

Effect of *Irvingia gabonensis* Kernel Oil on Blood and Liver Lipids on Lean and Overweight Rats

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Abstract: Many studies suggest oils with a high medium chain saturated fatty acids content are responsible for the cholesterol-raising effect of saturated fat. The aim of this study was to evaluate the effect of the *Irvingia gabonensis* kernel oil on plasma lipoproteins, blood glucose and liver lipids in rats. A feeding experiment was carried out in which rats were fed to a normal diet and then received a daily administration of oil 1 mL of *Irvingia* oil or desionised water water (controls). After 4 weeks, blood lipids, blood glucose liver and fecal lipids were measured using standard methods. After 4 weeks the plasma HDL cholesterol ($p < 0.01$) and triglyceride levels (0.01) were higher in *Irvingia* oil group. There was no difference in plasma cholesterol and LDL cholesterol level but LDL:HDL and total cholesterol:HDL ratios ($p < 0.01$) were significantly lower after the administration of the *Irvingia* oil. The Blood glucose level ($p < 0.01$) of animals receiving *Irvingia* oil was also lower compare to controls. The liver cholesterol ($p < 0.01$) and triglyceride levels ($P < 0.002$) were significantly higher in *Irvingia* oil group. Although the *Irvingia* oil has a myristic acid and lauric acid values of 39.2 and 51.1%, respectively, the hypocholesterolemic effect can be explain by high the Vitamin A, β - carotene and may be phytosterols levels.

Key words: *Irvingia* oil, blood lipids, blood glucose

INTRODUCTION

Epidemiological surveys showed low cholesterol levels and low prevalence of coronary heart disease in populations consuming diet low in total fat, saturated fatty acid and cholesterol. The effect of dietary Saturated Fatty Acids (SFA) on total cholesterol levels is well established. The increase in total cholesterol induced by SFA is due mostly to an increase in LDL cholesterol due to an increase in the number of LDL particles. The increase prevalence of coronary heart diseases in many population is associated to a high consumption of Saturated Fatty Acids (SFA) diets undoubtedly have a high coronary risk in spite of their higher HDL levels^[1-4]. Saturated dietary fat usually contains a mixture of SFA of different chain lengths. It has been demonstrated that the different SFA are not equally hypercholesterolaemic. The principal SFA in cameroonian diets is palmitic acid (C16:0), stearic acid (C18:0), myristic acid (C14:0) and lauric acid (C12:0). Many studies suggest that lauric, myristic and palmitic acids responsible for the cholesterol-raising effect of saturated fat^[5-7]. Recent findings about differences in the cholesterol-raising potential of the different SFA, the general recommendation to reduce the amount of SFA consumed. This study was designed to

evaluate the effect of *Irvingia gabonensis* oil on blood lipids and glucose in young and adults overweight rats.

MATERIAL AND METHODS

Plant: Fruit of *Irvingia gabonensis* were collected in the Southern province of Cameroon And identified in the National Herbarium (IRAD, Cameroon).

Preparation of the extract: The dry seeds of *Irvingia gabonensis* were ground in a mixer. Ground plant material was extracted with hexane as follows. Two Thousand gram of the dried powdered. Seeds were extracted with 5l of hexane (3l, 1l, 1l, three extractions). The solvent was evaporated to at room temperature for 2 weeks. The oil content of the seeds was 68 %.

Animals: Wistar male rats (270-280 g) were used in these experiments. The animals were housed in standard cages with food and water ad libitum, at room temperature ($20 \pm 2^\circ\text{C}$) with artificial light from 7.00 am to 7.00 pm. The animals kept under controlled environment following the standard operating procedures of the animal house facility.

Treatment: Rats were divided into 2 test groups of 8 animals. Both groups were fed on a standard diet. One group received one daily oral administration of 1mL of *Irvingia gabonensis* oil for four weeks. The other group received desionised water (1 mL) and served as controls. The diet was prepared according to the guidelines for care and use of experimental animals issued by the UK Home office And contained 36% maize starch,30% sucrose, 20% casein, 8% maize oil, 4% mineral mix and 2% vitamin mix. Throughout the study all rats were housed in individual cages and had free access to water and food. Body weight, food intake and fecal output were measured daily.

Sampling procedure: After four weeks of treatment, rats were were anesthetized with diethyl ether and were killed after a 12 h fasting. Blood was collected from the abdominal aorta into heparinized centrifuge tube. The liver, abdominals and subcutaneous fat were also removed, rinsed in ice-cold saline water, blotted dry with tissue paper, weighed and stored at - 4°C until extraction of lipids.

