

# Effect of *Amaranthus Spinosus* Extract On Haematological Parameters and Organ Weight in Albino Rats

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## ABSTRACT

*This study was designed to investigate the effect of Amaranthus spinosus extract on the haematological parameters and organ weight in albino rats using standard methodology. The result showed a significant ( $P<0.05$ ) increase in the body weight gained by the treated groups recording  $10.33\pm0.03^b$ ,  $14.67\pm0.15^c$  and  $22.30\pm2.05^d$  for the group treated with 500 mg/kg/bw, 1000 mg/kg/bw and 1,500 mg/kg/bw respectively compared with  $7.80\pm1.05^a$  recorded for the control group. However, there was no significant changes in the kidney weight of the treated groups and control. Moreover, in the haematological assay, there was no significant difference in the PCV as it ranged between 35.12% in control group to 36.82% in the group I, haemoglobin (9.16 g/dl in group I and 10.09 g/dl in group II) and white blood cell count of the treated rats compared with the control whereas, the platelets and red blood cell count of the group treated with the higher doses of the extract (1,000 and 1,500 mg/kg/bw) had a significantly ( $P<0.05$ ) higher count compared with the control and group treated with 500 mg/kg. Furthermore, the glucose (128.56 mg/dl in group III) and cholesterol (108.10 mg/dl) decreased significantly ( $P\leq0.05$ ) in the rat groups treated with the plant extract compared with the control group. However, urea, creatinine and  $K^+$  level in the treated rat groups and control were not different significantly ( $P<0.05$ ). These results justify the folkloric therapeutic claim of the ethanol extract of *A. spinosus*.*

**Keywords:** *Amaranthus spinosus*, haematology, biochemical, liver, kidney

## 1. INTRODUCTION

The plant kingdom is made up of many generals of plants which contain bioactive substances of medicinal importance. The African tropical forest is endowed with a large number of plants that are being explored for their therapeutic purpose in traditional medicine generally practiced in this part of the world especially, in Nigeria. About 80% of the African populations rely on local medicinal plants for remedy of various medical conditions [1].

In Nigeria, the first line of treatment for majority of people with high fever resulting from malaria is the use of herbal medicine at home. The dependence of people on indigenous herbal medicine are influenced by factors such as acceptability, poverty, cost-effectiveness, accessibility and unavailability of modern health facilities. Some of the plant extract have been found nourishing while others were harmful due to toxic nature of the constituents of such plant [2, 3].

*Amaranthus spinosus* Linn are erect, monoecious perennial, up to 1 m. Stem are terete or obtusely angular, glabrous or slightly pubescent, green, reddish-brown, glabrous, and branched. The leaves alternate and are simple without stipules; petiole is approximately as long as the leaf blade. The blade shape is ovate-lanceolate to rhomboid, acute and often slightly decurrent at base, obtuse, rounded or slightly retuse and often short mucronate at apex, entire, glabrous or slightly pubescent on veins when young [4].

The juice of the plant is boiled without salt and consumed for 2–3 days to cure jaundice. It is also used as anti-inflammatory, antimalarial, antibacterial, antimicrobial, antidiuretic, antiviral and for correction of hepatic disorders. The plant is reported to possess hepatoprotective, antioxidant activity, and significant immune-stimulating activity [5].

The plant is used in the treatment of abdominal pain, chicken pox, dysentery, dysurea, fever, hysteria, malaria, mania, tonsillitis and vomiting. Recent studies showed antidiabetic property of the plant. In many parts of Africa, it is in nutritional deficiency disorders and various other diseases. The usage of herbal preparations for the management of diseases have been gaining momentum since the turn of the century and there have been concern about the safety of some of the plants used in the folkloric medicine, therefore this study was designed to assess the effect of *Amaranthus spinosus* extract on haematological parameters and organ weight in albino rats [6].

## 2. MATERIALS AND METHODS

### 2.1 Plant collection, identification and preparation

Fresh *Amaranthus spinosus* whole plants were harvested from the compound of Rufus Giwa Polytechnic, Owo, Ondo State Southwest Nigeria. The plant material was identified at the herbarium section of the Department of Crop Production Technology and a voucher specimen (HX-1308Wx) was deposited. The authenticated plant materials were washed and cleaned thoroughly with tap water and then air-dried under shade. The dried samples were then ground into coarse powder with the aid of a mechanical grinder and were stored in clean air-tight containers, and kept in a cool, dry place until required for use. One hundred gram (100 g) of the powdered sample was soaked in 300 ml of ethanol for 72 hr with intermittent stirring using sterile spatula. The plant extracts were then filtered through Whatman No 1. Filter paper into bijou bottles and then dried using rotary evaporator at a temperature of 50°C to yield crude extracts.

