

2007/4

**BIOCHEMICAL STUDIES ON THE
INSECTICIDAL EFFECTS ON THE GENERAL
METABOLISM OF RATS.**

THESIS

Submitted By

HALA MAHDY EL DESSOUKY

Handwritten signature and scribbles.



For the Degree of
MASTER OF SCIENCE
in
BIOCHEMISTRY



Faculty of Science
Ain Shams University
Biochemistry Department

1997 ✓

1985

This Thesis Has Not Been Submitted For A
Degree At This Or Any Other University.

Hala M. El- Dessouky



ACKNOWLEDGEMENTS

I wish to express my thanks and gratitude to Prof. Dr. El-Gohori, head of the department of biochemistry, Faculty of Science, Ain Shams University for his continuous encouragements and for the facilities and advices he offered. My thanks and appreciation to Prof. Dr. E.A.Eisa, Prof. of biochemistry Faculty of Science, Ain Shams University for suggesting the problem, guidance and supervision. My cordial thanks to Dr. I.H.Borai, assist. Prof. of biochemistry, Faculty of Science, Ain Shams University, and to Dr. M.El-Sabbagh, lecturer in the same department for their tutorial guidance, their trustful help, and their active supervision throughout this work.

ABBREVIATIONS

4

AOAC	Association of Official Agriculture chemicals.
BHC	Benzene hexachloride.
b.p.	Boiling point
C	Degree centigrade.
Conc.	Concentration
DDT	Dichlorodiphenyl-trichloroethane.
dl	100 ml
g	gram.
GSH	Reduced glutathione.
Kg	Kilogram.
l	Litre
LD ₅₀	Lethal dose 50.
min.	Minute
mg	milligram.
N.S.	Not significant
2-PAM	Pyridine-2-aldoxime-N-methiodide.
S.E.	Standard error.
Sec.	Second.
SGOT	Serum glutamate oxaloacetate transaminase.
SGPT	Serum glutamate pyruvate transaminase.
St.	Standard.
TCA	Trichloroacetic acid.
TD ₅₀	Teratogenic dose 50.
u mol	micromole.
vit.	Vitamin
vol.	Volume
WHO	World Health Organisation.
wt.	Weight
%	Percent.

5

CONTENTS

	Page
Aim of the work	
I. Introduction	1
Classification of pesticides	3
Organic and organometal pesticides	3
Pesticides derived from plants and other organisms	4
Synergists	4
Propellants, Solvents and oil insecticides	5
Fumigants and nematocides	6
Chlorinated hydrocarbon insecticides	6
Organic phosphorus pesticides	7
Carbamate pesticides	8
Synthetic organic rodenticides	8
Herbicides	9
Fungicides and related compounds	10
Miscellaneous pesticides	10
- Mode of action of organophosphorus pesticides	10
- Chemical properties of diazinon	18
- Biological properties of diazinon	22
- Diazinon metabolism	30
II. <u>Materials and Methods.</u>	
- Biological analysis	37

6

	Page
The insecticide used	37
Animals	37
Serum samples	38
Liver samples	38
Diet	39
- Biochemical analysis	40
1. Estimation of liver glycogen	40
2. Estimation of liver glucose-6-phosphatase.....	42
3. Estimation of serum glucose	44
4. Quantitative estimation of serum total lipids..	47
5. Estimation of serum total cholesterol	49
6. Estimation of serum phospholipids	51
7. Estimation of serum Triglycerides	53
8. Quantitative estimation of serum total proteins	55
9. Electrophoretic separation of serum proteins...	57
10. Estimation of uric acid in serum	60
11. Determination of creatinine in serum	62
12. Determination of urea in serum	64
13. Determination of ascorbic acid in serum.....	66
14. Determination of Thiamine in serum	69
15. Determination of alkaline phosphatase in serum.	71
16. Estimation of serum transaminase	73
- Statistical analysis	75

III. Results.

- Effect of diazinon on serum glucose	77
- Effect of diazinon on liver glycogen	78
- Effect of diazinon on liver glucose-6-phosphatase	79
- Effect of diazinon on SGPT.....	80
- Effect of diazinon on SGOT	81
- Effect of diazinon on serum alkaline phosphatase	82
- Effect of diazinon on serum total lipids.....	83
- Effect of diazinon on serum total cholesterol..	84
- Effect of diazinon on serum Triglycerides.....	85
- Effect of diazinon on serum phospholipids.....	86
- Effect of diazinon on serum urea	87
- Effect of diazinon on serum uric acid	88
- Effect of diazinon on serum creatinine	89
- Effect of diazinon on serum thiamine	90
- Effect of diazinon on serum ascorbic acid.....	91
- Effect of diazinon on serum proteins	92
IV. Discussion.....	95
- Effect of diazinon on serum glucose, liver glycogen and liver glucose-6-phosphatase	96
- Effect of diazinon on lipid metabolism	100
- Effect of diazinon on serum proteins and their fractions	104

7

	Page
- Effect of diazinon on serum alkaline phosphatase SGPT and SGOT	108
- Effect of diazinon on serum urea, uric acid and creatinine	112
- Effect of diazinon on vitamin C and thiamine...	114
V. Summary	116
VI. References	119.