Analytical procedure: Total cholesterol and glucose in plasma were determined using enzymatic method^[8,9] and plasma triglyceride was determined as previously described^[10]. HDL cholesterol was determined using a heparin manganese precipitation of Apo B- containing lipoproteins^[11]. LDL cholesterol was calculated using the friedwald formula^[12] Total lipids in liver and feaces were extracted by the method of folch *et al.*,^[13]. The total cholesterol and triglyceride contents in this lipid fraction were measured using the same diagnostics kits for plasma analysis.

Statistical analysis: The data was expressed as Mean ± SEM for eight rats. All statistical analysis was done by unpaired student t-test.

RESULTS AND DISCUSSION

Body weight: The changes of body weight were not different between the two group, but abdominal fat was significantly lower ($p < 0.05$) in Irvingia oil group (Table 1).

Blood lipids and glucose: The plasma HDL cholesterol ($p < 0.01$), triglyceride (0.01) were higher in Irvingia oil group. There was no difference in plasma cholesterol and LDL cholesterol level but LDL:HDL and total cholesterol:HDL ratios ($p < 0.01$) were significantly lower after the administration of the Irvingia oil. The Blood glucose ($p < 0.01$) of animals receiving Irvingia oil was lower compare to controls (Table 1)

Table 1: Effect on body weight, blood lipids, blood glucose, liver and fecal lipids

Variables	Irvingia oil	Controls
Intial weight (g)	269.5±6.19	289±5.63
Final weight (g)	270.5±5.7	278.9±7.52
Intra abdominal fat (g ⁻¹ kg body weight)	24.8 ±6.12*	36.3±4.91
Subcutaneous fat (g ⁻¹ kg body weight)	36.3±4.91	35.7 ±3.95
Blood lipids		
Total cholesterol (mg dL ⁻¹)	61±12.242	53.00±2.95
Triglyceride (mg dL ⁻¹)	98.50±9.85**	63.25±2.53
HDL (mg dL ⁻¹)	23.25±2.13**	15.50±0.64
LDL (mg dL ⁻¹)	16.73±2.50	22.11±3.28
TC/HDL	2.75±0.15**	3.42±0.10
LDL/HDL	0.33±0.26**	1.47±0.17
Blood glucose (mg dL ⁻¹)	57.46.40±1.2**	64.80±1.74
Liver lipids		
Liver weight (g / 1000g body weight)	31,1 ±2,76	25,5 ±1,72
cholesterol (mg g ⁻¹ liver)	94±4.32	30.6±1.51*
Triglyceride (mg g ⁻¹ liver)	166,68±8.17	66±3.11**
Fecal lipids		
Fecal weight (wet wt /d)	2.30±0,02	2.26±0,03
cholesterol (mg g ⁻¹ feces)	26.8±0.63	22±0.85
Triglyceride (mg g ⁻¹ feces)	27.43±0.95	23±1.02

Mean ± SEM, n=8 * $p < 0.05$; ** $p < 0.01$ vs controls

Liver and fecal lipids: Irvingia oil increased both liver cholesterol ($p < 0.01$) and triglyceride level ($p < 0.002$) compare to controls. There was no difference in faecal lipid excretion.

Ejiofor^[14] has given myristic acid and lauric acid values of 39.2% and 51.1% from *I. gabonensis* var. *excelsa* (now *I. wombolu*) kernels from Cameroon.

DISCUSSION

Ejiofor^[14] and Okolo^[15] reported that the myristic acid and lauric acid content of *Irvingia* kernels vary depending on the source of the fruits (Nigeria: 50.6 and 38.8%; Sierra Leone: 33.5 and 58.6%, respectively). Unpublished data has given myristic acid and lauric acid values of 39.2% and 51.1% from *I. wombolu* kernels from Cameroon. Although Irvingia oil has a high level of myristic and lauric acid cited as having the greatest impact on serum cholesterol^[1,16,17], the administration of that oil to normaolipidemic rats did not affect the plasma total cholesterol. This results are in contradiction with previous studies which suggested that oil with a high levels of saturated fatty acids with chain lengths longer than 10 carbons raised serum cholesterol levels. Hegsted *et al.*^[18]. Dietschy *et al.*^[19] found that changes in plasma LDL-C concentration are secondary consequences to changes in liver metabolism of dietary cholesterol and fatty acids. A high levels of saturated fatty acids (C12:0, 14:0, 16:0), result in a decrease in the level of liver LDL receptor activity and an increase in the LDL-C production rate. The side effects of saturated fatty acid of the irvingia oil is limited by the phytonutrients such as carotenoids, tocopherols, tocotrienols and phytoosterols present in

irvingia oil in high amounts. Phytonutrients such as tocotrienols have been demonstrated to have potent antioxidant properties^[20], reduced cholesterol levels^[21, 22, 23], delay atherosclerosis progression^[24].

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