



## Effect of aqueous extract of *Acalypha wilkesiana* (Copper Leaf) on some enzyme activities and metabolites in the liver and kidney of albino rats

Alli Smith Yemisi Rufina, Adanlawo Isaac Gbadura, Aluko Bukola Tola And Omoluabi Isaac Oluwaseyi

*Department of Biochemistry, Faculty of Science, University of Ado-Ekiti, Nigeria*

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### ABSTRACT

*A study of the effect of aqueous extract (10%w/v) of the leaves of *Acalypha wilkesiana* (a popular medicinal plant used in Nigeria for the treatment of fever in infants) was studied in the liver and kidney of albino rats. The activities of Alkaline Phosphatase (ALP), Alanine Transaminase (ALT) and Aspartate Transaminase (AST) were determined. The effect of the extract on glucose and protein concentrations was also studied. The administration of the aqueous extract resulted in a significant reduction in the enzymes activities ( $p < 0.05$ ) in the liver and kidney which was complimented by an increased activity of these enzymes in the serum. However, the result obtained showed that prolonged usage or overdose of the aqueous extract of *Acalypha wilkesiana* could exhibit a dose dependent toxicity. It was also discovered that the aqueous extract exhibit transient hypoglycaemic effect.*

**Key words:** *Acalypha wilkesiana*, Alkaline Phosphatase, Transaminases, Liver, Kidney

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### INTRODUCTION

Medicinal plants have enjoyed a great popularity in the treatment of various diseases for many centuries. Medicinal plants are plants which are used for therapeutic purposes. The discovery of these useful plants was as a result of man's inquisitive and inventive nature as well as necessity to feed [1]. They include all higher plants that have been alleged to have medicinal properties, that is, effects that relates to health or which have been proven to be useful as drugs by western standards or which contain constituents that are used as drugs [2]. The active principles of medicinal plants are able to alleviate illnesses [2]. Based on their physiological and pharmacological actions and uses, medicinal plants are classified as; CNS active plants, anti-inflammatory agents, anti-allergic plants, anti-diabetic plants, cyto protective plants, antioxidants as well as antibiotics. A medicinal plant may have multidimensional effects falling into more than one of the classes mentioned above [3].

*Acalypha wilkesiana* (copper leaf) is a large genus of herbs and shrubs native to the Tropics and Subtropics. A number are grown as ornamental plants either for their attractive foliage or for

their showy inflorescence. It belongs to the family of *Euphobiaceae*. *Acalypha wilkesiana* has been shown to have anti-bacterial and anti-fungal properties. The pressed juice or boiled decoction is used for the treatment of gastrointestinal disorders and fungal skin infections [4, 5, and 6]. In traditional medicine, the leaves of this diuretic plant are eaten as vegetables in the management of hypertension. The aqueous extract is also used in the management of fever in infants as well as abnormal sodium and potassium metabolism that accompanies hypertension [6].

This study is therefore designed to assess the effect of *Acalypha wilkesiana* on the liver and kidney using albino rats as models.

## MATERIALS AND METHODS

### Plant materials

The leaves of *Acalypha wilkesiana* were collected from University of Ado Ekiti horticultural garden. They were identified and authenticated at the herbarium of Plant Science and Forestry department, University of Ado Ekiti, Nigeria. The leaves were cleaned and air dried and grounded into a powdery fine texture.

### Animal grouping

Twenty albino rats weighing between 100-200g were obtained from the Veterinary Physiology department of the University of Ilorin, Kwara State, Nigeria. They were divided into four groups (5 animals per group) and kept in cages and maintained in a well ventilated room. They were fed with grower's mash by Top feed, Nigeria and water *ad libitum*. Rats in group one serve as untreated control while group 2-4 received different doses of the extract.

### Administration of Extract

10g of the powdered leaves of copper leaves was dissolved in 100ml of distilled water and was administered orally to the rats at a dose of 100mg/kg body weight. Rats in group 2 were given only a dose and they were sacrificed after 24hrs. Rats in group 3 received two doses and were sacrificed 24hrs after the last dose. Rats in group 4 received three doses and were left for another 4days before they were sacrificed.

