

HISTOLOGICAL EFFECTS OF HERBICIDE (MACHETE) ON THE KIDNEY OF ALBINO RAT

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ABSTRACT

The histological changes and some parameters in the kidney of albino rat were examined to show the effect of daily 1/4 LD₅₀ (500 mg/kg b.w.) of herbicide Machete after 1st, 2nd, 3rd and 4th weeks post treatment. The results indicated a marked significant decrease in body weight, while a significant increase in kidney weight.

Kidney ; Hyperaemia was observed in the cortical blood vessels, while the epithelial cells lining the renal tubules had degenerative changes. Focal mononuclear leucocytic inflammatory cells infiltration was noticed inbetween the renal tubules. It could be stated that Machete herbicide causes pathogenesis in kidney tissue that could possibly leads to renal dysfunction.

Also, total protein, total bilirubin, uric acid creatinine and urea were changed in plasma of albino rat after oral administration 1/4 LD₅₀ herbicide Machete daily, it was observed an increase in total bilirubin, uric acid, creatinine and urea but a gradually decreases was recorded in total protein level at all tested periods, except at 1st week creatinine did not changed compared with control.

INTRODUCTION

Carbamates represent a group of the most widely used pesticides in most countries, butachlor (Machete) and aldicarb used as a herbicide and nematicide in Egypt, which causes considerable hazards not only for man and his domestic animals and other mammals (El-Hady, 1991 and Mattar *et al.*, 1992), but also for aquatic animals including fishes (Sastry and Siddiqui, 1982 and Matter *et al.*, 1992). However, the effects of pesticides on mammalian kidney were scarce although it is considered as one of the most essential target organs of the body. For this reason, the present work has aimed to clarify a real insight into the histological and morphometric changes induced by the sublethal dose of "Machete" on the kidney of treated rats. This may throw more light on its role in increasing the case of kidney failure nowadays.

MATERIALS AND METHODS

Tested compound : butachlor herbicide

Common name : Butachlor (BSI, E-ISO, (m) F-ISO, ANSI, WSSA, Jamaf).

Chemical name (Iupac), N-butoxy-methyl-2-chloro-2,6-diethyl-acetanilide; N-butoxymethyl-2-chloro-N-(2,6-diethylphenyl)= cetamide (9Cl); N-

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(butoxymethyl)-2-chloro-2-chloro-2, 6-diethyl-
acetanilide (8Cl). CAS:

Trade name "Machete".

Dosage : LD₅₀ equal 2000 mg/kg body weight.

This herbicide introduced by Monsanto Co.

Experimental animals :

Male albino rat (120-160 g b.w.) were obtained from Helwan Breeding Station, Cairo. The animals were given standard diet and water ad libitum, being kept in air conditional room with a 12 hour light / 12 hour dark cycle. After two weeks of acclimatization they were divided into two groups. The first one left as control, and the second group was daily oral, administered 1/4 LD₅₀ for one month. Five animals from control and treated animals were weighed and sacrificed at intervals 1, 2, 3 and 4 weeks post-treatment. Their kidneys were isolated, weighed, fixed, sectioned, stained and examined under microscope.

Blood was collected in heparinized centrifuge, the plasma was obtained by centrifugation at 3000 r.p.m. for 15 minutes and pipetted in clean and dry tubes then kept at -20°C for analysis. Total protein, total bilirubin, uric acid, creatinine and urea were determined according to Henry (1964), Billing *et al.* (1971), Caraway *et al.* (1966) and Patton and Crauch (1977).

Statistical analysis was done according to Snedecor and Cochran (1967).

RESULTS

1/4 LD₅₀ of "Machete" herbicide induce a gradually significant decreases in body weight and a constant significant increases in kidney weight at all intervals of the test, Table (1).

Table (1): Effect of herbicide (Machete) on body and kidney weight of albino rats treated with 1/4 LD₅₀/animal daily for 4 weeks.

Para- Meter	Control mean±S.E.	Weeks post-treatment			
		1st week mean±S.E.	2nd week mean±S.E.	3rd week mean±S.E.	4th week mean±S.E.
Body weight (g)	149.4 ±1.6	133.8 ±1.9**	134.2 ±1.8**	136.8 ±3.0*	116.0 ±2.1**
Kidney weight (g)	0.84 ±0.04	1.07 ±0.03*	1.06 ±0.01**	1.05 ±0.01**	1.07 ±0.01*

Data are expressed as mean ± S.E. of 5 rats.

Regarding the histological effects of 1/4 LD₅₀ herbicide Machete on kidney of albino rat was illustrated in Figs. (2, 3, 4 & 5). There were hyperemic cortical blood vessel (Fig. 2) at one week, hyperemic glomerular

tuft with degenerated lining epithelium of the renal tubules (Fig. 3) at two weeks; hyperemic glomerular tuft with degeneration and disfiguration of the renal tubules lining epithelium (Fig. 4) at 3rd week and focal mononuclear leucocytic inflammatory cells infiltration inbetween the renal tubules (Fig. 5) at 4 weeks post-treatment.

