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Short Communication

Protective effect of nettle (*Urtica doica L.*) against dimethoate-induced alterations in the liver and spleen of Wistar rats

Majda Samih*,$ and A. O. T. Ahami*,#

Unit of Clinic and Cognitive Neuroscience, Laboratory of Biology and Health,
Department of Biology, Faculty of Sciences, Ibn Tofail University, Kenitra, Morocco.

ABSTRACT

Stinging nettle has been shown to have antioxidant potential that plays a role in the prevention of hepatotoxicity. The purpose of this study is to explore the protective effect of this medicinal plant against dimethoate-induced liver and spleen injury in male rats. For this, we took forty male Wistar rats and divided them into two groups of 20 animals each. The first group **A** was used as the control. The second half was divided into two subgroups **B** and **C**. These two subgroups were designed to receive dimethoate dissolved in corn oil at a dose of 100 mg/kg body weight daily *via* gavage, while control **A** received only corn oil. Parallel to the intoxication, the subgroup **B** had free access to drinking water, and the animals of **C** received a decoction of the nettle at will. At the end of the treatment period, the effect on liver weight was recorded and the livers and spleen tissues were analyzed with an optical microscope. The results showed that there was a significant reduction in liver weight in the various components of subgroup **B** as well as several histopathological changes in the organs analyzed. In subgroup **C**, there was a slight decrease in body weight compared to the control, but the liver and spleen tissues retained their architecture without significant change. In conclusion, the decoction of nettle showed its effectiveness and protective role against poisoning, especially that induced by dimethoate.

KEYWORDS: dimethoate, histopathology, nettle decoction, liver, spleen.

INTRODUCTION

Pesticides are economically important chemicals in agriculture. Their use has led to agricultural progress through the eradication of pests, the control of disease vectors and the provision of food for a growing world population after the World War [1]. After this global change, the use of pesticides became a custom, then an obligation and finally farmers enter in competition to produce the maximum through the misuse of these products.

Several studies have shown that acute and sub-chronic exposure to dimethoate alters the antioxidant status and histology of the liver, brain and testes of rats [2-4]. In addition, it has been shown that dimethoate intoxication caused cell damage and oxidative stress, leading to lipid peroxidation and free radical genesis [5-7]. Other studies demonstrated that a dietary intake rich in antioxidant products exerts protective effects against oxidative stress [8, 9]; this has been also demonstrated for vitamin E [10, 11] and Selenium [9]. The characterization of phenolic compounds in nettle extracts is an important result with regard to the biological properties (antioxidant and antiradical) of these metabolites for their possible applications in various industrial activities, such as food/feed, cosmetics, phytomedicine, and

*Email id: $majda1_2000@yahoo.fr;
samih.majda1980@googlemail.com
#ahami_40@yahoo.fr

textiles [12]. Based on these results, this study was designed to investigate the protective effects of *Urtica Doica L.*, through its high antioxidant activity, on the liver and spleen of adult Wistar rats subjected to dimethoate intoxication.

MATERIALS AND METHODS

The chemical

Dimethoate was obtained from the commercial solution Dimethoate 50 (500 g of material per liter). The concentrated dimethoate solution was diluted in corn oil. Detoxification by phyto chelation was carried out using the extract of the pungent nettle plant (*Urtica dioica L.*), which was obtained by decoction.

Decoction preparation

40 g of fresh nettle leaves were cut and soaked in water for 24 hours. The contents were brought to a boil in 30 minutes in a covered stainless-steel pan. After cooling, the decoction was filtered and poured into the rat drinking trough. This filtrate was changed daily.

Animals and treatment

Forty healthy adult Wistar rats weighing between 147 and 168 g were obtained from the local breeding colony of the Faculty of Science in Kenitra, Morocco. The animals were housed in groups (12-hour light/dark cycle) with ad-libitum access to food and water. After two weeks of acclimatization, the animals were divided into 2 groups of 20 animals each, control and treatment. The treatment group was further divided into two subgroups **B** and **C** of ten rats each. The two subgroups received daily dimethoate dissolved in corn oil by gavage at a dose of 100 mg/kg body weight for 5 weeks. In parallel to the intoxication, one of the subgroups received natural water and the other a nettle decoction. Their controls **A** received corn oil.

Statistical analysis

We performed the statistical analyzes using the SPSS 20.0 software. The tests repetitive ANOVA parametric and 1-factor ANOVA were used to compare the data series. When there was a difference between more than two lots, additional analysis was performed with Tukey's post hoc test. The values of $p < 0.05$ were considered significant.

Histological study

At the end of the treatment period, rats were killed by beheading. For the histopathological examination, the livers and spleens were immediately removed, cleaned with tap water and separately fixed in a 10% formalin solution of volume enough to immerse the organs for approximately 48 hours at 4 °C. The above operation was carried out after the approval of the Institutional Ethics Committee.

Measurement of organ weights

The liver weight of the control and treated rats were measured by using an electronic compact scale balance (SF 400 A).

