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Assessment of the changes in some diagnostic parameters in male albino rats (*Rattus norvegicus*) toxicated with thiodicarb insecticide

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ABSTRACT

The Present work investigates the serum levels of glucose, cholesterol, protein, urea, creatinine and some enzyme activities (AST,ALT and ALP) in male albino rats treated orally with 1/10 LD50 dose of thiodicarb insecticide (carbamate group)daily for 7 days (short-term) and 30days (long-term).

A highly significant elevation in serum urea, creatinine, AST and ALT accompanied by a highly significant decrease in the body weight and a significant increase in serum glucose level were recorded in rats of long-term group. While, the short-term group showed a highly significant increase in serum level of glucose and urea. Moreover, a significant decrease in serum cholesterol content was recorded but the total protein concentration and ALP activity were not affected.

Keywords: Thiodicarb, carbamate, serum, insecticide, and albino rats.

INTRODUCTION

Carbamates are widely used in industry, agriculture and public health purposes. They were detected in well water and certain plants (Abdel-Rahman *et al*.,1985).Insecticides, even in very low concentrations, have been reported to interfere with basal metabolism (Sanders *et al*.,1974;Vigro and Bellward , 1975 and Write *et al*., 1977).

Carbamate pesticides are among the most toxic compounds employed for insect control. The need for a complete assessment of their potential toxicological hazards to man has assumed greater importance.

On the other hand, the extensive use of insecticides to control agricultural pests has caused a great concern because of the possible effects of these compounds on human being as well as wild and domestic animals (Ezzat *et al*., 1991) and (Alpalan *et al*., 2006). Thiodicarb is a highly effective oxime carbamate insecticide that has produced outstanding control of many pests of agricultural crops. Major features of this product include long residual activity (Hernandez *et al.,* 2006).The objective of this study is assessment a correlation between different biochemical parameters and the treatment by thiodicarb.

MATERIALS AND METHODS

Forty mature male albino rats ***(Rattus norvegicus)*** ranging in weight from 80-100 gm., were essentially obtained from Schistosoma Biological Supply Program Theodor Bilharz Research Institute. Each two rats were placed in metal cage. They were kept under suitable care before experimentation in clean laboratory conditions, fed on standard diet of compact chops which was obtained from Agricultural-Integration Company, Giza-Egypt. In addition of milk and water ***ad-Libitum***. They

kept under these normal conditions till they ranged in weight from100-120gm. before starting the experiment. The rats were allocated at random into 4 equal groups 10 rats each. Rats in group A were considered as controls for 7 days (short-term). Rats in group B were treated orally with a dose equal 1/10 LD 5O of thiodicarb insecticide daily for 7days. Rats in group C were considered as controls for 30 days (long-term).

Rats in group D were treated orally with a dose equal 1/10 LD 5O of thiodicarb insecticide daily for 30 days.

All of the control and treated animals were individually weighed in order to detect any change that may take place in their body weights. The percentage of body weight gain was calculated as follows:

$$\frac{\text{Mean final weight} - \text{Mean initial weight}}{\text{Mean initial body weight}} \times 100$$

Biochemical Studies:

At the end of experimental periods, individual samples were then collected after18h. Fast from the different groups. Samples of blood withdrawn 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 cholesterol was carried out according to **Allain *et al*., (1974)**. Serum total protein was estimated according to the method described by **Domas (1975)**. Urea was determined according to the method described by **Patton** and **Crouch (1977)**. Creatinine was measured according to "kinetic" method described by **Bartels** and **Bohmer (1972)**. Serum aspartate transaminase (AST) and alanine transaminase (ALT) activities were carried out according to **Reitman** and **Frankel (1957)**. Serum alkaline phosphatase (ALP) was determined by the method of **Kind** and **King (1954)**.

Data analysis:

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

RESULTS

The effects of repeated doses of thiodicarb insecticide on body weights (gain or loss) of the rats were recorded in Table (1) and Figure (1).The findings indicated that treated rats showed highly significant (P<0.001) decreases in their body weights after feeding for 30days as compared with control group (=-14.96% decrease), while the body weight was not obviously changed on the other tested period (7days).

