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Research Article

FLUORIDE INDUCED TOXICITY ON AMINO ACID, DNA AND RNA OF RAT, *RATTUS RATTUS* (WISTAR)

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ABSTRACT

Fluoride is a naturally occurring contaminant in the water and it is essential for normal maintenance of teeth and bones. However, prolonged exposure to high concentration of fluoride is found to be deleterious to teeth, bones, and other organs. In the present study, the effects of sodium fluoride induced toxicity in rat liver were evaluated. Twenty rats were divided into four experimental groups containing 5 rats each. 1st group was used for control and 2nd, 3rd and 4th groups were ingested with different concentrations of sodium fluoride water respectively for 56 days. The result of the present study was showed as significantly increased in total amino acid and free amino acid concentration along with a decreased in DNA and RNA content of the rat as compared to control.

Keywords: Sodium fluoride, Liver, DNA, RNA, Amino Acid.

INTRODUCTION

Fluoride is largely present in earth and essential trace element for human being and animals (Whitford, 1983). With oral route along with food and water, fluoride is found in small quantities in almost all foods and enters into the human body (Basha & Rao, 2014). Shulman & Wells, (1997) have demonstrated that fluoride problem occur with releasing of fluoride dust and fumes from different industries using hydrofluoric acid and fluoride salts. All the age groups in several countries have suffered from severe fluorosis due to ingestion of sodium fluoride (Susheela & Bhatnagar, 2002). Furthermore, in India, fluorosis is an irreversible disease and a major public health hazard. Approximately, 66 million people in 19 states in India are affected with fluorosis. Though, consumption of fluoride over a long period of time affects the soft tissues like muscle, liver, gastrointestinal tract and several other reproductive and endocrine organs by the property of simple diffusion and caused to impairment of soft tissues (Shashi *et al*., 1994; Shashi & Thapar, 2001; Zhan *et al*., 2006).

MATERIAL AND METHODS

Experimental Animal

Albino rat, *Rattus rattus* weighting 150-200 g, was used. Animals were purchased from wadhwani pharmacy Collage Yavatmal and acclimatized for two weeks in Animal House in the Department of Zoology, Govt. Vidharbha Institute of Science and Humanities Amravati. The Institutional Animal Ethical Committee already approved this study for the use of Rat. The rat were housed in well-ventilated animal house and caged also well, at room temperature and exposed to 10-12 h of daylight. Rats were divided into four groups having five animals each. 1st group was used for control and 2nd, 3rd and 4th groups were ingested with 0.02 gm, 0.04 gm, and 0.06 gm of sodium fluoride water respectively for 56 days. Animals from each dose group were deprived of food overnight and sacrificed at the end of 56 days. They were stunned by a blow on the head and operated. The liver was removed with adhering material by dipping in chilled normal saline and homogenized.

Chemical

All the reagents were purchased from Chaiga Traders, Yavatmal and were of analytical grade.

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Biochemical Analysis

The estimation of DNA and RNA were done from liver tissue by using (Giles, 1999; Mejboum, 1939) respectively. And free amino acid by using (Grundy *et al.*, 1958).

Statistical analysis

The results were expressed as the mean ± SEM. The data were statistically analyzed using one-way analysis of variance (ANOVA). The level of significance was taken as $p < 0.05$.

RESULT AND DISCUSSION

Table 1 depicts the content of total amino acid and free amino acid in the liver of control and experimental groups of rats. There was a significantly ($P<0.01$) increased in total amino acid and free amino acid in the liver of rat as compared to control. As shown in Table 1 DNA and RNA were significantly decreased with higher doses of fluoride content as compared to control.

Table 1. Effect of fluoride on amino acid and nucleic acid contents of rat.

Parameter	Control	0.02 gm/kg body weight	0.04 gm/kg body weight	0.06 gm/kg body weight
Total amino acid	0.11±0.34	0.16±0.40***	0.26±0.51***	0.26±0.51***
Free amino acid	0.39±0.62	0.40±0.63**	0.41±0.64**	0.41±0.64***
DNA	0.64±0.80	0.62±0.78***	0.61±0.76***	0.61±0.76***
RNA	0.64±0.80	0.62±0.79**	0.62±0.75***	0.61±0.75**

Values are expressed as Mean ± SE *=p<0.05; **=p<0.01;***=p<0.001; where nothing is shown =Non Significant.