RESULTS

Effects of sub-chronic dimethoate intoxication by gavage on liver weight

The Figure 1 illustrates the liver weight results of male rats after 5 weeks of dimethoate administration by gavage. A significant decrease in liver weight was observed in treated versus control rats. The difference in weight observed between the two groups was statistically significant ($p < 0.001$).

Histopathological studies of liver sections

Microscopic examination of the liver tissues in the control rat (Figure 2a) using standard colors (Hematein-eosin) shows normal cellular integrity and normal lobular architecture with central veins and radiating cords of hepatocytes, separated by blood sinusoids, in comparison with those of treated rats. Figure 2(b-f) shows obvious histopathological changes, characterized by the distortions in the liver organization as described below.

The hepatic tissues of the treated subgroups displayed slightly ectatic sinusoids especially around the centrilobular veins and they were clearly congestive. The bile ducts were normal without signs of cholangitis. The portal veins were the site of a discrete inflammatory polymorphic infiltration associated with some

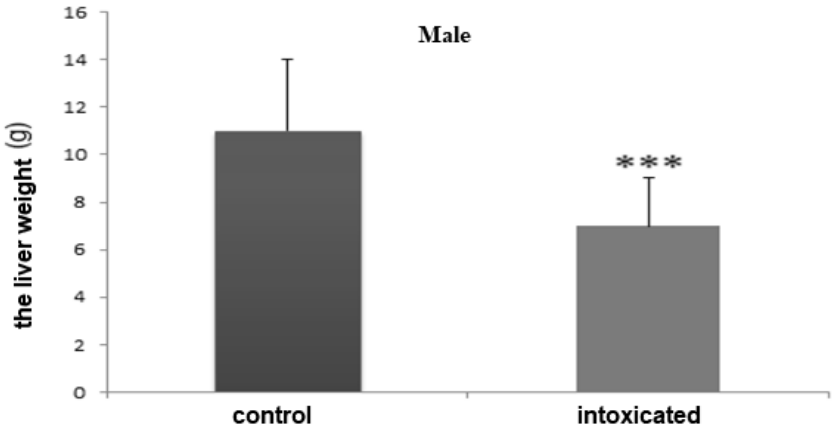

Figure 1. Effect of dimethoate exposure on liver weight; rats were intoxicated by gavage and had free access to drinking water. Liver weight (g) is expressed as mean ± mean standard error (SEM) (*** $p < 0.001$); comparison between intoxicated and control groups.

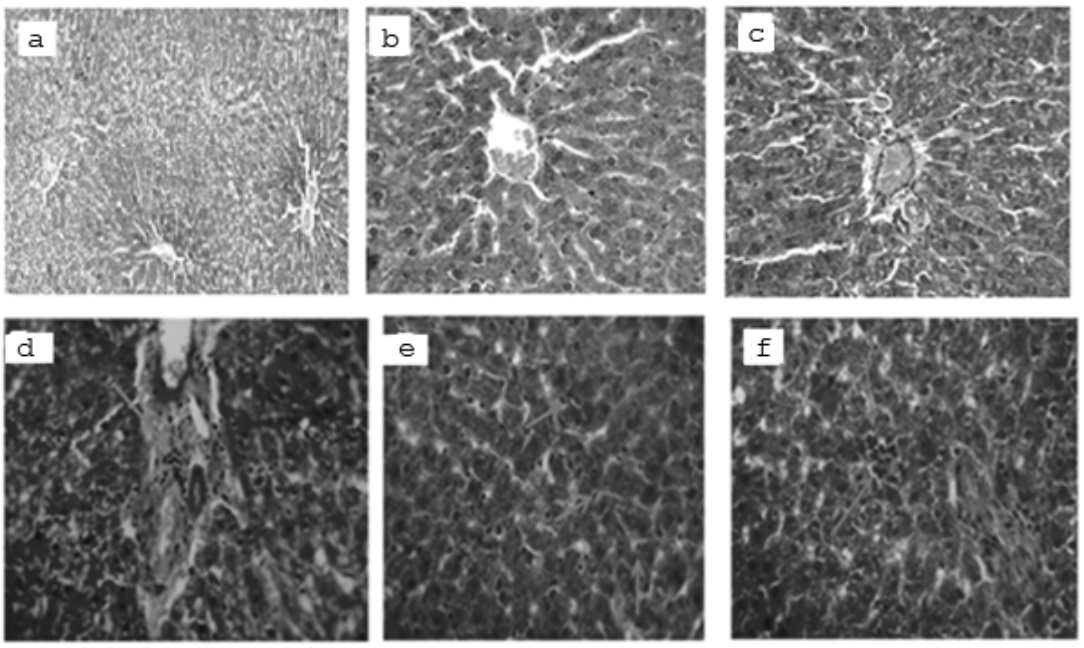

Figure 2. Effect of dimethoate exposure on liver tissues; rats were intoxicated by gavage and had free access to drinking water. (a) Histology of the untreated rat liver (control) with normal architecture. (b) Congestive centrilobular vein with peri-centrilobular sinus ectasia. (c) The bile ducts are normal without signs of cholangitis. (d) Portal veins housing eosinophilic polynuclear cells. (e) Hyperplasia of the stellar liver cells (ITO cell). (f) Very rare foci of lobular necrosis and groups of leukocytes around a hepatocyte.

polynuclear eosinophils without granuloma. The parenchyma also shows hyperplasia of the star cells of the liver (ITO cell) and very rare foci of lobular necrosis and groups of leukocytes around a hepatocyte.

