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ORIGINAL ARTICLE

Atrophic Changes in Hepatocytes by Excess of Garlic Consumption

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ABSTRACT

Background: Garlic (allium sativum) is proved as herbal medicine and is used as self-medication for the control of hypertension, diabetes mellitus and heart diseases. Prolonged usage and high dosage have harmful effects on liver.
Aim: To evaluate the injurious effects of garlic (allium sativum) on the liver of adult albino rats.
Study design: Experimental study
Place and duration of study: Department of Anatomy, Shaikh Zayed Postgraduate Medical Institute, Lahore from 1st October 2013 to 31st March 2014.
Methodology: Forty five wistar albino rats of both sexes weighing between 250-350 grams were selected randomly. Two different doses of 500 and 1000 mg/kg of fresh garlic extract were given to the animals by orogastric tube for thirty days. After this period the analysis of quantitative parameters including diameter of hepatic lobule, diameter of the hepatic lobules, diameters of the hepatocytes and their nucleus was then performed on the livers of the sacrificed rats.
Results: In the present study, atrophic changes on the size of hepatic lobule, hepatocytes and their nucleus is noted in both experimental group B and C as compared to control group A (P<0.001).
Conclusion: It is worth to note that there is a need to evaluate safe dose and to determine the optimal duration of usage of garlic in general public due to its harmful effects on liver.
Keywords: Garlic (allium sativum), liver, atrophy, albino rats

INTRODUCTION

Garlic has history of several thousand years of human consumption and its use as traditional medicine. It was found in Egyptian pyramids and ancient Greek temples. In many cultures garlic was administered to provide strength and increase in work capacity for laborers. Hippocrates as a physician prescribed garlic for various pathological conditions. Garlic was given different names like Russian penicillin, natural antibiotic, vegetable Viagra, rustic theriac and snake grass etc[1].

Garlic not only have the nutritional components that are important for human body but also contain compounds that have medical importance such as sulphur compounds (alliin, allicin, ajoene), cellulose, amino acids, lipids, steroids, saponosides, organic acids, minerals, vitamins and enzymes[2]. Modern use of garlic is focused on the biological responses that have been attributed to reduction of risk factors for cardiovascular diseases,[3] cancer prevention[4], stimulation of immune responses,[5] increase in detoxification of foreign compound[6], antioxidant effects,[7] hypocholesterolaemic effect[8], hypoglycemic effects,[9] and neuroprotective effect which helps to reduce dementia[10].

Different studies for garlic extract in mice and rats have reported LD50 values were greater than 32g/kg.[11] The garlic extract in dose of 2 g/kg has damaging effect on the gastric and intestinal epithelial mucosal membrane, resulted in bleeding ulcers and sloughing of the villus structure of jejunum[12,13].

Garlic has hepatotoxic effects and atrophy of hepatocytes with pyknosis of their nuclei and vacuolar degeneration along with inflammatory cell infiltrations[14].

The objective of the study was to evaluate the injurious effects of garlic (allium sativum) on the liver of adult albino rats.

MATERIALS AND METHODS

This experimental study was conducted in Department of Anatomy, Shaikh Zayed Postgraduate Medical Institute, Lahore after permission from IRB. A total of 45 wistar albino rats of both sexes weighing between 250-350 grams were selected for this study. After 14 days of acclimatization the animals were randomly divided into three groups. Each group comprised of 15 animals. Group A was control, the animals of this group were not given garlic extracts but instead received distilled 4 ml/kg body weight of water by orogastric tube for 30 days. The other two groups B & C were experimental. Garlic extract 500mg/kg and 1000mg/kg was given respectively to the rats of experimental groups B & C through the orogastric tube for 30 days.

Garlic bulbs were purchased from the local market and then its extract was obtained from PCSIR, Laboratories Complex Lahore, which was prepared by soaking garlic paste in purified water. From 25 g of raw garlic, 1ml of garlic extract was obtained which contained approximately 90mg of allicin. Two concentrations of extract were prepared 0.2 and 0.3g/ml corresponding to doses of 500 and 1000 mg/kg body weight of animals respectively.[7] At the end of this study, all the rats were euthanized by giving morphine 0.3–0.5mg/kg intraperitoneally, as an analgesic agent. The anaesthetic agent sodium pentabarbitol was administered intraperitoneally with dose of 45mg/kg. After dissection, the quantitative parameters were recorded. The data was entered and analyzed through SPSS-25.

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RESULTS

The average diameter of hepatic lobules for control group A was 711.65±23.11µm, for group B was 600.23±43.28µm and that for group C was 502.99±31.19 µm. This showed statistically significant atrophy of hepatic lobules in experimental groups. The difference was statistically significant (P<0.001). When pair wise comparison made between three groups, it was seen that the diameter of hepatic lobule was significantly reduced in group B and C as compared to group A (P<0.001). The diameter for lobules was also significantly reduced for group C as compared to group B (P<0.001). The diameter of hepatocyte for group A was 16.15±0.75µm, for group B 14.18±0.84 µm and for group C13.48±0.78µm. The difference for diameter between three groups was significant (P<0.001). The pair wise comparison revealed that the diameter of group B and C was significantly less than that of group A [P<0.001] (Tables 1-34 Fig.1-3)

Table 1: Diameter of hepatic lobules of rats (µm) in control and experimental groups after administration of garlic extract

Group	Mean±SD
Control	711.65±23.11
Experimental A	600.23±43.28
Experimental B	502.99±31.19

