

Study of Sodium fluoride Toxicity on Liver Enzymes of *Rat, Rattus Rattus (Wistar)*

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Abstract

Sodium fluoride induced liver enzymes activity was studied in rat. Different concentration of sodium fluoride was induced orally for short exposure period and long exposure period. After completion of 7 and 56 days exposure period liver were extracted for enzyme assay such as SDH, SGPT and SGOT. In the present study, it was found that all enzymes activity shows significant decline as compare to control rat. The level of enzymes decrease may be due to oxidative stress by sodium fluoride. Ando also we observe duration dependent effects of Naf long term duration of exposure period shows highly significant result as compare to short term duration of exposure period.

Keywords: - Sodium Fluoride, Liver, Enzymes, Rat.

Introduction

Fluorosis is an important public health problem in 24 countries, including India, which lies in the geographical fluoride belt that extends from Turkey to China and Japan through Iraq, Iran and Afghanistan [1]. 85 million tons of fluoride deposits on the earth's crust, 12 million are found in India [2]. Hence it is natural that fluoride contamination is widespread, intensive and alarming in India. Endemic fluorosis is prevalent in India since 1937 [3]. It has been estimated that the total population consuming drinking water containing elevated levels of fluoride is over 66 million. Endemic fluorosis resulting from high fluoride concentration in groundwater is a public health problem in India [4].

Krebs cycle function in the inner membrane of mitochondria is the major pathway for the generation of ATP molecules [5]. The mitochondrial respiratory enzyme SDH is a primary enzyme in the oxidative catabolism of sugars and as such is used effectively as a marker of mitochondrial abundance and activity. Succinic acid dehydrogenase is chosen as a representative of metabolic enzyme. It is a marker enzyme for detecting the presence of TCA cycle in tissue [5].

Liver is the versatile organ in the body concerned with regulation of internal chemical environment. Therefore damage to liver inflicted by hepatotoxic agents is of grave consequence. Liver damage is always associated with cellular necrosis, increase in lipid peroxidation and depletion in the tissue GSH levels. In addition serum levels of many biochemical markers like Serum glutamic oxaloacetic transaminase (SGOT) and serum glutamic pyruvic transaminase (SGPT), levels are elevated. Our aim in this study was to determine the effect of fluoride on the levels of liver enzymes such as SDH, SGPT and SGOT liver of rats.

Materials and method

Wistar albino rats of either sex weighing between 200-250 gm were obtained from P. Wadhvani College of pharmacy, Yavatmal. The animals were housed under standard environmental conditions $21 \pm 2^\circ\text{C}$, one week before the start and also during the experiment as per the rules and regulations of the Institutional Animal Ethics committee and conducted as per the guidelines of the Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA). They were fed with standard laboratory diet Food and water was allowed *ad libitum* during the experiment. Twenty albino wister rats were divided into four groups, Control groups given deflouridated, deionized water, while experimental groups 2, group 3, and group 4 administered sodium fluoride (Naf) of different concentration that is 0.02 mg/kg, 0.04 mg/kg, and 0.06 mg/kg respectively for 7 and 56 days. At the end of the

experiment, animals were sacrificed and their liver was quickly excised for enzyme assay. Succinate dehydrogenase (SDH) was assayed by the method of Slater and Bonner (1952). SGPT and SGOT were assayed by the method of King (1965a).

Statistical analysis

Data were described by proportion, mean, SD, range etc. The data were statistically analysed by using one way analysis of variance (ANOVA). The Statistical analysis was done by using student t test for estimation of significant results in experimental and control group of rat. P value of <0.05 , 0.01 and 0.001 were considered as significant.

