THE THERAPEUTIC PROPERTIES OF MEDICINAL PLANTS

Health-Rejuvenating Bioactive Compounds of Native Flora

Innovations in Plant Science for Better Health: From Soil to Fork

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Health-Rejuvenating Bioactive Compounds of Native Flora

Edited by

Megh R. Goyal

Hafiz Ansar Rasul Suleria

Ademola Olabode Ayeleso

T. Jesse Joel

Sujogya Kumar Panda

APP APPLE ACADEMIC PRESS

Apple Academic Press Inc.
4164 Lakeshore Road
Burlington ON L7L 1A4, Canada

Apple Academic Press Inc.
1265 Goldenrod Circle NE
Palm Bay, Florida 32905, USA

Exclusive worldwide distribution by CRC Press, a member of Taylor & Francis Group

International Standard Book Number-13: 978-1-77188-803-5 (Hardcover)
International Standard Book Number-13: 978-0-42926-520-4 (eBook)

Library and Archives Canada Cataloguing in Publication

Title: The therapeutic properties of medicinal plants : health-rejuvenating bioactive compounds of native flora/edited by Megh R. Goyal, Hafiz Ansar Rasul Suleria, Ademola Olabode Ayeleso, T. Jesse Joel, Sujogya Kumar Panda.

Names: Goyal, Megh Raj, editor. | Suleria, Hafiz, editor. | Ayeleso, Ademola Olabode, editor. | Joel, T. Jesse, editor. | Panda, Sujogya Kumar, editor.

Series: Innovations in plant science for better health.

Description: Series statement: Innovations in plant science for better health: from soil to fork | Includes bibliographical references and index.

Identifiers: Canadiana (print) 20190169990 | Canadiana (ebook) 20190170018 | ISBN 9781771888035 (hardcover) | ISBN 9780429265204 (ebook)

Subjects: LCSH: Materia medica, Vegetable. | LCSH: Medicinal plants—Research. | LCSH: Botanical chemistry—Research.

Classification: LCC RS164 .T54 2020 | DDC 615.3/21—dc23

Library of Congress Cataloging-in-Publication Data

Names: Goyal, Megh Raj, editor. | Suleria, Hafiz, editor. | Ayeleso, Ademola Olabode, editor. | Joel, T. Jesse, editor. | Panda, Sujogya Kumar, editor.

Title: The therapeutic properties of medicinal plants : health-rejuvenating bioactive compounds of native flora/edited by Megh R. Goyal, Hafiz Ansar Rasul Suleria, Ademola Olabode Ayeleso, T. Jesse Joel, Sujogya Kumar Panda.

Other titles: Innovations in plant science for better health

Description: Oakville, ON ; Palm Bay, Florida : Apple Academic Press, [2020] | Series: Innovations in plant science for better health: from soil to fork | Includes bibliographical references and index. | Summary: "This volume, The Therapeutic Properties of Medicinal Plants, provides some informative research on the scientific evidence of the health benefits that can be derived from medicinal plants and how their efficacies can be improved. The volume is divided into three sections covering the phytochemistry of medicinal plants, disease management with medicinal plants, and novel research techniques in medicinal plants. The pharmacological benefits of several specific plants, such as basil, fig, garlic, palm tree, etc., are discussed, addressing health issues including metabolic and mental disorders, acute mountain sickness, polycystic ovarian syndrome, and specific diseases such as Huntington's. It also looks at the role of antioxidants in disease management. Additionally, the book covers recent problems of drug resistance and how medicinal plants can serve as antibiotic, anthelmintic, and antiparasitic drugs that will be helpful for human and animals. Furthermore, it also covers novel approaches for the screening of plant-based medicines, extraction, toxicity and safety issues of essential oils, and nanoparticle-based delivery of plant metabolites. The findings reported in this book will be useful in health policy decisions and will help to motivate the development of new health care products from plants for health benefits. The book will further encourage the preservation of traditional medical knowledge of plants with therapeutic qualities. It will be a valuable reference for researchers, scientists, students, growers, traders, processors, industry professionals, dieticians, medical practitioners, and others"-- Provided by publisher.

Identifiers: LCCN 2019036017 (print) | LCCN 2019036018 (ebook) | ISBN 9781771888035 (hardcover) | ISBN 9780429265204 (ebook)

Subjects: LCSH: Materia medica, Vegetable. | Medicinal plants--Research. | Botanical chemistry--Research.

Classification: LCC RS164 .T522 2019 (print) | LCC RS164 (ebook) | DDC 615.3/21--dc23

LC record available at https://lccn.loc.gov/2019036017

LC ebook record available at https://lccn.loc.gov/2019036018

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Megh R. Goyal, PhD

Retired Professor in Agricultural and Biomedical Engineering, University of Puerto Rico, Mayaguez Campus; Senior Acquisitions Editor, Biomedical Engineering and Agricultural Science, Apple Academic Press, Inc.

Megh R. Goyal, PhD, PE, is a Retired Professor in Agricultural and Biomedical Engineering from the General Engineering Department in the College of Engineering at the University of Puerto Rico–Mayaguez Campus; and Senior Acquisitions Editor and Senior Technical Editor-in-Chief in Agriculture and Biomedical Engineering for Apple Academic Press, Inc. He has worked as a Soil Conservation Inspector and as a Research Assistant at Haryana Agricultural University and Ohio State University.

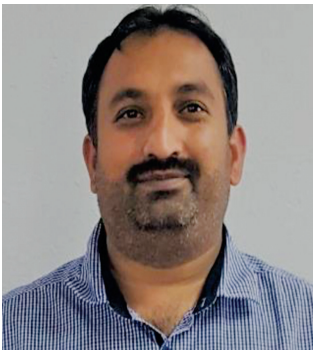
During his professional career of 50 years, Dr. Goyal has received many prestigious awards and honors. He was the first agricultural engineer to receive the professional license in Agricultural Engineering in 1986 from the College of Engineers and Surveyors of Puerto Rico. In 2005, he was proclaimed as "Father of Irrigation Engineering in Puerto Rico for the Twentieth Century" by the American Society of Agricultural and Biological Engineers (ASABE), Puerto Rico Section, for his pioneering work on micro irrigation, evapotranspiration, agroclimatology, and soil and water engineering. The Water Technology Centre of Tamil Nadu Agricultural University in Coimbatore, India, recognized Dr. Goyal as one of the experts "who rendered meritorious service for the development of micro irrigation sector in India" by bestowing the Award of Outstanding Contribution in Micro Irrigation. This award was presented to Dr. Goyal during the inaugural session of the National Congress on "New Challenges and Advances in Sustainable Micro Irrigation" held at Tamil Nadu Agricultural University. Dr. Goyal received the Netafim Award for Advancements in

Microirrigation: 2018 from the American Society of Agricultural Engineers at the ASABE International Meeting in August 2018.

A prolific author and editor, he has written more than 200 journal articles and textbooks and has edited over 70 books. He is the editor of three book series published by Apple Academic Press: Innovations in Agricultural & Biological Engineering, Innovations and Challenges in Micro Irrigation, and Research Advances in Sustainable Micro Irrigation. He is also instrumental in the development of the new book series Innovations in Plant Science for Better Health: From Soil to Fork.

Dr. Goyal received his BSc degree in engineering from Punjab Agricultural University, Ludhiana, India; his MSc and PhD degrees from Ohio State University, Columbus; and his Master of Divinity degree from Puerto Rico Evangelical Seminary, Hato Rey, Puerto Rico, USA.

ABOUT THE EDITORS



Hafiz Ansar Rasul Suleria, PhD

Alfred Deakin Research Fellow,
Deakin University, Melbourne, Australia;
Honorary Fellow, Diamantina Institute
Faculty of Medicine, The University of
Queensland, Australia

Hafiz Anasr Rasul Suleria, PhD, is currently working as the Alfred Deakin Research Fellow at Deakin University, Melbourne, Australia. He is also an Honorary Fellow at the Diamantina Institute, Faculty of Medicine, The University of Queensland, Australia.

Recently he worked as a postdoc research fellow in the Department of Food, Nutrition, Dietetic and Health at Kansas State University, USA.

Previously, he has been awarded an International Postgraduate Research Scholarship (IPRS) and an Australian Postgraduate Award (APA) for his PhD research at the University of Queens School of Medicine, the Translational Research Institute (TRI), in collaboration with the Commonwealth and Scientific and Industrial Research Organization (CSIRO, Australia).

Before joining the University of Queens, he worked as a lecturer in the Department of Food Sciences, Government College University Faisalabad, Pakistan. He also worked as a research associate in the PAK-US Joint Project funded by the Higher Education Commission, Pakistan, and the Department of State, USA, with the collaboration of the University of Massachusetts, USA, and National Institute of Food Science and Technology, University of Agriculture Faisalabad, Pakistan.

He has a significant research focus on food nutrition, particularly in the screening of bioactive molecules—isolation, purification, and characterization using various cutting-edge techniques from different plant, marine, and animal sources; and *in vitro*, *in vivo* bioactivities; cell culture; and animal modeling. He has also done a reasonable amount of work on functional foods and nutraceuticals, food and function, and alternative medicine.

Dr. Suleria has published more than 50 peer-reviewed scientific papers in different reputed/impacted journals. He is also in collaboration with more

than ten universities where he is working as a co-supervisor/special member for PhD and postgraduate students and is also involved in joint publications, projects, and grants. He is Editor-in-Chief for the book series Innovations in Plant Science for Better Health: From Soil to Fork, published by AAP.

Readers may contact him at: hafiz.suleria@uqconnect.edu.au.

Ademola Olabode Ayeleso, PhD

Senior Lecturer, Department of Biochemistry, Adeleke University, Nigeria

Ademola O. Ayeleso, PhD, is a Senior Lecturer in the Department of Biochemistry at Adeleke University, Ede, Nigeria. Dr. Ayeleso is working on the use of medicinal plants, plant products, and synthesized compounds in the management of diabetes mellitus that has become a major threat to the lives of people in both urban and rural areas throughout the world. He has presented research papers at different international conferences. He has also worked as a Post-doctoral Research Fellow at three different universities in South Africa. Dr. Ayeleso is a prolific writer with over 20 publications to his credit.

Dr. Ayeleso obtained his BTech degree in Biochemistry at the Federal University of Technology, Akure, Nigeria. He received his MSc degree in Biochemistry at the University of Port Harcourt, Port Harcourt, Nigeria, and his doctoral degree in Biomedical Technology at the Cape Peninsula University of Technology, Bellville, South Africa.

T. Jesse Joel, PhD

T. Jesse Joel, PhD, is at present an Assistant Professor in Microbiology at the Biotechnology and Biosciences Department in the School of Agriculture and Biosciences at Karunya University, Coimbatore, India. He is an editorial board member for the International Research Journal of Biological Sciences and is also on the Scientific and Technical Committee on Bioengineering and Life Sciences. He teaches undergraduate and postgraduate courses on microbiology, cell biology, molecular biology, biochemistry, biomaterials and artificial organs, taxonomy and phylogeny, etc.

During his professional career of 13 years, he has received two Awards of Excellence for best paper and best lecture. Currently Dr. Joel is working in the field of nanoscience using green synthesis of nanoparticles from plant extracts, probiotics, and oral bioformulations as well as exploring the ameliorative effects of oral microorganisms. He has published several book chapters and has attended over 36 scientific events where he has chaired sessions and delivered guest lectures and lead talks in conferences and technical symposiums, conducted nationally as well as abroad. He also works as a consultant microbiologist on several projects.

He earned his BSc degree (Triple Major: in Microbiology, Chemistry, and Botany) from Andhra Loyola College, Vijayawada, India; his MSc degree in Applied Microbiology from K.S. Rangasamy College of Arts and Science, Tiruchengode, India, and his PhD degree in Microbiology from the Faculty of Engineering, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad, India. He also received DMin from the Theological Extension Study Programme (TESPRO), Shillong, Meghalaya, India.

Sujogya Kumar Panda, PhD

Animal Physiology and Neurobiology,
KU Leuven, Belgium

Sujogya Kumar Panda, PhD, was formerly a faculty member in the P.G. Department of Microbiology at M.P.C (Auto) College and in the Department of Biotechnology, North Orissa University, Odisha, India. He has an eclectic background that includes teaching, research, writing, and publishing.

During the last 10 years he has worked in the field of ethno-pharmacology, nanoparticles, infectious diseases, and pharmaco-epidemiology. Dr. Panda is a reviewer and an editorial board member for many professional journals. He has edited three books and published more than 40 research articles in national and international peer-reviewed journals. Dr. Panda has also received a Young Scientist Award from the Science & Technology Department, Government of India; a Erasmus-Mundus postdoc fellowship at KU Leuven, Belgium; and a CICOPS fellowship at the University of Pavia, Italy, to his continue research. At present he is continuing his postdoctorate in Animal Physiology and Neurobiology at KU Leuven, Belgium, and is engrossed in purifying the active compounds from Indian medicinal plants using bioassay guided purification.

Sujogya Kumar Panda holds a BSc in Botany (Honors) and MSc in Applied and Industrial Microbiology with a specialization in Pharmaceutical and Clinical Microbiology. He is trained in natural products and obtained a PhD on working with medicinal plants.

CONTENTS

CONTRIBUTORS

Yapo Guillaume Aboua
Senior Lecturer, Department of Medical Laboratory Science, Faculty of Health and Applied Sciences, Namibia University of Science and Technology, Private Bag 13388 Windhoek Namibia,
Mobile: +264-814225104, E-mail: yaboua@nust.na

Abiola Fatimah Adenowo
Lecturer, Department of Medical Biochemistry, Lagos State University, College of Medicine, PMB 21266, Ikeja, Lagos, Nigeria; Email: afaatimah@yahoo.com

Idowu Jesulayomi Adeosun
PhD Student, Adeleke University, P.M.B 250, Ede, Osun State, Nigeria,
Mobile: +2348135209244, E-mail: adeosunidowu6@gmail.com

Huma Bader-Ul Ain
Research Associate, Institute of Home and Food Sciences, Government College University, Faisalabad, Pakistan, E-mail: humahums@yahoo.com

Muhammad Umair Arshad
Director, Institute of Home and Food Sciences, Government College University, Faisalabad, Pakistan,
Mobile: +92-333-6575583, E-mail: umairfood1@gmail.com

Ademola Olabode Ayeleso
Senior Lecturer, Department of Biochemistry, Adeleke University, Ede, Nigeria,
Mobile: +23408144556529,
E-mails: ademola.ayeleso@gmail.com, ademola.ayeleso@adelekeuniversity.edu.ng

Olutoyin Omolara Bamigboye
Associate Professor, Adeleke University, P.M.B 250, Ede, Osun State, Nigeria,
Mobile: +234-9039301158, +234-8035724474, E-mail: toyinphd@gmail.com

Kalpana Kumari Barwal
Assistant Professor, All India Institute of Medical Sciences, Sijua-751019, Odisha, India,
Mobile: +91-9438884026, E-mail: drkalpanabarhwal@hotmail.com

Satpal Singh Bisht
Professor, Department of Zoology, Kumaun University, Nainital, Uttarakhand, India

Nicole Lisa Brooks
Head, Department of Wellness Sciences, Faculty of Health and Wellness Sciences, Cape Peninsula University of Technology, PO Box 652, Cape Town, 8000, South Africa,
Mobile: +278-2939922, E-mail: BrooksN@cput.ac.za

Ibrahim Chikowe
Lecturer, Department of Pharmacy, College of Medicine, P/Bag 360, Blantyre, Malawi,
Mobile: +265-999328058, E-mail: ichikowe@medcol.mw

Abhijit Dey
Ethnopharmacology and Natural Product Research Laboratory, Department of Life Sciences, Presidency University, 86/1 College Street, Kolkata–700073, West Bengal, India,
Mobile: +919903214237, E-mail: abhijitbio25@yahoo.com, abhijit.dbs@presiuniv.ac.in

Sujatha Govindaraj
Assistant Professor, Department of Botany, Periyar E. V. R. College (Autonomous), Tiruchirappalli-620023, Tamil Nadu, India, Mobile: +91-9894568526, E-mail: sujathagovindaraj@gmail.com

Megh R. Goyal
Retired Faculty in Agricultural and Biomedical Engineering from College of Engineering at University of Puerto Rico-Mayaguez Campus, and Senior Technical Editor-in-Chief in Agricultural and Biomedical Engineering for Apple Academic Press Inc., PO Box 86, Rincon–PR–006770086, USA, E-mail: goyalmegh@gmail.com

Mayeso Gwedela
Assistant Lecturer, Division of Physiology, College of Medicine, P/Bag 360, Blantyre, Malawi, Mobile: +265-995154446, E-mail: mgwedela@medcol.mw

Sunil Kumar Hota
Scientist 'D,' Defense Institute of High Altitude Research (DIHAR), Ministry of Defense-Government of India, C/O 56 APO, Leh-Ladakh-901205, Jammu and Kashmir, India, Mobile: +91-9463998315, E-mail: drsunilhota@hotmail.com

Muhibah Folashade Ilori
PhD Candidate, Department of Biochemistry, College of Medicine, University of Lagos, Idi-Araba, Mushin, Lagos, Nigeria; Email: muhibbahalade@yahoo.ca

T. Jesse Joel
Assistant Professor, Department of Biotechnology, School of Agriculture and Biosciences, Karunya Institute of Technology and Sciences, Karunya Nagar, Coimbatore - 641114, Tamil Nadu. India; Email: jessejoel@karunya.edu

Kondwani Katundu
Lecturer, Division of Physiology, College of Medicine, P/Bag 360, Chichiri, Blantyre 3, Malawi, Mobile: +265-999313978, E-mail: kkatundu@medcol.mw

Mutiu Idowu Kazeem
Lecturer, Antidiabetic Drug Discovery Group, Department of Biochemistry, Lagos State University, PMB 001, Ojo, Lagos, Nigeria, Mobile: +234-8030622000, E-mail: mikazeem@gmail.com

Dadasaheb M. Kokare
Assistant Professor, Department of Pharmaceutical Sciences, Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur-440033, India, Mobile: +91 9850318502, E-mail: kokaredada@yahoo.com

Kushal Kumar
Fellow, Defense Institute of High Altitude Research (DIHAR), Ministry of Defense–Government of India, C/O 56 APO, Leh-Ladakh-901205, Jammu and Kashmir, India, Mobile: +91-9646633864, E-mail: kushal1kumar@gmail.com

Fanuel Lampiao
Associate Professor, and Deputy Director, Africa Centre of Excellence in Public Health and Herbal Medicine (ACEPHEM), College of Medicine, P/Bag 360, Blantyre Malawi, Mobile: +265-0995482713, E-mail: flampiao@medcol.mw

Gail B. Mahady
Associate Professor Director, Clinical Pharmacognosy Laboratory, University of Illinois at Chicago College of Pharmacy PAHO/WHO Collaborating Centre for Traditional Medicine Department of Pharmacy Practice, Chicago, IL-60612, USA, Mobile: +1-630931669, E-mail: gail.mahady@gmail.com

Suman Kalyan Mandal
Research Scholar, Department of Botany (UGC-DRS-SAP & DST-FIST Sponsored),
Visva Bharati, Santiniketan-731235, West Bengal, India, Mobile: +91-9851248512,
E-mail: skmandal.vb@gmail.com

Simeon A. Materechera
Professor, Indigenous Knowledge Systems, North-West University, Mafikeng Campus,
Private Bag X2046, Mmabatho-2745, South Africa, E-mail: albert.materechera@nwu.ac.za

Rojita Mishra
Lecturer, Department of Botany, Polosara Science College, Polosara, Ganjam, Odisha–761105,
E-mail: rojitamishra@gmail.com

Boitumelo Rosemary Mosito
PhD Candidate, Department of Wellness Sciences, Faculty of Health and Wellness Sciences,
Cape Peninsula University of Technology, PO Box 1906 Bellville 7535, South Africa,
E-mail: mositoboitumelo@yahoo.com

Anuradha Mukherjee
Anuradha Mukherjee, M.Sc., PhD Research Scholar, Assistant Teacher of Biological Sciences,
Moriswar Motilal High School (MMHS), Joynagar 7433337, District South 24 Parganas,
West Bengal, India; Email: anuradhamukherjee1980@gmail.com

Emmanuel Mukwevho
Professor, Diabetes and Obesity Therapeutics Research Group, Department of Biochemistry,
North-West University, Mmabatho, South Africa, Mobile: +27713839197,
E-mail:emmanuel.mukwevho@nwu.ac.za

Banadipa Nanda
Ethnopharmacology and Natural Product Research Laboratory, Department of Life Sciences,
Presidency University, 86/1 College Street, Kolkata–700073, West Bengal, India,
Mobile: +918240976279, E-mail: banadipa@gmail.com

Samapika Nandy
Ethnopharmacology and Natural Product Research Laboratory, Department of Life Sciences,
Presidency University, 86/1 College Street, Kolkata–700073, West Bengal, India,
Tel.: +9800203311, E-mail: samapika.nandy25@gmail.com

Francis N. Nkede
Postgraduate Student, Department of Botany and Plant Physiology. University of Buea,
P.O Box 63, Buea, Cameroon, E-mail: nkedefrancis1@gmail.com

Olugbenga Kayode Ogidan
Senior Lecturer, Department of Electrical & Computer Engineering, Elizade University,
P.M.B 002 Ilara Mokin, Ondo State, Nigeria, Mobile: +234-8035825897,
E-mail: olugbengaogidan@gmail.com

Ganiyat Abiola Oladunmoye
Undergraduate Student, Department of Animal Production and Health,
Federal University of Agriculture, PMB 2240, Abeokuta. Nigeria, Mobile: +234-7033277064,
E-mail: ganiyatoladunmoye@gmail.com

Abiodun Emmanuel Onile
Assistant Lecturer, Department of Electrical & Computer Engineering, Elizade University,
P.M.B 002 Ilara Mokin, Ondo State, Nigeria, Mobile: +234-8168305311,
E-mail: abiodun.onile@elizadeuniversity.edu.ng

Wilfred Otang-Mbeng
Senior Lecturer of Botany, School of Biology and Environmental Sciences,
Faculty of Natural Sciences and Agriculture, University of Mpumalanga,
Mbombela Campus, P/bag X11283, Nelspruit, 1200, South Africa,
Mobile: +271-30020235, E-mail: wilfred.mbeng@ump.ac.za

Shesan John Owonubi
Post-Doctoral Researcher, Department of Chemistry, University of Zululand, KwaDlangezwa,
KwaZulu-Natal, South Africa, Mobile: +27849718848, E-mail: oshesan@gmail.com

Chowdhury Habibur Rahaman
Associate Professor, Department of Botany (UGC-DRS-SAP & DST-FIST Sponsored),
Visva Bharati, Santiniketan-731235, West Bengal, India, Mobile: +919434210136,
E-mail: habibur_cr@yahoo.co.in, habibur_cr@rediffmail.com

Sujogya Kumar Panda
Postdoctoral Researcher, Animal Physiology and Neurobiology Section, Department of Biology,
University of Leuven, Naamsestraat 59 - box 2465, 3000 Leuven, KU, Belgium;
Email: sujogyapanda@gmail.com; sujogya.panda@kuleuven.be

Mahendra Rana
Assistant Professor, Department of Pharmaceutical Sciences, Kumaun University Campus,
Bhimtal, Uttarakhand, India

Nishikant A. Raut
Assistant Professor, Department of Pharmaceutical Sciences,
Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur-440033, India,
Mobile: +91 9422803768, E-mail: nishikantraut29@gmail.com

Anindya Sundar Ray
Research Scholar, Department of Botany (UGC-DRS-SAP & DST-FIST Sponsored),
Visva Bharati, Santiniketan-731235, West Bengal, India, Mobile: +919474311389,
E-mail: argharay90@gmail.com

Neerish Revaprasadu
Professor, Department of Chemistry, University of Zululand, KwaDlangezwa,
KwaZulu-Natal, South Africa, Tel: +27(0)359026137, E-mail: revaprasadun@unizulu.ac.za

Farhan Saeed
Assistant Professor, Institute of Home and Food Sciences, Government College University,
Faisalabad, Pakistan, E-mail: f.saeed@gcuf.edu.pk

Hafiz Ansar Rasul Suleria
Alfred Deakin Postdoctoral Research Fellow, Centre for Chemistry and Biotechnology,
School of Life and Environmental Sciences, Faculty of Science, Engineering and Built Environment,
Deakin University, 75 Pigdons Road, Geelong, VIC 3216, Australia,
Mobile: +61-470439670, E-mail: hafiz.suleria@uqconnect.edu.au

Azeez Olanrewaju Yusuf
Lecturer II, Department of Animal Production and Health, Federal University of Agriculture,
PMB 2240, Abeokuta, Nigeria, Mobile: +234-8036250504, E-mail: yusufao@funaab.edu.ng

ABBREVIATIONS

2-AAF	2-acetylaminofluorene
ABC	ATP binding cassette
ABPP	activity-based probe profiling
ABTS	2,2'-azino-bis (3-ethylbenzothiazoline-6-sulphonic acid)
ACE	angiotensin converting enzymes
AD	Alzheimer's disease
ADH	antidiuretic hormone
AFB1	aflatoxin B1
AGEs	advanced glycation end-products
AIDS	acquired immune deficiency syndrome
ALAD	δ-aminolevulinic acid dehydratase
$AlCl_3$	aluminum chloride
ALP	alkaline phosphatase
ALT	alanine aminotransferase
ALT	aspartate aminotransferase
AMI	age-induced memory impairment
AMP	adenosine monophosphate
AMS	acute mountain sickness
ANN	artificial neural network
ANP	atrial natriuretic peptide
ARE	antioxidant response element
ASOs	antisense oligonucleotides
ATBC	alpha-tocopherol beta-carotene
ATP	adenosine triphosphate
AVP	average precision
BaP	benzo[a]pyrene
BBB	blood-brain-barrier
BCA	bicinchoninic acid
BDNF	brain-derived neurotrophic factor
BHT	butylated hydroxytoluene
bZIP	basic-leucine zippe
C2C12	immortalized mouse myoblast cell line
CAGE	cap analysis of gene expression
CAM	complementary and alternative medicines

CAMD	compacted air microwave distillation
CAMs	cell adhesion molecules
CAT	catalase
CCCP	compound centric chemical proteomics
CDRI	Central Drug Research Institute
CLMT	Chaihu-Jia-Longgu-Muli Tan
CNC	Cap'n'Collar
CNS	central nervous system
COMT	catechol-O-methyl transferase
COX-2	cyclooxygenase 2
CP	crude protein
CUS	chronic unpredictable stress
CV	computer vision
CVD	cardiovascular disease
CVS	chronic variable stress
CYP1A2	cytochrome P450 1A2 enzyme
DDS	drug delivery system
DETAPAC	diethylenetriaminepentaacetic acid
DMAD	dimethylallyl diphosphate
DMBA	7,12-dimethylbenz(a)anthracene
DMSO	dimethyl sulfoxide
DNA	deoxyribonucleic acid
DPPH	diphenyl picryhydrazyl
DSS	dextran sodium sulfate
DUFARMS	directorate of university farms
EDTA	ethylenediaminetetraacetic acid
EGCG	epigallocatechin gallate
EOs	essential oils
EPG	egg count per gram
ERE	electrophile response element
ERK	extracellular regulated kinases
ESBL	extended spectrum beta lactamase
ESC	embryonic stem cell
EST	embryonic stem cell test
FAB-MS	fast atom bombardment mass spectrometry
FAO	Food and Agriculture Organization
FB_1	fumonisin B1
FDA	Food and Drug Administration
FEC	faecal egg count
$FeSO_4$	ferrous sulfate

FLBP	fuzzy local binary patterns
FRAP	ferric reducing antioxidant power
FSH	follicle stimulating hormone
FST	forced swim test
G1 phase	growth 1 phase
GABA	gamma amino butyric acid
GAD	generalized anxiety disorders
GAE	gallic acid equivalent
GC	gas chromatography
GCLC	glutamate cysteine ligase catalytic subunit
GDNF	glial cell derived neurotrophic factor
GGT	γ-glutamyl transferase
GIT	gastrointestinal tract
GLCM	gray level co-occurrence matrix
GLUT	glucose transporter
GPCRs	G-protein coupled receptors
GPx	glutathione peroxidase
GR	glutathione reductase
GUI	graphical user interface
H_2O_2	hydrogen peroxide
HbAA	hemoglobin A
HbSS	hemoglobin S
HBV	hepatitis B virus
HCl	hydrochloric acid
HD	Huntington's disease
HD	hydrodistillation
HDAC	histone deacetylases
HDL-C	high-density lipoprotein cholesterol
HDL	high-density lipoprotein
HHA axis	hypothalamus-adrenocortical axis
HHT	homoharringtonine
HIV	human immunodeficiency virus
HMF	hydroxymethylfurfurals
HPA	hypothalamus-pituitary-adrenocortical
HPBMDM	human peripheral blood monocyte derived macrophages
HPLC	high performance liquid chromatography
HPV	human papilloma virus
HS-CRP	high sensitive C reactive protein
HUVEC	human umblical vein endothelial cells
IC	inhibition concentration

IC_{50}	50% median inhibition concentration
ICT	information communication technologies
IgM	immunoglobulin M
IL	interleukin
IL-10	interleukin 10
IL-6	interleukin 6
iNOS	inducible nitric oxide synthase
IPD	isopentenyl diphosphate
IPP	isopentenyl pyrophospahte
ISO	International Standard Organization
IVF	*in vitro* fertilization
kDa	Kilo Dalton
KH_2PO_4	potassium phosphate
KV	kolaviron
LBP	local binary pattern
LBPV	local binary pattern variance
LC	liquid chromatography
LDH	lactate dehydrogenase
LDL-C	low density lipoprotein cholesterol
LH	luteinizing hormone
LLS	Lake Louise Score
LPO	lipid peoxidation
LPS	lipopolysaccharide
MAE	microwave-assisted extraction
MATLAB	matrix laboratory
MCV	mean cell volume
MDA	malondialdehyde
MDG	microwave dry-diffusion and gravity
MDR	multidrug resistant
MDR1	multi drug resistance gene-1
MedLeaf	medicinal leaf
mg/KgBW	milligram per kilogram body weight
MGDG	monogalactosyldiacyl glycerol
MHG	microwave hydrodiffusion and gravity
MIC	minimum inhibitory concentration
MILDA	microplate luminescence automated digital analyzer
MMC	mitomycin C
MNRET	micronucleated reticulocyte
MPA	metaphosphoric acid
MTT	3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide

