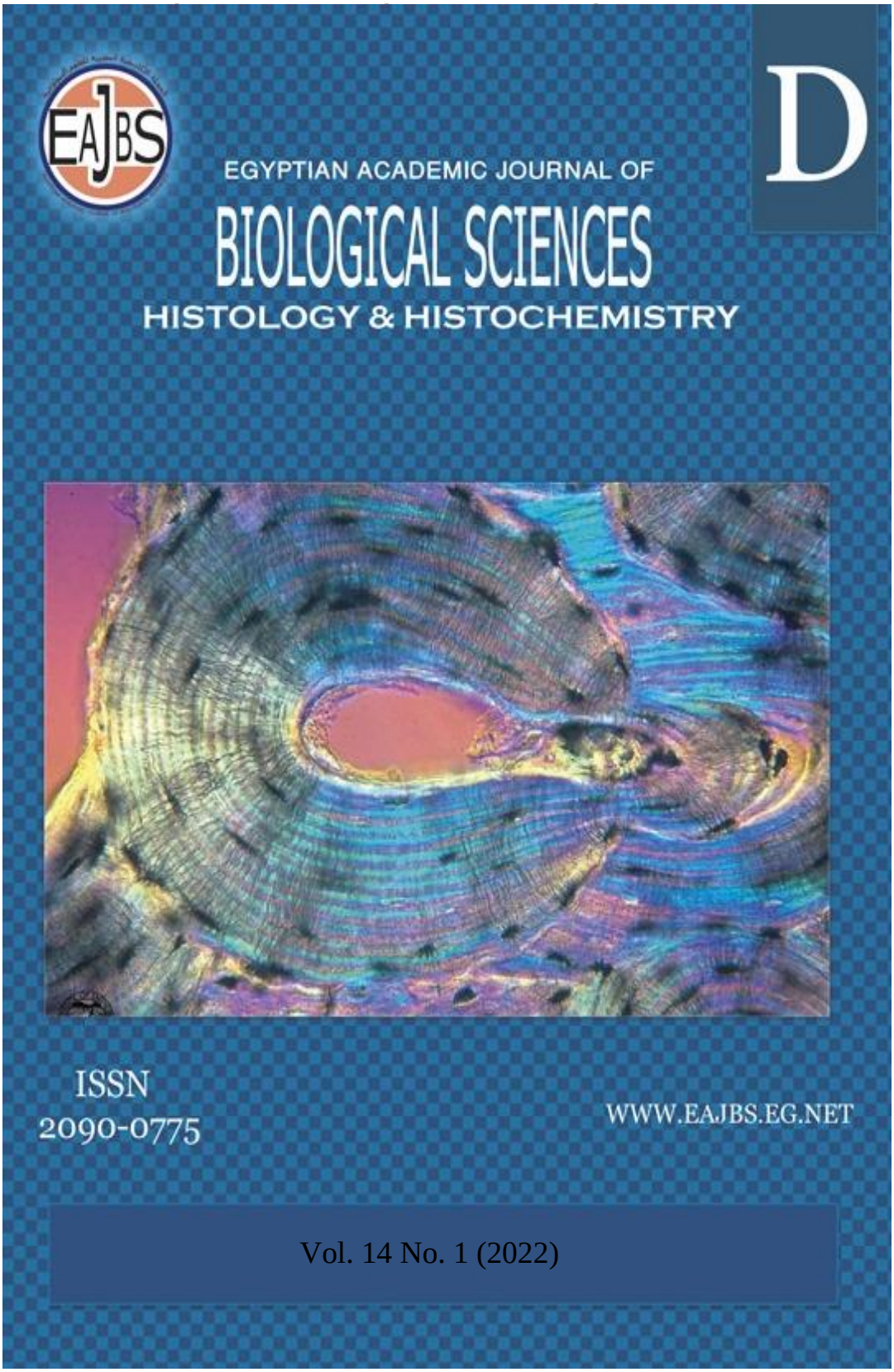

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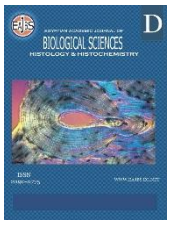

Protective Effects of Apricot Oil Against Mercuric Chloride-Induced Hepato-Renal Toxicity in Rats

