



ASSESSMENT OF ZINC, COPPER AND NITRIC OXIDE STATUS IN CHRONIC LYMPHOCYTIC LEUKEMIA (CLL) PATIENTS

Thesis

Submitted for Partial Fulfillment of Msc degree
In Internal Medicine

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2016

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

وَقُلْ اَعْمَلُوا فَسَيَرَى اللَّهُ
عَمَلَكُمْ وَرَسُولُهُ وَالْمُؤْمِنُونَ

صدق الله العظيم

سورة التوبة آية (١٠٥)

ACKNOWLEDGEMENT

First, thanks are all due to **ALLAH** for Blessing this work until it has reached its end, as a part of his generous help throughout our life.

My profound thanks and deep appreciation to **Prof. Dr. Inas Ahmed Hussein Asfour**, Professor of Internal Medicine and Haematology, Faculty of Medicine, Ain Shams University for her great support and advice, her valuable remarks that gave me the confidence and encouragement to fulfill this work.

I am deeply grateful to **Prof. Dr. Hany Mohammed Abdallah Hegab**, Professor of Internal Medicine and Haematology, Faculty of Medicine, Ain Shams university for his help and support throughout my residency.

I am also thankful to **Dr. Rasha Magdy Mohammed**, Lecturer of Internal Medicine and Haematology, Faculty of Medicine, Ain Shams University for her valuable supervision, co-operation and direction that extended throughout this work.

I want also to thank **my family and all my friends** for supporting me throughout my life.

Mahmoud Soliman Sheeba

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List of Abbreviations

2-CdA		Cladribine	
Ab		B-Amyloid Plaques	
AD		Alzheimer's Disease	
ADCC	.....	Antibody-Dependent Cytotoxicity	Cellular
ADP	.....	Adenosine Diphosphate	
AGEs	.....	Advanced Glycation End Products	
APCs	.....	Antigen Presenting Cells	
APP	.....	Amyloid Precursor Protein	
ARLTS1	.....	Adenosine Diphosphate (ADP)- Ribosylation Factor-Like Suppressor Gene 1	Tumor-
ATM gene	.....	Ataxia-Telangiectasia Mutated Gene	
ATOX 1	.....	Antioxidant 1 Copper Chaperone	
ATP	.....	Adenosine Triphosphate	
ATP7A	.....	Copper Transporting P-type Atpase	
ATP7B	.....	Copper Transporting P-type ATPase 2	
Bcl-2	.....	B Cell Lymphoma 2	
BCR	.....	B Cell Receptor	
BH3	.....	BCL-2 Homology Domain 3	
BLNK	.....	B Cell Linker	
BR	.....	Bendamustine	
BTK	.....	Bruton's Tyrosine Kinase	
Ca	.....	Calcium	
CAP	.....	Cyclophosphamide, Prednisone	Doxorubicin,
CCL 22	.....	C-C Motif Chemokine 22	
CCO	.....	Cytochrome C Oxidase	

List of Abbreviations

Cd	Cadmium
CD	Cluster of Differentiation
CDC	Complement-Dependent Cytotoxicity
CFAR	Fludara, Cyclophosphamide, Alemtuzumab and Rituximab
cGMP	cyclic guanosine monophosphate
cGMP	Cyclic Guanosine Monophosphate
CH2	Methylene Group
CHOP	Cyclophosphamide, Doxorubicin, Vincristine, Prednisone
CIRS	Cumulative Illness Rating Scale
CLB	Chlorambucil
CLL	Chronic Lymphocytic Leukemia
CM	Cardiomyopathy
COPD	Chronic Obstructive Airway Disease
COX	Cyclo-Oxygenases
Cp	Ceruloplasmin
CR	Complete Remission
Cu	Copper
Cu/Zn-SOD	Cu/Zn-Superoxide Dismutase
CXCL 12	C-X-C Motif Chemokine 12
CXCR	CXC Chemokine Receptor
DCs	Dendritic Cells
dG	Deoxyguanosine
DNA	Deoxyribonucleic Acid
DNA-PK	DNA-Dependent Protein Kinase
DOR	Duration of Response

List of Abbreviations

EGFR	Epidermal Growth Factor Receptor
EMA	European Medicines Agency
eNOS	Endothelial NO Synthase
ERK	Extracellular Signal Regulated Kinase
ESR	Electron Spin Resonance
FA	Fludarabine and Alemtuzumab
FAD	Flavin Adenine Dinucleotide
FC	Fludara and Cyclophosphamide
FCR	Fludara, Cyclophosphamide and Rituximab
FDA	Food and Drug Administration
Fe	Iron
FMN	Flavin Mononucleotide
FR2	Framework 2
G+C	Guanine and Cytosine
GATA-3 transcription factor	GATA Binding Protein 3 Transcription Factor
G-CSF	Granulocyte Colony Stimulating Factor
GEP	Gene Expression Profiling
GI	Gastrointestinal
GPI	Glycosyl Phosphatidyl Inositol
GPx	Glutathione Peroxidase
GSH	Reduced Glutathione
GTP	Guanosine 5'-Triphosphate
H2O2	Hydrogen Peroxide
Hb	Hemoglobin

