VARIABLES	CONTROL (n = 30)	TEST SUBJECTS (n = 30)	T-Statistics	P-Value
Uric Acid (mg/dl)	5.98 ± 1.42	7.89 ± 1.89	-4.40	0.000
Total Cholesterol (mg/dl)	206.41 ± 33.95	247.29 ± 22.63	-5.48	0.000
High Density Lipoprotein (mg/dl)	47.33 ± 11.10	35.31 ± 6.46	5.33	0.000
Low Density Lipoprotein (mg/dl)	116.48 ± 24.42	165.0 ± 17.27	-8.88	0.000
Triglyceride (mg/dl)	118.65 ± 22.16	172.06 ± 11.39	-11.73	0.000

Table 2. The relationship between chronic kola nut consumption and uricemic status of subjects

URICEMIC STATUS OF SUBJECTS	CONTROL SUBJECTS N (%)	TEST SUBJECTS N (%)	TOTAL N (%)
Normouricemia	21 (80.8)	5 (19.2)	26 (100)
Hyperuricemia	9 (26.5)	25 (73.5)	34 (100)
Total	30 (50.0)	30 (50.0)	60 (100)

$\chi^2 = 17.37$; DF = 2; p = 0.000

HDL is associated with kola nut consumption as seen among the test subjects who showed a significantly higher incidence of low HDL level. Chronic kola nut consumers are at greater odds of presenting abnormally low HDL levels compared to controls (table 3). No significant association was linked with LDL level and chronic kola nut consumption. Chronic kola nut consumers were not at greater risk of presenting abnormally high LDL levels compared to controls (table 4). Triglyceride showed a significant association with chronic kola nut consumption. Chronic kola nut consumers are at greater risk of presenting abnormally high triglyceride levels compared to controls (table 5). Our study reveals that chronic kola nut consuming test subjects are 4.9 times more likely to have hypercholesterolemia compared to controls. There is measure of significant association ($p < 0.05$) between total cholesterol status of test subjects and kola nut consumption (table 6).

DISCUSSION

The present study shows increased uric acid level in chronic kola nut consumption. This study reveals that chronic consumption of kola nut poses a high risk of hyperuricemia to consumers compared to non-kola nut consumption. Uric acid (UA) is the final product of purine metabolism in humans. Gout is caused by elevated levels of uric acid in the blood. Uric acid crystallizes, and the crystals deposit in joints, tendons, and surrounding tissues. Hyperuricemia has been previously associated with the metabolic syndrome visa-vis hypertension, glucose intolerance, dyslipidemia, weight/obesity and increased risk of cardiovascular disease [19-23]. There is also mounting evidence that hyperuricemia itself may be an independent risk factor for cardiovascular disease [24]. The mechanism behind the relationship between kola nut consumption and hyperuricemia is not clear. However, a previous study by Kim et al, [25] indicated that caffeine consumption might have an effect on serum uric acid in females; however, coffee, tea, and caffeine intakes were not associated with the risk of hyperuricemia. Another study by Choi & Curhan [26] had shown that total caffeine from coffee and other beverages and tea intake were not associated with serum uric acid levels; the inverse association with coffee appears to be via components of coffee other than caffeine. Kola nut contains other phytochemicals other than caffeine and these components differ from those of coffee or tea and may be contributory to the present effects observed on uric acid level. However, to the best of our knowledge, none of the other components of kola nut has been previously linked directly with hyperuricemia.

Table 3. The relationship between chronic kola nut consumption and high density lipoprotein status of subjects

HDL STATUS OF SUBJECTS	CONTROL SUBJECTS N (%)	TEST SUBJECTS N (%)	TOTAL N (%)
Normal HDL	29 (76.3)	9 (23.7)	38 (100)
Abnormal HDL	1 (4.5)	21 (95.5)	22 (100)
Total	30 (50.0)	30 (50.0)	60 (100)

$\chi^2 = 28.70$; DF = 2; p = 0.000

Table 4. Association between chronic kola nut consumption and low density lipoprotein status of subjects

LDL STATUS OF SUBJECTS	CONTROL SUBJECTS N (%)	TEST SUBJECTS N (%)	TOTAL N (%)
Normal	30 (52.6)	27 (47.4)	57 (100)
Abnormal	0 (0)	3 (100)	3 (100)
Total	30 (50.0)	30 (50.0)	60 (100)

$\chi^2 = 3.15$; DF = 2; p = 0.076

Table 5. Association between chronic kola nut consumption and triglyceride status of subjects

TRIGLYCERIDE LEVEL	CONTROL SUBJECTS N (%)	TEST SUBJECTS N (%)	TOTAL N (%)
Normal	30 (75.0)	10 (25.0)	40 (100)
Abnormal	0 (0)	20 (100)	20 (100)
Total	30 (50.0)	30 (50.0)	60 (100)

$\chi^2 = 30.0$; DF = 2; p = 0.000

Table 6. Association between chronic kola nut consumption and total choleterol status of subjects

TOTAL CHOLESTEROL LEVEL	CONTROL SUBJECTS N (%)	TEST SUBJECTS N (%)	TOTAL N (%)
Normal	18 (72.0)	7 (28.0)	25 (100)
Hypercholesterolemia	12 (34.3)	23 (65.7)	35 (100)
Total	30 (50.0)	30 (50.0)	60 (100)

$\chi^2 = 8.29$; DF = 2; p = 0.004

Our finding also shows that chronic kola nut consumption raised blood LDL, triglyceride and total cholesterol but lowered HDL levels. Our data further reveals that chronic kola nut consumers are more likely to have abnormally high total cholesterol, triglyceride and low HDL levels. Lipids are common components of food and may perform essential roles. Their types may be more important with regard to health and disease than their amount. Dyslipidemia is a major cause of coronary heart disease (CHD); the most-common cause of death in the Western world and is characterized by increased levels of total cholesterol, LDL cholesterol, and/or triglycerides and decreased levels of HDL cholesterol [27-28]. Adekunle & Adebisi [29] investigated the modulatory effects of *cola* species on lipid and lipoprotein. Kola nut (Cola acuminate) extract elevated serum total cholesterol and triglyceride; reduced serum HDL. Our findings on elevated serum total cholesterol and triglyceride; reduced serum HDL agree with the work of Adekunle & Adebisi to a large extent. However, there were differences in methodology; Adekunle & Adebisi [29] used animal (rats) models that were given specific specie of kola nut but the participants seen in our study consumed different species of cola. Nku et al, [17] showed that serum total cholesterol (TC) triglyceride (TG), very low density lipoprotein (VLDL-C) and low density lipoprotein (LDL-C) were significantly higher in rats fed with low dose of kola nut extract compared with control. High density lipoprotein (HDL-C) and LDL-C were significantly reduced in rats fed with high dose of kola nut extract compared with control. Our finding cannot be compared with that of Nku et al, because their assessment is based on low and high dose of kola nut extract while ours was based on chronic consumption.

CONCLUSION

long term consumption of kola nut raises the blood levels of uric acid, LDL, triglyceride and total cholesterol but lowers HDL level. Positive association exists between kola nut consumption and uric acid. Chronic kola nut consumers are more likely to have abnormally high total cholesterol, triglyceride, levels but low HDL. Possible adverse effect resulting from long term kola nut consumption is unknown. More study is required in this area to fully elucidate the possible toxicity associated with kola nut consumption using animal model.

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