BIOCHEMISTRY

EFFECT OF *Amaranthus spinosus* (Linn) LEAF EXTRACT ON PLASMA LIPID LEVELS IN RATS

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Abstract

The plasma lipid levels of rats treated for 14 days, with oral graded doses (25.0, 50.0 and 100mg/kg body weight) of aqueous leaf extract of *Amaranthus spinosus* were investigated. It was observed that relative to the control (water-treated) animals, the extract - treated animals showed decreased plasma total cholesterol, HDL - cholesterol, LDL - cholesterol and triglyceride levels. The HDL/I,DL - cholesterol ratio decreased in the treated animals which also showed reduced gain in body weight relative to the control. The effects of the extract on these parameters were dose dependent. It was suggested that prolonged consumption of *Amaranthus spinosus* could prevent atherosclerosis.

Key Words: *Amarathus spinosus,* amaranthaceae, Lipid levels, Rats.

Introduction

It is generally accepted that blood cholesterol level affects atherosclerosis and coronary heart disease; however, this level greatly depends on the kind of food consumed.

In Nigeria, vegetables are consumed as food because they are rich in protein, fat, minerals, vitamins and for treatment of different types of diseases (Obasi and Okoro, 1997). Though the consumption of some of these vegetables is often accompanied by serious side effects such as gastrointestinal disorders, which may be attributed to cathartic property of the vegetables (Arowolo *et al,* 1989), *Amaranthus spinosus* (family Amaranthaceae) leaves and stems are widely usedin many African countries including Nigeria to treat certain ailments such as snakebite, colic and menorrhagia (Ayesu, 1978). Though *A. spinosus* itself is not edible, it belongs to a genus whose members are widely cultivated and eaten as vegetables. Recently, the leaf extract was reported to possess anti-inflammatory activity (in *vitro)* and has high specific prostaglandin synthesis inhibiting activity (Ibekwuike *et al,* 1997).

Akinloye and Olorede (2000) also reported the anaemic as well as anti-diabetic properties of the leaf extract of *Amaranthus spinosus.* The present work was carried out to evaluate the effects of graded doses of the aqueousleaf extract of the plant on plasma cholesterol level.

Materials And Methods

Plant Materials

Fresh leaves of A. *spinosus* were harvested from a local garden in Sokoto and were authenticated by a Taxonomist, Mallam Umaru at the Botany Department of Usmanu Danfodiyo University, Sokoto.

Preparation of Crude Aqueous Extract

The fresh leaves were washed, air- dried and milled to fine powder. One hundred and sixty grams (160g) of the powder was soaked in distilled water (800ml) and left to stand for 24 hours with occasional shaking. Thereafter, the mixture was filtered, and the filtrate evaporated in a water bath at 97°C so as to obtain a solid residue. The yield of the extract was 13% w/w. The residue was obtained and stored in a dessicator. Solutions of required concentrations were prepared on each day of extract administration. Treatment of Animals with the Extract. The rats were separated into four groups (A,B,C and D) of five animals each. Animals in groups B, C and D were given *25,* 50 and 100mg/kg body wt. oral doses of the crude aqueous leaf extract in 1ml of water respectively. The control (Group A) animals were given water only. The animals were treated for 14 days.

They were weighed prior to the treatment on the first day and at the end of the 14 days of treatment.

Collection, Preparation and Analysis of Blood Samples

On Day 1 post-treatment (i.e. the fifteenth day), the animals were anaesthetized using chloroform and blood collected by cardiac puncture, using heparin as an anticoagulant. The blood was centrifuged at 5000g for 20 minutes and the plasma samples obtained for analysis. Plasma total cholesterol was measured by the procedure described by Allain *et al.* (1974), and high-density lipoprotein (HDL) cholesterol according to Warrick et *al.* (1982). Low-density lipoprotein (LDL) cholesterol was deduced from the values of total and HDL - cholesterol according to the modified procedure described by Friedewald *et al.* (1972), while triglyceride determination was by the method of Foster and Dunn(1973).

Statistical Analysis

The data are presented as mean ± S.D. The analysis of variance (ANOVA) was used (Steel and Torrie, 1960), and P values less than 0.05 were considered statistically significant.

Results

The results of the effects of *A. spinosus* leaf aqueous extract on plasma lipid levels are shown in Table 1. There were significant ($p<0.05$) decreases in total and HDL - cholesterol levels of the animals treated with the extracts. These decreases appear to be dose-dependent. The differences in LDL cholesterol levels in the treated animals were not significant ($p>0.05$). However; LDL-cholesterol level differs significantly *($p<0.05$)* in untreated (control) group compared to treated groups. A consideration of the HDL/LDL cholesterol ratio indicated that this ratio decreased in the animal groups treated significant decrease in the triglyceride level was also observed in the treated animals. The changes in the mean body weight of the animals treated with leaf extract between the first day (prior to treatment) and after the fourteenth day of treatment are shown in Table 2

Table 1: Plasma lipid levels in rats treated orally with different doses of *Amaranthus spinosus* extract for 14 days

Treatment Group	Total (cholesterol)	High Density Lipid	Low Density Lipid	HDL/LDL	TRIGLYCERIDE(TG)
A (Control)	73.4± 2.0[a]	59.5 ±1.15[a]	13.9 1.0[a]	4.2[a]	65.5± 0.02[a]
B	30.1± 1.73[b]	24.5 ±1.01[b]	5 . 6 ±1.5[b]	4.4[a]	27.4± 0.05[b]
C	24.1 ±1.60[c]	17.4 ±0.41[c]	6 . 7 ± 0.5[b]	2.6[b]	21.3± 0.01[c]
D	20.0 ±0.8[d]	12.8 ±0.53[d]	7 . 2 ± 0.71[d]	1.8[c]	17.7 ±0.03[b]

a,b,c,d Means in the same column with different superscripts differ significantly

