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Effects of Three Nigerian Stable Oils on the Plasma Lipid Profile of Wistar Rats

[1]J.A. Badmus, [1]A.L. Adedeji, [2]E.O. Omotoso, [2]A.O. Oyewopo and [3]A.O. Akintola
[1]Department of Biochemistry, [2]Department of Anatomy,
[3]Department of Science Laboratory Technology, Ladoke Akintola University of Technology,
Ogbomoso, Nigeria

Abstract: High intake of dietary fat has been implicated in the incidence of cardiovascular disease. The effects of 3 Nigerian dietary oils (crude palm oil, refined palm olein of Malaysian origin and crude groundnut oil) were assessed on plasma lipid profile of wistar albino rats. Twenty rats were randomly divided into four groups of 5 per group. Rats in the control group were given normal feeds only while in addition the treated groups were given 1 mL of additional crude palm oil, groundnut oil and refined palm olein oils as supplement *adlibitum* for 28 days. Results showed decline in High density lipoprotein (HDL-C), Low density lipoprotein cholesterol (LDL-C) and total cholesterol (HDL-C) concentrations in all the treated groups compared to control group. HDL-C reduction was significant only in groundnut oil treated group ($p< 0.05$) while LDL-C percentage concentration reduction were 14.6, 44.9 and 10.8% and TC decreased by 18.18, 25.59 and 17.14% in groups treated with palm oil, refined palm olein and groundnut oil, respectively. Plasma triacylglycerol (TG) was signicantly higher only in the group treated with refined palm olein ($p< 0.05$) while other treated groups showed insignificant reduction. There was no significant difference in plasma lipid ratios of LDL-C/HDL-C and TC/HDL-C in the treated groups compared to control group whereas there was higher Triacylglycerol/ HDL-C ratio as shown only in the group treated with refined palm olein. The present findings showed that refined palm olein oil like palm oil and groundnut oil has no adverse effect on plasma total cholesterol and LDL-C except in plasma triacylglycerol and TG/HDL-C ratio.

Key words: Dietary fat, cardiovascular, plasma lipid,wistar rats, Nigerian Stable oils

INTRODUCTION

Dietary fat is an essential nutrient in balanced diet and it has been implicated by several studies to specific diseases such as cardiovascular disease, cancer, high blood pressure and obesity. Dietary fat plays an important role in influencing blood lipid concentrations, thrombostic tendency and thus onset of Cardiovascular Disease (CVD) (Keys *et al*., 1986 and Hetzel *et al*., 1989). Cardiovascular disease remains the leading cause of death in both industralised and underdeveloped countries. (Van der Sande *et al*., 2001). Elevated concentrations of Plasma Total cholesterol, Triglyceride and Low density lipoprotein-cholesterol (LDL-C) have proved to be among the risk factors in the development of CVD (Stamler *et al*., 1986; Hegele *et al*., 2007). Red palm oil, groundnut oil and refined palm olein are sources of fat in Nigeria and some other part of Asian countries. The ratio of unsaturated to saturated fatty acid is close to one in red palm oil and it has been reported to contain antioxidants vitamins, reduce oxidative stress-induced hypertension in normal rats (Bayorh *et al*., 2005). Refined palm olein is the liquid fraction obtained from the refining and bleaching crude red palm oil. The refining process improves the quality with the addition of monounsaturated oleic acid and reduction of palmitic acid (MacFarlene *et al*., 1984). Groundnut oil contains 46 and 32% of monounsaturated and polyunsaturated fatty acids, respectively (USDA, 1997). Groundnut oil has also been reported to have effect on mycardial infaction (Srinivasan and Pugalendi, 2000) and on Total cholesterol (TC), Very low density lipo-protein-cholesterol (VLDL-C), Low density lipoprotein-cholesterol (LDL-C) and Triglyceride (TG) levels in diabetic rats (Ramesh *et al*., 2006). Manorama *et al*. (1991) has shown that crude palm oil has adequate nutritional quality compared with groundnut oil. However, there are few studies on the effect of refined palm olein on the plasma lipid profile and hence this study.

Corresponding Author: J.A. Badmus, Department of Biochemistry, Ladoke Akintola University of Technology, Ogbomoso, Nigeria

MATERIALS AND METHODS

Materials: All Kits used were obtained from Randox Laboratories Limited UK and stored according to manufacturer specifications. Other chemicals used were of analytical grade.

Oil samples: crude palm oil and groundnut oil were purchased from a local market in Ogbomoso, Nigeria. Refined palm olein of Malaysian origin (Turkey King Brand) was purchased from supermarket in Ogbomoso, Nigeria.

Animals: Twenty male albino rats were purchased from Animal House University of Ilorin, Nigeria. After acclimatization, rats were divided randomly into 4 groups.

