Ain Shams University
Faculty of Specific Education
Home Economy Department

Study of the Effect of Some Medicinal Herbs on Osteoporosis in Rats

By

Eman Gamal Mohamed Abdel Halim Abu Zeid

B.Sc. Specific Edu. (Home Economic Dept.), Ain Shams University, 2010
M.Sc. Specific Edu. (Home Economic Dept.), Ain Shams University, 2016

Athesis Submitted for Partial Fulfilment of the Requirements of Ph.D. Degree in Home Economic Dept., (Nutrition & Food Science)

Under the supervision of:

Prof. Dr. Zenab Mostafa Mosa
Prof. of Food Sci. & Nutrition. Home Economic Dept., Fac. of Specific Education. Ain Shams University

Prof. Dr. Samah Mohamed Ismael
Prof. of Food Sci. & Nutrition, Former Head of Home Economic Dept., Fac. of Specific Education Ain Shams University

Prof. Dr. Adel Bakeer Kholoussy
Prof. of Pathology. Pathology Dept . Fac. of Vet. Med. Cairo University

Prof. Dr. Sahar Othman Ahmed
Chief Researcher in Food Technology Research Institute. Head of House of Experimental Animals Section

2020

(قَالُواْ سُبْحَانَكَ لاَ عِلْمَ لَنَا إِلاَّ مَا عَلَّمْتَنَا إِنَّكَ أَنتَ الْعَلِيمُ الْحَكِيمُ)

صدق الله العظيم

(البقرة:32)

Approval Sheet

Student Name: Eman Gamal Mohamed Abdel Halim Abu Zeid

Title of thesis:

Study of the Effect of Some Medicinal Herbs on Osteoporosis in Rats

Degree: Ph.D. Degree in Specific Education- Home Economic **(Nutrition and Food Science)**

This Thesis for **Ph.D. Degree** has been approved by:

Prof. Dr. Naglaa Abdelkader Awad . Associate Prof., of Surgery, anaethesiologh and radiology Dept., Fac. of Vet. Med. Cairo University

Prof.Dr: Adel Bakeer Kholoussy. Prof. of Pathology. Pathology Dept . Fac. of Vet. Med. Cairo University.

Prof. Dr. Ekbal Mahmoud Mohamed Saleh, Prof. of Food Sci. & Nutrition, Home Economic Dept., Fac. of Specific Education, Ain Shams University.

Prof.Dr. Zenab Mostafa Mosa, Prof. of Food Sci. & Nutrition, Home Economic Dept., Fac. of Specific Education, Ain Shams University

Prof. Dr. Samah Mohamed Ismael, Prof. of Food Sci. & Nutrition, Former Head of Home Economic Dept., Fac. of Specific Education, Ain Shams University.

Committee in change: **Date: 18 / 11/ 2020**

ACKNOWLEDGMENT

First and foremost, all thanks and gratitude to ***Allah***, the Most Merciful, gives us the power to accomplish this work.

I would like to express my great thanks to **Prof. Dr. Adel Bakeer Kholoussy** Prof. of Pathology. Pathology. Dept. Fac. of Vet. Med. Cairo University for his encouragement throughout the time of this study and through the experimental work, highly supervision, sincere advice, scientific help, co-operation in all steps of this work.

I would like to express my deepest gratitude and cordial appreciation to **Prof. Dr. Zenab Mostafa Mosa**, Prof., of Food Science and Nutrition, Faculty of Specific Education Ain Shams University, for her guidance and continuous supervisor of the thesis. Her efforts, valuable guidance, and discussion are of great respect by the author. Her encouragement through all times and helping during practical work and in the final of my thesis.

I wish to express my grateful appreciation and deepest thanks to **Prof. Dr. Samah Mohamed Ismael**, Prof., of Food Science and Nutrition, and Previous Head of Home Economic Dept., Fac. of Specific Education, Ain Shams University for her direct supervision, careful guidance, willing cooperation, and valuable assistance as well as continuous encouragement throughout this study and through the experimental work. She really offered great support and to her I really offer my sincere appreciations**.**

My thanks are due to **Prof.Dr. Sahar Othman Ahmed Allam,** Chief Researcher of Food Technology Research Institute. Head of House of Experimental Animals Section for here direct supervision, careful guidance, willing cooperation, and valuable assistance as well as continuous. She really offered great support and to here I really offer my sincere appreciations**.**

I wish to introduce my deep respect and thanks to **Dr. Gamil Elsayed Ibrahim,** Chief Researcher of Flavour Chemistry, Flavour and Aroma Chemistry Dept., National Research Center, Egypt.

Thanks also to every one who provided help or advise me to achieve this manuscript.

Study of the Effect of Some Medicinal Herbs on Osteoporosis in Rats

By

Eman Gamal Mohamed Abdel Halim Abu Zeid

B.Sc. Specific Edu. (Home Economic Dept.), Ain Shams University, 2010.M.Sc. Specific Edu. (Home Economic Dept.), Ain Shams University, 2016

ABSTRACT

The present study was carried out to investigate the chemical and biological effects of ginger and turmeric as medicinal herbs on osteoporosis rats. Osteoarthritis is the most common form of arthritis, involving inflammation and major structural changes of the joint, causing pain and functional disability. Pain and stiffness, particularly after exercise, are the major symptoms. There is discordance between symptoms and radiographic changes, with some sufferers not experiencing symptoms, but showing osteoarthritic changes on X-ray. Major chemical constituent's (moisture, protein, fat, crude fibre, total digestible nutrients, ash, carbohydrate) of ginger and turmeric was determined. Also, phosphorous, calcium, volatile compounds and phytochemicals were determined to the same tested samples.

