LEAD AND LEAD CHELATION IN RELATION TO PHYSIOLOGICAL AND HISTOLOGICAL ASPECTS OF HEAT STRESSED RATS

By

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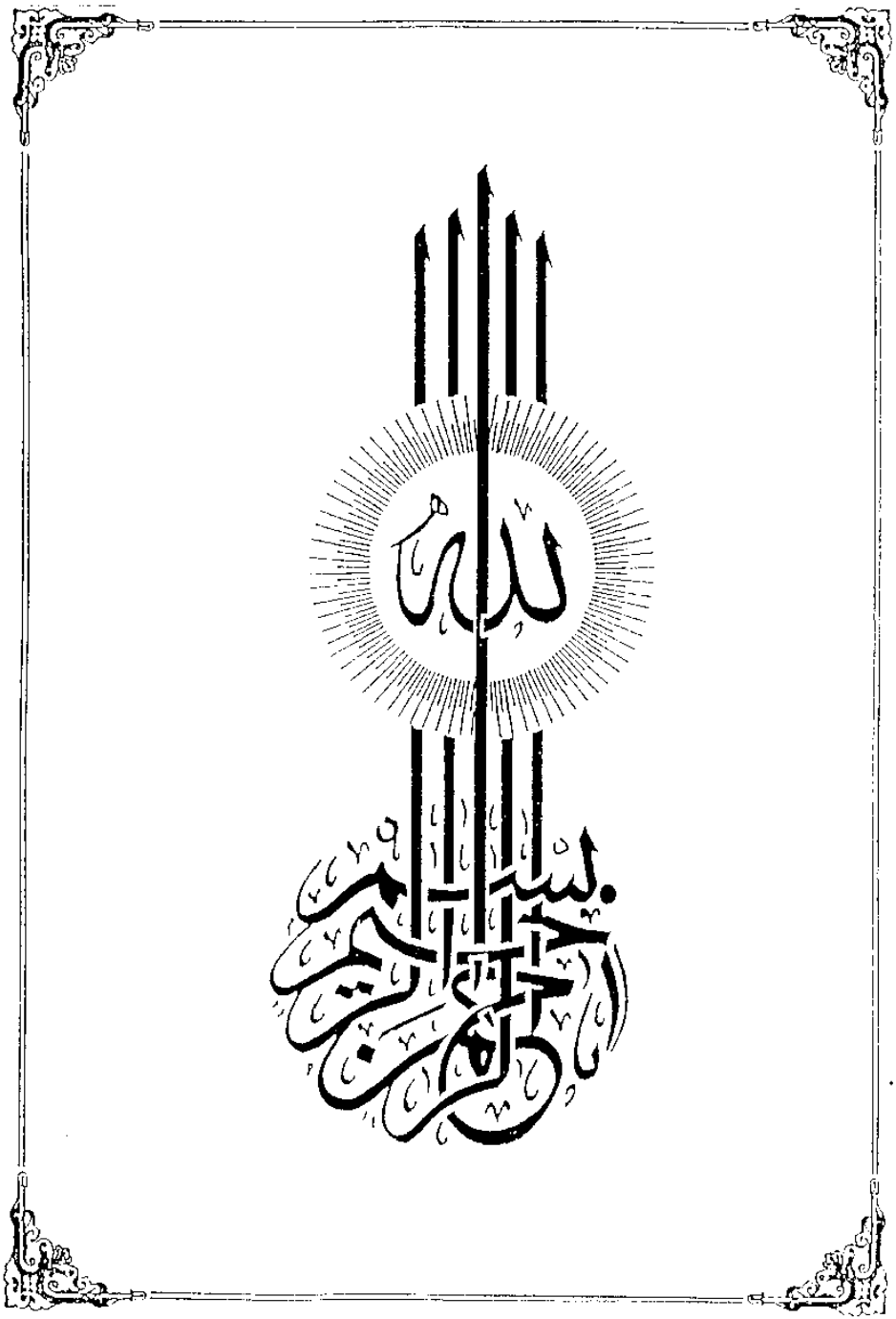

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ABSTRACT

Abstract

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Title: Lead and lead chelation in relation to physiological and histological aspects of heat stressed rats.