AIM OF THE WORK

The need for massive quantities of food requires massive production, which is impossible without the use of pesticides such as insecticides. Insecticides are at the moment man's chief weapon against insects pests. Since these insecticides have toxic effects on plants, animals, and human beings, it is very important to study the effect of insecticides on the mammalian metabolism.

Diazinon is one of the most widely used organophosphorus insecticides in the Egyptian fields and was chosen for this study.

The aim of this study was to investigate the biochemical changes that may appear in the blood constituents of rats previously fed on diets supplemented with this insecticide. The rats were fed on synthetic diets containing three different doses of diazinon, i.e., lethal, sublethal and postlethal doses, in comparison to control rats, fed on the normal free synthetic diet. This study included the following estimations:-

I- INTRODUCTION

INTRODUCTION

The destruction of insect pests on crops was long attempted, but with rather dispiriting results, using lead arsenate, tobacco dust, soap, and light petroleum. But in 1939, the dramatic possibilities of a potent and selective chemical for insect control were made evident by Paul Müller's discovery (in the Swiss firm, Geigy) of the insecticidal action of dichloro-diphenyl-trichloroethane (DDT). With this event, the modern era of insecticides was born (Albert, 1979).

DDT was used mainly by the Allied armies in the Second World War to control malaria and typhus during campaigns.

By increasing crop yields, it played an important part in alleviating the needs for food and clothing of an ever-expanding world population. In 1962, however, there was a sudden realization that, because of its poor biodegradability, DDT constituted an ecological risk, namely a potentially harmful effect of the residues on wildlife (mainly fish, large birds and bees) and possible toxicological effect on man through chronic over-dosage. As a result,

many countries banned the use of DDT in agriculture, or limited it to particular crops where no adequate substitute existed. The World Health Organization (WHO) successfully fought complete suspension of DDT use, while replacing it, wherever practicable. The principal replacements are; the biodegradable analogue methoxychlor, the more persistent of the carbamates as propoxur and of the phosphates (as diazinon), and abate (the tetramethyl ester of thio-4-,1-phenylene phosphorothioic acid). Other candidate phosphates are undergoing trial [particularly femitrothion (dimethyl 3-methyl-4-nitrophenyl phosphorothionate) and chloro-phoxim (diethyl 2-chloro α -cyano-benzylideneamino phosphoro-thionate)]. In places where resistance to chlorinated insecticides had set in, the change to carbamates or phosphates was imperative (Albert, 1979).

The suitability of a chemical to be used for insect control is not merely its degree of toxicity for there is a host, but also other factors must be considered. Chief among these are the action on the plant and the cost of the product, while a secondary but vitally important consideration is the ease of application (West and Hardy 1961)^a.

Classification of Pesticides:

Pesticides can be classified as follows as reported^a by Hayes, (1982):

1 . Inorganic and Organometal Pesticides: There are at least 18 elements that characterize one or more inorganic pesticides. Of these elements, ten (chromium copper, zinc, phosphorus, sulfur, tin, arsenic, selenium, fluorine, and chloride) have been shown to be essential for normal growth. In these instances, the toxic effects clearly do not depend on the element per se but on the specific properties of one form of the element or one of its compounds, or merely on an inordinately high dosage.

The other eight elements (barium, cadmium, mercury thallium, lead, bismuth, antimony, and boron) have not been shown to be essential to growth of animals, although there is evidence that some may be. In any event, experience has shown that toxicity is not an argument against essentiality. Some highly toxic elements such as iron, selenium, arsenic, and fluorine certainly are essential to normal development.

The organometals and organometalloids have been described in connection with the corresponding inorganic compounds because, even though organic combination

usually changes the absorption and distribution of a toxic metal and thus changes the emphasis of its effects, the basic mode of action remains the same.

2. Pesticides Derived From Plants and Other Organisms:

Different groups of pesticides derived from living organisms are entirely unrelated chemically and pharmacologically. They range from relatively simple alkaloids such as nicotine, with a molecular weight of only 162.23, through proteinaceous poisons to virulent living organisms.

3. Synergists:The possibility that synergists might assist in the control of pests is an attractive one that has been widely considered and selectively explored. Certain compounds increase the toxicity of pyrethrins to insects by as much as 100 times.

Synergists are also used with some of the synthetic pyrethrin analogues although the performance of these compounds is usually improved to a lesser degree. Synergists for certain methyl-carbamates, organophosphates and chlorinated hydrocarbons are also known. In fact, representatives of almost all types of organic insecticides can be synergized, at least as tested in houseflies. However, relatively few combinations of insecticides and