Table (1): Effect of thiodicarb insecticide on body weight (gain or loss gm.) of male albino rats.

	Long – term		Short – term	
	control	treated	control	treated
Mean ±S.D.	5.99 ± 0.87	5.23 ± 1.07	18.58 ± 0.59	15.80 ± 0.49
% of change	- 12.69		-14.96	
P value	P >0.05*		P >0.001***	

*Insignificant *** Highly Significant

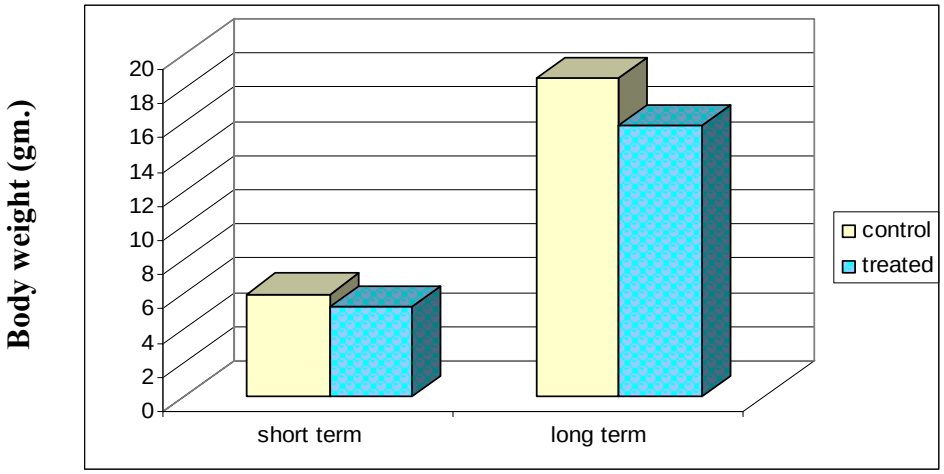


Fig. (1): chart illustration of thiodicarb insecticide compared with that of control effect on body weight (gain or loss gm.) of male albino rats.

The data represented in Table (2) and Figure (2) displayed the effect of thiodicarb on serum glucose level, total cholesterol and protein content. The glucose levels of treated animal groups recorded an elevation. It was highly significant ($P<0.001$) in short–term treated group (=+20.14% increase), and significant ($P<0.05$) in long–term treated group (=+12.45% increase). While serum content of total cholesterol was significantly ($P<0.05$) decreased in the two treated groups (=-3.85%,-3.81% decrease), but serum protein was not effected at any period of the experiment.

Table (2): Effect of thiodicarb insecticide on glucose level (mg/100ml);total cholesterol content(mg/dl)and total protein content(gm/dl) compared with that of control in male albino rat serum.

	glucose				Total cholesterol				Total protein			
	Short- term		Long - term		Short- term		Long - term		Short- term		Long - term	
	control	treated	control	treated	control	treated	control	treated	control	treated	control	treated
Mean ± S.D.	83.57 ± 3.99	100.40 ± 6.68	87.62 ± 6.29	98.53 ± 7.79	86.91 ± 0.41	83.56 ±1.12	86.86 ± 0.52	83.55 ± 3.80	6.85 ± 0.39	6.55 ± 0.55	6.96 ± 0.30	7.09 ± 0.41
% of change	+ 20.14		+12.45		- 3.85		- 3.81		- 4.38		+ 1.87	
P value	P<0.001***		P<0.05**		P<0.05**		P<0.05**		P>0.05*		P>0.05*	

