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# COMPARATIVE STUDIES OF THE EFFECTS OF *AMARANTHUS SPINOSUS* AND *AMARANTHUS CAUDATUS* EXTRACTS ON THE PHYSIOLOGY OF ALBINO RATS (Sprague dawley)

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**Abstract**

A comparative study of the effects of the *Amaranthus spinosus* and *Amaranthus caudatus* aqueous leaf extract on the physiology of albino rats was investigated. Both extracts increase the cholesterol level in dose dependent manner. The two leaf extracts, at the tested doses, had no significant effect on the total body weight gain of the rats. *A. spinosus* extract was found to lower the red blood cell (RBC) count, haemoglobin (Hb) concentration and blood glucose level. Furthermore, rats given *A. spinosus* aqueous extract exhibit some behavioral changes such as aggressive scratching of the body, drowsiness and watery stool after the administration of the extract although, they regained full consciousness after about 20-30 minutes.

**Keywords:** Comparative studies, *Amaranthus spinosus, Amaranthus caudatus*, physiology, albino rats.

## Introduction

Vegetables are generally consumed as foods worldwide because they are good source of dietary nutrients, particularly protein, fats mineral salts and vitamins. *Amaranthus caudatus* and *Amaranthus spinosus* belong to the family *Amaranthaceae* which originated from South America, but now widely distributed throughout the tropics (Tridall, 1983). Common names include *Amarante* (French), *Bledo* (Spanish), *Badi chanchi* (Indian), *Efo tete* (Yoruba). While *A.caudatus* is edible and commonly cultivated for consumption, *A.spinosus* is not but it grows in uncultivated lands as weed. *A.spinosus* for instance, has been reported to be used in the treatment of certain human ailment such as snakebite, colic and menorrhagia (Ayesu, 1986). Its leaf extract possess anti-inflammatory substances with specific prostaglandin inhibitory effects (Ibekweike *et al.* 1997), as well as hypocholesterolemic effects (Akinloye and Olorede, 2000). This study is a comparative evaluation of some physiological effects of both plants on albino rats, with a view to assess probably reasons why *A.spinosus* is not cultivated and consumed as food.

## Materials and Methods

### Animals

Albino rats weighing between 130-150g were purchased from the animal house of the Department of Biological Sciences, University of Agriculture, Abeokuta and kept in well ventilated plastic rat cages with free access to water and feeds (Ladokun and Sons Ltd) *ad libituum.*

### Extraction

The aqueous extracts of *A.caudatus* and *A.spinosus* were obtained using hot water extraction techniques in order to simulate the local procedure. 50g of dried leaves, ground into powder, was weighed into a conical flask, 500ml of distilled water was added, the mixture was boiled for 1hour, cooled and shaken thoroughly and filtered into a measuring cylinder, using a Whatman filter paper No 1 (12.5cm x 12.5cm). The aqueous extract was concentrated by evaporation, using water bath at 80°C, allowed to cool and then stored at 4°C until used.

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**Administration of the extracts**

The extracts were administered orally via catheter for 21 days according to the following schedule:

(i) Rats in group 1 served as control for the *A.spinosus* and A.caudatus. These were given distilled water which corresponded to the highest volume of extract administered to rat.

(ii) Rats in group 2 were given 140mg/Kg *A.spinosus* extract.

(iii) Rats in group 3 were given 155mg/Kg *A.spinosus* extract

(iv) Rats in group 4 were given 165mg/Kg *A.spinosus* extract.

(v) Rats in groups 5 to 7 were administered 140, 155 and 165mg/Kg *A.caudatus* extract/ Kg body weight respectively.

The animals were sacrificed after anesthesia by ether. Venous blood was collected from the heart of each rat in each group by cardiac puncture. The blood was allowed to clot, and then centrifuged at 5000g for 5mins. Serum was collected from centrifuged blood samples and used for analysis.

**Tissue homogenization and fractionation.**

Livers from the each of the rats in each group were excised and perfused with ice-cold distilled water, weighed and immediately frozen. They were later homogenized in 0.20M sucrose (1:4 w/v). The homogenate was then centrifuged at 5000g for 10min, the supernatant collected, stored in the ice and used in estimating protein content and phosphatases activities.

**Blood Analysis.**

Blood samples were collected into heparinized glass capillary tubes and used for the determination of packed cell volume (PCV), haemoglobin (Hb) concentration, red blood cell (RBC) count and white blood cell (WBC) count. The Hb concentration was determined by cyanomethaemoglobin method while WBC and RBC counts were determined using improved Neubauer Haemocytometer counting chamber (Dacie and Lewis, 1991; Jain, 1975). Serum glucose, creatinine, serum glutamate pyruvate transaminase (SGPT) and serum glutamate oxaloacetate transaminase (SGOT) were estimated using reagent kits (Ranbaxy Laboratories, Mumbai, India), while cholesterol level, alkaline and acid phosphatase activities were determined using reagent kit (Randox laboratories Ltd, Ardmore Diamond road, Brumlin, Co. UK.)

**Histopathology**

Histopathological examinations were carried out following the procedure described by Muyibi *et al.*, (2000).

**Statistical Analysis.**

The data collected in the study were subjected to statistical analysis using the student t-test with $p<0.05$ considered significant.

