



Faculty of Science  
Zoology Department

# **Mode of Action of Curcumin and Its Nanoparticles in Chemically Induced Liver Carcinoma in Male Albino Mice**

A Thesis

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Master of Science in Zoology

By

**Eman Shawky Mohammed Salem Ali**

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Supervisors

**Prof. Dr. Nadia Mohamed Abd El-Aziz El-Beih**

Professor of Physiology, Department of Zoology,  
Faculty of Science, Ain Shams University

**Prof. Dr. Mona Mohamed Kamel Zoheiry**

Professor of Immunology, Department of Immunology,  
Theodor Bilharz Research Institute

**Dr. Enas Ali El-Hussieny**

Assistant Professor of Physiology, Department of Zoology,  
Faculty of Science, Ain Shams University

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**LIST OF ABBREVIATIONS**

<b>8-oxodG</b>	8-Oxo-7,8-dihydroguanine
<b>AFB1</b>	Aflatoxin B1
<b>AFP</b>	Alpha-fetoprotein
<b>AgNO3</b>	Silver nitrate
<b>ALAT</b>	Alanine aminotransferase
<b>Alb</b>	Albumin
<b>ALP</b>	Alkaline phosphatase
<b>AMP</b>	2-amino-2-methyl-1-propanol
<b>ANOVA</b>	analysis of variance
<b>AP-1</b>	Activator protein-1
<b>Apaf-1</b>	Apoptotic protease activating factor-1
<b>ASAT</b>	Aspartate aminotransferase
<b>b.w</b>	Body weight
<b>BAK</b>	BCL2-Antagonist Killer
<b>Bax</b>	Bcl-2-associated X protein
<b>Bcl-2</b>	B cell lymphoma 2
<b>Bcl-xL</b>	B cell lymphoma-extra large (antiapoptotic protein)
<b>BMI</b>	Body mass index
<b>CAT</b>	Catalase
<b>CCl4</b>	Carbon tetrachloride
<b>cDNA</b>	Complementary Deoxyribonucleic Acid
<b>COX-2</b>	Cyclooxygenase-2
<b>C<sub>T</sub></b>	Cycle threshold
<b>Cur</b>	Curcumin
<b>CYP 2E1</b>	Cytochrome P450 2E1
<b>Cyt c</b>	Cytochrome c
<b>DEN</b>	Diethyl nitrosamine
<b>DHBS</b>	3,5-Dichloro -2-hydroxybenzene sulfonic acid
<b>DR5</b>	Death receptor-5
<b>DTNB</b>	5, 5' dithiobis-2- nitrobenzoic acid
<b>EDTA</b>	Ethylene diamine tetraacetic acid
<b>EGFR</b>	Epidermal growth factor receptor

<b>ELISA</b>	Enzyme linked immunosorbent assay
<b>ER</b>	Endoplasmic reticulum
<b>ERK</b>	Extracellular receptor kinase
<b>ERK</b>	Extracellular signaling Regulating kinase
<b>FADD</b>	Fas-associated death domain
<b>FGF</b>	Fibroblastic growth factor
<b>G-6-PD</b>	Glucose-6-phosphate dehydrogenase
<b>GAPDH</b>	Glyceraldehyde-3-phosphate dehydrogenase
<b>GPx</b>	Glutathione peroxidase
<b>GR</b>	Glutathione reductase
<b>GS</b>	Glutathione synthetase
<b>GSH</b>	Glutathione reduced
<b>GSK3<math>\beta</math></b>	Glycogen synthase kinase 3 beta
<b>GSSG</b>	Glutathione disulfide
<b>GST</b>	Glutathione-S-transferase
<b>H&amp;E</b>	Hematoxylin and eosin.
<b>H<sub>2</sub>O<sub>2</sub></b>	Hydrogen peroxide
<b>HBV</b>	Hepatitis B virus
<b>HCC</b>	Hepatocellular carcinoma
<b>HCV</b>	Hepatitis C virus
<b>HD</b>	High dose
<b>HIF-1<math>\alpha</math></b>	Hypoxia-inducible factor-1 $\alpha$
<b>HRP</b>	Horseradish peroxidase
<b>i.p</b>	Intraperitoneal
<b>IAPs</b>	inhibitory apoptosis proteins
<b>IKK</b>	Inhibitory $\kappa$ B kinase
<b>IL-8</b>	Interleukin-8
<b>iNOS</b>	Inducible nitric oxide synthase
<b>JNK</b>	C-jun N-terminal kinase
<b>KEAP</b>	Kelch-like ECH-associated protein
<b>LD</b>	Low dose
<b>LDH</b>	Lactate dehydrogenase
<b>LSD</b>	Least significant difference
<b>MAPK</b>	Mitogen activated protein kinase