* Insignificant ** Significant *** Highly Significant

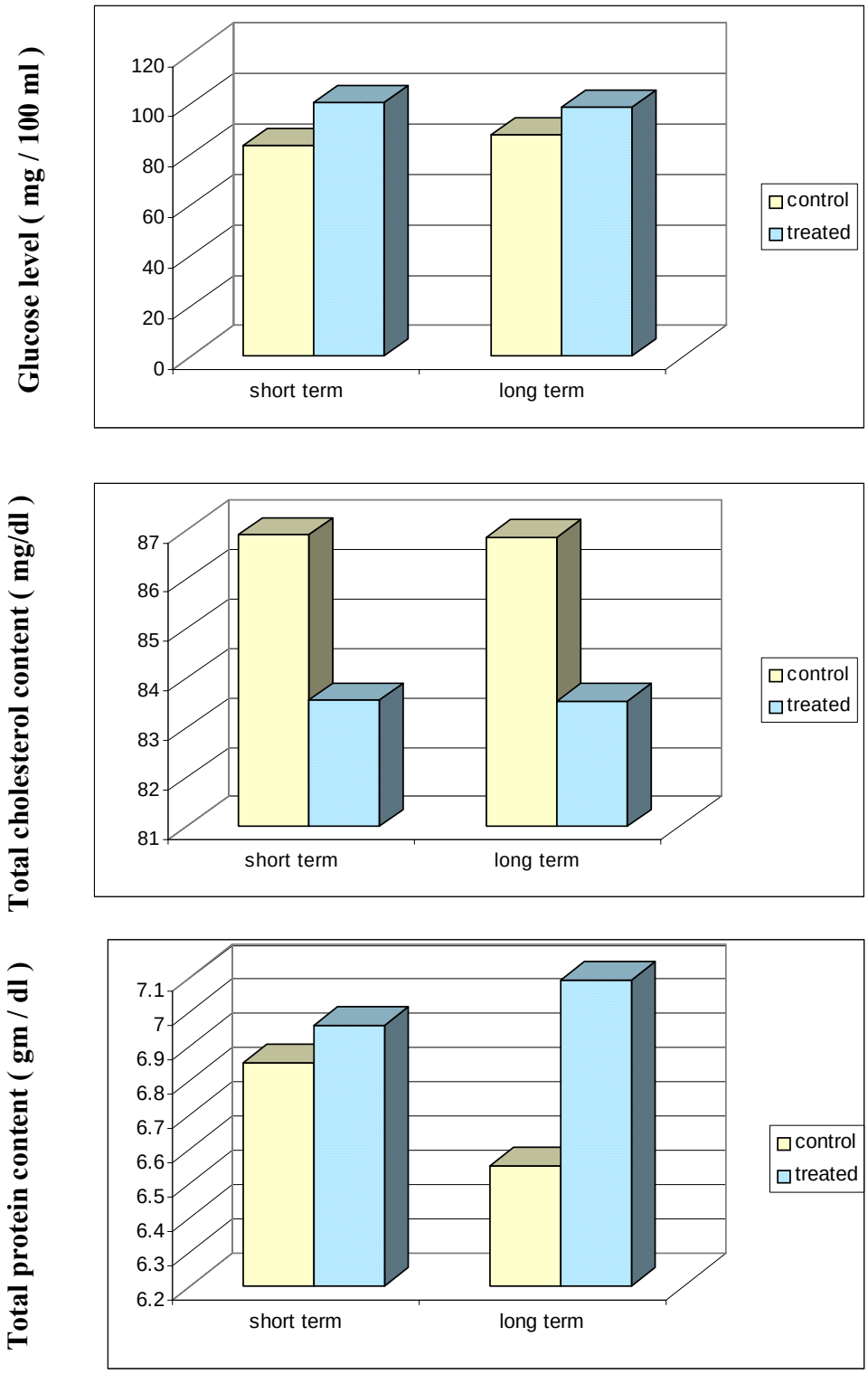


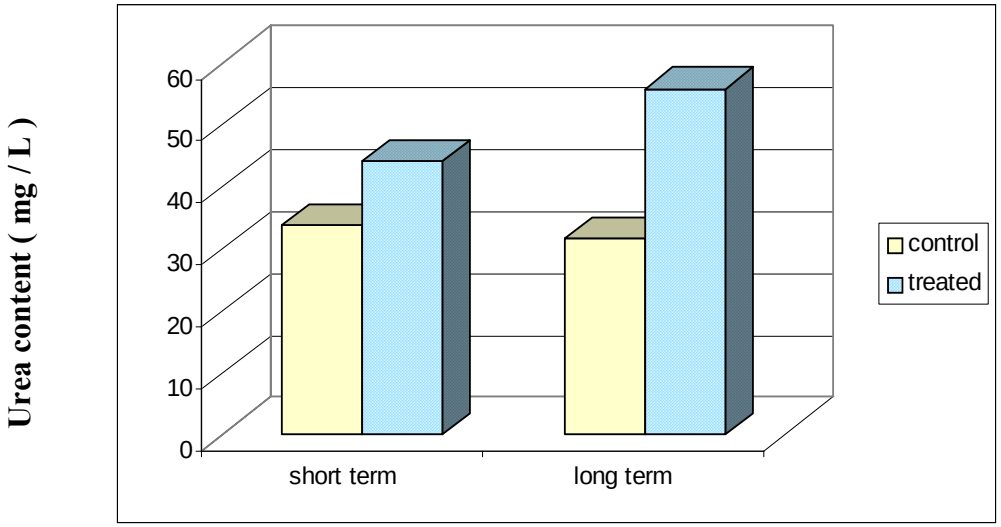
Fig. (2): Effect of thiodicarb insecticide on glucose level (mg / 100 ml) ; total cholesterol content (mg/dl) and total protein content (gm / dl) compared with that of control in male albino rat serum .

The obtained data in Table (3) as a short and long-term administration of thiodicarb showed a highly significant (P<0.001) raise of rat serum urea (=+30.69% +75.98% increase). Serum creatinine content was highly significant (P<0.001) elevated above the control values (=+27.07% increase) after 30 days in response to the thiodicarb treatment.

Table (3): Effect of thiodicarb insecticide on urea content(mg/l)and creatinine content(mg/l) comparing with the control in male albino rat serum.

	urea				creatinine			