MudPIT	multidimensional protein identification technology
MUFAs	mono-unsaturated fatty acids
MySQL	my structured query language
NAC	N-acetylcysteine
NAD	nicotinamide adenine dinucleotide
NAD(P)H	nicotinamide adenine dinucleotide phosphate
NADH	nicotinamide adenine dehydrogenase
NADP(H)	nicotinamide adenine dinucleotide phosphate
NaOH	sodium hydroxide
NB	Naivy Bayes
NCCIH	National Center for Complementary and Integrated Health
NCI	National Cancer Institute
NEMPS	nuclear-encoded mitochondrial proteins
NEUT	neutrophils
NF-κβ	nuclear factor-κβ
NIRS	near infrared spectroscopy
NMR	nuclear magnetic resonance
NO	nitric oxide
NPs	nanoparticles
NRF	nuclear receptor factor
O-PA	orthophosphoric acid
OPG	oocyst per gram
ORAC	oxygen radical absorbance capacity
OSRC	Oxidative Stress Research Centre
PCA	principal component analysis
PCOS	polycystic ovarian syndrome
PD	Parkinson Disease
PDR	pan drug resistant
PDR	product decision rule
PGC-1	peroxisome proliferator-activated receptor gamma coactivator-1
PKA	protein kinase A
PLE	pressurized liquid extraction
PLGA	poly(lactic-co-glycolic) acid
PNN	probabilistic neural network
PNPs	polymeric nanoparticles
PPI	prepulse inhibition
PQQ	pyroloquinoline quinone
Prx-1	peroxiredoxin-1
RAAS	renin-angiotensin-aldosterone system

RAGE	receptor the advanced glycation endproducts
RF	random forest
RIN-5F	rat islet tumor cell line
RNA	ribonucleic acid
RNAi	RNA interference
ROS	reactive oxygen species
RPMI	Roswell Park Memorial Institute
S phase	synthesis phase
SAGE	serial analysis of gene expression
SCA	sickle cell anemia
SCD	sickle cell disease
SCF	supercritical fluid technology
SCT	sickle cell trait
SD	sprague dawley
SDH	succinate dehydrogenase
SFE	supercritical fluid extraction
SFME	solvent-free microwave extraction
SL	simple *logistic*
SLNs	solid lipid nanoparticles
SMEDDS	self-microemulsifying drug delivery system
SOD	superoxide dismutase
SRC	standard rat chow
SSI	Sense of Smell Institute
SSRIs	selective serotonin reuptake inhibitors
STAT3	signal transduction as well as transcription 3
STZ	streptozotocin
SVMRFE	support vector machine recursive feature elimination
TBA	thiobarbituric acid
TBAR	thiobarbituric acid reactive
TBARS	thiobarbituric acid reactive substances
t-BHP	tertiary-butyl hydroperoxide
TC	total cholesterol
TFA	trifluoroacetic acid
Tfam	mitochondrial transcription factor A
TG	triglycerides
THPs	traditional health practitioners
TLC	thin layer chromatography
TNF-α	tumor necrosis factor-α
TPA	12-O-tetradecanoyl phorbol-13-acetate
TRAP	free radical trapping abilities

Txn-1	thioredoxin-1
UAE	ultrasound-assisted extraction
URF	University Research Fund
VEGF	vascular endothelial growth factor
VMHD	vacuum microwave hydro-distillation
VOCs	volatile organic compounds
WAD	West African Dwarf
WBC	white blood cells
WHCO5	human oesophageal cancer cells
WHO	World Health Organization
XDR	extensive drug resistant
YGS	Yi-gan san

SYMBOLS

μM	micromole
α-T	alpha-tocopherol
β-T	beta-tocopherol
γ-GT	γ-glutamyl transferase
γ-T	gamma-tocopherol
δ-T	delta-tocopherol

PREFACE

To be healthy is our moral responsibility;
Towards Almighty God, ourselves, our family, and our society;
Eating fruits and vegetables makes us healthy;
Believe and have faith;
Reduction of food waste can reduce the world hunger
and can make our planet ecofriendly.
—Megh R. Goyal, PhD
Senior Editor-in-Chief

Medicinal plants contain certain chemicals in their organs, such as leaves, stem, root, and fruits, which can provide therapeutic benefits against different kinds of diseases. These chemicals are often referred to as "phytochemicals." The word "phyto" is a Greek word, that means "plant." Phytochemicals are natural non-essential bioactive compounds found in plants/plant foods. Thousands of phytochemicals have already been identified, and more are still being discovered year by year. Plants that are used for medicinal purposes are often considered to be less toxic and induce fewer side effects than synthetic medicine. In our world today, many commercially available drugs have plant-based origins, with more than 30% of modern medicines directly or indirectly derived from medicinal plants. Indeed, plants can be a major source of pharmaceutical agents in the treatment of many life-threatening diseases.

The use of medicinal plants has largely increased because they are locally accessible, economical, as well as vital in promoting health. However, scientific data and information regarding the safety and efficacy of these medicinal plants are inadequate.

We introduce this book volume under the book series Innovations in Plant Science for Better Health: From Soil to Fork. This book mainly covers the current scenario of the research and case studies and contains scientific evidence on the health benefits that can be derived from medicinal plants and how their efficacies can be improved. The findings reported in this book can be useful in health policy decisions. It will also motivate the development of health care products from plants for health benefits. The book will further encourage the preservation of traditional medical knowledge of medicinal

plants. Therefore, these plant products are drawing the attention of researchers and policymakers because of their demonstrated beneficial effects against diseases with high global burdens such as diabetes, hypertension, cancer, and neurodegenerative diseases.

This book volume is a treasure house of information and an excellent reference for researchers, scientists, students, growers, traders, processors, industries, dieticians, medical practitioners, and others. We hope that this compendium will be useful for the students and researchers as well as those working in the food, nutraceutical, and herbal industries.

The contributions by the cooperating authors to this book volume have been most valuable in the compilation. Their names are mentioned in each chapter and in the list of contributors. We appreciate you all for having patience with our editorial skills. This book would not have been written without the valuable cooperation of these investigators, many of whom are renowned scientists who have worked in the field of plant science and food science throughout their professional career.

The goal of this book volume is to guide the world science community on how plant-based secondary metabolites can alleviate us from various conditions and diseases.

We will like to thank editorial and production staff, and Ashish Kumar, Publisher and President at Apple Academic Press, Inc., for making every effort to publish this book when all are concerned with health issues.

We request the reader to offer your constructive suggestions that may help to improve the next edition.

We express our admiration to our families and colleagues for their understanding and collaboration during the preparation of this book volume. As an educator, We give a piece of advice to one and all in the world: "*Permit that our almighty God, our Creator, provider of all and excellent Teacher, feed our life with Healthy Food Products and His Grace—; and Get married to your profession.*"

—Editors

PART I
Phytochemistry of Medicinal Plants

CHAPTER 1

ANTIOXIDANT AGENTS FROM GREEN LEAFY VEGETABLES: A REVIEW

ABIOLA FATIMAH ADENOWO, MUHIBAH FOLASHADE ILORI, and MUTIU IDOWU KAZEEM

ABSTRACT

Despite various reports on the biochemical importance of several green leafy vegetables abundant in Nigeria and other countries of sub-Saharan Africa, not enough research has been done on the utilization of these vegetables as nutraceuticals and drugs. It is highly recommended that further studies be carried out for:

1. Identification and isolation of the bioactive compounds responsible for the observed antioxidant properties of green leafy vegetables;
2. Utilization of isolated bioactive compound in the development of nutraceuticals and drugs to alleviate oxidative stress-related diseases and complications;
3. Utilization of bioactive component by the food manufacturing industry to retard oxidative degradation in foods in order to improve food quality and improve shelf-life.

1.1 INTRODUCTION

Green vegetables are herbaceous plant species, whose parts are eaten as auxiliary food or core dishes. The consumption of green leafy vegetables is a major aspect of cultural heritage that plays vital functions in the customs, traditions, and food culture of traditional households. Nigeria is bestowed with a diversity of traditional vegetables; and different ethnic groups consume different vegetables for various beneficial reasons [58].

Vegetables are reaped at different phases of growth and consumed either in fresh, processed, or semi-processed state by humans, whereas they are generally given in the fresh form to livestock. The nutritional constituents of vegetables differ substantially, but generally, they are not main sources of carbohydrates in comparison with starchy foods. Nevertheless, vegetables are packed with ample quantities of crude fiber, vitamins, minerals, carotene, and essential amino acids [38, 79].

Green leafy vegetables are useful for the preservation of health and prevention of diseases, due to treasured food nutrients necessary for body build-up as well as repair [1, 35]. Aside from rich nutritional values of vegetables, they are the cheapest and most abundant source of proteins due to their ability to produce amino acids from simple materials like water, carbon dioxide as well as atmospheric nitrogen [13, 20]. Aside from their low methionine content, most species of green leafy vegetables have amino acid profiles comparable with those of egg, fish, meat, and soybean; and their amino acid profile exceeds the Food and Agriculture Organization (FAO) stipulated pattern of essential amino acids [13].

Vegetables have low calories as well as insignificant amounts of utilizable energy; and therefore, these are ideal for obese individuals who can gratify their appetite without fear of accumulating calories. Additionally, vegetables are valuable in conserving alkaline reserve of the human body by acting as buffering mediators for acidic substances in the GI tract [4].

This chapter presents an overview of the antioxidant potential of green leafy vegetables and their role in the prevention and/or mitigation of oxidative stress-related diseases.

1.2 GREEN LEAFY VEGETABLES VERSUS OXIDATIVE STRESS-RELATED DISEASES

Numerous human degenerative conditions (such as cancer, atherosclerosis, *diabetes mellitus*, heart disease, stroke, ulcers, rheumatoid arthritis, osteoporosis, cataract, sunburn, and aging) have been documented as the outcome of damage by free radicals and reactive oxygen species (ROS) [3]. Several studies have also been undertaken on how to prevent or avoid the onset of such diseases. Nevertheless, the most possible and practical approach for combating degenerative ailments is by increasing the body antioxidant status, which can be realized by more intake of fruits and vegetables. Green leafy vegetables typically contain high amounts of natural antioxidants, which are able to scavenge free radicals [24, 25, 84].

The antioxidant action of leafy vegetables may be due to the presence of biocompounds like flavones, isoflavone, flavonoids, catechin, isocatechin, and anthocyanin rather than only vitamins C, E, and β-carotene [65, 70]. Dietary antioxidants are essential to manage ROS, which cause damage to the DNA, RNA, alter proteins, and affect lipid peroxidation (LPO) in the cells. Antioxidants can inhibit the commencement or proliferation of oxidative stress in organisms [64]. Researchers have shown a keen interest in the study of antioxidants for combating the deleterious consequence of free radicals; and natural products such as fruits and vegetables are in the limelight of such studies. Green leafy vegetables with reported antioxidant properties are discussed in this section.

1.2.1 TALINUM TRIANGULARE (WATER LEAF)

Talinum triangulare belongs to the family *Portulacaceae,* and originated from the tropical region of Africa, but it is extensively cultivated in Asia, South America and West Africa (especially in Nigeria) as a food crop [55]. It is greatly distributed in many ecological zones of Nigeria, where it is called '*Gbure*' in Yoruba, '*Nte-oka*' in Igbo and '*Alenyruwa*' in Hausa [64]. *T. triangulare* is a perennial plant and is popularly called 'waterleaf' due to its high moisture content of approximately 90.8mg/100mg of edible leaf [86]. It is an herbaceous plant with succulent stem and pink flowers, which is used as a sauce, flavoring as well as condiment in foods. Furthermore, it is utilized in folk medicine to alleviate diuretic ailments, gastrointestinal disorder, and edema [9, 19, 58].

This plant is rich in protein, essential oils (EOs), total lipids, cardiac glycosides, flavonoids as well as polyphenols. Phytochemical studies have revealed the occurrence of omega-3-fatty acids and copious amounts of essential minerals such as calcium, potassium as well as magnesium. It also contains soluble fibers like pectin as well as vitamins C; α-tocopherol, β-tocopherols, and β-carotene that are required for growth and development [54, 68].

Anyasor et al., [19] investigated the *in-vitro* antioxidant activity of aqueous and methanol extracts of *T. triangulare*. They showed that both extracts tested positive to rapid thin layer chromatography (TLC) screening for the presence of antioxidant activity. The color change upon spraying with diphenyl picrylhydrazyl (DPPH) (deep violet to yellow spots) suggested the presence of free radical scavengers. Notably, the free radical scavenging ability of the extracts was increased with increase in the concentration of the extract. Additionally, thiobarbituric acid reactive (TBAR) substances assays

indicated that the extract prevented LPO at a concentration of 100 µg/ml. A similar study by Amorim et al., [16] showed that the stems of this vegetable have phenolic compounds possessing high antioxidant activity based on the results of 1,1-diphenyl-2-picrylhydrazyl (DPPH) scavenging activity.

Liang et al., [55] evaluated the antioxidant activity of polysaccharides from *T. triangulare*. The polysaccharides were extracted with boiling water and deproteinized using the Savage method. The polysaccharides demonstrated varied degrees of antioxidant activities in a dose-dependent fashion, which necessitated further studies towards its utilization for the management of oxidative stress-induced diseases. Methanol and hydro-ethanol extracts of *T. triangulare* were also studied for their Fe^{3+} reducing ability and free radical scavenging activity. Results showed that both extracts demonstrated antioxidant activity, though the hydro-ethanol extract had stronger antioxidant properties [71].

1.2.2 TELFAIRIA OCCIDENTALIS (FLUTED PUMPKIN)

Telfairia occidentalis (fluted pumpkin) belongs to the family *Cucurbitaceae*. Once harvested, the leaves are cautiously detached from the stems because the stems are regarded as poisonous and are thus thrown away as waste [31]. Fluted pumpkins occur chiefly in the forest zones of Central and West Africa, mostly in Cameroun, Republic of Benin and Nigeria. The leaves of this plant are widely consumed due to its acknowledged nutritional and medicinal benefits. In Nigeria, it is called by various traditional names such as 'Ugu' in Igbo, 'Aporoko/Iroko' in Yoruba, 'Ubong' in Efik and 'Umeke' in Edo language [51, 67].

The seeds are cooked and used as a protein supplement in a wide range of local foods. The seeds are also utilized as composite flours for the manufacture of bakery produce like bread and cookies [39]. Mineral elements in this plant include calcium, magnesium, phosphorus, sodium, and iron. Interestingly, the high iron content (approximately 700 ppm) scientifically authenticate the folk tradition of administering aqueous extract of the leaves as a blood tonic to convalescing individuals [51, 67]. *T. occidentalis* also contain phenols, flavonoids, alkaloids, oxalates, saponins, resins, and glycosides [67, 81]. Additionally, it is enriched with amino acids, including alanine, aspartate, cysteine, methionine, and phenylalanine [20, 51].

Oboh et al., [67] investigated the antioxidant activity of aqueous and ethanol extracts of *T. occidentalis*. Both extracts showed antioxidant activity, but the aqueous extract exhibited significantly higher reducing

power (1.9 $O.D_{700}$) and free radical scavenging power (92%) than the ethanol extract. Several other researchers have equally established, with both *in vivo* and *in vitro* experiments, the ability of different extracts of *T. occidentalis* to prevent production of free radicals, scavenge free radicals, lower LPO as well as raised levels of antioxidant enzymes like catalase (CAT) and superoxide dismutase (SOD) [2, 46, 50, 63].

The recorded antioxidant potential of *T. occidentalis* might be attributed to the presence of bioactive constituents such as polyphenols, flavonoids, and vitamin C. An *in vivo* study showed the ability of aqueous leaf extract to enhance the oxidative status of the reproductive system of male Sprague-Dawley rats. The experimental rats were orally administered with 200, 400, and 800 mg/kg/day of freshly prepared aqueous extracts for 56 days (for spermatogenesis to take place). Thereafter, the animals were sacrificed, and the testicular oxidative status was assessed by measuring CAT activity, SOD activity, and glutathione peroxidase (GPx) activity. Results showed a dose-dependent (200 mg/kg/day gave best results) testiculo-protective ability of the aqueous extract of *T. occidentalis* [81].

1.2.3 GONGRONEMA LATIFOLIUM (UTAZI)

Gongronema latifolium (called 'Utazi' and 'Arokeke' in Igbo and Yoruba languages respectively in Nigeria) is a tropical rain forest plant predominantly used as a vegetable and spice. It is a member of the *Asclepiadaceae* family [32, 34]. This bitter-tasting green leafy vegetable is used traditionally in the management of anorexia, malaria, and nausea. Furthermore, the liquor of *G. latifolium* obtained after slicing the plant and boiling with lime extract or steeping in water for about three days is commonly taken as a purgative for colic, stomach upset and to treat signs associated with worm infections [35, 87].

Reports showed that this plant contains appreciable amounts of protein, fiber, saponins, EOs, flavonoids, and minerals (calcium, potassium, sodium, phosphorus, and cobalt). The amino acid profile revealed the plant is made up of both essential and non-essential amino acids and its pattern of amino acids is comparable with the World Health Organization (WHO) standards. Noteworthy is also the occurrence of high amounts of aspartic acid, glycine, and glutamic acid (13.8%, 10.3%, and 11.9%, respectively) [32, 33].

Fasakin et al., [37] studied the antioxidant activity of polyphenol extracts of *Gongronema latifolium in vitro*. Various assays (DPPH radical scavenging, chelation of metal ion, hydroxyl radical scavenging assay,

superoxide scavenging assay, and ferric reducing activity) confirmed the antioxidant property of various extracts of *G. latifolium*. The authors suggested that the leaf extract can function as a prospective source of natural antioxidants, while further research is needed for identification and isolation of the bioactive compounds for utilization in the food industry [37]. Similarly, other studies also confirmed the antioxidant activity of aqueous and ethanol extracts of *G. latifolium* [14, 87].

1.2.4 VERNONIA AMYGDALINA (BITTER LEAF)

Vernonia amygdalina belongs to the *Asteraceae* family, which grows in many African countries, including Cameroun, Zimbabwe, and Nigeria. It is commonly referred to as bitter leaf due to its bitter taste, which can be eliminated by continuous soaking in water and cooking. It is consumed as a vegetable food and in herbal preparations. Traditionally, it is used as a tonic, for tick control and in the treatment of constipation, fever, dysentery, hypertension, cough, and sexually transmitted diseases [36, 44]. Organic extracts of *V. amygdalina* have been established to possess cytotoxic activity against human carcinoma cells of nasopharynx as well as having antiparasitic and antimicrobial activities [36]. Numerous compounds with potent biological activities have been isolated from *V. amygdalina*, such as:

- Flavonoids;
- Anthraquinone;
- Steroids;
- Alkaloids;
- Glycosides;
- Luteolin;
- Luteolin 7-0-glucuronide;
- Luteolin 7-0-glucoside;
- Vernonioside [36, 47].

Johnson et al., [48] investigated the *in vitro* antioxidant activity of methanolic extract of *V. amygdalina*. The extract was established to possess DPPH scavenging activity of 96.65 µg/ml and Ferric reducing antioxidant power (FRAP) of 0.708. The results indicated that the extract possesses strong antioxidant activity [44]. Atangwho et al., [21] also reported a dose-dependent *in vitro* antioxidant activity of aqueous, methanol, chloroform as well as petroleum ester extracts of *V. amygdalina.*

Erasto et al., [34] also investigated the antioxidant effects (using reducing power assay and DPPH radical scavenging activity) of ethanol extract and two formerly isolated sesquiterpene lactones (vernodalol and vernolide) were reported. They showed that vernolide exhibited a higher reducing power than ethanol extract and vernodalol, while the ethanol extract showed higher radical scavenging activity. However, all three samples from *V. amygdalina* demonstrated appreciable antioxidant properties. Similarly, the antioxidant activity of boiled, cold, and methanolic extracts of *V. amygdalina* was estimated using DPPH free radical assay. Results confirmed the antioxidant action of this green leafy vegetable at various concentrations studied [43].

1.2.5 OCIMUM GRATISSIMUM (CLOVE BASIL OR SCENT LEAF)

Ocimum gratissimum is a perennial plant that is broadly distributed in the tropics of Africa as well as warm temperature regions. *O. gratissimum* (popularly called 'Scent leaf') is a traditional vegetable condiment used in Nigeria and some other countries to increase food flavor, as well as oral care products. This aromatic plant is widely used as expectorant and carminative, and traditionally employed in the treatment of epilepsy, rheumatism, paralysis, gonorrhea, diarrhea, influenza, and mental illness in India and Africa [22, 78]. It is used in south-eastern Nigeria in the management of umbilical cord of neonates to sustain sterility of the wound surfaces. Its roots are also used by Brazilian tropical forest inhabitants as part of the constituents of a decoction as a sedative for children [77]. Volatile aromatic oil from the leaves comprises principally of thymol and eugenol as well as xanthones, terpenes, and lactones, which possess antiseptics, antibacterial, and antifungal activities as well as an insect repellent [10].

The free radical scavenging ability of methanol extract of the leaves of *O. gratissimum* was evaluated by assessing its ability to scavenge 2,2-diphenyl-1-picrylhydrazyl, superoxide anion, hydroxyl, nitric oxide (NO) radicals, and its capability to inhibit LPO. It was concluded that the plant is a potential source of natural antioxidants that would be valuable in food manufacturing to retard oxidative degradation of lipids and thus increase food quality [22].

Akinmoladun et al., [10] showed that methanol extract of *O. gratissimum* had a DPPH scavenging activity of 84.6% at 250 µg/ml and a reductive potential of 0.77 at 100 µg/ml. These values were comparable with values obtained for standards, gallic acid, and ascorbic acid. These results affirm

to the wide traditional use of the plant extract in the management of various human maladies. The essential oil of *O. gratissimum* has also been confirmed to possess good antioxidant activity through the DPPH radical scavenging activity and β-carotene-linoleic acid bleaching assay in a dose-dependent fashion [78]. This is an indication that the essential oil will be valuable in food processing and preservation.

1.2.6 CORCORUS OLITORIUS (JUTE)

C. olitorius (Jute) belongs to the *Tiliaceae* family. This annual herb is native to Africa. It is also cultivated in several parts of India and Bangladesh [40, 65]. Jute plant is a common traditional vegetable, which is prepared into a slimy soup or sauce in many of West African culinary traditions. In Western Nigeria, it is known as 'ewedu' while the Songhay people of Mali refer to it as 'fakohoy.' Furthermore, it is a common meal ingredient in the Northern province of the Philippines, where it is known as 'saluyot' and in Taiwan where it is boiled with sweet potatoes into a nourishing meal. The plant is rich in flavonoids, α-tocopherol, carotenoids, polyphenols, as well as vitamin C, iron, and calcium [65, 91]. It is popularly used in folk medicine for treating ailments like dysentery, bone pains, fever, gastroenteritis, and diabetes. The seeds are also used traditionally as a contraceptive [26, 40, 92].

Azuma et al., [23] identified six phenolic compounds from the leaves of *C. olitorus* using nuclear magnetic resonance (NMR) and Fast atom bombardment mass spectrometry (FAB-MS). The compounds are 5-caffeoylquinic acid (chlorogenic acid), 3,5-dicaffeoylquinic acid, quercetin 3-galactoside, quercetin 3-glucoside, and quercetin 3-(6-malonylglucoside). Thereafter, the content of these phenolic acids, α-tocopherol, and ascorbic acid was assessed, and their antioxidant potential was measured with radical generator-initiated peroxidation of linoleic acid. The results revealed that 5-caffeoylquinic acid was the major phenolic antioxidant in the leaves of *C. olitorus* [23].

Similarly, Oboh et al., [69] assessed the antioxidant activity of hydrophilic (water) and lipophilic (hexane) extracts of *C. olitorusin vitro*. Their study showed that both extracts exhibited significant antioxidant properties. However, the hydrophilic extract showed higher free radical scavenging ability, reducing power and trolox equivalent antioxidant capacity than the lipophilic extract, due to the higher content of total phenol, total flavonoid, and ascorbic acid compared with the lipophilic extract [69].

1.2.7 GNETUM AFRICANUM (UKAZI)

Gnetum africanum belongs to the family *Gnetaceae*, which is extensively distributed in Cameroun, Equatorial Guinea, Central Africa Republic, Gabon, and Nigeria. It is widely consumed in the South East region of Nigeria, where it is known as 'Afang' or 'Ukazi.' It is often cooked with water-leaves and also consumed as vegetable salad [15, 30].

Traditionally, *G. africanum* is used in the management of several illnesses including nausea, boils, enlarged spleen, and neutralization of some poisons and to reduce the pain during childbirth. It is also used for the treatment of hemorrhoids, diabetes, and as worm expeller [46, 76]. The leaves have been reported to have great nutritional value constituting a significant source of protein, minerals, and essential amino acids. Numerous molecular compounds associated to the families of stilbenes, flavonostilbenes, and glycosylflavones have been isolated and identified in the leaf extract of this plant. These compounds may be responsible for the interesting properties and biological activities of the plant [15, 29].

The antioxidant potential of both raw and cooked leaf extracts of *G. africanum* was investigated by Ogbonnaya and Chinedum [72]. The results for vitamin assay showed that both the raw and cooked leaf extracts had a significant content of vitamin C and E, and their concentrations were not affected by cooking. Analysis of the scavenging activities of both extracts using 2,2-diphenyl-1-picrylhydrazyl radical showed that both extracts had significant scavenging activity. The results obtained can be attributed to their polyphenolic contents, which possess varying levels of antioxidant activity and the hydrogen donating capacity of the OH groups of the phenolic compounds. Similar results were also reported by other researchers [6, 11].

1.2.8 PIPER GUINEENSE (AFRICAN BLACK PEPPER)

Piper guineense belongs to the family *Piperaceae*, and there are about 700 species spread across tropical and subtropical regions of the world. It is generally called African black pepper or hot leaf in various parts of Africa such as Ghana, Cameroon, and Nigeria, where it is consumed as a spice due to its nutritional and therapeutic properties. In Nigeria, it is known by various local names such as 'Uziza' in Igbo and 'Iyere' in Yoruba [18, 60]. In Nigeria, the seeds are used by women after childbirth to increase uterine contraction in order to ease the ejection of the placenta as well as other residues from the womb. The leaves are also used in the management of

cough, male infertility, respiratory, and intestinal diseases. They also have carminative, appetitive, and eupeptic properties [7]. The antimicrobial, antiparasitic, antifungal, and insecticidal activities of the leaves and seeds have also been reported. Its phytoconstituents include:

- Alkaloids;
- Sterols;
- Flavonoids;
- Saponins;
- Glycosides [18, 60].

The hydro-ethanolic and ethanolic extracts of leaves and stems of the *P. guineense* were investigated for their free radical scavenging activities as well as antioxidant potential. The results showed that the extracts significantly inhibited the DPPH, $ABTS^{+}$, NO, and OH^{-} radicals in a concentration-dependent manner. A significant ferrous ion chelating ability was also observed through FRAP and phosphomolybdenum antioxidant potential assays. The study also revealed that the polyphenol content of this plant differs subject to the form of extracts and the solvent used. However, the hydro-ethanolic and ethanolic extracts of leaves presented a higher level of phenolic compounds [60]. Hence further studies need to be done to isolate and characterize the bioactive compounds responsible for the observed action. Similarly, Agbor et al., [7] investigated the *in vitro* antioxidant potential of three Piper species including *P. guineense*, and their results showed that methanolic leaf extract of all species studied possess antioxidant activity in a dose-dependent manner [7].

1.2.9 CELOSIA ARGENTIA (PLUMED COCKSCOMB)

Celosia argentea is a tropical herbaceous plant from the family *Amaranthaceae*, known for its attractive and distinctive brightly-colored flowers. It is commonly referred to as plumed cockscomb or the feathery amaranth. It is widely distributed in Southern Asia, China, and some parts of Africa. It is popularly consumed as a vegetable in the Western part of Nigeria, where it is known as 'red soko' due to red pigmentation on its leaves [49, 57, 90]. The seeds are very small and are used traditionally for the management of jaundice, fever, gonorrhea, and wounds; and for the treatment of itching, sores, ulcers, and fever. The plant has been studied for antibacterial, anti-inflammatory, diuretic, antipyretic, antidiarrheal and antidiabetic properties. Amino acids,

carbohydrates, flavonoids, tannins, saponins, phytosterols, and glycosides are some of the reported phytochemicals present in the plant [54, 82].

Mahadik et al., [56] investigated the antioxidant activity of ethanolic extract of *C. argentea in vitro* via the reducing power assessment. They showed that the ethanolic extracts of *C. argentea* compared significantly with that of the standard antioxidant agent ascorbic acid. Combination of the extract and ascorbic acid also produced a synergistic effect. These results indicated that ethanolic extract of the plant can be utilized as natural antioxidant either alone or in combination with ascorbic acid. A similar study with methanolic leaf extracts of *Celosia argentea* using DPPH, NO, and hydrogen peroxide (H_2O_2) radical showed a concentration-dependent free radical scavenging property [89]. *In vivo* and *in vitro* studies revealed the antioxidant ability of various extracts of *C. argentea*, and the observed activity was attributed to the presence of phenolic compounds in the plant [41, 80].

1.2.10 SOLANUM MACROCARPON (EGGPLANT)

Solanum macrocarpon is a flowering herbaceous plant usually used for its nutritional content and medicinal properties. It is commonly cultivated in Western Africa countries, where it functions as a source of fruit and leafy vegetable [27, 52]. It is found in the southwestern region of Nigeria, where it is called igbagba or 'Igbo' [62, 66]. The leaves are packed with fat, protein, calcium, zinc, crude fiber, as well as appreciable amounts of the amino acid and methionine [52].

Besides the use of the leaves for culinary purpose, different parts of the plants are used traditionally for diverse purposes. In Sierra Leone, the leaves are heated and masticated to treat throat complications; while in Kenya, the liquor from boiled roots is drinking to purge out hookworms, whereas the crushed leaves are taken to alleviate stomach disorders [27, 83]. The fruits are eaten in Nigeria as purgatives and are also used in the management of heart disease, while the flowers are chewed to maintain oral hygiene. The roots are also used for treating wounds, body aches, bronchitis, itch, and asthma while the seeds are used to cure toothache. Several reports on aqueous extract of its fruits have shown its hemolytic, hepatoprotective, and hypolipidemic activities [27, 52, 62, 66].

