International Journal of Basic and Applied Medical Sciences ISSN: 2277-2103 (Online)
An Online International Journal Available at http://www.cibtech.org/jms.htm
2013 Vol. 3 (1) January-April, pp.300-303/Mathur
Research Article

ESTIMATION OF FLUORIDE CONTENT IN LIVER OF SWISS ALBINO MICE AFTER CHRONIC ADMINISTRATION OF SODIUM FLUORIDE

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ABSTRACT
Plants are a source of dietary fluoride for animals and human beings. Thus, elevation of plant fluoride can result to a significant increase in animal exposure. Chronic toxicity has been studied in livestock, which usually develop skeletal and dental fluorosis Symptoms of acute toxicity are generally non-specific. Fluoride does not appear to induce direct mutagenic effects, but at high concentrations it may alter the response to mutagens. The alizarin fluoride blue method has been widely applied for direct spectrophotometric determination of fluoride. The animals in groups II–V exposed to NaF for 14 days showed a significant decrease in body weight in a dosage-dependent manner compared with the group I control animals. The Fluoride content in the exposed mice was significantly higher than in the control group in a dose dependent manner.

Key Words: *Fluoride, Toxicity, Fluoride Estimation, Albino Mice*

INTRODUCTION
The alkali fluorides are typical salts. They have high melting and boiling points and are fairly to highly soluble in water. All alkali fluorides, with the exception of the lithium salt, absorb hydrogen fluoride to form acid fluorides of the type MHF_2, where M is the alkali metal.
Sodium fluoride is the most important of the alkali fluorides. It is a white, free-flowing crystalline powder that is usually prepared by neutralizing aqueous solutions of hydrofluoric acid with sodium carbonate or sodium hydroxide. Sodium fluoride is widely used in fluxes and has been proposed for the removal of hydrogen fluoride from exhaust gases. Sodium fluoride was the first fluoride compound used in the fluoridation of drinking-water in the USA in 1950. There are more reports of accidental intoxications caused by sodium fluoride than by any other fluorine compound. This is chiefly because of the confusion of edible materials with sodium fluoride preparations domestically used for the extermination of insects, fungi, rodents, etc.

Review of Literature
In high concentrations, soluble fluoride salts are toxic and skin or eye contact with high concentrations of many fluoride salts is dangerous. Referring to a common salt of fluoride, NaF, the lethal dose for most adult humans is estimated at 1–10 grams a lethal dose is approximately 28 mg per kilogram of body mass. Clinical manifestations in Fluorosis reveal severe involvement of dental and skeletal tissues (Mc Clure *et al.,* 1951; Singh *et al.,* 1962; teotia *et al.,* 1971; Teotia *et al.,* 1991). However, it has been reported that Fluorosis is not merely a disease of bone and tooth, but it also affects the non-ossues tissues (Kathpalia *et al.,* 1978; kaul *et al.,* 1976, 1974, 1977). Collagen, one of the structural constituents of both osseus and non-osseus tissues, appears to be severely affected due to Fluoride intoxication (Susheela *et al.,* 1980). The constitution of nascent collagen protein in fluoride toxicity has been reported to be defective. The major defect has been localized in the absence of low molecular weight peptides which normally are known to fabricate the collagen fiber (Susheela *et al.,* 1980). Fluoride is an essential trace element in humanbodies and is highly correlated with the metabolism of bone and tooth. But excessive exposure to fluoride for a long term leads to bone damage with complicated pathological changes such as osteoporosis and osteopetrosis. Arsenide is an environmental toxicant and a known carcinogen (National Research Council 1999). Inorganic arsenide is highly accumulated *in vivo*. Fluoride in drinking water is easily absorbed by the intestines (Chinoy and Narayana, 1992) and is quickly distributed throughout the body.

Fluoride easily crosses membranes and enters tissues, thus affecting every phase of metabolism. (Zahvoronkov, 1981) Bones and teeth especially are the sink for fluoride, which accumulates in them and causes fluorosis (Singh *et al.,* 1962). Only limited work has been done, however, on the toxicity of fluoride on soft tissues, *viz* liver, kidney, muscles and testes. Several clinical investigations and animal experiments suggest that F has adverse impacts on male reproductive function (Chinoy *et al.,* 1992; Luke, 1997; Pushplata *et al.,* 2005) including structural and functional defects in spermatozoa (Chinoy and Narayana, 1992; Chinoy and Sharma, 1998; Kumar and Shuseela, 1994) a decrease in sperm count (Chinoy and Shukla, 1995; Ghosh *et al.,* 2002; Narayano *et al.,* 1994) disturbances in the levels of reproductive hormones, alterations in the epididymis and accessory reproductive glands, and reduced fertility.

