

Alteration In Liver Function Induced by Toluene Subcutaneous Administration in Rabbits

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Abstract. The current study aims to determine the effect of the dye on the liver morphology of male rabbits. The coloring substance is considered toxic when exposed to it for periods and remains inside the body. The study's results showed a significant effect on liver enzymes, thus affecting liver histology. The liver enzymes AST, ALP, and ALT increased, 38.514 +0.99 44.770 +0.105, and 50.758 + 0.882, respectively. These are considered indicators of liver damage, which is reflected in its functions

Highlights:

1. Dye exposure significantly affects liver morphology in male rabbits.
2. Elevated AST, ALP, and ALT indicate liver damage.
3. Histological changes reflect impaired liver function.

Keywords: toluene, liver, kidney, AST, ALP, ALT, and Liver tissue

Introduction

A crucial component of many different businesses is toluene, an aromatic hydrocarbon. Toluene has been used to make explosives, paints, adhesives, rubber and plastic products, benzoic acid, and many other things [1]. Toluene exposure can have detrimental impacts on a person's health [2, 3] by harming the kidneys [4] the liver tissue [5-7], and the central nervous system [8, 9]. In certain industries, such as petrochemical sites, industrial workplaces, chemical companies, cosmetics facilities, and pharmaceutical firms, toluene use, and noise levels have resulted in widespread exposure to these dangerous physical and chemical agents [10]. The relative importance of the concurrent effects of harmful variables is a topic of debate in the research on industrial and environmental toxicity [11, 12].

According to earlier studies, exposure to noise and toluene that does not occur simultaneously increases liver enzymes and many oxidant and anti-oxidant indices, including serum levels of SOD, MDA, and TAC, while decreasing serum levels of the anti-oxidant index Gpx. After 20 days of exposure to 100 dB noise, rats' blood levels of MDA and protein carbonyl (PC) were higher [13]. After 14 days of exposure to 100 dB noise,

the weight of the liver tissue dropped and the serum and liver tissue's MDA and glutathione levels rose [14, 15].

In the manufacturing of paints, glosses, adhesives, rubber, pharmaceuticals, and other chemical compounds, toluene is frequently utilized as an aromatic and chemical solvent [1, 16]. Toluene has been recognized to have certain toxicological effects on people, particularly in long-term exposures, including degenerative effects on the central and peripheral nervous systems [17-20]. Imbalance issues, limb trembling, tinnitus, impaired vision, loss of muscular control, seizures, eye irritation, allergic reactions in the nose, weakness, and liver and kidney damage. Acute toluene inhalation has been linked to several signs of central nervous system malfunction, such as headaches, nausea, fatigue, weakness, and drowsiness [21].

Large quantities of toluene cause poisoning. Toluene is eliminated by exhalation, and this substance is metabolized by converting it to benzene alcohol, which is exhaled unchanged through the lungs [22, 23]. It binds toluene with other chemicals. Their metabolism is similar, especially with benzene, and the harmful effect of toluene toxicity is related to the period of its excretion from the body [24].

Long-term exposure to toluene causes serious harm in addition to worsening Use in many professions and affects owners. The important effects are psychological, visual, and auditory, and may affect the cerebellum or atrophy of the visual organs [25-28]. Toluene is the second product in gasoline production. Its levels are low in Crude oil, which is also produced from the manufacture of coal for processing or as a result of the use of some alcoholic solvents used in the manufacture of perfumes [29].

Methods

In the current experiment, local rabbits weighing between 950-1200 grams were used. They were divided into two local experimental groups and placed in individual cages (360 200 190 mm) under appropriate environmental conditions, a 12-hour photoperiod, and free feeding. For six weeks, the second group received a subcutaneous dose of 0.3 ml toluene (97%)/kg of body weight, while the first group received a standard saline solution of 0.9% Na CL. Anesthesia was administered with a mixture of xylazine 2% (Alvasan - Dutch) and ketamine 10% (Kipro - Dutch). Blood was drawn from the heart and the serum was separated for laboratory tests. After that, the rabbits

were dissected, and their organs were isolated and preserved in 10% formalin. For histological examination

Result and Discussion

The rabbits' liver enzymes were boosted by the six weeks of toluene exposure. According to a recent study, rabbits fed s/c (0.3 /kg B.W toluene) showed significantly higher levels of AST, ALT, and ALP activation than rabbits given 1 ml of normal saline (0.9% NaCl) (table 1).

