Ain Shams University
Women's College
Department of
Biochemistry and Nutrition

Dietary effect of some plants on liver functions and lipid profile in experimental animals

By
Sahar Mousa Galal Ahmed Mousa
Assistant Lecturer in the Department of
Biochemistry and Nutrition,
Women's College, Ain Shams University

Thesis
Submitted for partial fulfillment of
Ph. D. Degree in
Biochemistry and Nutrition

Supervisors
Prof. Dr.Nazira Afify Shehata,
Professor of Nutrition, Department of
Biochemistry and Nutrition,
Women's College, Ain Shams University

Dr. Fatma Hassan Abd el-Razek,
Ass. Professor, Department of
Biochemistry and Nutrition,
Women's College, Ain Shams University

Dr. Andaira Asaad Abadeer,
Lecturer, Department of
Biochemistry and Nutrition,
Women's College, Ain Shams University

2005

ACKNOWLEDGMENT

I would like to express my deepest gratitude to **Prof. Dr.Nazira Afify Shehata,** *Professor of Nutrition, Department of Biochemistry and Nutrition, Women's College, Ain Shams University for her suggestion, continuous guidance, evaluation of the work and great encouragement.*

My deep appreciation to **Dr. Fatma Hassan Abd el-Razek,** *Ass. Professor in the Department of Biochemistry and Nutrition, Women's College, Ain Shams University for her great help and evaluation of the work.*

I wish to express my thanks to **Dr. Andaira Asaad Abadeer,** *Lecturer in the Department of Biochemistry and Nutrition, Women's College, Ain Shams University for her continuous advice.*

I wish to express my thanks to **Dr. Mona Nosseir,** Ass. *Professor in Teudor Belhars Institute, for great help in histopathological examination.*

LIST OF CONTENTS

Page No.

Introduction and Aim of the work-----1-5

Review of literature----------6-67

Antioxidants ----------*6*

Curcuma longa ----------*16*

Zingiber officinale ----------*34*

Moringa oleifera ---------- *44*

Cichorium intybus ----------*53*

Sonchus oleraceus ----------*61*

Materials and Methods----------68-85

Results----------86-130

Discussion ----------131-151

Summary---------- 152-158

Recommendations----------159

References----------160-184

Appendices----------

Arabic summary----------

ABSTRACT

Sahar Mousa Galal. Dietary effect of some plants on liver functions and lipid profile in experimental animals. Unpublished Doctor of Philosophy dissertation, Biochemistry and Nutrition, Women's College, Ain Shams University, 2005.

Fifty six male albino rats, Sprague Dawley strain were used. The rats were divided into seven groups of eight rats each with similar mean total weight. The rats were divided into two experiments. In experiment I, forty rats were used and divided into five groups. But, in experiment II, thirty two rats were used and divided into four groups where group 1 and 2 are the same in the two experiments and rats in two experiments were fed the experimental diets at 14% protein level with different types of plants for four weeks. Food and water were provided *ad-libitum*. At the end of the two experiments, rats were sacrificed under ether anesthesia and blood sample was taken from hepatic portal vein from each rat. Blood samples were subjected to the determination of serum and liver lipid profile and serum ALT, AST, ALP, MDA and erythrocyte –SOD. Also liver and heart were subjected to histopathological examination. The results indicated that the lowest mean value for serum total lipids, triacylglycerols, total cholesterol and VLDL- cholesterol was found in group of rats fed

HFC diet+ Moringa leaves and HFC diet+ turmeric as compared with positive control group. But the lowest mean value for serum LDL- cholesterol and highest mean value for serum HDL-cholesterol was found in group of rats fed HFC diet+ sonchus and HFC diet+ turmeric as compared with positive control group. While lipid pattern in liver showed a significant decrease in group of rats fed HFC diet+ Moringa leaves and HFC diet+ turmeric as compared with positive control group and other plant groups. Also, the lowest mean value in serum ALT, AST, ALP and MDA was found in group of rats fed HFC diet+ sonchus and HFC diet+ turmeric as compared with positive control group. But the highest mean value in erythrocyte-SOD was found in group of rats fed HFC diet+ sonchus and HFC diet+ turmeric as compared with positive control group. Histopathological examination of liver and heart shows that there was a decrease in fat accumulation in liver and heart among group of rats fed experimental dietary plants as compared with positive control group and group of rats fed HFC diet+ turmeric was almost as negative control group.

