

EXPERIMENTAL STUDIES
ON THE EFFECT OF AMPHETAMINE ON
THE BLOOD AND HAEMATOPOEITIC SYSTEM

THESIS

Presented to the Faculty of Girls
Ain Shams University

3
By

AMAL HASSAN AZMY

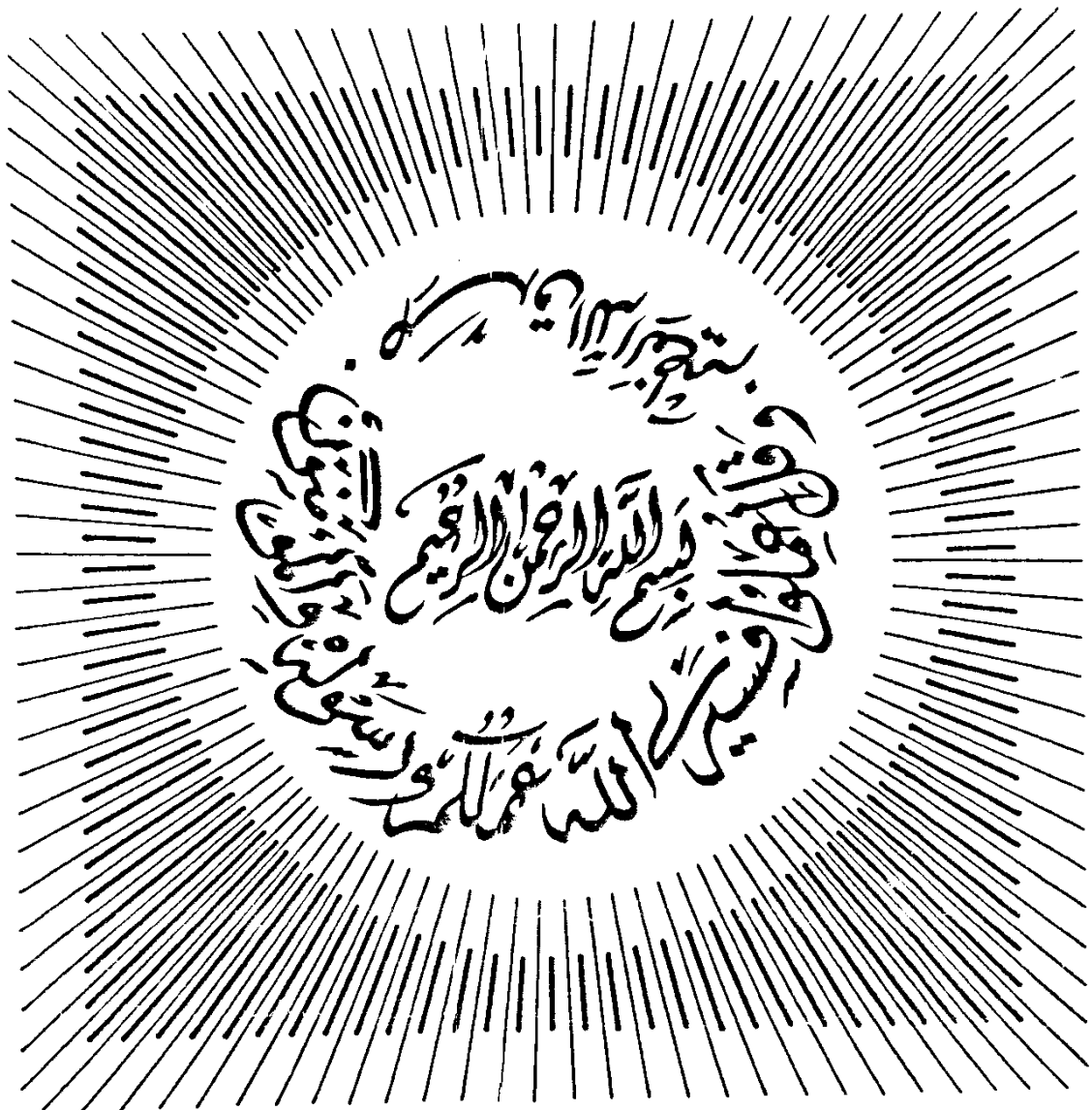
Demonstrator

Zoology Department, Faculty of Girls
Ain Shams University

29443

In Partial Fulfilment of the Requirements
For the Degree of
MASTER OF SCIENCE
(In Zoology)


1989





EXPERIMENTAL STUDIES
ON THE EFFECT OF AMPHETAMINE ON
THE BLOOD AND HAEMATOPOEITIC SYSTEM

COURSES

Studied by the Candidate in Partial Fulfilment
of the Requirements for the Degree of M.Sc.

- 1- Embryology and Experimental Embryology.
- 2- Histology and Experimental Histology.
- 3- German Language.