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ABSTRACT

This study was designed to investigate the possible protective role of apricot oil against liver and renal toxicity induced by mercuric chloride in rats by using biochemical approaches and tissue analysis. Twenty-four adult male albinos Wistar rats were randomly divided into four groups, the first served as a control; whereas the remaining groups were respectively treated with: mercuric chloride (0.25 mg/kg body weight i.p) + apricot oil (5ml/ kg b.w; by gavage after one month); apricot oil (5ml/ kg b.w; by gavage) and combination of apricot oil and HgCl2 at the same time. The result showed a moderately decreased body weight in all treated groups compared with the control ($p = 0,017$). Exposure of rats to mercuric chloride caused a significantly decreased activity of AST, ALT compared with the control, the differences were statistically significant for the AST ($P=0,017$) and ALT ($P=0,027$). Supplementation of apricot oil resulted in a decreased level of AST antioxidant enzymes level in the liver. Pancreatic hypoglycemia was noted in the group treated with mercuric chloride plus apricot oil compared to the control. Apricot oil also produced substantial decreases in the concentrations of total cholesterol, urea and creatinine ($P<0,05$). A significant decrease in phosphorus levels in the mercuric chloride group compared to control was observed. Supplementation of apricot oil resulted in a decrease in protide levels. The results clearly demonstrate that apricot oil treatment augments the antioxidants defense mechanism in mercuric chloride-induced toxicity and provides evidence that it may have a therapeutic role in free radical-mediated diseases.

INTRODUCTION

Herbs are one of the most important sources of medicines for humans in confronting diseases and disorders. The medicinal and therapeutic impact of apricot has not been deeply explored so far.

Apricot（*Prunus armeniaca* L.) of the family Rosaceae, is a very well-known plant for its delicious fruit, and it's distributed in most countries of the world (Özcan *et al.,* 2010; Wani *et al.,* 2015).

The apricot fruit has a high nutritional value and is a valuable raw material for the processing industry. The pulp is a good source of protein, essential amino acids and carbohydrates (Gezer *et al.*, 2015; Alpaslan *et al.*, 2006).

Apricot and its kernel have antiparasitic, anticancer, antiaging, antiatherosclerosan, antianginal, cardio/hepato/ renoprotective and antioxidant (especially β-caroten) effects. It has various minerals (especially K, Fe, Mg, P and Se), and vitamins (A, C and E). It is a rich fiber source and has also sedative, antispasmotic, antisestradial, antimicrobial, antimutagenic, antitussive, anti-inflammatory, antinociceptive, enzyme inhibitory and tonic effects that have been emphasized by many researchers (Miyazawa et *al*., 2006; Minaiyan *et al*., 2014)

The oil obtained from apricot seeds can be used in various edible, cosmetic, scent and industrial preparations (Alpaslan *et al.*, 2006; Dixit *et al.*, 2010), it also has been used as a remedy for various diseases, like asthma, constipation, cough, vaginal infections, furuncle, acne vulgaris, dandruff or skin irritation (Raj et al., 2012; Lee *et al.*, 2014) Till today, apricot oil is still used for its antibacterial, antifungal, and antioxidant activity (Raj *et al.*, 2012; Tian *et al.*, 2011)

In this study, an attempt has been made to highlight the medicinal impact of apricot oil in the treatment of mercury-induced toxicity.

MATERIALS AND METHODS

This work was carried out at the Biotoxicology laboratory, Faculty of science and life, SBA University (Algeria). The objective was to study the effect of apricot oil on lipid profiles and liver functions of albino rats intoxicated by Mercury chloride,

The apricot oil used in this work originated from SBA (west of Algeria). It was extracted by a traditional method.

For the laboratory animals, twenty-four Albino Wistar male rats were acquired from the Algiers Pasteur institute at the age of 8 weeks, with an average weight of 200g. all along the study period, the rats were kept in plexiglass cages, and the cages were placed in a room with an ambient temperature of 21±1°C and a 12h light cycle. The rats were divided into four experimental groups; each consists of eight rats. The first group served as the control. The second group was treated with apricot oil at a dose of 5ml/kg body weight, the third group was intraperitoneally injected with mercuric chloride at a dose of 0.25 mg/kg body weight. Finally, for the fourth group: apricot oil was orally given (5ml/kg body weight) at first, then 10 days after the rats were injected with mercuric chloride (0.25 mg/kg body weight). The treatment in all groups lasted for 35 consecutive days.

To estimate the protective role of apricot oil against mercury poisoning the following parameters were measured, relative weights and histology of target organs for mercury poisoning (liver, kidney, cholesterol, urea, creatinine and glucose)

Blood Sampling and Analysis:

Blood samples were collected after 14 and 28 days in tubes containing heparin as an anticoagulant from the eye plexuses under diethyl ether anesthesia and then centrifuged at 3000 rpm for 20 min to obtain plasma, which was kept frozen until analysis.

The total cholesterol was analyzed according to (Richmond, 1973). HDL-C was determined according to (López *et al.*, 1977). According to (Demacker *et al.*, 1984) LDL-C was calculated as the difference between total cholesterol and HDL-C. The triglycerides were analyzed according to (Fossati et Prencipe, 1982). Alanine-aminotransferase (ALT) and aspartate aminotransferase (AST) activities were measured according to the method described by (Retiman et Frankel, 1957). Total protein was determined according to (Tietz, 1976). Albumin was determined according to (Doumas *et al.*, 1971).