Histopathological studies of splenic sections

The spleen sections were also prepared from the treated rats and examined under an optical microscope. The intensity of the changes is presented in Figure 3 below:

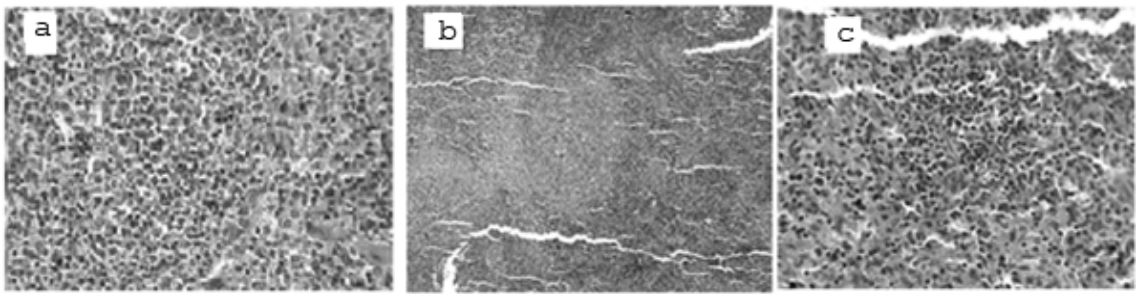

Figure 3. Effect of dimethoate exposure on spleen tissues; rats were intoxicated by gavage and had free access to drinking water. (a) Control group showing a normal architecture. (b) White pulp showing hyperplasia of lymphoid follicles and fibrous changes in red pulp. (c) The red pulp containing many siderophages.

Microscopic examination of the tissues of control group (Figure 3a) shows a splenic parenchyma of normal overall architecture. In Figure 3(b, c), the tissues of the treated subgroups show white pulp made up of clearly defined follicular lymphoid hyperplasia with enlarged clear germinal centers. The red pulp is home to congestive capillaries associated with many siderophages, and a fibrous reshaping also dissociates this splenic parenchyma.

DISCUSSION

The objective of this study was to evaluate the protective effect of nettle after dimethoate intoxication. For this purpose, two groups of rats receiving dimethoate by gavage were used. The first group had free access to water and the second had free access to nettle decoction.

A significant decrease in liver weight was observed in the first group; this result is consistent with the work of [13] that used Amitraz. These findings are in line with those of [14] that showed a decrease in relative liver weight in rats exposed to dimethoate. This result disagrees with that of [15] that found a significant increase in relative liver and kidney weights in mice treated with malathion. In the said subgroup the result showed a degeneration of liver tissues. Our results are consistent with those of [16] that found an infiltration of mononuclear cells, congestion, hydrophobic degeneration and hepatocellular damage in the liver of male rats treated with dimethoate, endosulfan and carbaryl. In addition, the results obtained are consistent with the reports of [17] that found that 30-day exposure of male rats to technical dimethoate at 6 and 30 mg/kg caused portal inflammation, centrizonal congestion and focal hepatocytic necrosis in rat liver. The histopathological lesions found in our study were consistent with [18] wherein the mice were treated with ethyl carbamate. Our results were also consistent with those of [19] that found the portal vein housing eosinophilic polynuclear cells in the liver of male albino rats treated with carbaryl. In the same subgroup the histopathological studies of splenic sections revealed various abnormalities, such as follicular lymphoid hyperplasia with enlarged clear germinative centers. A similar result was found by [20], wherein lymphoid atrophy and fibrosis was seen in the spleen of male and female rats of all chlorpropham-treated groups.

The subgroup drinking nettle decoction in parallel with dimethoate exposure revealed that the liver and spleen tissues are unchanged; our result conforms with the report of [21] which states that *Urtica Dioica L*. prevents damage in rat liver. Another finding revealed that the use of *Urtica dioica L*. seed extract against aflatoxin-exposure in rats has a hepatoprotective effect in rats with aflatoxicosis [22]. The study of [23] revealed that *Urtica dioica* has a protective effect on the liver in hepatic ischemia-reperfusion-injured rats.

CONCLUSION

We found a reduction in liver weight and significant histopathological changes in the liver and spleen in the subgroup that received drinking water in parallel with dimethoate intoxication. Whereas, the second subgroup that drank

Urtica Doica L. decoction in parallel, had a slight decrease in the body weight and the organs studied retained their architecture without change. These results led us to conclude that the antioxidant intake of nettle may have a protective effect against sub-chronic exposure to dimethoate however; a clinical study would be desirable to support these results.

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CONFLICT OF INTEREST STATEMENT

This is to certify that the reported work in the article entitled 'Protective effect of nettle (*Urtica Doica* L.) against dimethoate-induced alterations in the liver and spleen of Wistar rats submitted for publication in the journal, Current Topics in Toxicology has no conflicts of interest and this is a personal work.

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