



## Study of sodium fluoride toxicity on hematological parameter of *Rattus norvegicus*

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**ABSTRACT :** Sodium fluoride induced hematological parameters were measured in female Wistar rat *Rattus norvegicus*. 100ppm, 200ppm, and 300ppm concentration of dose were induced orally for 1month and 2month of exposure period. After completion of exposure period blood samples were analyzed for hemoglobin, RBC and WBC count and also for Electrophoretic separations. Hb and WBC count was found to be decreased as per increase in concentration and exposure period. While initially increased WBC fall down as per increase in concentration and exposure period indicating Sodium fluoride as a toxicant material.

**Keywords :** *Rattus norvegicus*, Sodium fluoride, hematological parameter.

### INTRODUCTION

Ground water contamination by fluoride has been reported in India. Fluoride is found in earth crust as fluorspar ( $\text{CaF}_2$ ), cryolite ( $\text{NaAlF}_6$ ) and fluoroapatite [ $\text{Ca}_{10}\text{F}_2(\text{PO}_4)_6$ ]. 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). Kurtio *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 ( $>1.5\text{mg/l}$ ) 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  $27^\circ\text{C} \pm 2^\circ\text{C}$ . Daily water consumption is  $5 \pm 2$  ml/day/animal. At the end of exposure period experiment animals were compared with normal group of animals. In which group I i.e. normal receives only tap water. Group II i.e. experimental animals were exposed to 100ppm, 200ppm and 300ppm of Sodium fluoride dose which was induced orally for 1 and 2 months of period. After completion of exposure period animals were sacrificed and blood was collected by cardiac puncture under anesthesia using 21gauge (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 Neubaus chamber. Hemoglobin estimation was estimated by using Sahalis Haematometer tube. Electrophoretic 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 important role. The cellular constituents, plasma protein and chemical composition of blood plays 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 toxicant 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 process. 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 period (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 Electrophoretic separation of blood serum, it was found that the bands appeared in the serum protein of experimental animals was 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
RBCMillion/ml	7.50	7.47	7.66	7.23	6.14	7.21	5.98
WBC/mm <sup>3</sup>	5600	8800	7500	8550	7350	8650	6600

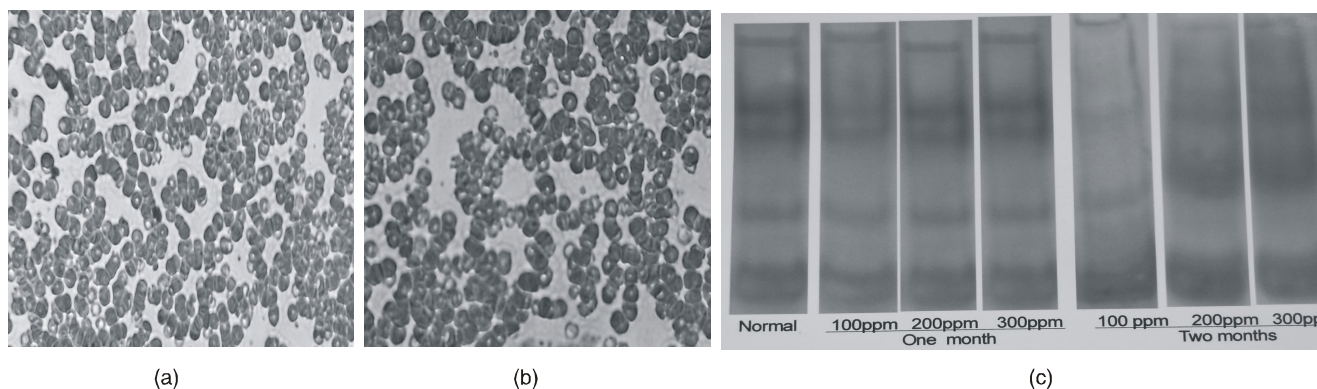


Fig. 1. (a) Blood smear of control group of rat. (b) Blood smear NaF induced rat. (c) Electrophoretic separation of blood protein for different concentration and exposure period of sodium fluoride in *Rattus norvegicus*.

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.

## ACKNOWLEDGEMENT

Authors are thankful to, Head Department of Zoology, Shivaji University Kolhapur for providing facilities in the progress of work.

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