

## Effects Of Orally Fed Diazinon On Some Biochemical Parameters Of Male Albino Rats

Mohammed Salah Ab.Ab.AL-Shinnawy

Biological and Geological Sciences Department , Faculty of Education , Ain Shams University , Cairo , Egypt .

### Abstract

**Background:**The current investigation was carried out to study the effect of orally administration of diazinon insecticide on some biochemical blood indices on male albino rats.

**Material and methods:** The organophosphorus insecticide , diazinon was orally administrated at a dose (100mg/kg body weight=1/3LD50) , daily for 10 days (short –term) and 20 days (long –term) to adult male albino rats .

**Results:** The results revealed the following:

- 1- Diazinon led to an increase in rat blood serum glucose & T3 (short and long –term); AST,ALT, and T4 (long-term).
- 2- Diazinon reduced the serum content of total cholesterol and protein in short–term treated rats.
- 3- Treatment of rats with diazinon did not alter activity of AST, ALT and T4 level at short –term period .In addition ; ALP serum levels were not altered in both short and long –term treated rats .

**Key Words:** Diazinon , Organophosphorus insecticide , Biochemical changes , Serum

### Introduction

The world loses about 6 billion pounds sterling every year of agricultural production due to pests. Farmers have therefore invested heavily in pesticides to reduce this loss . The international use of pesticides has increased food production in parallel with population growth in many parts of the world .Many insect – borne diseases have also been eliminated or controlled by the use of insecticides (Sungur and Güven, 2001).

On the other hand ,the extensive use of insecticides to control agricultural pests has caused great concern because of the possible effects of these compounds on human beings as well as wild and domestic animals (Ezzat *et al.*,1991 and Alpalan *et al.* ,2006) .

The organophosphorus insecticides comprise a very large group of compounds . They constitute the most important group of modern pesticides , being of wide application because they possess a high insecticidal activity as well as a high initial action of toxicity on pests (Hassall , 1990 ; Gralewicz & Socko , 1997).

Diazinon which is the object of this current study is one of the organophosphorus insecticides (Cindy *et al.*, 2007). It has been used at levels exceed the legal limits to control a wide variety of sucking and chewing insects and mites on a very wide range of crops , including deciduous fruit trees , citrus fruit , vines olives ,bananas , pineapples ,etc.....Also used as a veterinary ectoparasiticide .It has hazardous side effects on humans and economic farm animals that accidentally exposed to it (Kalender *et al.* ,2005).

### Material And Methods

Forty mature male albino rats (*Rattus norvegicus*)ranging in weight from 120 - 140 gm . , were essentially obtained from Schistosoma Biological Supply Program (SBSP) Theodor Bilharz Research Institute. The rats were allocated at random into 4 equal groups 10 rats each.

**The first group**,were kept as control being observed under the same laboratory conditions.

**The second group**, each rat of this group was orally given a dose (100mg/kg body weight) daily of diazinon pesticide for 10 days (short – term).

**The third group**, rats of this group were served as a control group (long – term treatment).

**The fourth group**, each rat of this group was orally given 100mg/kg body weight daily of diazinon for 20 days (long – term treatment).

All of the control and treated animals were individually weekly weighed in order to detect any change that may take place in their body weights.

#### **Biochemical studies:**

At the end of experimental periods, individual samples were then collected from the different groups after 18h. fast. Samples of blood drawn and left to clot in a clean dry test tube for each animal, then centrifuged at 3000 rpm for ten minutes. Part of the clear supernatant serum was used immediately for glucose determination. The remain serum was frozen at – 20C for the subsequent analysis.

Serum glucose level was measured according to the "enzymatic colorimetric" method described by Trinder(1969). The total serum cholesterol was carried out according to Allain *et al.* (1974). Serum total protein was estimated according to the method described by Domas(1975). Serum aspartate transaminase (AST) and alanine tansaminase (ALT) activities were carried out according to Berg Meyer and Bernt (1974). Serum alkaline phosphatase(ALP) was determined by the method of Belfield and Golbderg(1971).

