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Evaluating the Effect of *Mentha piperita* Extract on Lipid Profile and Blood Glucose Level of Lead- induced Toxicity Rats

Ahmed Saber Abu-zaiton
Department of Biology, Al-albayt University, Jordan
***Corresponding author: E-Mail: abuzaiton@aabu.edu.jo, Mobile: 00962 776095004**

ABSTRACT

Objectives: The aim of the present study was to investigate the effect of *mentha piperita* extract on the levels of triglycerides, cholesterol, and blood glucose in experimental rats following lead intoxication for five weeks period.
Methods: Thirty experimental male rats were divided into one control group plus four groups with lead-induced toxicity, then the levels of cholesterol, triglyceride, and blood glucose were measured after administration of *mentha piperita* extract in two doses, 500mg/kg and 1000mg/kg.
Results: Mean cholesterol, triglycerides, and blood glucose levels in lead-induced toxicity rats were: 5.29±0.41mmol/L, 1.79±0.16mmol/L 1.20±0.22mmol/L respectively, which shows significant ($p<0.05$) reduction in triglycerides levels following administration of *mentha piperita* extract at dose 1000mg/kg.
Conclusions: The therapeutic use of *Mentha piperita* extract was proved to be effective in reducing the plasma triglycerides levels in lead-induced toxicity rats, while there is no significant alteration in the concentration of blood glucose and cholesterol levels following administration of *Mentha piperita* extract.

KEY WORDS: *Mentha piperita*, lead Toxicity, lipid profile, anti-diabetic agents.

1. INTRODUCTION

Lead (Pb^{2+}) has been defined as a poison to the human body systems, and recently became one of the most common diseases of environmental fluctuations (Olympio, 2009). Lead intoxication can affect most of the body systems (e.g: gastrointestinal, cardiovascular, reproductive, renal, hematopoietic, and nervous system). (Brochin, 2008; Jiang, 2014). The lead particles can enter the human body through contaminated water or food ingestion, or through inhalation of contaminated air, the lead particles then get absorbed into the circulatory system and bind with red blood cells until reaching the target tissues (Zietz, 2001; Mason, 2014).

The mechanism action of lead intoxication can be explained by the fluctuating of the homeostasis and the disrupting of the normal physiological processes of the human body, the toxic effect is based on the similarity of ionized Pb^{2+} to calcium (Ca^{2+}) (Ahmed, 2013). Ca^{2+} can be affected by the level of Pb^{2+} in human body (*Brochin*, 2008).

Lead (Pb^{2+}) enters the cells through plasma membrane through the same channels that absorb Ca^{2+}, inducing competitive inhibition for the channels (Garza, 2006).

The most important site in human systems that illustrate the effect of Pb^{2+} on Ca^{2+} channels is the nerves synapses, where the reduction in the Ca^{2+} ATPase activity results in elevating intra-synaptosomal Ca^{2+} and causes nerves damage, which considers the base for many disorders in the human body including: reading difficulty, defected mathematical skills, and abnormal social behavior (Sandhir and Gill, 1994).

The association between lipid metabolism and lead exposure, in both humans and rats, has been shown in multiple studies. Lead increases lipid oxidation in red blood cells resulting in alteration of the fatty acids composition of their membranes. Also, the cholesterol and triglycerides levels were shown to increase in the experimental rats brains, resulting in myelin disorders. These evidences and results are more suggestive than conclusive about lead-induced changes in lipid oxidation (Estela, 1999).

Medicinal plants are commonly used for the treatment of different diseases, and though to have effective pharmacological impact without the side effect of usage (Saad, 2006). It is been reported that about 75 percent of the world's population uses some form of complementary and traditional medicine for the treatment of different diseases.

Peppermint (*Mentha piperita* L.) is a medicinal herb of the Labiatae family (Mesbahzadeh, 2015). *Mentha piperita* leaves and the essential oil extracted from the leaves are used in many foods, cosmetics, and pharmaceutical products (Alankar, 2009; Marjani, 2012).

Therefore, the aim of the present study is to evaluate the effect of *mentha piperita* extract on the level of triglycerides, cholesterol, and blood glucose in experimental rats following Pb^{2+} intoxication for 5 weeks period.

2. MATERIALS AND METHODS

Plant Extraction: Plants of *Mentha piperita* were prepared by washing them with water and cut into small pieces then dried at room temperature. The dried *Mentha piperita* plants were grounded to powder using an electric grinder, then macerated and soaked in 80% ethanol for 5 days. The extract was filtered using Whitman filter paper, and the collected filtered extract was concentrated on a rotary evaporator to remove the solvent and was prepared as a dark, gummy, green extract. The ethanol extract was stored in sterile bottles under refrigerated conditions until used.

Animals: The rats used were male Wistar rats, weight 200-250g, and the rats were kept under standard conditions in the animal house unit at Yarmouk University (Irbid, Jordan). The rats kept inside stainless-steel cages and were supplied with the commercial standard pellet and water *ad libitum*, at 50% relative humidity and 12 hours dark/light cycles throughout the period of the experiment of 6 weeks.

Experiment design: Animals were divided equally into five groups, with each group containing 6 rats. Group1 received distilled water

Group2 received 30mg/kg Pb^{2+} acetate.

Group3 treated with 30mg/kg Pb^{2+} acetate + 500mg/kg *Mentha piperita* extract. Group4 treated with 30mg/kg Pb^{2+} acetate + 1000mg/kg *Mentha piperita* extract. Group5 treated with 30mg/kg Pb^{2+} acetate + 100mg/kg calcium disodium versante ($CaNa_2$-EDTA).