List of Abbreviations

HBV	.....	Hepatitis B		
HCC	.....	Hepatocellular Carcinoma		
HCDR	.....	Heavy-Chain-Complementarity Determining Region		
HCV	.....	Hepatitis C		
HLA	.....	Human Leukocyte Antigen		
HO2	.....	Hydroperoxyl		
HOBr	.....	Hypobromous Acid		
HOCl	.....	Hypochlorous Acid		
IBD	.....	Inflammatory Bowel Disease		
ICT	.....	Idiopathic Copper Toxicosis		
IFN-gamma	.....	Interferon Gamma		
Ig	.....	Immunoglobulin		
IGHV	.....	Immunoglobulin Variable Gene	Heavy Chain	
IL-4	.....	INTERLEUKIN 4		
IL8	.....	Interleukin 8		
iNOS	.....	Inducible NO Synthase		
ITAMs	.....	Immunoreceptor Tyrosine Activation Motifs		
IWCLL	.....	the International Workshop on CLL		
JNK	.....	c-JUN NH2-Terminal Kinase		
KCNRG	.....	Potassium Channel Regulator Gene		
kDa	.....	Kilo Dalton		
LDL	.....	Low Density Lipoprotein		
LDT	.....	Lymphocyte Doubling Time		
LOX	.....	Lipoxygenase		

List of Abbreviations

LPO	Lipid Peroxidation
LPS	Lipopolysaccharide
LYN	Lck-Yes Novel Tyrosine Kinase
M2	Muscarinic Receptor
MAPKs	Mitogen-Activated Protein Kinases
MDA	Malondialdehyde
MHC	Major Histocompatibility complex
MIF	Migration Inhibitory Factor
miR	Microrna
MMP-9	Matrix Metalloproteinase 9
MMPs	Matrix Metalloproteinases
Mn	Manganese
MNC	Mononuclear Cells
MRD	Minimal Residual Disease
MSCs	Mesenchymal Stromal Cells
MTs	Metallothioneins
N2O3	Dinitrogen Trioxide
NADH	Nicotinamide Adenine Dinucleotide
NADPH	Nicotinamide Adenine Dinucleotide Phosphate
NAFLD	Non Alcoholic Fatty Liver Diseases
NCBC	Non-Ceruloplasmin-Bound Cu
NFKB	Nuclear Factor Kappa B
NHL	Non Hodgkin's Lymphoma
NK	Natural Killer Cells
NLC	Nurse-Like Cells
nNOS	Neuronal NO Synthase

List of Abbreviations

NO	.....	Nitric Oxide
NO₂	.....	Nitrogen Dioxide
NOS2	.....	Nitric Oxide Synthase 2
nPR	.....	Nodular Partial Response
O=C(O)O-	.....	Carbonate Radical
O₂-	.....	Superoxide
ONOO-	.....	Peroxynitrite
ONOOCO₂-	.....	Nitrosoperoxycarbonate
ONOOH	.....	Peroxynitrous Acid
OR	.....	Overall Response
OS	.....	Overall Survival
P53	.....	Phosphoprotein 53
PARP	.....	Poly (ADP-ribose) Polymerase
PBMC	.....	Peripheral Blood Mononuclear Cells
PFS	.....	Progression Free Survival
PI3K	.....	Phosphatidyl 3-Kinase
PIP3	.....	Phosphatidylinositol-3, 4, 5-triphosphate
PKC	.....	Protein Kinase C
PLCc2	.....	Phospholipase-Cc2
PLT	.....	Platelets
PLZF	.....	Promyelocytic Leukemia Zinc Finger
PR	.....	Partial Response
PrPC	.....	Cellular Prion Protein
RB	.....	Retinoblastoma Gene
R-CLB	.....	Rituximab and Chlorambucil
Retics	.....	Reticulocytic Count

List of Abbreviations

RFP	.....	Ring Finger Protein Gene
RING	.....	Really Interesting New Gene family
RNA	.....	Ribonucleic Acid
RNS	.....	Reactive Nitrogen Species
RO	.....	Alkoxy
RO2	.....	Peroxy
ROS	.....	Reactive Oxygen Species
SD	.....	Stable Disease
SDF-1	.....	Stromal Cell-Derived Factor 1
Se	.....	Selenium
sGC	.....	Soluble Guanylate Cyclase
SmIg	.....	Surface Immunoglobulin
SOD	.....	Superoxide Dismutase
SYK	.....	Spleen Tyrosine Kinase
TE	.....	Trace Element
TGF	.....	Tumor Growth Factor
TH1	.....	T Helper 1
TH2	.....	T Helper 2
TK	.....	Thymidine Kinase
TLR4	.....	Toll-Like Receptor 4
TNF	.....	Tumour Necrosis Factor
TP53	.....	Tumor Protein P53
TRAF	.....	TNF Receptor-Associated Factor
UV	.....	Ultraviolet
VEGF	.....	Vascular Endothelial Growth Factor
WD	.....	Wilson's Disease

List of Abbreviations

WHO	World Health Organization
ZAP-70	Zeta Chain Associated Protein Kinase 70
Zn	Zinc
ZnT	Zinc Transporter
β2M	β2 Microglobulin

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