Determination of thyroxine (T4) was carried out by using solid phase enzyme – immunoassay according to the method of Wood (1980). Measurement of serum tri – iodothyronine (T3) concentration was done by using enzyme – immunoassay Kit purchased from (Boehringer Mannheim West Germany).

#### **Data analysis**

Biological data resulted in the present study were computed and analysed statistically according to the mathematical principles of handling frequency distributions described by Compbell (1974).

#### **Results**

Results of the effects of repeated doses of diazinon pesticide on body weights of the rats are recorded in table(1). The findings indicated that treated rats showed highly significant decreases ( $P < 0.001$ ) in their body weights after feeding for 20 days, while the body weight was not obviously changed on the other tested period (10 days).

The data represented in table (2) display the effect of diazinon pesticide on serum glucose level, total cholesterol and protein content. The glucose levels of all treated groups recorded high significant increase ( $P < 0.001$ ), while serum content of total cholesterol was highly significant decrease ( $P < 0.001$ ) in short – term treated group, but it was significantly decrease ( $P < 0.05$ ) in long – term treated group.

Total proteins were highly significant decreased ( $p < 0.001$ ) in serum of treated rats (at short – term) and decreased ( $P < 0.05$ ) (at long – term).

The obtained data (recorded in table3), short term administration of diazinon showed insignificant changes in the activities of AST, ALT and ALP in rats. The activity of these transaminases after long – term administration of diazinon, was highly significant increased ( $P < 0.001$ ) in these animals.

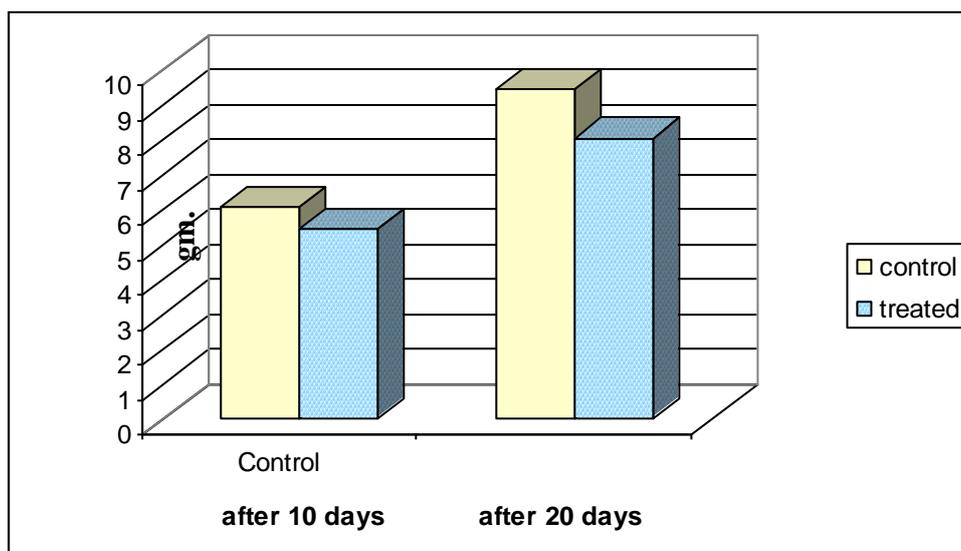
Serum T3 levels was highly significant elevate ( $P < 0.001$ ) above the control values after 10 and 20 days in response to the diazinon treatment (table 4). Data presented in the same table indicated that administration of diazinon into rats led to significantly increase ( $P < 0.05$ ) in T4 concentration in long – term treated rats.

**Table (1): Effect of Diazinon insecticide on body weight(gain or loss) ( gm) of rats .**

	After 10 days		After 20 days	
	Control	Treated	Control	Treated
Mean of body weight (gain or loss gm .) (Mean ± S . D)	6.11 ± 0.89	5.46 ± 1.09	9.48 ± 0.60	8.06 ± 0.50
% of change	-10.63		-14.99	
P value	P > 0.05*		P < 0.001***	

