

Effect of High Dose Ginger on Plasma Testosterone and Leutinising Hormone Levels in Male Rats after Lead Induced Toxicity

Fatima Riaz¹, Kirn-e-Muneera², Muhammad Adnan Saeed³

1. Department of Physiology, Islamic International Dental College, Riphah International University, Islamabad; 2 Department of Biochemistry, Islamic International Dental College, Riphah International University, Islamabad; 3 Nuclear Medicine Department, Atomic Energy Cancer Hospital, NORI, Islamabad

Abstract

Background: To study the effect of high dose ginger on plasma testosterone and leutinising hormone levels in male rats after lead induced toxicity

Methods: In this quasi experimental study, 30 adult male Sprague Dawley rats were divided in two equal groups. Group A was given 0.3% lead acetate in drinking water and kept as lead control while the Group B was given a dose of 1.5gm/kg body weight ginger orally along with 0.3% lead for 42 consecutive days. Rats were then sacrificed and serum testosterone and LH levels were analyzed using ELISA technique. Data was expressed as mean±SD. P-values <0.05 were considered as statistically significant.

Results: At the end of 42 days, mean serum testosterone level in Group A (control Group) was 2.2667± 0.45617ng/ml as compared to Group B (Experimental Group) 2.2667 ± 0.45617ng/ml and showed statistically insignificant change(p>0.05). Comparison of mean serum LH levels in Group A (5.3200 ± 0.72526ng/ml) revealed statistically insignificant difference (p>0.05) as compared to Group B (5.7467 ± 0.70190ng/ml).

Conclusion: High dose ginger (>1gm/kg body weight) failed to enhance the suppressed testosterone level due to lead toxicity in male rats.

Key Words: Lead toxicity, high dose ginger, plasma testosterone and LH levels

Introduction

The toxic effects of lead, an environmental pollutant, on the body systems are well documented. With the increased incidence of male infertility cases, researches regarding the antioxidant and androgenic activity of herbs have also been increased with different dimensions. Lead poisoning has been reported as a

major public health risk, particularly in developing countries which affects multiple organ systems.¹ Both clinical and animal studies have shown that lead affects sperm count, motility and testosterone level, hence causing infertility in males.^{2,3} The underlying common mechanism in all the environmental pollutants is oxidative stress which disrupts the prooxidant/antioxidant balance in the body.⁴ Researchers have conducted multiple studies on herbal products as natural antioxidants in lead poisoning because of their fewer side effects and cheap availability.⁵ Numerous studies have documented a decrease in the level of free radicals with the concomitant administration of herbal products such as ginger.⁶

Ginger (*Zingiberofficinale* Roscoe, *Zingiberaceae*) is routinely used as a household spice and its antioxidant, anti-inflammatory and androgenic activity has been documented in various animal studies.^{7,8} It significantly lowers lipid peroxidation by increasing the levels of antioxidant enzymes. Ginger's protective role has also been studied in animal models, in various reproductive toxicities like those induced by cyclophosphamide, cisplatin, malathion and diabetes.⁹⁻¹¹ It is a well-known fact that lead poses a deleterious effect on male reproductive organ.¹² In one study, it was shown that when ginger in doses of 0.5 to 1gm/kg body weight was co-administered along with lead, plasma testosterone level resumed to near normal levels.¹³

Regarding the use of herbs for health purposes, patients and physicians usually lack accurate information about safety, efficacy and proper dosage of herbal remedies. Over the last few years, interest in ginger or its various components as valid preventive/therapeutic agents has increased markedly, and so is the focus on verification of ginger's pharmacological and physiological actions. However no specific dosing studies have been performed on ginger in animal models. Most research

has used ginger between doses of 250 mg and 1 g of the powdered root, taken one to four times daily.¹⁴ However, one study by XiangluRong has documented that at a very high dose (2000 mg/kg), ginger led to slightly reduced absolute and relative weights of testes.¹⁵

