

**BENEFICIAL EFFECT OF *TAMARINDUS INDICA* ON THE LIVER OF ALBINO RAT AFTER FLUORIDE INTOXICATION****P.K. SINGH AND KHALIL AHMAD***Department of Zoology, School of Life Sciences, Khandari Campus, Dr. B.R. Ambedkar University, Agra – 282 002, India***ABSTRACT**

The oxidative stress of fluoride on the liver and beneficial effect of *T. indica* fruit extract on antioxidant was also studied. The male albino rats of wistar strain were divided into seven groups five in each group. The results of control group was compared with fluoride water injection groups, while *T. indica* treatment along with fluoride water injection groups were compared with fluoride treated groups. Due to the side effects of ground water fluoride the body weight, organ weight and their ratio decrease significantly, while lipid peroxidation increased significantly and the level of antioxidant like GST, CAT, SOD, and GR were also decreased significantly. But due beneficial effects of *T. indica* treatment the body weight, organ weight and their ratio increased significantly, while lipid peroxidation decreased significantly and the level of GST, CAT, SOD, and GR were also increased significantly. All result indicate that *Tamarindus indica* is beneficial as a rich source of antioxidant.

KEYWORDS: Albino rats; Rat liver; Antioxidant; Fluoride; Lipid peroxidation; *Tamarindus indica*; GST; SOD; GR;**P.K. SINGH**Department of Zoology, School of Life Sciences, Khandari Campus, Dr. B.R.
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INTRODUCTION

Fluoride contamination in drinking water is one of such problems worldwide. At present, twenty nine countries, are reported to be affected with fluorosis and the fluoride related disease. The problem in India, too is known for quite a long time.¹ Many villages in (U.P) around Agra city has concentration of fluoride in drinking water. Fluoride in varying concentration induce free radical toxicity in both animals and in people living in areas of endemic fluorosis. The superoxide free radicals and peroxidation play an important role in fluorosis.² Fluoride also decline the activities of some antioxidant enzymes viz, superoxide dismutase (SOD), glutathione peroxidase (GSH-PX), and catalase, as well as alterations in the level of reducing substances like glutathione and ascorbic acid. (vitamins C). Natural antioxidant among which *Tamarindus* pulp has been reported to scavenge reactive oxygen species (ROS).³ It's beneficial effects were also reported in dogs and human.⁴ In the present study the *Tamarindus indica* fruit extract showed beneficial effect on the liver of albino rat after fluoride water injection.

MATERIALS AND METHODS

(i) Experimental animal

Thirty five male albino rats (*Rattus norvegicus*) of almost equal size and weight 120 ± 25 gm and eight weeks aged were selected. The albino rats were obtained from the animal house of zoology department, School of Life Sciences, Khandari Campus, Agra. The rats were randomly divided into seven groups five rats in each group and maintained in controlled temperature ($25 \pm 2^\circ\text{C}$), humidity ($65 \pm 10\%$) and proper circadian rhythm. They were fed with Goldmohar brand feed and water *ad libitum*. The guidelines of committee for the purpose of control and supervision on experiments on animals (CPCSEA no. AZ103456) were followed.

(ii) Collection of Fluoride water

The fluoride water was collected from fluoride region at villages, Panchgai, Khera, Sikandra and Trans Yamuna in Agra (Indian). The water samples were collected directly from different as usual water sources like hand pumps in polypropylene bottles. The selection of the fluoride water was made from panchgai village near

Agra which has maximum concentration of fluoride 14.29 mg/L.

(iii) Experimental protocol

The selective thirty five albino rats of almost equal weight and size were divided into seven groups of five rats of each. The one group of albino rats was treated as control group, while next three groups of albino rats were treated with fluoride water for 7, 14 and 21 days respectively and the remaining three groups of albino rats were first treated with fluoride water in the same way and then given *Tamarindus indica* (10 gm/kg, b.w.) dose for 3, 7 and 14 days respectively. The concentration of fluoride ions in water sample was measured by ion selective method⁵. The fruits of *Tamarindus indica* were collected from local market. All the materials was taxonomically identified by Department of Botany, School of Life Sciences, Khandari Campus, Dr. B.R. Ambedkar University, Agra. In some previous studies *Tamarindus indica* was administered orally to dogs and human at 10 gm/kg body weight in juice formulation. The rats were sacrificed under light anaesthesia. Body weight was measured before and after the experimental period.