\*Insignificant

\*\*\* Highly Significant



**Fig .(1): changes in the body weight (gm) of control and Diazinon–treated rats.**

**Table(2): Effect of Diazinon insecticide on glucose level (mg/100ml) , total cholesterol content (mg/dl) and total protein content (gm/dl) in albino rat serum**

	glucose				Total cholesterol				Total protein			
	10 days		20 days		20 days		20 days		10 days		20 days	
	control	treated	control	treated	control	treated	control	treated	control	treated	control	treated
Mean ±S.D.	100.68 ±2.25	107.14 ±1.86	101.24 ±1.98	120.18 ±2.21	79.01 ±0.37	75.96 ±1.02	78.96 ±0.47	75.95 ±3.45	6.05 ±0.02	5.66 ±0.48	6.05 ±0.03	5.42 ±0.49
% of change	+ 6.42		+18.71		-3.86		-3.81		-6.45		-10.41	
P value	P <0.001***		P <0.001***		P <0.001***		P <0.05**		P <0.05**		P <0.001***	

\* Insignificant

\*\*\* Highly Significant

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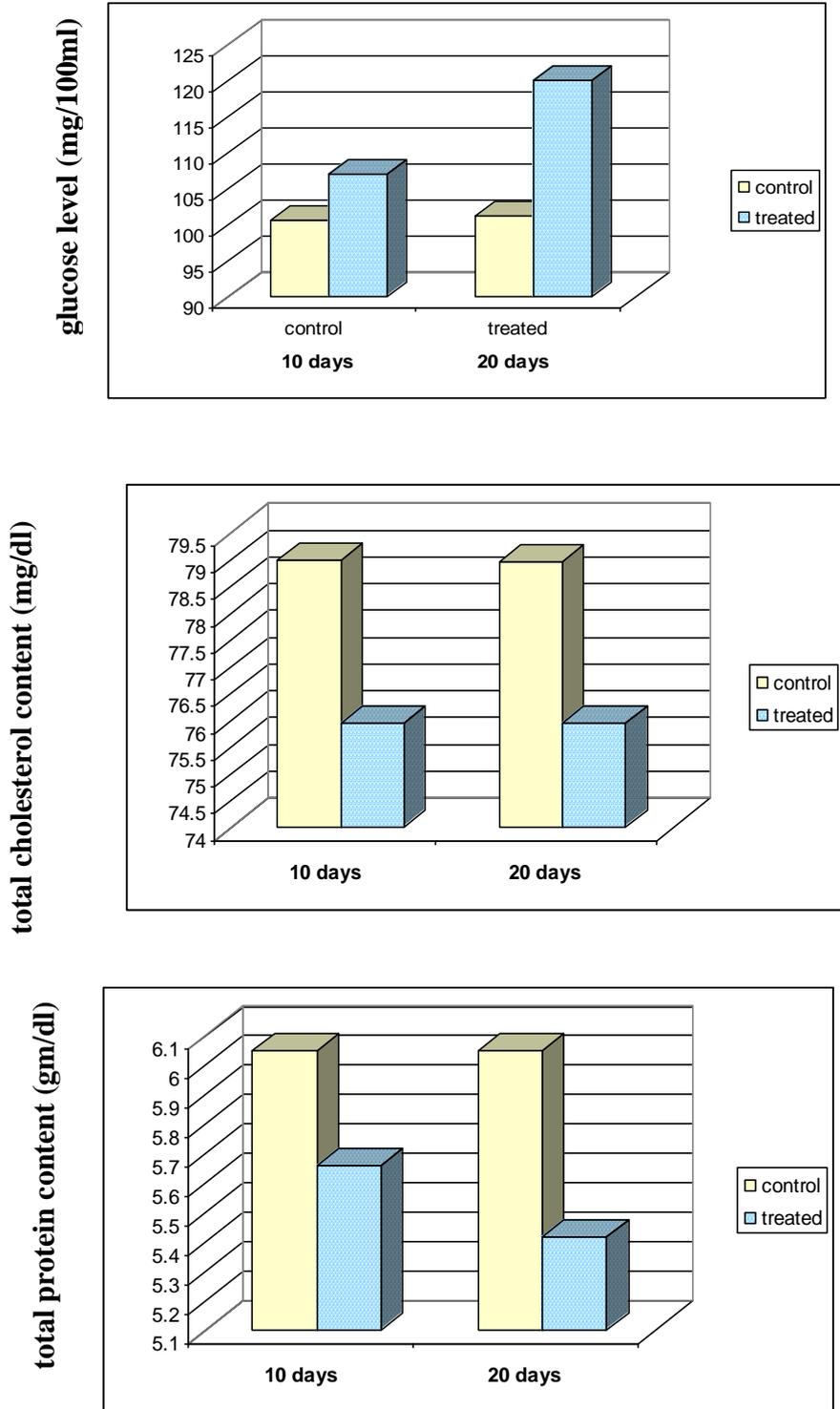