### Preparation of Tissue Homogenates

The rats were sacrificed by cervical dislocation and the blood was collected into a clean beaker and serum was prepared as described [7]. The rats were dissected and the liver and kidney was removed into 0.25M ice cold sucrose solution. The organs were cut into tiny pieces and homogenised in 0.25m ice cold sucrose solution in ratio 1:5w/v. The homogenates were kept frozen overnight prior to enzyme assay.

### Enzyme substrate

Sodium salts of pyruvic acid,  $\alpha$ -ketoglutarate and P-nitrophenol or orthophosphate were products of Randox Laboratories (Ltd), Atim, U.K and British Drug house limited, Poole, U.K respectively. All other reagents used were of analytical grade and were prepared in volumetric flasks.

### Determination of Enzyme activities, protein and glucose concentrations

Spectrophotometric methods of Kings [8] were used to measure the activities of alanine and aspartate transaminases while alkaline phosphatase activity was determined by measuring the p-

nitrophenyl phosphate at 400nm [9]. Protein concentration was measured by biuret method [10] while glucose concentration was determined by glucose oxidase method [11].

## RESULTS AND DISCUSSION

**Table I: effect of copper leaf on alkaline phosphatase activity {U/L} in albino rat tissues**

Groups	Days of sacrifice	SERUM	LIVER	KIDNEY
1	0	52.08 ± 3.40 <sup>a</sup>	52.78 ± 5.20 <sup>a</sup>	1837.50 ± 10.02 <sup>a</sup>
2	1	19.11 ± 1.15 <sup>b</sup>	27.08 ± 1.61 <sup>b</sup>	982.93 ± 10.29 <sup>b</sup>
3	3	68.56 ± 0.42 <sup>b</sup>	18.64 ± 1.17 <sup>b</sup>	513.56 ± 16.00 <sup>b</sup>
4	7	52.92 ± 3.13 <sup>a</sup>	42.68 ± 2.34 <sup>a</sup>	1836.00 ± 10.80 <sup>a</sup>

Values are expressed as mean ± standard deviation. Statistical significance was tested using student's *t*- test compared with control values at  $P < 0.05$ . Values with different superscript are significantly different.

**Table II: effect of copper leaf on aspartate transaminase activity {U/L} in albino rat tissues**

Groups	Days of sacrifice	SERUM	LIVER	KIDNEY
1	0	52.00 ± 11.12 <sup>a</sup>	233.00 ± 9.90 <sup>a</sup>	278.00 ± 22.3 <sup>a</sup>
2	1	191.00 ± 51.92 <sup>b</sup>	283.00 ± 19.88 <sup>b</sup>	327.00 ± 24.00 <sup>b</sup>
3	3	66.00 ± 10.80 <sup>b</sup>	148.00 ± 10.01 <sup>b</sup>	153.00 ± 17.00 <sup>b</sup>
4	7	52.90 ± 11.10 <sup>a</sup>	214.00 ± 10.34 <sup>a</sup>	277.00 ± 23.40 <sup>a</sup>

Values are expressed as mean ± standard deviation. Statistical significance was tested using student's *t*- test compared with control values at  $P < 0.05$ . Values with different superscript are significantly different.

**Table III: effect of copper leaf on alanine transaminase activity {U/L} in albino rat tissues**

Groups	Days of sacrifice	SERUM	LIVER	KIDNEY
1	0	34.02 ± 2.08 <sup>a</sup>	161.00 ± 1.20 <sup>a</sup>	923.00 ± 3.70 <sup>a</sup>
2	1	72.00 ± 2.86 <sup>b</sup>	166.00 ± 1.20 <sup>b</sup>	132.30 ± 4.60 <sup>b</sup>
3	3	75.00 ± 1.00 <sup>b</sup>	139.00 ± 5.50 <sup>b</sup>	50.00 ± 2.80 <sup>b</sup>
4	7	35.00 ± 3.00 <sup>a</sup>	158.00 ± 3.11 <sup>a</sup>	924.00 ± 3.00 <sup>a</sup>

Values are expressed as mean ± standard deviation. Statistical significance was tested using student's *t*- test compared with control values at  $P < 0.05$ . Values with different superscript are significantly different.

