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EFFECT OF ALUMINIUM FLUORIDE ON LIVER FUNCTIONS OF *RATTUSNORVEGICUS* AFTER AMELIORATION BY *MORINGA OLEIFERA*

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Abstract

Animals and humans are frequently exposed to aluminium and fluoride, and poisoning can occur. Ingestion of aluminium-fluoride occurs primarily through inhalation of aerosols or particles, food, water and medication. This study addresses the serious effects of aluminum fluoride on liver function in albino rats (SGPT, SGOT and ALP) and their amelioration by *Moringa oleifera*. In this study, we selected 150 healthy adult male albino rats of almost same size and weight ((120 ± 25 gm) and eight weeks old)(because they have the same physiology as humans) and divided them into three groups (control group, treated-I with ALF and treated-II (ALF + Moringa). Rats were maintained on the diet selected according to diagnosis. According to the experimental protocol, rats were exposed to aluminum fluoride and Moringa. Biochemical studies of blood were performed according to standard methods and procedures. Significant changes in liver function (SGOT, SGPT and ALP) were observed in this study. The results showed that excessive aluminum fluoride intake worsened liver function, possibly due to the toxicity of aluminum fluoride. Aluminum fluoride induced liver dysfunction is mediated by increased oxidative stress in rats. Aluminum fluoride has a negative effect on blood sugar in albino rats. However, by including moringa in the treatment of albino rat, the negative effects of fluoride are reduced due to its healing effects.

Keywords: Aluminium, Fluoride, *Moringa oleifera*, Albino Rat, SGPT, SGOT, ALP.

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Introduction

Fluoride is a pervasive and persistent contaminant because it does not biodegrade. The fluoride in drinking water, foods, and medications is the primary source. Previous human investigations (Zhan *et al*., 2005) have shown that children raised in an endemic fluorosis area have lower levels of mental activity capacity and intelligence quotient than children reared in a non-endemic location. Humans are not more likely to develop chronic kidney disease as a result of consuming the trace amounts of fluoride found in food and water (Ludlow *et al*., 2007). Because of this, those who already have renal problems should be extremely careful about ingesting too much fluoride through drinking water or other means (Xianzhi *et al*., 2007). It has been shown that kidney injury worsens fluoride's effects on the body, both in terms of metabolism and excretion (Panda *et al*., 2015).

Aluminum is a chemical element that makes up around 8% of the mineral abundance on Earth's crust. Aluminum is also widely utilized in the production of kitchen and storage items. Antacids, vaccinations, phosphate binders, and water purification treatments all use aluminium in their formulations (Newairy *et al*., 2009). (Ali *et al*., 2005) Food additives and toothpaste this highlights the human capacity for exposure to it and its susceptibility to have adverse effects (Zhang *et al*., 2005). Indian-origin *Moringa oleifera* thrives in warm climates everywhere. It is also known as the Horseradish tree or the Drumstick tree. The entire *Moringa oleifera* tree can be used for food or profit due to its high nutrient content. Moringa oleifera leaf extract effectively attenuated toxicant-induced increases in hepatic enzyme activity (Saalu *et al*., 2012). Moringa oleifera leaves have been found to have hepatoprotective properties, and this effect appears to be mediated by antioxidants provided by the leaves' different bioactive components (Fakurazi *et al*., 2012). With these considerations in mind, the current work set out to demonstrate the harmful effects of aluminum fluoride on liver function in albino rats and the protective effects of an artificial supplement containing Moringa oleifera.

Materials and Methods

All of the current research has been conducted on acclimated albino rats (*Rattus norvegicus*).

Collection of Experimental Animals

Albino rats were bred in the animal house of Dr. B.R. Ambedkar University Agra's Zoology Department, School of Life Sciences, Khandari Campus. For these studies, we chose 150 male albino rats that were all roughly the same size and weight (120 25 g) and were eight weeks old.

The albino rats lived in polypropylene cages of 45 x 25 x 15 cm, which were kept at 25 2 degrees Celsius, 65% 10% relative humidity, and on a 12 hour light/12 hour dark schedule. Cages were disinfected on a regular basis to prevent the spread of disease and unpleasant odors. They drank municipal water and were fed Goldmohar brand feed, both of which were produced by Lipton India Ltd. in New Delhi.