Table (2) revealed the occurrence of a significant reduction in plasma total protein after 1/4 LD₅₀ herbicide Machete at 4th week only. While a non-significant increases were recorded in plasma bilirubin at all tested periods. Concerning uric acid in plasma, there were a significant increases at 1, 2, 3 and 4 weeks post-treatment.

A non significant increases were recorded in plasma creatinine at all tested intervals, while a significant increases at 2nd and 4th week post-treatment in urea after 1/4 LD₅₀ herbicide Machete administration but at the rest period, the increases were non-significant.

Table (2) Effect of 1/4 LD₅₀ herbicide Machete on total protein, total bilirubin, uric acid, creatinine and urea in plasma of albino rats.

Para-Meter	Control Mean ± S.E	Weeks post-treatment							
		1 st		2 nd		3 rd		4 th	
		Mean ± S.E	% Diff.	Mean ± S.E	% Diff.	Mean ± S.E	% Diff.	Mean ± S.E	% Diff.
Total Protein Mg/dl	27.2 ±2.9	25.2 ±1.8	-7.4	22.8 ±1.00	-16.2	22.0 ±2.1	-19.1	19.6 ±1.1	-27.9*
Total Bilirubin Mg/dl	0.32 ±0.06	0.84 ±0.60	162.5	0.86 ±0.03	168.7	1.56 ±0.13	387.5***	2.50 ±0.90	681.2***
Uric acid Mg/dl	3.10 ±0.40	5.55 ±0.78	77.4*	7.77 ±0.35	148.3**	10.2 ±2.0	229.0**	12.44 ±1.24	301.3***
Creatinine Mg/dl	0.90 ±0.1	0.90 ±0.90	0.0	1.20 ±0.12*	33.3	1.45 ±0.35	61.1	1.50 ±0.4	66.6***
Urea Mg/dl	31.6 ±1.6	37.9 ±4.7	19.9	56.2 ±2.5*	77.8	58.4 ±2.5	84.8***	65.8 ±2.7*	108.2

Each value expressed as mean ± S.E of 5 rat.

* P > 0.05 Significant

** P > 0.01 Highly significant

*** P > 0.001 Very highly significant

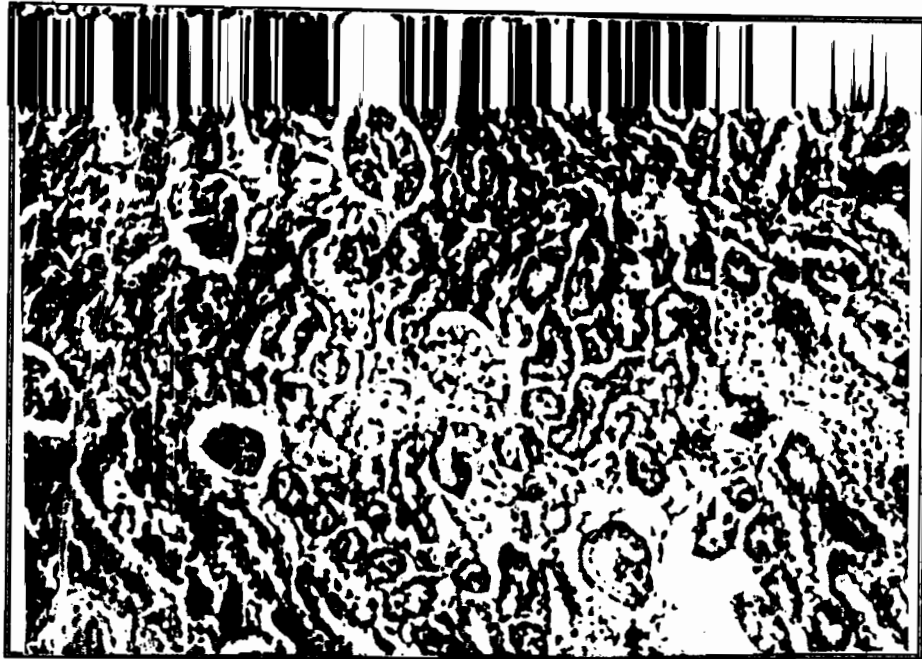


Fig. 1- Kidney of rat in control group (H & E X40).



Fig. 2.- Kidney of rat treated and sacrificed after one week showing hyperemic cortical blood vessel (H & E X40).



Fig. 3.- Kidney of rat treated and sacrificed after 2 weeks, showing hyperemic glomerular tuft with degenerated lining epithelium of the renal tubules (H & E X160).