Histopathological Examination:

Liver and lungs from autopsied animals were excised and fixed in formalin (10%). Five microns sections were prepared using a microtome and

these sections were stained with hematoxyline and eosin.

For the identification of histological alterations, these slides were observed under a light microscope.

Statistical Analyses:

The data collected from this experiment were analyzed using IBM Spss 25, and Microsoft Excel 2019.

The comparison between the means for the four groups when analyzing the blood samples was made using the Anova test.

The comparison between the control group and the others was done using the Student T-test.

A probability value of ($P<0,05$) was considered statically significant.

RESULTS

After 35 days there was a significant difference in body weight between the control group and the group treated with oil and mercury chloride $p = 0.017$ (Fig. 1).

The data in figure 2 shows the concentrations of cholesterol concentration in all groups. After 35 days, the results revealed that the apricot oil group showed an increase in plasma total cholesterol in comparison with the control group, this difference was statistically significant ($P<0,01$).

For the Albumin level and its variation between the control and the other treated groups, results showed it is higher in the oil after the HgCl2 group compared with the other groups (Fig. 3), this difference was however not statistically significant ($p=0,993$).

Exposure of rats to mercuric chloride caused a significantly decreased activity of AST, and ALT in the intoxicated group compared to the control Fig.4).

The difference was statistically significant for the AST ($P=0,017$) and ALT ($P=0,027$)

Supplementation of apricot oil resulted in a decreased level of AST antioxidant enzymes in the liver as shown in figure 5.

Concerning the hepatic function, the relative liver weight was moderately decreased in all treated groups compared with the control, and the rate of total protein was also decreased in the control group, HgCl2 plus apricot oil and the apricot oil after HgCl2 groups, whereas the group treated with only apricot oil showed a remarkable reduction in protein levels.

Apricot oil also improved triglyceride levels in both the HgCl2 plus oil group and the oil after the HgCl2 group.

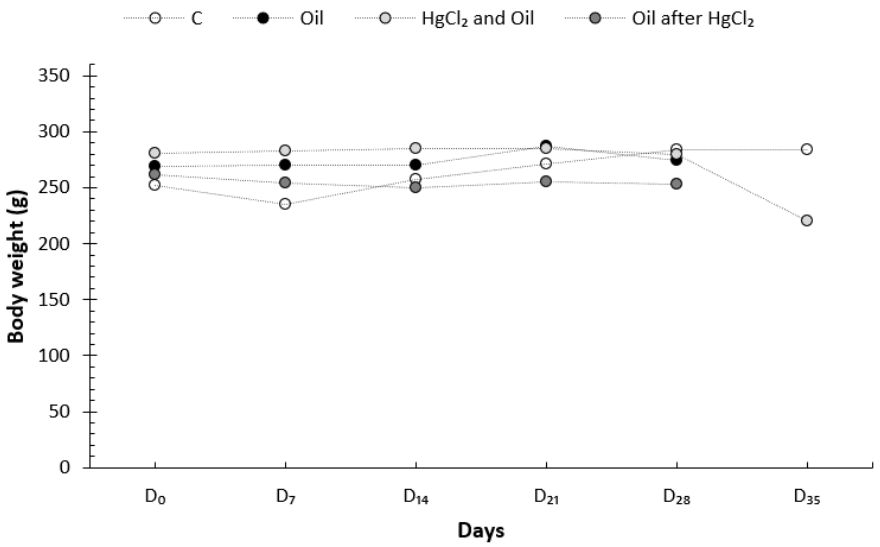

Fig 2: Bodyweight variations in the control and treated groups after 5 weeks of treatment (mg/100g).