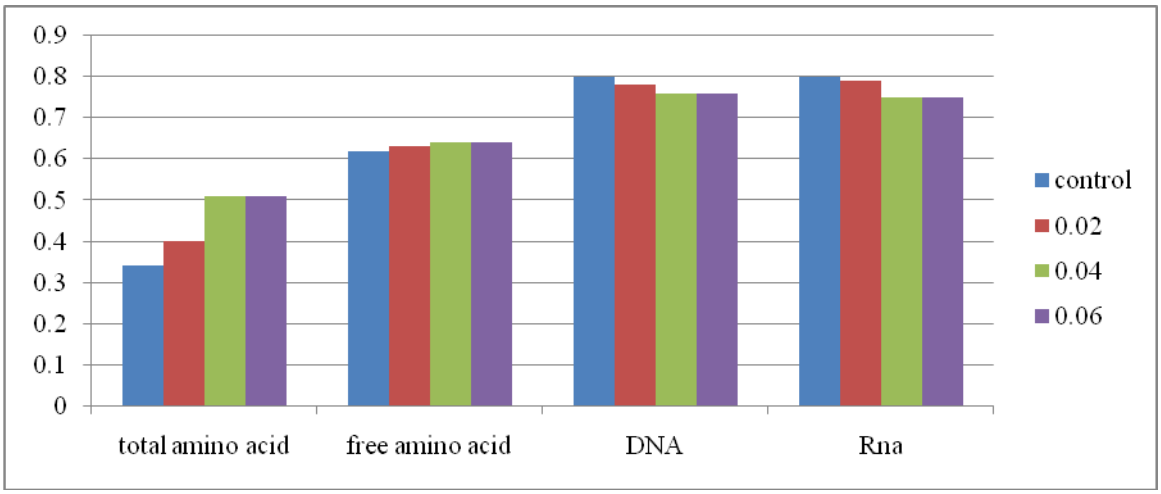

Figure 1. Effect of fluoride on amino acid and nucleic acid contents of rat.

The present study indicated that increased in free amino acid and total amino acid while decreased in DNA and RNA content as compared to control. The increase in concentration of amino acids reflects a decreased shunting of amino acids into the tricarboxylic acid cycle for energy production as fluoride also inhibits enzyme enolase (Wiseman, 1970). Verm *et al.*,2007) showed similar result as the oral administration of sodium fluoride (NaF, 6 and 12 mg/kg body weight/day, for 30 days) caused a significant, dose-dependent reduction in the DNA, RNA, and the protein contents in the cerebral hemisphere, cerebellum, and in the medulla oblongata of the brain in mice. The fluoride intoxication in rabbits resulted in increase in the free amino acids in the brain similar conclusion was also stated by Shashi *et al.* (1994). Fluoride affects the mechanism of glutamine synthesis; a stage in the deamination process and in Na+- and K+- activated ATPase which is essential for active uptake of amino acids (Whittam & Chipperfield, 1973). The abnormal increase in hepatic amino acids may also be due to reduced incorporation of amino acids into proteins (Holland, 1979). In addition, fluoride affects the amino acid sequence of newly synthesized proteins in rat liver (Rymar, 1974). The inhibitory effect of fluoride on the synthesis of nucleic acids and protein in the brain has been reported by few authors. Alteration in nucleic acid synthesis may be ascribed due to improper attachment of mRNA to the ribosome and supposed to be involved in fluoride induced alteration of protein metabolism (Mejboum, 1939). Disturbances in translational as well as transcriptional processes, mitotic cell division and chromosomal aberrations are evident in fluoride toxicity which may

involve change in DNA/RNA, DNA/protein and RNA/protein ratios (Temple *et al*., 2005).

CONCLUSION

From the results, it is clearly indicated that 56 days of sodium fluoride exposed to rats caused a significantly decreased in DNA, RNA content in treated rat as well as total amino acid and free amino acid were elevated as compared to control.

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