**Results**

Table 1 shows the effects of administration of *A.caudatus* and *A. spinosus* aqueous leaf extracts on the body weight of the test and control rats. There was no significant differences ($p>0.05$) in the body weight gained in both tested and control group of rats. Table 2 shows haematological and some physiological indices. *A. spinosus* extract at the tested doses lowered the red blood cell count, haemoglobin concentration and blood glucose level of the test groups from (5.2 to 4.2 mol/mm$^3$, 15.3 to 14.3 g/dl and 85 to 80 mg/dl respectively) compared to the control. However, both extracts i.e *A.spinosus* and *A.caudatus* caused an increase in the cholesterol levels in the test groups form 198 to 212 mg/dl and 198 to 207 respectively. The activities of the phosphatases, SGPT and SGPT were not significantly ($p>0.05$) affected in the test group compared to the control.

**TABLE 1: Mean body weight changes in rats given aqueous leaf extract of *A.spinosus* and *A.caudatus* orally.**

| Parameters | EXTRACT (A.S) | | | | EXTRACT (A.C) | | | |
|---|---|---|---|---|---|---|---|---|
| | Doses (mg/Kg body weight) | | | | Doses (mg/Kg body weight) | | | |
| | 0 | 145 | 155 | 165 | 0 | 140 | 155 | 165 |
| Mean b.w gained | 16.4 | 24.8 | 24.8 | 25.2 | 15.8 | 25.3 | 24.7 | 24.3 |

**Table 2 : Haematological and Physiological indices of rats given A.S and A.C aqueous leaf extracts.**

| PARAMETERRS | EXTRACT (A.s) | | | | EXTRACT (A.c\|) | | |
|---|---|---|---|---|---|---|---|
| | Doses (mg/Kg body weight) | | | | Doses (mg/Kg body weight) | | |
| | 0 | 140 | 155 | 165 | 140 | 155 | 165 |
| Packed cell volume(%) | 46 | 44 | 43 | 43 | 44 | 33 | 45 |
| Haemoglobin (g/dl) | 15.3 | 14.8 | 14.4 | 143.3 | 14.1 | 13.0 | 15.1 |
| RBC (mol/mm3) | 5.2 | 5.0 | 4.6 | 4.2 | 5.0 | 4.2 | 5.1 |
| WBC (mol/mm3) | 5200 | 5800 | 5600 | 5400 | 5800 | 6000 | 5600 |
| MCV (U3) | 89 | 88 | 88 | 88 | 89 | 87 | 88 |
| MCH (m/mg) | 30 | 29 | 30 | 29 | 31 | 29 | 30 |
| MCHC (%) | 34 | 33 | 34 | 33 | 35 | 33 | 34 |
| Glucose (mg/dl) | 85 | 83 | 81 | 80 | 82 | 82 | 79 |
| Cholesterol (mg/dl) | 198 | 197 | 202 | 212 | 192 | 199 | 207 |
| Creatinine (mg/dl) | 1.4 | 1.5 | 1.4 | 1.5 | 1.4 | 1.2 | 1.4 |
| Acid phosphatase (U/L) | 25 | 27 | 26 | 27 | 25 | 27 | 27 |
| Alkaline phosphatase(U/l) | 73 | 75 | 76 | 78 | 70 | 27 | 27 |
| SGPT (U/L) | 8 | 8 | 9 | 9 | 8 | 6 | 9 |
| SGOT (U/l) | 9 | 10 | 10 | 11 | 9 | 7 | 10 |

SGPT- Serum Glutamate Pyruvate Transaminase.
SGOT- Serum Glutamate Oxaloacetate Transaminase.

Within 5-10 min of oral administration of *A. spinosus* extract into all the animals, body-itching reaction was elicited, coupled with drowsiness and passage of watery stool, which later subsided after about 20-30 minutes. The section of the excised liver of the treated animals in the dose ranges given showed no statistically significant or observable morphological differences when compared with that of the control.

**Discussion**

The results from this study showed that both plant extracts had no effect on the body weight gain of the treated groups. This probably implies that the leaf extracts may not contain antinutritive factor and thus had no inhibitory effect on the feeding habit. The decrease in the red blood cell caused by *A.spinosus* extract is in agreement with the report of Akinloye and Olorede (2000), that *A. spinosus* leaf extract possess anemic properties. Also, the blood glucose lowering effect exhibited by the extracts support the report of Osilesi *et.al.* (1997), that patients fed with vegetables showed a lowered blood glucose response compared to those that were fed with fruits. The probable mechanism for this observable hypoglycemic effect might be due to an increase in the insulin response during feeding; however, this will be subjected to further studies. Lamella *et. al.*,(1985) also reported that aqueous infusion of some medicinal plants caused

hypoglycemia in rats by increasing the level of insulin in the blood. The increase in serum cholesterol exhibited by both extracts contracts the report of Arowolo *et al.* (1989), that *A. caudatus* leaf extract possess hypocholestrolaemic effect that is accompanied by induced hypotension in cats. This disparity could be attributed to difference in the concentration of the extract administered. It may also be due to differences in the metabolic and physiologic apparatus or mechanism of the experimental animals Increase in cholesterol level is more pronounced in rats given A.s than A.c. Such increase may also be observed in conditions as diabetes mellitus, obstructive jaundice, myxocedema and in Xanthomatosis (Havel *et al.* 1973). The activities of liver function biomarker enzymes were not significantly affected in all groups, an indication of a non-toxic effect or absence of hepatocellular damage at the tested doses. This was further buttressed by an apparent or no observable morphological differences in the liver examined in the treated compared to the control group.

In conclusion, the findings from this study revealed to some extent that both plant extracts seems not to have serious adverse physiologic effects on the rats at the tested concentrations and therefore suggest a safe nutritional and therapeutic benefit.

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