Study on the free radical scavenging activity of the ethanolic leaves extract using the DPPH assay showed a dose-dependent activity, which may be attributed to its high phenolic content [52]. Similarly, Olajire and Azeez [74] investigated the total antioxidant activity of various commonly

consumed vegetables in Nigeria. Their findings showed that *S. macrocarpon* has the best antioxidant properties, compared to other vegetables and standard antioxidant agent tocopherol. This was revealed by its lowest IC_{50} value (6.21 mg ml^{-1}), compared to α-tocopherol (IC_{50}: 13.20 mg mL^{-1}). It also possesses the highest total phenolic, flavonoid as well as ascorbic acid contents compared with the other vegetables studied. Similar works also confirmed the ability of various extracts of *S. macrocarpon* leaves to alleviate oxidative stress due to its antioxidant activity [52, 59, 73].

1.2.11 BASELLA ALBA (VINE SPINACH)

Basella alba is a perennial plant, which belongs to the *Basellaceae* family. It is commonly called Malabar spinach, Red vine spinach or creeping spinach. It is generally found in the tropical countries of the world, including Nigeria, where it is common in the south-west region. It is composed of fat, proteins, vitamins A, B (folic acid), C, E, and K, as well as riboflavin, niacin, thiamine. It also has minerals, including iron, calcium, and magnesium. Studies showed that it has some unique constituents like betalain, basellasaponins, and kaempferol [5, 42, 75].

Various parts of the plant are used for several purposes in traditional medicines. In Nepal, the leaf extract is used in the treatment of cold and cough while the pastes are used externally in treating boils. The boiled leaves and stems are administered as laxatives, and the flowers are useful as an antidote for poisons [88]. The leaves and stem are also used in the management of diarrhea, dysentery, anemia, cough, cold, headaches, and ringworm. It also aids in the removal of placenta after childbirth as well as increase the flow of milk in nursing mother [5, 85].

Sridevi et al., [85] investigated the antioxidant potential of ethanolic leaf extract of *Basella alba* using *in vitro* assays and using 2,2-diphenyl-1-picryl hydrazyl (DPPH), reducing power assay, and phosphomolybdenum assay. The results showed that the extract exhibited significant free radical scavenging activity compared with the standard, gallic acid.

In an effort to study the antioxidant potential of ethyl acetate and chloroform extracts of *Basella alba* leaves, the phenol and flavonoid content of the extracts were measured by aluminum chloride assays and Folin Ciocalteu assay, respectively. Results showed that the total phenolic contents of the ethyl acetate and chloroform extracts were 0.029 mg/g and 0.030 mg/g, respectively, whereas the total flavonoids content were 0.045 mg/g and 0.085 mg/g, respectively.

Furthermore, both extracts showed radical scavenging activity in a concentration-dependent manner. Hence, *Basella alba* contains ample antioxidant agents and may be valuable for the formulation of drugs/nutraceuticals to combat oxidative stress-related disorders [75].

1.3 SUMMARY

This review summarizes some reported findings on the antioxidant potential of some commonly consumed green leafy vegetables in Nigeria. It focuses on the reported ability of various extracts of the studied green leafy vegetables to alleviate conditions associated with oxidative stress both *in vivo* and *in vitro*. Hence, these green vegetables are recommended for further study towards the development of nutraceutical and drugs for combating oxidative stress associated conditions.

KEYWORDS

- **antioxidants**
- **bitter leaf**
- **clove basil**
- **epilepsy**
- **fluted pumpkin**
- **free radicals**
- **kaempferol**
- **omega-3 fatty acid**
- **oxidative stress**
- **plumed cockscomb**
- **polyphenols**
- **saponins**
- **superoxide dismutase**
- **nuclear magnetic resonance**
- **vernodalol**
- **waterleaf**

REFERENCES

1. Acho, C. F., Zoue, L. T., Akpa, E. E., Yapo, V. G., & Niame, S. L., (2014). Leafy vegetables consumed in Southern Côte d'Ivoire: A source of high value nutrients. *Journal of Animal and Plant Science*, *20*(3), 3159–3170.
2. Adaramoye, O. A., Achem, J., Akintayo, O. O., & Fafunso, M. A., (2007). Hypolipidemic effect of *Telfairia occidentalis* (fluted pumpkin) in rats fed a cholesterol-rich diet. *Journal of Medicinal Foods*, *10*(2), 330–336.
3. Adefegha, S. A., & Oboh, G., (2011). Enhancement of total phenolics and antioxidant properties of some tropical green leafy vegetables by steam cooking. *Journal of Food Processing and Preservation*, *35*(5), 615–622.
4. Adeniyi, S. A., Ehiagbonare, J. E., & Nwangwu, S. C. O., (2012). Nutritional evaluation of some staple leafy vegetables in Southern Nigeria. *International Journal of Agriculture and Food Science*, *2*(2), 37–43.
5. Adhikari, R., Naveen, K. H. N., & Shruthi, S. D., (2012). A review on medicinal importance of *Basella alba. L. International Journal of Pharmaceutical Science and Drug Research*, *4*(2), 110–114.
6. Agbor, G. A., Moumbegna, P., Oluwasola, E. O., Nwosu, L. U., Njoku, R. C., Kanu, S., Emekabasi, E., Akin, F., Obasi, A. P., & Abudei, F. A., (2011). Antioxidant capacity of some plants foods and beverages consumed in the eastern region of Nigeria. *African Journal of Traditional Complementary and Alternative Medicine, 8*(4), 362–369.
7. Agbor, G. A., Vinson, J. A., Oben, J. E., & Ngogang, J. Y., (2008). *In vitro* antioxidant activity of three piper species. *Journal of Herbal Pharmacotherapy*, *7*(2), 49–64.
8. Agbor, G. A., Vinson, J. A., Sortino, J., & Johnson, R., (2012). Antioxidant and anti-atherogenic activities of three Piper species on atherogenic diet fed hamsters. *Experimental and Toxicologic Pathology*, *64*(4), 387–391.
9. Aja, P. M., Okaka, A. N. C., Ibiam, U. A., Uraku, A. J., & Onu, P. N., (2010). Proximate analysis of *Talinum triangulare* (Water Leaf) leaves and its softening principle. *Pakistan Journal of Nutrition*, *9*(6), 524–526.
10. Akinmoladun, A. C., Ibukun, E. O., Afor, E., Obuotor, E. M., & Farombi, E. O., (2007). Phytochemical constituent and antioxidant activity of extract from the leaves of *Ocimum gratissimum*. *Science Research and Essay*, *2*(5), 163–166.
11. Akintola, A. O., Ayoola, P. B., & Ibikunle, G. J., (2012). Antioxidant activity of two Nigerian green leafy vegetables. *Journal of Pharmaceutical and Biomedical Science*, *14*(14), 110–119.
12. Akuodor, G. C., Idris-Usman, M. S., Mbah, C. C., Megwas, U. A., Akpan, J. L., Ugwu, T. C., Okoroafor, D. O., & Osunkwo, U. A., (2010). Studies on anti-ulcer, analgesic and antipyretic properties of the ethanolic leaf extract of *Gongronema latifolium* in rodents. *African Journal of Biotechnology*, *9*(15), 2316–2321.
13. Aletor, O., Oshodi, A. A., & Ipinmoroti, K., (2002). Chemical composition of common leafy vegetables and functional properties of their leaf protein concentrates. *Food Chemistry*, *78*(1), 63–68.
14. Alhaji, U. I., Samuel, N. U., Aminu, M., Chidi, A. V., Umar, Z. U., Umar, U. A., & Adewale, B. M., (2014). *In vitro* antitrypanosomal activity, antioxidant property and phytochemical constituents of aqueous extracts of nine Nigerian medicinal plants. *Asian Pacific Journal of Tropical Diseases*, *4*(5), 348–355.

15. Ali, F., Assanta, M. A., & Robert, C., (2011). *Gnetum africanum*: A wild food plant from the African forest with many nutritional and medicinal properties. *Journal of Medicinal Foods*, *14*(11), 1289–1297.
16. Amorim, A. P. O., De Oliveira, M. C. C., De Azevedo Amorim, T., & Echevarria, A., (2013). Antioxidant, iron chelating and tyrosinase inhibitory activities of extracts from *Talinum triangulare* leach stem. *Antioxidants*, *2*, 90–99.
17. Andarwulan, N., Batari, R., Sandrasari, D. A., Bolling, B., & Wijaya, H., (2010). Flavonoid content and antioxidant activity of vegetables from Indonesia. *Food Chemistry*, *121*(4), 1231–1235.
18. Anyanwu, C. U., & Nwosu, G. C., (2014). Assessment of the antimicrobial activity of aqueous and ethanolic extracts of *Piper guineense* leaves. *Journal of Medicinal Plant Research*, *8*(10), 436–440.
19. Anyasor G, N., Ogunwenmo, K. O., Ogunnowo, A. A., & Olabisi, A. S., (2010). Comparative antioxidant, phytochemical and proximate analysis of aqueous and methanolic extracts of *Vernonia amygdalina* and *Talinum triangulare*. *Pakistan Journal of Nutrition*, *9*(3), 259–264.
20. Asaolu, S. S., Adefemi, O. S., Oyakilome, I. G., Ajibulu, K. E., & Asaolu, M. F., (2012). Proximate and mineral composition of Nigerian leafy vegetables. *Journal of Food Research*, *1*(3), 214–218.
21. Atangwho, I. J., Egbung, G. E., Ahmad, M., Yam, M. F., & Asmawi, M. Z., (2013). Antioxidant versus anti-diabetic properties of leaves from *Vernonia amygdalina Del*. growing in Malaysia. *Food Chemistry*, *141*(4), 3428–3434.
22. Awah, F. M., & Verla, A. W., (2010). Antioxidant activity, nitric oxide scavenging activity and phenolic contents of *Ocimum gratissimum* leaf extract. *Journal of Medicinal Plants Research*, *4*(24), 2479–2487.
23. Azuma, K., Nakayama, M., Koshioka, M., Ippoushi, K., Yamaguchi, Y., Kohata, K., Yamauch, Y., Ito, H., & Higashio, H., (1999). Phenolic antioxidants from the leaves of *Corchorus olitorius* L. *Journal of Agricultural and Food Chemistry*, *47*(10), 3963–3966.
24. Boivin, D., Lamy, S., Lord-Dufour, S., Jackson, J., Beaulieu, E., Côté, M., Moghrabi, A., Barrette, S., Gingras, D., & Béliveau, R., (2009). Antiproliferative and antioxidant activities of common vegetables: A comparative study. *Food Chemistry*, *112*(2), 374–380.
25. Chu, Y. F., Sun, J. I. E., Wu, X., & Liu, R. H., (2002). Antioxidant and antiproliferative activities of common vegetables. *Journal of Agricultural and Food Chemistry*, *50*(23), 6910–6916.
26. Dewanjee, S., Sahu, R., Karmakar, S., & Gangopadhyay, M., (2013). Toxic effects of lead exposure in Wistar rats: Involvement of oxidative stress and the beneficial role of edible jute (*Corchorus olitorius*) leaves. *Food and Chemical Toxicology*, *55*, 78–91.
27. Dougnon, T. V., Bankolé, H. S., Johnson, R. C., Klotoé, J. R., Dougnon, G., Gbaguidi, F., Assogba, F., Gbenou, J., Sahidou, S., Ategbo, J., & Rhin, B., (2012). Phytochemical screening, nutritional and toxicological analyses of leaves and fruits of *Solanum macrocarponLinn (Solanaceae)* in Cotonou (Benin). *Food and Nutritional Science*, *3*(11), 1595–1608.
28. Eddy, N. O., & Ebenso, E. E., (2010). Corrosion inhibition and adsorption properties of ethanol extract of *Gongronema latifolium* on mild steel in H_2SO_4. *Pigment and Resin Technology*, *39*(2), 77–83.
29. Edet, U. U., Ehiabhi, O. S., Ogunwande, I. A., Walker, T. M., Schmidt, J. M., Setzer, W. N., & Ekundayo, O., (2005). Analyses of the volatile constituents and antimicrobial

activities of *Gongronema latifolium (Benth.)* and *Gnetum africanum L*. *Journal of Essential Oil Bearing Plants*, *8*(3), 324–329.
30. Ekop, A. S., (2007). Determination of chemical composition of *Gnetum africanum* (Afang) seeds. *Pakistan Journal of Nutrition*, *6*(1), 40–43.
31. Ekpete, O. A., & Horsfall, M. J. N. R., (2011). Preparation and characterization of activated carbon derived from fluted pumpkin stem waste (*Telfairia occidentalis* Hook F). *Research Journal of Chemical Science*, *1*(3), 10–17.
32. Eleyinmi, A. F., (2007). Chemical composition and antibacterial activity of *Gongronema latifolium. Journal of Zhejiang University of Science B*, *8*(5), 352–358.
33. Eleyinmi, A. F., Sporns, P., & Bressler, D. C., (2008). Nutritional composition of *Gongronema latifolium* and *Vernonia amygdalina*. *Nutritional and Food Science*, *38*(2), 99–109.
34. Erasto, P., Grierson, D. S., & Afolayan, A. J., (2007). Antioxidant constituents in *Vernonia amygdalina* leaves. *Pharmaceutical Biology*, *45*(3), 195–199.
35. Falade, O. S., Sowunmi, O. R., Oladipo, A., Tubosun, A., & Adewusi, S. R., (2003). The level of organic acids in some Nigerian fruits and their effect on mineral availability in composite diets. *Pakistan Journal of Nutrition*, *2*(2), 82–88.
36. Farombi, E. O., & Owoeye, O., (2011). Antioxidative and chemopreventive properties of *Vernonia amygdalina* and *Garcinia* biflavonoids. *International Journal of Environmental Research and Public Health*, *8*(6), 2533–2555.
37. Fasakin, C. F., Udenigwe, C. C., & Aluko, R. E., (2011). Antioxidant properties of chlorophyll-enriched and chlorophyll-depleted polyphenolic fractions from leaves of *Vernonia amygdalina* and *Gongronema latifolium. Food Research International*, *44*(8), 2435–2441.
38. Fasuyi, A. O., (2006). Nutritional potentials of some tropical vegetable leaf meals: Chemical characterization and functional properties. *African Journal of Biotechnology*, *5*(1), 49–53.
39. Giami, S. Y., Achinewhu, S. C., & Ibaakee, C., (2005). The quality and sensory attributes of cookies supplemented with fluted pumpkin (*Telfairia occidentalis* Hook) seed flour. *International Journal of Food Science and Technology*, *40*(6), 613–620.
40. Gupta, M., Mazumder, U. K., Pal, D. K., & Bhattacharya, S., (2003). Anti-steroidogenic activity of methanolic extract of *Cuscuta reflexa Roxb*. stem and *Corchorus olitorius Linn*. seed in mouse ovary. *Indian Journal of Experimental Biology*, *41*(6), 641–644.
41. Hamzah, R. U., Jigam, A. A., Makun, H. A., & Egwim, E. C., (2014). Phytochemical screening and *in-vitro* antioxidant activity of methanolic extract of selected Nigerian vegetables. *Asian Journal of Basic and Applied Sciences*, *1*(1), 1–14.
42. Haskell, M. J., Jamil, K. M., Hassan, F., Peerson, J. M., Hossain, M. I., Fuchs, G. J., & Brown, K. H., (2004). Daily consumption of Indian spinach *(Basella alba)* or sweet potatoes has a positive effect on total-body vitamin A stores in Bangladeshi men. *American Journal of Clinical Nutrition*, *80*(3), 705–714.
43. Iwalewa, E. O., Adewunmi, C. O., Omisore, N. O. A., Adebanji, O. A., Azike, C. K., Adigun, A. O., Adesina, O. A., & Olowoyo, O. G., (2005). Pro- and antioxidant effects and cytoprotective potentials of nine edible vegetables in southwest Nigeria. *Journal of Medicinal Foods*, *8*(4), 539–544.
44. Iwalokun, B. A., Efedede, B. U., Alabi-Sofunde, J. A., Oduala, T., Magbagbeola, O. A., & Akinwande, A. I., (2006). Hepatoprotective and antioxidant activities of *Vernonia amygdalina* on acetaminophen-induced hepatic damage in mice. *Journal of Medicinal Foods*, *9*(4), 524–530.

45. Iweala, E. E. J., & Obidoa, O., (2009). Some biochemical, haematological and histological responses to a long term consumption of *Telfairia occidentalis* supplemented diet in rats. *Pakistan Journal of Nutrition*, *8*(8), 1199–1203.
46. Iweala, E. E., Uhuegbu, F. O., & Obidoa, O., (2009). Biochemical and histological changes associated with long term consumption of *Gnetum africanum Welw*. leaves in Rats. *Asian Journal of Biochemistry*, *4*(4), 125–132.
47. Izevbigie, E. B., (2003). Discovery of water-soluble anticancer agents (edotides) from a vegetable found in Benin City, Nigeria. *Experimental Biology and Medicine*, *228*(3), 293–298.
48. Johnson, M., Kolawole, O. S., & Olufunmilayo, L. A., (2015). Phytochemical analysis, *in vitro* evaluation of antioxidant and antimicrobial activity of methanolic leaf extract of *Vernonia amygdalina* (bitter leaf) against Staphylococcus aureus and *Pseudomonas aeruginosa. International Journal of Current Microbiology and Applied Science*, *4*(5), 411–426.
49. Kachchhi, N. R., Parmar, R. K., Tirgar, P. R., Desai, T. R., & Bhalodia, P. N., (2012). Evaluation of the antiurolithiatic activity of methanolic extract of *Celosia argentea* roots in rats. *International Journal of Phytopharmacy*, *3*(3), 249–255.
50. Katerere, D. R., Graziani, G., Thembo, K. M., Nyazema, N. Z., & Ritieni, A., (2012). Antioxidant activity of some African medicinal and dietary leafy African vegetables. *African Journal of Biotechnology*, *11*(17), 4103–4108.
51. Kayode, A. A. A., & Kayode, O. T., (2011). Some medicinal values of *Telfairia occidentalis*: A review. *American Journal of Biochemistry and Molecular Biology*, *1*, 30–38.
52. Komlaga, G., Sam, G. H., Dickson, R. A., Mensah, M. L. K., & Fleischer, T. C., (2014). Pharmacognostic studies and antioxidant properties of the leaves of *Solanum macrocarpon*. *Journal of Pharmaceutical Science Research*, *6*(1), 1–4.
53. Kumar, A., Prasad, M. N. V., & Sytar, O., (2012). Lead toxicity, defense strategies and associated indicative biomarkers in *Talinum triangulare* grown hydroponically. *Chemosphere*, *89*(9), 1056–1065.
54. Kumar, C. P., & Mohana, K. N., (2014). Phytochemical screening and corrosion inhibitive behaviour of *Pterolobium hexapetalum* and *Celosia argentea* plant extracts on mild steel in industrial water medium. *Egyptian Journal of Petroleum*, *23*(2), 201–211.
55. Liang, D., Zhou, Q., Gong, W., Wang, Y., Nie, Z., He, H., Li, J., Wu, J., & Zhang, J., (2011). Studies on the antioxidant and hepatoprotective activities of polysaccharides from *Talinum triangulare*. *Journal of Ethnopharmacology*, *136*(2), 316–321.
56. Mahadik, S. U., Jagtap, V. N., Oswal, H., Kumawat, N., & Kothari, R., (201*1*). *In vitro* Antioxidant activity of ethanolic extracts of *Celosia argentea* aerial parts, fresh fruits of *Fragaria vesca*, *Tamarindus indica, Psidium guajava, Zizyphus mauritiana*. *Research Journal of Pharmaceutical Technology*, *4*(11), 1782–1784.
57. Malomo, S. O., Ore, A., & Yakubu, M. T., (2011). *In vitro* and *in vivo* antioxidant activities of the aqueous extract of *Celosia argentea* leaves. *Indian Journal of Pharmacology*, *43*(3), 278–285.
58. Mensah, J. K., Okoli, R. I., Ohaju-Obodo, J. O., & Eifediyi, K., (2008). Phytochemical, nutritional and medical properties of some leafy vegetables consumed by Edo people of Nigeria. *African Journal of Biotechnology*, *7*(14), 2304–2309.
59. Morrison, J. F., & Twumasi, S. K., (2013). Comparative studies on the *in vitro* antioxidant properties of methanolic and hydro-ethanolic leafy extracts from eight edible leafy vegetables of Ghana. *African Journal of Biotechnology*, *9*(32), 5177–5184.

60. Moukette, B. M., Anatole, P. C., Biapa, C. P. N., Njimou, J. R., & Ngogang, J. Y., (2015). Free radicals quenching potential, protective properties against oxidative mediated ion toxicity and HPLC phenolic profile of a Cameroonian spice: *Piper guineensis. Toxicology Reports*, *2*, 792–805.
61. Nantia, E. A., Manfo, F. P., Beboy, N. S., & Moundipa, P. F., (2013). *In vitro* antioxidant activity of the methanol extract of *Basella alba L (Basellaceae)* in rat testicular homogenate. *Oxid. Antioxid. Med. Sci., 2*(2), 131–136.
62. Nwanna, E. E., Ibukun, E. O., & Oboh, G., (2013). Inhibitory effects of methanolic extracts of two eggplant species from South-western Nigeria on starch hydrolysing enzymes linked to type-2 diabetes. *African Journal of Pharmacy and Pharmacology*, *7*(23), 1575–1584.
63. Nwanna, E. E., & Oboh, G., (2007). Antioxidant and hepatoprotective properties of polyphenol extracts from *Telfairia occidentalis* (Fluted Pumpkin) leaves on acetaminophen induced liver damage. *Pakistan Journal of Biological Sciences*, *10*(16), 2682–2687.
64. Nwauzoma, A. B., & Dappa, M. S., (2013). Ethnobotanical studies of Port Harcourt metropolis, Nigeria. *ISRN Botany*, 1–11.
65. Oboh, G., Ademiluyi, A. O., Akinyemi, A. J., Henle, T., Saliu, J. A., & Schwarzenbolz, U., (2012). Inhibitory effect of polyphenol-rich extracts of jute leaf (*Corchorus olitorius*) on key enzyme linked to type 2 diabetes (α-amylase and α-glucosidase) and hypertension (angiotensin I converting) *in vitro*. *Journal of Functional Foods*, *4*(2), 450–458.
66. Oboh, G., Ekperigin, M. M., & Kazeem, M. I., (2005). Nutritional and haemolytic properties of eggplant (*Solanum macrocarpon*) leaves. *Journal Food Composition and Analysis*, *18*(2), 153–160.
67. Oboh, G., Nwanna, E. E., & Elusiyan, C. A., (2006). Antioxidant and antimicrobial properties of *Telfairia occidentalis* (fluted pumpkin) leaf extracts. *Journal of Pharmacology and Toxicology*, *5*(8), 539–547.
68. Oboh, G., Raddatz, H., & Henle, T., (2008). Antioxidant properties of polar and non-polar extracts of some tropical green leafy vegetables. *Journal of the Science of Food and Agriculture*, *88*(14), 2486–2492.
69. Oboh, G., Raddatz, H., & Henle, T., (2009). Characterization of the antioxidant properties of hydrophilic and lipophilic extracts of jute *(Corchorus olitorius)* leaf. *International Journal of Food Science and Nutrition*, *60*, 124–134.
70. Oboh, G., & Rocha, J. B. T., (2007). Antioxidant in foods: A new challenge for food processors. *Leading Edge Antioxidants Research*, 35–64.
71. Ofusori, D. A., Adelakun, A. E., Ayoka, A. O., Oluwayinka, O. P., Omotoso, E. O., Odukoya, S. A., & Adeyemi, D. O., (2008). Waterleaf (*Talinum triangulare*) enhances cerebral functions in Swiss albino mice. *Journal of Neurological Science*, *25*(4), 239–246.
72. Ogbonnaya, E. C., & Chinedum, E. K., (2013). Health promoting compounds and *in vitro* antioxidant activity of raw and decoctions of *Gnetum africanum* Welw. *Asian Pacific Journal of Tropical Diseases*, *3*(6), 472–479.
73. Ogunlade, I., Tucker, G., Fisk, I., & Ogunlade, A., (2009). Evaluation of antioxidant activity and vitamin E profile of some selected indigenous vegetables in Nigerian diet. *Journal of Food Agriculture and Environment*, *7*(2), 143–145.
74. Olajire, A. A., & Azeez, L., (2011). Total antioxidant activity, phenolic, flavonoid and ascorbic acid contents of Nigerian vegetables. *African Journal of Food Science and Technology*, *2*(2), 22–29.

75. Olaniyi, T. A., Adeniran, S. A., Adebayo, L. A., Olusegun, K. A., & Oyedeji, T. A., (2013). Antioxidant and anti-lipid peroxidation potentials of the ethylacetate and chloroform extracts of *Basella alba* leaves. *Asian Journal of Natural and Applied Science*, *2*(2), 81–88.
76. Omoregie, E. S., & Osagie, A. U., (2012). Antioxidant properties of methanolic extracts of some Nigerian plants on nutritionally-stressed rats. *Nigerian Journal of Basic and Applied Science*, *20*(1), 7–20.
77. Prabhu, K. S., Lobo, R., Shirwaikar, A. A., & Shirwaikar, A., (2009). *Ocimum gratissimum*: A review of its chemical, pharmacological and ethnomedicinal properties. *Open Complementary Medicine Journal*, *1*, 1–15.
78. Prakash, B., Shukla, R., Singh, P., Mishra, P. K., Dubey, N. K., & Kharwar, R. N., (2011). Efficacy of chemically characterized *Ocimum gratissimum L.* essential oil as an antioxidant and a safe plant based antimicrobial against fungal and aflatoxin B_1 contamination of spices. *Food Research International*, *44*(1), 385–390.
79. Prasad, K. N., Shivamurthy, G. R., & Aradhya, S. M., (2008). *Ipomoea aquatica*, an underutilized green leafy vegetable: A review. *International Journal of Botany*, *4*(1), 123–129.
80. Rub, R. A., Patil, M. J., Siddiqui, A. A., Ghorpade, P. R., & Moghe, A. S., (2015). Free radical scavenging and cytotoxic potential of *Celosia argentea*. *Pharmacognosy Journal*, *7*(3), 191–197.
81. Saalu, L. C., Kpela, T., Benebo, A. S., Oyewopo, A. O., Anifowope, E. O., & Oguntola, J. A., (2010). The dose-dependent testiculoprotective and testiculotoxic potentials of *Telfairiaoccidentalis* hook f. leaves extract in rat. *International Journal of Applied Research and Natural Products*, *3*(3), 27–38.
82. Sharma, P., Vidyasagar, G., Singh, S., Ghule, S., & Kumar, B., (2010). Antidiarrhoeal activity of leaf extract of *Celosia Argentea* in experimentally induced diarrhoea in rats. *Journal of Advanced Pharmaceutical and Technology Research*, *1*(1), 41–47.
83. Sodipo, O. A., Abdulrahman, F. I., Akan, J. C., & Akinniyi, J. A., (2008). Phytochemical screening and elemental constituents of the fruit of *Solanum macrocarpumLinn*. *Continental Journal of Applied Science*, *3*, 88–97.
84. Song, W., Derito, C. M., Liu, M. K., He, X., Dong, M., & Liu, R. H., (2010). Cellular antioxidant activity of common vegetables. *Journal of Agricultural and Food Chemistry*, *58*(11), 6621–6629.
85. Sridevi, K., Ravishankar, K., & Bhandhavi, P. P., (2013). *In vitro* antioxidant activities of ethanolic seed extract of *Millettia pinnata* and leaf extract of *Basella alba. International Journal of Pharmaceutical Chemical and Biological Science*, *3*(2), 269–274.
86. Swarna, J., & Ravindhran, R., (2013). Pharmacognostical and phytochemical evaluation of *Talinum triangulare* (Jacq.) wild. *International Journal of Pharmacy and Pharmaceutical Science, 5*, 249–256.
87. Ugochukwu, N. H., & Babady, N. E., (2003). Antihyperglycemic effect of aqueous and ethanolic extracts of *Gongronema latifolium* leaves on glucose and glycogen metabolism in livers of normal and streptozotocin-induced diabetic rats. *Life Science*, *73*(15), 1925–1938.
88. Ugochukwu, N. H., & Babady, N. E., (2002). Antioxidant effects of *Gongronema latifolium* in hepatocytes of rat models of non-insulin *diabetesmellitus*. *Fitoterapia*, *73*(7), 612–618.
89. Urmila, G. H., Ganga, R. B., & Satyanarayana, T., (2013). Phytochemical and *in-vitro* antioxidant activity of methanolic extract of *Lactuca scariola* and *Celosia argentea* leaves. *Journal of Drug Delivery and Therapy*, *3*(4), 114–117.

90. Wu, Q. B., Wang, Y., Liang, L., Jiang, Q., Guo, M. L., & Zhang, J. J., (2013). Novel triterpenoid saponins from the seeds of *Celosia argentea* L. *Natural Products Research*, *27*(15), 1353–1360.
91. Yan, Y. Y., Wang, Y. W., Chen, S. L., Zhuang, S. R., & Wang, C. K., (2013). Anti-inflammatory effects of phenolic crude extracts from five fractions of *Corchorus Olitorius* L. *Food Chemistry*, *138*(2), 1008–1014.
92. Zakaria, Z. A., Sulaiman, M. R., & Gopalan, H. K., (2007). Antinociceptive and anti-inflammatory properties of Corchorus capsularis leaves chloroform extract in experimental animal models. *Yakugaku Zasshi*, *127*(2), 359–365.