<b>MDA</b>	Malondialdehyde
<b>MDH</b>	Malate dehydrogenase
<b>MMP</b>	Matrix metalloproteinase.
<b>mRNA</b>	Messenger Ribonucleic acid
<b>NAD<sup>+</sup></b>	Nicotinamide adenine dinucleotide
<b>NADH</b>	Nicotinamide adenine dinucleotide (reduced form)
<b>NADP<sup>+</sup></b>	Nicotinamide adenine dinucleotide phosphate
<b>NADPH</b>	Nicotinamide adenine dinucleotide phosphate (reduced form)
<b>NAFLD</b>	Nonalcoholic fatty liver disease
<b>Nano Cur</b>	Nanoparticulate curcumin
<b>NASH</b>	Non-alcoholic steatohepatitis
<b>NBT</b>	Nitroblue tetrazolium
<b>NEMO</b>	NF-kappa-B essential modulator
<b>NF-<math>\kappa</math>B</b>	Nuclear Factor kappa B
<b>NK cells</b>	Natural killer cells
<b>NO</b>	Nitric oxide
<b>NO<sup>•</sup></b>	Nitric oxide radical
<b>NO<sub>2</sub><sup>-</sup></b>	Nitrites
<b>NOXA</b>	NADPH oxidase activator.
<b>Nrf-2</b>	Nuclear factor (erythroid-derived 2)-like 2
<b>O<sub>2</sub><sup>-</sup></b>	Superoxide radical
<b>OCs</b>	Oral contraceptives
<b>OD</b>	Optical density
<b>OH<sup>•</sup></b>	Hydroxyl radical
<b>ONOO-</b>	Peroxynitrite
<b>P53</b>	Tumor Suppressor Protein
<b>PBS</b>	Phosphate buffered saline
<b>PMS</b>	Phenazine methosulphate
<b>pNPP</b>	p-nitrophenylphosphate
<b>PUMA</b>	P53 upregulated modulator of apoptosis
<b>PVP</b>	polyvinyl pyrrolidine

<b>RNS</b>	Reactive nitrogen species
<b>ROS</b>	Reactive oxygen species
<b>SEM</b>	Standard errors of mean
<b>SOD</b>	Superoxide dismutase
<b>STAT</b>	Signal transducers and activators of transcription
<b>Tak1</b>	TGF-beta activated kinase 1
<b>TBA</b>	Thiobarbituric acid
<b>TEM</b>	Transmission electron microscope
<b>TGF-<math>\beta</math></b>	Transforming growth factor beta
<b>TGF-<math>\alpha</math></b>	Transforming growth factor alpha
<b>TLR4</b>	Toll-like receptor4
<b>TNFR1</b>	Tumor necrosis factor receptor-1
<b>TNF-<math>\alpha</math></b>	Tumor-Necrosis-Factor-alpha
<b>TP</b>	Total protein
<b>VEGF</b>	Vascular endothelial growth factor
<b><math>\gamma</math>-GCS</b>	$\gamma$ -glutamyl cysteine synthetase

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