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Effect of Potassium Bromate on Thyroid of Swiss Albino Mice

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Abstract : *The role of potassium bromate, a food additive, on body weight, histology of thyroid gland and hormonal change were investigated. No significant change was found in the body weight of the experimental mice. However, damage in the thyroid tissues were seen, which were more prominent in the mice treated with a higher dose of potassium bromate and also the TSH level was significantly increased. Therefore, it is suggested that potassium bromate should not be used as a food additive.*

Key words: *Potassium bromate, TSH.*

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Introduction :

Potassium bromate is a white crystalline powder. It is a colourless, odourless and tasteless compound having no medicinal value. It is used as a food additive in flour, fish paste, beer and cheese (Chipman et al., 1998). It assists in the dough raising process and produces texture in the finished products that is appealing to the public (Sivasakar, 2002). Prolonged exposure may result in skin burns and ulcerations. Over exposure by inhalation may cause respiratory irritation (Ueno et al., 2000). It was discovered that potassium bromate administered to rats resulted in combined incidence of adenomas and carcinomas of the kidney (Kurokawa et al., 1986). Potassium induces renal oxidative stress which is known to cause kidney cancer (De Angelo et al., 1998, Parson and Chipman, 2000). The thyroid gland holds a key position among the endocrine glands, as it works for normal body metabolism, growth and development including regulation of Basal Metabolic Rate (Capen et al, 1991; Lu and Anderson, 1994). Thus, an investigation into the effects of potassium bromate on the thyroid gland becomes vital.

Materials and Methods :

From an inbred stock, twenty one healthy female Swiss albino mice with average weight (26.92 ± 0.75g) and average age 3-4 months were used for the experiment. The animals were divided into three groups of 7 female mice each. The first group (A) was treated orally with a lower dose of potassium bromate (75 mg/kg bwt. per day) dissolved in distilled water for 30 days. The second group (B) was treated orally with a higher dose of potassium bromate (200 mg/kg bwt. per day). The third group as control group were given only distilled water. The mice of all the three groups were sacrificed on 31st day. Blood was collected through cardiac puncture for TSH (Thyroid Stimulating Hormone) analysis. The ERBA Thyrokit TSH kit assay based on immunoenzymatic sandwich principle was followed.

Since no study has been conducted on the effects of oral exposure of potassium bromate on thyroid of Swiss albino mice till now, we decided to go ahead and work on this project by conducting thyroid biochemical analysis along with monitoring the aspects like mortality, body weight, usual morphological changes and damage in the thyroid tissues. These values can be extrapolated to human beings.

Results and Discussion :

Mortality was observed to be nil in all the experimental groups. There was no significant change in initial and final body weights of all the experimental group mice (Table 1).

Table 1. Initial and final body weight of mice

Values are Mean ± SEM

Initial	Final weight (g) (X ± S.E.)	't' weight (g) (X ± S.E.)	Level value	of signi-ficance
Control	27.25 ± 0.89	28.75± 0.83	1.15	NS
Group 'A' (mice treated with lower dose)	26.40 ± 0.56	27.40± 0.62	0.60	NS
Group 'B' (mice treated with higher dose)	26.66 ± 0.82	25.66 ±1.11	0.66	NS

General hair loss from the body, especially on the face region were found in the mice of treated groups. Weakness in limbs was prominent, affecting the general movements of the animals. Other activities, like feeding and drinking behaviour was found to be reduced. The plasma level of the TSH showed a marked increase over control in the treated groups as compared with the control group in the sequence (Table-2).

Table 2. Comparison of TSH level between (Group A and Group B)

Values are Mean ± SEM.