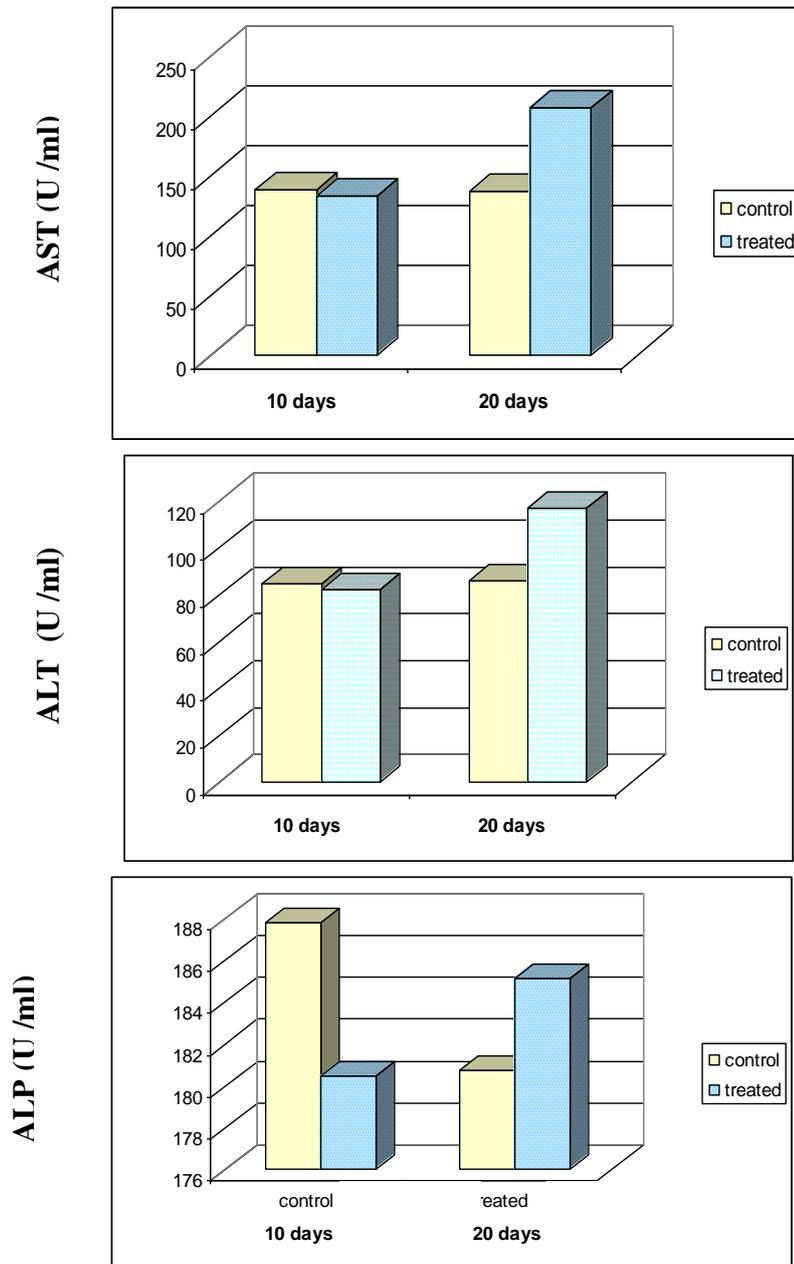
Fig (2):Effect of Diazinon insecticide on glucose level (mg /100ml) , total cholesterol content (mg /dl) and total protein content(g /dl) in albino rat serum .

