



Faculty of Women for Arts, Science and Education
Biochemistry and Nutrition Department

Comparative Study of Marjoram (*Origanum majorana L.*) and Silymarin (*Silybum marianum L.*) against Hepatic Injury Induced by Carbon tetrachloride in Rats

Thesis

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Abstract

Comparative study of Marjoram (*Origanum majorana L.*) and Silymarin (*Silybum Marianum L.*) extracts against carbon tetrachloride induced hepatic injury in rats. Aya Hussien Hikal, MSc. degree, Biochemistry and Nutrition Department, Faculty of Women for Arts, Science and Education, Ain Shams University.

The present study aimed to evaluate the hepatoprotective effect of Marjoram (*Origanum majorana L.*) and Silymarin (*Silybum Marianum L.*) against CCl₄ intoxicated rats. Sixty four male wistar rats were divided into 8 groups, eight rats in each group. Rats were received the commercial diet. Group 1 (normal control): Rats were received distilled water daily by oral for 8 weeks and administer olive oil single dose (1ml/kg b.wt. i.p.) at the end of the fourth week from the beginning of the experiment. Group 2: Rats were received distilled water daily by oral for 8 weeks and single dose of CCl₄ (1ml/kg b.wt. i.p.) at the end of the fourth week from the beginning of the experiment. Group 3, 4 and 5: Rats were received marjoram extract (250mg/kg b.wt), Silymarin extract (100mg/kg b.wt) and mixture of them, respectively daily by oral for 8 weeks and were received olive oil single dose (1ml/kg b.wt. i.p.) at the end of the fourth week of the experiment. Group 6, 7 and 8: Rats were received marjoram extract (250mg/kg b.wt.), Silymarin extract (100mg/kg b.wt) and mixture of them, respectively daily by oral for 8 weeks and were received single dose of CCl₄ (1ml / kg b.wt. i.p.) at the end of the fourth week of the experiment.

Data obtained showed that, CCl₄ intoxication caused a significant decrease in final body weight and increase in absolute and relative liver weight. The activity of serum alanine aminotransferase (ALT), serum aspartate aminotransferase (AST), alkaline phosphatase (ALP) and gamma glutamyl transferase (γ GT) enzymes were significantly increased. The serum total antioxidant capacity level (TAC), liver catalase (CAT) and superoxide dismutase (SOD) enzymes activity were significantly decreased in CCl₄ group as well as liver tumor necrosis factor alpha (TNF- α) and cytochrome P450 (CYP) enzyme activity showed a significant increase in CCl₄ intoxicated group. Administration of marjoram and/or silymarin caused an ameliorative effect which evidenced by the significant decrease in oxidative and inflammatory biomarkers, liver function enzymes activity with an improvement of liver cells. The results of this study suggested that the protective effect of marjoram and silymarin is due to their antioxidant and anti-inflammatory properties.

List of Abbreviations

Abbreviation	Meaning
ADH	Alcohol Dehydrogenase
ALDH ₂	Aldehyde dehydrogenase 2
ALP	Alkaline phosphatase
ALT	Alanine aminotransferase
AST	Aspartate aminotransferase
CAT	Catalase
CCl ₄	Carbon tetrachloride
COX	Cyclooxygenase
CYP	Cytochrome P450
CYP2E1	Cytochrome P 450 2E1
DMN	Dimethylnitrosamine
FE	Fraxinus excelsior
GGT	Gamma Glutamyl Transferase
GLN	Glycyrrhizin
GP _x	Glutathione peroxidase
GST	Glutathione S-transferases
HZ	<i>Helminthostachys Zeylanica</i>
H ₂ O ₂	Hydrogen peroxide