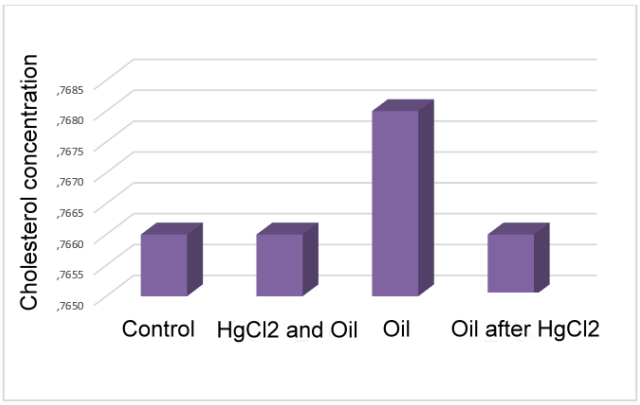

Fig 2: Cholesterol concentration levels in the four groups

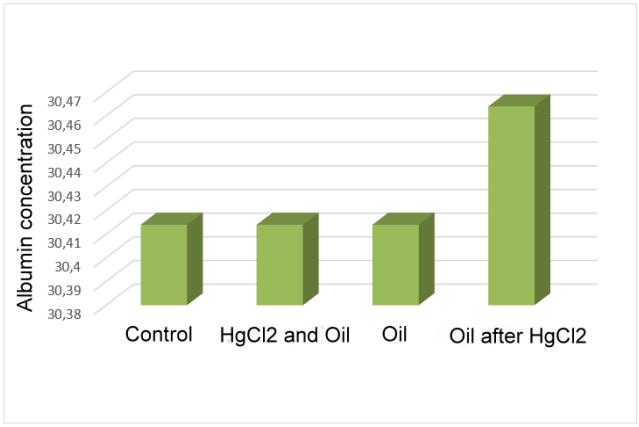

Fig 3: Albumin concentration levels in the four groups.

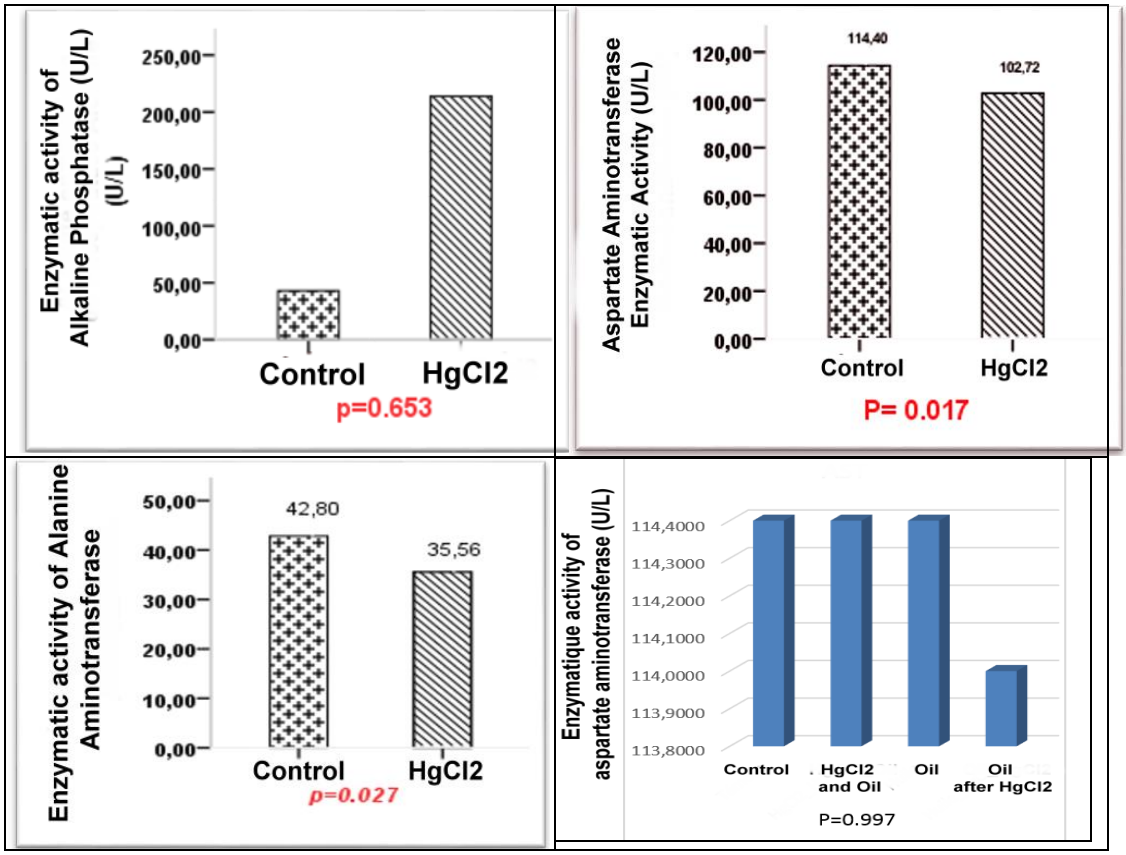

Fig 4: Variation in the enzymatic activity of AST, ALT and PAL in the control group and the groups treated with Hg and apricot oil after 35 days of treatment.

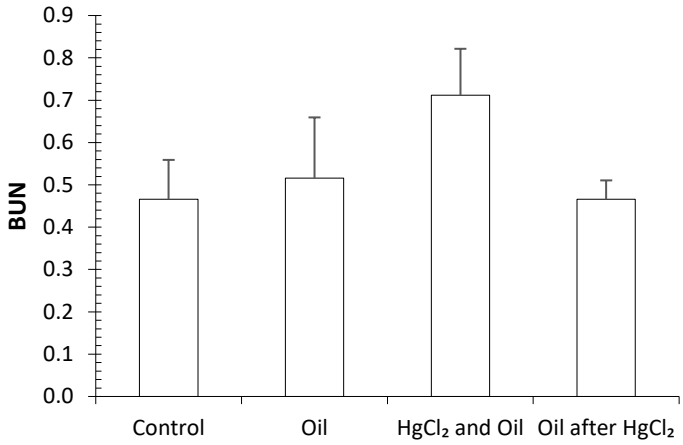

Fig 5: Variation in the level of blood urea nitrogen in the four groups after 35 days of treatment.

