Research Paper Veterinary Science

Haemato Biochemical Changes Induced by Atrazine Toxicity in Albino Rats

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ABSTRACT

The present study was designed to study the haematobiochemical alterations induced by atrazine toxicity in albino rats. Seventy two Sprague dawley rats were divided into four groups of 12 female animals and 6 male animals in each. Groups I, II and III were administered with atrazine @ 30, 60, 120 mg/kg b.wt/day respectively by oral gavage for 60 days where as group IV was served as control. At the end of 60th day, 6 females and 3 males from each group were sacrificed and before sacrifice blood and serum samples were collected for estimation of haematological and serum biochemical parameters. Haematological profile revealed a significant (P< 0.01) reduction of TEC, Hb, PCV, MCV, MCH, MCHC values and a significant (P< 0.01) increase in TLC values in all the treatment groups in dose dependent manner as compared with control group. Serum biochemical profile revealed significant (P< 0.01) increase in AST, ALT, BUN, creatinine levels and a significant (P< 0.01) decrease in total serum protein, serum albumin, serum globulin levels in groups I, II and III in dose dependent manner as compared with control group.

KEYWORDS Atrazine, haematology, serum biochemistry, rats

INTRODUCTION

Atrazine belongs to the group of chloro-s-triazine herbicides and broad-spectrum pesticides that are used both for control of pre- and post-emerging of weeds in crops such as corn, soybeans, sugarcane and maize, pineapple (EPA, 2001). Owing to its ability to control broadleaf weeds, atrazine is the most commonly used herbicide in the world (Hopenhayn-Rich et al., 2002). The world wide production rate of atrazine is approximately 154 million pounds annually (Jennifer and Aaron, 2006). The residues of atrazine are found in drinking water (Ghosh and Philip, 2006). Atrazine and their metabolites are relatively persistent in soil, with mean aerobic and anaerobic soil half life ranging from 20-146 and 58-547 days, respectively, and aerobic aquatic half–life about 2-fold higher (Enoch et al., 2007).

Indiscriminate use of atrazine has negative impact on the quality of environment and ultimately on the animal and human population. Present study was conducted to evaluate the haematology and serum biochemical alterations induced by atrazine in rats.

MATERIALS AND METHODS

A total of seventy two Sprague Dawley rats were procured from National Institute of Nutrition (NIN), Hyderabad. The experiment was conducted as per CPCSEA guidelines and prior approval by the Institutional Animal Ethics Committee. The rats were housed in solid bottom polypropylene cages and were maintained in controlled environment (Temperature 20-220C). Rice husk was used as bedding material. All the rats were provided ad libitum with standard pellet diet (procured from NIN) and water throughout the experimental period.

Following an acclimatization period of one week, the animals were divided into four groups consisting of 12 females and 6males in each. The groups were numbered as group I to IV. Group I was treated with atrazine at the rate of 30 mg/kg b.wt/day, group II was administered with atrazine at the rate of 60 mg/kg b.wt/day and group III was fed with atrazine at the rate of 120 mg/kg b.wt/day and group IV was fed with basal diet. The drug was administered by oral gavage every day consequently for 60 days. After completion of 60 days treatment, 6 females and 3 males from each group were sacrificed by cervical dislocation. Before sacrifice 2 to 3 ml of blood samples were collected from retro orbital plexus with the help of capillary tubes in to K3 -EDTA anticoagulant vials and following haematological parameters viz., total erythrocyte count (TEC), haemoglobin (Hb), packed cell volume (PCV), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC) and total lecocyte count (TLC) were analyzed by using automatic whole blood analyzer (Merck Specialities Pvt. Ltd). Blood samples were also collected in anticoagulant free vials, allowed to clot and serum was separated and stored at -200C. Stored serum samples were analysed for alanine transaminase (ALT), aspartate transaminase (AST), blood urea nitrogen (BUN), creatinine, total protein and albumins by using standard diagnostic kits. Globulins were estimated by subtracting the value of albumin from the total protein. The data were subjected to statistical analysis by applying one way ANOVA (Snedecor and Cochran, 1994).