EXPERIMENTAL STUDIES
ON THE EFFECT OF AMPHETAMINE ON
THE BLOOD AND HAEMATOPOEITIC SYSTEM

BOARD OF SCIENTIFIC SUPERVISION

- Professor Dr. Madiha A.M. Ashry, (Ph.D). *M. Ashry*
Head of the Department of Zoology, Professor
of Histochemistry, Faculty of Girls, Ain Shams
University, Cairo, Egypt.

- Dr. Sanaa M.R. Wahba, (Ph.D.). *Sanaa R. Wahba*
Assistant Professor of Histochemistry,
Department of Zoology, Faculty of Girls, Ain
Shams University, Cairo, Egypt.

M. Ashry
Head of Department

CONTENTS

	Page
LIST OF TABLES	
LIST OF FIGURES.....	
INTRODUCTION.....	1
 <u>CHAPTER I : REVIEW OF LITERATURE</u>	 3
I. Toxic Effect of Amphetamine.....	3
1- Growth rates and food intake.....	3
2- General behaviour.....	8
3- Amphetamine distribution in tissues..	15
 II. Biochemical Investigation.....	 19
1- Effect of amphetamine on biological systems.....	 19
2- Effect of amphetamine on blood and haematopoietic system.....	 28
 III. Histological Effects.....	 33
 <u>CHAPTER II: MATERIAL AND METHODS</u>	 38
MATERIAL:.....	38
1- d-Amphetamine Sulphate.....	38
2- Drug Administration.....	39
3- Experimental Animals.....	39

	Page
METHODS:	40
1- Housing of Experimental Animals.....	40
2- Body Weights.....	40
3- Spleen Weights.....	40
4- Histological Methods.....	41
5- Haematological Methods.....	41
a) Determination of total erythrocytic count.	42
b) Determination of haemoglobin concentration	42
c) Determination of packed cell volum (P.C.V.)	42
d) Determination of total leucocytic count...	43
e) Differential leucocytic count.....	43
6- Bone Marrow Method (preparation of bone marrow smear).....	44
7- Statistical Analysis.....	44
Experimental Design.....	47
 CHAPTER III: RESULTS	50
Part I. Morphological Investigation.....	50
1) General behaviour.....	50
2) Growth rates.....	51
3) Absolute spleen weights.....	54
4) Relative spleen weights to body weights.	57

	Page
Part II. Haematological Studies.....	60
1) Determination of total red blood cell count.....	60
2) Determination of haemoglobin concentra- tion.....	62
3) Determination of packed cell volume (P.C.V.).....	65
4) Determination of total leucocytic counts	67
5) Differential count of leucocytes.....	69
Part III. Gross and Histological studies of the spleen.....	74
Part IV. Bone Marrow Studies.....	91
<u>CHAPTER IV: DISCUSSION</u>	108
I. Morphological Investigation.....	108
II. Haematological Studies.....	112
III. Histological Studies.....	118
IV. Bone Marrow Studies.....	121
<u>CHAPTER V: SUMMARY</u>	123
BIBLIOGRAPHY	129
ARABIC SUMMARY	

LIST OF TABLES

	Page
Table (1): Group distribution.....	47
Table (2): Average of body weights (Grams).....	52
Table (3): Averages of absolute spleen weights (grams $\pm$ S.D.).....	55
Table (4): Averages of relative spleen weights (grams $\pm$ S.D.).....	57
Table (5): Averages of R.B.C. counts (million/ mm ³ $\pm$ S.D.).....	60
Table (6): Averages of Haemoglobin content (grams/100 ml blood $\pm$ S.D.).....	62
Table (7): Averages of packed cell volume (% $\pm$ S.D.).....	65
Table (8): Averages of leucocytic counts (thousands/mm ³ $\pm$ S.D.).....	67
Table (9): Averages of differential leuco- cytic count (% $\pm$ S.D.).....	70

LIST OF FIGURES

	Page
Fig. (1): Average of body weights in grams.....	53
Fig. (2): Averages of absolute spleen weights in grams.....	56
Fig. (3): Averages of relative spleen weights to body weights.....	58
Fig. (4): Averages of total R.B.C. counts (million/ mm ³).....	61
Fig. (5): Averages of Haemoglobin content (grams/ 100 ml blood).....	63
Fig. (6): Averages of packed cell volume (P.C.V.).....	66
Fig. (7): Averages of total leucocytic counts (thousands/mm ³)	68
Fig. (8): Averages of differential leucocytic count of:	71
(8a) : Lymphocytes.	
(8b) : Monocytes.	
(8c) : Neutrophils.	
(8d) : Eosinophils.....	
Fig. (9): Section of normal control spleen (HX - E)...	75
Fig.(10): Section of spleen after one week of 5 mg/kg amphetamine injection showing early signs of inflammation with mononuclear and polymorphonuclear leucocytes (HX-E)...	78