	Mean ± SD	't' value	Level of significance
Control	0.96 ± 1.71	0	NS
Group 'A' (mice treated with lower dose)	0.054 ± 0.003	0.5	NS
Group 'B' (mice treated with higher dose)	0.081 ± 0.10	2.28	P< 0.05

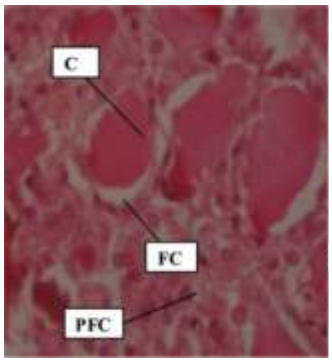


Fig. 1. Microphotograph of thyroid of control mouse showing normal colloid (C), follicular cells (FC), parafollicular cells (PFC) X 400

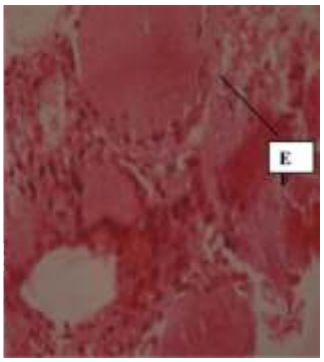


Fig. 2. Microphotograph of thyroid of mouse treated with potassium bromate 75 mg/kgbwt. It shows a slightly enlarged follicle (EF) with colloid X 400

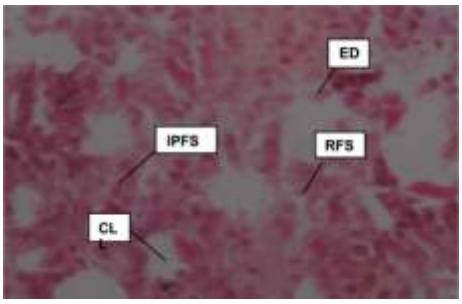
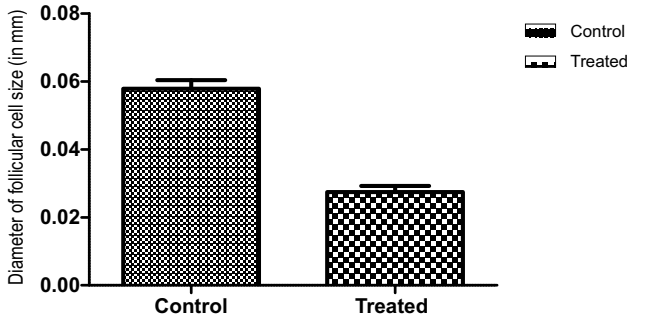


Fig. 3. Microphotograph of thyroid of mouse treated with potassium bromate 200mg/kgbwt. Its shows colloid loss (CL), epithelial damage (ED), reduced follicle size (RFS) and increased parafollicular cell size (IPFS) X 400.

Text Fig. 1
Decrease in the diameter of follicular cell size (in mm) in section of thyroid of mice treated orally with 200 mg/kg bw potassium bromate for 30 days



The thyroid of control mice showed normal structure (Fig. 1), whereas thyroid of mice treated with the higher dose displayed many histological alterations, such as, loss of colloid from the follicles, loss of cytoplasm, epithelial damage, decrease in the size of the follicles (Fig. 3) at $P<0.001$ when compared to control. Thyroid of mice treated with lower dose revealed normal structure with slightly increased follicle size (Fig.2).

The toxicity levels of any chemical depends upon route, rate of absorption and duration of exposure: (Marty, 1998; Sumner et al., 2001). The higher dose of potassium bromate disturbed the BMR of mice which was evident by decrease in mean body weight but it was not significant. Decreases in food and water consumption, general hair loss from the body surface were observed; similar findings were recorded by Sharma et al (2008). Thyroid tissue were affected by the higher dose of potassium bromate as they showed many histological damages like colloid loss, epithelial damage, reduced follicle size. Therefore toxicological symptoms can be compared with the increased levels of TSH and consequently decreased levels of T3 and T4, resulting in hypothyroidism.

Conclusion :

Thus, it is concluded, that short term exposure of mice to a higher dose of potassium bromate has caused alterations in the histological and hormonal aspects. This might be partly due to oxidative stress.

Thus, the available information based upon the test carried out confirms the toxicity of potassium bromate.

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