INTRODUCTION

Ground water contamination by fluoride has been reported in India. Fluoride is found in earth crust as fluorspar (CaF\(_2\)), cryolite (NaAlF\(_6\)) and fluoroapatite [Ca\(_{10}\)F\(_2\)(PO\(_4\))\(_6\)]. Due to erosion and leaching of soil, fluorides get mixed with water. In the year 2004-05 the physico-chemical ground water analysis of village of Sanganeer Tehsil, Jaipur District was carried out by Sharma et.al., and reported that water contain very high fluoride concentration which is responsible for various health problem (Sharma et.al., 2007). Kurttio et.al., (1999) noted that in rural area houses are generally not connected to the municipal drinking water supply instead of which only well water used for drinking purpose, with high fluoride contamination in it resulting in the formation of health hazards to the people living in the area.

Ramaraju et.al., (2000) found that fluoride when consumed in excess (>1.5mg/l) can causes several health problem such as skeletal and non skeletal fluorosis, dental fluorosis and or sometime combination of above. According to RGNGWM, (1994) fluoride is also responsible to induced ageing and no amount of medicines can cure or improve these damages in the body. Shen et.al., (2004) reported that fluorosis has effect on phospholipids and fatty acids composition in brain cells. Cytotoxic effect of fluoride on rat pancreas showed acute disintegration of acini as of lobules (Shashi et.al., 2009). High fluoride concentration inhibits protein synthesis and cell cycle progression (Holland et.al.,1979). Recently Kamble and Velhal (2010), showed histologically disturbed uterine cells and its musculature in which they found squeezed endometrial cells, altered blood vessels and accumulation of mucosal cells due to fluoride induction as per increased concentration and exposure period in Rattus norvegicus.

The literature regarding excess fluoride in the body resulting to health hazards is scanty. By taking review of information in this we have decided to investigate the hematological parameters and its alteration by the induction of excess fluoride in the body of Rattus norvegicus.

MATERIAL AND METHODS

Healthy matured female Wistar rat (Rattus norvegicus) weighing average about 180-220gm were used for experiments. Animals were reared in departmental animal house (CPC SEA 233) of Department of Zoology, Shivaji University, Kolhapur. Animals were feed on standard diet from Pranav Agro industries, Kolhapur, Maharashtra, India. For the toxicological analysis water miscible Sodium fluoride (NaF) was used with its mol. wt. 41.99 which was purchased from Loba Chemicals Pvt. Ltd., Kolhapur, Maharashtra, India. In the toxicological study experimental groups of animals were divided into three groups as per their doses 100ppm, 200ppm and 300ppm respectively. The experimental groups were exposed for the period of 1 month and 2 months. As experiments were carried out in summer, it was found that water consumption by experimental animals was high so as to monitor the experiment. Temperature was maintained at 27°C ± 2°C. Daily water consumption is 5 ± 2 ml/day/animal. At the end of exposure period experiment animals were sacrificed and blood was collected by cardiac puncture under anaesthesia using 21gauze (21G) BD falcon 1ml syringe in EDTA coated serum tube. Blood was further used for RBC count, WBC count, Hb estimation and Electrophoresis. RBC and WBC count was taken on Neubauer’s chamber. Hemoglobin estimation was estimated by using Sahalis Haematometer tube. Electrophoratic separation was done by using blood serum from both experimental and normal group of rat Rattus norvegicus.
RESULT AND DISCUSSIONS

Circulatory system in any animal plays an important role. The cellular constituents, plasma protein and chemical composition of blood plays a vital role in the different metabolic activities. Any toxicants when entered in the body get circulated throughout the body by the circulatory system. When the concentration of these toxicants increases in the body, it will cause qualitative and quantitative abnormalities in the exposed animals.

In the trace amount, Sodium fluoride is essential for the body for different physiological processes. If the concentration of Sodium fluoride increases, it will cause deformities and destructions in the different systems in body.

In our experiment, we found that when rat _Rattus norvegicus_ was exposed to different concentration of Sodium fluoride (100ppm, 200ppm, and 300ppm) for different time periods (one and two months), the circulatory system specifically blood corpuscles and the plasma protein found to be disturbed. Sodium fluoride in the dose 100ppm, 200ppm, and 300ppm caused time dependent and dose dependent transient effect on RBC, WBC count, and Hb, which indicates immunological suppression. As dose and exposure period increases total RBC count and percent hemoglobin were found decreases. On the other hand, initially total WBC count was found increased as compared to normal value after 1 month of exposure. Then after as the exposure period and concentration of Sodium fluoride increases total WBC count was found reduced up to the end of exposure period. In Electrophoratic separation of blood serum, it was found that the bands appeared in the serum protein of experimental animals were disturbed and scattered as per the doses and period of Sodium fluoride intoxication to the animals. (Table 1).

| Table 1: Showing hematological parameter in normal and experimental animals. |
|---------------------------------|------|------|------|------|------|------|
|                                | Normal | 100ppm | 200ppm | 300ppm |
|                                |       | 1 month | 2 months | 1 month | 2 months | 1 month | 2 months |
| Hb gm/dl                        | 12.8  | 13.00   | 10.00   | 12.9   | 11.1   | 12.9   | 10.00   |
| RBC Million/ml                 | 7.50  | 7.47    | 7.66    | 7.23   | 6.14   | 7.21   | 5.98    |
| WBC/mm$^3$                      | 5600  | 8800    | 7500    | 8550   | 7350   | 8650   | 6600    |

Fig. 1. (a) Blood smear of control group of rat. (b) Blood smear NaF induced rat. (c) Electrophoratic separation of blood protein for different concentration and exposure period of sodium fluoride in _Rattus norvegicus_.

The above results coincide with investigations of Sharma _et al._, (2007), in which they found that hematological parameter such as percent Hb and total WBC count were decreased after receiving 6ppm Sodium fluoride dose for 30 days exposure period. A.W. Obianem _et al._, (2009) observed that Hb, PVC, lymphocytes and WBC values was decreased due to effect of ammonium metavanadate in female Wistar rat and there was increase in serum concentration of free radicals. They also found ammonium metavanadate causes biphasic response on hematological parameters. Controversial effects was seen by Adeneye (2008), concluded that methanol seed extract of _Citrus paradisi_ showed significant increase in RBC and Hb percent in female Wistar rat _Rattus norvegicus_. Fluoride when consumed in excess concentration affects virtually in every phase of human metabolism, it can readily penetrate cell membrane including those of erythrocytes (Chinoy _et al._, 1999). Susheela _et al._, (1996) investigated that fluoride toxicity may cause adverse effects in the reproductive system of male mice. Freni (1994), investigated that high-fluoride concentrations in drinking water was associated with decreased human birth rate.

Above results confirmed that the Sodium fluoride when
accumulated in the blood causes reduction in the blood components and disturbed the protein level in the body. At the end of experiment we found that due to decrease in Hb, RBC and WBC in the experimental animals, animals were lost their mobility and become sluggish changing their normal attitude in the cage.

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REFERENCES