The albino rats were cared for according to the standards set forth by the CPCSEA (Committee for the Purpose of Control and Supervision of Animal Experiments).

Experimental Compounds

- **Aluminum fluoride:** The inorganic compound aluminum fluoride (AlF3) is crucial in the aluminum-making process. Rosenbergite is the natural form of aluminum fluoride trihydrate. Oskarssonite is the mineral name for the dehydrated form.
- ***Moringa oleifera* :** The oxygen radical absorbent capacity experiment found that, of all the natural foods tested, Moringa oleifera had the highest antioxidant concentration. Minerals, vitamins, and other beneficial compounds abound in the leaves.

Absorption, Distribution and Excretion

Fluoride is absorbed through the stomach, lungs and skin. The intestines are the source of absorption. Soluble compounds such as sodium fluoride are almost completely absorbed. Fluoride is found in all organs and tissues. There is no evidence that it is active in tissues other than bone, thyroid, aorta, and possibly the kidney. The main route of excretion is the kidneys; However, small amounts of fluoride are found in sweat, milk and intestinal mucosa. Approximately 90% of the fluoride ions filtered by the renal glomeruli are reabsorbed by the renal tubules.

Dose of Experimental Compounds

The aluminum fluoride was used as experimental chemical. The compound was prepared in solution form and given to rats orally by gavage tube. The dose of aluminum fluoride was given to rats was 200mg/kg body weight.

The dose of *moringa oleifera* (0.1ml/100g) were given to rats orally by cathedral tube daily for the entire experimental period.

Experimental Protocol

The selected albino rats of almost equal weight and size were divided in three groups (control, treated-I and treated-II). The one group of albino rats were treated as control group for 7, 15, 30, 45 and 60 days, while aluminum fluoride was given to next group(treated-I) of albino rats for 7,15 30, 45 and 60 days, respectively. The other group (treated-II) of albino rats were first treated with aluminum fluoride in the same way and then given *moringa oleifera* dose for 7,15 30, 45 and 60 days, respectively.

Collection of Experimental Samples

The albino rats were anaesthetized under light chloroform anesthesia and dissected carefully. The samples of blood were collected from the ventricle of heart by hypodermic needle and stored in sterilized centrifuge tubes for further assessments. The liver was excised carefully for biochemical estimations.

Serum Separation

The centrifuge tubes containing blood samples were allowed to stand on a sloping surface to clot for about three minutes. It was then centrifuged at 3000 rpm for duration of 15 minutes. Supernatant serum was separated by a rubber bulb pipette in separate test tubes. The serum samples were used for calculation of biochemical parameters viz. SGPT, SGOT, ALP.

Statistical Calculations

Table I: Beneficial effects of *moringa oleifera* in liver functions (SGPT, SGOT and ALP) of albino rat after aluminum fluoride intoxication.

S.No.	Parameters	No. of Albino rat	Period (days)	Control Group	Treated-I (AlF)	Treated-II (AlF+*Moringa oleifera*)
				Mean ± S.Em.	Mean ± S.Em.	Mean ± S.Em.
1	SGPT (u/dl)	10	7	36.70 ± 0.605	41.08 ± 0.839 *	39.04 ± 1.124*
		10	15		45.65 ± 0.791***	43.56 ± 0.953*
		10	30		48.65±0.846****	46.90 ± 0.702*
		10	45		55.43 ± 0.874*	48.37 ± 1.601*
		10	60		63.15 ± 1.345*	51.67 ± 1.253*
2	SGOT (u/dl)	10	7	221.60 ± 0.707	238.87+-1.573 *	227.07 ± 1.396*
		10	15		251.01 ± 0.993***	235.99 ± 1.05*
		10	30		277.80±1.386****	255.41 ± 1.068*
		10	45		290.31 ± 1.107*	265.53 ± 1.074*
		10	60		295.38 ± 0.95*	280.19 ± 1.694*
3	ALP (u/dl)	10	7	314.70 ± 0.707	325.55 ± 0.853 *	320.18 ± 0.95*
		10	15		335.89 ± 0.985***	324.842 ± 0.959*
		10	30		364.66±0.844***	329.922 ± 1.497*
		10	45		375.51 ± 1.082*	342.87 ± 2.42*
		10	60		391.48 ± 2.349*	351.32 ± 1.404*