Animals were continuous orally administration of lead acetate and *Mentha piperita* extract daily for 5 weeks. On the week number 6, rats in group5 were intraperitoneally injected with CaNa2-EDTA daily for 1 week as appositive control. The Pb^{2+} acetate and $CaNa_2$-EDTA were obtained from Sigma-Aldrich.

Blood collection: After 5 weeks, the experimental rats were killed by cervical dislocation and blood samples were collected in fresh vials and centrifuged at 3000 rpm for about 15 minutes. While taking care not to disturb the cell layer or transfer any cells, the serum was carefully injected into a centrifuge tube. In order to remove the remaining insoluble particles, turbid samples were centrifuged and aspirated again. Blood serum samples were analyzed for blood glucose, triglycerides and cholesterol levels.

Blood glucose estimations: An electronic glucometer, Accu-Check (Bayers Diagnostic Pvt. Ltd., Germany), was used to measure blood glucose level through the glucose dehydrogenase method.

Serum lipids profile estimation: Enzymatic colorimetric method was used to measure the serum total cholesterol and triglycerides levels, using Mannheim diagnostic kits.

Statistical analysis: The values are expressed as Mean (n=6) ±SD. The results were statistically analyzed using one-way ANOVA to find out the level of significance wherever required. The minimum level of significance was fixed at $p<0.05$.

3. RESULTS

Mean cholesterol and triglycerides values for all experimental rats, are shown in figure 1. Triglycerides values were significantly ($p<0.05$) higher in the lead-exposed rats groups; a similar trend, which did not reach statistical significance, was found for cholesterol level. Administration of *Mentha piperita* extract in the dose of 1000mg/kg, significantly reduction in triglycerides level. The results showed that there are increasing in blood glucose levels in rats' groups exposed to lead acetate. No significant changes in blood glucose levels were observed in all experiment groups following administration of *Mentha piperita* extract. Figure 2.

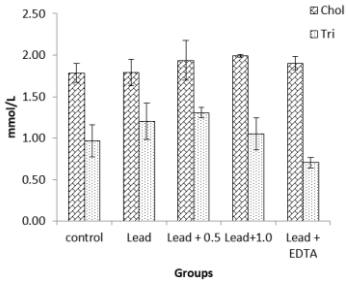

Figure.1. Effect of mentha piperita extract on cholesterol and triglyceride level of lead- induced toxicity rats

All data are presented as Mean ± SD

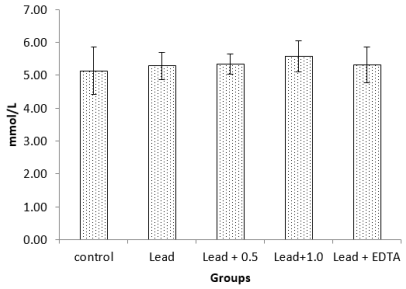

Figure.2. Effect of mentha piperita extract on blood glucose level of lead- induced toxicity rats

DISCUSSION

The major conclusion of this research is that, compared with the control group, the triglycerides, cholesterol, and blood glucose levels were increased in rats that have been injected with 30mg/kg lead acetate. A relationship

between the dose of lead and the plasma lipid levels was observed in the experimental groups, suggesting an alteration in the lipid metabolism related to lead administration. The elevated rates of cardiovascular diseases, and the high percent morbidity in the peoples exposed to lead, could be explained by the assessment of a predicted relationship between serum lipid levels and blood lead concentrations (Estela, 1999). This relationship, between lead administration and the high plasma lipid levels, is biologically plausible and could be explained by increasing synthesis or impairing the feedback inhibition of lipid metabolism (Shyam, 2012).

In our study, Lead administration in experimental rats has been connected to multiple disorders in the biological systems of the rats (Wani, 2015). These alterations were recorded as up or down regulation of the serum lipid levels by affecting the action of some enzymes involved in the lipid metabolism. These values agree with results of (Regina, 2013; Goldstein, 1990)

The elevated concentrations of the cholesterol and triglycerides in the plasma could be attributed to defect in the distribution between the blood plasma and the cells, through increase the absorption of cholesterol from the gastrointestinal system, increase the production of endogenous cholesterol, and decreased cholesterol transformation to bile salts (Lynda, 2011).

Rat's exposure to lead acetate was related to elevation in blood glucose levels (Figure.2). This consider as a risk factor for humans that exposed to environments where such derivatives of lead available.

The effect of *Mentha piperita* extract was studied in this research along the effects of lead exposure on the cholesterol, triglycerides and blood glucose levels in the rats.

Our results showed that after 5 weeks of treatment, there is significant reduction in triglycerides levels following administration of *Mentha piperita* extract -1000 mg/kg b.w- to the experimental rats that received lead acetate in comparison with control group, suggesting that the extract's effect is possibly due to its continent of water soluble vitamin which reduce the plasma concentration of triglycerides by triggering the triglycerides oxidation into bile acids. Elements of Ment*ha piperita* plant may bind to the lead-affected enzymes leading to oxidation of triglycerides and maintaining a normal homeostasis.

This agrees with other studies that tested the effectiveness of using medicinal plants extracts and antioxidant-vitamins in prompting the excretion of absorbed lead (Gurer and Ercal, 2000; Flora, 2009). Our results revealed that cholesterol and blood glucose levels remain unchanged in all lead exposed groups following administration of *Mentha piperita* extract.

4. CONCLUSION

The values of this research have showed that lead toxicity is capable of inducing dyslipidemia. The therapeutic use of *Mentha piperita* extract was shown to be effective in normalizing plasma triglycerides level, while the changes in the levels of cholesterol and blood glucose have no significant changes.

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