

RESEARCH ARTICLE

Toxic Effect of fluoride on Neuclic acids and Lipoproteins of rat, *Rattus rattus* (Wistar)

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Manuscript details:	ABSTRACT
<p>Available online on http://www.ijlsci.in</p> <p>ISSN: 2320-964X (Online) ISSN: 2320-7817 (Print)</p> <p>Editor: Dr. Arvind Chavhan</p>	<p>Fluoride is a ubiquitous substance found naturally in soil, water, plants, and animals in trace quantities and is also a common air pollutant in some industrial productions. The experimental model comprised albino rats treated with different concentration of sodium fluoride for 72 days. Parameters were neuclic acids and lipoproteins. The data indicate significant reduction in DNA, RNA and HDL concentration with significant increase in LDL and VLDL concentration.</p> <p>Keywords: Albino rat, sodium fluoride, LDL, VLDL, HDL.</p>
<p>Cite this article as: Dipali Pillewar and Pawar SS (2017) Toxic Effect of fluoride on Neuclic acids and Lipoproteins of rat, <i>Rattus rattus</i> (Wistar), <i>Int. J. of Life Sciences</i>, Special Issue, A8:117-120.</p> <p>Acknowledgements: One of the authors, Dipali D. Pillewar is highly thankful to Dr. S.S. Pawar, Associate Professor in the department of Zoology, G.V.I.S.H. Amravati.</p>	<p>INTRODUCTION</p> <p>Fluorine and fluoride compounds are constituents of minerals in rocks and soils, and the main sources of fluoride exposure for humans include foodstuffs, fluoride supplements, fluoride dentifrices, and water contaminated with high concentrations of fluoride compounds from geological sources (Ozsvath,2009; Ruiz-Payan <i>et al.</i>,2005). Fluoride compounds are being utilised in the life-science industry, crops, pharmaceuticals, hygiene, cosmetics, and domestic commodities. Their production has been increasing steadily over the years (muller,2007). Excessive chronic fluoride intake results in fluorosis, characterised by a vast array of symptoms and pathological changes such as dental mottling, crippling deformities, osteoporosis, and osteosclerosis (Whitford <i>et al.</i>, 1979; Zahvoronkov and Strochkova, 1981). Endemic fluorosis has now become a global concern (Fawell <i>et al.</i>,2006). Fluoride crosses the cell membrane very rapidly (Sireli and Bülbül ,2004), and is distributed in the skeletal and cardiac muscle, liver, skin, and erythrocytes (Perumal,2013; Akdogan, 2002). In vivo studies (Kaushik <i>et al.</i>,2002; Reddy <i>et al.</i>,2003 and Schiff, 2008) have proven that fluoride to be a cell toxin. The high toxicity of NaF arises from its being a very reactive ion. The chronic toxic action of fluoride also has been investigated in the liver.</p>
<p>Copyright: © Author, This is an open access article under the terms of the Creative Commons Attribution-Non-Commercial - No Derives License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.</p>	<p>Present study focuses on the sodium fluoride induced toxicological changes in nucleic acids (DNA and RNA) and lipoprotein content in rat liver.</p>

MATERIALS AND METHODS

Animal experiment

Albino rat, *Rattus rattus* weighting 150-200 g, were used. Animals were purchased from wadhvani 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, 0.04gm, and 0.06 gm of fluoride water respectively for 72 days. Animals from each dose group were deprived of food overnight and sacrificed at the end of 72 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.

Biochemical Analysis

The estimation of DNA and RNA were done from liver tissue by using Giles and Meyer,1965. and Mejboum,1939 respectively. And lipoproteins by measuring protein concentrations.

Statistical analysis

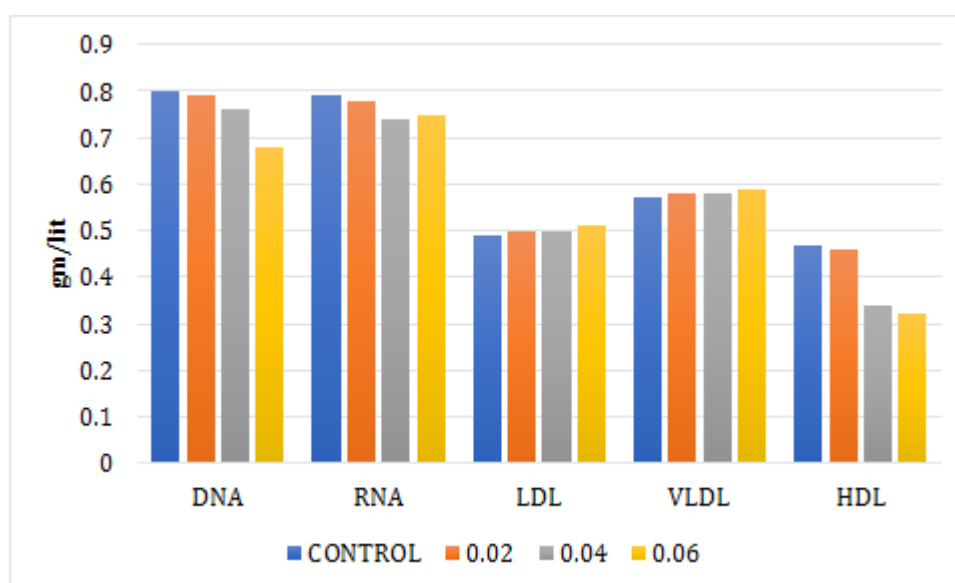
The results were expressed as the mean \pm SEM. The data were statistically analyzed using one-way analysis of variance (ANOVA). The level of significance was taken as $p < 0.05$.