S.Em. = Standard Error of Mean,

**** = Very Highly Significant (p<0.001), *** = Highly Significant (p<0.01), **= Significant (p<0.05), * = non-significant(p>0.5)

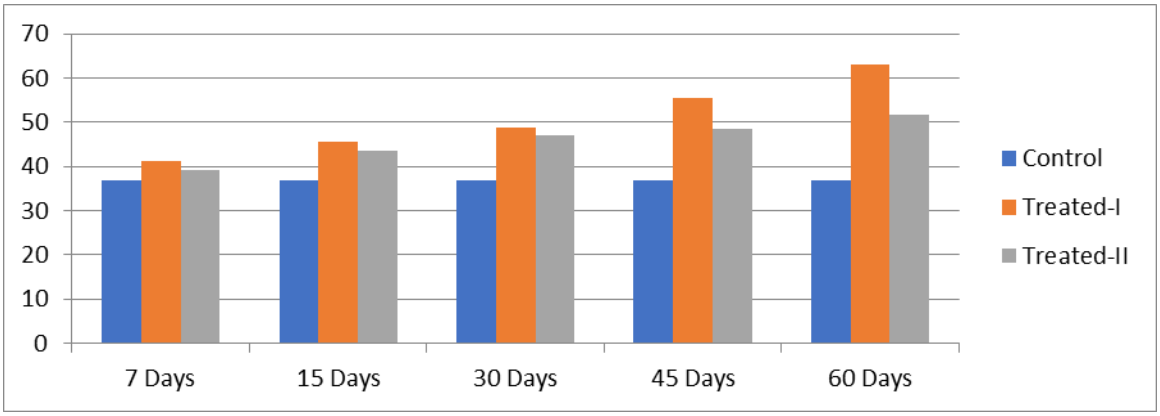

Fig. 1: Representation of SGPT values in all groups (Control, Treated-I and Treated-II)

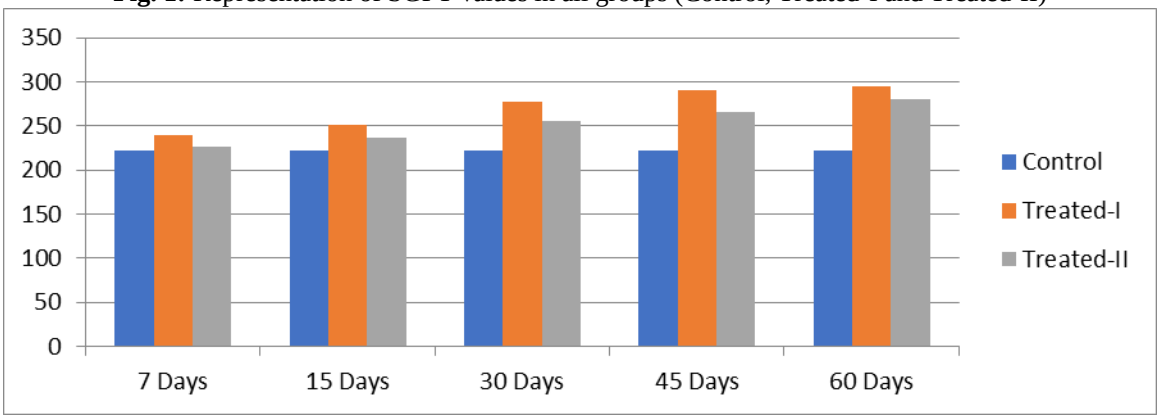

Fig. 2: Representation of SGOT values in all groups (Control, Treated-I and Treated-II)

