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Asian Journal of Plant Science and Research, 2016, 6(4):1-5

ISSN : 2249-7412
CODEN (USA): AJPSKY

Anticlastogenic effect of *Allium sativum* extract against lead-induced necrosis in liver and kidney of albino rats

Tugbobo O. S., Ologunde C. A. and Orji E. E.

Department of Science Technology, Federal Polytechnic, Ado-Ekiti, Nigeria

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ABSTRACT

The anticlastogenic potential of Allium sativum aqueous extract was evaluated on lead-induced necrosis in liver and kidney tissues of albino rats in vivo. The rats were administered 2.5mg/kg lead acetate and 100mg/kg Allium sativum aqueous extract for a period of 4-weeks. The change in organ to body weight ratio of the treated rats as well as the pathological condition of the liver and kidney tissues were also assessed. The result showed that change in organ to body weight ratio of the animals fed with lead acetate was significant ($P<0.05$) when compared with control. Besides, the histopathological examination of liver and kidney tissues of rat fed with the clastogen alone indicates grossly necrotic or mutated cells, riddled with lesions of varying degrees. However, a slight modification was observed in tissues of animals fed with the extract which were fairly normal and well vascularized. Hence, Allium sativum could possibly offer protection against heavy metal-induced necrosis in liver and kidney tissues.

Keywords: Clastogen, histopathology, lead acetate, *Allium sativum*, necrosis.

INTRODUCTION

Heavy metals are mostly clastogens in the environment causing oxidative burst in the exposed individuals leading to tissue damage. Damage to DNA and other body tissues by these metals is likely to be a major cause of cancer and genetic birth defects and may as well contribute to aging and cardiovascular diseases. These metals are mostly chemicals present in the diets as complex mixture, or as contaminants as well as e-waste. Large amount of these chemicals were tested on their ability to cause damage with newly developed short and long-term tests that assay for mutagenicity, clatogenicity and carcinogenicity among which lead, cadmium, arsenite, mercury are notable (1). Studies conducted about a decade ago by Environmental Protection Agency and other associated International Regulatory agencies showed that low level exposure to lead is associated with societal problems such as brain dysfunction, neurobehavioural changes as well as kidney and liver diseases (2). Besides, *Allium sativum* has since been known for ages for its antibiotic, antiatheroslerotic, and antithrombic properties (3). Its addition has been reported to reduce cholesterol levels (4) and prevention of gastrointestinal cancer (5). Also, laboratory experiments have shown that garlic inhibits the growth of *Moris hepatomas* and *Ehrlish ascites* cells (6) as well as production of tissue plaminogen activator (7). This study was designed to investigate and evaluate the anticlastogenic potential of *Allium sativum* extract against lead-induced necrosis in liver and kidney of albino rats. In addition, to further justify the hypothesis that every mutated cell is a potential cancer cell.

MATERIALS AND METHODS

Experimental Design

Twenty four (24) male albino rats were used and were divided into three groups A, B and C with eight animals in each group. Animals in group A, B and C were treated with distilled water, 2.5mg/kg lead acetate and 100mg/kg *Allium sativum* aqueous extract and 2.5mg/kg lead acetate respectively for 30-days. The animals were fed with normal diet (21% protein), their body weights monitored and recorded weekly as well as change in their physical appearances. The animals were later anaesthetized with ether after 30-days and change in organ to body weight ratio was determined.

Procedure

The rats were sacrificed and their liver and kidney tissues were quickly removed, weighed and later cut into small pieces less than 5cm in size. The tissues were later processed and paraffin blocks prepared and were stained with PAS-sulphuric acid haematoxylin. The stained sections were observed with compound microscope for qualitative assessment of the pathophysiology of the uniferous tubules as well as atrophic change in their morphology. Change in organ to body weight ratio was determined and observations were recorded from four different sections of the slides chosen at random. Four stained slides from each of the twenty four animals were examined with respect to body weights and were analyzed statistically by applying students' t-test.

RESULTS

Table 1: Change in organ to body weight ratio of rats treated with 2.5mg/kg lead acetate and 100mg/kg aqueous extract of *Allium sativum* clove

Organ	First Week	Second Week	Third Week	Fourth Week
Control	0.11 ± 0.04^{a}	0.13 ± 0.04^{a}	0.12 ± 0.11^{a}	0.12 ± 0.11^{a}
Liver	0.31 ± 0.01^{b}	0.23 ± 0.01^{a}	0.23 ± 0.02^{a}	0.26 ± 0.02^{c}
Kidney	0.40 ± 0.02^{b}	0.42 ± 0.02^{b}	0.40 ± 0.02^{b}	0.35 ± 0.03^{a}

Values are means ±SEM. (n=4). Difference in organ / weight loss by the animals was significant at ($p<0.05$) along the rows with different superscripts.

