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Original article

Effects of aqueous extracts of garlic (Allium sativum) and ginger (Zingiber officiale) on liver function profile in wistar rats

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ABSTRACT

The present study evaluated the effect of Garlic *(Allium sativum)* and Ginger *(Zingiberofficiale)* extracts in rats. To achieve this objective,animals were assigned into the following groups as follows: Group 1: Served as control group and received 1ml of distilled water, Group 2: Received 20mg/kg b w of garlic, Group 3: Received 40mg/kg b w of garlic, Group 4: Received 20mg/kg b w of ginger, Group 5: Received 40mg/kg b w of ginger, Group 6: Received garlic 10mg and ginger 10mg/kg b w Group 7: Received garlic 20mg and ginger 20mg/kg b w. All administration was done orally for a period of 28 days. At the end of treatment all animals were sacrificed from all groups and blood samples collected and the serum separated for liver enzymes analysis. The liver tissue was carefully exicised and then subjected to routine histological investigation. The results of the study showed no statistically significant ($p>0.05$) difference on the level of serum ALT and AST in the experimental group fed with single and combined doses of garlic and ginger extract when compared to control group. There was also no significant change ($p>0.05$) on serum level of ALP in the group that received 20 and 40 mg/kg b w of garlic respectively when compared to the control group. However, the serum level of ALP was a statistically significant different ($p<0.05$) in the groups treated with 20 and 40 mg/kg b w of ginger and its combined doses when compared to their control group. The histological findings showed that the plant extract did not adversely affect the morphology of liver tissues in all groups treated with various doses of garlic and ginger extract at both single and combined doses administered to

animals. In conclusion, the observed effect of the extract at both single and combined doses suggests a non toxic and deleterious effect of the plant extract on the liver tissue, hence safe for consumption especially in humans.

1. Introduction

Many plants and their components have been extensively researched for their health promoting benefits that includes anti-oxidant, cardiovascular protection, anti-cancer, anti-microbial, and immune modulatory agents (Miller *et al.,* 2004). Ginger is used worldwide as a cooking spice, condiment and herbal remedy (Qureshi*et al.,* 1989). Fresh ginger contains 80.9% moisture, 2.3% protein, 0.9% fat, 1.2% minerals, 2.4% fibre and 12.3% carbohydrates. The minerals present in ginger are iron, calcium and phosphorous. It also contains vitamins such as thiamine, riboflavin, niacin and vitamin C (Govindarajan, 1982). The active components of ginger is reported to stimulate digestion, absorption, relieve constipation and flatulence by increasing muscular activity in the digestive tract (Stewart *et al.,*1991).Ginger is reported to be useful in treating inflammation and rheumatism (Kiuchi*et al.,*1992). Ginger has strong anti-bacterial and to some extent antifungal properties (James *et al.,* 1999). In traditional Chinese medicine, ginger is used to improve the flow of body fluids. It stimulates blood circulation throughout the body by powerful stimulatory effect on the heart muscle and by diluting blood. The improved circulation is believed to increase the cellular metabolic activity, thus contributing to the relief of cramps and tension (Kobayashi et al., 1988). Despite the numerous therapeutic effects attributed to garlic, the chemistry behind its health promoting effect is still poorly understood. Garlic is probably one of the earliest known medicinal plants. Over the centuries, garlic has acquired a special position in the folklore of many cultures as a formidable prophylactic and therapeutic medicinal agent (Moyers, 1996). Garlic has been reported to have many medicinal uses. It is well reported to scavenge oxidants, increase superoxide dismutase, catalase, glutathione peroxidase, and glutathione levels, as well as inhibit lipid peroxidation and inflammatory prostaglandins. Garlic also reduces cholesterol synthesis by inhibiting 3-hydroxy-3-methylglutaryl-CoA. Garlic has been shown to inhibit LDL oxidation, platelet aggregation, arterial plaque formation, decrease homocysteine, lower blood pressure, and increase micro circulation, which is important in diabetes (Borek, 2006). This research work was designed to assess the effect Garlic *(Allium sativum)* and Ginger *(Zingiberofficiale)* on liver function profile in wistar rats.