**Table(3): Effect of Diazinon insecticide on AST , ALT and ALP activities (U/ml) in male albino rat serum.**

	ASR				ALT				ALP			
	10 days		20 days		10 days		20 days		10 days		20 days	
	control	treated	control	treated	control	treated	control	treated	control	treated	control	treated
<b>Mean ±S.D.</b>	138.75 ±9.43	133.50 ±9.43	137.18 ±7.92	207.75 ±5.88	85.13 ±6.01	82.50 ±3.17	86.03 ±4.16	11.83 ±11.23	187.83 ±11.23	180.52 ±15.81	180.74 ±7.21	185.16 ±2.81
<b>% of change</b>	- 3.78		+50.75		3.09-		+36.58		-3.89		+2.45	
<b>P value</b>	<b>P &lt;0.05*</b>		<b>P &lt;0.001***</b>		<b>P &lt;0.05*</b>		<b>P &lt;0.001***</b>		<b>P &lt;0.05*</b>		<b>P &lt;0.05*</b>	

\* Insignificant

\*\*\* Highly Significant



**Fig (3) : Effect of Diazinon insecticide on AST , ALT and ALP activities (U /ml) in albino rat serum**

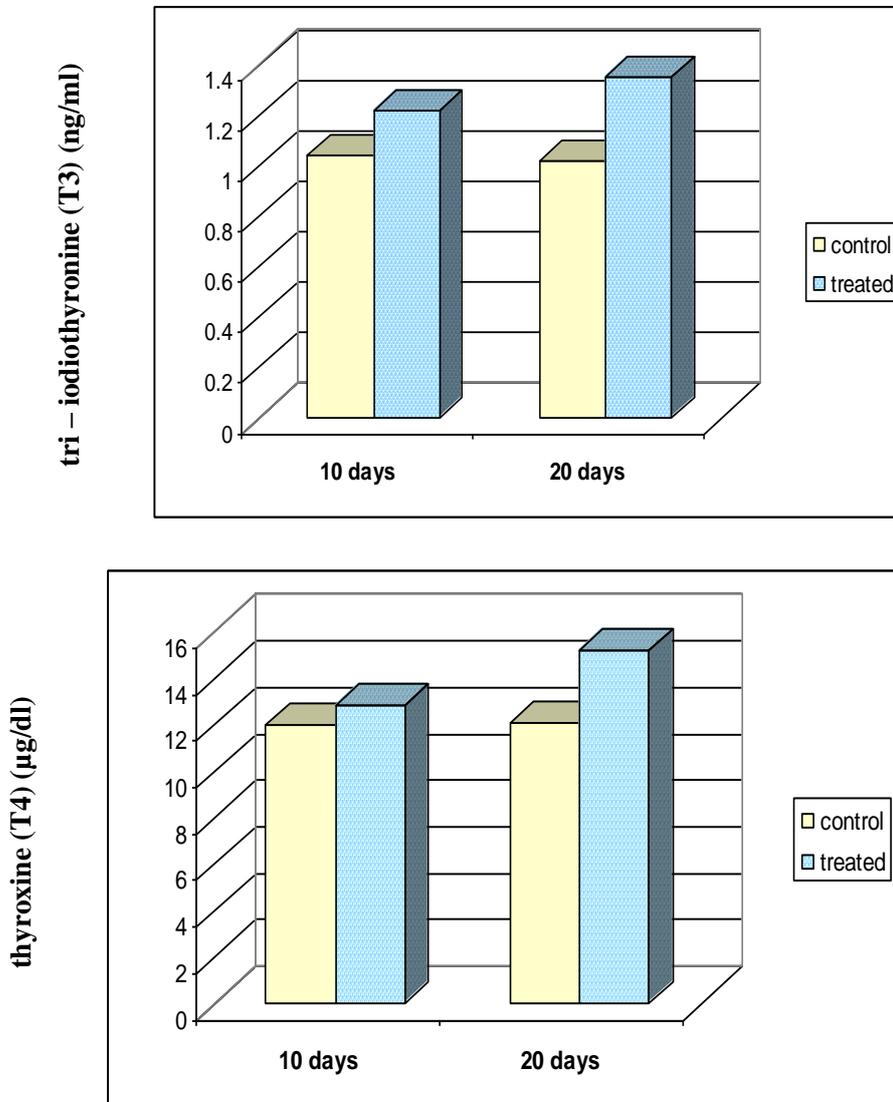
**Table(4): Effect of Diazinon insecticide on thyroxine (T4) ( $\mu\text{g}/\text{dl}$ ) and tri – iodothyronine (T3) ( $\text{ng}/\text{ml}$ ) concentrations in albino rat serum.**