Table 1 The effect of s/c administration of toluene on rabbits' liver enzymes after six weeks (Mean+ SE).

parameter	AST/IU	ALT/IU	ALP/IU
group			
control group	9.515 + 0.330	13.785 + 0.441	24.666 ± 0.774
treated group	38.514 ± 0.99**	44.770 ± 0.105**	50.758 ± 0.882**

N=10 differences between group p 0.05 vs control

When mice or rats are exposed to toluene inhalation regularly, investigations have shown enlarged liver diameters or histological abnormalities, as well as dramatically elevated serum ALT, AST, and tissues [29-31]. Rats exposed to toluene at concentrations higher than 1,125 mg/m³ (300 ppm) on multiple occasions have shown elevated liver weights and blood levels of liver enzymes. Six hours per day [5].

According to a study, rats given toluene had higher levels of plasma transaminase. Additionally, there was some hepatocyte degradation and invasion of mononuclear cells in the liver moreover, their study observed that high doses of toluene lead to apoptosis [32].

Hepatocytes flattened and vacillated, Hepatocytes with larger pyknotic nuclei and a disorganized hepatic architecture were among the histopathological changes observed in rabbits' livers following 6 weeks of Toluene administered subcutaneously (0.3 cm/Kg B.W.) (Figure 2), (Figure 1) in contrast to the control group.

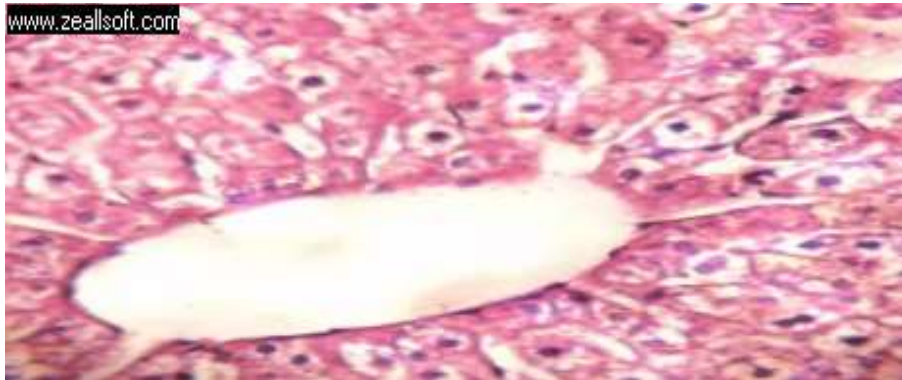


Figure 1 CS in normal rabbit liver

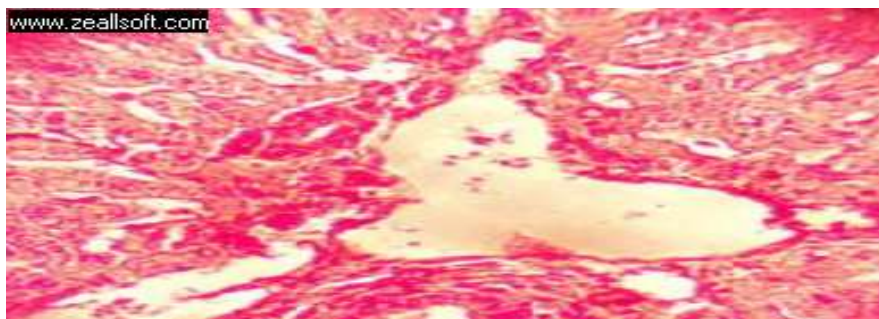


Figure 2: Toluene-treated rabbit liver cross-section displaying hepatocyte (H&E) disarray and a clogged central vein x 400

Because toluene is lipophilic, it interacts with proteins and changes the lipid structure of the cell wall. It dramatically raises the Na/K-ATPase activity in acute dosages, increasing membrane fluidity [33]. According to some experts, toluene damages tissue by causing an increase in oxygen radicals [34]. Although glutathione peroxidase levels decreased, exposure to noise and toluene increased liver enzymes, serum levels of superoxide dismutase, malondialdehyde, and total antioxidant capacity. Malondialdehyde, gamma-glutamyl transferase, aspartate transaminase, alanine transaminase, and total antioxidant capacity [35]. Individuals at work. Higher exposure levels of toluene are a risk for shoemakers, printers, and those involved in the production of toluene or items containing it [36].

Conclusion

The results of the current study summarized the presence of a significant effect of coloring injections in male rabbits on liver enzymes and histological structure

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