2. Materials and methods

2.1. Collection and preparation of plant extract

The fresh plant of garlic and ginger were purchased from Samaru market in Zaria, Kaduna State and dried under shade and then ground into fine powder using laboratory mortar and pestle. The powder (150g) of garlic and (208g) of ginger was macerated in cold water at room temperature for 24 hours. This was then filtered using a filter paper and the filtrate was evaporated to dryness on water bath at 40 ^{0}C to a dry residue of (24g) of garlic and (34g) of ginger and kept in an air tight bottle until they were reconstituted for administration.

2.2. Care and management of animals

Strains of albino wistar rats of both sexes between the ages of 12 -16 weeks old and weighing between 150-200 g were procured from Department of Pharmacology Clinical Pharmacy and Therapeutics Animal House. The animals were kept in well aerated laboratory cages in the Department of Human physiologyanimal house and were allowed to acclimatize to thelaboratory environment for a period of two weeks beforethe commencement of the experiment. They weremaintained on standard animal feeds and drinking water*ad libitum* during the acclimatization period.

2.3. Experimental design

In the study thirty five (35) animals were used. Each group consisted of five (5) Wistar rats and was divided into the following groups as follows:

Group 1: Served as control and were administered with 1ml of distilled water orally, Group 2: Received 20mg/kg body weight of garlic orally, Group 3: Received 40mg/kg body weight of garlic orally, Group 4: Received 20mg/kg body weight of ginger orally, Group 5: Received 40mg/kg body weight of ginger orally, Group 6: Received garlic 10mg and ginger 10mg/kg body weight orally, Group 7: Received garlic 20mg and ginger 20mg/kg body weight orally. The animals were treated once daily for a period of twenty days.

2.4. Collection and preparation of sera samples

Following the last day of treatment all animals were euthanized by exposing them to over dose of chloroform soaked in cotton wool placed in anesthetic box covered with lid. Blood samples were drawn from the heart of each sacrificed animal from all groups by cardiac puncture after they have been fasted for 12 hours. Blood samples was collected were collected in plain tubes and were allowed to clot and the serum separated by centrifugation using Denley BS400 centrifuge (England) at 1968 g for 15 minutes and subjected for liver enzyme assay.

2.5. Evaluation of serum liver enzymes

The serum enzymes Alanine aminotransferase (ALT), Aspartate aminotransferase (AST), Alkaline phosphatase (ALP) were determined spectrophotometrically, using enzymatic colometric assay kits according to the laboratory procedures of Randox Laboratories Limited kits, United kingdom.

2.6. Histological Preparation of liver tissue

Portion of liver and kidney tissues were fixed in 10% neutral formal-saline fixative solution for histological studies. After fixation, tissues were embedded in paraffin, solid sections were cut at 5µm and various sections were stained with haematoxylin and eosins as described by (Galozhger and Kocloff, 1971).

2.7 Statistical analysis

Data obtained were expressed as mean ± SEM. The data obtained were statistically analyzed using one-way analysis of variance (ANOVA) with Tukey's multiple comparison post hoc tests to compare the level of significance between control and experimental groups. All statistical analysis was evaluated using SPSS Version 17.0 software. The values of $p < 0.05$ and $p < 0.01$ were considered as significant (Duncan et al., 1997).

3. Results

The study showed that there was no statistically significant ($p>0.05$) difference on the level of serum ALT and AST in the experimental group with various doses of ginger and garlic as well as its combination when compared to control group as shown in figure 1 and 2. There was also no significant ($p>0.05$) change on serum level of ALP in the group that received 20 and 40 mg/kg b w of garlic respectively when compared to the control group. But there was a statistically significant difference ($p<0.05$) on the serum level of ALP in the groups treated with 20 and 40 mg/kg b w of ginger as well as their combination when compared to their control group respectively (figure 3).

The histological features of liver of control and the experimental groups administered with garlic and ginger extract are shown in plate 2-7. In this study, the histological findings showed that the plant extract did not adversely affect the morphology of liver tissues in all groups treated with various doses of garlic and ginger extract at both single and combined doses. The liver tissues showed cords of hepatocytes that are well preserved and essentially normal and arranged in fairly radial position in relation to the central vein, cytoplasm not vacuolated, sinusoids well demarcated, no area of necrosis, no fatty degeneration and change (plate 2-7) when compared to the control group (plate 1).