	Tri – iodothyronine (T3) ( $\text{ng}/\text{ml}$ )				Thyroxine (T4) ( $\mu\text{g}/\text{dl}$ )			
	10 days		20 days		10 days		20 days	
	control	treated	control	treated	control	treated	control	treated
<b>Mean of body weight (gain or loss gm.) (Mean <math>\pm</math> S . D)</b>	1.04 $\pm$ 0.09	1.22 $\pm$ 0.06	1.02 $\pm$ 0.08	1.35 $\pm$ 0.19	12.02 $\pm$ 1.89	12.82 $\pm$ 1.58	12.09 $\pm$ 1.74	15.21 $\pm$ 1.88
<b>% of change</b>	+ 17.31		+ 32.35		+ 6.66		+ 25.81	
<b>P value</b>	<b>P &lt;0.001***</b>		<b>P &lt;0.001***</b>		<b>P &lt;0.05*</b>		<b>P &lt;0.05*</b>	

\* Insignificant

\*\* Significant

\*\*\* Highly Significant



**Fig (4) : Effect of Diazinon insecticide on thyroxine (T4) ( $\mu\text{g}/\text{dl}$ ) and tri – iodothyronine (T3) ( $\text{ng}/\text{ml}$ ) concentrations in albino rat serum**

## Discussion

There is an increasing interest from the hygienic point of view for the safety of the feeding stuffs for consumption. The intensive use of pesticides to eliminate pests or to regulate crop growth has led to pesticide residues in soil, air, water, stored grains, crops and plants at concentration levels which exceed the legal limits (Süsse and Müller, 1996). The great hazards caused by pesticides on the live stocks are due to their accidental exposure to these pesticides either by ingestion or inhalation (Yamanaka *et al.*, 1996). The disappearance of pesticide residues at a given location does not mean the end of the problem, but they can be translocated, bioconcentrated or converted into more dangerous chemicals (Mastmura, 1985). Therefore, This study was designed to evaluate the influence of these compounds on adult male albino rats.

The results of the present investigation revealed that only those rats fed on diazinon showed highly significant decreases in their body weights after feeding for 20 days. This decrease may probably attribute to the loss of appetite, lesser food intake and/or metabolic disturbance caused by diazinon treatment. These results are in harmony with those obtained by (Dikshith *et al.*, 1991) on hexachlorocyclic hexane, (Badawy *et al.*, 1992) on curacron, (Paul *et al.*, 1993) on Endosulfan (Abd El-Hady and Abdeen, 1997). Also, the loss of body weight may be due to diarrhea, diabetes and decreased nucleic acid contents (Rashwan *et al.*, 1994).

There exists a positive correlation between relative body weight and concentrations of lipids (Harper *et al.*, 1993).

In the present investigation high level of serum glucose were recorded in all groups of diazinon treated rats. These results are in good agreement with those findings obtained by Arechon and Plumb (1990); Thaker and Garg (1993); Kumar *et al.* (1996); Gad (2000) and Fouda (2004).

The hyperglycemia observed in the present work may be due to diazinon administration enhance the activities of the enzymes involved in gluconeogenesis leading to formation of glucose from non-carbohydrate source (Evans, 1996).

The weight loss encountered in this study may be a consequence to diazinon which appears to have a hypocholesterolemic effect as revealed by a decrease in total serum cholesterol content of the corresponding rat groups. These results are supported by the findings of Shakoori *et al.* (1988) and Saleh (1990).