IL-6	Interleukin 6
IL-17	Interleukin 17
iNOS	Inducible nitric oxide synthase
LPO	Lipid peroxidation
MCP	Monocyte chemotactic protein
MDA	Malondialdehyde
MPT	Mitochondrial Permeability Transition
MT	Milk thistle
NAC	N – acetylcysteine
NAD	Nicotinamide adenine dinucleotide
NDEA	N-nitrosodiethylamine
NDMA	N-nitrosodimethylamine
NF- κ B	Nuclear factor-kappa B
NO	Nitric oxide
OM	<i>Origanum majorana L.</i>
OMO	<i>Origanum majorana</i> volatile oil
OMM	<i>O. majorana</i> methanolic
OMW	<i>Origanum majorana</i> water extract
RA	Rheumatoid arthritis
RNS	Reactive Nitrogen Species
ROS	Reactive Oxygen Species

SBN	silibinin
SLN	silymarin
SM	<i>Silybum marianum</i>
SOD	Superoxide dismutase
TNF- α	Tumor Necrosis Factor Alpha

List of contents

Subject	Page
Introduction	1
Aim of the Work	5
Review of Literature	6
1. Liver	6
1.1. Anatomy and physiology of liver	6
1.2. Liver Injury	8
1.2.1. Liver Injury, Oxidative Stress and Antioxidant Status	13
1.2.2. Liver Injury and Inflammation	20
1.3. Hepatoprotective Effects of Some Plants	27
2. Marjoram (<i>Origanum majorana L.</i>)	30
2.1. Active constituents of <i>Origanum majorana L.</i>	32
2.2. Beneficial Effects of Marjoram	35
2.3. Marjoram and Heart Diseases	36
2.4. Marjoram and Diabetes	37
2.5. Marjoram and Polycystic Ovary Syndrome	38
2.6. Antioxidant Effect of Marjoram	38
2.7. Marjoram and Liver Injury	40
3. Silymarin (<i>Silybum marianum L.</i>)	41
3.1. Active Constituents of <i>Silybum marianum L.</i>	42
3.2. Beneficial Effects of <i>Silybum marianum</i>	44

3.3. <i>Silybum marianum</i> and Heart disease	46
3.4. <i>Silybum marianum</i> and Diabetes	48
3.5. <i>Silybum marianum</i> and Cancer	49
3.6. Antioxidant Effect of <i>Silybum marianum</i>	50
3.7. <i>Silybum marianum</i> and Liver Injury	51
Materials and Methods	55
Materials	55
1.Chemicals	55
2.Animals	55
3.Diet	55
4.Plant Material	56
Methods	56
1. Preparation of <i>Origanum majorana</i> and <i>Silybum marianum</i> Ethanolic Extracts:	56
2. Induction of Liver Injury	57
3. Experimental Design	57
4. Collection of Blood and Tissue Samples	59
5. Biological Measurements	60
6. Biochemical Analysis	60
A.Serum Measurements	60
1-Determination of Serum Alanine Aminotransferase (ALT) Enzyme Activity	60
2- Determination of Serum Aspartate Aminotransferase (AST) Enzyme Activity	62
3- Determination of Serum Alkaline Phosphatase (ALP) Enzyme Activity	64

4- Determination of Serum γ -Glutamyltransferase (γ GT) Enzyme Activity	67
5-Determination of Serum Total Antioxidant Capacity (TAC) Level	68
B.Liver Measurements	70
1- Determination of Liver Catalase (CAT) Enzyme Activity	70
2-Determination of Liver Superoxide Dismutase (SOD) Enzyme Activity	73
3- Determination of Liver Tumor Necrosis Factor Alpha (TNF- α) Level	76
4- Determination of Liver Cytochrome P450 (CYP)	79
7.Histological Examination	82
8.Statistical Analysis	82
Results and Discussion	83
1-Effect of marjoram and/or silymarin extracts on final body weight, absolute and relative liver weight of experimental rats	83
2-Effect of marjoram and/or silymarin extracts on serum ALT, AST, ALP and γ GT enzymes activity of experimental rats	91
3-Effect of marjoram and/or silymarin extracts on serum TAC level, liver CAT and SOD activity of experimental rats	101
4-Effect of marjoram and/or silymarin extracts on liver TNF- α level and CYP activity of experimental rats	111

5-Effect of marjoram and/or silymarin extracts on microscopic examination of liver of experimental rats	121
Summary	133
Conclusion	140
Recommendations	141
References	142
Arabic summary	