Fourty eight non-pregnant female Albino rats weighing (160 to 210 g) were taken and divided into eight groups, each with (6) rats. The first group is the negative control (-) group and fed on basal diet for (8) weeks. The other groups injected with beta methasone (4 mg / kg bw) three times per week for three weeks to induce osteoporosis, Positive control group (+) which fed on basal diet only but the other groups fed on basal diet with different doses (10 - 15%) from ginger, turmeric and mixture of them. The results revealed that all groups fed on basal diet and administrated with different doses of ginger and

turmeric **(**10 -15%) had significant decrease in liver function (ALT, AST)**,** phosphorus, total calcium, ionized calcium comparing with the positive control group (injected with prednisone acetate). On the other hand, x-ray and histopathology of the positive control group after two months revealed bone loss of different parts such as fibula, tibia and femur in addition to bone demineralization, femoral fracture and fibula bone trabexculae showed dystrophy and resorption and osteoporosis. These findings revealed that ginger and turmeric treatment attenuated and treated degrees to osteoporosis in compare to positive control group.

Keywords: Osteoporosis, Ginger, Turmeric, Prednisone acetate, Chemical Analysis, Phytochemicals, Liver enzymes, X-ray, Histopathology.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PHOTO

LIST OF ABBREVIATIONS

µCT	Micro-computerized tomography
A.V. values	Actuarial *values*
ACE	Angiotensin converting enzyme
ACR	American College of Rheumatology
AD	Alzheimer disease
ADAMTS-5	Key enzymes in osteoarthritis†
ALT	Aspartate amino transferase
ApoB	Apo lipoprotein B
ARGS	Antibiotic Resistance Genes
AST	Alanine amino transferase
ATOAC	The Athletic Trainers' Osteoarthritis Consortium
ATP	Alanine Transferase
ATs	Athletic trainers
BHA	Butylated hydroxyani-sole
BHT	Butylated hydroxytoluene
BM P2,BM P4,and RUNX2 genes	Expression in mesenchymal cells induces osteoblast differentiation and bone formation. BMP blocking agents were used to show that RUNX2-dependent osteoblast
BMI	Body mass index
BWG %	Body weight gain%
CEO	Curcumin essential oils
CGIC	Clinician Global Impression Change
CHD	Coronary heart disease
CI	Confidence interval
CKD	Chronic kidney disease
CL	*Curcuma longa* L.
COX	Cyclooxygenase
COX	Cyclo-oxygenase

DEXA	dual x-ray absorptiometry
DNA	DeoxyriboNucleic Acid
DNP	Donepezil
DXA	Dual-energy x-ray absorptiometry
EGb	Effects of *Ginkgo* biloba extract
EGb	*Ginkgo* biloba extract
ERs	Estrogen receptors
EST	Expressed Sequence Tag
EU	European Union
ESR	Erythrocyte sedimentation rate
FDA	Food And Drug Administration
FI	food intake
FPP	Farnesylpyrophosphate
FR	fibrous roots of ginger
FRAP	ferric-reducing antioxidant power assay
GC–MS	Gas chromatography–mass spectrometry
GEO	Ginger essential oils
GG	Ginger group
GIO	Glucocorticoid-induced osteoporosis
GIO	Glucocorticoid-induced osteoporosis
GIOP	Glucocorticoid-induced osteoporosis
GKC	Ginger kidney compress
GPP	Ginger phenylpropanoids
GRAS	Generally Recognized as Safe
GS	Glucosamine sulphate
HDL-c	High-density lipoprotein cholesterol
HPLC	High-performance liquid chromatography
hs-CRP	Hs-C reactive protein
HssAChE	Human acetylcholinesterase
IBD	Infectious bursal disease
IL	Interleukin
IP	Intraperitoneally

ITT	Intention-to-treat
KI	Kovat index on DB5
KOA	Osteoarthritis of knee
LDL-C	Low-density lipoprotein cholesterol
MAbs	Monoclonal antibodies
MDA	Malondialdehyde
MetSs	Metabolic syndromes
MG	Matured ginger rhizome
mMCP-1	Mast cell protease-1
MMPs	Matrix metalloproteinases
MS/MS	Method from water and ethanol extracts of ginger
NCBI	National Cholesterol Program1
ND	Newcastle disease
NF-Kb	Nuclear factor-Kb
NIH	National Institutes of Health
NLC	Nanostructured lipid carriers
NO	Nitric oxide
NSAIDs	Non-steroidal anti-inflammatory drugs
OA	Osteoarthritis
OH	Oxygen and hydrogen
OR	Odds ratio
OVA	Ovalbumin
OVX	Ovariectomized
PG	placebo group
PGA	Patient Global Assessment
PGE_2	prostaglandin-E_2
PPAR-γ	peroxisome proliferator-activated receptor-γ
PTOA	posttraumatic OA
qCT	Computed tomography
RA	Rheumatoid arthritis
ROS	Reactive oxygen species
RR	Risk ratio