When it comes to renal function they were disrupted by mercury, a significant increase in the relative weight of the kidney in the HgCl2 plus oil group was observed, while the oil after the HgCl2 group showed an important decrease compared with the control,

Creatinine decreased in control, the oil group, and oil after HgCl2 compared with the group treated with oil and HgCl2 group, in which the level was higher (Fig.6).

Whereas a significant increase in the urea level was found in the oil only group and the oil after HgCl2 group, the lowest level was found in the HgCl2 plus oil group.

It is clear that exposure to mercury can affect the pancreas, damage and dysfunction caused pancreatic hypoglycemia in the HgCl2 plus Oil group compared to the control, however, the slight improvement in the groups treated with Oil showed the prevention effect of apricot oil, and a significant decreased in phosphorus levels in the HgCl2 group was observed compared to control (Fig.7). The difference in the phosphorus concentration was statistically different between the control and HgCl2 group (P=0,002).

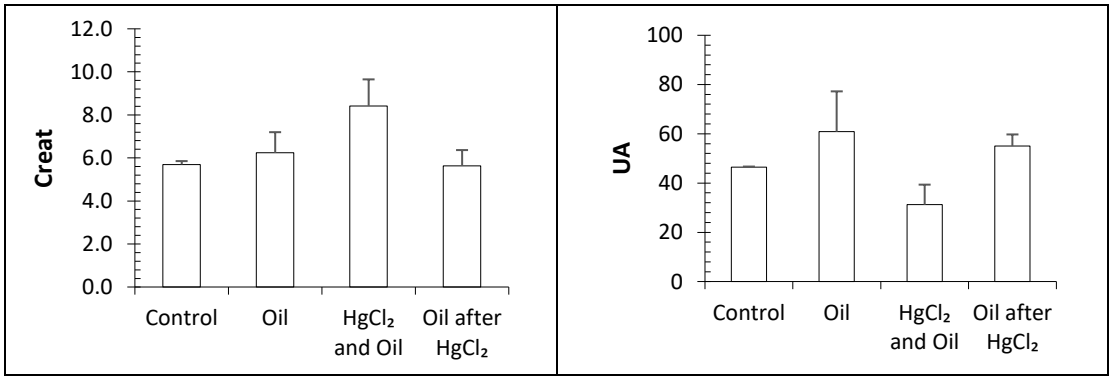

Fig 6: variation of urea and creatinine levels in the four groups.

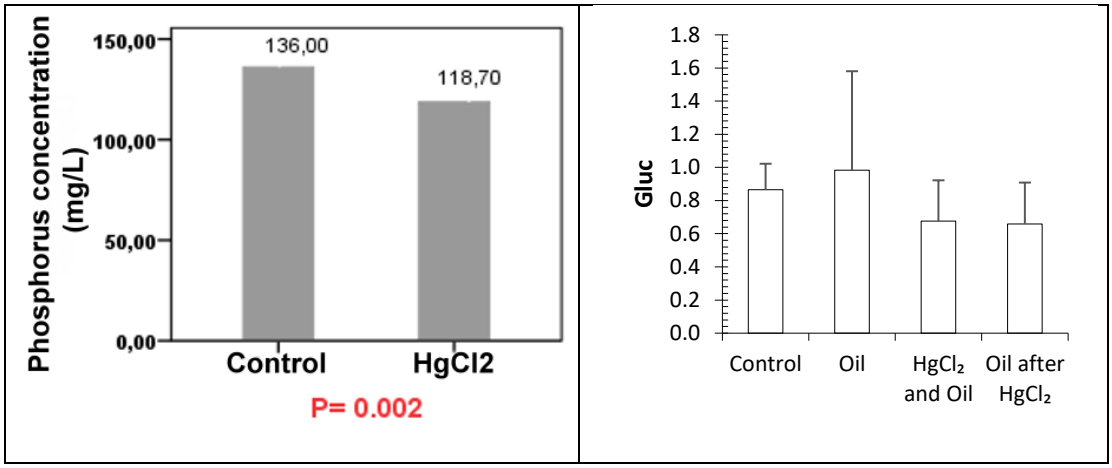

Fig 7: Alteration of phosphorus and blood sugar levels**.**

Histological Study:

The histology of the lungs, liver, and testis reflects the changes and damage caused by mercury (Figs. 8,9, &10); membrane degeneration, hepatocyte necrosis, pycnotic nuclei and caryolysis in the liver, however, changes are less important in other treatment groups indicating that antioxidants are essential to prevent cells and tissues from oxidative damage caused by mercury.