Fig. 1. Effects of garlic and ginger on mean (±SEM) serum alanine aminotransferase level in wistar rats. (Bar represent mean±SEM for six animals in each group).

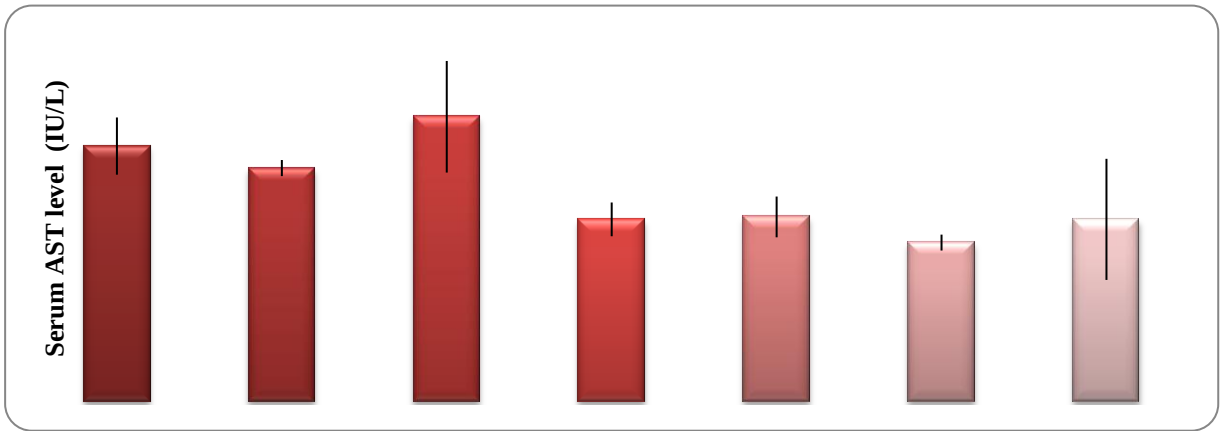

Fig. 2. Effects of garlic and ginger on mean (±SEM) serum aspartate aminotransferase level in wistar rats. (Bar represent mean±SEM for six animals in each group).

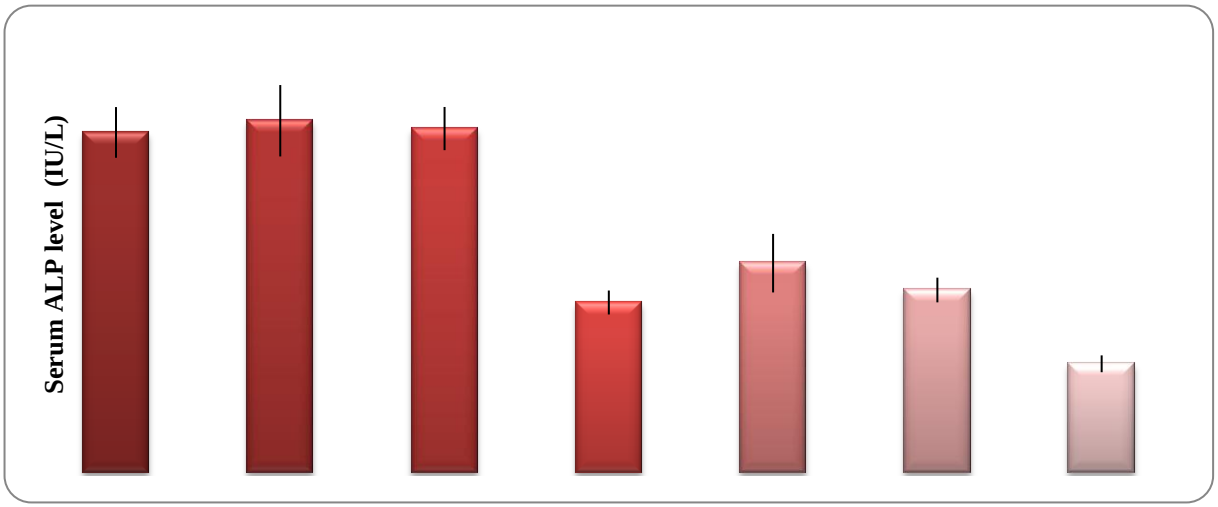

Fig. 3. Effects of garlic and ginger on mean (±SEM) serum alkaline phosphatase level in wistar rats. (Bar represent mean ± SEM for six animals in each group).

