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Effect of Potassium Bromate on the Liver of Swiss Albino Mice

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Abstract : *Potassium bromate is a white crystalline solid and a food additive often used in bread as flour improver. It is also used in fish paste, cheese, beer, cold hair wave solution and in other laboratory processes. Exposure of mice to potassium bromate at two dose levels (75 mg/kg bw and 200 mg/kg bw) was investigated for its effects on the liver. Mortality was found to be nil in all the experimental groups. A significant decrease in body weight and increase in liver weight was observed with dose concentration. A significant increase was observed in SGPT (Serum Glutomic Pyruvic Transaminase) and ALP (Alkaline phosphatase) level which was directly proportionate to the concentration of dose. Histological examinations revealed dilation of sinusoids, necrosis of hepatocytes, vacuolation of cytoplasm due to hydropic degeneration and fatty changes.*

Key words : *Potassium bromate, SGPT, ALP.*

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Introduction :

Potassium bromate is found as white crystalline, granules or powder which is colourless, odourless and tasteless. It has no medicinal value but is added to flour as a maturing agent to dough, to fish paste as a conditioner and also added in beer or cheese (Chipman,1988).It assists in dough raising process and produces a texture in the finished product that is appealing to the public(Sivasakar,2000).It is also used as laboratory reagent and oxidising agent in permanent wave compounds, as a food additive .(National Toxicology Program,1991;Budavari,1996).

Potassium bromate is also called Bromic acid or potassium salt.Its structural formula is $KBrO_3$ and relative molecular mass is 167.01g/mol.Its

vapour density is 5.8(air=1) and density of 3.27g/cm3 (USEPA,1993).It is soluble in water[3.1g/100ml(0°C),6.91g/100ml(20°C) and 13.3g/100ml(40°C)] . It is slightly soluble in alcohol ,acetone, dimethyl sulfoxide ,ethanol, methanol and toluene (National Toxicology Program, 1991). In a series of studies carried out by Kurokawa et al(1986 a,b).The effects of administration of potassium bromate in rats and mice were noted in the kidney. This organ was found to be having lesions characteristic of adenoma.

The available data, suggest however, that potassium bromate causes renal tumours through mechanism that involves oxidative damage to DNA(Lee et al,1996).

Chipman et al (1998) and Watanabe et al(2001) also reported that potassium bromate produced a serious oxidative modification to protein, lipid and DNA. Most of the studies were carried out on the kidney of rats and mice. The present study was therefore undertaken to examine the effects of potassium bromate orally administered in subacute doses to Swiss Albino mice in the liver, by observing fluctuations in SGPT, and ALP levels as they are released into the blood by the rupture of hepatic cells.

Materials and Methods :

Twenty one male Swiss albino mice with average weight (27.57±1.03g) and average age 3-4 months were used for the experiment. The mice were taken from the animal house of Patna Women's College. They were kept in polypropylene cages in air conditioned room at 22° C in a 12 hours light and 12 hours dark cycle. They were fed on homemade bread, Bengal gram, soyabean crunches and water.

The animals were divided into three groups of seven male mice(n=7 per group).The first group 'A' were administered sublethal dose of potassium bromate (75mg/kg bwt. per day) dissolved in 10 ml of distilled water for 21 days.The second group 'B' were treated with high dose of potassium bromate that is (200mg/kg bwt per day) dissolved in distilled water for 21 days. The third group on the contrary were administered distilled water and considered as control group.

The mice of all the three groups were sacrificed on the 22nd day of dose after giving chloroform. Before the sacrifice was done the weight of all the mice was taken. Weight of the liver was also taken after dissection. Blood was collected through cardiac puncture for Serum Glutamic Pyruvic Transaminase (SGPT) analysis and Alkaline Phosphatase (ALP)analysis.

Initial and final body weight of mice, the relative weight of body of control and treated mice, the relative weight of the liver of the control and treated mice were compared with student t-test. P value less than 0.05 was considered statistically significant.

Results :

Mice treated with potassium bromate showed no behavioural changes in general and in feeding mechanism . There was slight decrease in the final body weight of treated mice. Hence, there was no significant change in the initial and final body weight. Contrary to that there was a rise in the final body weight of the control group. (Table 1).

No significant changes occurred in the weight of the liver between treated group and control group of mice.(Table 2).

No significant changes were revealed in SGPT level between control group and treated group 'A' of mice. However, there was a significant raise in SGPT level between the control group and treated group 'B' of mice ($t = 2.24$, $P < 0.05$) . (Table 3).

There was also an insignificant increase in ALP level when the control group was compared

the treated group 'A' whereas when the control group and treated group 'B' were compared, there was a significant increase in the ALP level (t=4.03, P<0.05). (Table 4).

Liver of control mice showed compactly arranged hepatocytes with narrow sinusoids or spaces with the prominent central vein . Cytoplasm and blood vessels present(Figure 1 and 2). Whereas liver of mice treated with potassium bromate showed many histopathological alterations such as dilation of sinusoids , necrosis of hepatocytes, free nuclei, vacuolation of cytoplasm due to hydropic degeneration . There was also mild congestion of central veins , rupture of hepatocytes (Fig – 1,2 and 3).

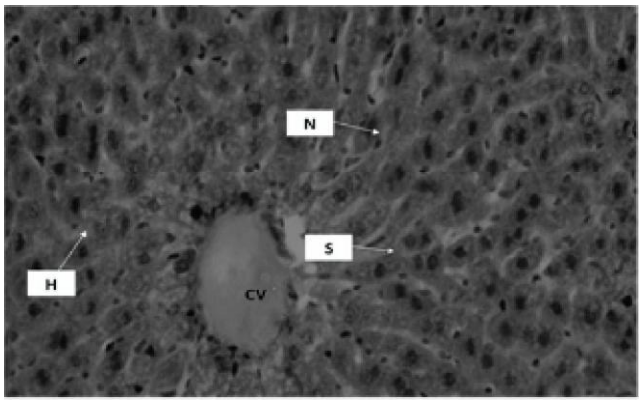

Fig2. Microphotograph of liver of control mouse. Showing normal central vein (CV) hepatocytes (H), sinusoids (S) and nucleus (N), X 1000.

