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Effect of Garlic along with Lead Acetate Administration on Lead Burden of Some Tissues in Mice

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Abstract: Garlic ability to reduce lead burden in body tissues before and during chronic lead toxicity was studied. Eighty mice were divided into 8 groups. Group D received placebo. Groups A1, A2 and A3, respectively received 500, 250 and 125 mg kg^{-1} day garlic and Groups B1, B2 and B3, respectively 1/4, 1/8 and 1/16 garlic tablet kg^{-1} day in first four weeks and in second four weeks they received 5 mg kg^{-1} day lead acetate plus garlic or garlic tablet. Group C received placebo in first four weeks and in second four weeks they received 5 mg kg^{-1} day lead acetate and placebo. Reduction in lead burden of kidney, liver, bone and blood (except for group A3) in experimental groups was significant compared with group C ($p<0.05$). Results showed that fresh garlic extract and garlic tablet had almost same effects on lead reduction in tissues.

Key words: Lead, mice, garlic

INTRODUCTION

Lead toxicity is one of the most common poisonings in farm animals (Radostits *et al*., 2000; Dwivedi *et al*., 1995).

Lead can be resided in tissues, thus in animals, which supply meat for humans, this issue, have a special hygienic importance and there is a possibility of lead entrance in human food circle (Dwivedi *et al*., 1995; Rai and Raizada, 1988). Furthermore it is also implicated in causing carcinogenesis, mutagenesis and teratogenesis in experimental animals (Pitot and Dragan, 1996). Because of diverse sources, which enter little amount of lead in body, so harmful effects of lead are ignored (Dwivedi *et al*., 1995).

Several metal chelators have been used to manage lead toxicity in the event of exposure, but none are suitable in reducing lead burden in chronic lead exposure. Moreover, these chelators in turn are potentially toxic and often fail to remove lead from all body tissues (Hanafy *et al*., 1994; Osweiler, 1999).

Garlic (*Aliium sativum*) has been used as a spice, food and folk medicine since ancient times. It has been found to possess cholesterol-reducing and antiatherosclerotic, anticoagulant, antibacterial, antifungal activities. The bulb of garlic is used as an antirheumatic and stimulant besides its use in conditions like paralysis, forgetfulness, colicky pain and chronic fever (Senapati *et al*., 2001). Cha (1987) reported that rats consuming raw garlic in their diet decreased Hg accumulation in liver, kidneys, bone, after exposure to MeHgCl in their drinking water and stated that garlic could be used for other heavy metal toxicity as well. Senapati (1997) reported that garlic extract could increase lead concentrations in urine and feces of rats. Other reports revealed that simultaneously administration of garlic and lead acetate (Hanafy *et al*., 1994; Senapati *et al*., 2001; Pourjafar *et al*., 2007b) or use of garlic after lead administration (Hanafy *et al*., 1994) is effective in lead reduction.

In this project garlic and garlic tablet ability to reduce lead burden in different body tissues before and during chronic lead toxicity in mice were studied.

MATERIALS AND METHODS

Eighty mature male mice with 35-40 g body weight selected and maintained under similar management conditions. All mice were kept under observation for about one week. In this period and during the experiment the diet consists of pellet concentrate. They were divided into eight groups and each group was consists of 10 mice. Details of protocols of experiment shown in Table 1.

When the period of this experiment (8 weeks) was over all mice were euthanized and samples were taken from their liver, kidney, femur and blood. For detection the amount of lead in tissues Atomic absorption device was used. In this study ANOVA test was used to compare the average of factors between different groups. The multiple comparison test of LSD was also used after the ANOVA

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Table 1: Details of protocols of experiment

Period	Substance	A1	A2	A3	B1	B2	B3	C	D
First 4-weeks	Lead acetate (mg kg^{-1})	-	-	-	-	-	-	-	-
	Garlic (mg kg^{-1})	500	250	125	-	-	-	-	-
	Garlic tablet (mg kg^{-1})	-	-	-	1/4	1/8	1/16	-	-
	Placebo	-	-	-	-	-	-	1/4	1/4
Second 4-weeks	Lead acetate (mg kg^{-1})	5	5	5	5	5	5	5	-
	Garlic (mg kg^{-1})	500	250	125	-	-	-	-	-
	Garlic tablet (mg kg^{-1})	-	-	-	1/4	1/8	1/16	-	-
	Placebo	-	-	-	-	-	-	1/4	1/4

test to compare the groups. Analysis was done by SPSS software program and $p<0.05$ was considered to be significant.

RESULTS AND DISCUSSION

In all experimental groups lead concentration of blood; kidney, liver and bone had a significant decrease in comparison with positive control group (group C) after second 4 weeks period. The range of lead content in experimental groups were as follows:

In blood: 0.33-0.54 μg mL^{-1}, in liver: 0.94-1.06 μg g^{-1}, in kidney: 1.11-1.46 μg g^{-1} and in bone: 7.66-10.01 μg g^{-1} (Table 2). In all groups (experimental, positive control and negative control) the degree of lead accumulation in different tissues was as follows: bone>kidney>liver> blood, which is exactly in accordance with the use of fresh garlic or garlic tablet after lead acetate administration in mice (Pourjafar *et al*., 2007a) and is different from previous report of simultaneous administration of fresh garlic or garlic tablet with lead acetate in experimental and positive control in dog (Pourjafar *et al*., 2007b).