1. Abbasi, A. M., Khan, M. A., Ahmad, M., Zafar, M., Jahan, S., & Sultana, S., (2010). Ethnopharmacological application of medicinal plants to cure skin diseases and in folk cosmetics among the tribal communities of North-West Frontier Province, Pakistan. *Journal of Ethnopharmacology, 41*, 22–25.
2. Alam, E. A., (2011). Phytochemical screening on different plant parts of some succulent plants of Egypt. *New York Science Journal, 4*, 5–18.
3. Buwa, L. V., & Afolayan, A. J., (2009). Antimicrobial activity of some medicinal plants used for the treatment of tuberculosis in the Eastern Cape Province, South Africa. *African Journal of Biotechnology, 8*, 6683–6687.
4. Debruyne, D., (1997). Clinical pharmacokinetics of fluconazole in superficial and systemic mycoses. *Clinical Pharmacology, 33*, 52–57.
5. Green, E., Samie, A., Obi, C. L., Bessong, P. O., & Ndip, R. N., (2010). Inhibitory properties of selected South African plants against *Mycobacterium tuberculosis*. *Journal of Ethnopharmacology, 130*, 151–157.
6. Ibtissem, B., Chedly, A., & Souad, S., (2012). Antioxidant and antibacterial properties of *Mesembryanthemum crystallinum* and *Carpobrotus edulis* extracts. *Advances in Chemical Engineering and Science, 2*, 359–365.
7. Jeruto, P., Nyangacha, R. M., & Mutai, C., (2015). *In vitro* and *in vivo* antiplasmodial activity of extracts of selected Kenyan medicinal plants. *African Journal of Pharmacy and Pharmacology, 9*, 500–505.
8. Martins, A., Vasas, Z., Schelz, M., Viveiros, J., Molnár, J., Hohmann, J., & Amaral, L., (2010). Constituents of *Carpobrotus edulis* inhibit P-Glycoprotein of MDR1-transfected mouse lymphoma cells. *Anticancer Research, 30*, 829–836.
9. Martins, A., Vasas, Z., Schelz, M., Viveiros, J., Molnár, J., Hohmann, J., & Amaral, L., (2011). Antibacterial properties of compounds isolated from *Carpobrotus edulis*. *International Journal of Antimicrobial Agents*, *37*(5), 438.
10. Mathabe, M. C., Nikolova, R. V., Lall, N., & Nyazema, N. Z., (2006). Antibacterial activities of medicinal plants used for treatment of diarrhea in Limpopo Province, South Africa. *Journal of Ethnopharmacology, 105*, 286–293.
11. Muregi, F. W., Chhabra, S. C., Njagi, E. N., Langat-Thoruwa, C. C., Njue, W. M., Orago, A. S., Omar, S. A., & Ndiege, I. O., (1985). *In vitro* antiplasmodial activity of some plants used in Kisii, Kenya against malaria and their chloroquine potentiation effects. *Journal of Ethnopharmacology, 84*, 235–239.
12. Omoruyi, B. E., Afolayan, A. J., & Graeme, B., (2014). The inhibitory effect of *Mesembryanthemum edule* (L.) bolus essential oil on some pathogenic fungal isolates. *Complementary and Alternative Medicine, 14*, 168–176.

13. Omoruyi, B. E., Graeme, B., & Afolayan, A. J., (2012). Antioxidant and phytochemical properties of *Carpobrotus edulis* (L.) bolus leaf used for the management of common infections in HIV/AIDS. *BMC Complementary and Alternative Medicine, 12*, 215–219.
14. Omoruyi. B. E., Afolayan, A. J., & Graeme, B., (2014). Chemical composition profiling and antifungal activity of the essential oil and plant extracts of *Mesembryanthemum edule* (L.) bolus leaves. *African Journal of Traditional Complementary and Alternative Medicine, 11*(4), 19–30.
15. Ordway, D., Judit, H., Miguel, V., Antonio, V., Joseph, M., Clara, L., Maria, J. A., Maria, A. G., & Leonard, A., (2003). *Carpobrotus edulis* methanol extract inhibits the MDR efflux pumps, enhances killing of phagocytosed *S. aureus* and promotes immune modulation. *Phytotherapy Research, 17*, 512–519.
16. Rybicki, E. P., Chikwamba, R., Koch, M., Rhodes, J. I., & Groenewald, J. H., (2012). Plant-made therapeutics: Emerging platform in South Africa. *Biotechnology Advances, 30*, 449–459.
17. Scott, G., & Hewett, M. L., (2008). Pioneers in ethnopharmacology: The Dutch East India Company (VOC) at the Cape from 1650 to 1800. *Journal of Ethnopharmacology, 115*, 339–360.
18. Shai, L. J., McGaw, L. J., Aderogba, M. A., Mdee, L. K., & Eloff, J. N., (2008). Triterpenoids with antifungal and antibacterial activity from *Curtisia dentate* (Burm) leaves. *Journal of Ethnopharmacology, 119*, 238–241.
19. Van Der watt, E., & Pretorius, J. C., (2001). Purification and identification of active antibacterial components in *Carpobrotus edulis* L. *Journal of Ethnopharmacology, 76*, 87–91.
20. Van Wyk, B. E., Van Oudtshoorn, B., & Gericke, N., (1997). *Medicinal Plants of Southern Africa* (p. 88). Briza Publications, Pretoria, South Africa.
21. Watt, J. M., & Breyer-Brandwijk, M. G., (1962). *The Medicinal and Poisonous Plants of Southern and Eastern Africa* (p. 162). Livingstone, London.
22. Weber, E., D'Antonio, C., (1999). Germination and growth responses of hybridizing *Carpobrotus* species (Aizoaceae) from coastal California to soil salinity. *American Journal of Botany*, *86*, 1257–1263.
23. Wisura, W., & Glen, H. F., (1993). The South African species of *Carpobrotus* (*Mesembryanthema*, Aizoaceae) contribution. *Boletim Herbage*, *15*, 76–107.
24. World Health Organization (2008). *World Malaria Report,* http://whqlibdoc.who.int/publications/2008/9789241563697_eng.pdf?ua=1 (Accessed on 29 July 2019).

1. Aeschbach, R., Löliger, J., Scott, B. C., Murcia, A., Butler, J., Halliwell, B., & Aruoma, O. I., (1994). Antioxidant actions of thymol, carvacrol, 6-gingerol, zingerone and hydroxytyrosol. *Food and Chemical Toxicology*, *32*, 31–36.
2. Aijaz Ahmad, A., Khan, A., Kumar, P., Bhatt, R. P., & Manzoor, N., (2011). Antifungal activity of *Coriaria nepalensis* essential oil by disrupting ergosterol biosynthesis and membrane integrity against *Candida*. *Yeast*, *28*(8), 611–617.
3. Amonkar, A. J., Padma, P. R., & Bhide, S. V., (1989). Protective effect of hydroxychavicol, a phenolic component of betel leaf, against the tobacco-specific carcinogens. *Mutation Research*, *210*(2), 249–253.
4. Andrade, M. A., Das Graças, C. M., De Andrade, J., Silva, L. F., Teixeira, M. L., Valério Resende, J. M., Da Silva Figueiredo, A. C., & Barroso, J. G., (2013). Chemical composition and antioxidant activity of essential oils from *Cinnamodendron dinisii* Schwacke and *Siparuna guianensis* Aublet. *Antioxidant*, *2*(4), 384–397.

5. Andrade, T. C., De Lima, S. G., Freitas, R. M., Rocha, M. S., Islam, T., Da Silva, T. G., & Militão, G. C., (2015). Isolation, characterization and evaluation of antimicrobial and cytotoxic activity of estragole, obtained from the essential oil of *Croton zehntneri* (Euphorbiaceae). *Anais Da Academia Brasileira De Ciências*, *87*(1), 173–182.
6. Antelme, R. S., & Rossini, S., (2001). *Sacred Sexuality in Ancient Egypt: The Erotic Secrets of the Forbidden Papyrus* (p. 112). Inner Traditions/Bear, Rochester, United States.
7. Arunasree, K. M., (2010). Anti-proliferative effects of carvacrol on a human metastatic breast cancer cell line, MDA-MB 231. *Phytomedicine*, *17*, 581–588.
8. Ashakirin, S. N., Tripathy, M., Patil, U. K., & Majeed, A. B. A., (2017). Chemistry and bioactivity of cinnamaldehyde: A natural molecule of medicinal importance. *International Journal of Pharmaceutical Sciences and Research*, *8*(6), 2333–2340.
9. Astani, A., & Schnitzler, P., (2014). Antiviral activity of monoterpenes beta-pinene and limonene against herpes simplex virus *in vitro*. *Iranian Journal of Microbiology*, *6*(3), 149–155.
10. Baldwin, C. M., Bell, I. R., & O'Rourke, M. K., (1999). Odor sensitivity and respiratory complaint profiles in a community-based sample with asthma, hay fever, and chemical odor intolerance. *Toxicology and Industrial Health*, *15*(3/4), 403–409.
11. Baratta, M. T., Dorman, H. J. D., Deans, S. G., Figueiredo, A. C., Barroso, J. G., & Ruberto, G., (1998). Antimicrobial and anti-oxidant properties of some commercial essential oils. *Flavor and Fragrance Journal*, *13*, 235–244.
12. Berwick, A., (1994). *Holistic Aromatherapy: Balance the Body and Soul with Essential Oils* (p. 118). Llewellyn Publications, St. Paul, MN.
13. Bezerra, D. P., Marinho, F. J. D. B., Alves, A. P. N. N., Pessoa, C., De Moraes, M. O., Pessoa, O. D. L., et al., (2009). Antitumor activity of the essential oil from the leaves of *Croton regelianus* and its component ascaridole. *Chemistry and Biodiversity*, *6*, 1224–1231.
14. Bighetti, E. J. B., Hiruma-Lima, C. A., Gracioso, J. S., & Brito, A. R. M. S., (1999). Anti-inflammatory and antinociceptive effects in rodents of the essential oil of *Croton cajucara* Benth. *Journal of Pharmacy and Pharmacology*, *51*(12), 1447–1453.
15. Bonamin, F., Moraes, T. M., Dos Santos, R. C., Kushima, H., Faria, F. M., Silva, M. A., et al., (2014). The effect of a minor constituent of essential oil from *Citrus aurantium*: the role of β-myrcene in preventing peptic ulcer disease. *Chemico-Biological Interactions*, *212*, 11–19. doi: 10.1016/j.cbi.2014.01.009.
16. Bou, D. D., Lago, J. H. G., Figueiredo, C. R., Matsuo, A. L., Guadagnin, R. C., Soares, M. G., & Sartorelli, P., (2013). Chemical composition and cytotoxicity evaluation of essential oil from leaves of *Casearia sylvestris*, its main compound α-zingiberene and derivatives. *Molecules*, *18*, 9477–9487.
17. Braga, P. C., Dal Sasso, M., Culici, M., Galastri, L., Marceca, M. T., & Guffanti, E. E., (2005). Antioxidant potential of thymol determined by chemiluminescence inhibition in human neutrophils and cell-free systems. *Pharmacology*, *76*, 61–68.
18. Britto, A. C. S., De Oliveria, A. C., Henriques, R. M., Cardoso, G. M., Bomfim, D. S., Carvalho, A. A., et al., (2012). *In vitro* and *in vivo* antitumor effects of the essential oil from the leaves of *Guatteria friesiana*. *Planta Medica*, *78*(5), 409–414.
19. Buchbauer, G., (2010). Biological activities of essential oils. In: Hüsnü, K., (ed.), *Handbook of Essential Oils: Science, Technology, and Applications. 2nd Edition.* K. Husnu Can Baser and Gerhard Buchbauer. Boca Raton - FL: CRC Press; October 27, 2015; 1112 Pages.

20. Buck, L., & Axel, R., (1991). A novel multigene family may encode odorant receptors: A molecular basis for odor recognition. *Cells*, *65*(1), 175–187.
21. Busch, W., Magerl, U., Kern, J., Haas, G. H., & Eichhammer, P., (2012). The effect of deep and slow breathing on pain perception, autonomic activity, and mood processing-an experimentalstudy. *Pain Medicine*, *13*(2), 215–218.
22. Carnesecchi, S., Bras-Goncalves, R., Bradaia, A., Zeisel, M., Gosse, F., Poupon, M. F., & Raul, F., (2004). Geraniol, a component of plant essential oils, modulates DNA synthesis and potentiates 5-fluorouracil efficacy on human colon tumor xenografts. *Cancer Letter*, *215*, 53–59.
23. Carson, C. F., & Riley, T. V., (1995). Antimicrobial activity of the major components of the essential oil of *Melaleuca alternifolia*. *Journal of Applied Bacteriology*, *78*, 264–269.
24. Cavar, S., Maksimovic, M., Vidic, D., & Paric, A., (2012). Chemical composition and antioxidant and antimicrobial activity of essential oil of *Artemisia annua* L. from Bosnia. *Industrial Crops and Products, 37*, 479–485.
25. Chang, M. C., Uang, B. J., Tsai, C. Y., Wu, H. L., Lin, B. R., Lee, C. S., Chen, Y. J., Chang, C. H., Tsai, Y. L., Kao, C. J., & Jeng, J. H., (2007). Hydroxychavicol, a novel betel leaf component, inhibits platelet aggregation by suppression of cyclooxygenase, thromboxane production and calcium mobilization. *British Journal of Pharmacology*, *152*(1), 73–82.
26. Chaouki, W., Leger, D. Y., & Liagre, B., (2009). Citral inhibits cell proliferation and induces apoptosis and cell cycle arrest in MCF-7cells. *Fundamental & Clinical Pharmacology, 23*, 549–556.
27. Chen, W., & Viljoen, A. M., (2010). Geraniol: A review of a commercially important fragrance material. *South African Journal of Botany*, *76*(4), 643–651.
28. Chen, Y., Zeng, H., Tian, J., Ban, X., Ma, B., & Wang, Y., (2013). Antifungal mechanism of essential oil from *Anethum graveolens* seeds against *Candida albicans*. *Journal of Medical Microbiology*, *62*, 1175–1183.
29. Chouhan, S., Sharma, K., & Guleria, S., (2017). Antimicrobial activity of some Essential oils—present status and future perspectives. *Medicines*, *4*(58), 2–21.
30. Cimanga, K., Kambu, K., Tona, L., Apers, S., De Bruyne, T., Hermans, N., Totté, J., Pieters, L., & Vlietinck, A. J., (2002). Correlation between chemical composition and antibacterial activity of essential oils of some aromatic medicinal plants growing in the Democratic Republic of Congo. *Journal of Ethnopharmacology, 79,* 213–220.
31. Cox, S. D., Mann, C. M., Markham, J. L., Bell, H. C., Gustafson, J. E., Warmington, J. R., & Wyllie, S. G., (2000). The mode of antimicrobial action of the essential oil of *Melaleuca alternifolia* (tea tree oil). *Journal of Applied Microbiology*, *88*(1), 170–175.
32. Crawford, G. H., Katz, K. A., Ellis, E., & James, W. D., (2004). Use of aromatherapy products and increased risk of hand dermatitis in massage therapists. *Archives of Dermatology*, *140*(8), 991–996.
33. Cristani, M., D'Arrigo, M., Mandalari, G., Castelli, F., Sarpietro, M. G., Micieli, D., et al., (2007). Interaction of four monoterpenes contained in essential oils with model membranes: Implications for their antibacterial activity. *Journal of Agricultural and Food Chemistry, 55,* 6300–6308.
34. Dahham, S. S., Tabana, Y. M., Ahamed, M. B. K., & Abdul, M. A. M. S., (2015). *In vivo* anti-inflammatory activity of β-caryophyllene, evaluated by molecular imaging. *Molecules & Medicinal Chemistry 1*, E-article 1001. doi: 10.14800/mmc.1001.

35. De Logu, A. G., Loy, M. L., Pellerano, L. B., & Schivo, M. L., (2000). Inactivation of HSV-1 and HSV-2 and prevention of cell-to-cell virus spread by *Santolina insularis* essential oil. *Antiviral Research*, *48*(3), 177–185.
36. De Oliveira, T. M., De Carvalho, R. B., Da Costa, I. H., De Oliveira, G. A., De Souza, A. A., De Lima, S. G., & De Freitas, R. M., (2015). Evaluation of p-cymene, a natural antioxidant. *Pharmaceutical Biology, 53*(3), 423–428.
37. Demirci, F., Berber, H., & Baser, K. H. C., (2007). Biotransformation of *p*-cymene to thymoquinone. *Book of Abstracts of the 38th ISEO, SL-1*, p. 6.
38. Derengowski, L. S., De-Souza-Silva, C., Braz, S. V., Mello-De-Sousa, T. M., Báo, S. N., Kyaw, C. M., & Silva-Pereira, I., (2009). Antimicrobial effect of farnesol, a *Candida albicans* quorum sensing molecule, on *Paracoccidioides brasiliensis* growth and morphogenesis. *Annals of Clinical Microbiology and Antimicrobials*, *8*(13), p. 8, E-article, doi: 10.1186/1476–0711–8–13.
39. Derwich, E., Chabir, R., Taouil, R., & Senhaji, O., (2011). *In-vitro* antioxidant activity and GC/MS studies on the leaves of *Mentha piperita* (Lamiaceae) from Morocco. *International Journal of Pharmaceutical Sciences and Drug Research*, *3*(2), 130–136.
40. Devereux, P., (1997). *The Long Trip: A Prehistory of Psychedelia* (p. 82). London, Penguin Arkana.
41. Dhar, S. K., (1995). Anti-fertility activity and hormonal profile of trans-anethole in rats. *Indian Journal of Physiology and Pharmacology*, *39*(1), 63–67.
42. Di-Campli, E., Di Bartolomeo, S., Delli, P. P., Di Giulio, M., Grande, R., & Nostro, A., (2012). Activity of tea tree oil and nerolidol alone or in combination against *Pediculus capitis* (head lice) and its eggs. *Parasitology Research*, *111*(5), 1985–1992.
43. Djilani, A., & Dicko, A., (2012). The therapeutic benefits of essential oils. In: Bouayed, J., (ed.), *Nutrition* (pp. 155–178). *Well-Being and Health*. In-Tech, Croatia.
44. Dunning, T., (2013). Aromatherapy: Overview, safety and quality issues. *OA Alternative Medicine, 1*(1), 1–6.
45. Edris, A. E., (2007). Pharmaceutical and therapeutic potentials of essential oils and their individual volatile constituents: A review. *Phytotherapy Research*, *21*, 308–323.
46. Enomoto, S., Asano, R., Iwahori, Y., Narui, T., Okada, Y., Singab, A. N., & Okuyama, T., (2001). Hematological studies on black cumin oil from the seeds of *Nigella sativa* L. *Biological and Pharmaceutical Bulletin, 24*, 307–310.
47. Esposito, E. R., Bystrek, M. V., & Klein, J. S., (2014). An elective course in Aromatherapy science. *American Journal of Pharmaceutical Education*, *78*(4), 1–9.
48. Fang, H. J., Su, X. L., Liu, H. Y., Chen, Y. H., & Ni, J. H., (1989). Studies on the chemical components and anti-tumor action of the volatile oils from *Pelargonium graveolens*. *Yao Xue Xue Bao*, *24*, 366–371.
49. Ferguson, L. R., & Philpott, M., (2008). Nutrition and mutagenesis. *Annual Review of Nutrition*, *28*, 313–329.
50. Fisher, K., & Phillips, C., (2008). Potential antimicrobial uses of essential oils in food: Is citrus the answer? *Trends in Food Science and Technology*, *19*, 156–164.
51. Fitzgerald, D. J., Stratford, M., Gasson, M. J., Ueckert, J., Bos, A., & Narbad, A., (2004). Mode of antimicrobial action of vanillin against *Escherichia coli*, *Lactobacillus plantarum* and *Listeria innocua*. *Journal of Applied Microbiology*, *97*, 104–113.
52. Fogang, H. P. D., Maggi, F., Tapondjou, L. A., Womeni, H. M., Papa, F., Quassinti, L., et al., (2014). *In vitro* biological activities of seed essential oils from the Cameroonian spices *Afrostyrax lepidophyllus* Mildbr. and *Scorodophloeus zenkeri* harms rich in sulfur-containing compounds. *Chemistry and Biodiversity*, *11*, 161–169.

53. Fujita, K. I., & Kubo, I., (2004). Potentiation of fungicidal activities of trans-anethole against *Saccharomyces cerevisiae* under hypoxic conditions. *Journal of Bioscience and Bioengineering*, *98*(6), 490–492.
54. Galeotti, N., Ghelardini, C., Mannelli, L., Mazzanti, G., Baghiroli, L., & Bartolini, A., (2001). Local anaesthetic activity of (+)- and (−)-menthol. *Planta Medica*, *67* 174–176.
55. Ghelardini, C., Galeotti, N., Di Cesare, M. L., Mazzanti, G., & Bartolini, A., (2001). Local anaesthetic activity of beta-caryophyllene. *Farmaco, 56*(5–7), 387–389.
56. Gill, A. O., & Holley, R. A., (2006). Disruption of *Escherichia coli*, *Listeria monocyto genes* and *Lactobacillus sakei* cellular membranes by plant oil aromatics. *International Journal of Food Microbiology*, *108*, 1–9.
57. Gkinis, G., Tzakou, O., Iliopoulou, D., & Roussis, V., (2003). Chemical composition and biological activity of *Nepeta parnassica* oils and isolated nepetalactones. *Zeitschrift für Naturforschung C*, *58*, 681–686.
58. Gogoi, P., Baruah, P., & Nath, S. C., (2008). Microbiological research. effects of *Citrus sinensis* (L.) Osbeck epicarp essential oil on growth and morphogenesis of *Aspergillus niger* (L.) Van Tieghem. *Microbiological Research*, *163*, 337–344.
59. Guin, J. D., (1982). History, manufacture, and cutaneous reactions to perfumes. In: Frost P, Horwitz SW (eds) *Principles of cosmetics for the dermatologist.* Mosby, St. Louis, Calif.; pages 111–129.
60. Gulluce, M., Sahin, F., Sokmen, M., Ozer, H., Daferera, D., Sokmen, A., Polissiou, M., Adiguzel, A., & Ozkan, H., (2007). Antimicrobial and antioxidant properties of the essential oils and methanol extract from *Mentha longifolia* L. sp. *longifolia. Food Chemistry*, *103*, 1449–1456.
61. Gupta, S. C., Prasad, S., Sethumadhavan, D. R., Nair, M. S., Mo, Y. Y., & Aggarwal, B. B., (2013). Nimbolide, a limonoid triterpene, inhibits growth of human colorectal cancer xenografts by suppressing the proinflammatory microenvironment. *Clinical Cancer Research*, *19*(16), 4465–4476.
62. Hajhashemi, V., Ghannadi, A., & Sharif, B., (2003). Anti-inflammatory and analgesic properties of the leaf extracts and essential oil of *Lavandula angustifolia* Mill. *Journal of Ethnopharmacology*, *89*, 67–71.
63. Hamid, A. A., Aiyelaagbe, O. O., & Usman, L. A., (2011). Essential oils: Its medicinal and pharmacological uses. *International Journal of Current Research*, *33*, 86–98.
64. Haque, E., Irfan, S., Kamil, M., Sheikh, S., Hasan, A., Ahmad, A., Lakshmi, V., Nazir, A., & Mir, S. S., (2016). Terpenoids with antifungal activity trigger mitochondrial dysfunction in *Saccharomyces cerevisiae*. *Microbiology*, *85*, 436–443.
65. Helander, I. M., Alakomi, H. L., Latva-Kala, K. S., Mattila-Sandholm, T., Pol, I., Smid, E. J., Gorris, L. G. M., & Wright, A. V., (1998). Characterization of the action of selected essential oil components on gram-negative bacteria. *Journal of Agricultural Food Chemistry*, *46*, 3590–3595.
66. https://ayurvedicoils.com/tag/pharmacological-effects-of-b-pinene, https://ayurvedicoils.com/tag/menthone (Accessed on 29 July 2019).
67. Hua, Y., Zhang, J., Kong, W., Zhao, G., & Yang, M., (2017). Mechanisms of antifungal and anti-aflatoxigenic properties of essential oil derived from turmeric (*Curcuma longa* L.) on *Aspergillus flavus*. *Food Chemistry*, *220*, 1–8.
68. Huang, Y., Zhao, J., Zhou, L., Wang, J., Gong, Y., Chen, X., Guo, Z., Wang, Q., & Jiang, W., (2010). Antifungal activity of the essential oil of *Illicium verum* fruit and its main component trans-anethole. *Molecules 15*(11), 7558–7569.

69. Hussain, A. I., Anwar, F., Hussain, S. S. T., & Przybylski, R., (2008). Chemical composition, antioxidant and antimicrobial activities of basil (*Ocimum basilicum*) essential oils depends on seasonal variations. *Food Chemistry*, *108*, 986–995.
70. Hwang, E., & Shin, S., (2015). The effects of aromatherapy on sleep improvement: A systematic literature review and meta-analysis. *Journal of Alternative and Complementary Medicine, 21*(2), 61–68.
71. Hyldgaard, M., Mygind, T., & Meyer, R. L., (2012). Essential oils in food preservation: Mode of action, synergies and interactions with food matrix components. *Frontiers in Microbiology*, *3*, 12–18.
72. Işcan, G., Kirimer, N., Kürkcüoğlu, M., Başer, K. H., & Demirci, F., (2002). Antimicrobial screening of *Mentha piperita* essential oils. *Journal of Agricultural and Food Chemistry*, *50*(14), 3943–3946.
73. Jabra-Rizk, M. A., Meiller, T. F., James, C. E., & Shirtliff, M. E., (2006). *Effect of farnesol on Staphylococcus aureus biofilm formation and antimicrobial susceptibility. Antimicrobial Agents and Chemotherapy, 50*(4), 1463–1469.
74. Jäger, W., Nasel, B., Nasel, C., Binder, R., Stimpfl, T., Vycudilik, W., & Buchbauer, G., (1996). Pharmacokinetic studies of the fragrance compound 1, 8-cineol in humans during inhalation. *Chemical Senses*, *21*(4), 477–480.
75. Jahangir, T., Khan, T. H., Prasad, L., & Sultana, S., (2005). Alleviation of free radical mediated oxidative and genotoxic effects of cadmium by farnesol in Swiss albino mice. *Redox Report*, *10*(6), 303–310.
76. Jayaprakasha, G. K., Murthy, K. N. C., Uckoo, R. M., & Patil, B. S., (2012). Chemical composition of volatile oil from *Citrus limettioides* and their inhibition of colon cancer cell proliferation. *Industrial Crops and Products*, *45*, 200–207.
77. Jimbo, D., Kimura, Y., Taniguchi, M., Inoue, M., & Urakami, K., (2009). Effect of aromatherapy on patients with Alzheimer's disease. *Psychogeriatrics*, *9*, 173–179.
78. Juergens, U. R., Stober, M., Schmidt-Schilling, L., Kleuver, T., & Vetter, H., (1998). The anti-inflammatory activity of L-menthol compared to mint oil in human monocytes *in vitro*: A novel perspective for its therapeutic use in inflammatory diseases. *European Journal of Medical Research*, *3*, 539–545.
79. Kaefer, C. M., & Milner, J. A., (2008). The role of herbs and spices in cancer prevention. *Journal of Nutrition and Biochemistry*, *19*, 347–361.
80. Karkabounas, S., Kostoula, O. K., Daskalou, T., Veltsistas, P., Karamouzis, M., Zelovitis, I., et al., (2006). Anticarcinogenic and antiplatelet effects of carvacrol. *Experimental Oncology*, *28*, 121–125.
81. Kathirvel, P., & Ravi, S., (2012). Chemical composition of the essential oil from basil (*Ocimum basilicum* Linn.) and its *in vitro* cytotoxicity against HeLa and HEp-2 human cancer cell lines and NIH 3T3 mouse embryonic fibroblasts. *Natural Product Research*, *26*, 1112–1118.
82. Khalil, A. A., Rahman, U., Khan, M. R., Sahar, A., Mehmood, T., & Khan, M., (2017). Essential oil eugenol: Sources, extraction techniques and nutraceutical perspectives. *RSC Advances*, *7*(52), 32669–32681.
83. Khayyat, S. A., & Al-Zahrani, S. H., (2014). Thermal, photosynthesis and antibacterial studies of bioactive safrole derivative as precursor for natural flavor and fragrance. *Arabian Journal of Chemistry*, *7*, 800–804.

84. Kianinodeh, F., Tabatabaei, S. M., Alibakhshi, A., Mahshid, G., & Kaveh, T., (2017). Anti-tumor effects of essential oils of red clover and ragweed on MCF-7 breast cancer cell line. *Multidisciplinary Cancer Investigation, 1*(4), 17–23.
85. Kim, E. Y., Baik, I. H., Kim, J. H., Kim, S. R., & Rhyu, M. R., (2004). Screening of the antioxidant activity of some medicinal plants. *Korean Journal of Food Science and Technology*, *36*, 333–338.
86. Kimutai, A., Ngeiywa, M., Mulaa, M., Njagi, P. G., Ingonga, J., Nyamwamu, L. B., Ombati, C., & Ngumbi, P., (2017). Repellent effects of the essential oils of *Cymbopogon citratus* and *Tagetes minuta* on the sandfly, *Phlebotomus duboscqi*. *BMC Res Notes*, *10*(1), 98. doi: 10.1186/s13104–017–2396–0.
87. Koh, K. J., Pearce, A. L., Marshman, G., Finlay-Jones, J. J., & Hart, P. H., (2002). Tea tree oil reduces histamine-induced skin inflammation. *Brazilian Journal of Dermatology*, *147*, 1212–1217.
88. Koparal, A. T., & Zeytinoglu, M., (2003). Effects of carvacrol on a human nonsmall cell lung cancer (NSCLC) cell line, A549. *Cytotechnology*, *43*, 149–154.
89. Krishna, A., Tiwari, R., & Kumar, S., (2000). Aromatherapy-an alternative health care through essential oils. *Journal of Medicinal and Aromatic Plant Science*, *22*, 798–804.
90. Ku, C. M., & Lin, J. Y., (2015). Farnesol, a sesquiterpene alcohol in herbal plants, exerts Anti-inflammatory and Antiallergic effects on ovalbumin-sensitized and -challenged Asthmatic mice. *Evidence-Based Complementary and Alternative Medicine.* 387357. doi:10.1155/2015/387357.
91. Kumar, A., Malik, F., Bhushan, S., Sethi, V. K., Shahi, A. K., Kaur, J., Taneja, S. C., Qazi, G. N., & Singh, J., (2008). An essential oil and its major constituent isointermedeol induce apoptosis by increased expression of mitochondrial cytochrome and apical death receptors in human leukemia HL-60 cells. *Chemico Biological Interaction*, *171*, 332–347.
92. Kumar, A. M., & Devaki, T., (2015). Geraniol, a component of plant essential oils–a review of its pharmacological activities. *International Journal of Pharmacy and Pharmaceutical Sciences*, *7*(4), 67–70.
93. Lalthazuali, & Mathew, N., (2017). Mosquito repellent activity of volatile oils from selected aromatic plants. *Parasitology Research*, *116*(2), 821–825.
94. Lambert, R. J. W., Skandamis, P. N., Coote, P. J., & Nychas, G. J. E., (2001). A study of the minimum inhibitory concentration and mode of action of oregano essential oil, thymol and carvacrol. *Journal of Applied Microbiology, 91*, 453–462.
95. Laude, E. A., Morice, A. H., & Grattan, T. J., (1994). The antitussive effects of menthol, camphor and cineole in conscious guinea-pigs. *Pulmonary Pharmacology*, *7*, 179–184.
96. Lee, J. H., Kim, C., Kim, S. H., Sethi, G., & Ahn, K. S., (2015). Farnesol inhibits tumor growth and enhances the anticancer effects of bortezomib in multiple myeloma xenograft mouse model through the modulation of STAT3 signaling pathway. *Cancer Letter*, *360*(2), 280–293.
97. Lee, S. H., Kim, J. Y., Yeo, S., Kim, S. H., & Lim, S., (2015). Meta-analysis of massage therapy on cancer pain. *Integrative Cancer Therapies*, *5*, 245–256.
98. Legault, J., Dahl, W., Debiton, A. P., & Madelmont, J. C., (2003). Antitumor activity of balsam fir oil: Production of reactive oxygen species induced by α-humulene as possible mechanism of action. *Planta Medica*, *69*(5), 402–407.
99. Legault, J., & Pichette, A., (2007). Potentiating effect of beta-caryophyllene on anticancer activity of alpha-humulene, isocaryophyllene and paclitaxel. *Journal of Pharmacy and Pharmacology*, *59*(12), 1643–1647.