RESULTS AND DISCUSSION

Table 1 depicts the levels of DNA, RNA in the liver of control and experimental groups of rats. There was a significant ($P < 0.01$) decrease in DNA, RNA in the liver of rat. As shown in Table 1 LDL, VLDL were significantly increased and decrease in HDL with higher doses of fluoride content as compared to control.

Table and fig 1 Effect of fluoride on nucleic acid and lipoprotein contents in rat liver

Parameter	Control	0.02 gm/lit	0.04 gm/lit	0.06 gm/lit
DNA	0.64 \pm 0.80	0.63 \pm 0.79***	0.57 \pm 0.76***	0.47 \pm 0.68***
RNA	0.63 \pm 0.79	0.62 \pm 0.78**	0.55 \pm 0.74**	0.54 \pm 0.75***
LDL	0.24 \pm 0.49	0.24 \pm 0.50	0.25 \pm 0.50*	0.25 \pm 0.51*
VLDL	0.33 \pm 0.57	0.34 \pm 0.58*	0.34 \pm 0.58***	0.35 \pm 0.59***
HDL	0.22 \pm 0.47	0.21 \pm 0.46*	0.12 \pm 0.34***	0.10 \pm 0.32***



Values are expressed as Mean \pm SE * = $p < 0.05$; ** = $p < 0.01$; *** = $p < 0.001$; where nothing is shown = Non-Significant

Fluoride-induced reduction in DNA, RNA and protein content might be due to direct or indirect effect of fluorosis (Jha, *et al.*,2012). The value of DNA & RNA decreased after NaF treatment (Chinoy and Shah,2004; Trivedi *et al.*,2008 and Sarkar *et al.*,2014) this decrease might be due to the inhibitory action of fluoride on DNA synthesis or to alteration in the synthesis of RNA (Verma *et al.*, 2007). Fluoride produced free radicals directly or indirectly alters the activities of DNA and RNA, which affected the transcription and translation processes, ultimately would affect the protein synthesis (Verma and Chakraborty,2008; Patel and Chinoy,1998 and Memon and Chinoy,2000).

Chronic fluoride intake has been recorded to cause hyperlipidemia and oxidative stress by many investigators (Barbier *et al.*, 2010; Rupal *et al.*, 2010 and Rupal *et al.*, 2011b). Rupal and Narasimhacharya (2012) reported significant high level of total lipid, TC, LDL-C and VLDL-C after exposure of rats to 100ppm of NaF for four weeks.

In the present study, a significant increase level of VLDL and LDL were observed. The changes in the serum lipid profiles and other lipid compounds noted in the fluoride treated rats may be explained by the increased activity of HMG-CoA via accumulation of ROS releasing inflammatory cytokines in the liver (Afolabi *et al.* 2013). The changes in the activity of HMG-CoA reductase may depress LDL receptor gene expression. Defects in LDL receptor interfere with cholesterol uptake from the blood stream, which in turn causes excess cholesterol synthesis in liver and high levels of plasma cholesterol and LDL-C (Rupal *et al.* 2012). Lipase enzyme responsible for the controlling of triglyceride accumulation in the liver, but the buildup of ROS induced by fluoride inhibit the lipase enzyme and increase the triglycerides (TG) level in the tissue and serum. Increasing levels of TG leads to elevation of VLDL-C in the serum because VLDL particles are the main transporters of TG in plasma (Sharma *et al.*,2003). The overproduction of hepatic VLDL-C and impaired catabolism of TG-rich particles may lead to hypertriglyceridemia. Lowered level of plasma HDL- C implies the altered metabolism of the major HDL apoprotein A-I in the liver (Suttie & Phillips 1960).

High density lipoproteins (HDL) are mostly synthesized in the liver. Afolabi et.al performed a

study on male rats exposed to 50 mg/L and 100 mg/L of F through drinking water for seven weeks and observed that both concentrations promoted hypercholesterolemia and decreased HDL level. In the present study decreased level of HDL may be due to interference of fluoride with lipid metabolism.

CONCLUSION

From the results, it is clearly indicated that 72 days of sodium fluoride exposure to rats caused a significant decrease in DNA, RNA and HDL but LDL and VLDL were elevated in the exposed rats.

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

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