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CHANGES IN HEMOGLOBIN PERCENTAGE AFTER CADMIUM CHLORIDE EXPOSURE IN MOUSE

Dr. Jaihree Daverey*

ABSTRACT

Heavy metals are naturally occurring elements that are widely distributed in the earth's crust. Excessive levels of trace elements may occur naturally as a result of geological phenomenon such as ore formation, weathering of rocks and leaching. Human activities, for instance, burning of fossil fuel, mining, smelting, discharging industrial, agricultural and domestic waste are far more responsible for the presence of heavy metals in the atmosphere than the natural geological phenomenon. Cadmium as an industrial pollutant has aroused a great concern due to its toxic effects on the various body tissues. Therefore, an attempt has been made to study the changes in the values of hemoglobin of Swiss albino mice after cadmium chloride exposure. For the experiment, adult healthy male Swiss albino mice (6-8 weeks old) were used for the experiment. The aqueous solution of the cadmium chloride was prepared by dissolving 20 mg of cadmium chloride in 1000 ml of the glass distilled water, thus giving the concentration of 20 ppm and then administered orally in drinking water. Animals were autopsied by cervical dislocation at each post-treatment interval of 1, 2, 4, 7, 10, 14 and 28 days. Immediately after autopsy, the blood was collected by cardiac puncture in heparinized tubes for studying haemoglobin percentage. The present investigation revealed decrease in haemoglobin values continuously upto day-4 after cadmium exposure and increasing thereafter. Cadmium interferes with the formation of haemoglobin, almost certainly in the bone marrow and intoxication by cadmium can hinder the resorption of iron resulting in an iron deficiency anaemia.

Keywords: *Cadmium Chloride, Haemolgobin, Haemolymph.*

Introduction

Environmental pollution is an undesirable change in physical, chemical and biological characteristics of water, air and soil that is harmful for all living organisms including plants. Most of the pollution problems which we face today stem from the overexploitation of our natural resources, technological advancement, urbanization and industrial revolution. Human activities, for instance, burning of fossil fuel, mining, smelting, discharging industrial, agricultural and domestic waste are far more responsible for the presence of heavy metals in the atmosphere than the natural geological phenomenon. Cigarette smoking can cause significant increase in the concentrations of cadmium in kidney, the main target organ for cadmium toxicity. [1] Once perpetuated in the environment, metals are not readily detoxified by metabolic activity. As a result they get accumulated contributing to potential environmental hazard. Some of the most common toxic metals are lead, mercury, chromium, cadmium, arsenic are highly toxic in minor quantities [2]. These metallic elements are considered systemic toxicants that are known to induce multiple organ damage, even at lower levels of exposure [3]. In the human body, these heavy metals are transported and compartmentalized into body cells and tissue binding to proteins, nucleic acids destroying these macromolecules and disrupting their cellular function [4]. Cadmium as an industrial pollutant has aroused a great concern due to its toxic effects on the various body tissues.

Therefore, an attempt has been made to study the variations in the values of haemoglobin content of Swiss albino mice after cadmium chloride exposure.

* Assistant Professor, Department of Zoology, J.D.B. Government Girls College, Kota, Rajasthan, India.

Materials and Methods

Adult healthy male Swiss albino mice (6-8 weeks old) were used for the experiment. Animals were fed with standard mice feed and water *ad libitum*.

Cadmium Chloride Treatment

The aqueous solution of the cadmium chloride was prepared by dissolving 20 mg of cadmium chloride in 1000 ml of the glass distilled water, thus giving the concentration of 20 ppm and then administered orally in drinking water.

The animals for the experiment were divided into following groups:-

- **Group I :** Animals of this group served as control (Normal).
- **Group II:** Animals of this group were orally fed with $CdCl_2$ at the dose rate of 20 ppm *ad libitum* in drinking water continuously till the end of the experiment.