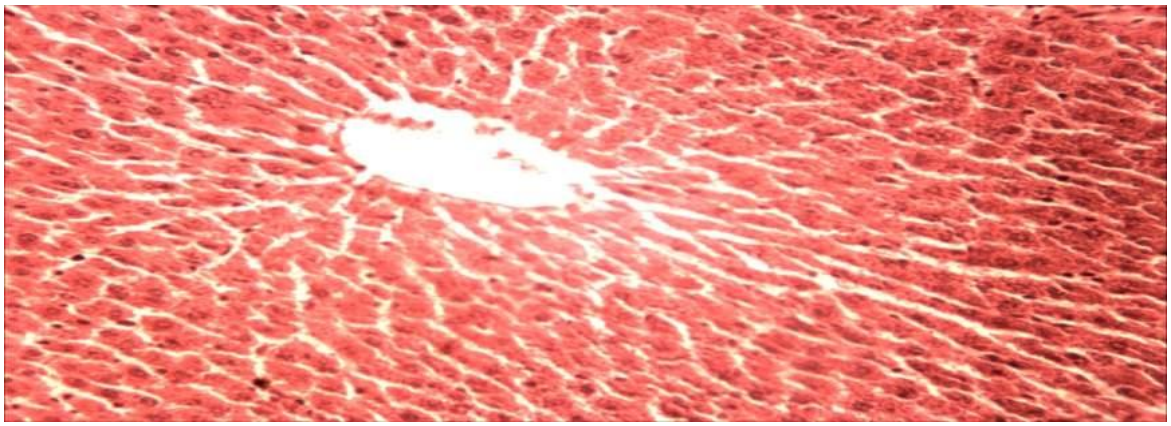

Plate 1. Photomicrograph of a section of liver of rats administered with 1ml of dsistilled water orally: showing normal architecture of central vein (CV), cords of hepatocytes (H) are distinct and essentially normal, cytoplasm are not vacuolated and sinusoids arranged in fairly radial position in relation to the central vein. H&E Stained X 250.

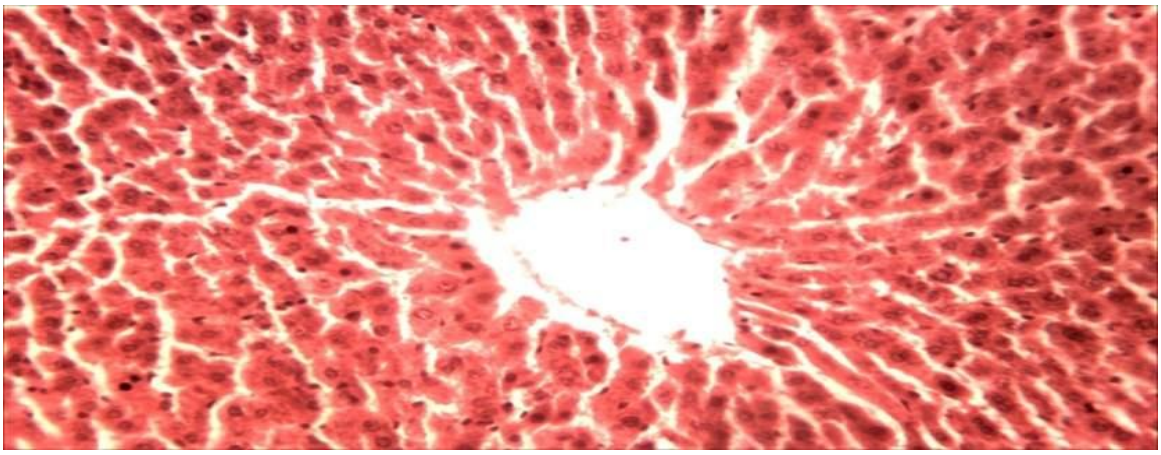

Plate 2. Photomicrograph of a section of liver of rats administered with aqueous extract of garlic 20mg/kg body weight orally: showing normal architecture of central vein (CV), intact hepatocytes (H) and sinusoids arranged in fairly radial position in relation to the central vein. H &EStained X250.