	Short- term		Long - term		Short- term		Long - term	
	control	treated	control	treated	control	treated	control	treated
Mean ± S.D.	33.82 ± 1.79	44.20 ± 3.18	31.72 ± 3.83	55.82 ± 3.24	11.84 ± 1.33	11.07 ± 0.91	14.22 ± 1.48	18.07 ± 1.62
% of change	+ 30.69		+ 75.98		- 6.50		+ 27.07	
P value	P <0.001***		P <0.001***		P >0.05*		P <0.001***	

* Insignificant *** Highly Significant



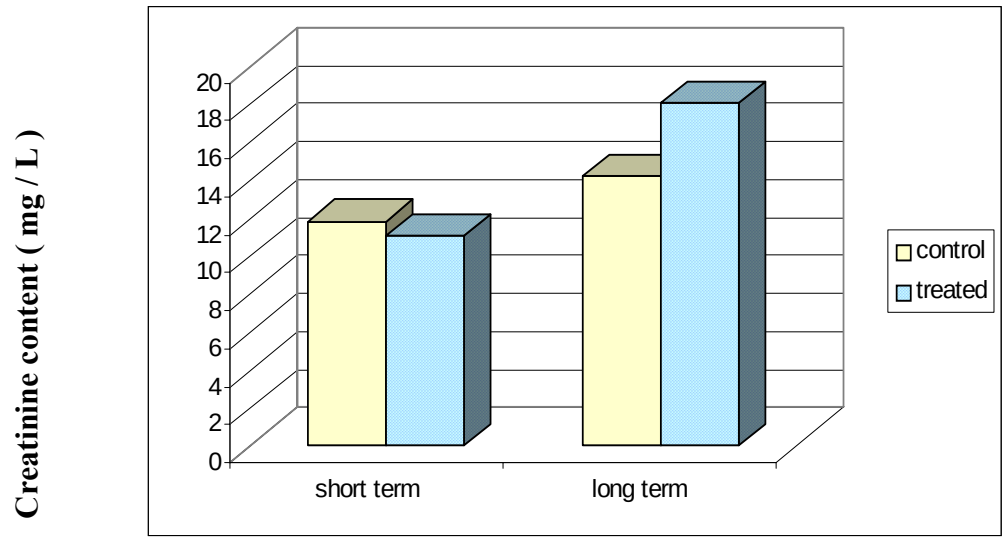


Fig (3): Effect of thiodicarb insecticide on urea content (mg / L) and creatinine content (mg / L) compared with that of control in male albino rat serum.

The data represented in Table (4) and Figure (4) showed that there are no changes in activities of AST, ALT and ALP in all rats of short-term treated group. But rats of long-term treated group, the transaminases (AST, ALT) activities recorded a highly significant (P<0.001) increase.