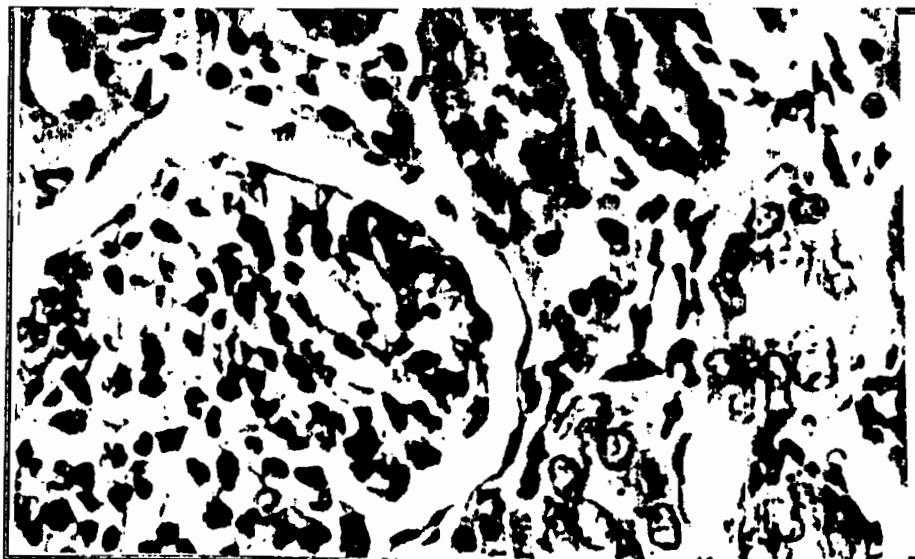


Fig. 4.- Kidney of rat treated and sacrificed after 3 weeks, showing hyperemic glomerular tuft with degeneration and disfiguration of the renal tubules lining epithelium (H & E X160).

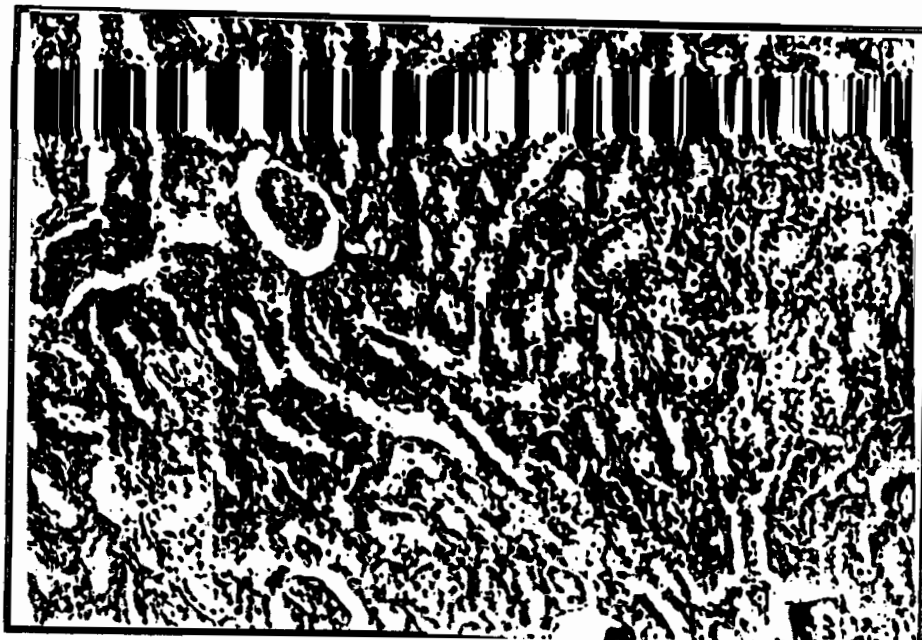


Fig. 5.- Kidney of rat treated and sacrificed after 4 weeks, showing focal mononuclear leucocytic inflammatory infiltration inbetween the renal tubules (H & E X40)

DISCUSSION

The kidneys comprise only 0.5 % of body weight, yet they receive 25 % of the cardiac output. Thus, it is hardly surprising that toxic environment can damage the kidney and that disease of the kidney affect responses to toxic substance (Laurence and Bennett, 1992).

In the present study, gross findings indicated slight enlargement with the results of Ebert *et al.* (1992) who found toxic effects in rat after treatment with Trifluralin (herbicide) represented by increased renal organ weight. Concurrently, histological changes observed at 1, 2, 3 and 4 weeks after 1/4 LD₅₀ herbicide Machete administration, the cortical blood vessels and glomeruli were hyperemic, while the epithelial cells lining the renal tubules had degenerative changes. Also, focal mononuclear leucocytic inflammatory cells infiltration was noticed inbetween the renal tubules. These results may be related to plasma potassium level falls, these findings may offer a support to the view speculated by Elwi (1967), who demonstrated impairment of the oxidative phosphorylation processes of the Krebs' cycles and consequently reduced release of energy necessary for the regulation of the concentration of ions in the cells. A loss of intracellular potassium ion is followed by the entry of more sodium ions into the cells. The tendency of the cell to become hypertonic is balanced by the entry of water and the injured mitochondria become swollen and vacuolated and presumably the site of water accumulation. The toxicity of herbicide Paraquat induced swelling of the

tubular epithelial cells and their granular cytoplasm may be related to proteinuria (Curran, 1990).

