# STUDY OF GLUTATHIONE PEROXIDASE AND SUPEROXIDE DISMUTASE ACTIVITIES IN ERYTHROCYTES OF PATIENTS WITH DIABETES MELLITUS

#### **Thesis**

Submitted in Partial Fulfillment of M.D. Degree in Chemical and Clinical Pathology



BY

EMAN ABD ELMONEM ALGAWHARI (M.B.,B.CH)

(Master Degree in Chemical and Clinical Pathology)

0 2 0

Supervisors

Prof. Dr. MAHMOUD SABRY SALLAM Professor of Chemical and Clinical Pathology Faculty of Medicine, Ain Shams University

Prof. Dr. MONA SALEM Professor of Pediatrics Faculty of Medicine, Ain Shams University

DR. OLA HAMDY DEMERDASH \ ^3 Assistant Prof. in Chemical and Clinical Pathology
Faculty of Medicine, Ain Shams University

Na: hun Elladaen

DR. NASHWA AHMED ADEL EL BADAWI Assistant Prof. in Chemical and Clinical Pathology Faculty of Medicine, Ain Shams University

> FACULTY OF MEDICINE AIN SHAMS UNIVERSITY 1996

merson



#### **ACKNOWLEDGEMENT**

I would like to express my deepest gratitude to Professor Dr. Mahmoud Sabry Sallam, Professor of Clinical Pathology, Faculty of Medicine, Ain Shamas University, for his valuable support, guidance and encouragement, and for giving me the opportunity to work under his supervision.

Special thanks and appreciation for Dr. Mona Salem Professor of Pediatrics, Faculty of Medicine, Ain Shamas University, for her creative and fruitful advice.

I also offer my sincere thanks to Dr. Ola Hamdy Demerdash, Assistant Professor of Clinical Pathology, from whom I have learned a lot, for her generous cooperation, sincere guidance and for her help in the delivery of this work.

I am also very grateful to Dr. Nashwa Ahmed El Badawy, Assistant Professor of Clinical Pathology, for her continuos supervision, stimulating suggestions, constant advice throughout this work.

I cheerfully acknowledge my husband, whose patience and willing support was a constant source of encouragement.

Lastly but not least I am wholeheartedly indebted to my mother, for her enthusiastic encouragement, perpetual support, and I pray God to reward her to return.

Eman Al-Gawhary



#### LIST OF TABLES

* Review literature
Table (1): WHO classification of diabetes mellitus (1979)(2)
Table (2):  The pathogenesis of type I diabetes mellitus(7)
Table (3):  Clinical characteristic of the two types of diabetes mellitus(32)
Table (4): Typical clinical course of diabetic nephropathy(32)
Table (5): Criteria for diagnosis of DM (NDDG, 1979)(57)
Table (6):  Types of free radicals with biological relevance(62)
Table (7):  Causes of increased intracellular generation of free radicals(74)
Table (8): The important antioxidants of human biology(88)
Table (9):  Non enzymatic antioxidants(89
Table (10): Antioxidant roles of vitamin C(9)



* Results
Table (1):  Erythrocyte SOD and GPX activities in different tudies groups(159)
Table (2):  Statistical comparison between erythrocyte SOD activities of the patients groups a compared to the control group using the logistic "t" test (160
Table (3):  Statistical comparison between erythrocyte SOD and GPX activities of adult diabetic patients with complications as compared to patients without complications, using the complex of the compl
Table (4):  Statistical comparison between erythrocy and GPX activities of diabetic patients with microvascular complications, to those with macrovascular complications using "t" test(162
Table (5):  Statistical comparison between erythrocyte SOD and GPX activities of patients with diabetic nephropathy per se compared to patients with nephropathy and retinopathy on neuropathy using logistic "t" test(163).
Table (6):  Statistical comparison between glycated haemoglobin and fructosamine levels of diabetic patients with complications compared to those without complications in both IDDM and NIDDM using logistic "t" test(164)
Table (7a):  Correlation study between erythrocyte SOD and fasting serum glucose, glycatec haemoglobin and fructusamine in adult diabetic group(165)
Table (7b):  Correlation study between erythrocyte GPX and fasting serum glucose, glycated haemoglobinand fructosamine adult diabetic group(165)
Table (8):  Correlation study between erythrocyte SOD and GPX fructosamine in children group with IDDM(166)
Table (9):  Correlation study between erythrocyte SOD and GPX activities and fasting serum glucose, glycated haemoglobin and fructosamine in alldiabetic groups collectively(167)
Table (10):  Diagnostic performance of erythrocyte SOD as marker for diabetic complications in NIDDM at different decision leve(168)
Table (11):  Diagnostic performance of erythrocyte SOD as a marker for diabetic complications in IDDM at different decision levels(169)
Table (12):  Diagnostic performance of erythrocyte SOD as a marker for diabetic complications in all diabetics at different decision levels



Table	e (13):
	Diagnostic performance of erythrocyte GPX as a marker for diabetic complications in NIDDM at different decision levels(171)
Table	
	Diagnostic performance of erythrocyte GPX a marker for diabetic complications in IDDM at different decision levels(172)
Table	(15):
	Diagnostic performance of erythrocyte GPX as amarker for diabetic complications in all diabetics collectively at different decision levels



## LIST OF FIGURES

### \* Review literature

Figure (1):
Pathogenesis of hyperglycaemia, deursis andvolume depletion in DKA (34)
Pathogenesis of ketonemia in in DKA(34)
Hypothetical cascade linking key component mechanisms involved in microvascular failure in D.M(44)
Figure (4):
The univalent reduction of oxygen(64)
* 'gui € (5);
Scheme of L-arginine/No pathway(68)
* igui ((0);
Free radical mechanisms of lipid proxidation(70)
- 'guic (/);
Interacting mechanisms of cell injury by free radical(72)
Schematic sequence of C
hypoxia(78)
Figure (9):
The final common pathway of both cell destruction(86)
Figure(10):
Enzymatic defense mechanisms against reactive oxygen(112)
Figure (11):
But-c (11);
Schematic depiction of glutathione redox cycle(114)



Res	ults
Fig	Erythrocyte SOD activity in different diabetic patients as compared to their contro groups(174)
Figu	Erythrocyte GPX activity in different diabetic patients as compared to their control re (3):
Figu	The ROC Curve of erythrocyte SOD and GPX for detection of diabetic complications in The (4):
Figur	The ROC curve of and
Figur	IDDM patients(177)  e (5):  The ROC curve of erythrocyte SOD and GPX for detection of diabetic complications in all adult diabetic groups(178)