Table 2: Pair wise comparison of diameter of hepatic lobules (µm) in control and experimental groups after administration of garlic extract

(I) Groups	(J) Groups	Mean Difference (I-J)	Std. Error	P value
Group A	Group B	111.4	12.25	<0.001*
	Group C	208.7	12.25	<0.001*
Group B	Group C	97.2	12.25	<0.001*

Based on Tukey's Test *Significant difference (P<0.05)

Table 3: Diameter of hepatocytes of rats (µm) in control and experimental groups after administration of garlic extract

Group	Mean±SD
Control	16.15±0.75
Experimental A	14.18±0.84
Experimental B	13.48±0.87

Table 4: Pair wise comparison of diameter of hepatocytes (µm) in control and experimental groups after administration of garlic extract (Tukey's Test)

(I) Groups	(J) Groups	Mean Difference (I-J)	Std. Error	P value
Group A	Group B	1.97	0.3	< 0.001*
	Group C	2.67	0.3	< 0.001*
Group B	Group C	0.71	0.3	0.060++

Based on Tukey's Test *Significant difference (P<0.05)
++ Non-significant difference (P > 0.05)

Fig. 1: Photomicrograph of liver of adult albino rat of control with normal parenchyma and experimental group with atrophy of hepatocytes and disrupted margins of hepatic lobule (Black Arrows) (H&E, 5x)

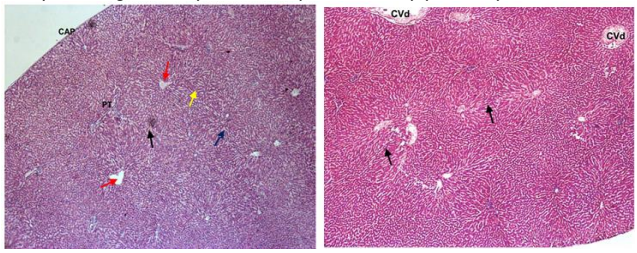


Fig. 2: Comparison of diameter of hepatic lobules of rats in control and experimental groups after administration of garlic extract

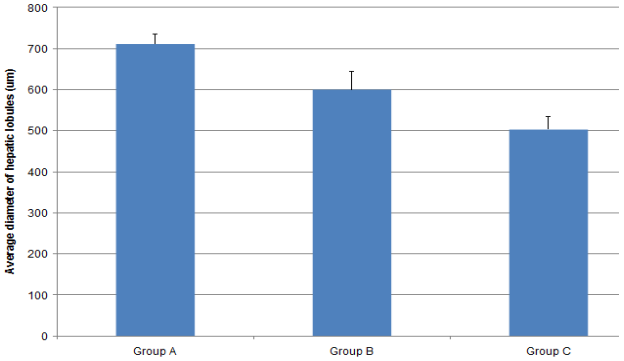
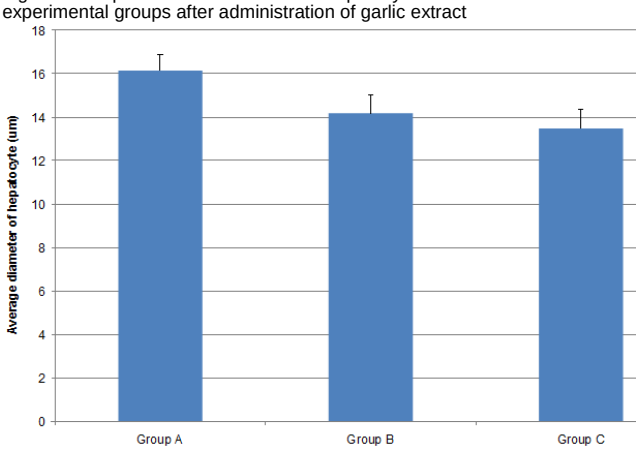


Fig. 3: Comparison of diameter of hepatocytes of rats in control and experimental groups after administration of garlic extract



DISCUSSION

The average diameter of hepatic lobules and hepatocytes showed statistically significant shrinkage in size and decrease in diameter in experimental groups. When pair wise comparison made between three groups, it was seen that the diameter of hepatic lobule and hepatocytes was significantly reduced in experimental groups B and C as compared to control group A (P<0.001).

The possible cause of atrophy of hepatic lobule and hepatocytes after garlic administration would be sinusoidal congestion and irregularities in blood circulation leading to ischemic atrophy in low perfused areas and well perfused areas showed compensatory nodular regenerative hyperplasia.[14] These findings of atrophied hepatocytes and hepatic lobule are in accordance with the findings of Manal, who also noted the atrophy of hepatocytes after administration of 10% dried garlic powder.[15] There is evident nuclear shrinkage with increased basophilia that is suggesting the pyknotic nuclei in the hepatocytes undergoing necrosis[16]. In this study many binucleated nuclei were also observed. The increase in the number of binucleated cells would most likely thought to be due to inhibition of cell division process during cellular injury[17]. These findings coincide with the histological changes observed by Rehman and Banerjee in their research on albino rats that showed hepatocellular necrosis in the animals due to higher doses of garlic[18].

CONCLUSION

The use of garlic extract in high doses for longer time caused significant cellular damage in liver of albino rats. It is worth noting that garlic is completely metabolized in liver and that is the main cause of its toxicity. The possible mechanism behind its damaging effect is oxidative stress at cellular level. It must kept in mind while prescribing garlic to hypertensive and diabetic patients because it is not safe as used in excess.

Conflict of interest: Nil

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