100. Leicester, R., & Hunt, R., (1982). Peppermint oil to reduce colonic spasm during endoscopy. *Lancet*, *2*(8305), 989.
101. Li, W. R., Shi, Q. S., Liang, Q., Xie, X. B., Huang, X. M., & Chen, Y. B., (2014). Antibacterial activity and kinetics of *Litsea cubeba* oil on *Escherichia coli*. *PLoS One*, *9*(11), 1–6.
102. Li, Y. L., Yeung, C. M., Chiu, L. C. M., Cen, Y. Z., & Ooi, V. E. C., (2009). Chemical composition and antiproliferative activity of essential oil from the leaves of a medicinal herb, *Schefflera heptaphylla*. *Phytotherapy Research*, *23*, 140–142.
103. Lima, R. K., Cardoso, M. G., Andrade, M. A., Guimarães, P. L., Batista, L. R., & Nelson, D. L., (2012). Bactericidal and antioxidant activity of essential oils from *Myristica fragrans* Houtt and *Salvia microphylla* H. B. K. *Journal of the American Oil Chemists' Society, 89*, 523–528.
104. Lin, J. P., Li, Y. C., Lin, W. C., Hsieh, C. L., & Chung, J. G., (2001). Effects of (−)-menthol on arylamine N-acetyltransferase activity in human liver tumor cells. *The American Journal of Chinese Medicine*, *29*, 321–329.
105. Liu, S. H., Lin, T. H., & Chang, K. M., (2013). The physical effects of aromatherapy in alleviating work-related stress on elementary school teachers in Taiwan. *Evidence-Based Complementary and Alternative Medicine* (p. 13). E-article. doi: 10.1155/2013/853809.
106. Loizzo, M. R., Saab, A., & Tundis, R., (2008a). Phytochemical analysis and *in vitro* evaluation of the biological activity against *Herpes simplex* virus type 1 (HSV-1) of *Cedrus libani* A. Rich. *Phytomedicine*, *15*(1/2), 79–83.
107. Loizzo, M. R., Saab, A. M., & Tundis, R., (2008b). Phytochemical analysis and *in vitro* antiviral activities of the essential oils of seven Lebanon species. *Chemistry & Biodiversity*, *5*, 461–472.
108. Loutrari, H., Magkouta, S., & Pyriochou, A., (2006). Mastic oil from *Pistacia lentiscus* var. *chia* inhibits growth and survival of human K562 leukemia cells and attenuates angiogenesis. *Nutrition and Cancer*, *55*(1), 86–93.
109. Madrid, A., Espinoza, L., Pavéz, C., Carrasco, H., & Hidalgo, M. E., (2014). Antioxidant and toxicity activity *in vitro* of twelve safrole derivatives. *Journal of the Chilean Chemical Society*, *59*(3), 2598–2601.
110. Maestri, D. M., Nepote, V., Lamarque, A. L., & Zygadlo, J. A., (2006). Natural products as antioxidants. In: Filippo, I., (ed.), *Phytochemistry: Advances in Research* (pp. 105–135). Res. Signpost, Trivandrum, India.
111. Maheshwari, R. K., Singh, A. K., Gaddipati, J., & Srimal, R. C., (2006). Multiple biological activities of curcumin: A short review. *Life Sciences*, *78*, 2081–2087.
112. Manniche, L., (1999). *Sacred Luxuries: Fragrance, Aromatherapy and Cosmetics in Ancient Egypt*. Cornell University Press, New York.
113. Marchand, L., (2014). Integrative and complementary therapies for patients with advanced cancer. *Annals of Palliative Medicine, 3*(3), 160–171.
114. Masaoka, Y., Takayama, M., Yajima, H., Kawase, A., Takakura, N., & Homma, I., (2013). Analgesia is enhanced by providing information regarding good outcomes associated with an odor: Placebo effects in aromatherapy? *Evidence-Based Complementary and Alternative Medicine* (p. 10). E-article. doi: 10.1155/2013/921802.
115. Masaoka, Y., Yajima, H., Takayama, M., Kawase, A., Takakura, N., & Homma, I., (2010). Olfactory stimuli modifies pain and unpleasantness: Investigating respiration and brain areas estimated by a dipole tracing method. *Journal of Japanese Society of Aromatherapy*, *9*(1), 23–29.

116. Mau, J. L., Lai, E. Y., Wang, N. P., Chen, C. C., Chang, C. H., & Chyau, C. C., (2003). Composition and antioxidant activity of the essential oil from *Curcuma zedoaria*. *Food Chemistry*, *82*, 583–591.
117. McCord, J. M., (2000). The evolution of free radicals and oxidative stress. *American Journal of Medicine*, *108*, 652–659.
118. Miguel, M. G., (2010). Antioxidant and anti-inflammatory activities of essential oils: A short review. *Molecules*, *15*, 9252–9287.
119. Millqvist, E., & Lowhagen, O., (1996). Placebo-controlled challenges with perfume in patients with asthma like symptoms. *Allergy*, *51*(6), 434–439.
120. Mills, C., Cleary, B. J., Gilmer, J. F., & Walsh, J. J., (2004). Inhibition of acetylcholine esterase by tea tree oil. *Journal of Pharmacy and Pharmacology*, *56*, 375–379.
121. Moreno, L., Bello, R., Primo-Yufera, E., & Esplugues, J., (2002). Pharmacological properties of the methanol extract from *Mentha suaveolens* Ehrh. *Phytotherapy Research*, *16*, 10–13.
122. Murakami, C., Cordeiro, I., Scotti, M. T., Moreno, P. R. H., & Young, M. C. M., (2017). Chemical composition, antifungal and antioxidant activities of *Hedyosmum brasiliense* mart. ex Miq. (chloranthaceae) essential oils. *Medicines (Basel)*, *4*(3), E55–E66.
123. Nakamura, C. V., Ueda-Nakamura, T., Bando, E., Negrão, M. A. F., Garcia, C. D. A., & Dias, F. F. B. P., (1999). Antibacterial activity of *Ocimum gratissimum* L. essential oil. *Memories do Instituto Oswaldo Cruz*, *94*, 675–678.
124. Nerio, L. S., Olivero-Verbela, J., & Stashenkob, E., (2010). Repellent activity of essential oils: A review. *Biores Tech*, *101*(1), 372–378.
125. Nguefack, J., Leth, V., Amvam, Z. P. H., & Mathur, S. B., (2004). Evaluation of five essential oils from aromatic plants of Cameroon for controlling food spoilage and mycotoxin producing fungi. *International Journal of Food Microbiology, 94*(3), 329–334.
126. Nissen, L., Zatta, A., Stefanini, I., Grandi, S., Sgorbati, B., Biavati, B., & Monti, A., (2010). Characterization and antimicrobial activity of essential oils of industrial hemp varieties (*Cannabis sativa* L.). *Fitoterapia*, *81*(5), 413–419.
127. Okokon, J. E., & Dar, A., (2013). Immuno modulatory, cytotoxic and antileishmanial activity of phytoconstituents of *Croton zambesicus*. *Phytopharmacology Journal*, *4*(1), 31–40.
128. Okuyama, E., Umeyama, K., Saito, Y., Yamazaki, M., & Satake, M., (1993). Ascaridole as a pharmacologically active principle of "Paico," a medicinal Peruvian plant. *Chemical and Pharmaceutical Bulletin*, *41*(7), 1309–1311.
129. Oliveira, C. B. S., Meurer, Y. S. R., & Medeiros, T. L., (2016). Anti-toxoplasma activity of estragole and thymol in murine models of congenital and noncongenital toxoplasmosis. *Journal of Parasitology*, *102*(3), 369–376.
130. Onwukaeme, N. D., (1995). Anti-inflammatory activities of flavonoids of *Baphia nitida* Lodd. (Leguminosae) on mice and rats. *Journal of Ethnopharmacology*, *46*, 121–124.
131. Owolabi, M. S., Ogundajo, A. L., Dosoky, N. S., & Setzer, W. N., (2013). The cytotoxic activity of *Annona muricata* leaf oil from Badagary, Nigeria. *The American Journal of Essential Oil and Natural Product 1*(1), 1–3.
132. Ozkan, A., Erdogan, A., Sokmen, M., Tugrulay, S., & Unal, O., (2010). Antitumoral and antioxidant effect of essential oils and *in vitro* antioxidant properties of essential oils and aqueous extracts from *Salvia pisidica*. *Biologia*, *65*(6), 990–996.
133. Pavela, R., Maggi, F., Cianfaglione, K., Bruno, M., & Benelli, G., (2018). Larvicidal activity of Essential oils of five Apiaceae taxa and some of their main constituents against *Culex quinquefasciatus*. *Chemistry & Biodiversity*, *15*(1), 80–90.

134. Pereira, F. O., Mendes, J. M., Lima, I. O., Mota, K. S., Oliveira, W. A., & Lima, E. O., (2015). Antifungal activity of geraniol and citronellol, two monoterpenes alcohols, against *Trichophyton rubrum* involves inhibition of ergosterol biosynthesis. *Pharmaceutical Biology 53*(2), 228–234.
135. Perry, N., & Perry, E., (2006). Aromatherapy in the management of psychiatric disorders clinical and neuropharmacological perspectives. *CNS Drugs, 20*, 257–280.
136. Pinheiro, M. A., Magalhães, R. M., Torres, D. M., Cavalcante, R. C., Mota, F. S., & Oliveira, C. E. M., (2015). Gastroprotective effect of alpha-pinene and its correlation with antiulcerogenic activity of essential oils obtained from *Hyptis* species. *Pharmacognosy Magazine*, *11*(41), 123–130.
137. Politeo, O., Jukic, M., & Milos, M., (2007). Chemical composition and antioxidant capacity of free volatile aglycones from basil (*Ocimum basilicum* L.) compared with its essential oil. *Food Chemistry*, *101*, 379–385.
138. Potawale, S. E., Luniya, K. P., Mantri, R. A., Mehta, U. K., Waseem, M., Sadiq, M., Vetal, Y. D., & Deshmukh, R. S., (2008). *Chenopodium ambrosioides*: An ethnopharmacological review. *Pharmacologyonline*, *2*, 272–286.
139. Priestley, C. M., Burgess, I. F., & Williamson, E. M., (2006). Lethality of essential oil constituents towards the human louse, *Pediculus humanus* and its eggs. *Fitoterapia, 77*(4), 303–309.
140. Priyadarsini, S. C., Murugan, R. S., Sripriya, P., Karunagaran, D., & Nagini, S., (2010). The neem limonoids azadirachtin and nimbolide induce cell cycle arrest and mitochondria-mediated apoptosis in human cervical cancer (HeLa) cells. *Free Radical Research*, *44*(6), 624–634.
141. Promoting Healthy Life. http://www.who.int/whr/2002/en/ (Accessed on 29 July 2019).
142. Rajput, S. B., & Karuppayil, S. M., (2013). Small molecules inhibit growth, viability and ergosterol biosynthesis in *Candida albicans*. *Springer plus*, *2*(1), 2–6.
143. Rao, V. S. N., Menezes, A. M. S., & Viana, G. S. B., (1990). Effect of myrcene on nociception in mice. *Journal of Pharmacy and Pharmacology*, *42*(12), 877–878.
144. Rashid, S., Rather, M. A., Shah, W. A., & Bhat, B. A., (2013). Chemical composition, antimicrobial, cytotoxic and antioxidant activities of the essential oil of *Artemisia indica* Willd. *Food Chemistry*, *138*, 693–700.
145. Rosato, A., Vitali, C., De Laurentis, N., Armenise, D., & Antonietta, M. M., (2007). Antibacterial effect of some essential oils administered alone or in combination with norfloxacin. *Phytomedicine*, *14*, 727–732.
146. Sadraei, H., Asghari, G., & Alipour, M., (2016). Anti-spasmodic assessment of hydroalcoholic extract and essential oil of aerial part of *Pycnocycla caespitosa* Boiss. & Hausskn on rat ileum contractions. *Research in Pharmaceutical Science*, *11*(1), 33–42.
147. Sánchez, E., García, S., & Heredia, N., (2010). Extracts of edible and medicinal plants damage membranes of *Vibrio cholerae*. *Applied and Environmental Microbiology, 76*, 6888–6894.
148. Sanchez-Vioque, R., Polissiou, M., Astraka, K., Mozos-Pascual, M., Tarantilis, P., Herraiz-Penalver, D., & Santana-Meridas, O., (2013). Polyphenol composition and antioxidant and metal chelating activities of the solid residues from the essential oil industry. *Industrial Crops and Products*, *49*, 150–159.
149. Satchell, A. C., Saurajen, A., Bell, C., & Barnetson, R. S., (2002). Treatment of dandruff with 5% tea tree oil shampoo. *Journal of the American Academy of Dermatology*, *47*, 852–855.

150. Scur, M. C., Pinto, F. G. S., Pandini, J. A., Costa, W. F., Leite, C. W., & Temponi, L. G., (2016). Antimicrobial and antioxidant activity of essential oil and different plant extracts of *Psidium cattleianum* Sabine. *Brazilian Journal of Biology, 76*, 101–108.
151. Selvakumar, P., Edhayanaveena, B., & Prakash, S. D., (2012). Studies on the antidandruff activity of the essential oil of *Coleus amboinicus* and *Eucalyptus globulus*. *Asian Pacific Journal of Tropical Disease*, *2*(2), S715–S719.
152. Shahsavari, R., Ehsani-Zonouz, A., Houshmand, M., Salehnia, A., Ahangari, G., & Firoozrai, M., (2009). Plasma glucose lowering effect of the wild *Satureja khuzestanica* Jamzad essential oil in diabetic rats: Role of decreased gluconeogenesis. *Pakistan Journal of Biological Sciences, 12*(2), 140–145.
153. Sharma, M., Agarwal, S. K., Sharma, P. R., Chadha, B. S., Khosla, M. K., & Saxena, A. K., (2010). Cytotoxic and apoptotic activity of essential oil from *Ocimum viride* towards COLO 205 cells. *Food and Chemical Toxicology*, *48*, 336–344.
154. Sheikh, B. A., Ayyasamy, L. P., & Chandramohan, R. R., (2015). Trans-anethole, a terpenoid ameliorates hyperglycemia by regulating key enzymes of carbohydrate metabolism in streptozotocin induced diabetic rats. *Biochimie*, *112*, 57–65.
155. Shim, C., & Williams, M. H., (1986). Effect of odors in asthma. *American Journal of Medicine*, *80*(1), 18–22.
156. Shinde, U. A., Phadke, A. S., Nair, A. M., Mungantiwar, A. A., Dikshit, V. J., & Saraf, M. N., (1999). Studies on the anti-inflammatory and analgesic activity of *Cedrus deodara* (Roxb.) Loud. wood oil. *Journal of Ethnopharmacology*, *65*(1), 21–27.
157. Sikkema, J., De Bont, J. A. M., & Poolman, B., (1995). Mechanisms of membrane toxicity of hydrocarbons. *Microbiology Reviews*, *59*, 201–222.
158. Sikkema, J., De Bont, J. A., & Poolman, B., (1994). Interactions of cyclic hydrocarbons with biological membranes. *Journal of Biological Chemistry*, *269*, 8022–8028.
159. Silva, J., Abebe, W., Sousa, S. M., Duarte, V. G., Machado, M. I. L., & Matos, F. J. A., (2003). Analgesic and anti-inflammatory effects of essential oils of *Eucalyptus. Journal of Ethnopharmacology*, *89*, 277–283.
160. Silva, M. T., Ribeiro, F. P., Medeiros, M. A., Sampaio, P. A., Silva, Y. M., Silva, M. T., Quintans, J. S., Quintans-Júnior, L. J., & Ribeiro, L. A., (2015). The vasorelaxant effect of p-cymene in rat aorta involves potassium channels. *Scientific World Journal* (p. 8). E-article ID: 458080. doi: 10.1155/2015/458080.
161. Singh, S., & Majumdar, D. K., (1997). Evaluation of anti-inflammatory activity of fatty acids of *Ocimum sanctum* fixed oil. *Indian Journal of Experimental Biology*, *35*, 380.
162. Sinico, C., De Logu, A., Lai, F., Valenti, D., Manconi, M., Loy, G., Bonsignore, L., & Fadda, A. M., (2005). Liposomal incorporation of *Artemisia arborescens* L. essential oils and *in vitro* antiviral activity. *European Journal of Pharmaceutics and Biopharmaceutics*, *59*(1), 161–168.
163. Smith, C. A., Collins, C. T., & Crowther, C. A., (2011). Aromatherapy for pain management in labor. *The Cochrane Database of Systematic Reviews, 8*, 79–86.
164. Smith-Palmer, A., Stewart, J., & Fyfe, L., (1998). Antimicrobial properties of plant essential oils and essences against five important food-borne pathogens. *Letters in Applied Microbiology, 26*, 118–122.
165. Sousa, A. A., Soares, P. M., Almeida, A. N., Maia, A. R., Souza, E. P., & Assreuy, A. M., (2010). Antispasmodic effect of *Mentha piperita* essential oil on tracheal smooth muscle of rats. *Journal of Ethnopharmacology*, *130*(2), 433–436.
166. Sousa, O. V., Silvério, M. S., Del-Vechio-Vieira, G., Matheus, F. C., Yamamoto, C. H., & Alves, M. S., (2008). Antinociceptive and anti-inflammatory effects of the essential oil from *Eremanthus erythropappus* leaves. *Journal of Pharmacy and Pharmacology*, *60*(6), 771–777.

167. Suppakul, P., Miltz, J., Sonneveld, K., & Bigger, S. W., (2003). Antimicrobial properties of basil and its possible application in food packaging. *Journal of Agricultural and Food Chemistry*, *51*, 3197–3207.
168. Svoboda, K. P., & Deans, S. G., (1995). Biological activities of essential oils from selected aromatic plants. *Acta Horticulturae*, *390*, 203–209.
169. Tepe, B., Donmez, E., Unlu, M., Candan, F., Daferera, D., Vardar-Unlu, G., Polissiou, M., & Sokmen, A., (2004). Antimicrobial and antioxidative activities of the essential oils and methanol extracts of *Salvia cryptantha* (Montbret et Aucherex Benth.) and *Salvia multicaulis* (Vahl). *Food Chemistry*, *84*, 519–525.
170. Tisserand, R., Gattefossé, R. M., & Davies, L., (2012). *Gattefossé's Aromatherapy*. London: Ebury Digital. E-book.
171. Tomaino, A., Cimino, F., Zimbalatti, V., Venuti, V., Sulfaro, V., De Pasquale, A., & Saija, A., (2005). Influence of heating on antioxidant activity and the chemical composition of some spice essential oils. *Food Chemistry*, *89*, 549–554.
172. Tripathi, R., Mohan, H., & Kamat, J. P., (2007). Modulation of oxidative damage by natural products. *Food Chemistry*, *100*(1), 81–90.
173. Ultee, A., Bennik, M. H. J., & Moezelaar, R., (2002). The phenolic hydroxyl group of carvacrol is essential for action against the food-borne pathogen *Bacillus cereus*. *Applied and Environmental Microbiology*, *68*, 1561–1568.
174. Ultee, A., Kets, E. P. W., & Smid, E. J., (1999). Mechanisms of action of carvacrol on the food-borne pathogen *Bacillus cereus*. *Applied and Environmental Microbiology*, *65*, 4606–4610.
175. Vijayalaxmi, A., Bakshi, V., Begum, N., Kowmudi, V., Naveen, K. Y., & Reddy, Y., (2016). Anti-arthritic and anti inflammatory activity of β Caryophyllene against Freund's complete adjuvant induced arthritis in Wistar Rats. *Journal of Bone Reports and Recommendations*, *1*, 9. doi: 10.4172/2469–6684.10009.
176. Walia, M., Mann, T. S., Kumar, D., Agnihotri, V. K., & Singh, B., (2012). Chemical composition and *in vitro* cytotoxic activity of essential oil of leaves of *Malus domestica* growing in Western Himalaya (India). *Evidence Based Complement and Alternative Medicine*. doi: 10.1155/2012/649727.
177. Weil, A., (1983). *Health and Healing* (p. 215). Houghton Mifflin, Boston, MA.
178. Wendakoon, C. N., & Morihiko, S., (1995). Inhibition of amino acid decarboxylase activity of *Enterobacter aerogenosa* by active components in spices. *Journal of Food Protection, 58*, 280–283.
179. Wiirzler, L. A. M., Silva-Filho, S. E., Aguiar, R. P., Cavalcante, H. A. O., & Cuman, R. K. N., (2016). Evaluation of anti-inflammatory activity of Estragole by modulation of Eicosanoids production. *International Journal of Pharma and Chemical Research*, *2*(1), 7–13.
180. Xiao, Y., Yang, F., Li, S. P., Hu, G., Lee, S. M. Y., & Wang, Y. T., (2008). Essential oil of *Curcuma wenyujin* induces apoptosis in human hepatoma cells. *World Journal of Gastroenterology*, *14*, 4309–4318.
181. Yang, Z. C., Wang, B. C., Yang, X. S., & Wang, Q., (2005). Chemical composition of the volatile oil from *Cynanchum stauntonii* and its activities of anti-influenza virus. *Colloids and Surfaces B: Biointerfaces*, *43*, 198–202.
182. Yu, J. Q., Liao, Z. X., Cai, X. Q., Lei, J. C., & Zou, G. L., (2007). Composition, antimicrobial activity and cytotoxicity of essential oils from *Aristolochia mollissima*. *Environment Toxicology and Pharmacology*, *23*, 162–167.

183. Yutani, M., Hashimoto, Y., Ogita, A., Kubo, I., Tanaka, T., & Fujita, K., (2011). Morphological changes of the filamentous fungus *Mucor mucedo* and inhibition of chitin synthase activity induced by anethole. *Phytotherapy Research*, *25*, 1707–1713.
184. Zanetti, M., Ternus, Z. R., Dalcanton, F., De Mello, M. M. J., De Oliveira, D., Araujo, P. H. H., Riella, H. G., & Fiori, M. A., (2015). Microbiological characterization of pure geraniol and comparison with bactericidal activity of the cinnamic acid in gram-positive and gram-negative bacteria. *Journal of Microbial and Biochemical Technology 7*(4),
185. Zhu, R., Liu, H., Liu, C., Wang, L., Ma, R., Chen, B., Li, L., Niu, J., Fu, M., Zhang, D., & Gao, S., (2017). Cinnamaldehyde in diabetes: A review of pharmacology, pharmacokinetics and safety. *Pharmacological Research*, *122*, 78–89.

1. Aishwarya, B., (2015). Therapeutic uses of peppermint: Review. *Journal of Pharmaceutical Science & Research*, *7*(7), 474–476.
2. Aromaworld 4-U. http://www.aromaworld4u.co/ExtractionMethods/Florasols.html (Accessed on 29 July 2019).
3. Badami, S., Rai, S. R., & Suresh, B., (2004). *In-vitro* antioxidant properties of Indian traditional paan and its ingredients. *Indian Journal of Traditional Knowledge*, *3*(2), 187–191.
4. Baser, K. H. C., & Buchbauer, G., (2010). *Handbook of Essential Oils: Science, Technology, and Applications* (1st edn.). CRC Press, Boca Raton, FL.
5. Baser, K. H. C., & Buchbauer, G., (2015). *Handbook of Essential Oils: Science, Technology, and Applications* (2nd edn., p. 1128). CRC Press, Boca Raton, FL.
6. *Bauer, K., Garbe, D., & Surburg, H., (1997). Common Fragrance and Flavor Materials: Preparation, Properties and Uses* (p. *290*). *WILEY-VCH.*
7. Berger, R. G., (2007). *Flavors and Fragrances: Chemistry, Bioprocessing and Sustainability* (p. 648). Springer Science and Business Media, Heidelberg.
8. Chami, F., Chami, N., Bennis, S., Trouillas, J., & Remmal, A., (2004). Evaluation of carvacrol and eugenol as prophylaxis and treatment of vaginal candidiasis in an immunosuppressed rat model. *Journal of Antimicrobial Chemotherapy*, *54*, 909–914.
9. Chrissie, W., (1996). *The Encyclopedia of Aromatherapy* (pp. 16–21). Healing Arts Press, Vermont.
10. Craveiro, A. A., Matos, F. J. A., Alencar, J. W., & Plumel, M. M., (1989). Microwave oven extraction of an essential oil. *Flavor Fragrance Journal*, *4*, 43–44.
11. Dawidowicz, A. L., Rado, E., Wianowska, D., Mardarowicz, M., & Gawdzik, J., (2008). Application of PLE for the determination of essential oil components from *Thymus Vulgaris* L. *Talanta*, *76*, 878–884.
12. Deyama, T., & Horiguchi, T., (1971). Studies on the components of essential oil of clove (*Eugenia caryophylatta* Thumberg). *Yakugaku Zasshi*, *91*, 1383–1386.
13. Djilani, A., & Dicko, A., (2012). The therapeutic benefits of essential oils. In: Bouayed, J., & Bohn, T., (eds.), *Nutrition, Well-Being and Health* (pp. 155–178). Intech, Croatia.
14. Farhat, A., Fabiano-Tixier, A. S., Visinoni, F., Romdhane, M., & Chemat, F., (2010). A surprising method for green extraction of essential oil from dry spices: Microwave dry-diffusion and gravity. *Journal of Chromatography*, *1217*(47), 7345–7350.
15. Fluid Management Systems. http://www.fms-inc.com/Products/PressurizedLiquid Extraction.aspx (Accessed on 29 July 2019).
16. Gledhill, D., (1990). *The Names of Plants* (2nd edn., p. 150). Cambridge University Press, Cambridge, MA.
17. *Global Food Book*. https://globalfoodbook.com/health-benefits-of-basil-*Ocimum basilicum* (Accessed on 29 July 2019).

18. Govindaraj, S., & Kumari, B. D. R., (2013). Composition and larvicidal activity of *Artemisia vulgaris* L. stem essential oil against *Aedes aegypti*. *Jordan Journal of Biological Sciences*, *6*(1), 11–16.
19. Guenther, E., (1953). *The Essential Oils: Individual Essential Oils of the Plant Families Gramineae, Lauraceae, Burseraceae, Myrtaceae, Umbelliferae and Geraniaceae* (p. 752). D. Van Nostrand Co., New York, volume IV.
20. *Guyanun Limited*. Available at: http://www.gyanunlimited.com/health/wonder-health-benefits-and-medicinal-uses-of-coriander-cilantro/9565/ (Accessed on 29 July 2019).
21. Haider, F., Dwivedi, P. D., Naqvi, A. A., & Bagchi, G. D., (2003). Essential oil composition of *Artemisia vulgaris* harvested at different growth periods under indo-Gangetic plain conditions. *Journal of Essential Oil Research*, *15*(6), 376–378.
22. Hammer, K. A., & Carson, C. F., (2011). Antibacterial and antifungal activities of essential oils. In: Thormar, H., (ed.), *Lipids and Essential Oils as Antimicrobial Agents* (pp. 255–306). John Wiley & Sons, Ltd, UK.
23. Hoffman, D., (1996). *The Complete Illustrated Holistic Herbal* (p. 256). Element Books Inc., Rockport, MA.
24. Hunter, M., (2012). *Essential Oils: Art, Agriculture, Science* (p. 780). Nova Science Publishers, Inc., Hauppauge, NY.
25. Judzentiene, A., & Buzelyte, J., (2006). Chemical compositions of essential oils of *Artemisia vulgaris* L. (mugwort) from North Lithuania. *Chemija*, *17*(1), 12–15.
26. Laribi, B., Kouki, K., M'Hamdi, M., & Bettaieb, T., (2015). Coriander (*Coriandrum sativum* L.) and its bioactive constituents. *Fitoterapia*, *103*, 9–26.
27. Mann, J., Davidson, R. S., Hobbs, J. B., Banthorpe, D., & Harborne, J. B., (1994). *Natural Products: Their Chemistry and Biological Significance* (p. 455). Longman Scientific and Technical, Harlow.
28. Marwat, S. K., & Khan, M. A., (2011). Interpretation and medicinal potential of Ar-Rehan (*Ocimumbasilicum*L.)–A review. *American-Eurasian Journal of Agricultural and Environmental Sciences*, *10*, 478–484.
29. Mason, T., Chemat, F., & Vinatoru, M., (2011). The extraction of natural products using ultrasound and microwaves. *Current Organic Chemistry, 15*, 237–247.
30. *Medical News Today*. https://www.medicalnewstoday.com/articles/266259.php (Accessed on 29 July 2019).
31. Mengal, P., Behn, D. B. M., & Monpon, B., (1993). VMHD: Extraction of essential oil by microwave. *Parfums, Cosmétiques, Arômes*, *114*, 66–67 (in French).
32. Mercola, J., (2018). *Herbs and Spices*. Available at: https://articles.mercola.com/herbs-spices/eucalyptus.aspx (Accessed on 29 July 2019).
33. Mercola, J., (2018). *Herbal Oils*. https://articles.mercola.com/herbal-oils/lemongrass-oil.aspx (Accessed on 29 July 2019).
34. Mercola, J., (2018). *Herbal Oils*. https://articles.mercola.com/herbal-oils/jasmine-absolute-oil.aspx (Accessed on 29 July 2019).
35. Meyer-Warnod, B., (1984). Natural essential oils: Extraction processes and application to some major oils. *Perfumer and Flavorist*, *9*, 93–104.
36. Milind, P., & Deepa, K., (2011). Clove: A champion spice. *International Journal of Research in Ayurvedha and Pharmacy*, *2*(1), 47–54.
37. Moghaddam, M., & Mehdizadeh, L., (2017). Chemistry of essential oils and factors influencing their constituents. In*: Soft Chemistry and Food Fermentation* (pp. 379–419). Elsevier.