Results and Discussion

The various biochemical parameters studied at the end of treatments. That is the effects of sodium fluoride on the activity of succinate dehydrogenase (SDH), SGPT and SGOT were studied in rat. SDH is involved in Kreb's cycle and catalyzes succinic to fumarate. Along with brain cells, this reaction is important in nearly all mammalian cells [6]. The results in the present study have revealed that the level of succinic dehydrogenase has been found to be decreased after the treatment of fluoride. This observations are consistent with earlier reports that the level of brain succinic dehydrogenase activity has been found to be decreased after acute and sub-acute treatments of beta-cyfluthrin and in recovery studies is in accordance to Brouillet *et al.*, (1998), Zatta *et al.*, [7] and Stachowska *et al.*, [6] who observed decreased brain SDH activity after nitropropionic acid, aluminium and fluoride exposure in rats respectively.

There are many reports regarding fluoride induced toxicity in brain and liver relevant to present study. Chinoy and Memon 35 reported decreased SDH activity in gastrocnemius muscle and liver of mice with combined exposure of calcium fluoride and aluminium. In the present study, SGPT (Serum glutamate pyruvate transferase) and SGOT (Serum glutamate oxaloacetate transaminase) were studied following fluoride water

Table 1 Comparison of different enzymes (SDH, SGPT, SGOT) activity in liver of rats exposed to different concentration of sodium fluoride for 7 days.

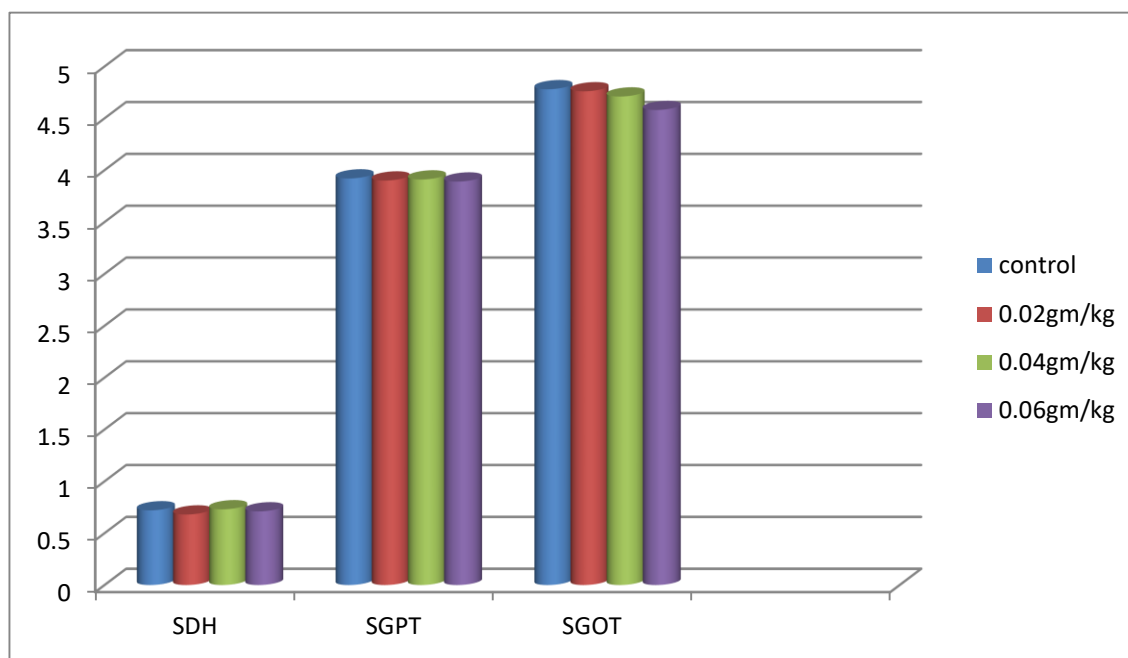
Parameter	Control	0.02 gm/kg body weight	0.04 gm/kg body weight	0.06 gm/kg body weight
SDH	0.52±0.72	0.47±0.68	0.54±0.73	0.49±0.71
SGPT	15.37±3.92	15.23±3.90	15.21±3.91	15.13±3.89
SGOT	22.89±4.78	22.71±4.76	22.27±4.71	20.99±4.58

Significant result shows *P≤0.05, **P≤0.01 and *** P≤0.001

Table 2 Comparison of different enzymes (SDH, SGPT, SGOT) activity in liver of rats exposed to different concentration of sodium fluoride for 56 days.