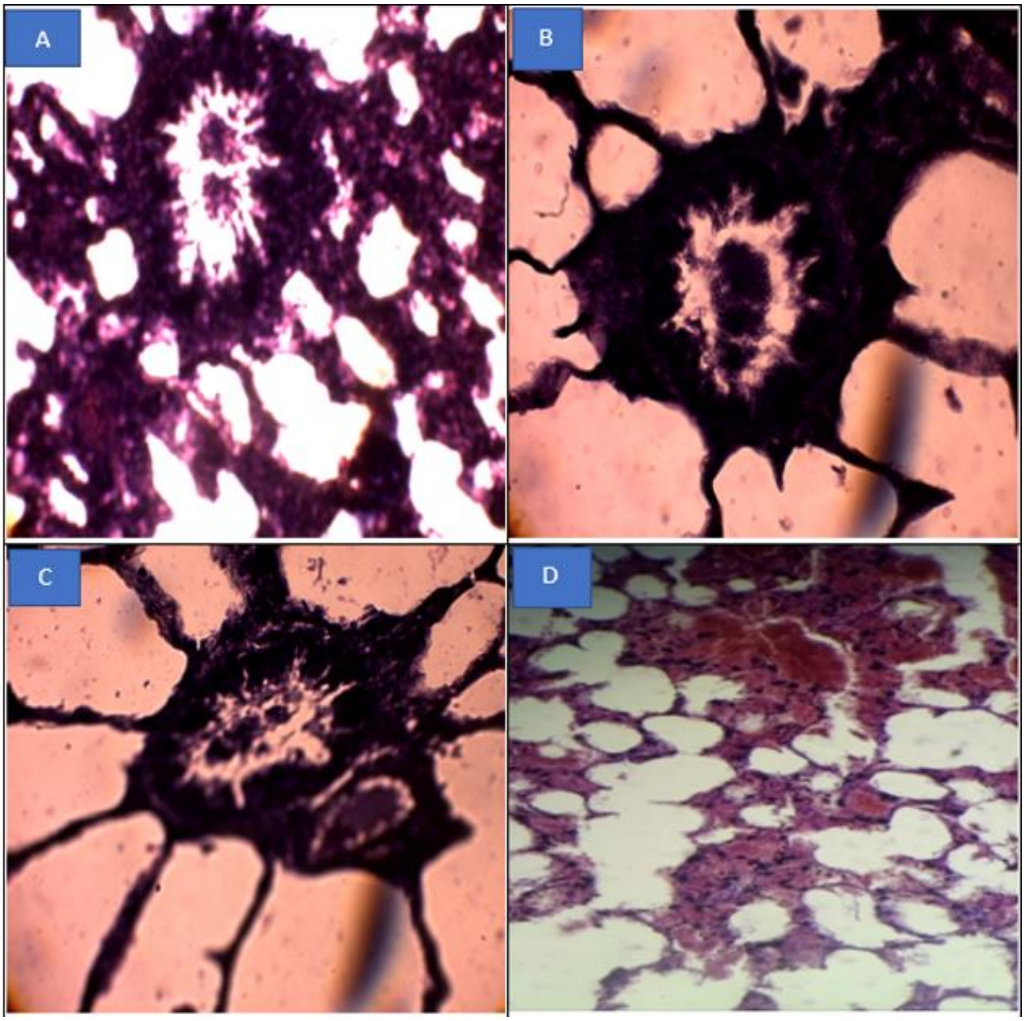

Fig 8: Photomicrographs of lungs tissue in the four groups.
A: Contol, B: Apricot oil, C: Mercury chloride plus Apricot oil, D: Apricot Oil after Mercury Chloride.