38. Moss, M., Cook, J., Wesnes, K., & Duckett, P., (2003). Aromas of rosemary and lavender essential oils differentially affect cognition and mood in healthy adults. *International Journal of Neuroscience, 113*, 15–38.
39. Nentwig, G., (2003). Use of repellents as prophylactic agents. *Parasitology Research 90*, S40–S48.
40. Okoh, O., Sadimenko, A., & Afolayan, A., (2010). Comparative evaluation of the antibacterial activities of the essential oils of *Rosmarinus officinalis* L. obtained by hydrodistillation and solvent free microwave extraction methods. *Food Chemistry*, *120*(1), 308–312.
41. Peerzada, N., (1997). Chemical composition of the essential oil of *Hyptis Suaveolens*. *Molecules*, *2*, 165–168.
42. Peirce, A., (1999). *The American Pharmaceutical Association Practical Guide to Natural Medicines* (p. 752). William Morrow and Company, Inc., New York.
43. Pingret, D., Fabiano-Tixier, A. S., & Chemat, F., (2013). Degradation during application of ultrasound in food processing: A review. *Food Control*, *31*, 593–606.
44. Porto, C., Decorti, D., & Kikic, I., (2009). Flavor compounds of *Lavandula angustifolia L*. to use in food manufacturing: Comparison of three different extraction methods. *Food Chemistry*, *112*, 1072–1078.
45. Sharma, M. M., & Sharma, R. K., (1999). Coriander. *Handbook of Herbs and Spices* (pp. 1–6). Woodhead Publishing Ltd., Cambridge, UK.
46. Shibamoto, K., Mochizuki, M., & Kusuhara, M., (2010). Aromatherapy in anti-ageing medicine. *Anti-Ageing Medicine*, *7*, 55–59.
47. Silva, J., Abebe, W., Sousa, S. M., Duarte, V. G., Machado, M. I., & Matos, F. J., (2003). Analgesic and anti-inflammatory effects of essential oils of eucalyptus. *Journal of Ethnopharmacology*, *89*(2/3), 277–283.
48. Sujatha, G., Ranjitha-Kumari, B. D., Cioni, P. L., & Flamini, G., (2008). Mass propagation and essential oil analysis of *Artemisia vulgaris* L. *Journal of Bioscience and Bioengineering*, *105*(3), 176–183.
49. Teixiera Da Silva, J. A., (2004). Mining the essential oils of Anthemideae. *African Journal of Biotechnology*, *3*(12), 706–720.
50. Tisserand, R., & Young, R., (2013). *Essential Oil Safety: A Guide for Health Care Professionals* (p. 784). Elsevier health sciences (Churchill Livingstone), United Kingdom.
51. *Useful Tropical Plant Database*. http://tropical.theferns.info/viewtropical.php?id=Hyptis+suaveolens (Accessed on 29 July 2019).
52. Vecchio, M. G., Loganes, C., & Minto, C., (2016). Beneficial and healthy properties of Eucalyptus plants: A great potential use. *The Open Agricultural Journal*, *10*, 52–57.
53. Virmani, O. P., Srivastava, R., & Datta, S. G., (1979). Oil of lemongrass, Part 2: West Indian. *World Crops*, *31*(3), 120–121.
54. Vishin, A. P., & Sachin, A. N., (2014).A review on *Eucalyptus globulus*: A divine medicinal herb. *World Journal of Pharmacy and Pharmaceutical Sciences*, *3*(6), 559–567.
55. *Wikipedia*. https://en.wikipedia.org/wiki/Oregano (Accessed on 29 July 2019).
56. Williams, L. R., Stockley, J. K., Yan, W., & Home, V. N., (1998). Essential oils with high antimicrobial activity for therapeutic use. *International Journal of Aromatherapy*, *8*(4), 30–39.
57. Zill-e-Huma, H., Abert-Vian, M., Elmaataoui, M., & Chemat, F., (2011).A novel idea in food extraction field: Study of vacuum microwave hydrodiffusion technique for by-products extraction *Journal of Food Engineering*, *105*, 351–360.

58. Zuzarte, M., & Salgueiro, L., (2015). Essential oils chemistry. In: De Sousa, D. P., (ed.), *Bioactive Essential Oils and Cancer* (pp. 19–28). Springer, Switzerland.
1. Aggarwal, P., Rai, V., & Singh, R. B., (1996). Randomized placebo - controlled single blind trial of holy basil leaves in patients with non-insulindependent *diabetes mellitus*. *International Journal of Clinical Pharmacology and Therapeutics, 34*, 406–409.
2. Ahmad, A., Rasheed, N., Gupta, P., Singh, S., Siripurapu, K. B., Ashraf, G. M., et al., (2012) Novel ocimumoside A and B as anti-stress agents: Modulation of brain monoamines and antioxidant systems in chronic unpredictable stress model in rats. *Phytomedicine*, *19*, 639–647.
3. Alzheimer's disease facts and figures: Alzheimer's association report, (2013). *Alzheimer's and Dementia, 9*(2), 208–245.
4. Bhargava, K. P., & Singh, N., (1981). Anti-stress activity of *Ocimum sanctum* Linn. *Indian Journal of Medical Research*, *73*, 443–451.
5. Bhattacharyya, D., Sur, T. K., Jana, U., & Debnath, P. K., (2008). Controlled programmed trial of Ocimum sanctum leaf on generalized anxiety disorders. *Nepal Medical College Journal*, *10*, 176–179.
6. Callahan, D., (1973). The WHO definition of 'health.' In: *The Concept of Health* (Vol. 1, No. 3, pp. 77–87). The Hastings Center Studies, Garrison, New York.
7. Chatterjee, M., Verma, P., Maurya, R., & Palit, G., (2011). Evaluation of ethanol leaf extract of Ocimum sanctum in experimental models of anxiety and depression. *Pharmaceutical Biology*, *5*, 477–483.
8. Chattopadhyay, R. R., (1993). Hypoglycemic effect of *Ocimum sanctum* leaf extract in normal and streptozotocin diabetic rats. *Indian Journal of Experimental Biology*, *31*(11), 891–893.
9. Cohen, M. M., (2014). Tulsi-*Ocimum sanctum*: A herb for all reasons. *Journal of Ayurveda and Integrative Medicine*, *5*, 251–259.
10. Dhar, M. L., Dhar, M. M., Dhawan, B. N., Mehrotra, B. N., & Ray, A. C., (1968). Screening of Indian plants for biological activity, Part I. *Indian Journal of Experimental Biology*, *6*(4), 232–247.
11. Dias, V., Junn, E., & Mouradian, M. M., (2013). The role of oxidative stress in Parkinson's disease. *Parkinson's Disease*, *4*, 461–491.
12. Giri, J. P., Suganthi, B., & Meera, G., (1987). Effect of tulsi on diabetes mellitus. *The Indian Journal of Nutrition and Dietetics*, *24*, 337–341.
13. Godhwani, S., Godhwani, J. L., & Was, D. S., (1988). *Ocimum sanctum*- A preliminary study evaluating its immunoregulatory profile in albino rats. *Journal of Ethnopharmacology*, *24*, 193–198.
14. Gradinariu, V., Cioanca, O., Hritcu, L., Trifan, A., Gille, E., & Hancianu, M., (2015). Comparative efficacy of *Ocimum sanctum* L. and *Ocimumbasilicum* L. essential oils against amyloid beta(1–42)-induced anxiety and depression in laboratory rats. *Phytochemistry Reviews, 14*, 567–575.
15. Gupta, P., Yadav, D. K., Siripurapu, K. B., Palit, G., & Maurya, R., (2007). Constituents of *Ocimum sanctum* with antistress activity. *Journal of Natural Products*, *70*, 1410–1416.
16. Hill, M. N., Hellemans, K. G. C., Verma, P., Gorzalka, B. B., & Weinberg, J., (2012). Neurobiology of chronic mild stress: Parallels to major depression. *Neuroscience & Biobehavioral Reviews*, *36*, 2085–2117.
17. Huang, Y., & Mucke, L., (2012). Alzheimer mechanisms and therapeutic strategies. *Cell*, *148*(6), 1204–1222.

18. Huang, Y. C., Wu, B. N., Lin, Y. T., Chen, S. J., Chiu, C. C., Cheng, C. J., & Chen, I. J., (1999). Eugenedilol: A third-generation h-adrenoceptor blocker derived from eugenol, with a-adrenoceptor blocking and h-2-adrenoceptor agonist associated vasorelaxant activities. *Journal of Cardiovascular Pharmacology*, *34*, 10–20.
19. Ittiyavirah, S., & Anurenj, D. A., (2014). Adaptogenic studies of acetone extract of *Musa paradisiaca* L. fruit peels in albino Wistar rats. *International Journal of Nutrition, Pharmacology, Neurological Disease, 4*, 88–94.
20. Jaggi, R. K., Madaan, R., & Singh, B., (2003). Anticonvulsant potential of holy basil, *Ocimum sanctum* Linn. and its cultures. *Indian Journal of Experimental Biology*, *11*, 1329–1333.
21. Joshi, H., & Parle, M., (2006). Evaluation of nootropic potential of *Ocimum sanctum* Linn. in mice. *Indian Journal of Experimental Biology*, *44*, 133–136.
22. Kelm, M. A., Nair, M. G., Strasburg, G. M., & DeWitt, D. L., (2000). Antioxidant and cyclooxygenase inhibitory phenolic compounds from *Ocimum sanctum* Linn. *Phytomedicine*, *7*, 7–13.
23. Kirtikar, K. R., & Basu, B. D., (1975). *Ocimum sanctum* Linn. In: Blatter, E., Caius, J. F., & Mhaskar, K. S., (eds.), *Indian Medicinal Plants* (Vol. III, pp. 1965–1968). M/s. Bishen Singh Mahendra Pal Singh Publisher, Dehradun.
24. Lin, Y. T., Wu, B. N., Horng, C. F., & Huang, Y. C., (1999). Selective beta1-adrenergic antagonist with tracheal and vascular smooth muscle relaxant properties. *Japanese Journal of Pharmacology*, *80*, 127–136.
25. Luthy, N., & Martinez-Fortun, O., (1964). A study of a possible oral hypoglycemic factor in *Albahaca morada* (*Ocimum sanctum* L.). *The Ohio Journal of Science*, *64*(3), 223–224.
26. Maity, T. K., Mandal, S. C., Saha, B. P., & Pal, M., (2000). Effect of *Ocimum sanctum* roots extract on swimming performance in mice. *Phytotherapy Research*, *14*, 120–121.
27. Manu, G., Hema, N. G., Parashivamurthy, B. M., & Kishore, M. S., (2014). Evaluation of effect *Ocimum sanctum* in experimental models of depression. *International Medical Journal*, *1*(9), 599–602.
28. Mizoguchi, K., Yuzurihara, M., Ishige, A., Aburada, M., & Tabira, T., (2003). *Saiko-ka-ryukotsu-borei-to*: A herbal medicine, ameliorates chronic stress-induced depressive state in rotarod performance. *Pharmacology Biochemistry and Behavior*, *75*, 419–425.
29. Mukherjee, J., Bhaumik, U., Mukherjee, P. K., & Saha, B. P., (2009). CNS activity of the methanol extract obtained from the roots of *Ocimum sanctum* Linn. *Pharmacology Online*, *2*, 673–685.
30. Nadkarni, K. M., & Nadkarni, A. K., (1954). *Ocimum sanctum* Linn. In: Nadkarni's, K. M., (ed.), *Indian Materia Medica, with Ayurvedic, Unani-Tibbi, Siddha, Allopathic, Homeopathic, Naturopathic & Home Remedies, Appendices & Indexes* (Vol. 1, pp. 865–867). Popular Prakashan, Panvel, Bombay.
31. NIH (National Institutes of Health), (2018). *Collection Development Manual*, NLM *(U. S. National Library of Medicine)*. https://www.nlm.nih.gov/tsd/acquisitions/cdm/subjects24.html (Accessed on 29 July 2019).
32. *NIH*. stress_factsheet_14289, https://www.nimh.nih.gov/health/publications/stress/index.shtml (Accessed on 29 July 2019).
33. Nishijima, T., Uchida, R., Kamayama, K., Kawakami, N., Ohkubo, T., & Kitamura, K., (1999). Mechanisms mediating vasorelaxing action of eugenol, a pungent oil, on rabbit arterial tissue. *Japanese Journal of Pharmacology*, *79*, 327–334.

34. Pare, W. P., & Glavin, G. B., (1986). Restraint stress in biomedical research: A review. *Neuroscience and Biobehavioral Reviews*, *10*, 339–370.
35. Pemminati, S., Gopalakrishna, H. N., Alva, A., Pai, M. R. S. M., Seema, Y., Raj, V., & Pillai, D., (2010). Antidepressant activity of ethanolic extract of leaves of *Ocimum sanctum* in mice. *Journal of Pharmacy Research*, *3*, 624–626.
36. Pemminati, S., Nair, V., Dorababu, P., & Gopalakrishna, H. N., (2007). Effect of ethanolic extract of leaves of *Ocimum sanctum* on haloperidol induced catalepsy in albino mice. *Indian Journal of Pharmacology*, *39*(2), 87–89.
37. Prajapati, N. D., Purohit, S. S., Sharma, A. K., & Kumar, T., (2003). *A Handbook of Medicinal Plants: A Complete Source Book* (pp. 12–18). Agrobios (India), New Delhi.
38. Raghavendra, M., Maiti, R., Kumar, S., & Acharya, S. B., (2009). Role of *Ocimum sanctum* in the experimental model of Alzheimer's disease in rats. *International Journal of Green Pharmacy*, 6–15.
39. Rai, V., Mani, U. V., & Iyer, U. M., (1997). Effect of *Ocimum sanctum* leaf powder on blood lipoproteins, glycated proteins and total amino acids in patients with non-insulin-dependent diabetes mellitus. *Journal of Nutritional & Environmental Medicine*, *7*, 113–118.
40. Rajagopal, S. S., Lakshminarayanan, G., & Rajesh, R., (2013). Neuroprotective potential of *Ocimum sanctum* (Linn) leaf extract in monosodium glutamate induced excitotoxicity, *African Journal of Pharmacy and Pharmacology*, *7*(27), 1894–1906.
41. Ramanathan, M., Balaji, B., & Justin, A., (2011). Behavioral and neurochemical evaluation of Perment an herbal formulation in chronic unpredictable mild stress induced depressive model. *Indian Journal of Experimental Biology*, *49*, 269–275.
42. Ravindran, R., Sheela Devi, R., Samson, J., & Senthilvelan, M., (2005). Noise stress induced brain neurotransmitter changes and the effect of *Ocimum sanctum* (Linn) treatment in albino rats. *Journal of Pharmacological Sciences, 98*, 354–360.
43. Richard, E. J., Illuri, R., Bethapudi, B., & Anandhakumar, S., (2016). Anti-stress activity of *Ocimum sanctum*: Possible effects on hypothalamic-pituitary-adrenal axis. *Phytotherapy Research*, *30*, 805–814.
44. Ryan, K. K., (2014). Stress and metabolic disease. In: *Sociality, Hierarchy, and Health: Comparative Biodemography: A Collection of Papers* (pp. 247–268). National Academy Press, Washington DC.
45. Sakina, M. R., Dandiya, P. C., & Hamdard, M. E., (1990). Preliminary psychopharmacological evaluation of *Ocimum sanctum* leaf extract. *Journal of Ethnopharmacology*, *28*, 143–150.
46. Samson, J., Sheeladevi, R., & Ravindran, R., (2007). Oxidative stress in brain and antioxidant activity of *Ocimum sanctum* in noise exposure. *Neuro Toxicology*, *28,* 679–685.
47. Samson, J., Sheeladevi, R., Ravindran, R., & Senthilvelan, M., (2006). Biogenic amine changes in brain regions and attenuating action of *Ocimum sanctum* in noise exposure. *Pharmacology, Biochemistry and Behavior*, *83*, 67–75.
48. Sarkar, A., Lavania, S. C., Pandey, D. N., & Pant, M. C., (1994). Changes in the blood lipid profile after administration of *Ocimum sanctum* leaves in the normal albino rabbits. *Indian Journal of Physiology and Pharmacology*, *38*(4), 311–312.
49. Saxena, R. C., Singh, R., Kumar, P., & Negi, M. P. S., (2012). Efficacy of an extract of *Ocimum tenuiflorum* (OciBest) in the management of general stress: A double-blind, placebo-controlled study. *Evidence-Based Complementary and Alternative Medicine*, 1–7.

50. Schildkraut, J. J., (1965). The catecholamine hypothesis of affective disorders: A review of supporting evidence. *American Journal of Psychiatry*, *122*(5), 509–522.
51. Sembulingam, K., Sembulingam, P., & Namsivayam, A., (2005). Effect of *Ocimum sanctum* Linn. on the changes in central cholinergic system induced by acute noise stress. *Journal of Ethnopharmacology*, *96*, 477–482.
52. Sen, P., Maiti, P. C., Puri, S., & Ray, A., (1992). Mechanism of anti-stress activity of *Ocimum sanctum* Linn, eugenol and *Tinosporamalabarica* in experimental animals. council for research in Ayurveda and Siddha, New Delhi.
54. Stradford, D., (2012). Promoting wellness in mental health: The CAM approach in psychiatry. In: Stradford, D., Berger, C., Vickar, G., & Cass, H., (eds.), *The Flying Publisher Guide to Complementary and Alternative Medicine Treatments in Psychiatry* (pp. 13–21). The Flying Publisher, Bernd KampsSteinhauser Verlag.
55. Subhani, A. R., Kamel, N., & Mohamad, S. M. N., (2018). Mitigation of stress: New treatment alternatives. *Cognitive Neurodynamics*, *1*, 1–20.
56. Tabassum, I., Siddiqui, Z. N., & Rizvi, S. J., (2010). Effects of *Ocimum sanctum* and *Camellia sinensis* on stress induced anxiety and depression in male albino *Rattus norvegicus*. *Indian Journal of Pharmacology*, *42*, 283–288.
57. Tupper, T., & Gopalakrishnan, G., (2007). Prevention of diabetes development in those with the metabolic syndrome. *Medical Clinics of North America*, *91*, 1091–1105.
58. Venuprasad, M. P., Kumar, K. H., & Khanum, F., (2013). Neuroprotective effects of hydroalcoholic extract of Ocimum sanctum against H_2O_2 induced neuronal cell damage in SH-SY5Y cells via its antioxidative defense mechanism. *Neurochemical Research*, *38*, 2190–2200.
59. Welty, F. K., Alfaddagh, A., & Elajami, T. K., (2016). Targeting inflammation in metabolic syndrome. *Translational Research, 167*, 257–280.
60. Wicks, S. M., Lawal, T. O., Raut, N. A., & Mahady, G. B., (2017). Interactions of commonly used prescription drugs with food and beverages. In: *Sustained Energy for Enhanced Human Functions and Activity* (pp. 465–477). Academic Press (An imprint of Elsevier), London Wall, London, UK.
61. Yanpallewar, S. U., Rai, S., Kumar, M., & Acharya, S. B., (2004). Evaluation of antioxidant and neuroprotective effect of *Ocimum sanctum* on transient cerebral ischemia and long term cerebral hypoperfusion. *Pharmacology, Biochemistry and Behavior*, *79*, 155–164.
62. Zhou, C., Huang, Y., & Przedborski, S., (2008). Oxidative stress in Parkinson's disease: A mechanism of pathogenic and therapeutic significance. *Annals of the New York Academy of Sciences*, *1147*, 93–104.
1. Abd El-Ghani, M. M., (2016). Traditional medicinal plants of Nigeria: An overview. *Agricultural and Biology J. of North America*, *7*(5), 220–247.
2. Archaya, D., & Silvastava, A., (2008). *Indigenous Herbal Medicines: Tribal Formulations and Traditional Herbal Practices* (1st edn., p. 241). Havishker Publishers, New Delhi–India.
3. Ahmed, A. A., Mahmoud, A. A., William, H. J., & Scott, A. I., (1993). New sesquiterpene α-methylene lactones from the Egyptian plant *Jalconiacandicans*. *J. Nat. Prod, 56*, 1276–1280.

4. Alviano, D. S., & Alviano, C. S., (2009). Plant extracts: Search for new alternatives to treat microbial diseases. *Curr. Pharm. Biotechnol*, *10*(1), 106–121.
5. Anesini, E., & Perez, C., (1993). Screening of plants used in Argentina folk medicine for antimicrobial activity. *J. Eth. Pharmacol, 39*, 119–128.
6. Angulo, F., Johnson, K., Tauxe, R., & Cohen, M., (2000). Origins and consequences of antimicrobial resistant non-typhoidal Salmonella: Implications for the use of fluoroquinolones in food animals. *Microbial Drug Resist, 6*, 77–83.
7. Ayafor, J. F., Tchuendim, M. H. K., & Nyasse, B., (1994). Novel bioactive diterprenoids from *Aframomumaulacocarpos. J. Nat. Prob. Cross-Ref Medline, 57*, 917–923.
8. Bankole, A. E., Adekunle, A. A., & Sowemimo, A. A., (2016). Phytochemical screening and *in vivo* antimalarial activity of extracts from three medicinal plants used in malaria treatment in Nigeria. *Braz. J. Microbiol*, *115*, 299–305.
9. Bauer-Garland, J., Frye, J. G., Gray, J. T., Berrang, M. E., Harrison, M. A., & Fedorka-Cray, P. J., (2006). Transmission of salmonella serotype typhimurium, in poultry with or without antimicrobial selective pressure. *J. Appl. Micro, 101*, 1301–1308.
10. Bonomo, R. A., & Szabo, D., (2006). Mechanism of multidrug resistance in Acinetobacter species and Pseudomonas aureginosa. *J. Infect. Dis. Clin., 43*, 49–56.
11. Centre for Disease Control and Prevention (CDC), (2017). *Antibiotic and Antimicrobial Resistance* (p. 23). CDC, Atlanta, GA, USA.
12. Chandra, H., Bishnoi, P., Yadav, A., Patni, B., Mishra, A. P., & Nautiyal, A. R., (2017). Antimicrobial resistance and the alternative resources with special emphasis on plant-based antimicrobials - A review. *Plants, 6*(2), 16, E-article. doi: 10.3390/plants6020016.
13. Cowan, M. M., (1999). Plant products as antimicrobial agents. *Clinical Microbiology Reviews, 12*(4), 564–582.
14. Cruz, M. C., Santos, P. O., Barbosa, A. M., Melo, D. L., & Alviano, C. S., (2007). Antifungal activity of Brazilian medicinal plants involved in popular treatment of mycoses. *J. Ethnopharmacology, 11*(2), 409–412.
15. Dabur, R., Gupta, A., Mandal, T. K., & Singh, D. D., (2007). Antimicrobial activity of some Indian medicinal plants. *Afr. J. Trad. Compl. Med., 4*(3), 313–318.
16. Davies, J., (1994). Inactivation of antibiotics and the dissemination of resistant genes. *Science* (New York, NY), *264*(3), 75–82.
17. Dean, D. A., & Burchard, K. W., (1996). Fungal infection in surgical patients. *Am. J. Surg., 171*, 374–382.
18. Dixon, R. A., Dey, P. M., & Lamb, C. J., (1983). Phythoalexin: Enzymology and molecular biology. *Adv. Enzymol. Relat. Areas Mol. Biol., 55*, 1–69.
19. Dorman, H. J., & Deans, S. G., (2000). Antimicrobial agents from plants: Antibacterial activity of plant volatile oils. *J. Appl. Microbial.*, *88*(2), 308–316.
20. Falodun, A., Imieje, V., Erhiruiji, O., Ahomafor, J., Jacob, M. R., Khen, S. I., & Hamann, M. T., (2014). Evaluation of 3 medicinal plants extracts against *Plasmodium falciparum* and selected microorganisms. *Afr. J. Trad. Complent. Altern. Med.*, *11*(4), 142–146.
21. Farjana, A., Zerin, N., & Kabir, S., (2014). Antimicrobial activity of medicinal plant leaf extracts against pathogenic bacteria. *Asian Pacific J. of Tropical Diseases, 2*(2), 920–923.
22. Finch, R. D., Greenwood, D., Norly, S. R., & Whitley, R. J., (2003). *Antibiotic and Chemotheraphy: Anti-Infective Agent and Their Use in Therapy* (8th edn., pp. 45–49). Living Stone, Churchill, UK. ISBN-13–978–04430712.
23. Fujioka, T., & Kashiwada, Y., (1994). Anti-AIDS agents: 11 Betulinic acid and plantonic acid as anti-HIV principles from *Syzigiumclariflorum* and the anti-HIV activity of

structurally related triterpenoids. *J. Nat. Prod, 57*, 243–247.
24. Geissman, T. A., (1963). *Flavonoids Compounds, Tannins, Lignins and Related Compounds in Pyrole Pigments, Isoprenoid Compounds and Phenolic Plant Constituents* (pp. 265–234). Elsevier, New York, N. Y.
25. Ghoshal, S., Krishna-Prasad, B. N., & Lakshmi, V., (1996). Anti-amoebic activity of *Piper langum* fruits against *Entamoeba histolytica in vitro* and *in vivo*. *J. Ethno Pharmacol., 50*, 167–170.
26. Gislene, G. G., Nascimento, F., Locatelli, J., Freitas, P. C., & Silva, G. L., (2000). Antibacterial activity of plant extracts and phytochemicals on antibiotic resistant bacteria. *Braz. J. Microbiol., 31*(4), 1678–4405.
27. Govaerts, R., (2001). How many species of seed plants are there? *Taxon,* 1085–1090.
28. Graybill, J. R., (1988). Systemic fungi infections: Diagnosis and treatment with therapeutic agents. *Infectious Disease Clinic of North America*, *14,* 805–825.
29. Hostelman, K., & Marston, A., (2002). Twenty years of research into medicinal plants: Results and perspectives. *Phytochem. Res., 2*, 278–285.
30. Khan, U. A., Rahman, H., Niaz, Z., & Rehman, B., (2013). Antibacterial activity of some medicinal plant against selected human pathogenic bacteria. *European Journal of Microbiology and Immunology, 4,* 272–274.
31. Kirby, G. C., (1996). Medicinal plants and the control of parasites. *Trans. Roy. Soc. Trop. Med. Hyg., 90*, 605–609.
32. Manchandra, V., Sanharta, S., & Singh, N. P., (2010). Multidrug resistant acinetobacter. *Journal of Global Infectious Diseases, 2*(3), 291–304.
33. Marker, B., (2010). *Antibiotic Resistance in Salmonella, Marler Blog*. www.marlerblog.com/case-news/antibiotic-resistance-in-*salmonella/* (Accessed on 29 July 2019).
34. Martinez, M. J., Vasquez, S. M., Espinosa-Perez, C., Dias, M., & Hermera, S., (1994). Antimicrobial properties of Argentatine isolated from *Parthenium argentatum. Filoterapia*, *65*, 371–372.
35. Martinez, M. J., Betancourt, J., Alanso-Gonzalez, N., & Jauregui, A., (1996). Screening of some Cuban medicinal plant for adults. *J. Eth. Pharmacol, 52*, 171–174.
36. Matthew, A., Gissel, R., & Liamthong, S., (2000). Antibiotic resistance in bacteria associated with food animals: United States perspective of livestock production. *Foodborne Path. and Dis.*, *4*(2), 115–133.
37. Narang, G. D., Nayar, S. M., & Cndiratta, D. K., (1962). Antibacteria activity of some indigenous drugs. *J. Vet. Animal Hus, 6*(1), 22–25.
38. Nasir, I. A., Babyo, A., Emeribe, A. U., & Sani, W. O., (2015). Surveillance for antibiotic resistance in Nigeria: Challenges and possible solutions. *Trends in Medical Research*, *10,* 106–113.
39. Ndihokubwayo, J. B., Yahaya, A. A., Detsa, A. T., Ki-zerbo, G., & Odei, E. A., (2013). Antimicrobial resistance in the African region: Issues, challenges and actions proposed. *Afr. Health Min.*, *16*, 27–30.
40. Ng, P. C., (1994). Systemic fungi infections in Neonates. *Arch. Dis. of Childhood*, *71*, 130–135.
41. Nikado, H., (1994). Prevention of drug access to bacterial targets. Permeability barriers and active efflux. *Science*, *264*(5157), 382–388.
42. Orhan, D. D., Ozpeluk, B., Ozgen, S., & Ergun, F., (2010). Antibacterial, antifungal, and antiviral activities of some flavonoids. *Microbiological Research*, *165*(6), 496–504.
43. Ozcelik, B., Aslan, M., Orhan, I., & Kahaoglu, T., (2005). Antibacterial, antifungal and antiviral activities of the lipohylic extracts of *Pistaciavera. Microbiol. Res, 160*(2), 159–164.