Serum total protein in this study exhibited a significant decrease in rats fed on diazinon after 10 days, while total protein revealed a highly significant decrease after 20 days (table 2). This result is in accordance to those of Saleh *et al.* (1993); Sova *et al.* (1992) and Mossad & Azab (1999). This decrease in serum total protein level may be due to several pathological processes including renal damage and elimination of protein in the urine as explained by Pfeifer and Weber (1979). Regarding the effect of some insecticides on blood proteins, the result reported by several authors are contradictory. This contradiction may be attributed to several factors such as the type and used dose sex of the experimental animals, organ under investigation and period of treatment.

The obtained data (recorded in table 3), short-term administration of diazinon showed insignificant changes in the activity of AST, ALT and ALP in rats. The activity of transaminases (AST, ALT) after long-term administration of diazinon, was highly significant increased. Elevations of transaminase activity in blood have been considered as indicator of tissue damage.

Similar results were reported by Abdel Mageed *et al.* (2001); Fouda & Azab (2003), and El-Shater (2003). The authors indicated that insecticides caused an increase in serum AST and ALT activities in several species of animals.

The results obtained for T<sub>3</sub> (triiodothyronine) levels revealed a high significant increase in all groups of diazinon treated rats. Concerning T<sub>4</sub> (thyroxine) level in serum of rats, it was found that administration of diazinon for 20 days only led to a significant increase in T<sub>4</sub> concentration.

The literatures concerning the effect of insecticides on thyroid function are

rather contradictory and conflicting results of the present investigation seems to be in agreement with Rusmey *et al.*(1983) and Yadav & Singh (1987) who stated that organophosphorus had a stimulating effect on thyroid function in beef steers. Many authors reported significant decrease in T3 and T4 after treatment with organophosphorus insecticides on rats [ Akhtar *et al.* (1996) ; Hasheesh *et al.*(2002) and El-Shater (2003)].

Generally the increase in activity of T3 and T4 of thyroid gland paralleled the reduction of total cholesterol in serum and the degradation process of body weight in rats fed on diazinon. Hyperthyroidism may play a significant role in the genesis of decreasing serum lipids content of rats fed on organophosphorus insecticides. Therefore, the reduction of body weight may be attributed to the stimulation of thyroid gland.

### Concolusion

Because all the harmful alterations that diazinon had caused, the present investigation recommended for taking the almost care and minimize the use of this pesticide.

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## تأثيرات الديازينون على بعض المقاييس الكيموحيوية في ذكور الجرذان البيضاء عن طريق الفم

محمد صلاح عبد الحميد عبد الله الشناوى

قسم العلوم البيولوجية - كلية التربية - جامعة عين شمس - مصر - القاهرة

فى هذه الدراسة عوملت ذكور الجرذان البيضاء بجرعة يومية من المبيد الحشرى ديازينون (من مجموعة الفوسفاتات العضوية) قدرها (100مجم/كجم من وزن الجسم، تعادل 3/1 نصف الجرعة المميتة) عن طريق الفم ولمدة 10 أيام متتالية كمجموعة أولى قصيرة الأمد ولمدة 20 يوماً كمجموعة أخرى طويلة الأمد) وأظهرت النتائج ما يلى:

- 1- انخفض وزن جسم الحيوانات المعاملة بالمبيد فى الفترة طويلة الأمد انخفاضاً ملحوظاً.
- 2- أدى إعطاء الديازينون إلى زيادة فى مستوى مصل دم الفئران من الجلوكوز وثلاثى يود الثيرونين فى المجموعات المعاملة للفترتين قصيرة وطويلة الأمد ، بينما لوحظ ارتفاعاً واضحاً بعد الفترة طويلة الأمد لتركيز الأنزيمات الناقلة للأمين (AST , ALT ) إضافة إلى الثيروكسين.
- 3- لوحظ انخفاض واضح فى محتوى مصل الجرذان المعاملة من الكوليستيرول والبروتين الكلى للفترة قصيرة الأمد.
- 3- أظهر التحليل الإحصائى عدم تغير فى تركيزات الأنزيمات الناقلة للأمين (AST , ALT) وكذلك الثيروكسين فى الجرذان المعاملة بالديازينون للفترة قصيرة الأمد إضافة إلى أن مستوى المصل من إنزيم الفوسفات القلوى لم يتغير فى كل من مجموعتى الجرذان المعاملة خلال الفترتين قصيرة وطويلة الأمد .