Meyer *et al.*, 1990) and Damian *et al.* (1991) emphasized that as a results of severe Paraquat (herbicide) poisoning, renal damage occurs (renal failure). Renal toxicity after Trifluralin (herbicide) treatment was recorded to be injury of proximal tubules and increased incidence of hyaline droplets in the tubular epithelium (Ebert *et al.*, 1992).

El-Hady (1994) revealed that the histological changes in the *Arvicantis niloticus* uriniferous tubules following Aldicarb administration included hydropic degeneration, vacuolization vascular congestion, lymphatic cells infiltration and dilated blood vessels. The size and numbers of vacuoles had increased significantly by the advancement of treatment. Also, Abou-Zaid and El-Balshy (1994) revealed that the kidney of mice treated with caffeine showed glomerulonephritis, cloudy swelling, hydropic degeneration and finally necrosis. El-Deeb *et al.* 1997 reported that the kidney of house sparrow and palm dove after treatment with Lebaycide avicide revealed congestion, lesion, hydropic degeneration and necrosis of the renal parenchyma. Also, Abdel-Gawad *et al.* (2001) found that kidney of house sparrow after 1/4 LD₅₀ camphor leaves ethanol extract revealed congestion with lymphocytic infiltration and fibrosis, while kidney of palm dove showed cloudy swelling. The same observation was recorded by El-Essely (2002) when studied the effect of chlorphacinone and warfarin (rodenticides) on kidney of albino rats.

Concerning the metabolites changes in plasma, the present results revealed an increases in total bilirubin, uric acid, creatinine and urea but a decreases was recorded in total protein level at all tested periods. These findings are agree with El-Mahrouky *et al.* (1997) who studied the effect of repeated 1/16 LD₅₀ calciferol rodenticide on urea, creatinine, cholesterol, uric acid and total bilirubin levels in rat serum during 1, 3, 7, 14, 21 and 28 days post-treatment, it was noticed that the effect was continuous throughout all periods in the case of cholesterol and uric acid, while in urea, creatinine and total bilirubin a significant increases were recorded. Also, Abdel-Khalek (1985) indicated that non- significant changes were observed in the values of serum total bilirubin of chickens affected by flocoumafen rodenticide. Moreover, Al-Sahhaf (1995) stated that there was no significant change in the urea nitrogen, while total bilirubin and creatinine showed a significant increase in treated toad with Lannate.

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التأثيرات الهستولوجية لمبيد الحشائش ماشيت على كلية الفأر الأبيض
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أجرى هذا البحث بهدف دراسة التأثير الهستولوجى على كلية الفأر الأبيض بعد تناوله
¼ الجرعة النصف مميتة (1/4 L D₅₀) لمدة شهر يوميا. ثم الذبح بعد اسبوع - أسبوعين -
ثلاث أسابيع - أربع أسابيع من المعاملة حيث أظهرت النتائج أن هناك نقص معنوى فى وزن
الحصم بينما زاد وزن الكلية زيادة معنوية ، بالنسبة للتغيرات الهستولوجية فى الكلية. كما أوضحت
النتائج أيضا وجود احتقان فى الأوعية الدموية فى الجزء الخارجى من الكلية (القشرة) وأيضا فى
الكلبية. أما بالنسبة للخلايا الطلائية المبطنة للأنابيب الكلوية فقد تلاحظ وجود تغيرات انتكاسية مع
وجود ارتشاح والتهابات فى الخلايا البؤرية وحيدة النواه .
من هذا يتضح أن مبيد الحشائش الماشيت أدى الى حدوث تغيرات هستولوجية (مرضية)
فى أنسجة الكلى مما أدى الى حدوث فشل كلوى .
وأما بالنسبة لقياس البروتين الكلى والبليروبين والكرياتينين واليوريا وحمض اليوريك فى
البلازما. فقد أوضحت النتائج أن الجرعة المستخدمة أدت الى زيادة فى كل من البليروبين الكلى
والكرياتينين واليوريا وحمض اليوريك . وأما بالنسبة للبروتين الكلى فكان هناك نقص فى مستواه
فى كل فترات المعاملة ما عدا الأسبوع الأول بينما لم يحدث تغيير فى الكرياتينين عند مقارنة
بالكنترول الغير معامل .