44. Pitout, J. J. D., (2008). Multi resistant enterobacteriaceae: New threat of an old problem. *Expert Review of Anti-Infective Therapy*, *6*(5), 657–669.
45. Ruberto, G., Baratta, M. T., Deans, S. G., & Dorman, H. J., (2000). Antioxidant and antimicrobial activity of *Foeniculum vulgare* and *Crithmummaritimum* essential oils. *Plant Med.*, *66*(8), 687–693.
46. Scalbert, A., (1992). Antimicrobial properties of tannins phytochemistry. In: *Proceedings of the 2nd North American Tannin Conference* (p. 8). Plenum Press, New York.
47. Seradzki, K., Wu, S., & Tomasz, A., (1999). Inactivation of the methicillin resistance gene mecA in Vancomycin-resistant *Staphylococcus aureus*. *Micro Drug Resist*, *5*(4), 253–257.
48. Smith, A., (2003). Bacteria resistance to Ab. In: Denyer, S. P., Hodges, N. A., & Arman, S. P., (eds.), *Hugo and Russel's Pharmaceutical Microbiology* (8th edn., pp. 220–224). Blackwell Science Ltd., Massachusetts, USA.
49. Starr, M. P., & Reynolds, D. M., (1951). Steptomycin resistance of coliform bacteria from turkey feed. *Am. J. Public Health, 25*, 1375–1380.
50. Tahl, W. H., & Mahasneh, A. M., (2010). Antimicrobial, cytotoxicity and phytochemical screening of Jordamain plants used in traditional medicine. *Molecules*, *15*(3), 1811–1824.
51. Tenover, F. C., (2006). Mechanism of antimicrobial resistance in bacteria. *Am. J. Infect. Control, 34*(5), 3–10.
52. Tringali, C., (2001). *Bioactive Compounds from Natural Sources: Isolation, Characteristics and Biological Properties* (p. 261). Taylor and Francis Group, London.
53. Webber, M. A., & Piddock, L. J., (2003). The importance of efflux pumps in bacterial antibiotic resistance. *The Journal of Antimicrobial Chemotherapy*, *51*, 9–11.
54. WHO., (2001). *Strategy for Containment of Antimicrobial Res. Report by WHO/CDS/CSR/DRS/2001* (pp. 1–105). Department of communicable disease surveillance and response, WHO, Geneva, Switzerland.
55. Wilke, M. S., Lovering, A. L., & Strynadka, N. C. J., (2005). β-Lactam antibiotic resistance: A current structural perspective. *Curr. Opin. Microbiol*., *8*, 525–533.
56. Zhag, R., Eggleston, K., Rotimi, V., & Zeckhauser, R. J., (2006). Antibiotic resistance as a global threat: evidence from China, Kuwait and the United States. *Global Health*, *2*, 6–8.
57. Zhou, G., Shi, Q. S., Huang, X. M., & Xie, X. B., (2015). The three bacterial lines of defense against antimicrobial agents. *Int. J. Mol. Sci., 16*(9), 21711–21733.
1. Agostinho, L. A., Dos Santos, S. R., Alvarenga, R. M. P., & Paiva, C. L. A., (2013).A systematic review of the intergenerational aspects and the diverse genetic profiles of Huntington's disease. *Genet Mol Res*, *12*, 1974–1981.
2. Ahmadi, A., Shadboorestan, A., Nabavi, S. F., Setzer, W. N., & Nabavi, S. M., (2015). The role of hesperidin in cell signal transduction pathway for the prevention or treatment of cancer. *Current Medicinal Chemistry*, *22*, 3462–3471.
3. Ajayi, S. A., Ofusori, D. A., Ojo, G. B., Ayoka, O. A., Abayomi, T. A., & Tijani, A. A., (2011). The microstructural effects of aqueous extract of Garcinia kola (Linn) on the hippocampus and cerebellum of malnourished mice. *Asian Pacific Journal of Tropical Biomedicine*, *1*, 261–265.
4. Alkhalidy, H., Moore, W., Zhang, Y., McMillan, R., Wang, A., Ali, M., & Hulver, M., (2015). Small molecule kaempferol promotes insulin sensitivity and preserved pancreatic β-cell mass in middle-aged obese diabetic mice. *Journal of Diabetes Research*.

5. Al-Sabahi, B. N., Fatope, M. O., Essa, M. M., Subash, S., Al-Busafi, S. N., Al-Kusaibi, F. S., & Manivasagam, T., (2017). Pomegranate seed oil: Effect on 3-nitropropionic acid-induced neurotoxicity in PC12 cells and elucidation of unsaturated fatty acids composition. *Nutritional Neuroscience*, *20*, 40–48.
8. Ashafaq, M., Khan, M. M., Raza, S. S., Ahmad, A., Khuwaja, G., Javed, H., & Islam, F., (2012). S-allyl cysteine mitigates oxidative damage and improves neurologic deficit in a rat model of focal cerebral ischemia. *Nutrition Research*, *32*, 133–143.
9. Ayyappan, P., Palayyan, S. R., & Kozhiparambil, G. R., (2016). Attenuation of oxidative damage by Boerhaaviadiffusa L. against different neurotoxic agents in rat brain homogenate. *Journal of Dietary Supplements*, *13*, 300–312.
10. Ben, P., Zhang, Z., Xuan, C., Sun, S., Shen, L., Gao, Y., & Luo, L., (2015). Protective effect of L-theanine on cadmium-induced apoptosis in PC12 cells by inhibiting the mitochondria-mediated pathway. *Neurochemical Research*, *40*, 1661–1670.
11. Berkov, S., Bastida, J., Sidjimova, B., Viladomat, F., & Codina, C., (2011). Alkaloid diversity in Galanthus elwesii and Galanthus nivalis. *Chemistry & Biodiversity*, *8*, 115–130.
12. Bernstein, P. S., Li, B., Vachali, P. P., Gorusupudi, A., Shyam, R., Henriksen, B. S., & Nolan, J. M., (2016). Lutein, zeaxanthin, and meso-zeaxanthin: The basic and clinical science underlying carotenoid-based nutritional interventions against ocular disease. *Progress in Retinal and Eye Research*, *50*, 34–66.
13. Binawade, Y., & Jagtap, A., (2013). Neuroprotective effect of lutein against 3-nitro-propionic acid–induced Huntington's disease–like symptoms: Possible behavioral, biochemical, and cellular alterations. *Journal of Medicinal Food*, *16*, 934–943.
14. Bruyn, G. W., Bots, G. T. A. M., & Dom, R., (1979). Huntington's chorea: Current neuropathological status. *Advances in Neurology*, *23*, 83–93.
15. Carrasco-Pozo, C., Tan, K. N., & Borges, K., (2015). Sulforaphane is anticonvulsant and improves mitochondrial function. *Journal of Neurochemistry*, *135*, 932–942.
16. Carroll, J. B., Bates, G. P., Steffan, J., Saft, C., & Tabrizi, S. J., (2015). Treating the whole body in Huntington's disease. *The Lancet Neurology*, *14*, 1135–1142.
17. Chambers, R. P., Call, G. B., Meyer, D., Smith, J., Techau, J. A., Pearman, K., & Buhlman, L. M., (2013). Nicotine increases lifespan and rescues olfactory and motor deficits in a Drosophila model of Parkinson's disease. *Behavioral Brain Research*, *253*, 95–102.
18. Chen, C. C., Hung, T. H., Lee, C. Y., Wang, L. F., Wu, C. H., Ke, C. H., & Chen, S. F., (2014). Berberine protects against neuronal damage via suppression of glia-mediated inflammation in traumatic brain injury. *PloS One*, *9*, e115694.
19. Chen, C. M., (2011). Mitochondrial dysfunction, metabolic deficits, and increased oxidative stress in Huntington's disease. *Chang Gung Med. J.*, *34*(2), 135–152.
20. Chen, Z., Jalabi, W., Shpargel, K. B., Farabaugh, K. T., Dutta, R., Yin, X., & Trapp, B. D., (2012). Lipopolysaccharide-induced microglial activation and neuroprotection against experimental brain injury is independent of hematogenous TLR4. *Journal of Neuroscience*, *32*, 11706–11715.
21. Choi, B. S., Kim, H., Lee, H. J., Sapkota, K., Park, S. E., Kim, S., & Kim, S. J., (2014). Celastrol from 'Thunder God Vine'protects SH-SY5Y cells through the preservation of mitochondrial function and inhibition of p38 MAPK in a rotenone model of Parkinson's disease. *Neurochemical Research*, *39*, 84–96.
22. Chopra, K., Tiwari, V., Arora, V., & Kuhad, A., (2010). Sesamol suppresses neuro-inflammatory cascade in experimental model of diabetic neuropathy. *The Journal of Pain*, *11*, 950–957.

23. Cooperstone, J. L., Ralston, R. A., Riedl, K. M., Haufe, T. C., Schweiggert, R. M., King, S. A., et al., (2015). Enhanced bioavailability of lycopene when consumed as cis-isomers from tangerine compared to red tomato juice, a randomized, cross-over clinical trial. *Molecular Nutrition & Food Research*, *59*, 658–669.
24. Courtes, A. A., Arantes, L. P., Barcelos, R. P., Da Silva, I. K., Boligon, A. A., Athayde, M. L., Puntel, R. L., & Soares, F. A. A., (2015). Protective effects of aqueous extract of Lueheadivaricata against behavioral and oxidative changes induced by 3-nitropropionic acid in rats. *Evidence-Based Complementary and Alternative Medicine.* E-article ID: 723431. http://dx.doi.org/10.1155/2015/723431
25. Cristina, C. H., Divino, D. R. M., Pereira, D. V. F., Carolina, N. P., Calve, F. P., Alberto, M. F. C., Barreiro, E., & Viegas, C., (2011). The role of natural products in the discovery of new drug candidates for the treatment of neurodegenerative disorders I: Parkinson's disease. *CNS & Neurological Disorders-Drug Targets (Formerly Current Drug Targets-CNS & Neurological Disorders)*, *10*, 239–250.
26. Denny, J. K. M., (2014). Neuroprotective efficacy of a combination of fish oil and ferulic acid against 3-nitropropionic acid-induced oxidative stress and neurotoxicity in rats: Behavioral and biochemical evidence. *Applied Physiology, Nutrition, and Metabolism*, *39*, 487–496.
27. Dey, A., (2017). Natural products against Huntington's disease (HD): Implications of neurotoxic animal models and transgenics in preclinical studies. *Neuroprotective Natural Products: Clinical Aspects and Mode of Action*, 185–246.
28. Dey, A., & De, J. N., (2015). Neuroprotective therapeutics from botanicals and phytochemicals against Huntington's disease and related neurodegenerative disorders. *Journal of Herbal Medicine*, *5*, 1–19.
29. Ehrnhoefer, D. E., Duennwald, M., Markovic, P., Wacker, J. L., Engemann, S., Roark, M., et al., (2006). Green tea (−)-epigallocatechin-gallate modulates early events in huntingtin misfolding and reduces toxicity in Huntington's disease models. *Human Molecular Genetics*, *15*, 2743–2751.
30. Faust, K., Gehrke, S., Yang, Y., Yang, L., Beal, M. F., & Lu, B., (2009). Neuroprotective effects of compounds with antioxidant and anti-inflammatory properties in a Drosophila model of Parkinson's disease. *BMC Neuroscience*, *10*, 109.
31. Ferreira, P. E. B., Lopes, C. R. P., Alves, A. M. P., Alves, É. P. B., Linden, D. R., Zanoni, J. N., & Buttow, N. C., (2013). Diabetic neuropathy: An evaluation of the use of quercetin in the cecum of rats. *World Journal of Gastroenterology: WJG*, *19*, 6416–6426.
32. Fricker, G., (2008). Drug interactions with natural products at the blood brain barrier. *Current Drug Metabolism*, *9*, 1019–1026.
33. Gao, Y., Chu, S. F., Li, J. P., Zhang, Z., Yan, J. Q., Wen, Z. L., Xia, C. Y., Mou, Z., Wang, Z. Z., He, W. B., & Guo, X. F., (2015). Protopanaxtriol protects against 3-nitropropionic acid-induced oxidative stress in a rat model of Huntington's disease. *Acta Pharmacologica Sinica*, *36*, 311.
34. Giridharan, V. V., Thandavarayan, R. A., Arumugam, S., Mizuno, M., Nawa, H., Suzuki, K., & Konishi, T., (2015). Schisandrin B ameliorates ICV-infused amyloid β induced oxidative stress and neuronal dysfunction through inhibiting RAGE/NF-κB/MAPK and up-regulating HSP/Beclin expression. *PLoS One*, *10*, e0142483.
35. Gómez-Sierra, T., Molina-Jijón, E., Tapia, E., Hernández-Pando, R., García-Niño, W. R., Maldonado, P. D., & Pedraza-Chaverri, J., (2014). S-allylcysteine prevents cisplatin-induced nephrotoxicity and oxidative stress. *Journal of Pharmacy and Pharmacology*, *66*, 1271–1281.

36. Gopinath, K., & Sudhandiran, G., (2015). Protective effect of naringin on 3-nitropropionic acid-induced neurodegeneration through the modulation of matrix metalloproteinases and glial fibrillary acidic protein. *Canadian Journal of Physiology and Pharmacology*, *94*, 65–71.
37. Gupta, S., & Sharma, B., (2014). Pharmacological benefits of agomelatine and vanillin in experimental model of Huntington's disease. *Pharmacology Biochemistry and Behavior*, *122*, 122–135.
38. Harper, P. S., (1992). The epidemiology of Huntington's disease. *Human Genetics*, *89*, 365–376.
39. Hermel, E., Gafni, J., Propp, S. S., Leavitt, B. R., Wellington, C. L., Young, J. E., et al., (2004). Specific caspase interactions and amplification are involved in selective neuronal vulnerability in Huntington's disease. *Cell Death and Differentiation*, *11*, 424.
40. Hickey, M. A., & Chesselet, M. F., (2003). Apoptosis in Huntington's disease. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, *27*, 255–265.
41. Ho, Y. S., So, K. F., & Chang, R. C. C., (2010). Anti-aging herbal medicine—how and why can they be used in aging-associated neurodegenerative diseases? *Ageing Research Reviews*, *9*, 354–362.
42. Hong, Z., Xu, Y., Yin, J. F., Jin, J., Jiang, Y., & Du, Q., (2014). Improving the effectiveness of (−)-epigallocatechin gallate (EGCG) against rabbit atherosclerosis by EGCG-loaded nanoparticles prepared from chitosan and polyaspartic acid. *Journal of Agricultural and Food Chemistry*, *62*, 12603–12609.
43. Huang, C. L., Yang, J. M., Wang, K. C., Lee, Y. C., Lin, Y. L., Yang, Y. C., & Huang, N. K., (2011). Gastrodiaelata prevents huntingtin aggregations through activation of the adenosine A2A receptor and ubiquitin proteasome system. *Journal of Ethnopharmacology*, *138*, 162–168.
44. Im, A. R., Chae, S. W., Jun, Z. G., & Lee, M. Y., (2014). Neuroprotective effects of psoraleacorylifolia Linn seed extracts on mitochondrial dysfunction induced by 3-nitropropionic acid. *BMC Complementary and Alternative Medicine*, *14*, 370.
45. Ivanov, D. A., Georgakopoulos, J. R., & Bernards, M. A., (2016). The chemoattractant potential of ginsenosides in the ginseng–Pythium irregular pathosystem. *Phytochemistry*, *122*, 56–64.
46. Jamwal, S., & Kumar, P., (2016). Spermidine ameliorates 3-nitropropionic acid (3-NP)-induced striatal toxicity: Possible role of oxidative stress, neuroinflammation, and neurotransmitters. *Physiology & Behavior*, *155*, 180–187.
47. Jang, M., & Cho, I. H., (2016). Sulforaphane ameliorates 3-nitropropionic acid-induced striatal toxicity by activating the Keap1-Nrf2-ARE pathway and inhibiting the MAPKs and NF-κB pathways. *Molecular Neurobiology*, *53*, 2619–2635.
48. Jang, M., Lee, M. J., Kim, C. S., & Cho, I. H., (2013). Korean red ginseng extract attenuates 3-Nitropropionic acid-induced huntington's-like symptoms. *Evidence-Based Complementary and Alternative Medicine,* E-article ID: 237207. doi: 10.1155/2013/237207.
49. Jeong, D., Choi, J. M., Choi, Y., Jeong, K., Cho, E., & Jung, S., (2013). Complexation of fisetin with novel cyclosophoroase dimer to improve solubility and bioavailability. *Carbohydrate Polymers*, *97*, 196–202.
50. Jiang, W., Wei, W., Gaertig, M. A., Li, S., & Li, X. J., (2015). Therapeutic effect of berberine on Huntington's disease transgenic mouse model. *PLoS One*, *10*, e0134142.

51. Kam, A., M Li, K., Razmovski-Naumovski, V., Nammi, S., Chan, K., Li, Y. Q., & Li, G., (2012). The protective effects of natural products on blood-brain barrier breakdown. *Current Medicinal Chemistry*, *19*, 1830–1845.
52. Kanter, M., Unsal, C., Aktas, C., & Erboga, M., (2016). Neuroprotective effect of quercetin against oxidative damage and neuronal apoptosis caused by cadmium in hippocampus. *Toxicology and Industrial Health*, *32*, 541–550.
53. Kaur, M., Prakash, A., & Kalia, A. N., (2016). Neuroprotective potential of antioxidant potent fractions from convolvulus *pluricaulis Chois* in 3-nitropropionic acid challenged rats. *Nutritional Neuroscience*, *19*, 70–78.
54. Killoran, A., & Biglan, K. M., (2014). Current therapeutic options for Huntington's disease: Good clinical practice versus evidence-based approaches? *Movement Disorders*, *29*, 1404–1413.
55. Kim, J. H., Kim, S., Yoon, I. S., Lee, J. H., Jang, B. J., Jeong, S. M., et al., (2005). Protective effects of ginseng saponins on 3-nitropropionic acid-induced striatal degeneration in rats. *Neuropharmacology*, *48*, 743–756.
56. Kumar, P., & Kumar, A., (2009). Possible neuroprotective effect of withaniasomnifera root extract against 3-nitropropionic acid-induced behavioral, biochemical, and mitochondrial dysfunction in an animal model of Huntington's disease. *Journal of Medicinal Food*, *12*, 591–600.
57. Kumar, P., & Kumar, A., (2010). Protective effect of hesperidin and naringin against 3-nitropropionic acid induced Huntington's like symptoms in rats: possible role of nitric oxide. *Behavioural Brain Research*, *206*, 38–46.
58. Kumar, P., & Kumar, A., (2009). Protective effects of epigallocatechin gallate following 3-nitropropionic acid-induced brain damage: Possible nitric oxide mechanisms. *Psychopharmacology*, *207*, 257–270.
59. Kumar, P., Kalonia, H., & Kumar, A., (2009). Lycopene modulates nitric oxide pathways against 3-nitropropionic acid-induced neurotoxicity. *Life Sciences*, *85*, 711–718.
60. Kumar, P., Kalonia, H., & Kumar, A., (2010). Protective effect of sesamol against 3-nitropropionic acid-induced cognitive dysfunction and altered glutathione redox balance in rats. *Basic & Clinical Pharmacology & Toxicology*, *107*, 577–582.
61. Kumar, P., Padi, S. S. V., Naidu, P. S., & Kumar, A., (2006). Effect of resveratrol on 3-nitropropionic acid-induced biochemical and behavioral changes: possible neuroprotective mechanisms. *Behavioral Pharmacology*, *17*, 485–492.
62. Lagoa, R., Lopez-Sanchez, C., Samhan-Arias, A. K., Gañan, C. M., Garcia-Martinez, V., & Gutierrez-Merino, C., (2009). Kaempferol protects against rat striatal degeneration induced by 3-nitropropionic acid. *Journal of Neurochemistry*, *111*, 473–487.
63. Lam, P. Y., & Ko, K. M., (2012). Beneficial effect of (–) Schisandrin B against 3-nitropropionic acid-induced cell death in PC12 cells. *Biofactors*, *38*, 219–225.
64. Lambert, J. D., Hong, J., Kim, D. H., Mishin, V. M., & Yang, C. S., (2004). Piperine enhances the bioavailability of the tea polyphenol (−)-epigallocatechin-3-gallate in mice. *The Journal of Nutrition*, *134*, 1948–1952.
65. Lambert, J. D., Sang, S., Hong, J., Kwon, S. J., Lee, M. J., Ho, C. T., & Yang, C. S., (2006). Peracetylation as a means of enhancing in vitro bioactivity and bioavailability of epigallocatechin-3-gallate. *Drug Metabolism and Disposition*, *34*, 2111–2116.
66. Lee, Y. C., Yang, Y. C., Huang, C. L., Kuo, T. Y., Lin, J. H., Yang, D. M., & Huang, N. K., (2012). When cytokinin, a plant hormone, meets the adenosine A2A receptor: A novel neuroprotectant and lead for treating neurodegenerative disorders? *PloS One*, *7*, e38865.

67. Li, X. Z., Zhang, S. N., Liu, S. M., & Lu, F., (2013). Recent advances in herbal medicines treating Parkinson's disease. *Fitoterapia*, *84*, 273–285.
68. Lian, X. Y., Zhang, Z., & Stringer, J. L., (2005). Protective effects of ginseng components in a rodent model of neurodegeneration. *Annals of Neurology*, *57*, 642–648.
69. Liu, Y., Hettinger, C. L., Zhang, D., Rezvani, K., Wang, X., & Wang, H., (2014). Sulforaphane enhances proteasomal and autophagic activities in mice and is a potential therapeutic reagent for Huntington's disease. *Journal of Neurochemistry*, *129*, 539–547.
70. Mahdy, H. M., Mohamed, M. R., Emam, M. A., Karim, A. M., Abdel-Naim, A. B., & Khalifa, A. E., (2014). Puerarin ameliorates 3-nitropropionic acid-induced neurotoxicity in rats: Possible neuromodulation and antioxidant mechanisms. *Neurochemical Research*, *39*, 321–332.
71. Mahdy, H. M., Tadros, M. G., Mohamed, M. R., Karim, A. M., & Khalifa, A. E., (2011). The effect of Ginkgo biloba extract on 3-nitropropionic acid-induced neurotoxicity in rats. *Neurochemistry International*, *59*, 770–778.
72. Maher, P., Dargusch, R., Bodai, L., Gerard, P. E., Purcell, J. M., & Marsh, J. L., (2010). ERK activation by the polyphenols fisetin and resveratrol provides neuroprotection in multiple models of Huntington's disease. *Human Molecular Genetics*, *20*, 261–270.
73. Malik, J., Choudhary, S., & Kumar, P., (2015). Protective effect of Convolvulus pluricaulis standardized extract and its fractions against 3-nitropropionic acid-induced neurotoxicity in rats. *Pharmaceutical Biology*, *53*, 1448–1457.
74. Mani, R. B., (2004). The evaluation of disease modifying therapies in Alzheimer's disease: A regulatory viewpoint. *Statistics in Medicine*, *23*, 305–314.
75. Manyam, B. V., Giacobini, E., & Colliver, J. A., (1990). Cerebrospinal fluid acetylcholinesterase and choline measurements in Huntington's disease. *Journal of Neurology*, *237*, 281–284.
76. Márquez-Valadez, B., Maldonado, P. D., Galván-Arzate, S., Méndez-Cuesta, L. A., Pérez-De La Cruz, V., Pedraza-Chaverrí, J., & Santamaría, A., (2012). Alpha-mangostin induces changes in glutathione levels associated with glutathione peroxidase activity in rat brain synaptosomes. *Nutritional Neuroscience*, *15*, 13–19.
77. Martin, D. D., Ladha, S., Ehrnhoefer, D. E., & Hayden, M. R., (2015). Autophagy in Huntington disease and huntingtin in autophagy. *Trends in Neurosciences*, *38*, 26–35.
78. McBride, J. L., & Clark, R. L., (2016). Stereotaxic surgical targeting of the nonhuman primate caudate and putamen: Gene therapy for Huntington's disease. In: *Gene Therapy for Neurological Disorders* (pp. 409–428). Humana Press, New York, NY.
79. Menze, E. T., Esmat, A., Tadros, M. G., Abdel-Naim, A. B., & Khalifa, A. E., (2015). Genistein improves 3-NPA-induced memory impairment in ovariectomized rats: impact of its antioxidant, anti-inflammatory and acetylcholinesterase modulatory properties. *PLoS One*, *10*, e0117223.
80. Menze, E. T., Tadros, M. G., Abdel-Tawab, A. M., & Khalifa, A. E., (2012). Potential neuroprotective effects of hesperidin on 3-nitropropionic acid-induced neurotoxicity in rats. *Neurotoxicology*, *33*, 1265–1275.
81. Merienne, N., & Déglon, N., (2015). Approches de gene silencing pour le traitement de la maladie de Huntington. *Médecine /Sciences*, *31*, 159–167.
82. Mohagheghi, F., Bigdeli, M. R., Rasoulian, B., Zeinanloo, A. A., & Khoshbaten, A., (2010). Dietary virgin olive oil reduces blood brain barrier permeability, brain edema, and brain injury in rats subjected to ischemia-reperfusion. *The Scientific World Journal*, *10*, 1180–1191.

83. Myers, R. H., MacDonald, M. E., Koroshetz, W. J., Duyao, M. P., Ambrose, C. M., Taylor, S. A. M., et al., (1993). De novo expansion of a (CAG) n repeat in sporadic Huntington's disease. *Nature Genetics*, *5*, 168.
84. Naz, R. K., Lough, M. L., & Barthelmess, E. K., (2016). Curcumin: A novel non-steroidal contraceptive with antimicrobial properties. *Frontiers in Bioscience (Elite Edition)*, *8*, 113–128.
85. Ohtsuki, S., (2004). Physiological function of blood-brain barrier transporters as the CNS supporting and protecting system. *Yakugakuzasshi: Journal of the Pharmaceutical Society of Japan*, *124*, 791–802.
86. Osathanunkul, M., Madesis, P., & De Boer, H., (2015). Bar-HRM for authentication of plant-based medicines: Evaluation of three medicinal products derived from Acanthaceae species. *Plos One*, *10*, e0128476.
87. Pallos, J., Bodai, L., Lukacsovich, T., Purcell, J. M., Steffan, J. S., Thompson, L. M., & Marsh, J. L., (2008). Inhibition of specific HDACs and sirtuins suppresses pathogenesis in a Drosophila model of Huntington's disease. *Human Molecular Genetics*, *17*, 3767–3775.
88. Pan-In, P., Wongsomboon, A., Kokpol, C., Chaichanawongsaroj, N., & Wanichwecharungruang, S., (2015). Depositing α-mangostin nanoparticles to sebaceous gland area for acne treatment. *Journal of Pharmacological Sciences*, *129*, 226–232.
89. Park, J. E., Lee, S. T., Im, W. S., Chu, K., & Kim, M., (2008). Galantamine reduces striatal degeneration in 3-nitropropionic acid model of Huntington's disease. *Neuroscience Letters*, *448*, 143–147.
90. Paulsen, J. S., Zhao, H., Stout, J. C., Brinkman, R. R., Guttman, M., & Ross, C. A., (2001). Huntington study group, clinical markers of early disease in persons near onset of Huntington's disease. *Neurology*, *57*, 658–662.
91. Pedraza-Chaverrí, J., Reyes-Fermín, L. M., Nolasco-Amaya, E. G., Orozco-Ibarra, M., Medina-Campos, O. N., González-Cuahutencos, O., & Mata, R., (2009). ROS scavenging capacity and neuroprotective effect of α-mangostin against 3-nitropropionic acid in cerebellar granule neurons. *Experimental and Toxicological Pathology*, *61*, 491–501.
92. Pérez-De La Cruz, V., González-Cortés, C., Pedraza-Chaverrí, J., Maldonado, P. D., Andrés-Martínez, L., & Santamaría, A., (2006). Protective effect of S-allylcysteine on 3-nitropropionic acid-induced lipid peroxidation and mitochondrial dysfunction in rat brain synaptosomes. *Brain Research Bulletin*, *68*, 379–383.
93. Pérez-Severiano, F., Rodríguez-Pérez, M., Pedraza-Chaverrí, J., Maldonado, P. D., Medina-Campos, O. N., Ortíz-Plata, A., & Santamaría, A., (2004).S-allylcysteine, a garlic-derived antioxidant, ameliorates quinolinic acid-induced neurotoxicity and oxidative damage in rats. *Neurochemistry International*, *45*, 1175–1183.
94. Prakash, D., Gopinath, K., & Sudhandiran, G., (2013). Fisetin enhances behavioral performances and attenuates reactive gliosis and inflammation during aluminum chloride-induced neurotoxicity. *Neuromolecular Medicine*, *15*, 192–208.
95. Prasad, J., Baitharu, I., Sharma, A. K., Dutta, R., Prasad, D., & Singh, S. B., (2013). Quercetin reverses hypobaric hypoxia-induced hippocampal neurodegeneration and improves memory function in the rat. *High Altitude Medicine & Biology*, *14*, 383–394.
96. Pringsheim, T., Wiltshire, K., Day, L., Dykeman, J., Steeves, T., & Jette, N., (2012). The incidence and prevalence of Huntington's disease: A systematic review and meta-analysis. *Movement Disorders*, *27*, 1083–1091.

