

**BIOCHEMICAL STUDIES OF THE  
ANTIOXIDANT EFFECTS OF POMEGRANATE  
ON HEPATIC INJURY COMPOUNDS IN MALE  
ADULT ALBINO RATS**

**By**

**ALAA ALI KHALIL ALI OMAR**

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### ABSTRACT

In ancient times Egyptians regarded pomegranate fruit as a symbol of fertility due to the round shape and abundant seeds .They used it to heal many ailments. Pomegranate fruit mentioned in our holy Quran not less than three times and paid attention for its importance. Most pomegranate (*Punica granatum Linn., Punicaceae*) fruit parts are known to possess enormous antioxidant activity. The present study was carried out to determine the phenolic and flavonoid contents of pomegranate juice and nanoparticles pomegranate juice. It was an attempt to evaluate the toxic effect of chlorpyrifos (CPF) with either pomegranate juice or nanoparticles pomegranate juice treatments and as antioxidant agents. Therefore, the present study also aimed to elucidate the possible ameliorative role of pomegranate juice (PJ) or nanoparticles pomegranate juice (NPJ) in CPF toxicity when given to male rats and compared with ursodeoxycholic acid (UDCA) drug. This was done through studying the effects of CPF on serum and antioxidant enzymes in liver and kidneys as well as histopathological changes in vital organs such as liver and kidney. Results showed that CPF-intoxicated rats caused significant changes in serum enzyme activity in liver and kidneys, liver function and kidneys function, when compared with normal control. Ingestion of CPF along with PJ or NPJ or UDCA drug improved those parameters. Histopathological reports also revealed that there is a regenerative activity in the liver and kidney cells. PJ and NPJ showed to be hepatoprotective and renal protective against CPF -induced hepatic injury. On the basis of the previous results it can be concluded that pomegranate extracts especially NPJ is a promising natural product, which could be useful for the prevention of diseases caused by oxidative stress and this study reveals biological evidence that supports the use of PJ and NPJ in the treatment of chemical-induced hepatotoxicity and renal toxicity.

**Key words:** Pomegranate juice, Nanoparicles, Ursodeoxycholic acid, Chlorpyrifos toxicity, Lipid peroxidation, Antioxidant activity

## **DEDICATION**

*I dedicate this work to whom my heartfelt thanks; to my father and mother for their patience and help, as well as to my brothers and my sister for all the supports they lovely offered along the period of my post graduation and I can't find adequate words to express my feeling towards them. Also, I wish to express my feeling to my grand father; Khalil (late), my friend; Fawziya (late) and other friends for encouragement.*

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***Alaa Ali Khalil Ali Omar***

## ABBREVIATIONS, EXPRESSIONS AND SYMBOLS

<b>4-AAP</b>	4-aminoantipyrine
<b>AA</b>	Antioxidant activity or ascorbic acid
<b>AAE</b>	Ascorbic acid equivalent
<b>AAP</b>	4-aminophenazone
<b>ACh</b>	Acetylcholine
<b>AChE</b>	Acetylcholinesterase
<b>ALP</b>	Alkaline phosphatase
<b>ALT</b>	Alanine transaminase
<b>ANOVA</b>	Analysis of variance
<b>AST</b>	Aspartate transaminase
<b>b.w.</b>	Body weight
<b>BHA</b>	Butylated hydroxyanisole
<b>BHT</b>	Butylated hydroxytoluene
<b>BPA</b>	Bisphenol A
<b>BuChE</b>	Butyrylcholinesterase or pseudocholinesterase or plasma cholinesterase
<b>CAT</b>	Catalase
<b>CDNB</b>	1-chloro-2, 4- dinitrobenzene
<b>CE</b>	Catechin equivalent
<b>CEs</b>	Carboxylesterases
<b>CFIDS</b>	Chronic fatigue immunodeficiency syndrome
<b>ChE</b>	Cholinesterase
<b>CPF</b>	Chlorpyrifos
<b>CPFO</b>	Chlorpyrifos-oxon
<b>CYP450</b>	Cytochrome P450
<b>DHBS</b>	3, 5-dichloro-2-hydroxy benzene sulfonic acid
<b>DNA</b>	Deoxyribonucleic Acid
<b>DPPH</b>	2, 2-diphenyl-1-picrylhydrazyl or 1, 1-diphenyl-2- picryl- hydrazyl
<b>DTNB</b>	5, 5' dithiobis (2 - nitrobenzoic acid)
<b>EA</b>	Ellagic acid
<b>EDTA</b>	Ethylene di-amine tetra acetic acid
<b>EGCG</b>	Epigallocatechin gallate
<b>ENMs</b>	Engineered nanoscale materials
<b>ET</b>	Ellagitannins