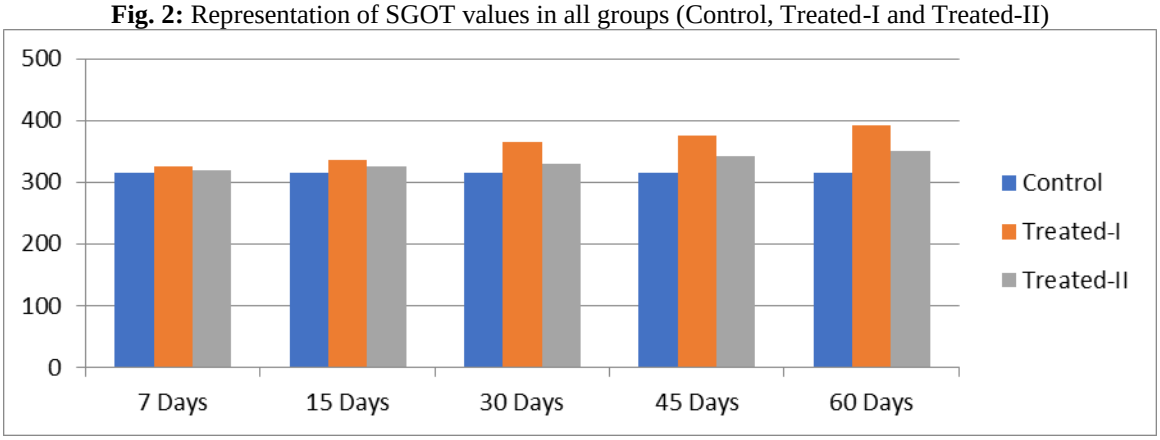

Fig. 3: Representation of ALP values in all groups (Control, Treated-I and Treated-II)

Result

The present study suggests significant changes were occurred in liver functions tests viz. SGOT, SGPT and ALP after aluminum fluoride treatment which gets almost normalized after amelioration with moringa oleifera along with aluminum fluoride in experimental albino rats [Table I]. It can be toxic effects of aluminum fluoride on liver. A battery of liver function tests is commonly used to detect liver injury in clinical settings. Serum bilirubin, alanine aminotransferase, and alpha-glutamyl transferase are used as an index of biliary excretion; serum albumin and hepatic clotting factors are used to determine biosynthetic capability.However, some liver biochemical tests such as protein, albumin, and globulin showed significant changes, showing different patterns between groups. It is well known that the liver is an effective site of detoxification and is greatly affected by fluoride toxicity. SGOT, SGPT and ALP enzymes are markers of liver function. After rats were exposed to fluoridated water, the activities of SGOT, SGPT and ALP enzymes were significantly affected ($p < 0.001$), indicating that fluoride in this study had a cytotoxic effect on distressed rats.Our results show that excessive fluoride intake affects liver function, which is associated with the toxicity of aluminum fluoride. Fluoride-induced liver failure is mediated by reduction of oxidative stress in rats. Fluoride has a negative effect on blood sugar in albino rats. However, the improvement in rats treated with moringa reduced the negative effects produced by fluoride due to its healing effects. It is known that it activates various hydroxylase enzymes that function in many tissues and plays an important role in reducing the toxicity caused by fluoride. Therefore, this study clearly demonstrates the utility of Moringa as a beneficial food in reducing fluoride toxicity.

Discussions

Fluoride is mostly absorbed into the body through the ingestion of food and water. Humans and laboratory animals that were exposed to high levels of fluoride by inhalation or

ingestion absorbed it quickly through their digestive systems. Fluoride is absorbed into the bloodstream, where it can induce metabolic disruptions and ultimately be eliminated by the kidneys (Carlson *et al*., 1960). The liver plays a key role in metabolism and the detoxification of harmful substances.

Degenerative and inflammatory changes in the liver's structure have been linked to fluoride exposure. There were further reports of similar findings (Chinoy *et al*., 1993).In the present investigation, we found that the hepatic cells of the experimental mice died. Kaur *et al*. (1981) reported findings that were consistent with these. Moringa oleifera is crucial for the health of our teeth, gums, and bones. Verma *et al*. (2001) found that administration of Moringa oleifera greatly mitigated fluoride-induced toxicity in mice. It aids in the utilization of phosphorous and calcium in the blood and the maintenance of a healthy neurological system. Protective effects against fluoride-induced oxidative stress in several rat organs were shown when the rats were fed a diet high in protein, vitamins, essential amino acids, and minerals (Blazczyk *et al*., 2008). Moringa oleifera can reduce fluoride's toxicity by increasing calcium absorption and keeping blood calcium and phosphorus levels within acceptable ranges. The liver's hepatic cells began to recover after receiving moringa oleifera treatment.

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