List of Tables

Table	Title	Page
1	Effect of marjoram and/or silymarin extracts on final body weight, absolute and relative liver weight of experimental rats.	84
2	Effect of marjoram and/or silymarin extracts on serum ALT, AST, ALP and γ GT enzymes activity of experimental rats.	93
3	Effect of marjoram and/or silymarin extracts on serum TAC level, liver CAT and SOD enzymes activity of experimental rats.	103
4	Effect of marjoram and/or silymarin extracts on liver TNF- α level and CYP activity of experimental rats.	113

List of Figures

Fig.	Title	Page
A	Liver anatomy	8
B	General mechanisms of oxidative stress induced by various factors on liver disease	14
C	Oxidative pathways of alcohol metabolism	15
D	The redox hemostasis in the liver	17
E	The metabolic process in hepatocyte and the generation of ROS contributing to liver disease	18
F	Aerial parts of <i>Origanum majorana L</i>	31
G	The chemical structure of ursolic acid	33
H	Major phyto-constituents reported in <i>Origanum majorana L</i> . essential oil	34
I	Silymarin (<i>Silybum Marianum L.</i>)	41
J	Chemical structure of some silymarin components	42
1	Effect of marjoram and/or silymarin extracts on final body weight of experimental rats.	85
2	Effect of marjoram and/or silymarin extracts on absolute liver weight of experimental rats.	85

3	Effect of marjoram and/or silymarin extracts on relative liver weight of experimental rats.	86
4	Effect of marjoram and/or silymarin extracts on serum ALT enzyme activity of experimental rats.	94
5	Effect of marjoram and/or silymarin extracts on serum AST enzyme activity of experimental rats.	94
6	Effect of marjoram and/or silymarin extracts on serum ALP enzyme activity of experimental rats.	95
7	Effect of marjoram and/or silymarin extracts on serum γ GT enzyme activity of experimental rats.	95
8	Effect of marjoram and/or silymarin extracts on serum TAC level of experimental rats.	104
9	Effect of marjoram and/or silymarin extracts on liver CAT activity of experimental rats.	104
10	Effect of marjoram and/or silymarin extracts on liver SOD activity of experimental rats.	105
11	Effect of marjoram and/or silymarin extracts on liver TNF- α level of experimental rats.	114
12	Effect of marjoram and/or silymarin extracts on CYP activity of experimental rats.	114

13	Liver section of rat from normal control group	123
14	Liver section of rat from CCl ₄ intoxicated group	123
15	Liver section of rat from the marjoram group	124
16	liver section of rat from the silymarin group	124
17	Liver section of rat from Silymarin and marjoram group	125
18	Liver section of rat from CCl ₄ treated group which administrated marjoram	125
19	Liver section of rat from CCl ₄ treated group with Silymarin administration	126
20	Liver section of rat from CCl ₄ treated group which administrated Silymarin and marjoram	126

Introduction

The liver is considered as the second largest organs in the body and it is the factory necessary for survival. Liver have blood supply around 80% from the portal circulation and 20% of blood coming from the hepatic artery. The blood circulation to the liver is around 20-25% of the cardiac output. It is the first step for toxins, drugs and all nutrients absorbed by the digestive tract. Liver is responsible for metabolism and decomposition of red blood cells, glycogen storage, detoxification and plasma protein synthesis (*Kumar et al., 2013*).

Liver diseases are well-known as the most serious health problems in the world. The hepatic disease and the oxidative stress and inflammation roles herein are well established and accordingly, blocking or retarding the chain reactions of oxidation and inflammation process could be promising therapeutic strategies for treatment and preventing liver injury. The liver have unique capacity for regeneration following injury which could give rise to malignancies commonly associated with the inflammatory state of cirrhosis or advanced fibrosis (*El-Denshary et al., 2012*).

Liver diseases are a global health problem with acute liver injury associated with high mortality rates. The molecular processes underlying the pathogenesis of acute liver injury are known to involve a complex interplay of