Table 2: Mean body weight of rats treated for 14 days orally with different doses of leaf extract of *Amaranthus spinosus*

TREATMENT GROUP	EXTRACT DOSE(mg/kg)	BODY WEIGHTS (g)*		
		Before treatment	After treatment	% gain in weight
A	0.0	113± 0.34	117 ±0.36	3.54
B	251	118 ±0.13	121± 0.14	2.5
C	50	120 ±0.30	121.5 ±0.50	1.25
D	100	116 ±0.13	117 ±0.14	0.86

The results indicated that Group D animals showed the lowest gain in body weight (0.86%) while the control animals showed the highest (3.54%) gain. Groups B and C showed 2.50% and 1.25% gain in body weight respectively.

Discussion

Hyperlipidaemia is an important risk factor in such metabolic states as atherosclerosis. This disease usually involves derangement in the hepatic activity that manifests in altered lipid. (and composition of lipoprotein classes) in the hepatocytes. Consequently, there are changes in the plasma concentration of lipids including lipoprotein classes and their constituents (Obasi and Okoro, 1997). This study shows that aqueous extract of *Amaranthus spinosus* could elicit hypocholesterolaemic effect in rats. This decrease in the HDL/LDL-Cholesterol ratio in the treated animal groups indicates a tendency for lower level of cholesterol in the peripheral tissues of the treated animals, thereby preventing them against atherosclerotic conditions. In an earlier report by Kritchevsky *et al.* (1977), it was shown that rabbits fed cholesterol-free diet were less prone to atherosclerotic conditions. The reduction in plasma cholesterol was found to be dose-dependent; thus hypocholesterolaemic effect of the extract could be due to high fraction of oleic acid in its total fatty acid component (Osilesi *et al,* 1997).

It may also be due to increased metabolism of cholesterol by the liver resulting in a reduction in the release of cholesterol into the blood. This is in conformity with the hypocholesterolaemic effect of the extract *of Amaranthus candatus* that is accompanied by an induced hypotension in cats (Arowolo *et al,* 1989). Since there is a high correlation between blood lipids and development of cardiovascular diseases (Yarnamoto, 1991; Fuller, 1985), further work will assess effectiveness of A. *spinosus* in the treatment of hypertension using experimentally induced hypertensive animals.

References

Akinloye, O. A. and Olerede, B. R. (2000). Effect of *Amaranthus spinosus* leaf extract on haematology and serum chemistry of rats. *Nig. J. Nat.Prod. Med.* 4:79-81.

Allain, C.C; Poon, L.S; Chan, C. S; Richmond, W. and Fu, P.C. (1974). Enzymatic determination of total cholesterol. Clin. Chem. 20: 470- 475.

Arowolo, R. O; Olowookorun, M. O; Adepujo, F.O. and Dina, O.A. (1989). Some aspects of the pharmacology of four Nigerian Vegetables. *Int. Drugs Therap. 6(1): 74-77.*

Ayesu, F. S. (1978). Medicinal Plants of West Africa. Reference Publications, pp.330, Inc., Michigan.

Foster, B. L. and Dunn, R. T. (1973). Stable reagents for determination of Serum Triglycerides by a colorimetric Hantzsch Condensation Method. C*lin. Chem.* 19:338 - 340.

Friedewald, W. T; Levy, R. I. and Fredrickson, D.S. (1972). Estimation of the concentration of low density lipoprotein cholesterol in plasma without use of the preparative centrifuge. *Clin. Chem.* 18(6):499-502.

Fuller, J. H. (1985). Epidemiology of hypertension associated with diabetes mellitus. *Hypertension* 7:113-117.

Ibekwuike, J. C; Ogundaini, A. O; Bohlin, L. and Ogungbarnila, E. O.(1997). Anti-inflammatory activity of selected Nigerian Medicinal Plants. *Nig. J. Nat. Prod. Med.* 1:10-14.

Kritchevsky, D; Tepper, S. A; William, D.E; and Storey, J. A. (1977). Experimental atherosclerosis.in rabbits fed cholesterol-free diets. Interaction of animal or vegetable protein with fibre. *Atheroscler.* 26:397 -401.

Obasi, S.C. and Okoro, C.U. (1997). Hyperglycaemic effects of *Gongronema latifolium* (Benth) in the albino rat. J. *Environ. Toxicol.*1(1): 22-25.

Osilesi, O; Adeniyi, A; Ogunyemi, E. O. and Fakunle, J. B. (1997). Glycemic response to selected fruits and vegetables in Nigerian diabetics. *Afr. J. Med. Pharm. Sci.* 1:1-6.

Steel, R. G. and Torrie, J. H. (1960). Principles and Procedures of Statistics. New York. McGraw - Hill Book Co.

Warrick, G.R; Berdersond, J. and Alberts, J.J.(1982). Dextran - Sulphate-Mg precipitation procedure for quantitation of high-density lipoprotein cholesterol. *Clin. Chem.* 28:1379-1388.

Yamamoto, A. (1991). Regression of atherosclerosis in humans by lowering serum cholesterol. *Arterioscler.* 89:1-10.