### 2.2 Reagents /chemicals

All reagents and chemicals were of analytical grade and were obtained from the Department of Science Laboratory Technology, Rufus Giwa Polytechnic, Owo, Ondo State, Nigeria.

### 2.3 Experimental Design

#### 2.3.1 Laboratory Animals

Twenty (20) 6 weeks old male albino rats of wistar strain were sourced from Department of Animal Production and Health, Federal University of Technology, Akure. They were housed in metal cage and allowed to acclimatize for 10 days prior to experiment. They were handled according to standard protocol and fed with rat crumbs (Top feeds, Sapele, Nigeria) and water *ad libitum*. At the end of the acclimatization period, the animals were divided into four groups of five (5) rats each. Group I, II, and III were given 500, 1,000 and 1,500 mg/Kg body weight of the extract respectively while group IV received only water using orogastric tubes. The extracts were administered for a period of 21 days after which they were fasted overnight before being sacrificed after 24 hrs after the last administration in accordance with the method of [7].

#### 2.3.2 Determination of Haematological Parameters and Internal Organ Weight

At the end of the treatment period, the animals were anaesthetized in chloroform vapour and the blood collected via cardiac puncture into a plane tube. Heparinised test tubes were used to collect blood samples for haematological indices assay. White blood cells (WBCs), Red blood cells (RBCs), packed cell volume (PCV), Haemoglobin (Hb) and platelets were assayed by automated techniques using the Sysmex (Sysmex K21, Tokyo, Japan) Automated machine respectively. After the blood collection liver and kidneys were weighed in triplicates.

#### 2.3.3 Determination of blood biochemical parameters

Glucose, urea, cholesterol, and creatinine were measured using an autohumalyser (Autohumalyser 900Splus Human, Germany). Sodium, potassium, and chloride ions were determined by an electrolyte analyzer (9180 Electrolyte Analyzer, Roche, Germany). Total protein was analyzed by refractometry (Refractometry, American Optical Company, U.S.A).

#### 2.3.4 Statistical Analysis

All the values in the test are presented as mean and standard error of the mean (mean  $\pm$  SEM). Statistical differences between the means of various groups were evaluated by one-way analysis of variance (ANOVA) followed by Student's t-test using SPSS version 25 program. P-values  $<0.05$  were considered significant.

## 3. RESULTS AND DISCUSSION

The effect of *Amaranthus spinosus* leaf extract on some haematological and biochemical parameters of the blood, and weight of liver and kidney were studied in this investigation. The body weight gained by the rats as well as the liver and kidney weight are presented in Table 1. All the rats treated with the plant extract at the various concentrations (i.e. 500, 1000, 1500 mg/kg/bw) showed significant increase ( $P \leq 0.05$ ) in their body weight compared with the control recording  $10.33 \pm 0.03^b$ ,  $14.67 \pm 0.15^c$  and  $22.30 \pm 2.05^d$  while the control recorded  $7.80 \pm 1.05^a$ . Also, there appear to be increase in body weight gain as the concentration of the extract increased. The same trend was revealed in the liver weight of the rats. However, there was no significant change in the weight of kidneys of the treated rat groups and the control.

The observation showed that treatment of rats with the plant extract at different doses used was well tolerated by all the animals, since no toxic effects were observed by direct visual observation of the animals throughout the experimental period. There was no record of death and apparent behavioural changes during the experiment in all treatment groups as well as the control group. This indicates that the plant extract may not have toxic effect on laboratory animals. Further, there was no difference in the feed consumption of the treated groups and that of the control as the rate of food and water intake of all the groups were comparable. This is in agreement with earlier report that *A. spinosus* is not toxic to albino rats at dose of 5,000 mg/kg although this was a one off acute toxicity test and it suggests that the plant is edible [8]. There was a higher level of body weight gain by the rats given the plant extracts compared with the control. The increase in weight observed may suggest that *A. spinosus* is a good source of nutrition. This is in line with earlier reports on the proximate composition of the plant reported by Oya and Uygur [9] where it is reported that the plant contain appreciable amount of important nutrients such as vitamins, proteins, minerals, carbohydrates and fats. There was a slight increase in liver weight whereas there was no difference in the kidney weights of the treated rat groups compared with the control. This suggest that the extract may not contain toxic compounds that may have deleterious effect on the liver and kidney of the laboratory animals.