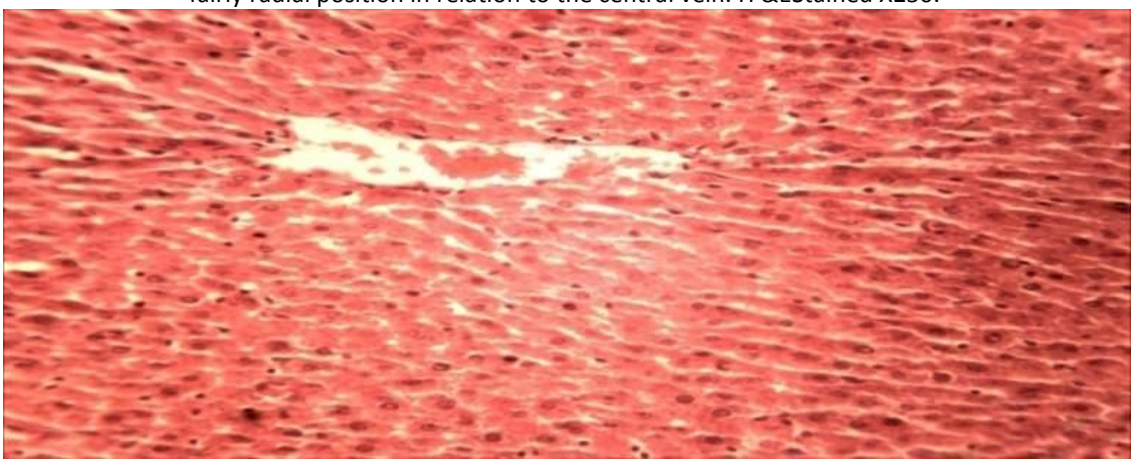

Plate 3. Photomicrograph of a section of liver from Normal Wistar rats administered with aqueous extract of garlic 40mg/kg body weight orally: showing normal architecture of central vein (CV), cord of hepatocytes (H) well preserved, no fatty degeneration and change and sinusoids arranged in fairly radial position in relation to the central vein, H&E Stained X 250.

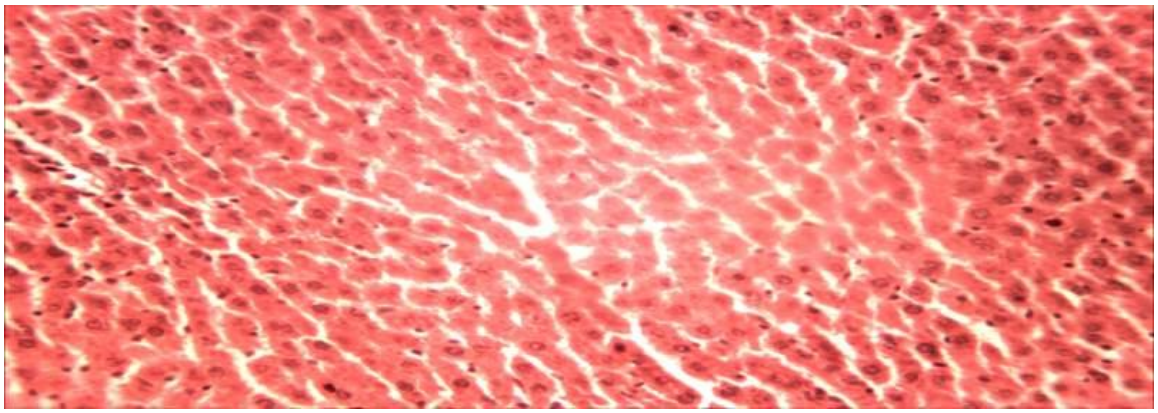

Plate 4. Photomicrograph of a section of liver of rat administered with aqueous extract of ginger 20mg/kg body weight orally: showing normal architecture of central vein (CV), cord of hepatocytes (H) well preserved, no fatty degeneration and change and sinusoids are well demarcated. H&E Stained X 250.