TO MY FAMILY

List of Abbreviations

AIN-76	American Institute of Nutrition 1976
AIR	alcohol insoluble residues
AMD	Age-related macular degeneration
bdmc	bis- demethoxycurcumin
BHA	Butylated hydroxyanisole
BHT	Butylated hydroxytoleune
CCl_4	Carbon tetrachloride
CHD	Coronary heart disease
CO Q 10	Coenzyme Q 10
CVD	Cardiovascular diseases
CY	Cytochrome
dmc	demethoxycurcumin
DPPH`	Diphenyl- 2- picryl hydrazyl
DXA	Dual-energy x-ray absorptionmetry
E	Eosin
E^0	Apolipoprotein- E- deficient
ER	Ethoxyresorufin
EtOH	Ethanol
FFA	Free fatty acid
G6PD	Glucose-6-phosphate dehydrogenase
GPX	Glutathione peroxidase
GR	Glutathione reductase
GST	Glutathione-S-transferase
HDL	High density lipoprotein
HFC	High fat and high cholesterol
HPLC	High performance liquid chromatography
HX	Hematoxylin

IL-2	Interleukine-2
IL-4	Interleukine-4
IV	Iodine value
LDL	low density lipoprotein
M.	Mycobacterium
MABA	Micro plate Alamer blue assay
MDA	Malondialdehyde
MR	Methoxyresorufin
MW	Molecular weight
NAC	N-Acetyl cysteine
NADH	Nicotinamide adenine Dinucleotide H
NK	Natural killer
NSP	Non- starch polysaccharides
OVA	Oval albumin
PAHs	Polycyclic aromatic hydrocarbons
PEITC	Phenethyl- isothiocyanates
PITC	Phenyl - isothiocyanates
POV	Peroxide value
PPs	Polyphenols
PR	Pentoxyresorufin
RNS	Rreactive nitrogen species
ROS	Reactive oxygen species
ROS	Reactive oxygen species
S-ALP	Sserum alkaline phosphatase
S-ALT	Serum alanine aminotransferase
S-AST	Serum aspartate aminotransferase
SOD	Superoxide dismutase
TBARS	Thiobarbituric acid reactive substances
TC	Total cholesterol
TCE	Trichloroethylene
TCS	Thiocarbamates

UFAs	Unsaturated fatty acids
VLDL	Very low density lipoprotein
WBBA	Whole body bone area
WBBMC	Whole-body bone mineral content
WBBMD	Whole body bone mineral density

LIST OF FIGURES

		Page No.
Fig. 1	Effect of the experimental dietary plants on serum total lipids	90
Fig. 2	Effect of the experimental dietary plants on serum triacylglycerols	90
Fig. 3	Effect of the experimental dietary plants on Serum total cholesterol	90
Fig. 4	Effect of the experimental dietary plants on serum VLDL- cholesterol	93
Fig. 5	Effect of the experimental dietary plants on serum LDL- cholesterol	93
Fig. 6	Effect of the experimental dietary plants on serum HDL- cholesterol	93
Fig. 7	Effect of the experimental dietary plants on liver total lipids	96
Fig. 8	Effect of the experimental dietary plants on liver triacylglycerols	96
Fig. 9	Effect of the experimental dietary plants on liver total cholesterol	96
Fig. 10	Effect of the experimental dietary plants on serum - ALT	98
Fig. 11	Effect of the experimental dietary plants on serum - AST	98
Fig. 12	Effect of the experimental dietary plants on serum - ALP	98

Fig.	13	Effect of the experimental dietary plants on serum malondialdehyde (MDA)	101
Fig.	14	Effect of the experimental dietary plants on erythrocyte-superoxide dismutase(SOD)	101
Fig.	15	Effect of the experimental dietary plants(turmeric and ginger) on serum total lipids	104
Fig.	16	Effect of the experimental dietary plants(turmeric and ginger) on serum , triacylglycerols	104
Fig.	17	Effect of the experimental dietary plants(turmeric and ginger) on serum total cholesterol	104
Fig.	18	Effect of the experimental dietary plants (turmeric and ginger) on serum VLDL-cholesterol	107
Fig.	19	Effect of the experimental dietary plants (turmeric and ginger) on serum LDL-cholesterol	107
Fig.	20	Effect of the experimental dietary plants (turmeric and ginger) on serum HDL-cholesterol	107
Fig.	21	Effect of the experimental dietary plants (turmeric and ginger) on liver total lipids	109
Fig.	22	Effect of the experimental dietary plants (turmeric and ginger) on liver triacylglycerols	109