Table 1: Body weight gain and organ weights in albino rats treated with *Amaranthus spinosus* extract

Group	Treatment (mg/kg/bw)	Change in body weight (g)	Liver weight (g/100g bw)	Kidney weight (g/100g bw)
I	500	10.33±0.03 <sup>b</sup>	5.07±1.15 <sup>b</sup>	0.75±0.01 <sup>a</sup>
II	1,000	14.67±0.15 <sup>c</sup>	5.33±0.08 <sup>c</sup>	0.76±0.05 <sup>a</sup>
III	1,500	22.30±2.05 <sup>d</sup>	5.52±0.12 <sup>d</sup>	0.79±0.10 <sup>a</sup>
IV	Control	7.80±1.05 <sup>a</sup>	4.89±0.62 <sup>a</sup>	0.82±0.00 <sup>a</sup>

Key: values are mean±SEM, P<0.05, N=5.

In the haematological parameters assay as presented in Table 2, there was no significant difference in the PCV as it ranged between 35.12% in control group to 36.82% in the group I, haemoglobin (9.16 g/dl in group I and 10.09 g/dl in group II) and white blood cell count of the treated rats compared with the control whereas, the platelets and red blood cell count of the group treated with the higher doses of the extract (1,000 and 1,500 mg/kg/bw) had a significantly (P<0.05) higher count compared with the control and group treated with 500 mg/kg.

The haematological parameters screening has been described as a good tool in evaluation of the haematotoxic potential of plant extracts in area of pharmacognosy [10]. Therefore, the non-significant (p< 0.05) change recorded for WBC, PCV and haemoglobin following the administration of ethanol extract of *A. spinosus* is an indication that the plant may not influence the haematopoietic system of the rats and therefore safe for consumption. This contradicts the report of Olufemi et al. [11] who reported significant (P<0.05) reduction in the PCV, RBC and Hb of the pigs administered with *A. spinosus* extract seven days post treatment while their observations in the weight gains correlate well with the results of this study. However, the significant increase in the RBC and platelets suggest that the extract contain some bioactive constituents which could boost the production of RBC thus, preventing anaemia. Therefore, it may be inferred that the bioactive constituents of the extract may have increased the production of regulatory factors or interfered with the sensitivity of the committed stem cell at all the concentrations used. This observation is in agreement with the report of [12].

Table 2: Haematological properties of the rats treated with *Amaranthus spinosus* extract

Group	Treatment (mg/kg/bw)	RBC (x10 <sup>6</sup> /μl)	WBC (x10 <sup>3</sup> /μl)	Platelets (x10 <sup>3</sup> /μl)	HB (g/dl)	PCV (%)
I	500	11.03±0.01 <sup>a</sup>	6.37±0.02 <sup>a</sup>	397.35±0.01 <sup>a</sup>	9.16±0.05 <sup>a</sup>	36.82±0.02 <sup>a</sup>
II	1,000	13.05±0.15 <sup>b</sup>	6.78±0.10 <sup>a</sup>	458.13±0.07 <sup>b</sup>	10.09±0.01 <sup>a</sup>	36.17±0.10 <sup>a</sup>
III	1,500	12.89±1.02 <sup>b</sup>	6.62±0.03 <sup>a</sup>	482.25±0.30 <sup>b</sup>	10.02±0.00 <sup>a</sup>	37.31±0.05 <sup>a</sup>
IV	Control	10.06±0.10 <sup>a</sup>	6.05±0.18 <sup>a</sup>	389.15±0.19 <sup>a</sup>	9.62±0.20 <sup>a</sup>	35.12±0.02 <sup>a</sup>

Key: values are mean±SEM, p<0.05, N=5.

