RESEARCH ARTICLE

Effect of fluoride ingestion on trace elements on brain and liver of Rat *Rattus rattus* (Wistar)

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ABSTRACT

Fluoride (F) is highly electronegative anion with cumulative toxic effects, from prolonged ingestion that can lead to the pathogenesis known as fluorosis. Present study was aim to investigate the effect of sodium fluoride on trace elements such as Zn, Cu , Mn and Fe in brain and liver of rats. Albino rats were divided into four different group control, Group I, Group II, Group III (0.02gm/L, 0.04gm/L, 0.06gm/L) repectively treated with sodium fluoride dissolved in distilled water for 72 days. Trace elements concentration analysed by Atomic absorbtion spectrophoto-meter. In liver and brain level of Zn, Cu and Fe decreased significantly. Mn level shows significantly decreased in liver and significantly increased in brain.

Keywords: Sodium Fluoride, Brain, Liver, Trace Elements..

INTRODUCTION

Fluoride is a highly electronegative trace element which is the 13th most abundant element in the earth's crust (Jha et al., 2011). Fluoride is toxic when consumed in excess, and has lead to a condition known as fluorosis. Many vital organs and tissue in the body, such as liver (Ersan et al., 2010), kidney (Iano et al., 2014), cerebrum and cerebellum (Yaqoob 2012., Chirumari and Reddy 2007., Webb and Bradley 1966) the skeleton (Levy 2014) and teeth (DenBesten and Li 2011) may be damaged by excessive accumulation of Fluoride. Fluoride interacts with other minerals including trace elements (Nese et al., 2014). Trace minerals exist in cells and tissues of the animal body in a variety of chemical combinations, and in characteristic concentrations, which vary with the trace mineral and tissue (McDowell, 1989, 1992; Underwood and Suttle, 1999). The present study was planned to investigate the effects of fluoride on trace elements of brain and liver

MATERIALS AND METHODS

Adult albino rat, *Rattus rattus* (Wistar) were obtained from P. Wadhwani College of pharmacy, yavatmal. The rats were housed in polypropylene cages with stainless steel grill tops and were fed with standard pellet diet and given distilled water ad libitum. The animals were allowed to acclimatize to the laboratory conditions for seven days before experiments began. The rats were randomly divided into 4 groups, the first group served as controls and was given water ad libitum. The second group animals were given sodium fluoride (NaF) 0.02gm/l water ad libitium. The third group animals were given sodium fluoride 0.04gm/l water ad libitum. The fourth group animals were given 0.06 gm/l water ad libitum and maintained for 72 days. The body weight of each animal was noted before treatment and also on day 73 and rats were sacrificed and their Brain and liver were quickly excised and Metal concentrations in the tissue digest will be determined by Atomic absorption spectrophotometer at the following wavelength Zn-213.8nm; Cu-324.8nm; Fe-248.3nm; Mn-279nm.