<b>FRAP</b>	Ferric reducing antioxidant power
<b>GAE</b>	Gallic acid equivalent
<b>GK</b>	Glycerol kinase
<b>GPO</b>	Glycerol phosphate oxidase
<b>GPx</b>	Glutathione peroxidase
<b>GR</b>	Glutathione reductase
<b>GRAS</b>	Generally recognized as Safe
<b>GSH</b>	Reduced glutathione
<b>GSSG</b>	Oxidized glutathione
<b>GST</b>	Glutathione-s-transferase
<b>H&amp;E</b>	Hematoxylin and eosin
<b>HDL</b>	High density lipoproteins
<b>HF</b>	Hydrofluoric acid
<b>HPLC</b>	High performance liquid chromatograph
<b>HTs</b>	Hydrolysable tannins
<b>IC</b>	Injury control
<b>LD<sub>50</sub></b>	Lethal dose
<b>LDH</b>	Lactate dehydrogenase
<b>LDL</b>	Low density lipoproteins
<b>LMWAs</b>	Low molecular weight antioxidants
<b>LPL</b>	Lipoprotein lipase
<b>LPO</b>	Lipid peroxide
<b>MDA</b>	Malondialdehyde
<b>MFO</b>	Mixed function oxidase
<b>MP</b>	Methyl parathion
<b>MPS</b>	Myofascial pain syndrome
<b>NADP<sup>+</sup></b>	Nicotinamide adenine dinucleotide phosphate
<b>NC</b>	Normal control
<b>ND</b>	Not detected
<b>NFkB</b>	Nuclear factor k B
<b>NO</b>	Nitric oxide
<b>NPJ</b>	Nanoparticles pomegranate juice
<b>NPs</b>	Nanoparticles
<b>NTE</b>	Neuropathy target esterase
<b>OFRs</b>	Oxygen free radicals
<b>OP</b>	Organophosphorus
<b>OPT</b>	Organophosphorothionate
<b>PCB's</b>	Polychlorinated biphenyls
<b>PJ</b>	Pomegranate juice

<b>PON 1</b>	Paraoxonase 1
<b>PSO</b>	Pomegranate seed oil
<b>PUFA</b>	Polyunsaturated fatty acid
<b>RDA</b>	Recommended dietary allowance
<b>RNS</b>	Reactive nitrogen species
<b>ROS</b>	Reactive oxygen species
<b>RSA</b>	Radical scavenging activity
<b>SD</b>	Standard deviation
<b>SEM</b>	Scanning electron microscope
<b>SOD</b>	Superoxide dismutase
<b>SPSS</b>	Statistical package for social sciences
<b>SSC</b>	Suspended-sediment concentrations
<b>TA</b>	Tetratable acidity
<b>TAC</b>	Total antioxidant capacity
<b>TB</b>	Total bilirubin
<b>TBA</b>	2-Thiobarbituric acid
<b>TBA</b>	Thiobarbituric acid
<b>TBARS</b>	Thiobarbituric acid reactive substances
<b>TBHQ</b>	Tertiary butyl hydroquinone
<b>TC</b>	Total cholesterol
<b>TCA</b>	Trichloroacetic acid
<b>TCP</b>	3, 5, 6-trichloro-2-pyridinol
<b>TEM</b>	Transmission electron microscopy
<b>TFC</b>	Total flavonoids content
<b>TG</b>	Triglycerides
<b>TL</b>	Total lipids
<b>Tocs</b>	Tocopherols
<b>TP</b>	Total proteins
<b>TPC</b>	Total phenolic compounds
<b>UA</b>	Uric acid
<b>UDCA</b>	Ursodeoxycholic acid
<b>UV</b>	Ultraviolet
<b>VLDL</b>	Very Low density lipoproteins
<b>WHO</b>	World health organization



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