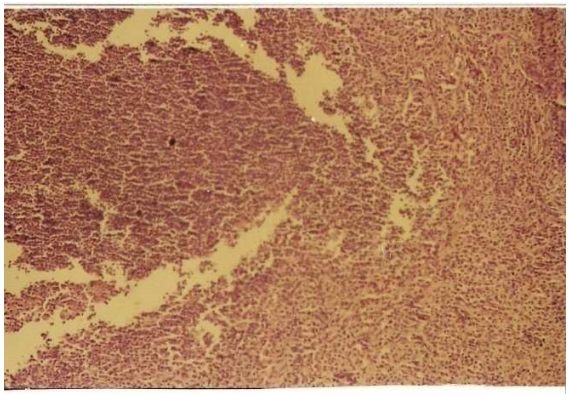

Plate 1: Fairly normal liver of rat treated with 2.5mg/kg lead acetate and 100mg/kg aqueous extract of *Allium sativum* clove

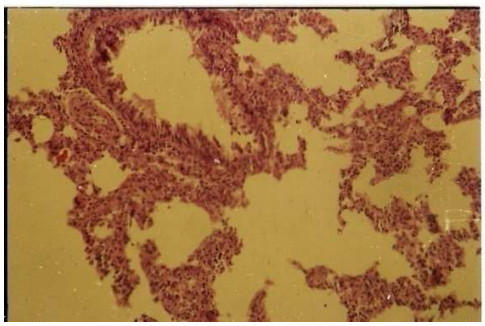

Plate 2: Necrotic liver of rat treated with 2.5mg/kg lead acetate

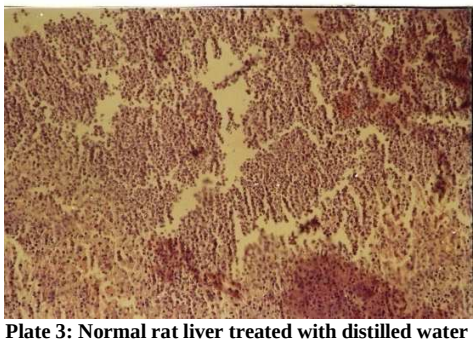

Plate 3: Normal rat liver treated with distilled water

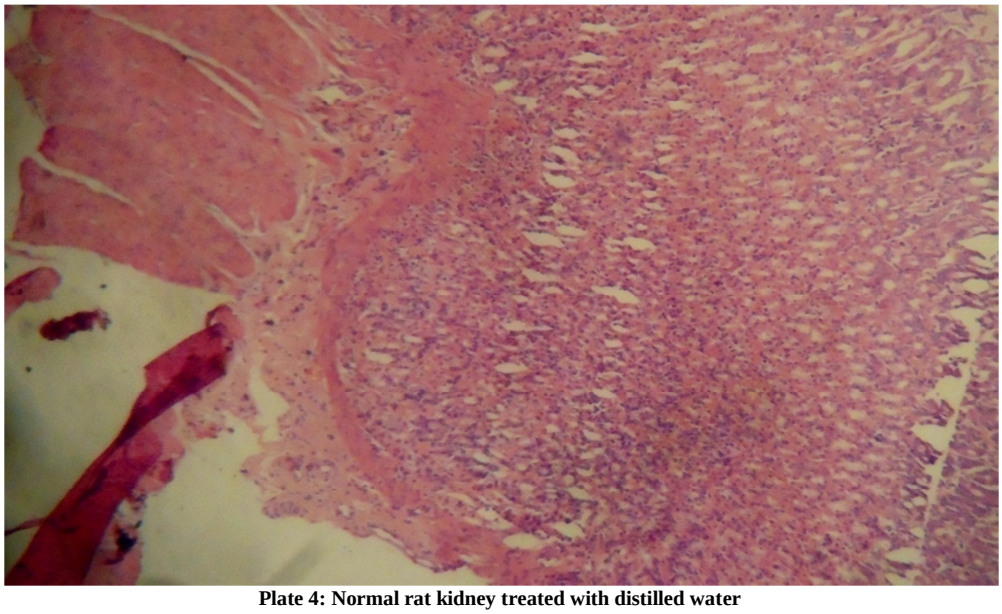

Plate 4: Normal rat kidney treated with distilled water

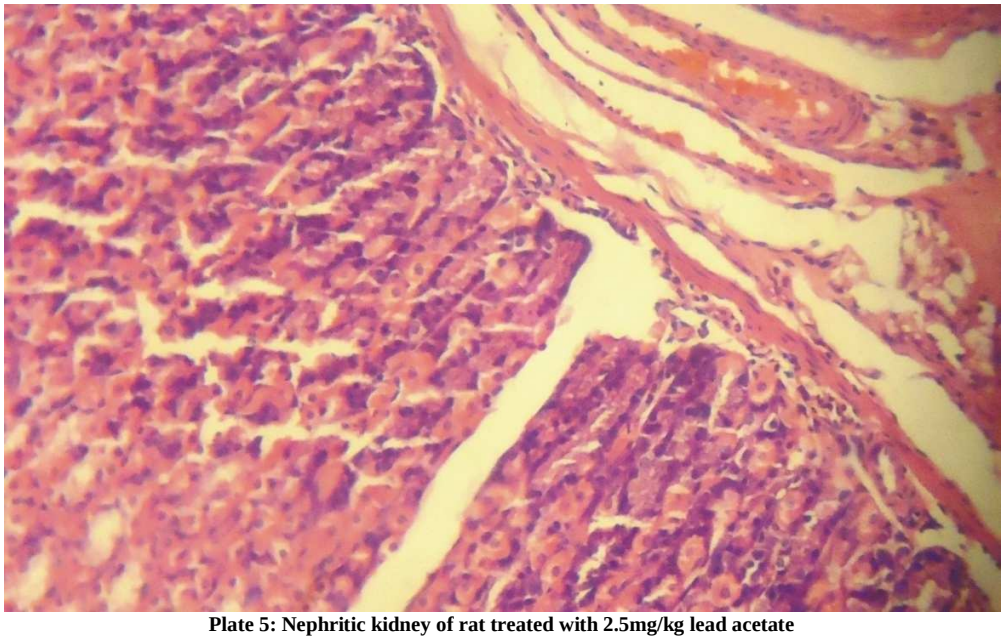

Plate 5: Nephritic kidney of rat treated with 2.5mg/kg lead acetate

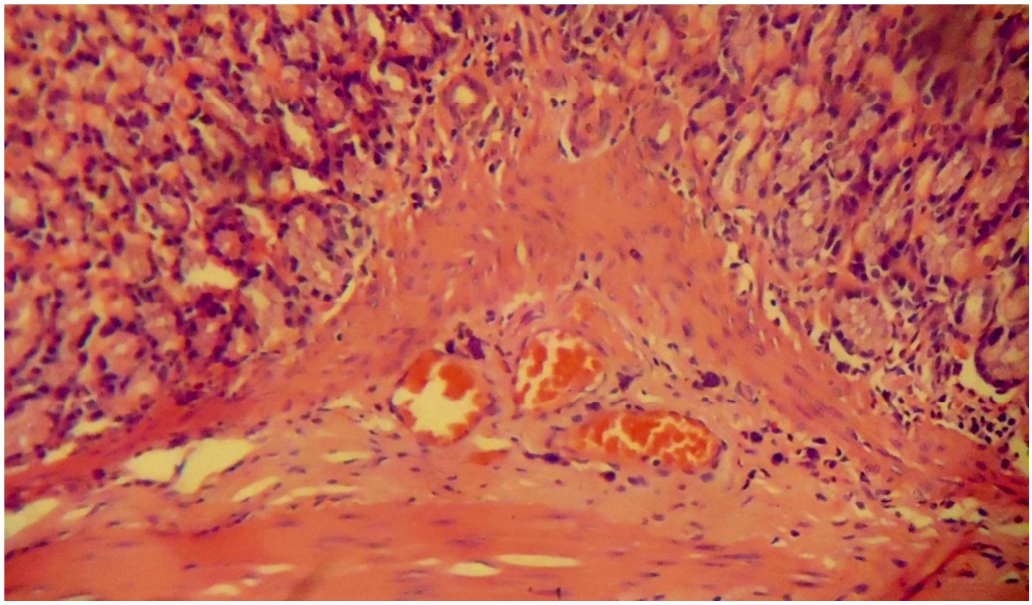

Plate 6: Modified rat kidney treated with 2.5mg/kg lead acetate and 100mg/kg aqueous extract of Allium sativum clove

DISCUSSION

In this study animals in group B that were fed lead acetate exclusively had no appetite for food, lost considerable weights on weekly basis and appeared emaciated, irritable and sickly due to the effect of the clastogen. However, those that were treated with the extract in group C appeared more agile, active with normal feeding behavior and were sensitive to their environment. Group A animals (control) were active, healthy with normal feeding behavior. The group B animals that were administered lead acetate only, were less active, appeared more irritable and lost considerable degree of weights. However, animals in group C fed with the extract together with the lead acetate showed fairly normal feeding behavior, active with sharp agility and were responsive to their environment prior to sacrifice. The considerable dose (100mg/kg) of the extract investigated in this study altered the final body weights as well as organ to body weight ratio of the test animals.

The increase recorded in liver and kidney tissues of animals fed with the clastogen when compared with control was significant ($p<0.05$). The increase in hepatic weights might be due to fat accumulation in the liver. This could be due to impaired synthesis of the lipoprotein that transports triglycerols away from these organs (8). Also, increase in liver weight could be due to the fact that fats assimilated by the liver were not mobilized adequately for use in normal body growth. Increase in the mass of liver, heart, lungs, kidney, spleen and testicles have also been reported in dead experimental rats fed oxidized fats (9). Besides, the increase could be due to bioaccumulation of unabsorbed iron in the liver cells where they cause cytotoxic effect in the liver cells which later manifest as series of liver diseases. The increase in kidney weight per body weight ratio due to ingestion of lead acetate might result from deleterious effect of lead on renal function because of its effects on cellular respiration. The increase in organ to body weight ratio in the tissues studied suggests that they are all prone to oxidative assault due to the ingestion of lead as a potent clastogen capable of inducing necrosis in animal tissues.

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