Fig.	23	Effect of the experimental dietary plants (turmeric and ginger) on liver total cholesterol	109
Fig.	24	Effect of the experimental dietary plants (turmeric and ginger) on serum - ALT	112
Fig.	25	Effect of the experimental dietary plants (turmeric and ginger) on serum - AST	112
Fig.	26	Effect of the experimental dietary plants (turmeric and ginger) on serum - ALP	112
Fig.	27	Effect of the experimental dietary plants (turmeric and ginger) on serum malondialdehyde (MDA)	115
Fig.	28	Effect of the experimental dietary plants (turmeric and ginger) on erythrocyte-superoxide dismutase(SOD)	115
Fig.	29	Liver from group 1(Negative control)	117
Fig.	30	Liver from group 2 (Positive control)	118
Fig.	31	Liver from group 3 (HFC diet + Chicory)	119
Fig.	32	Liver from group 4 (HFC diet + Sonchus)	120
Fig.	33	Liver from group 5 (HFC diet + *Moringa* leaves)	121
Fig.	34	Liver from group 6 (HFC diet + turmeric)	122

Fig. 35 Liver from group 7 (HFC diet + ginger) 123

Fig. 36 Heart from group 1 (Negative control) 124

Fig. 37 Heart from group 2 (Positive control) 125

Fig. 38 Heart from group 3 (HFC diet + Chicory) 126

Fig. 39 Heart from group 4 (HFC diet + Sonchus) 127

Fig. 40 Heart from group 5 (HFC diet + *Moringa* leaves) 128

Fig. 41 Heart from group 6 (HFC diet + turmeric) 129

Fig. 42 Heart from group 7 (HFC diet + ginger) 130

LIST OF TABLES

		Page No.
Table 1	Composition of the standard diet (g/100g diet)	70
Table 2	Composition of high fat and high cholesterol diet (g/100g diet)	71
Table 3	Composition of the experimental diets (g/Kg diet) in the experiment I	74
Table 3\	Composition of the experimental diets (g/Kg diet) in the experiment II	75
Table 4	The activity of ALT (u/l)	81
Table 5	The activity of ALT (u/l)	82
Table 6	Proximate analyses of the experimantal dried plantes (g/100g)	87
Table 7	Effect of the experimental dietary plants on serum total lipids, triacylglycerols and total cholesterol (mean ±S.E)	89
Table 8	Effect of the experimental dietary plants on serumVLDL-,LDL- and HDL- cholesterol (mean ±S.E)	92

Table	9	Effect of the experimental dietary plants on liver total lipids, triacylglycerols and total cholesterol (mean ±S.E)	95
Table	10	Effect of the experimental dietary plants on serum - ALT,AST and ALP (mean ±S.E)	97
Table	11	Effect of the experimental dietary plants on serum malondialdehyde (MDA) and erythrocyte-superoxide dismutase (SOD) (mean ±S.E)	100
Table	12	Effect of the experimental dietary plants (turmeric or ginger) on serum total lipids, triacylglycerols and total cholesterol (mean ±S.E)	103
Table	13	Effect of the experimental dietary plants (turmeric or ginger) on VLDL-,LDL- and HDL- cholesterol (mean ±S.E)	106
Table	14	Effect of the experimental dietary plants (turmeric or ginger) on liver total lipids, triacylglycerols and total cholesterol (mean ±S.E)	108
Table	15	Effect of the experimental dietary plants (turmeric or ginger) on serum - ALT,AST and ALP (mean ±S.E)	111
Table	16	Effect of the experimental dietary plants (turmeric or ginger) on serum malondialdehyde (MDA) and erythrocyte-superoxide dismutase(SOD) (mean ±S.E)	114