(iv) Estimation of Antioxidant indices

The liver was dissected out carefully, blotted free of blood, and weighted on the Roller Smith Torison Balance (USA) to the nearest milligram. The liver were homogenized and centrifuged and the supernant was then analyzed for lipid peroxidation⁶, Superoxide Dismutase (SOD)⁷; Chloramphenicol Acetyl Transferase (CAT)⁸; Glutathione S-Transferases (GST)⁹ Glutathione Reductase (GR).¹⁰ The value of experimental group was calculated by the Mean \pm S.E. The significance of the difference between mean at the same period was determine by analysis of variance (ANOVA) and student's 't' test.

RESULTS

Body weight, organ weight, ratio, lipid peroxidation, Superoxide dismutase (SOD), Chloramphenicol Acetyl Transferase (CAT), Glutathione S-Transferases (GST), Glutathione Reductase (GR) of the control, fluoride water (F.W.) and the fluoride water, *Tamarindus indica* (TI) treated rats were given in Table 1 and 2.

Table 1
Changes in body weight, organ weight and their ratio: values are expressed in gram

Group	Body weight	Organ weight	Organ – body weight ratio
Control	135.8 \pm 1.428	4.904 \pm 0.0813	0.0356 \pm 0.000812
7 days F.W.I.	130 \pm 1.4142*	4.298 \pm 0.0402***	0.0326 \pm 0.000600**
3 days T.i. treatment after 7 days F.W.I.	134 \pm 1.4142*	4.74 \pm 0.0669***	0.0348 \pm 0.000538*
14 days F.W.I.	120 \pm 1.4142***	3.948 \pm 0.0512***	0.0324 \pm 0.000748**
7 days T.i. treatment after 14 days F.W.I.	130.8 \pm 1.019***	4.66 \pm 0.0623***	0.0352 \pm 0.000489**
21 days F.W.I.	114.6 \pm 1.326***	3.778 \pm 0.0506***	0.0324 \pm 0.0004**
14 days T.i. treatment after 21 days F.W.I.	128.4 \pm 1.166***	4.646 \pm 0.0658***	0.0356 \pm 0.000927**

Data are expressed as Mean \pm S.E. *P < 0.05; **P < 0.01; ***P < 0.001.

Comparison of control with fluoride water ingestion F.W.I., and F.W.I. treated by *Tamarindus indica* with F.W. (n = 5)

Table 2

Changes in lipid peroxidation, Superoxide dismutase (SOD), Chloramphenicol Acetyl Transferase (CAT), Glutathione S-Transferases (GST), Glutathione Reductase (GR) with liver. Values are expressed in $\mu\text{mol/mL}$

Group	Lipid peroxidation	SOD	CAT	GST	GR
Control	5.403 \pm 0.0566	3.5 \pm 0.04538	9.982 \pm 0.0500	0.876 \pm 0.0370	17.51 \pm 0.0484
7 days F.W.I.	5.878 \pm 0.0344***	3.134 \pm 0.0421***	8.816 \pm 0.0458***	0.704 \pm 0.0471*	16.84 \pm 0.0426***
3 days T.i. treatment after 7 days F.W.I.	5.26 \pm 0.0378***	3.388 \pm 0.0394**	9.688 \pm 0.0339***	0.814 \pm 0.0338*	17.48 \pm 0.0411***
14 days F.W.I.	6.23 \pm 0.0349***	2.916 \pm 0.0436***	8.122 \pm 0.0316***	0.522 \pm 0.0386***	16.38 \pm 0.0424***
7 days T.i. treatment after 14 days F.W.I.	5.36 \pm 0.0386***	3.486 \pm 0.0399***	9.124 \pm 0.0511***	0.71 \pm 0.0386**	17.32 \pm 0.0396***
21 days F.W.I.	6.916 \pm 0.049***	2.584 \pm 0.0791***	7.868 \pm 0.0351***	0.326 \pm 0.0312***	15.87 \pm 0.0438***
14 days T.i. treatment after 21 days F.W.I.	5.118 \pm 0.0333**	3.492 \pm 0.0448***	9.424 \pm 0.0515***	0.71 \pm 0.0404***	17.56 \pm 0.0539***

Data are expressed as Mean \pm S.E. * $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$.