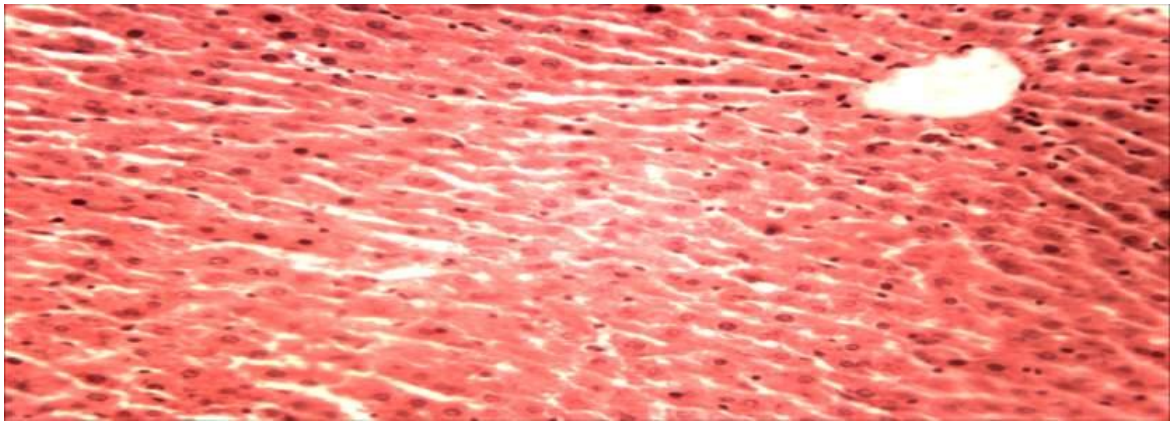

Plate 5. Photomicrograph of a section of liver of rat administered with aqueous extract of ginger 40mg/kg body weight orally: showing normal architecture of central vein (CV), cord of hepatocytes (H) well preserved, no fatty degeneration and change and sinusoids arranged in fairly radial position in relation to the central vein, H&E Stained X 250.

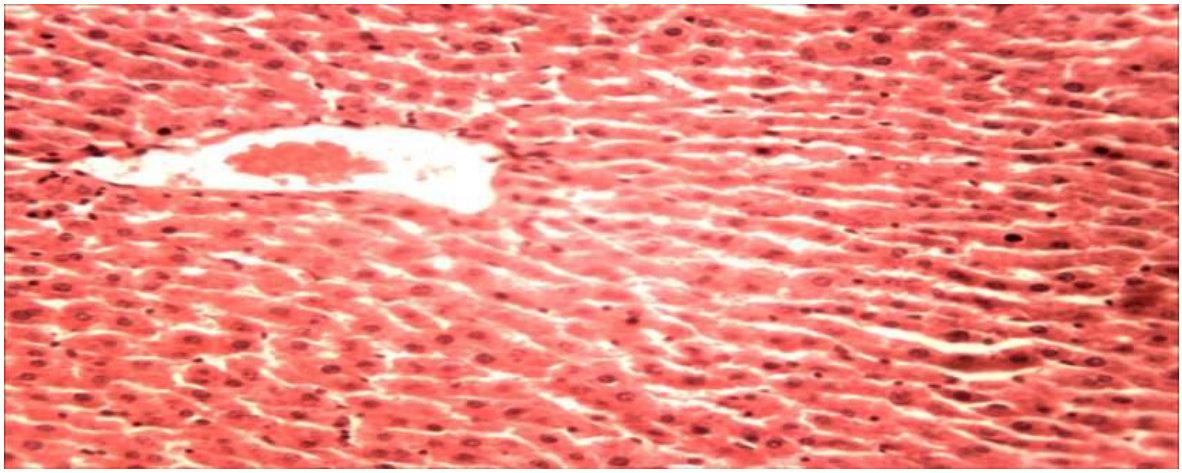

Plate 6. Photomicrograph of a section of liver of rat administered with aqueous extract of garlic 10mg/kg and ginger 10mg/kg body weight orally: showing normal architecture of central vein (CV), cord of hepatocytes (H) well preserved, no fatty degeneration and change and sinusoids are well demarcated. H&E Stained X 250.