Experimental protocol: In control group, rats were fed with normal diet only and treated groups were fed in addition to normal diet with 1 mL of different oils for 28 days. At the end of the experiment, the feeding of rats was stopped for 12 h before they were sacrificed by cervical dislocation and blood was taken through cardiac puncture.

The plasma levels of cholesterol, triglyceride, HDL-C and LDL-C were analyzed using commercial Kit from Randox Laboratories Limited UK.

Statistical analysis: All data expressed as the mean±SD. One-Way Analysis of Variance was used and $p<0.05$ was considered to be significant.

RESULTS AND DISCUSSION

Recent scientific reports have indicated abnormal blood lipid level, particularly total cholesterol and low density lipoprotein cholesterol predispose individual to atherosclerosis and cardiovascular diseases (Nwanjo and Oze, 2007; Chrysohoou *et al.,* 2004; Glew *et al.,* 2001 and Ginsberg, 1994). Several studies have shown the role of palm oil and groundnut oil (Edem, 2002; Ramesh *et al*., 2006) on the predictors of cardiovascular disease but there is limited information on the refined palm olein that is increasingly becoming preference of people because of improved taste and bleached colour.

In the present study, the plasma lipid profile of rats fed with palm oil, groundnut oil and refined palm olein against the control group were evaluated. The results revealed that Plasma cholesterol concentrations of all the treated groups were lowered compared to control group and the reduction was significant in refined palm olein treated group (Table 1).

HDL and LDL are 2 of the 4 main groups of plasma lipoprotein that are involved in lipid metabolism and exchange of cholesterol, cholesterol ester and triglycerides between tissues (Gordon and Rifkind, 1989; Sviridiv, 1999; McNamara, 1999). Studies have demonstrated an inverse relationship between HDL-C and incidence of cardiovascular disease (Maron, 2000). HDL-C concentration for all the treated groups showed insignificant reduction compared to control group. This probably may be due to reduced plasma cholesterol concentration observed in the treated groups. Plasma LDL-C concentration of the treated groups were lowered compared to control group and there was significant reduction of LDL-C as shown in the group treated with refined palm olein oil. Nwanjo and Oze (2007) have shown the relationship between plasma LDL-C and the incidence of cardiovascular disease is well documented.

Elevated plasma triglyceride concentration also contribute directly to increase risk of cardiovascular disease and such elevation is associated with obesity, metabolic syndrome, proinflammatory and prothrombotic biomarkers and type 2 diabetes mellitus which, predispose to CVD (Hodis *et al*., 1999). Palm oil and groundnut oil treated groups showed insignificant reduction in triacylglycerol concentrations compared to control while refined palm olein oil treated group significantly showed elevation in plasma triacylglyceride concentration ($p<0.05$). The increase in plasma triacylglycerol may be due to upregulating synthesis and secretory pathways or reduced lipoprotein lipase activity (Hegele *et al*., 2007).

Lipid ratios like total cholesterol/HDL-C and the LDL-C/HDL-C also correlate with cardiovascular disease (Oladipo *et al.,* 2005) and also triacylglycerol/ HDL-C has been recognized as a potentially stronger predictor of myocardial infarction (Maruyama., 2003). Total/ HDL-C and LDL-C/HDL-C ratios in the treated groups showed no significant difference as compared to control group. Triglyceride/HDL-C ratios in the treated groups were also

Table 1: The effects of the oils on the plasma lipid profile of rats

Groups	Treatments	TRG (mg 100 mL^{-1})	TC (mg 100 mL^{-1})	HDL-C (mg 100 mL^{-1})	LDL-C (mg 100 mL^{-1})
A	Palm oil	48.3±10.8	72.0±13.7	35.6±9.00	26.8±9.73
B	Refined palm olein	63.0±2.64	66.0±10.4	36.3±8.50	17.3±2.61
C	Groundnut oil	49.0±2.40	73.5±14.5	34.5±1.70	28.0±14.5
D	Control	50.7±4.51	88.7±4.60	47.0±1.70	31.4±5.60

Values are expressed as means±SD, n = 5

Table 2: The effects of the oils on the plasma lipid ratios

Groups	Treatments	TC/HDL	LDL/HDL	TRG/HDL
A	Palm oil	2.10±0.45	0.51±0.32	1.38±0.25
B	Refined palm olein	1.83±0.15	0.49±0.09	1.80±0.44
C	Groundnut oil	2.10±0.36	0.81±0.41	1.42±0.12
D	Control	1.90±0.10	0.67±0.13	1.08±0.13

Values are expressed as means±SD, n = 5

not significant except in the group treated with refined palm olein oil, which was significant compared to control group (Table 2).

CONCLUSION

Results of the present 28 days study support the ealier reports on the effect of both palm oil and groundnut oil on the rat plasma lipids profile. Further studies, however, is required to confirm the long time effect of refined palm olein on the Plasma triacylglycerol.

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