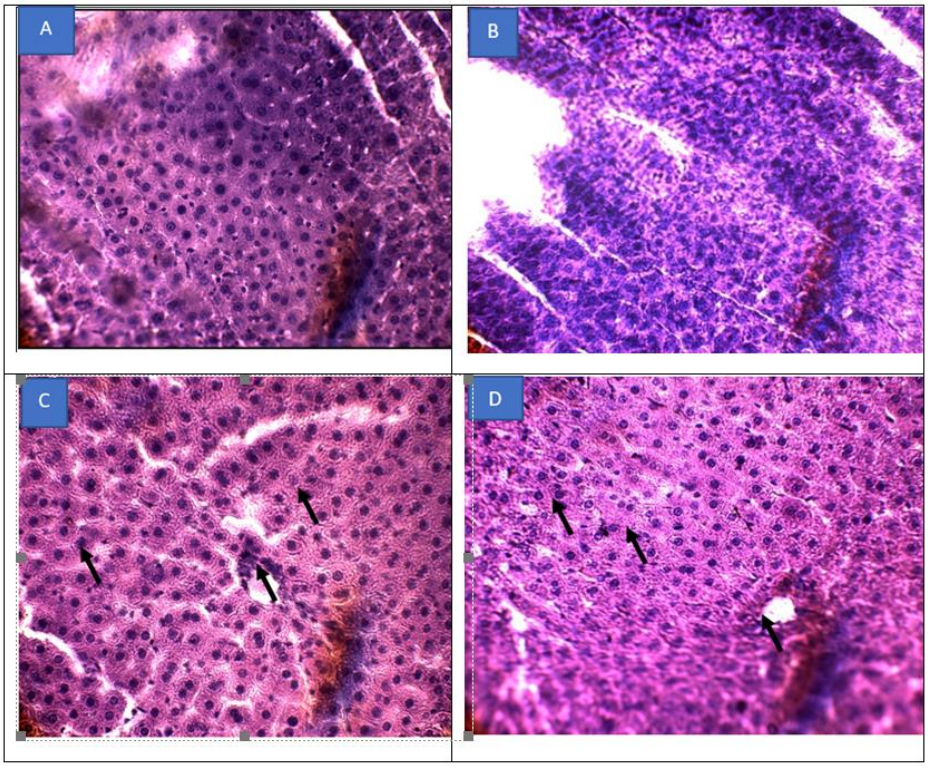

Fig 9: Photomicrographs of hepatic lobules (liver) in the four groups
A: Contol, B: Apricot oil, C: Mercury chloride plus Apricot oil, D: Apricot Oil after Mercury Chloride.

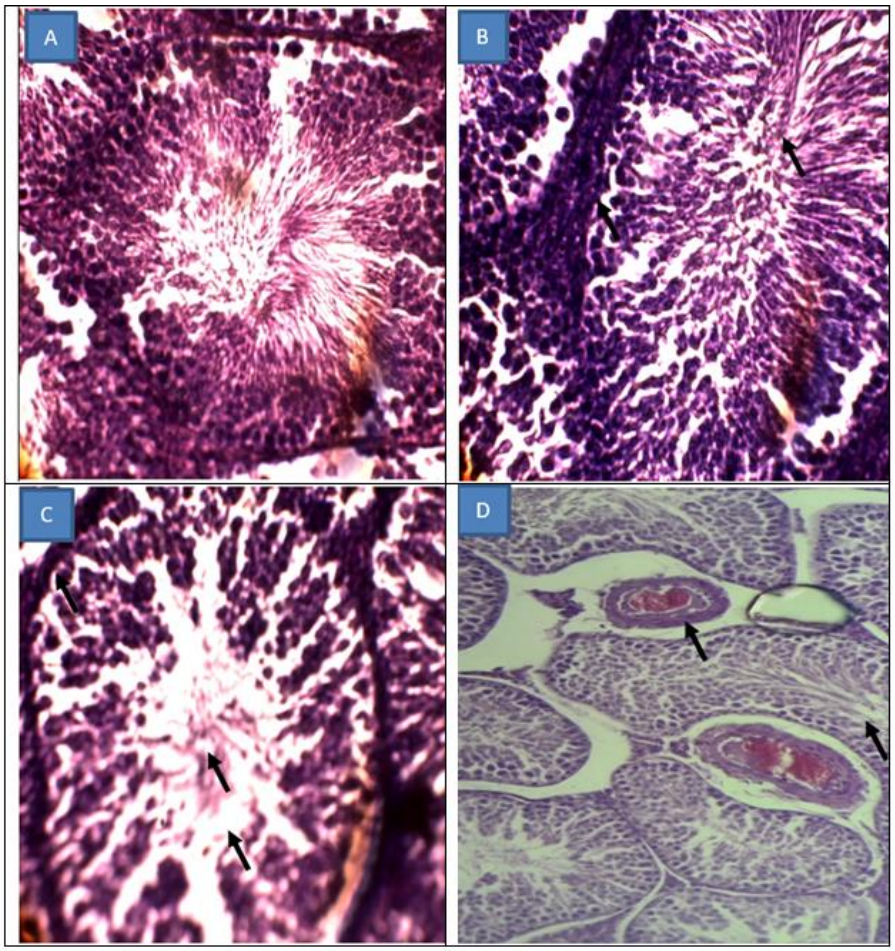

Fig 10: Photomicrographs of seminiferous tubules (Testis) in the four groups
A: Contol, B: Apricot oil, C: Mercury chloride plus Apricot oil, D: Apricot Oil after Mercury Chloride

DISCUSSION

In the present study, serum urea and creatinine levels were significantly increased after the 35 days experiment, showing the insufficiency of renal function.