Table(4): Effect of thiodicarb insecticide on AST , ALT and ALP activities (U/ml) expressed as percent change from control in male albino rat serum.

	AST				ALT				ALP			
	Short- term		Long - term		Short- term		Long - term		Short- term		Long - term	
	control	treated	control	treated	control	treated	control	treated	control	treated	control	treated
Mean ± S.D.	141.53 ± 9.00	136.17 ± 9.62	138.70 ± 8.70	211.91 ± 6.00	86.94 ±2.70	85.26 ±3.15	86.01 ±3.25	118.86 ±4.51	184.07 ±11.05	176.90 ±15.49	177.13 ±7.07	181.46 ± 2.75
% of change	- 3.78		+52.78		- 1.93		+ 38.19		- 3.90		+2.45	
P value	P> 0.05*		P<0.001***		P>0.05*		P<0.001***		P>0.05*		P>0.05*	

* Insignificant *** Highly Significant

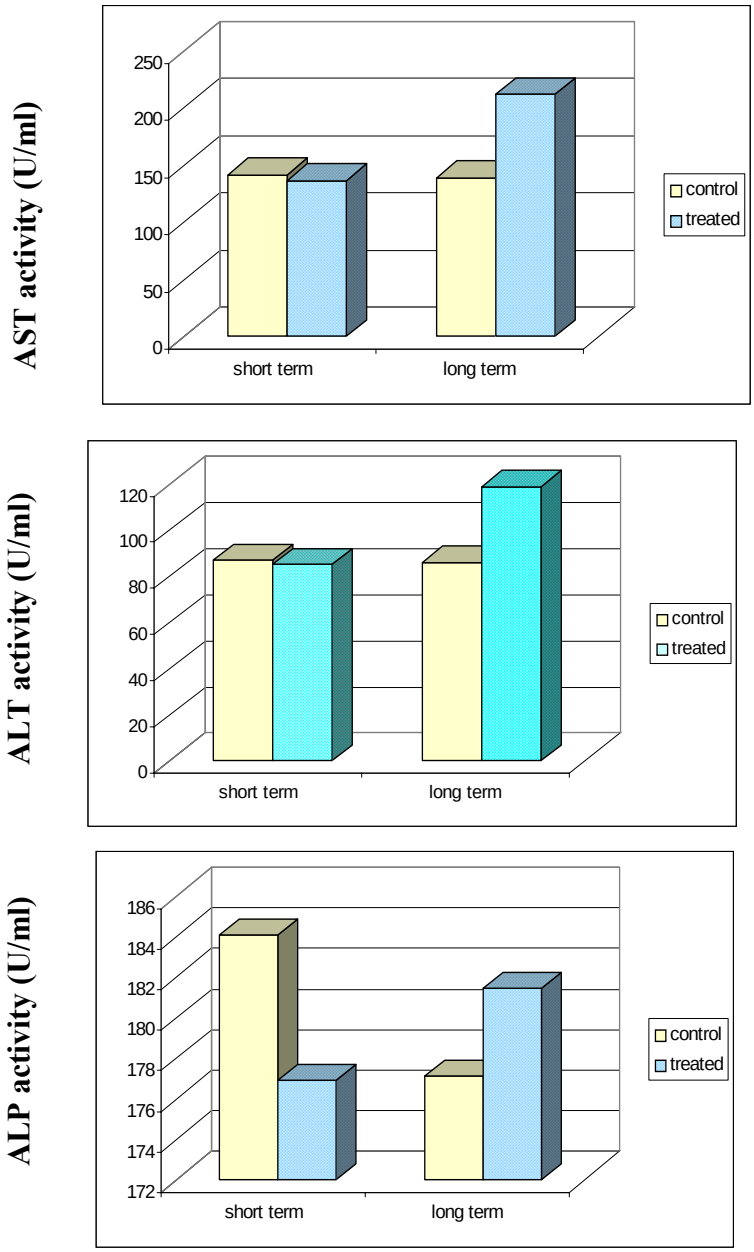


Fig (4): Effect of thiodicarb insecticide on AST, ALT and ALP activities (U/ml) compared with the control in male albino rat serum .