Comparison of control with fluoride water ingestion F.W.I. and F.W.I. treated by *Tamarindus indica* with F.W. (n = 5)

DISCUSSION

The body weight, organ weight and their ratio were significant increased due to side effect of fluoride water treatment while decreased significantly after *Tamarindus indica* treatment due to beneficial effect of *Tamarindus indica*. The lipid peroxidation increased due to side effect of fluoride intoxication in the liver while decreased due to beneficial effect of *Tamarindus indica* which has vitamin C supplement and recover the liver cells. The SOD, CAT, GST and GR decreased significantly due to side effect of fluoride intoxication in the liver while increased due to beneficial effect of *Tamarindus indica* which has vitamin C supplement and recover the liver cells. Many studies indicate that excessive fluoride can induced free radical toxicity in the human and animals.¹¹ Fluoride has toxic effect on various body organs. The balance between the oxidative system and the antioxidant system is broken and oxidative stress is augmented during fluoride exposure.¹² Oxidative stress can be effectively prevented by supplementing with natural antioxidants, among which *Tamarind* pulp has been reported to scavenge reactive oxygen species (ROS) with beneficial effect in dogs human and rabbits.⁹ The adverse toxic effects of fluoride arise due to enzyme inhibition, collagen break down, gastric damage and disruption of the immune system.¹⁴ *Tamarindus indica* possesses antioxidant properties and protects organ against toxin induced oxidative stress.¹⁵ *Tamarind* contains considerable amount of tartaric acid. Tartarate - resistant acid phosphatases are known to be present in bone cells. The *Tamarind* intake appears to have an addition beneficial effect on mobilization of deposited fluoride from bone by enhancing urinary excretion of fluoride.⁹ In the present study the body weight, organ weight and their ratio decreased due to side effect of ground water fluoride. Similar findings have been reported in dogs and in rats after beneficial effects of amino acid, glycine.¹⁹ Side effects of chronic fluorosis and aluminium in the muscle and liver of male mice.²¹

An increased lipid peroxidation in the liver due to side effect of ground water fluoride; while, decreased due to beneficial effect of *Tamarindus indica*. Similar findings have also been observed in rat after adverse effect of fluoride due to antagonistic effect on antioxidant.²² Fluoride intoxication increased lipid peroxidation in liver and decrease other antioxidant indices. Enhanced lipid peroxidation and decreased activities of antioxidant enzymes have been reported in soft tissues of fluoride-treated mice.⁵ In the present study the SOD, CAT, GST and GR level in the liver decreased due to side effect of ground water fluoride; while, increased due to beneficial effect of *Tamarindus indica*. Similar observations have been reported in liver of rat due to side effect of fluoride and also observed the efficiency of *Tamarindus indica* to protect against fluoride intoxication and oxidative stress.¹³ In rats the ability of the tissue to handle oxygen radicals decreased due to fluoride intoxication.³² Fluoride induce toxicity in the liver and kidney of mice.⁵ the decrease in the activity of the antioxidant enzyme in the liver decrease fluoride intoxication.¹⁹ The fluoride stimulated the respiratory burst and produces superoxide and hydroxyl radicals and decreases these antioxidant enzymes possibly by forming a strong hydrogen bond with the amide group. Because of their free radical scavenging ability, antioxidants have an important role in ameliorating fluoride toxicity.²² The free radical scavenging effect of *Tamarind* pulp is authenticated by the decrease lipid peroxidation content in the liver and by the increased level of polyphenols and flavonoids.⁷

CONCLUSION

From this investigation it could be concluded that the *Tamarindus indica* is beneficial in the medicinal perspective against the toxic effects of fluoride by disrupting the normal function of antioxidant indices in the liver of the concerned ground water toxicity.

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