However, the combined treatment of apricot oil with mercuric chloride results in gradual recovery in AST, ALT, ALP activities as compared to mercuric chloride treated rats. An elevation in albumin level was observed in mercuric chloride intoxicated rats.

Elevated blood levels of total cholesterol and LDL-C have established risk factors for the development of coronary heart disease (CHD), the major health problem in developed countries (Hajar, 2017). A large majority of epidemiological studies have demonstrated that elevated plasma triglycerides and/or reduced plasma HDL-C concentrations are associated with increased cardiovascular risk (Harchaoui *et al.*, 2009). Apricot kernel contains 40% oil which is composed of 30% linoleic acid (C18:2) and 60% oleic acid (C18:1) (Stryjecka *et al.,* 2019). Apricot oil (AO) is also a good source of vitamin E (78 mg/100g) and ST (Fratianni *et al.,* 2018)

In addition, it's reported that a 1 % rate and 120 days period of apricot oil consumption showed beneficial effects for each gender of rats (especially on red blood cells (RBC), hemoglobin (HgB) and hematocrit (HCT)). They also emphasized that the results may have a significance for therapy, preservation and/or eradication of some types of anemia in humans (Yilmaz, 2012)

In rats, the hepatoprotective effect of apricot leaf distill against paracetamol-induced liver toxicity has been approved by histopathological investigations of liver tissues (Raj *et al.,* 2016)

Mercuric chloride induces various pathological alterations in the liver of rats. These alterations were characterized by centrilobular necrosis, degranulation, destruction of membrane cells, cytoplasmic vacuolization.

A number of researchers reported the benefits of the consumption of different fruits including apricot and its kernel. Additionally, a number of studies elaborated on the pharmacological and biological effects of apricot.

Apricot is also known as stone fruit, belonging to the genus *Prunus*. Usually, an apricot tree is *Prunus armeniaca*, but some similar species like *P. brigantina, P. mandshurica, P. mume* and *P. sibirica* are also known as apricots (Raj *et al.*, 2016)

A variety of pharmacological effects of apricot and its kernel have been reported which included antiparasitic, anticancer, antiaging, antiatherosclerating, antianginal, cardioprotective, hepatoprotective, renoprotective and antioxidant (especially β-carotene). It also has been reported that apricot fruit is rich in good minerals especially K, Fe, Mg and P. Apricot is also a very good source of vitamin A, C and E and fibre.

In another study, the elements existing in seed oil were detected and apricot has been found as rich in P, Ca, Mg, Fe and Cu, and seed oil also comprised of oleic acid (73.58%), linoleic acid (19.26%), palmitic acid (3.31%), myristic acid (1.18%) and stearic acid (2.68%). It was noticed that apricot kernel oil causes improvements in the liver antioxidant status of rats in collation to sunflower oil which is a usually consumed vegetable oil (Yılmaz, 2018).

Studies also reported apricot to exhibit sedative, antispasmolytic, anticestodal, antimicrobial, antimutagenic, antitussive, anti-inflammatory, antinociceptive, enzyme inhibitory and tonic effects (Miyazawa *et al.,* 2006; Minaiyan *et al.,* 2014)

It has also been reported that apricot kernel oil caused an improvement in liver antioxidant status of rats in comparison to sunflower oil, a

commonly consumed vegetable oil (Kutlu *et al.,* 2009)

Kutlu and coworkers reported the hepatoprotective effect exhibited by the leaf extract against paracetamol-induced liver toxicity in rats, which was further confirmed in histopathological examinations (Kutlu *et al.,* 2009)

hepatoprotective effects were reported against acute acetaminophen overdose-induced liver histopathology in rats (Yilmaz *et al.,* 2015) and ketamine-induced hepatotoxicity in rats (Yilmaz *et al.,* 2015)

Apricot kernel appeared to be an important natural antioxidant source like tocopherols and phenolic compounds (Durmaz *et al.,* 2007)

Additionally, amygdalin which is naturally present in apricot kernels and after eating converts to cyanide. Cyanide was also determined in apricot, almond, peach and apple seeds and studies indicated that 0.5 - 3.5 mg/kg bw cyanide can be lethal, but normal apricot consumption does not pose a health risk to consumers. It has actively promoted the intake of 10 to 60 kernels per day for the general population and patients with cancer (EFSA, 2016).

Conclusion: This study analyzed the beneficial and protective properties of apricot oil against mercury chloride-induced toxicity in rats

Hence it could be concluded from the result of this study that dry apricot is a good source of health-promoting constituents, and can be used for therapeutic purposes.

Our results showed that apricot is one of the rare fruits that could serve as a useful nutritional and therapeutic agent against certain disease and disorder conditions but with certain limitations.

More research on the practical applications of apricot oil should be done, especially focusing on its implication as a pharmaceuticals product that can be used for specific health benefits or disease prevention.

Conflicts of Interest:

There are no conflicts of interest among the authors.

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