Fresh garlic extract and garlic tablet administration, during the experiment, lead to remarkable Pb excretion from tissues. Therefore lead burden of liver, bone, kidney and blood in 6 studied groups decreased and in comparison with group C, decline was significant (except for group A3).

Results of comparison of lead concentrations in groups A1 to A3 and also in groups B1 to B3 showed a relationship between therapeutic-prophylactic effects and amount of garlic extract/tablet. Lead concentrations of these tissues in groups A1 to A3 in comparison with groups B1 to B3 showed that garlic extract/tablet has almost equal effects on lead uptake from tissues and prevention of lead accumulation in tissues.

In addition, results revealed that garlic (extract or tablet) is more effective on uptake of lead from kidney tissue. This finding is in accordance with report of use of fresh garlic or garlic tablet after lead acetate administration in mice (Pourjafar *et al*., 2007a) and is not in accordance with report of simultaneous administration of fresh garlic or garlic tablet with lead acetate in dog that showed garlic is most effective on liver detoxification (Pourjafar *et al*., 2007b).

Table 2: Measure of lead (μg g^{-1} of wet tissue and μg mL^{-1} of serum) in all groups (mean±SD)

Group	Blood	Bone	Kidney	Liver
A1	0.362±0.020*	7.657±0.491*	1.240±0.137*	0.937±0.112*
A2	0.501±0.015*	8.883±0.481*	1.179±0.162*	0.986±0.007*
A3	0.539±0.054*	9.574±0.269*	1.457±0.196*	1.025±0.023
B1	0.330±0.014*	7.897±0.471*	1.114±0.151*	0.954±0.013*
B2	0.370±0.028	9.783±0.296*	1.341±0.091*	1.008±0.033*
B3	0.474±0.022*	10.010±0.388*	1.149±0.184*	1.061±0.081*
C	0.555±0.060	12.256±1.64	2.140±0.177	1.361±0.233
D	0.409±0.018*	6.224±0.598*	0.616±0.076*	0.543±0.079*

*Significant difference with group C ($p<0.05$)

Our results under the protocol of before and concurrent garlic administration, led to significant reduction of lead in liver, blood, bone and kidney. This finding is in accordance with previous reports that revealed simultaneously administration of garlic and lead acetate (Hanafy *et al*., 1994; Senapati *et al*., 2001; pourjafar *et al*., 2007b) or use of garlic after lead administration (Hanafy *et al*., 1994) are effective in lead reduction. The present study, in contrast with Pourjafar *et al*. (2007a, b) showed that when garlic used before and during lead administration, not only 250 mg kg^{-1} but also 125 mg kg^{-1} can results in lead reduction of different tissues significantly in mice.

Garlic contains sulfur-containing amino acids, like S-allyl cystine, S-allyl mercaptocystein and alliin (Hanafy *et al*., 1994; Horie *et al*., 1992). Sulfur-containing amino acids like cysteine have already been reported for their chemo prophylactic use in lead toxicosis (Quarterman *et al*., 1980; Radostits *et al*., 2000; Rai and Raizada, 1988; Smith, 2002). The efficiency of garlic was perhaps due to the presence of these sulfur-containing amino acids and compounds having free carboxyl (c = o) and amino (NH2) groups in their structures. These biologically active compounds might have chelated lead and enhanced its excretion from the body resulting in reduced lead accumulation in tissues and blood. Further published results also showed that garlic extracts increased the lead concentrations in the urine as well as the feces of rats lending credence to this hypothesis (Senapati, 1997).

Besides chelation, other components of garlic (S-allyl cystine, S-allyl mercaptocystein and some micronutrients) also prevent absorption of lead from the gastro-intestinal tract (Crow and Morgan, 1996). Therefore it can be

suggested that the beneficial effect of garlic was probably due to the combine effects both on metal absorption and on excretion from the body. Concomitant use of garlic extract and lead acetate in rats was found to reduce tissue lead burden, considerably indicating the potential therapeutic activity of garlic against lead toxicity (Senapati *et al*., 2001). Lead burden was reduced in muscle and liver tissues of chickens given both lead and garlic simultaneously or garlic as a supplement after lead treatment (Hanafy *et al*., 1994).

Several chelating compounds have been used to manage lead toxicity in the event of exposure, but none are suitable in reducing lead burden in chronic lead exposure (Osweiler, 1999). Moreover, these chelators in turn are potentially toxic (Gilman *et al*., 1991) and often fail to remove lead from all body tissues (Bratton *et al*., 1981; Cory-Slechta *et al*., 1987).

Present finding showed that garlic and garlic tablet could decrease lead content as well as bone in chronic lead toxicity in mice. So it can be concluded that garlic can improve lead toxicity in mice and probably in humans and animals.

According to the results, it can be concluded that garlic is a safe supplement in chronic lead toxicity in human and animals.

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