Three animals from each group were autopsied by cervical dislocation at each post-treatment interval of 1, 2, 4, 7, 10, 14 and 28 days. Three normal mice were also autopsied.

Immediately after the autopsy, the blood was collected by cardiac puncture in heparinized tubes. The haemoglobin in the blood was estimated by cynameth-haemoglobin method described by Drabkin and Austin (1932). The haemoglobinometer (Make-Systronics type-181) was used for the estimation.

Result and Discussion

Changes in the haemoglobin Content (gms/100 ml of blood) in mice after cadmium chloride exposure are mentioned in Figure-1.

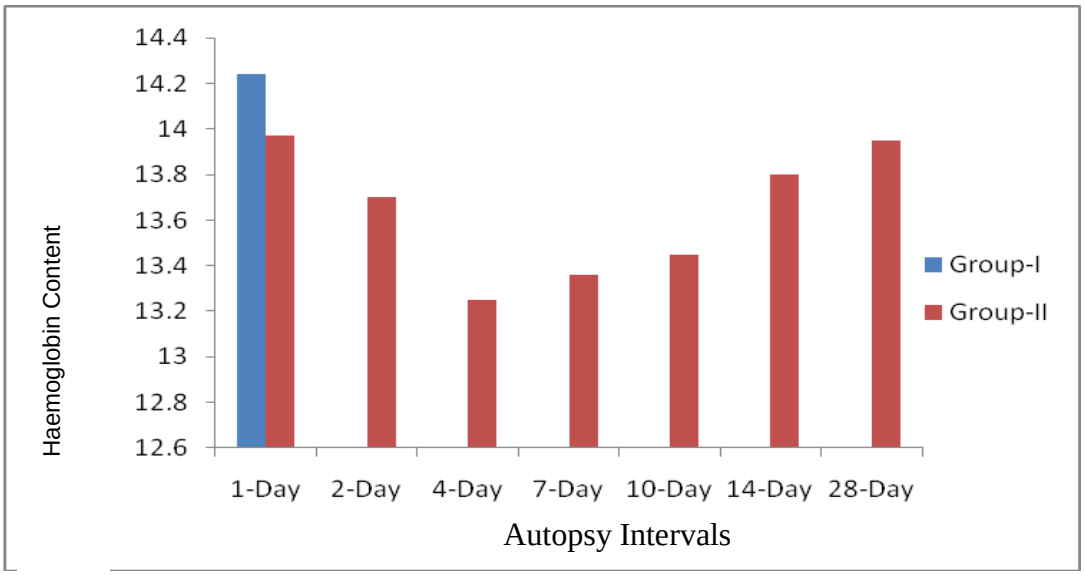

Figure-1

After administration via inhalation, ingestion or injection, cadmium is transported by the blood various other tissues in the body. Therefore, the concentration of cadmium in the blood is maximum immediately after intravenous injection and decreases with time because of its distribution to tissues and elimination from the body. The malpighian tubules, gut and epidermis are the primary sites of cadmium accumulation, whereas the haemolymph was the temporary target organ of cadmium accumulation, with the cadmium being transferred to other internal tissues via the haemolymph [5]. In the present investigation, the haemoglobin content of blood dropped down from the normal value, continuously till day-4 and increasing thereafter. After dietry exposure to cadmium, decreased haemoglobin concentration was among the early signs of cadmium toxicity. Cadmium interferes with the formation of haemoglobin almost certainly in the bone marrow. The combination of iron with haeme is inhibited. It has been demonstrated that intoxication by cadmium can hinder the resorption of iron resulting in iron deficiency anaemia. Cadmium-induced decrease in the values of haemoglobin was also observed by Mackova *et al.,* 1996, Chen X *et al .,*2015.

Conclusion

Although the mechanisms of cadmium toxicity are not very clear however, the main mechanism of heavy metal toxicity may be due to the generation of free radicals to cause oxidative stress and damage of DNA.

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