The present study aimed to investigate the effect of lead and evaluate the role of EDTA treatment, in minimizing lead toxicity, and their relation with the physiological and histological aspects of heat stressed rats compared to the corresponding findings under mild conditions.

The following parameters were estimated for each rat: serum lead level, Hb content, HC value, RBC, reticuocytes and Heinz bodies counts, clotting time, serum calcium, magnesium, T_3, T_4, urea, and creatinine levels, alkaline phosphatase and γ-GT activities. Histological structure of kidney and liver were also studied. The results showed the following:

Lead treatment of rats kept under mild conditions caused a significant increase of Heinz bodies, serum lead, urea, creatinine levels and alkaline phosphatase activity. It caused a significant decrease of body weight, hematocrit value, RBC and reticulocyte counts, haemoglobin content, serum calcium, magnesium, T_3 and T_4 levels.

Rats treated with EDTA under mild conditions showed a significant increase of clotting time, serum urea, creatinine levels and alkaline phosphatase activity. It caused a significant decrease of reticulocytes count, haemoglobin content, serum calcium and magnesium levels.

Combined treatment with both lead and EDTA of rats kept under mild conditions showed a significant increase of clotting time, serum urea, creatinine levels and alkaline phosphatase and

γ-GT activities and a significant decrease of reticulocytes count and serum calcium and magnesium levels.

Treating the rats with lead under heat stress conditions showed a significant increase of Heinz bodies, serum lead, urea, creatinine levels and alkaline phosphatase and γ-GT activities. It caused a significant decrease of body weight, haemoglobin content, hematocrit value, RBC and reticulocyte counts and serum calcium, magnesium, T_3 and T_4 levels.

EDTA treatments of rats kept under heat stress conditions showed a significant increase of clotting time, serum urea, creatinine levels and alkaline phosphatase and γ-GT activities. It caused a significant decrease of reticulocytes count and haemoglobin level and serum calcium and magnesium levels.

Treating rats with combined lead and EDTA under heat stress conditions induced a significant increase of clotting time, serum lead, urea, creatinine levels and alkaline phospahates and γ-GT activities. It caused a significant decrease of haemoglobin content, reticulocytic count, serum calcium and magnesium levels.

Heat stress exaggerated the effects of lead and EDTA administrated separately or in combination on the tested parameters compared to the corresponding ones under mild conditions.

The histological examination of kidney and liver, presented in this study showed that both lead and EDTA administration caused histopathological changes in kidney and liver tissues. However, the combined treatment of lead and EDTA showed more sever damages of kidney and liver cells. These changes were time dependent Moreover, heat stress enhanced the effects of lead and EDTA separately or in combination, on the architecture of the kidney and liver cells causing more histopathological damages compared to those recorded for mild conditions.

It is concluded from the results of the present study that administration of EDTA combined with lead decreased the levels of plasma lead and restored it almostly to the control level under mild conditions. It also improved the depressive effect of lead on hemopoietic series. This points to the efficiency of EDTA as a chelating agent in lowering the lead levels and diminishing its toxic effect on the body to a minimal level.

However, EDTA caused disturbance of some minerals and kidney and liver functions most probably due to its continuos administration for long period and/or to its wide spectrum of chelating essential metals as a polydentate chelator. Thus using EDTA for a short-period of chelation process may abolish the undesirable effects, at the same time addition of some essential metals as Ca, iron Cu and Zinc may be more of beneficial effects on lead chelation.

There is no doubt that hyperthermia exaggerates the toxic effect of lead on different body systems and at the same time antagonizes the effects of EDTA as a lead chelating agent. Thus, a simple ameliorating heat stress method is necessary for hot climate lead exposed workers and populations.

Prolonged administration of lead worsen the histological architecture and the biochemical functions of the kidney and to a lesser extent the liver specially under heat stress conditions, thus temporary substitution of lead exposed workers under relatively high temperatures is absolutely necessary accompanied with administration of the essential metals and/or safe and effective chelators may be more valuable

INTRODUCTION