



## Lead induced alterations in hemoglobin content during gestation and lactation in Swiss albino mice

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### ABSTRACT

Numbers of studies in animal models have shown changes in hemoglobin content after lead administration during gestation and lactation, still lead induced hematological changes are not well established. In the present study, hemoglobin content of normal and lead exposed pregnant and lactating Swiss mice were compared. Pregnant females were exposed to heavy metal lead orally on diet containing 4.5% lead nitrate and lead acetate trihydrate during gestation to 3<sup>rd</sup> week of lactation. Hemoglobin content and blood cell counts were examined on 15<sup>th</sup> day of gestation and on 1<sup>st</sup>, 11<sup>th</sup> and 21<sup>st</sup> day after birth. The results indicated that in lead intoxicated pregnant females, hemoglobin content decreased. From the results of above study it can be concluded that high levels of lead exposure during gestation and lactation can severely damage heme synthesis.

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### Introduction

It has been known since ancient times that lead may cause poisoning in man. In the modern era, thousands of hazardous chemicals and heavy metals are being produced and used in a wide variety of work places all over the world. Heavy metals are trace metals that are at least five times denser than water and are taken into body via inhalation, ingestion and skin absorption. It should be noted that most of the pathological conditions in body arise as a result of the exposure to these injurious substances. Lead and other heavy metals create reactive radicals which damage cell structure including DNA and cell membrane (Flora et al., 2008). Lead poisoning can cause a variety of symptoms and signs which vary depending on the individual and the duration of lead exposure (Karri et al., 2008; Kosnett, 2005). Gestational lead exposure has many adverse effects on development; a few of them may be most pronounced during the first trimester (Mogra et al., 2009) Many investigators studied the lower as well as higher exposure levels to lead. The amount of lead in blood and tissues, as well as the time course of exposure, determines the level of toxicity (Pearson and Schonfeld, 2003). Blood often shows pathological changes before the external signs of poisoning become apparent. The absorbed lead enters the blood stream where over 90 percent of it is bound to the red cells with a biological half life of 25-28 days (Azar et al., 1975). Toxicological effects of lead have their origin in perturbation in cell function of various organ systems. The major biochemical effect of lead is its interference with heme synthesis which leads to hematological damage (Awad and William, 1997). Despite several published accounts on pathophysiological alterations of lead toxicity and the cure of lead poisoning by sequestering agents (Royce and Rosenberg, 1993), the approaches are limited in scope. The present investigation was focused to evaluate the changes Hb content during pregnancy and lactation.

### Materials and Methods

Random breed Swiss albino mice were used for the present study. Sexually mature male and females weighing 25-30 gm were put in breeding cages in the ratio of 1:1 (6 female: 6 male) and were provided standard diet and water ad libitum. The cages were checked every day in the morning and females showing vaginal plug were isolated. The pregnant female was housed in an individual cage and was started on diet containing 4.5% lead nitrate and lead acetate trihydrate respectively along water ad libitum. Comparable litters that received normal standard diet and water ad libitum were studied concurrently as controls. All the experimental work was approved by the institutional animal ethics committee (Ref. No. IAEC/257).

- (1) Group 1- Control.
- (2) Group 2- Exposure of 4.5% lead nitrate.
- (3) Group 3- Exposure of 4.5% lead acetate trihydrate.

During the respective tenure of experiment, hemoglobin content of female Swiss mice were recorded on 15<sup>th</sup> day of gestation and on 1<sup>st</sup>, 11<sup>th</sup> and 21<sup>st</sup> day of lactation. Blood samples for hemoglobin were obtained from the tail of each mouse. The tip of the tail was cleaned with spirit before being cut with a sharp blade and was not squeezed to avoid dilution of blood by tissue fluid. The first few drops of blood were discarded. The hemoglobin was estimated by hemoglobinometer. The statistical analysis was performed by using analysis of variance (ANOVA) for the comparison of data between different experimental groups.

### Results

Introducing lead nitrate and lead acetate trihydrate to female Swiss mice during gestation and lactation period produced a significant decrease in the hemoglobin content. Data regarding changes in hemoglobin among different experimental groups and the results obtained for hemoglobin, Tables 1. It is evident from the tables that control animals have 12.4 g/dL Hb, on 15<sup>th</sup>

day of gestation. As compared to controls, hemoglobin in lead-treated female mice was significantly decreased at the time of birth. It is evident that control animals have 11.3, 12.5 and 13.9 g/dL Hb in their blood on 1<sup>st</sup>, 11<sup>th</sup> and 21<sup>st</sup> day of lactation, respectively. Table 1. Hemoglobin (g/dL) in pregnant and lactating female Swiss mice treated with lead nitrate and lead acetate trihydrate.

#### Discussion

In any living tissue toxic influences exert their effects first at the molecular and then at biochemical levels (Robbins and Angell, 1976). The alterations in hematological changes serve as the earliest indicator of toxic effects on tissue (Paprika and Sharma, 2003). Therefore in the present investigation, toxic effects of lead were evaluated by using hemoglobin content as the hematological parameters. Anemia may result when the cell membranes of RBCs become more fragile as the result of damage to their membrane (Yu, 2005). Rugh and Somogyi (1969) reported that hemoglobin declines during the early postnatal period (a phenomenon referred to as physiological anemia). According to Harkness and Wagner (1993), mean hemoglobin levels for rodents vary from 10 to 17 g/dL. Table 1. represent the cyclical changes in the hemoglobin during pregnancy and lactation. The maximum decreases in hemoglobin were observed during the first 7 days after parturition. In conclusion, the present study indicates that lead adversely affects hemoglobin. The results observed in this paper can be used as background information for the evaluation of reproductive toxicity induced by lead during gestation and lactation in Swiss mice.

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**Table 1. Hemoglobin (g/dL) in pregnant and lactating female Swiss mice treated with lead nitrate and lead acetate trihydrate. Values were expressed as means  $\pm$  S.D., values are significantly different ( $p < 0.05$ ).**

Treatment Groups	Days			
	Prenatal	Postnatal		
	15	1	11	21
Control	12.4 $\pm$ 0.25	11.3 $\pm$ 0.19	12.5 $\pm$ 0.36	13.9 $\pm$ 0.66
Lead nitrate	11.0 $\pm$ 0.86*	10.5 $\pm$ 0.82	10.2 $\pm$ 0.83*	10.1 $\pm$ 0.50*
Lead acetate trihydrate	10.8 $\pm$ 0.82*	10.4 $\pm$ 0.41*	10.1 $\pm$ 0.91*	9.90 $\pm$ 0.84*