	Page
Fig. (11): Section of spleen after two weeks of 5 mg/kg amphetamine injection showing degenerative changes (HX-E).....	78
Fig. (12): Section of spleen after two weeks of 5 mg/kg amphetamine injection showing stagnant blood within splenic vessels (HX-E).....	80
Fig. (13): Section of spleen after three weeks of 5 mg/kg amphetamine injection showing reticular fibres invading the capsule tissue layers (HX-E).....	80
Fig. (14): Section of spleen after four weeks of 5 mg/kg amphetamine injection showing marked haemorrhagic changes within the red pulp (HX-E).....	81
Fig. (15): Section of spleen after five weeks of 5 mg/kg amphetamine injection showing partial necrosis (HX-E).....	81
Fig. (16): Section of spleen after six weeks of 5 mg/kg amphetamine injection showing obliteration of splenic architecture (HX-E).....	83
Fig. (17): Section of spleen after six weeks of 5 mg/kg amphetamine injection showing thickened and fibrosed capsule and trabeculae (HX-E).....	83

Fig. (18):	Section of spleen after one week of 10 mg/kg amphetamine injection showing atrophied follicles (HX-E).....	84
Fig. (19):	Section of spleen after one week of 10 mg/kg amphetamine injection showing signs of fatty degeneration (HX-E)...	84
Fig. (20):	Section of spleen after two weeks of 10 mg/kg amphetamine injection showing congested and dilated sinusoidal spaces (HX-E).	85
Fig. (21):	Section of spleen after two weeks of 10 mg/kg amphetamine injection showing immature cells of granulocyte and erythrocyte series (HX - E).....	85
Fig. (22):	Section of spleen after three weeks of 10 mg/kg amphetamine injection showing clusters of large eosinophilic mononuclear histiocytes (HX-E).....	87
Fig. (23):	Section of spleen after four weeks of 10 mg/kg amphetamine injection showing hyaline material in intersinusoidal red pulp (HX - E).....	87
Fig. (24):	Section of spleen after five weeks of 10 mg/kg amphetamine injection showing degenerative necrotic cells (HX-E).....	89

	Page
Fig. (25): Section of spleen after five weeks of 10 mg/kg amphetamine injection showing fibrocytic cells (HX-E).....	89
Fig. (26): Section of spleen after six weeks of 10 mg/kg amphetamine injection showing thickened and fibrosed trabeculae (HX-E).....	90
Fig. (27): Section of spleen after six weeks of 10 mg/kg amphetamine injection showing large number of lymphoid blast cells with large nuclei (HX-E).....	90
Fig. (28): Smear of normal bone marrow (HX-E).....	
Fig. (29): Smear of normal bone marrow (HX-E).....	92
Fig. (30): Smear of normal bone marrow showing megakaryocyte (HX-E).....	95
Fig. (31): Smear of bone marrow after four weeks of 5 mg/kg amphetamine injection showing erythroid hyperplasia (HX-E).....	97
Fig. (32): Smear of bone marrow after four weeks of 5 mg/kg amphetamine injection showing different stages of mitosis in normoblast (HX-E).....	97

	Page
Fig. (33): Smear of bone marrow after four weeks of 5 mg/kg amphetamine injection showing deep eosinophilic granulation in the cytoplasm of eosinophil granulocytes (HX-E).....	98
Fig. (34): Smear of bone marrow after four weeks of 5 mg/kg amphetamine injection showing neutrophil nucleus appeared irregularly stained with areas of vacuolation (HX - E).....	98
Fig. (35): Smear of bone marrow after six weeks of 5 mg/kg amphetamine injection showing degenerative changes (HX-E).....	100
Fig. (36): Smear of bone marrow after five weeks of 5 mg/kg amphetamine injection showing irregular shaggy outlines of megakaryocyte. (HX-E).....	100
Fig. (37): Smear of bone marrow after six weeks of 5 mg/kg amphetamine injection showing a megakaryocyte ingesting several cells of the granular myelocytes series(HX-E).	101
Fig. (38): Smear of bone marrow after one week of 10 mg/kg amphetamine injection showing increase in diffused lipid droplets (HX-E).....	101

	Page
Fig. (39): Smear of bone marrow after one week of 10 mg/kg amphetamine injection showing accumulation of large droplets of fat (HX-E).....	102
Fig. (40): Smear of bone marrow after three weeks of 10 mg/kg amphetamine injection showing haemosiderin granules (HX-E).....	102
Fig. (41): Smear of bone marrow after three weeks of 10 mg/kg amphetamine injection showing increase in cells of erythrocytic and lymphocytic series (HX-E).....	104
Fig. (42): Smear of bone marrow after four weeks of 10 mg/kg amphetamine injection showing yellowish hyaline material spread among the degenerative haemopoietic cells (HX-E).....	104
Fig. (43): Smear of bone marrow after four weeks of 10 mg/kg amphetamine injection showing obvious increase in cells of the megakaryocytic series (HX-E).....	105
Fig. (44): Smear of bone marrow after four weeks of 10 mg/kg amphetamine injection showing malformed and degenerative mature megakaryocyte (HX-E).....	105