

**BIOCHEMICAL AND MOLECULAR  
STUDIES  
OF SOME PLANTS AS ANTICANCER**

**By**

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B.Sc. Agric. Sci. (Agric. Biochemistry), Fac. Agric., Cairo Univ.,  
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APPROVAL SHEET

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### ABSTRACT

Medicinal plants play an important role in our life. Therefore, this work aimed to study the antioxidant, anti-inflammatory and anticancer effects of the ethanolic extract of *Rosmarinus officinalis*, *Acacia nolitca*, *Borage officinalis* and *Ammi majus*. Primary compounds were determined in dried plants. Preliminary phytochemical screening of the ethanolic extracts of the four plants demonstrated the presence or absence of terpenes, tannins and flavonoids. Quantitative analysis was conducted to determine total phenols and alkaloids for all extracts. Antioxidant activity was determined by DPPH at various concentrations. The effects to quench the DPPH radical was estimated in dose dependent manner for the four plants and the best results were at 1000 ppm for *Rosmarinus officinalis*. The anti-inflammatory activity was determined by using carrageenan induced rats paw edema compared to indomethacin against the four plants with doses 5, 10, 20 mg/kg. The highest effect for both *Rosmarinus officinalis* and *Acacia nolitca* was at 20mg/kg where *Borage officinalis* was at 10 mg /kg and *Ammi majus* was at 5mg/kg. The anticancer activity was determined in A549 lung cancer cell line with the ethanolic extract of *Rosmarinus officinalis*, *Acacia nolitca*, against doxorubicine as a positive control by using neutral red assay. Different concentrations (12.5, 25, 50, 75, 100 ppm) were used. *Rosmarinus officinalis* recorded higher anticancer activity (100%) at 100 ppm with no cell viability while *Acacia nolitca* recorded 28.57%. The expression of apoptosis genes BCL2-Bax was determined. The data showed that BAX expression was increased after treatment by both plants extracts while BCL2 was decreased after treatment by *Acacia nolitca* and *Rosmarinus officinalis* extracts with 0.028 and 0.18 fold change respectively.

TNF-Alpha and 8-hydroxy-desoxyguanosine (8-OHdG) were determined to investigate the anticancer mechanism of the ethanolic extract for both *Rosmarinus officinalis* and *Acacia nolitca* using IC<sub>50</sub>. *Rosmarinus officinalis* recorded the higher effect.

**Key words:** *Rosmarinus officinalis*, *Acacia nilotica*, A549, TNF-alpha, 8-OHdG, apoptosis.

## DEDICATION

*I dedicate this work to my beloved queen mother whose prayers successfully made me the person I am becoming, my father who taught me how to fight with honor till I reach my goal, my sisters Jihad & Eman who supported me a lot to continue and finally my brother Khalid who encouraged me when I faint; your support made me able to gain such success and honor.*

*Thanks from the earth to the edge of the universe ...*

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## Abbreviations

8-OHG: 8 –hydroxy-desoxyguanosine

ABTS: 2,2-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid

*A. catechu*: *Acacia catechu*

*A. majus*: *Ammi majus*.

*A. nilotica*: *Acacia nilotica*

APAF: apoptotic protease activating factor.

*A.victoriae*: *Acacia victoriae*

ALL : acute lymphoblastic leukemia .

ALP : alkaline phosphatase.

ALT: alanine transaminase.

AP-1 : activator protein 1 .

Apc : adenomatous polyposis coli .

AST: aspartate transaminase.

ATL: the adult T-cell leukemia/lymphoma

BC12: B-cell lymphoma 2

*B. officinalis* : *Borage officinalis* .

BHT: butylated hydroxyl toluene.

CD: cluster of differentiation

CDKs: Cyclin-dependent kinases

cGMP : cyclic guanosine monophosphate

CLP : cecal ligation and puncture .

CNS : central nervous system.

COX-2 : cyclooxygenase -2.

CRI: cancer related inflammation.

DAG : diacylglycerols.

DAL : Dalton's ascitic lymphoma .

DPPH: 2,2-Diphenyl-1-picrylhydrazyl

EGFR : Epidermal growth factor receptor

ELISA : Enzyme linkage immuno-sorbant assay

ERK : extracellular signal –regulated kinase.

FFA : free fatty acids.

FRAP: The Ferric Reducing Power of Plasma.

GC-MS : Gas chromatography mass spectrometry.

GGT : gamma glutamyltransferase.

GSH : Reduced glutathione.

GSHPX: Glutathione peroxidase

HCV : Hepatitis C Virus.

HIV : human immunodeficiency virus .

HIV-1 PR : human immunodeficiency virus -1 protease .

IC<sub>50</sub> : the half maximal inhibitory concentration .

ICAM: Intercellular Adhesion Molecule

IL: Interleukin

iNOS : inducible nitric oxide synthase

IAPs: inhibitors of apoptosis proteins

JNK : c-jun N-terminal kinase.

LDL : low density lipoprotein

LPS : lipopolysaccharide

LPO:Lipid Peroxidation

MAG : Monoacylglycerols.

MCF7 : Michigan cancer foundation-7.

MMP-9mRNA : matrix metalloproteinase 9.

NADPH: Nicotinamide Adenine Dinucleotide Phosphate-Oxidase

NF-Kappa B : nuclear factor kappa –light chain enhancer of activated B cells.

NGF : nerve growth factor.

NSCLC : non-small cell lung cancer.

OCD : obsessive compulsive disorder.

PA: phosphatidic acid.

PARP: Poly adeno ribose polymerase

PBMC : peripheral blood mononuclear cell.

PC: phosphatidylcholine.

PGE2: Prostaglandin E2

PMNL : polymorphonuclear leukocytes.

PS : phosphatidylserine.

*R. officinalis: Rosmarinus officinalis .*

ROS : reactive oxygen species

RT-PCR : Reverse transcriptase polymerase chain reaction.

SCLC : small cell lung cancer.

SMFM : Sucrose methyl 3-formyl-4-methylpentanoate.

SOD: Super Oxide Dismutase

TNF-alpha: tumor necrosis factor alpha.

TAG : triacyl-glycerols .

TKI: tyrosine kinase inhibitor



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