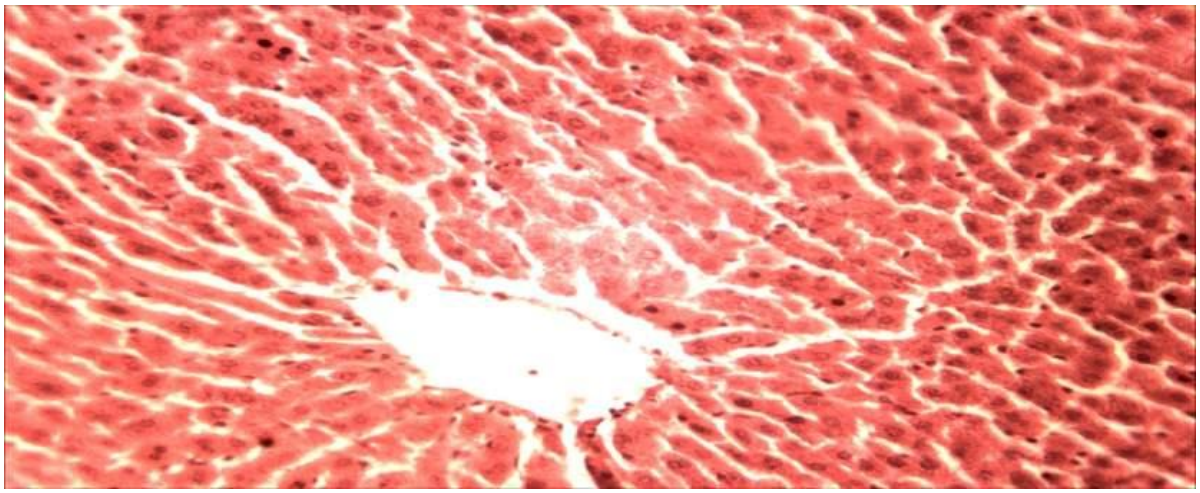

Plate 7. Photomicrograph of a section of liver of rat administered with aqueous extract of garlic 20mg/kg and ginger 20mg/kg body weight orally: showing normal architecture of central vein (CV), cord of hepatocytes (H) well preserved, no fatty degeneration and change and sinusoids are well demarcated. H&E Stained X 250.

4. Discussion

The present study investigated the effect of garlic and ginger on serum liver enzymes in rats. The study showed no statistically significant difference ($p>0.05$) on the level of serum ALT and AST in groups fed with single and combined doses of garlic and ginger extract when compared to control group. There was also no significant ($p>0.05$) change on serum level of ALP in the group that received 20 and 40 mg/kg b w of garlic when compared to the control group. However, there was a statistically significant change ($p<0.05$) on the serum level of ALP in the groups treated with 20 and 40 mg/kg b w of ginger and its combined doses when compared to their control group respectively. The liver is the main target organ of acute toxicity where exposed to the foreign substances being absorbed in intestines and metabolized to other compounds which may or may not be hepatotoxic to the rats (Rhiouania*et al.,* 2008). In this study, the liver histology revealed evidence of normal hepatocytes and did not cause any alteration to the structure of the liver cells. Also there was no necrosis, inflammatory reaction, fibrosis or local fatty degeneration in the liver of the control group (plate 1) and the garlic and ginger extract treated animals (plate 2-7) when compared to control group. The observed non significant change on serum levels of these enzymes as well as the preserved the structural integrity of liver tissues in all groups of animals fed with single and combined doses of garlic and ginger suggests the non deleterious effects of the plant extract, hence safe for consumption especially in human (Banerjee *et al.,* 2001).

5. Conclusion

In conclusion, the result of the study showed that the administration of garlic and ginger extract to animals produced a non significant change on serum liver enzymes; and this observed effect suggests non toxic and deleterious effect of the plant extract on the liver tissue, hence safe for consumption in especially in human.

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