SUMMARY

The present work-done has been summarized under various chapters: Introduction, Historical account, Materials and methods, Experimental design, Observation, Discussion, Summary and References.

Introduction

Heavy metals and their salts constitute an important group of environmental pollutant and metabolic inhibitors in terrestrial and aquatic animal. Now there is wide spread environmental contamination with Cd level vary according to region as we get most of it from soil by our food. The toxic metals alter the immune response of animal as well as humans. In addition to the well documented and numerous toxic effects of cadmium on various target organs (Liver, kidney and spleen). A number of studies shown that chronic exposure to cadmium may result in impairment of immune functions in biological systems of animals.

In recent years the field of immunotoxicity has attracted greater attention of scientific community. Immune responses, haematological, immunological and biochemical parameters are closely related in blood hence any change in the immune responses would also induce alterations in these parameters.
### Materials and methods

The effects of cadmium acetate on certain haematological, biochemical, immunological and immunopathological parameters have been investigated in male albino rats pre and post treatment of exposure to sub-lethal dose of cadmium acetate after 35 and 70 days.

The toxicity of cadmium acetate in male albino rat is evaluated by determining its LD$_{50}$ value. The toxicity of cadmium acetate is dependent on concentration and exposure time of metals.

Experimental protocol has been divided into following heads –

- A. Immunological
- B. Haematological
- C. Biochemical
- D. Immunopathological

#### Model

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<td>Albino Rat</td>
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#### A. Immunological study

- i. Analysis of serum protein profile by gel electrophoresis
- ii. T & B lymphocytes
B. **Haematological studies** –
   i. Total Erythrocyte Count (TEC)
   ii. Total Leukocyte Count (TLC)
   iii. Haemoglobin (Hb)
   iv. Packed cell volume (PCV)
   v. Mean Corpuscular Haemoglobin (MCH)
   vi. Mean Corpuscular Volume (MCV)
   ix. Mean Corpuscular Haemoglobin Concentration (MCHC)
   x. Differential Leucocyte Count (DLC)

C. **Biochemical studies** –
   i. Serum protein
   ii. Serum glucose
   iii. Serum cholesterol
   iv. Serum urea
   v. Serum acid phosphatase
   vi. Serum alkaline phosphatase

D. **Immunopathological study**

   Following tissues were kept for immunopathology –
   i. Liver
   ii. Spleen

   To study the above aspect, healthy male albino rats (100-150gms) were kept in polythene cages. Before experimentation the rats were maintained in laboratory conditions temperature 30°C ± 5°C, D 12h: L 12h. The experimental animals were grouped into two sets – one control set – ‘A’ of ten rats and experimental sets ‘B’ of ten rats. The experimental sets were exposed to 3.5 mg/kg body weight (sub lethal dose) for 35 and 70 days. Each control group and experimental group were regularly checked for activity, behaviour, weight and
other related conditions during the experimentation period for the studies as per
experimental design. The four rats were sacrificed after 35 days of control and
experimental group and remaining rats of both groups were sacrificed after 70
days of post treatment.

A. IMMUNOLOGICAL STUDY

Immune response in relation to serum protein profile: The serum was collected
from both the groups of albino rats on the 35 and 70 days of post treatment and
was subjected to Agrose gel electrophoresis for different serum protein profile.
The five major bands assigned were albumin alpha 1 globulin, IgA1 antibodies,
alpha – 2 globulin, depicting IgA^2 antibodies, beta globulin & gamma globulin
depicting and IgG antibodies. The electrophoresis were scanned for the relative
percentage of albumin and globulin fractions. The result obtained revealed that
the albino rats treated with sub-lethal dose of cadmium acetate sowed
pronounced immune response with a bank (27.81%) use in gamma globulin
percentage in comparison to control and treated group.

B. HAEMATOLOGICAL STUDY

The total RBC count, haemoglobin concentration and haematocrit value
decreases significantly after exposure to cadmium acetate which causes
inadequate oxygenation of blood resulting hypoxic polycythaemia in albino rats.
The total WBC count increases significantly after exposure to cadmium acetate exposure at both intervals. The increase in WBC count is due to accumulation cadmium acetate which causes damage to tissue membrane and leads to migration of white blood cells to site of tissue injury resulting in leucopenia in albino rats.

The red cell indices viz. MCV and MCH decreases significantly after exposure to cadmium acetate. MCHC value slightly increase at 35 days of post treatment and slightly decrease at 70 days of post treatment. A fall in these values of red cell indices is directly correlated with increase in total RBC count, haemoglobin concentration and haematocrit value causing hypoxic polycythaemia in albino rats.

Differential leucocyte count revealed leucocyte in albino rat treated with cadmium acetate. The rise in total eucocyte counts, lumphocytes, eosinophils, monocytes and basophils was obviously due to the immune responses against cadmium toxication in albino rats. A fall of nutrophils were found in present study. Destruction of neutrophils in the peripheral blood due to toxic effect of cadmium could be the reason of reduce number of neutrophils.

C. BIOCHEMICAL STUDY

The serum total protein decreases significantly after exposure to cadmium acetate. The decrease in serum total protein is due to respiratory and digestory
inflammation accompanied with epithelial cell injury by cadmium acetate exposure causing leakage of proteins from serum to site of tissue injury leading to decrease in serum total protein value in albino rats.

The blood glucose increases significantly after exposure to cadmium acetate. An increase in blood glucose level is due to accumulation of cadmium acetate which causes tissue injury and stress condition which stimulates gluconeogenesis and glycogenolysis resulting in hyperglycemia in albino rats. An increase in blood glucose is also correlated with increase in glucose-6-phosphate dehydrogenase and serum total lipid in cadmium acetate treated albino rats.

The serum total cholesterol increases significantly after exposure to cadmium acetate. An increase in serum total cholesterol is correlated with increase in blood glucose and glucose-6-phosphate dehydrogenase which increases lipolysis in albino rats. Reduced lipoprotein lipase activity is also a basis of hyper-cholesterolaemia in albino rats due to cadmium acetate treatment.

The serum acid phosphate increases significantly after exposure to cadmium acetate. The increase in the values of serum acid phosphate is correlated with hypoxic polycythaemia in albino rats and increase in blood glucose level inducing hypophosphatemia in albino rats.

The serum alkaline phosphatase increases significantly after exposure to cadmium acetate in albino rats. The increase in serum alkaline phosphatase
activity is attributed to damaging effect of cadmium acetate on biliary lining causing damage to liver cells resulting in impaired liver function in albino rats.

D. IMMUNOPATHOLOGICAL STUDIES

Immunopathological changes in liver of albino rat after cadmium acetate treatment

Central vein was observed to be dilated with infiltration of the red blood cells. Focal collection of lymphocytes and thick band of fibrotic layer were distinctly observed around the central vein. Hepatocytes revealed vacuolization, cloudy swelling and nuclear changes such as pyknosis, karyolysis and karyorrhexis were also observed. Interstitium showed haemorrhages, oedema, and fatty degeneration. Portal region also showed thick band of fibrotic layer.

Immunopathological changes in spleen of Albino rats after treatment of cadmium acetate

Outer capsular wall was ruptured and inner capsular wall thickened to be observed. White pulp area and red pulp area were loosely packed spongy tissue lymphocytes were increased. Secondary nodules and oedema was observed.