Materials and Methods

In this experimental study thirty adult male Sprague Dawley rats, weighing 130-200 grams were randomly selected. They were divided into two groups with fifteen rats in each group. Group A served as normal control, which was given 0.3% lead acetate dissolved in drinking water, whereas group B was given ginger in a dose of 1.5 gm/Kg body weight along with 0.3% lead acetate. Ginger powder was added to lead acetate solution and mixed thoroughly. It was given in clean, inverted drinking bottles specific for the rat cages. All the groups were fed on standard pellet diet and water ad libitum in the animal house of National Institute of Health (NIH), Islamabad and kept in separate standard cages designed accordingly. Drinking water consumption in all the groups was recorded daily and rats were weighed on weekly basis to adjust the dose of ginger. Treatment in all groups continued for six weeks. After the last experimental day, they were sacrificed and three to five ml blood was drawn by intra cardiac catheterization. Samples were immediately transferred into labeled gold top vacutainers without anticoagulant kept in an ice packed rack. Serum was separated by centrifugation, transferred into labeled 1.5 ml eppendorf tubes, frozen and stored at -20 °C till assayed. Testosterone and LH levels in both groups were quantitatively measured using solid phase ELISA. Using semi-algorithmic graph paper a standard curve was constructed by plotting the mean absorbents obtained from each standard against its concentration with absorbance values at Y-axis and concentration on the horizontal X-axis. Thus the corresponding concentration for each sample was determined from the standard curve.

Statistical analysis was done using SPSS-23. Mean±SD of all observations were calculated. For the quantitative comparison of both the tests independent t-test was used. p-value<0.05 was taken as significant.

Results

All the 30 rats in the two groups were sacrificed a day after the last experimental day. At the end of day 42 mean serum testosterone level in Group A (Control group) was 2.2667± 0.45617ng/ml as compared to Group B (Experimental group) level of 2.2667 ± 0.45617ng/ml and showed no statistically significant

change(p>0.05). Comparison of mean serum LH levels in Group A (Control group) 5.3200 ± 0.72526ng/ml revealed statistically insignificant difference (p>0.05) as compared to Group B (Experimental group) 5.7467 ± 0.70190ng/ml (Table).

Table 1: Comparison of plasma testosterone and LH levels among lead treated (Group A) and Lead Ginger treated (Group B)

Hormone Levels (ng/ml)	Lead Treated (group A)	Lead+high dose Ginger(group B)
Testosterone	2.267 ± .45617	2.267 ± .45617
LH	5.320 ± .18726	5.746 ± .18123

Discussion

Lead induced suppressed reproduction and testosterone level is a known fact. Male rats exposed to lead acetate showed a significant decrease in the weight of both the testes, along with decreased plasma testosterone level.^{16,17} In a previous study, 0.5% lead administration in drinking water to male rats led to statistically significant reduction in plasma testosterone level with no statistical significant change in LH levels.¹⁸

An increase in oxidative stress biomarkers is common among all these heavy metals along with lead.¹⁹ Day by day, the use of herbs is increasing in our daily life considering their health benefits. The rich phytochemistry of ginger scavenges free radicals produced in biological systems. These anti-oxidative and androgenic properties of ginger have been explored in various in vitro and in vivo tests.^{6,20} Regarding the current scenario it has been documented in another study that ginger ameliorates lead toxicity by enhancing serum testosterone levels at doses of 0.5 and 1gm/kg body weight when given concomitantly.¹³ We can find similar studies regarding ginger's antioxidant and androgenic role in between the doses of 250 mg and 1 g of the powdered root, taken one to four times daily.^{9,2,22}

Although ginger is generally considered to be safe, we need to be cautious about its consumption. Careful scientific research is required in establishing the safety and efficacy of potential therapeutic plant remedies. According to Badrelin review on toxicological properties of ginger, it was considered safe to consume up to 1gm/kg of ginger to pregnant female rats with no teratogenic or toxic effects on reproductive organs. Some minor adverse effects observed at higher doses were mild diarrhea and heart burn.²² The results of toxicological studies showed a broad safety range for ginger usage. In a 35-day toxicity study the oral administration of ginger powder up to 2 g/kg

once daily did not cause any mortality or abnormal changes of the general condition in either male or female rats. All the hematological and biochemical parameters presented normally except for serum lactate dehydrogenase in dose dependent manner in males. The male rats also showed a slight but significant decrease of testes weight and the ratio of the testis weight to body weight in rats.¹⁵ No further research so far has been shown regarding its effect on serum testosterone levels at this dose (2g/kg/b.w)

Conclusion

High dose ginger (>1gm/kg body weight) failed to enhance the suppressed testosterone level due to lead toxicity in male rats.

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