MATERIALS AND METHODS

Methodology

Adult female rats about, weighing 30-40 g, were used The animals were housed in polypropylene cages at 25±2ºC on a 12 hr light/dark cycle and were maintained on a standard rat pellet diet (Hindustan Lever Ltd, Lipton India, Bangalore) with fluoride mixed water until autopsy. Rats were divided into 5 groups of 6 each. Each rat was administered intraperitoneally 1 mL of solution containing required quantities of NaF/100 g body weight each day for 14 days.

Group I served as controls that were treated with 1 mL of mammalian physiological saline.
Group II received 1 mg NaF/kg body weight
Goup III 5 mg NaF/kg body weight
Group IV 10 mg NaF/kg body weight and
Group V 20 mg NaF/kg body weight.

These doses are well below the LD50 for rodents, which is reported to be 51.6 mg F/kg bw/day. The NaF solutions were preparedfresh in glass with distilled water prior to use. After 14 days the rats were sacrificed by cervical dilocation. The liver were rapidly removed and dissected out, blotted free of blood and transferred to small aluminum foil cups at ice temperature, and processed immediately as per the requirement for each parameter to be studied.

Body Weight and Organo-Somatic Index

The body weight of each animal was noted before treatment and also on day 14 before sacrifice. After the mice were sacrificed the liver weight of each animal was also recorded. From these values the organo-somatic index (OSI) was calculated by the following formula:

$$\text{Organo-Somatic index} = \frac{\text{weight (g) of Liver}}{\text{Total body weight}} \times 100$$

Estimation of Fluoride

Fluoride levels in the liver of control and treated mice were determined by the method of Birkel with required modifications and are expressed as µg F/g dry tissue. In this method the livers were each pooled, homogenized, and dried for 24 hr at 105ºC. In a closed compartment, a weighed 200 mg dry sample was dissolved in 2 mL of a 1:1 mixture of 11.6 M perchloric acid and 14.3 M nitric acid and neutralized with citrate buffer to a pH 5.5 with a mixture of 7.8 M sodium hydroxide and 1.0 M trisodium citrate. The resulting solution sample thus obtained was used after appropriate dilutions for recording the Fluoride content.

RESULTS AND DISCUSSION

The animals in groups II–V exposed to NaF for 14 days showed a significant decrease in body weight in a dosage-dependent manner compared with the group I control animals. The organo-somatic liver index value was also significantly reduced in the NaF-exposed groups III, IV, and V. The Fluoride content in the liver in the exposed mice was significantly higher than in the control group in a dose dependent manner

Table 1: Effect of NaF after 14 days on mean body weight of mice. Values are Mean±SD of six animals per group. The values of multiple comparison test were significant among groups I, II, III, IV, and V.

Sr. No.	Fluoride Dosage group	Body weight (gms)
1.	Group I	40gms
2.	Group II	40gms
3.	Group III	40gms
4.	Group IV	40gms
5.	Group V	40gms

Table 2: Effect of NaF after 14 days on organosomatic index of mice liver. The values are Mean±SD of six animals per group. The values of multiple comparison test were significant among groups I, II, III, IV, and V.

Sr. No.	Fluoride Dosage group	Organo-somatic index
1.	Group I	2.05
2.	Group II	1.86
3.	Group III	1.77
4.	Group IV	1.65
5.	Group V	1.34

Table 3: Fluoride levels after 14 days in liver in control and NaF-treated mice. Values are expressed as Mean±SD of six animals per group. The values of multiple comparison test were significant ($p<0.05$) among groups I, II, III, IV, and V.

Sr. No.	Fluoride Dosage group	Microgram of fluoride/gram tissue
1.	Group I	0.32
2.	Group II	0.38
3.	Group III	0.44
4.	Group IV	0.65
5.	Group V	0.82

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