The Table 3 shows the blood biochemical parameters of the rats treated with the plant extract. The table revealed that glucose (128.56 mg/dl in group III) and cholesterol (108.10 mg/dl) decreased significantly (P<0.05) in the rat groups treated with the plant extract compared with the control group. However, urea, creatinine and K<sup>+</sup> level in the treated rat groups and control were not different significantly (P<0.05).

In the biochemical parameters of the rats studied, the blood glucose level, cholesterol and Na<sup>+</sup> level of the treated rat groups decreased especially as the concentration of administration increased. This is in agreement

with the findings of earlier researchers [13]. This may be that *A. spinosus* may contain some insulin-like effect on peripheral tissues either by promoting glucose uptake and metabolism or by inhibiting gluconeogenesis [14]. It may also be that the plant extract possess some effect on tissue utilization of glucose by inhibiting hepatic gluconeogenesis or absorption of glucose into the muscles and adipose tissues [15].

Table 3: Blood biochemical parameters of the rats treated with *Amaranthus spinosus* extract

Group	Treatment (mg/kg/bw)	Glucose (mg/dl)	Urea (mg/dl)	Creatinine (mg/dl)	Total protein (mg/dl)	Cholesterol (mg/dl)	Na <sup>+</sup> (mmol/l)	K <sup>+</sup> (mmol/l)	Cl <sup>-</sup> (mmol/l)
I	500	157.18±0.02 <sup>a</sup>	42.01±0.05 <sup>a</sup>	0.77±0.01 <sup>a</sup>	6.43±0.20 <sup>ab</sup>	129.11±0.02 <sup>c</sup>	130.11±0.05 <sup>b</sup>	7.18±0.03 <sup>a</sup>	127.06±0.04 <sup>a</sup>
II	1,000	132.17±0.15 <sup>a</sup>	45.00±0.02 <sup>a</sup>	0.79±0.01 <sup>a</sup>	6.21±0.01 <sup>a</sup>	120.15±0.01 <sup>b</sup>	134.29±0.02 <sup>b</sup>	7.25±0.10 <sup>a</sup>	129.17±0.07 <sup>a</sup>
III	1,500	128.56±0.07 <sup>b</sup>	44.06±0.01 <sup>a</sup>	0.76±0.02 <sup>a</sup>	6.18±0.07 <sup>a</sup>	108.10±0.10 <sup>a</sup>	138.51±0.01 <sup>b</sup>	7.42±0.05 <sup>a</sup>	128.35±0.0 <sup>b</sup>
IV	Control	167.30±1.01 <sup>c</sup>	48.06±0.10 <sup>a</sup>	0.78±0.04 <sup>a</sup>	5.97±0.03 <sup>a</sup>	142.47±0.10 <sup>d</sup>	122.40±0.32 <sup>a</sup>	7.93±0.12 <sup>ab</sup>	132.15±0.08 <sup>b</sup>

Key: values are mean±SEM, p<0.05, N=5.

In the same way, there was significant decrease in the blood cholesterol level of the treated rats compared with the control which followed a dose dependant-nature. This is in agreement with the study reported by Sangameswaran and Jayakar [16]. Later, Ashok Kumar *et al.*, [17] proved, that methanol extract of *Amaranthus spinosus* exhibits alpha amylase enzyme inhibition by CNPG3 (2-chloro – 4-nitrophenol a- D-maltotrioxide). The extract also had an *in vivo* antioxidant potential on malondialdehyde (MDA), glutathione (GSH), catalase (CAT) and total thiols (TT) in alloxan induced in diabetic rats. From the report, the methanolic extract of *Amaranthus spinosus* has been found to have a potent inhibition on alpha amylase, anti-diabetic and antioxidant activities. These reports supports the results obtained in this study and has lend credence to the folkloric use of the plant in managing different ailments. Furthermore, the extract did not show significant change on urea, creatinine, total protein, K<sup>+</sup> and Cl<sup>-</sup> as compared to the control group. This may indicate non-toxic activity of *A. spinosus* on the body metabolism of the rats.

#### 4. CONCLUSION

From the foregoing, this study showed that treatment of rats with the ethanol extract of *A. spinosus* increased the body weight in rats and that there were no after adverse effects observed on the liver and kidney. Further, the plant extract had a lowering effect on the blood glucose and cholesterol level in the rats. These confirm the therapeutic potential claim of the plant in the traditional medicinal practice.

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