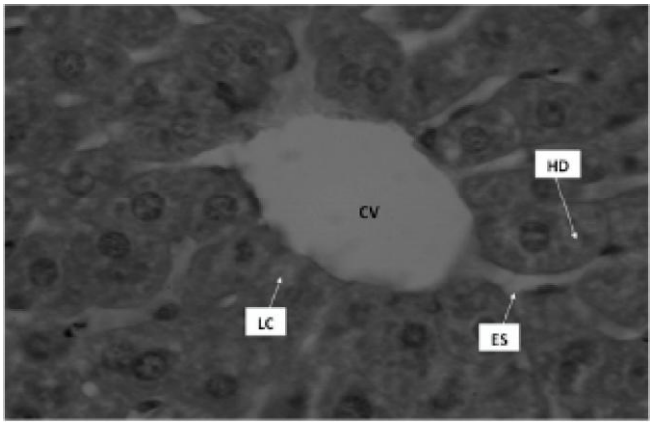

Fig4. Microphotograph of liver treated with potassium bromate 75mg/kg bwt. It shows loss of cytoplasm (LC), enlarged sinusoids (ES) and hydropic degeneration (HD) X 1000.

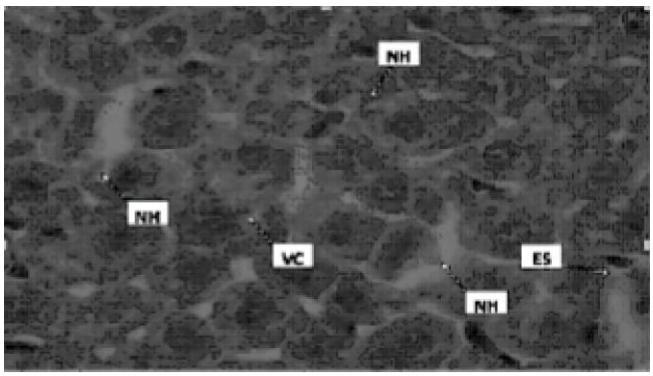

Fig4. Microphotograph of liver treated with potassium bromate. It shows necrosis of hepatocytes (NH), enlarged sinusoids (ES), vacuolation of cytoplasm (VC) due to hydropic degeneration, x 1000

Table No. 1 Comparison of initial and final body weight of mice.Values are Mean ± SEM

	Initial weight	Final weight	't'Value	Level of signi-ficance
CONTROL	27.52±1.03	29.37±0.73	1.33	NS
GROUP'A' (Mice treated with lower dose)	27.5±0.93	23.62±0.67	1.60	NS
GROUP'B' (Mice treated with higher dose)	26.0±1.5	23.62±1.13	1.318	NS

Table No. 2 Comparison of liver weight between control and treated group of mice.Values are Mean±SEM

	Mean ± SEM
CONTROL	1.40272±0.04
GROUP'A' (Mice treated with lower dose)	1.40738±0.05
GROUP'B' (Mice treated with higher dose)	1.41018±0.02

Thus in comparison with the control group the weight of liver of group'A' increased significantly by 0.33% whereas the weight of liver of group'B' mice increased significantly by 0.53%.

Table No. 3 Comparison of SGPT level between control and treated mice(group A and group B). Values are Mean±SEM

	Mean ± SEM	't' Value	Level of significance
CONTROL	25.30±1.78	0	NS
GROUP'A'(Mice treated with lower dose)	30.13±1.96	1.66	NS
GROUP'B'(Mice treated with higher dose)	36.41±2.30	2.24	P<0.05

Table No. 4 Comparison of ALP level between control and treated mice(Group A and Group B). Values are Mean±SEM

	Mean ± SEM	't' Value	Level of significance
CONTROL	5.923±0.73	0	NS
GROUP'A'(Mice treated with lower dose)	7.694±0.70	1.59	NS
GROUP'B' (Mice treated with higher dose)	12.007±1.16	4.03	P<0.05

Discussion :

There was no significant change in the body and organ weight of the treated mice as compared to the control mice. A slight fall in the final body weight of treated group of mice might have occurred due to decreased rate of metabolism. There was a slight increase in the liver weight of treated group of mice which was possibly due to accumulation of the chemical. In other comparable study , Balkan and Aktac (2005) fed benomyl (200 mg/kg bwt^{-1})to rats for five days and found a significant increase in the weight of liver of treated mice as compared to the control.

The serum transferase SGPT (ALT) activity which is known as hepatotoxicity marker, increase in this enzyme activity in the treated group of the mice. There was a significant increase in SGPT level in the treated group'B' of mice.There was a significant increase in ALP level in the treated group'B' of mice.This suggests that the liver gets affected and causes hepatic disorders due to intake of potassium bromate.

The liver seemed to be mostly affected by the higher dose of potassium bromate.The changes reported were mostly expansion of sinusoids due to shrinkage and damaged hepatocytes. Vacuolation occurred due to hydropic degeneration and mild congestion of central veins occurred. Similar changes in the histology of liver were caused by fluoride was reported by Y.Ersan,E.KOC,I.ARI,B.Karademir (2010).

Conclusion :

The result of the present investigation suggests that, short term exposure of mice to sub acute dose of potassium bromate causes changes in biochemical parameters and histology of the liver which might have occurred due to decrease in metabolic rate, as a result of oxidative stress.

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