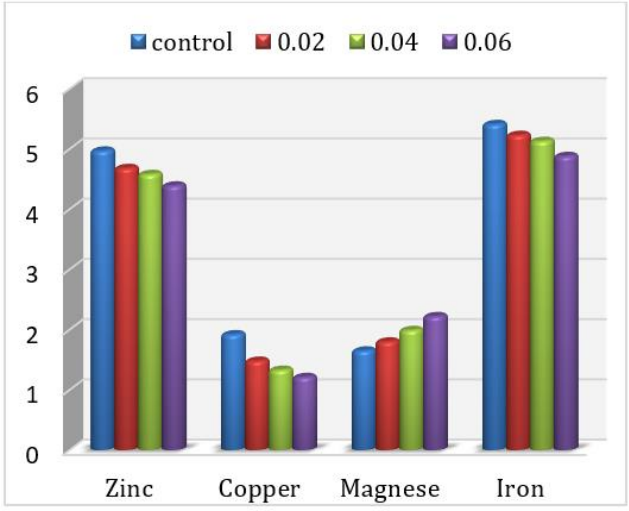
RESULTS AND DISCUSSION

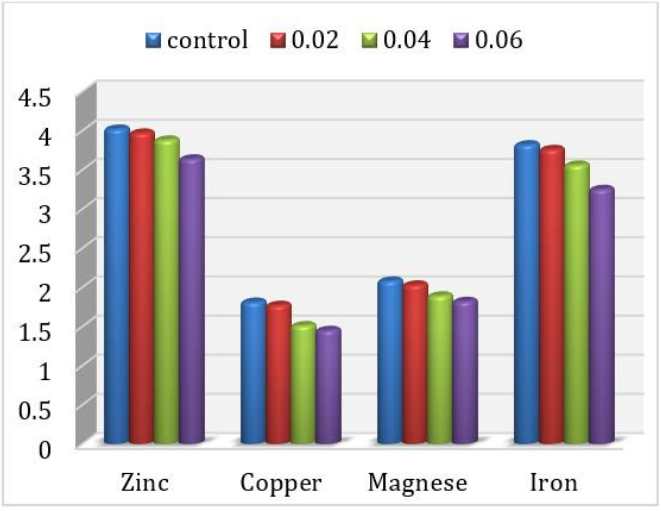
As seen in the table, depletion of zn in the rats occurred mostly in liver and brain of fluoride intoxicated rats. Similar reports were reported for zinc levels in fluorosis with decreases being reported in liver (Narayanaswamy and Piler 2010 and Krasowska and Włostowski 1981). The activity of some Zn-dependent enzymes, such as alkaline phosphatase, increases during F toxicity (Singh and Swarup 1999 ; Ranjan 2007). Oxidative stress and increased superoxide dismutase (SOD) activity with Zn involvement have also been observed in experimental F intoxication (Ranjan et al., 1999; hniak and Inkielewicz 2005). Liver is known to be as a storehouse for copper, and the kidneys and heart also maintain elevated Cu concentrations (Shenkin 2009).

Table :1

	Parameters	Zinc	Copper	Manganese	Iron
Brain	Control	24.76 ±4.97	2.75±1.92	2.75±1.65	29.32±5.41
	Experiment 1	21.97±4.68*	2.19 ±1.48*	3.25±1.80*	27.37±5.23*
	Experiment 2	21.06±4.58*	2.94±1.33**	3.98±1.99**	26.39±5.13***
	Experiment 3	19.32±4.39**	2.62±1.21**	4.27±2.22***	25.30±4.88***
Liver	Control	16.18±4.02	3.29±1.81	4.35±2.08	14.64±3.82
	Experiment 1	15.82±3.97*	3.14±1.77	4.14±2.03*	14.88±3.76*
	Experiment 2	15.70±3.88**	2.30±1.51**	3.58±1.89**	15.95±3.56***
	Experiment 3	13.28±3.64***	2.10±1.45***	3.33±1.82***	16.25±3.25***

* ???





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Hepatic storage and biliary Cu secretion are predominant pathways for adjustment to fluctuations in Cu intake (Sauberlich 1999). In the present study cu level fells significantly in brain and liver of fluoride intoxicated rats. Similar results were observed by Bhatnagar *et al.,* 2003. Manganese is a cofactor in many enzymatic systems and has roles in bone formation and metabolism of carbohydrates and cholesterol (Santos et al., 2013). This enzyme is involved in fatty acid and protein synthesis as well as melanin and dopamine production (Hardy et al., 2008). After oxidation in its trivalent form, manganese is bound to transmanganin and is successfully deposited in the liver, skin, and skeletal muscle (Boullata 2013). Mn level fells significantly in liver but increase in brain Bhatnagar *et al.,* 2003.

Iron functions as haemoglobin in the transport of oxygen. In cellular respiration, it functions as essential component of enzymes involved in biological oxidation such as cytochromes c, c1, a1, etc (Malhotra, 1998). Fe is an important constituent of succinate dehydrogenase as well as a part of the haeme of haemoglobin (Hb), myoglobin and the cytochromes (Chandra, 1990). In the present study fe also fells significantly in brain and liver. Similar reports were observed by Bhatnagar *et al.,* 2003.

CONCLUSION

Trace minerals such as zinc, copper and manganese and iron play a wide variety of biological and physiological roles in animal development and health.These minerals take part in the antioxidant defense and DNA repair, bone and tissue development, and immune function. The result of this study gives valuable information about disturbance in the metal concentration of liver and brain of fluoride intoxicated rat.

Conflicts of interest: The authors stated that no conflicts of interest.

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