**Table IV: effect of copper leaf on protein and glucose concentrations in the serum of albino rats**

Groups	Days of sacrifice	PROTEIN(g/l)	GLUCOSE(mg/dl)
1	0	81.92 ± 4.14 <sup>a</sup>	7.70 ± 0.05 <sup>a</sup>
2	1	66.08 ± 4.14 <sup>b</sup>	2.27 ± 0.38 <sup>b</sup>
3	3	145.00 ± 2.00 <sup>b</sup>	5.50 ± 0.45 <sup>b</sup>
4	7	80.36 ± 1.55 <sup>a</sup>	7.50 ± 0.40 <sup>a</sup>

Values are expressed as mean ± standard deviation. Statistical significance was tested using student's *t*- test compared with control values at  $P < 0.05$ . Values with different superscript are significantly different

Table I shows the effect of copper leaf on alkaline phosphatase activity in some albino rat tissues. There was a significant reduction ( $P < 0.05$ ) in the activities of this enzymes in the liver, kidney and serum when compared with the control values within the first day of administration of the extract. This decline in the enzyme activity could be due to inhibition of the enzyme activity by the presence of the extract. It should be noted that magnesium ion is an activator of alkaline phosphatase and as such an induced magnesium deficiency can cause a decline in the enzyme activity [12]. There was also a significant decrease in the activity of the enzymes in the liver and kidney with a corresponding increase in the serum after 3days of administration of the extract. However, the activity of the alkaline phosphatase on the 7<sup>th</sup> was not significantly different when compared with the control in all the tissues studied. This suggest that, the tissues

has some self –repair mechanism which it can employ when the presence of a chemical or toxin is withdrawn or when the presence is not prolonged, since these chemicals or toxins can cause irreversible hepatocellular damage [13].

Table II shows that there was a significant increase in the activities( $P<0.05$ ) of Aspartate transaminase in the liver, kidney and serum of albino rats after 24hours of administration of aqueous extract of copper leaf which could be as a result of enzyme activation in the hepatocytes and kidney cells. After 3days of administration on the other hand, there was a significant decrease in AST activities ( $P<0.05$ ) in all the tissues which could be attributed to either of two reason; damage to plasma membrane and the mitochondrial membrane which houses the AST or the inhibition of enzyme activity by the extract component. The activities of AST however returned to normal when compared with the control values after 7days, which is indicative of a self-tissue repair mechanism after stoppage of the extract [14].

The activities of Alanine Transaminase were presented in Table 4. ALT is found in significant quantity in the liver, kidney and skeletal muscles in decreasing order [15]. ALT is a cytosolic enzyme produced in the liver cells and is more specific for liver damage [16]. When hepatocytes are damaged, ALT level rises. Increased levels of ALT in the serum may indicate any condition that produces acute hepatocellular damage [17]. The activities of ALT increased significantly in the serum and liver but there was a significant decrease in the kidney after 24hours of the extract administration. However, after 3days of extract administration, there was a significant decrease in the liver and kidney with a corresponding increase in the serum. An increase in the activity of plasma or serum is an indicator of even minor cellular damage [18]. The activities of ALT return to near normal in the albino rat tissues after 7days, indicating a self-repair mechanism to circumvent and gradually nullify the toxic effect of the administered extract.

Table 4 presents the effect of copperleaf on protein and glucose concentrations in the serum of albino rats. The concentration of glucose reduces after 24hours and 3days of administration of the extract of copper leaf but upon termination of administration on the 3<sup>rd</sup> day, the concentration returns back to normal after 7days, this indicate that the extract has hypoglycaemic properties which could mean that the extract contains metabolites that has inhibitory effect on glucose synthesis or release. On the other hand, protein concentration reduced significantly when compared with the control after 24hour but there was a drastic increment after 3days which returns to normal after 7days. Serum total protein consists of functional and low levels of non functional proteins. With increased cell death or altered cell membrane, enzymes from diseased or damaged tissues enter the blood [19].

## CONCLUSION

The results of this study showed that repeated administration of the aqueous extract of copper leaf or its prolonged usage can lead to the damage of the two vital organs, which is the liver and kidney. Interestingly, the aqueous extract of copper leaf causes reduction of blood glucose level in normoglycemic rats suggesting the possibility of its usage in managing diabetes or hyperglycaemia.

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