DISCUSSION

The intensive use of pesticides to eliminate pests or to regulate crop growth led to pesticide residues in soil, air, water, stored grains, crops and plants at concentration levels which exceed the legal limits**(Süsse and Müler,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**; **Hernandez *et al*., 2006** and **Gokhan *et al*., 2008)**.Therefore, it was decided to perform this investigation to determine more clearly, the influence of these insecticides on male albino rats.

The present study revealed that only those rats fed on thiodicarb showed highly significant decreases in their body weights after toxication for 30 days. This decrease may probably attributed to the loss of appetite, lesser food intake and/or metabolic disturbance caused by thiodicarb treatment. These results are in harmony with those obtained by **Dikdshith *et al*.,1991** ; **Badawy *et al*., 1992** ; **Paul *et al*.,1993**; **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)**.

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

The hyperglycemia observed in the present work may be due to thiodicarb 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 thiodicarb 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)**.While the serum total protein in this study was not clearly affected at the two periods, this result is in accordance to **Fayez** and **Kilgore (1992)**.

The present investigation showed a highly significant increase in serum urea content of all toxicaded rats. These results are in accordance with those of **Abu-EL-Zahab *et al.,* (1993); Abdel-Baky (1999) ; Gad (2000)** and **Khan *et al.,*(2008)**.

Creatinine is a waste product of creatine metabolism whose measurement provides an exceptionally useful index of kidney function. The level of serum creatinine in group D showed a highly significant increase.Similar observations of raised serum creatinine level were reported by **Al-Sahhaf (1995)**; **Yousef *et al.,* (2003)**; **Fouda (2004)** and **Khan *et al.,*(2008)**.

Serum transaminases (AST,ALT) activity are known as toxicity markers in the study of hepatotoxicity by chemicals **(Govindwar and Dalvi,1990)**.An increase in the activities of these enzymes is termed as the early recognition of toxic hepatitis.

A highly significant increase in these enzyme activities was observed at long-term period of treated group, indicating liver damage. Similar results were reported by **Abdel Mageed *et al.,* (2001); Fouda** and **Azab (2003); El-Shater (2003);Khan *et al.,*(2008)** and **Jyotsna *et al.,* (2008)**.The authors indicated that insecticides caused an increase in serum AST and ALT activities in several species of animals.

Finally, it would be **concluded** that countries should use all publicity media to inform the public, the safe use of insecticides. Thus the use of insecticides in farms or houses must be under strict measures.

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ARABIC SUMMERY

تقييم تغيرات بعض المعايير التشخيصية فى ذكور الجرذان البيضاء (راتس نورفيجيكس) المسممة بالمبيد الحشرى ثيوديكارب

محمد صلاح عبد الحميد عبد الله الشناوى
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يهدف البحث إلى الكشف عن مستوى الجلوكوز، الكوليستيرول والبروتين الكلى ومحتوى المصل من اليوريا والكرياتينين ونشاط بعض الإنزيمات (AST,ALT,ALP) فى ذكور الجرذان البيضاء المعاملة فميا بجرعة يومية قدرها 10/1 نصف الجرعة المميتة للمبيد الحشرى ثيوديكارب (من مجموعة الكاربامات) لمدة سبعة أيام (قصيرة الأمد) وثلاثون يوما(طويلة الأمد) وأظهرت النتائج انخفاضا ذو دلالة عالية فى وزن جسم الجرذان المعاملة للفترة طويلة الأمد ،كما لوحظ زيادة معنوية عالية فى محتوى المصل من اليوريا والكرياتينين وAST و ALT فى جرذان المجموعة المعاملة للفترة طويلة الأمد ، و زاد مستوى كل من الجلوكوز واليوريا فى مصل الجرذان المعاملة للفترة قصيرة الأمد0كما زاد مستوى الجلوكوز فى المجموعة طويلة الأمد 0وأظهر محتوى المصل من الكوليستيرول الكلى انخفاضا معنويا فى مجموعتى الجرذان المعاملة بالمبيد، بينما لم يتأثر نشاط الـ ALP والبروتين الكلى فى الجرذان المعاملة.