RESULTS

Haematological parameters: In present study, the TEC, Hb, PCV, MCV, MCH, MCHC values were significantly (P< 0.01) reduced but TLC values were significantly (P< 0.01) increased in groups I, II, III in dose dependent manner as compared with group IV (Table 1)

Serum biochemical parameters: Biochemical profile revealed a significantly (P< 0.01) increase in AST, ALT, BUN, creatinine and significantly (P< 0.01) decrease in serum total protein, serum albumin, serum globulin levels in groups I, II, III in dose dependent manner as compared with group IV (Table 2)

DISCUSSION

Decreased total erythrocyte count (TEC), haemoglobin (Hb), packed cell volume (PCV), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC) might be due to reduced feed intake, toxic inhibition of bone marrow by atrazine leading to reduced erythropoiesis and the other reasons may include atrazine induced liver and kidney damage which was evident from serobiochemical alterations in the present study. These blood values were in agreement with previous reports

in mice (Mencoboni et al., 1992) and dogs (Thompson et al., 1992). The increase in the total lecocyte count (TLC) may be due to the neutrophilia.

Increased transaminase activity (AST and ALT) was observed in group III rats in comparison with other groups, which might be due to hepatic damage induced by atrazine that resulted in leakage of transaminases from necrosed hepatocytes. These findings were in agreement with the earlier reports in rats (Santa Maria et al., 1987) and pigs (Gojmerac et al., 1995).

In the present study, there was a significant increase in BUN and creatinine levels in comparison to other groups which may be attributed to nephrotoxicity induced by atrazine that resulted in impaired clearance mechanism. A significant hypoproteinaemia, hypoalbuminaemia and hypoglobulinaemia were observed in group III rats might be due to decreased feed intake and hepatic insufficiency.

Conclusion

Present study revealed that exposure to atrazine at different doses (30, 60 and 120 mg/kg b.wt/day) in rats altered the haemato-biochemical parameters in dose dependent manner.

TABLES

Table 1: Mean hematological values (mean ± S.E) in rats of different experimental groups due to atrazine toxicity.

Group	TEC ($x10^6$/µl)	Hb (g/dl)	PCV (%)	MCV (fl)	MCH (pg)	MCHC (g/dl)	TLC ($x10^3$/µl)
I	6.88^b ± 0.19	13.50^b ± 0.25	41.28^a ± 0.55	59.43^b ± 0.06	20.22^b ± 0.09	33.82^b ± 0.11	7.44^c ± 1.11
II	6.49^c ± 0.10	12.19^c ± 0.28	40.49^a ± 0.43	58.49^c ± 0.08	19.53^c ± 0.22	32.24^c ± 0.38	8.12^b ± 0.04
III	6.19^d ± 0.12	11.35^d ± 0.30	35.8^b ± 0.47	57.22^d ± 0.10	18.10^d ± 0.26	31.51^d ± 0.38	9.02^a ± 0.16
IV	7.18^a ± 0.23	14.89^a ± 0.19	40.8^a ± 0.59	60.20^a ± 0.11	21.89^a ± 0.32	35.05^a ± 0.32	7.30^c ± 0.07
P-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: Means with different superscripts in a column differ significantly at P < 0.05.

Table 2: Various mean biochemical values (mean ± S.E) in rats of different experimental groups due to atrazine toxicity.

Group	ALT (IU/L)	AST (IU/L)	BUN (mg/dl)	Creatinine (mg/dl)	Total protein (gm/dl)	Albumin (gm/dl)	Globulin (gm/dl)
I	52.55^a ± 0.62	218.33^a ± 1.03	21.83^a ± 1.01	1.58^c ± 0.06	6.58^a ± 0.11	3.26^a ± 0.09	3.75^a ± 0.20
II	61.50^b ± 0.80	230.33^b ± 1.08	36.33^b ± 2.33	2.94^b ± 0.15	5.55^b ± 0.14	2.55^b ± 0.19	3.05^b ± 0.13
III	71.83^c ± 1.10	245.00^c ± 1.52	61.66^c ± 2.20	5.03^a ± 0.20	4.25^c ± 0.18	1.80^c ± 0.08	2.32^c ± 0.11
IV	47.16^d ± 1.08	207.16^d ± 0.69	15.00^d ± 3.67	1.46^c ± 0.08	6.61^a ± 0.19	3.55^a ± 0.11	3.90^a ± 0.18
P-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: Means with different superscripts in a column differ significantly at P < 0.05.

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