Parameter	Control	0.02 gm/kg body weight	0.04 gm/kg body weight	0.06 gm/kg body weight
SDH	0.59±0.77	0.43±0.65**	0.42±0.64***	0.33±0.57**
SGPT	17.44±4.17	16.25±4.03***	15.84±3.90***	12.59±3.54***
SGOT	24.28±4.92	24.05±4.90*	23.76±4.87***	22.23±4.71**

Significant result shows *P≤0.05, **P≤0.01 and *** P≤0.001

**Fig 1 Comparison of different enzymes (SDH, SGPT, SGOT) activity in liver of rats exposed to different concentration of sodium fluoride for 7 days**

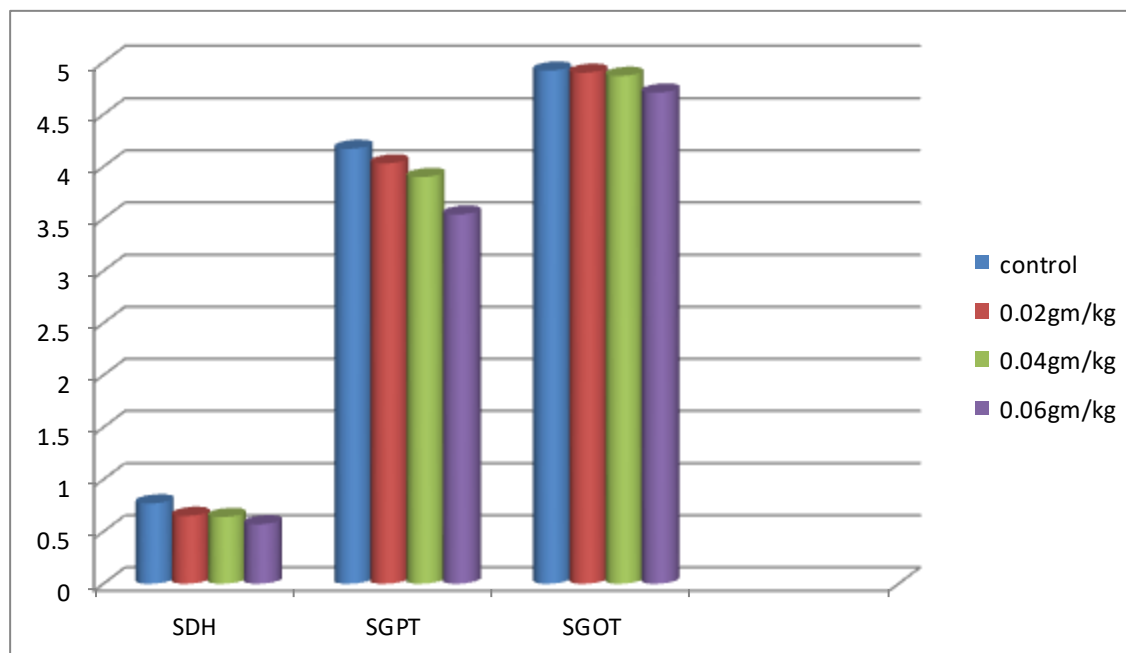


Fig 2 Comparison of different enzymes (SDH, SGPT, SGOT) activity in liver of rats exposed to different concentration of sodium fluoride for 56 days.

treatment. SGPT (Serum glutamate pyruvate transferase) and SGOT (Serum glutamate oxaloacetate transaminase) showed significant reduction following different fluoride water treatment.

Conclusion

From data of present study, it is concluded that short term administration of fluoride and long term administration of fluoride to albino rats, induced organ damage, due to long term administration the more significant changes were observed. The level of enzymes decrease may be due to oxidative stress by sodium fluoride. Thus fluoride accumulation leads cascading effect resulting in alter structural and pathological manifestation in liver of fluorotic rats.

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

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