97. Qi, X., Qin, J., Ma, N., Chou, X., & Wu, Z., (2014). Solid self-microemulsifying dispersible tablets of celastrol: Formulation development, characterization and bioavailability evaluation. *International Journal of Pharmaceutics*, *472*, 40–47.
98. Quik, M., Mallela, A., Ly, J., & Zhang, D., (2013). Nicotine reduces established levodopa-induced dyskinesias in a monkey model of Parkinson's disease. *Movement Disorders*, *28*, 1398–1406.
99. Quintanilla, R. A., & Johnson, G. V., (2009). Role of mitochondrial dysfunction in the pathogenesis of Huntington's disease. *Brain Research Bulletin*, *80*, 242–247.
100. Ragelle, H., Crauste-Manciet, S., Seguin, J., Brossard, D., Scherman, D., Arnaud, P., & Chabot, G. G., (2012). Nanoemulsion formulation of fisetin improves bioavailability and antitumor activity in mice. *International Journal of Pharmaceutics*, *427*, 452–459.
101. Rong, W., Wang, J., Liu, X., Jiang, L., Wei, F., Hu, X., Han, X., & Liu, Z., (2012). Naringin treatment improves functional recovery by increasing BDNF and VEGF expression, inhibiting neuronal apoptosis after spinal cord injury. *Neurochemical Research*, *37*, 1615–1623.
102. Rong, Z., Pan, R., Xu, Y., Zhang, C., Cao, Y., & Liu, D., (2013). Hesperidin pretreatment protects hypoxia–ischemic brain injury in neonatal rat. *Neuroscience*, *255*, 292–299.
103. Sagredo, O., Pazos, M. R., Satta, V., Ramos, J. A., Pertwee, R. G., & Fernández-Ruiz, J., (2011). Neuroprotective effects of phytocannabinoid-based medicines in experimental models of Huntington's disease. *Journal of Neuroscience Research*, *89*, 1509–1518.
104. Sagredo, O., Ramos, J. A., Decio, A., Mechoulam, R., & Fernández-Ruiz, J., (2007). Cannabidiol reduced the striatal atrophy caused 3-nitropropionic acid in vivo by mechanisms independent of the activation of cannabinoid, vanilloid TRPV1 and adenosine A2A receptors. *European Journal of Neuroscience*, *26*, 843–851.
105. Sajjadi, S. E., Shokoohinia, Y., & Moayedi, N. S., (2012). Isolation and identification of ferulic acid from aerial parts of Kelussiaodoratissima Mozaff. *Jundishapur Journal of Natural Pharmaceutical Products*, *7*, 159.
106. Sandhir, R., & Mehrotra, A., (2013). Quercetin supplementation is effective in improving mitochondrial dysfunctions induced by 3-nitropropionic acid: Implications in Huntington's disease. *Biochimica et Biophysica Acta (BBA)-Molecular Basis of Disease*, *1832*, 421–430.
107. Sandhir, R., Mehrotra, A., & Kamboj, S. S., (2010). Lycopene prevents 3-nitropropionic acid-induced mitochondrial oxidative stress and dysfunctions in nervous system. *Neurochemistry International*, *57*, 579–587.
108. Sandhir, R., Yadav, A., Mehrotra, A., Sunkaria, A., Singh, A., & Sharma, S., (2014). Curcumin nanoparticles attenuate neurochemical and neurobehavioral deficits in experimental model of Huntington's disease. *Neuromolecular Medicine*, *16*, 106–118.
109. Sanna, V., Chamcheu, J. C., Pala, N., Mukhtar, H., Sechi, M., & Siddiqui, I. A., (2015). Nanoencapsulation of natural triterpenoid celastrol for prostate cancer treatment. *International Journal of Nanomedicine*, *10*, 6835.
110. Sarkar, S., Davies, J. E., Huang, Z., Tunnacliffe, A., & Rubinsztein, D. C., (2007). Trehalose, a novel mTOR-independent autophagy enhancer, accelerates the clearance of mutant huntingtin and α-synuclein. *Journal of Biological Chemistry*, *282*, 5641–5652.
111. Satoh, T., Takahashi, T., Iwasaki, K., Tago, H., Seki, T., Yaegashi, N., & Arai, H., (2009). Traditional Chinese medicine on four patients with Huntington's disease. *Movement Disorders*, *24*, 453–455.

112. Seguin, J., Brullé, L., Boyer, R., Lu, Y. M., Romano, M. R., Touil, Y. S., & Chabot, G. G., (2013). Liposomal encapsulation of the natural flavonoid fisetin improves bioavailability and antitumor efficacy. *International Journal of Pharmaceutics*, *444*, 146–154.
113. Setter, S., Neumiller, J., Dobbins, E., Wood, L., Clark, J., DuVall, C., & Santiago, A., (2009). Treatment of chorea associated with Huntington's disease: Focus on tetrabenazine. *The Consultant Pharmacist®*, *24*, 524–537.
114. Shinomol, G. K., (2008). Effect of *Centellaasiatica* leaf powder on oxidative markers in brain regions of prepubertal mice in vivo and it's in vitro efficacy to ameliorate 3-NPA-induced oxidative stress in mitochondria. *Phytomedicine*, *15*, 971–984.
115. Shinomol, G. K., (2008). Prophylactic neuroprotective property of Centellaasiatica against 3-nitropropionic acid induced oxidative stress and mitochondrial dysfunctions in brain regions of prepubertal mice. *Neurotoxicology*, *29*, 948–957.
116. Shinomol, G. K., & Ravikumar, H., (2010). Prophylaxis with *Centellaasiatica* confers protection to prepubertal mice against 3-nitropropionic-acid-induced oxidative stress in brain. *Phytotherapy Research*, *24*, 885–892.
117. Shinomol, G. K., & Bharath, M. S., (2012). Pretreatment with *Bacopa monnieri* extract offsets 3-nitropropionic acid induced mitochondrial oxidative stress and dysfunctions in the striatum of prepubertal mouse brain. *Canadian Journal of Physiology and Pharmacology*, *90*, 595–606.
118. Shinomol, G. K., & Bharath, M. S., (2012). Neuromodulatory propensity of Bacopa monnieri leaf extract against 3-nitropropionic acid-induced oxidative stress: *In vitro* and *in vivo* evidences. *Neurotoxicity Research*, *22*, 102–114.
119. Shivasharan, B. D., Nagakannan, P., Thippeswamy, B. S., Veerapur, V. P., Bansal, P., & Unnikrishnan, M. K., (2013). Protective effect of calendula officinalis Linn. Flowers against 3-nitropropionic acid induced experimental Huntington's disease in rats. *Drug and Chemical Toxicology*, *36*, 466–473.
120. Shoba, G., Joy, D., Joseph, T., Majeed, M., Rajendran, R., & Srinivas, P. S. S. R., (1998). Influence of piperine on the pharmacokinetics of curcumin in animals and human volunteers. *Planta Medica*, *64*, 353–356.
121. Sigrist, S. J., Carmona-Gutierrez, D., Gupta, V. K., Bhukel, A., Mertel, S., Eisenberg, T., & Madeo, F., (2014). Spermidine-triggered autophagy ameliorates memory during aging. *Autophagy*, *10*, 178–179.
122. Sorolla, M. A., Rodríguez-Colman, M. J., Vall-llaura, N., Tamarit, J., Ros, J., & Cabiscol, E., (2012). Protein oxidation in Huntington disease. *Biofactors*, *38*, 173–185.
123. Sudati, J. H., Fachinetto, R., Pereira, R. P., Boligon, A. A., Athayde, M. L., Soares, F. A., De Vargas Barbosa, N. B., & Rocha, J. B. T., (2009). *In vitro* antioxidant activity of *Valeriana officinalis* against different neurotoxic agents. *Neurochemical Research*, *34*, 1372.
124. Takahashi, S., Isaka, M., Hamaishi, M., Imai, K., Orihashi, K., & Sueda, T., (2014). Trehalose protects against spinal cord ischemia in rabbits. *Journal of Vascular Surgery*, *60*, 490–496.
125. Tanaka, M., Machida, Y., Niu, S., Ikeda, T., Jana, N. R., Doi, H., & Nukina, N., (2004). Trehalose alleviates polyglutamine-mediated pathology in a mouse model of Huntington disease. *Nature Medicine*, *10*, 148.

126. Tariq, M., Khan, H. A., Elfaki, I., Al Deeb, S., & Al Moutaery, K., (2005). Neuroprotective effect of nicotine against 3-nitropropionic acid (3-NP)-induced experimental Huntington's disease in rats. *Brain Research Bulletin*, *67*, 161–168.
127. Tasset, I., Agüera, E., Olmo-Camacho, R., Escribano, B., Sánchez-López, F., Delgado, M. J., Cruz, A. H., Gascón, F., Luque, E., Peña, J., Jimena, I. M., & Túnez, I., (2011). Melatonin improves 3-nitropropionic acid induced behavioral alterations and neurotrophic factors levels. *Prog. Neuropsychopharmacol Biol. Psychiatry*, *35*, 1944–1949.
128. Tasset, I., Pontes, A. J., Hinojosa, A. J., De la Torre, R., & Túnez, I., (2011). Olive oil reduces oxidative damage in a 3-nitropropionic acid-induced Huntington's disease-like rat model. *Nutritional Neuroscience*, *14*, 106–111.
129. Thangarajan, S., Deivasigamani, A., Natarajan, S. S., Krishnan, P., & Mohanan, S. K., (2014). Neuroprotective activity of L-theanine on 3-nitropropionic acid-induced neurotoxicity in rat striatum. *International Journal of Neuroscience*, *124*, 673–684.
130. Tian, J., Shi, J., Zhang, X., & Wang, Y., (2010). Herbal therapy: a new pathway for the treatment of Alzheimer's disease. *Alzheimer's Research & Therapy*, *2*, 30.
131. Tiwari, S. K., Agarwal, S., Seth, B., Yadav, A., Nair, S., Bhatnagar, P., & Srivastava, V., (2013). Curcumin-loaded nanoparticles potently induce adult neurogenesis and reverse cognitive deficits in Alzheimer's disease model via canonical Wnt/β-catenin pathway. *ACS Nano*, *8*, 76–103.
132. Tosun, F., Erdem, C. K., & Eroğlu, Y., (2003). Determination of genistein in the Turkish Genista L. species by LC-MS. *Die Pharmazie-An International Journal of Pharmaceutical Sciences*, *58*, 549–550.
133. Túnez, I., Montilla, P., Del Carmen, M. M., Feijóo, M., & Salcedo, M., (2004). Protective effect of melatonin on 3-nitropropionic acid-induced oxidative stress in synaptosomes in an animal model of Huntington's disease. *Journal of Pineal Research*, *37*, 252–256.
134. Uabundit, N., Wattanathorn, J., Mucimapura, S., & Ingkaninan, K., (2010). Cognitive enhancement and neuroprotective effects of *Bacopa monnieri* in Alzheimer's disease model. *Journal of Ethnopharmacology*, *127*, 26–31.
135. Urquhart, B. L., & Kim, R. B., (2009). Blood− brain barrier transporters and response to CNS-active drugs. *European Journal of Clinical Pharmacology*, *65*, 1063.
136. Vattakatuchery, J. J., & Kurian, R., (2013). Acetylcholinesterase inhibitors in cognitive impairment in Huntington's disease: A brief review. *World Journal of Psychiatry*, *3*, 62.
137. Warby, S. C., Visscher, H., Collins, J. A., Doty, C. N., Carter, C., Butland, S. L., Kanazawa, I., Ross, C. J., & Hayden, M. R., (2011). HTT haplotypes contribute to differences in Huntington disease prevalence between Europe and East Asia. *European Journal of Human Genetics*, *19*, 561.
138. Wei, J. C. C., Huang, H. C., Chen, W. J., Huang, C. N., Peng, C. H., & Lin, C. L., (2016). Epigallocatechin gallate attenuates amyloid β-induced inflammation and neurotoxicity in EOC 13.31 microglia. *European Journal of Pharmacology*, *770*, 16–24.
139. Wu, A. G., Wong, V. K. W., Xu, S. W., Chan, W. K., Ng, C. I., Liu, L., & Law, B. Y. K., (2013). Onjisaponin B derived from radix polygalae enhances autophagy and accelerates the degradation of mutant α-synuclein and huntingtin in PC-12 cells. *International Journal of Molecular Sciences*, *14*, 22618–22641.
140. Wu, J., Jeong, H. K., Bulin, S. E., Kwon, S. W., Park, J. H., & Bezprozvanny, I., (2009). Ginsenosides protect striatal neurons in a cellular model of Huntington's disease. *Journal of Neuroscience Research*, *87*, 1904–1912.

141. Yan, L., & Zhou, Q. H., (2012). Study on neuroprotective effects of astragalan in rats with ischemic brain injury and its mechanisms. *Zhongguoyingyong sheng li xue za zhi=Zhongguoyingyongshenglixuezazhi (Chinese Journal of Applied Physiology)*, *28*, 373–377.
142. Yu, L., Chen, C., Wang, L. F., Kuang, X., Liu, K., Zhang, H., & Du, J. R., (2013). Neuroprotective effect of kaempferol glycosides against brain injury and neuroinflammation by inhibiting the activation of NF-κB and STAT3 in transient focal stroke. *PloS One*, *8*, e55839.
143. Zhang, H., Pan, N., Xiong, S., Zou, S., Li, H., Xiao, L., & Huang, Z., (2012). Inhibition of polyglutamine-mediated proteotoxicity by Astragalus membranaceus polysaccharide through the DAF-16/FOXO transcription factor in Caenorhabditis elegans. *Biochemical Journal*, *441*, 417–424.
144. Zhang, Y. Q., & Sarge, K. D., (2007). Celastrol inhibits polyglutamine aggregation and toxicity though induction of the heat shock response. *Journal of Molecular Medicine*, *85*, 1421–1428.
145. Zhang, Y. S., Li, Y., Wang, Y., Sun, S. Y., Jiang, T., Li, C., Cui, S. X., & Qu, X. J., (2016). Naringin, a natural dietary compound, prevents intestinal tumorigenesis in Apc Min/+ mouse model. *Journal of Cancer Research and Clinical Oncology*, *142*, 913–925.
146. Zhao, Y., Tang, G., Tang, Q., Zhang, J., Hou, Y., Cai, E., & Wang, S., (2016). A method of effectively improved α-mangostin bioavailability. *European Journal of Drug Metabolism and Pharmacokinetics*, *41*, 605–613.
1. Abbott, N. J., (2002). Astrocyte-endothelial interactions and blood-brain barrier permeability. *J. Anat., 200*(6), 629–638.
2. Aggarwal, B. B., Prasad, S., Reuter, S., Kannappan, R., & Yadev, V. R., (2011). Identification of novel anti-inflammatory agents from Ayurvedic medicine for prevention of chronic diseases: “Reverse pharmacology” and “bedside to bench” approach. *Curr. Drug Targets*, *12*(11), 1595–1653.
3. Balaban, D. Y., Machina, M. A., Han, J. S., Katznelson, R., & Minkovich, L. L., (2012). The interaction of carbon dioxide and hypoxia in the control of cerebral blood flow. *Pflugers Arch*., *464*, 345–351.
4. Barry, J. W., & Pollard, A. J., (2003). Altitude illness. *BMJ*, *326*, 915–919.
5. Baxter, J. D., Lewicki, J. A., & Gardner, D. G., (1988). Atrial natriuretic peptide. *Nature Biotechnology*, *6*, 529–546.
6. Brown, R. C., Mark, K. S., & Egleton, R. D., (2003). Protection against hypoxia-induced increase in blood-brain barrier permeability: Role of tight junction proteins and NFkappaB. *J Cell Sci*., *116*, 693–700.
7. Buchman. A. L., Keen, C., Commisso, J., Killip, D., Ou, C. N., & Rognerud, C. L., (1998). The effect of a marathon run on plasma and urine mineral and metal concentrations. *J. Am. Coll. Nutr*., *17*(2), 124–127.
8. Carod-Artal, F. J., (2014) High-altitude headache and acute mountain sickness. *Neurologia*, *29*(9), 533–540.
9. Carozzi Albert, V., Crettaz, Bernard., & Ripoll, D., (1999). *Les plis du temps, Mythe* (The folds of time, myth). In: De Saussure, H. B., (ed.), *Science* (p. 368). Ethnographic Museum, Conches Annex. Geneva.
10. Casoni, I., Guglielmini, C., Graziano, L., Reali, M. G., & Mazzotta, D., (1990). Changes of magnesium concentrations in endurance athletes. *Int. J. Sports Med*., *11*, 234–237.
11. Castellani, J. W., Muza, S. R., Cheuvront, S. N., Sils, I. V., & Fulco, C. S., (2010). Effect of hypohydration and altitude exposure on aerobicexercise performance and acute mountain sickness. *J. Appl. Physiol 109*(6), 1792–1800.

12. Cipolla, M. J., (2010). *The Cerebral Circulation* (p. 70). Morgan & Claypool Life Sciences, San Rafael (CA).
13. Coote, J. H., (1991). Pharmacological control of altitude sickness. *Trends in Pharmacological Sciences*, *12*, 450–455.
14. Coote, J. H., (1995). Medicine and mechanisms in altitude sickness. *Recommendations in Sports Med*., *20*(3), 148–159.
15. Cox, I. M., Campbell, M. J., & Dowson, D., (1991). Red blood cell magnesium and chronic fatigue syndrome. *Lancet*, *337*(8744), 757–760.
16. De Franceschi, L., Bachir, D., Galacteros, F., et al., (1997). Oral magnesium supplements reduce erythrocyte dehydration in patients with sickle cell disease. *Journal of Clinical Investigation*, *100*(7), 1847–1852.
17. Dellasanta, P., Gaillard, S., Loutan, L., & Kayser, B., (2007). Comparing questionnaires for the assessment of acute mountain sickness. *High Alt. Med. Biol*., *8*(3), 184–191.
18. Deweber, K., & Scorza, K., (2010). Return to activity at altitude after high-altitude illness. *Sports Health*, *2*(4), 291–300.
19. Doherty, M. J., (2003). James Glaisher's 1862 account of balloon sickness: Altitude, decompression injury, and hypoxemia. *Neurology*, *60*(6), 1016–1018.
20. Dong, J. Q., Zhang, J. H., Qin, J., & Li, Q. N., (2013). Anxiety correlates with somatic symptoms and sleep status at high altitudes. *Physiol. Behav*., *112, 113*, 23–31.
21. Ellsworth, A. J., Larson, E. B., & Strickland, D., (1987). A randomized trial of dexamethasone and acetazolamide for acute mountain sickness prophylaxis. *Am. J. Med*., *83*(6), 1024–1030.
22. Ellsworth, A. J., (1989). Preventing and treating acute mountain sickness. *West J. Med*., *150*(2), 196.
23. Ellsworth, A. J., Meyer, E. F., & Larson, E. B., (1991). Acetazolamide or dexamethasone use versus placebo to prevent acute mountain sickness on Mount Rainier. *West J. Med*., *154*(3), 289–293.
24. Gilbert, D. L., (1983). The first documented report of mountain sickness: The China or Headache Mountain story. *Respir Physiol*., *52*(3), 315–326.
25. Doherty, C., (2004). Breath of life: the evolution of oxygen therapy. *Journal of the Royal Society of Medicine*, *97*(10), 489–493.
26. Hackett, P., & Mangione, M. P., (2015). Fluid and electrolyte balance. In: Sikka, P., Beaman, S., & Street, J., (eds.). *Basic Clinical Anesthesia* (p. 715). Springer, New York, NY.
27. Hackett, P. H., & Hornbein, T., (1988). Disorder of high altitude. In: Murray, J. F., & Nadel, J. A., (ed.), *Textbook of Respiratory Medicine* (pp. 1646–1663). Saunders, Philadelphia.
28. Hackett, P. H., & Roach, R. C., (2001). High-altitude illness. *N. Engl. J. Med*., *345*, 107–114.
29. Hansen, J. E., & Evans, W. O., (1970). A hypothesis regarding the pathophysiology of acute mountain sickness. *Arch. Environ. Health*, *21*(5), 666–669.
30. Hornbein, T. F., (1992). Long term effects of high altitude on brain function. *Int. J. Sports Med*., *13*, S43–S45.
31. Houston, C. S., (1980). *Going High* (p. 87). Queen City Printers, Burlington, VT.
32. Hultgren, H., (1997). *High Altitude Medicine* (p. 550). Hultgren Publications, Stanford –CA.
33. Imray, C., Wright, A., Subudhi, A., & Roach, R., (2010). Acute mountain sickness: Pathophysiology, prevention, and treatment. *Prog. Cardiovasc. Dis*., *52*, 467–484.

34. James, N. T., Forough, M., & Thomas, G. P., (2010). Intracellular and extracellular effects of S100B in the cardiovascular response to disease. *Cardiovascular Psychiatry and Neurology.* 2010; E-article ID: 206073. doi: 10.1155/2010/206073.
35. Jeon, S. W., & Kim, Y. K., (2016). Neuroinflammation and cytokine abnormality in major depression: Cause or consequence in that illness? *World Journal of Psychiatry*, *6*(3), 283–293.
36. Jeong, J. H., Kwon, J. C., Chin, J., Yoon, S. J., & Na, D. L., (2002). Globus pallidus lesions associated with high mountain climbing. *J. Korean Med. Sci.*, *17*(6), 861–863.
37. Julian, C. G., Subudhi, A. W., Wilson, M. J., Dimmen, A. C., Pecha, T., & Roach, R. C., (1985). Acute mountain sickness, inflammation, and permeability: New insights from a blood biomarker study. *Journal of Applied Physiology*, *111*(2), 392–399.
38. Kayser, B., Aliverti, A., Pellegrino, R., & Dellaca, R., (2010). Comparison of a visual analogue scale and Lake Louise symptom scores for acute mountain sickness. *High Alt. Med. Biol*., *11*(1), 69–72.
39. Keen, C. L., Lowney, P., Gershwin, M. E., Hurley, L. S., & Stern, J. S., (1987). Dietary magnesium intake influences exercise capacity and hematologic parameters in rats. *Metabolism*, *36*(8), 788–793.
40. Kumar, K., Sharma, S., Vashishtha, V., & Bhardwaj, P., (2016). *Terminaliaarjuna* bark extract improves diuresis and attenuates acute hypobaric hypoxia induced cerebral vascular leakage. *J. Ethnopharmacol.*, *180*, 43–53.
41. Laragh, J. H., (1330). Atrial natriuretic hormone, the renin-aldosterone axis, and blood pressure-electrolyte homeostasis. *N. Engl. J. Med*., *313*, 1330–1340.
42. Leaf, D. E., & Goldfarb, D. S., (1313). Mechanisms of action of acetazolamide in the prophylaxis and treatment of acute mountain sickness. *J. Appl. Physiol*., *102*(4), 1313–1322.
43. Loeppky, J. A., Icenogle, M. V., Maes, D., Riboni, K., Scotto, P., & Roach, R. C., (2003). Body temperature, autonomic responses, and acute mountain sickness. *High Alt. Med. Biol*., *4*(3), 367–373.
44. Lukaski, H. C., Bolonchuk, W. W., Siders, W. A., & Milne, D. B., (1990). Chromium supplementation and resistance training: Effects on body composition, strength, and trace element status of men. *Am. J. Clin. Nutr*., *63*, 954–965.
45. Luks, A. M., McIntosh, S. E., Grissom, C. K., & Auerbach, P. S., (2014). Wilderness medical society practice guidelines for the prevention and treatment of acute altitude illness, update. *Wilderness Environ Med*., *25*, S4–14.
46. Luks, A. M., McIntosh, S. E., Grissom, C. K., & Auerbach, P. S., (2010). Wilderness medical society consensus guidelines for the prevention and treatment of acute altitude illness. *Wilderness Environ Med*., *21*(2), 146–155.
47. Lyons, T. P., Muza, S. R., Rock, P. B., & Cymerman, A., (1995). The effect of altitude pre-acclimatization on acute mountain sickness during reexposure. *Aviat. Space Environ Med*., *66*(10), 957–962.
48. Maggiorini, M., Buhler, B., Walter, M., & Oelz, O., (1990). Prevalence of acute mountain sickness in the Swiss Alps. *BMJ*, *301*, 853–854.
49. Marenholz, I., Heizmann, C. W., & Fritz, G., (2004). S100 proteins in mouse and man: from evolution to function and pathology (including an update of the nomenclature)." *Biochemical and Biophysical Research Communications*, *322*(4), 1111–1122.

50. Memari, B., Bouttier, M., Dimitrov, V., Ouellette, M., Behr, M. A., Fritz, J. H., & White, J. H., (2015). Engagement of the aryl hydrocarbon receptor in mycobacterium tuberculosis-infected macrophages has pleiotropic effects on innate immune signaling. *J. Immunol., 195*(9), 4479-4491.
51. Michetti, F., Corvino, V., Geloso, M. C., & Lattanzi, W., (2012). The S100B protein in biological fluids: More than a lifelong biomarker of brain distress. *J. Neurochem*., *120*(5), 644–659.
52. Montgomery, A. B., Mills, J., & Luce, J. M., (1989). Incidence of acute mountain sickness at intermediate altitude. *JAMA*, *261*(5), 732–734.
53. Moraga, F. A., Osorio, J. D., & Vargas, M. E., (2002). Acute mountain sickness in tourists with children at Lake Chungará (4400 m) in northern Chile. *Wilderness Environ Med*., *13*(1), 31–35.
54. Moore, L. G., Jahnigen, D., Rounds, S. S., & Reeves, J. T., (1982). Maternal hyperventilation helps preserve arterial oxygenation during high altitude pregnancy. *J. Appl. Physiol.*, *52*, 690–694.
55. Nerin, M. A., Palop, J., & Montano, J. A., (2006). Acute mountain sickness: Influence of fluid intake. *Wilderness Environ Med*., *17*(4), 215–220.
56. Nussbaumer-Ochsner, Y., Ursprung, J., Siebenmann, C., Maggiorini, M., & Bloch, K. E., (2012). Effect of short-term acclimatization to high altitude on sleep and nocturnal breathing. *Sleep*, *35*(3), 419–423.
57. Otis, S. M., Rossman, M. E., & Schneider, P. A., (1988). Relationship of cerebral blood flow regulation to acute mountain sickness. *J. Ultrasound Med*., *8*(3), 143–148.
58. Palmer, B. F., & Clegg, D. J., (2014). Ascent to altitude as a weight loss method: The good and bad of hypoxia inducible factor activation. *Obesity (Silver Spring, Md.)*., *22*(2), 311–317.
59. Pandit, A., Karmacharya, P., & Pathak, R., (2014). Efficacy of NSAIDs for the prevention of acute mountain sickness: A systematic review and meta-analysis. *Journal of Community Hospital Internal Medicine Perspectives*, *4*(4), 10.
60. Pigman, E. C., & Karakla, D. W., (1990). Acute mountain sickness at intermediate altitude: Military mountainous training. *Am. J. Emerg. Med*., *8*(1), 7–10.
61. Pigman, E. C., (1991). Acute mountain sickness. Effects and implications for exercise at intermediate altitudes. *Sports Med*., *12*(2), 71–79.
62. Rabold, M. B., (1992). Dexamethasone for prophylaxis and treatment of acute mountain sickness. *Journal of Wilderness Medicine*, *3*(1), 54–60.
63. Ramasamy, R., Yan, S. F., & Schmidt, A. M., (2011). Receptor for AGE (RAGE): Signaling mechanisms in the pathogenesis of diabetes and its complications. *Annals of the New York Academy of Sciences*, *1243*, 88–102.
64. Ravenhill, T., (1913). Some experiences of mountain sickness in the Andes. *J. Trop. Med. & Hyg*., *20*, 313–320.
65. Rehrer, N. J., (2001). Fluid and electrolyte balance in ultra-endurance sport. *Sports Med*., *31*(10), 701–715.
66. Sakamoto, R., Okumiya, K., Norboo, T., & Tsering, N., (2017). Sleep quality among elderly high-altitude dwellers in Ladakh. *Psychiatry Res*., *249*, 51–57.
67. Sanchez, D. R. M., & Moskowitz, M. A., (1999). High altitude headache – lessons from headaches at sea level. In: Roach, R. C., Wagner, P. D., & Hackett, P. H., (eds.), *Hypoxia: Into the Next Millennium* (pp. 145–153). Kluwer Academic/Plenum Publishers, New York.
68. Schneider, M., & Bernasch, D., (1886). Acute mountain sickness: Influence of susceptibility, preexposure, and ascent rate. *Med. Sci. Sports Exerc*., *34*(12), 1886–1891.

69. Schoch, H. J., Fischer, S., & Marti, H. H., (2002). Hypoxia-induced vascular endothelial growth factor expression causes vascular leakage in the brain. *Brain*, *125*, 2549–2557.
70. Serrano, D. M., (2005). High altitude headache: Prospective study of its clinical characteristics. *Cephalalgia*, *25*, 1110–1116.
71. Silber, E., Sonnenberg, P., & Collier, D. J., (2003). Clinical feature of headache at altitude: A prospective study. *Neurology*, *60*, 1167–1671.
72. Singh, I., Khanna, P. K., & Srivastava, M. C., (1969). Acute mountain sickness. *N. Engl. J. Med*., *280*(4), 175–184.
73. Song, T. T., Bi, Y. H., & Gao, Y. Q., (2016). Systemic pro-inflammatory response facilitates the development of cerebral edema during short hypoxia. *Journal of Neuroinflammation*, *13*(1), 63.
74. Sorci, G., & Bianchi, R., (2010). S100B Protein, a damage-associated molecular pattern protein in the brain and heart, and beyond. *Cardiovascular Psychiatry and Neurology*, 656481.
75. Sun, B., Liu, H., & Nie, S., (2013). S100B protein in serum is elevated after global cerebral ischemic injury. *World J. Emerg. Med*., *4*(3), 165–168.
76. Swaminathan, R., (2003). Magnesium metabolism and its disorders. *The Clinical Biochemist Reviews*, *24*(2), 47–66.
77. Swenson, E. R., (1997). High altitude diuresis: Fact or fancy. In: Houston, C. S., & Coates, G., (eds.), *Hypoxia: Women at Altitude* (pp. 272–283). Queen City Printers, Burlington – VT.
78. Vos, P. F., Koomans, H. A., & Boer, P., (1992). Effects of angiotensin II on renal sodium handling and diluting capacity in man pretreated with high-salt diet and enalapril. *Nephrol Dial Transplant*, *7*(10), 991–996.
79. Wang, W. Y., Tan, M. S., Yu, J. T., & Tan, L., (2015). Role of pro-inflammatory cytokines released from microglia in Alzheimer's disease. *Annals of Translational Medicine*, *3*(10), 136–142.
80. West, J. B., & Alexander, M., (1985). Physiological challenge of Mt. Everest. *J. Appl. Physiol*., *63*(1), 3–11.
81. West, J. B., (2013). Joseph Barcroft's studies of high-altitude physiology. *Am. J. Physiol. Lung. Cell Mol. Physiol*., *305*(8), L523–L529.
82. Westerterp, K. R., & Kayser, B., (2006). Body mass regulation at altitude. *Eur. J. Gastroenterol. Hepatol*., *18*, 1–3.
83. Westerterp-Plantenga, M. S., Westerterp, K. R., & Rubbens, M., (1999). Appetite at "high altitude" [Operation Everest III (Comex-'97)]: A simulated ascent of Mount Everest. *J. Appl. Physiol*., *87*(1), 391–399.
84. White, A. P., (2001). High life: A history of high-altitude physiology and medicine. *The Yale Journal of Biology and Medicine*, *74*(2), 139–141.
85. Willie, C. K., Tzeng, Y. C., Fisher, J. A., & Ainslie, P. N., (2014). Integrative regulation of human brain blood flow. *The Journal of Physiology*, *592*, 841–859.
86. Wilson, M. H., & Milledge, J., (2008). Direct measurement of intracranial pressure at high altitude and correlation of ventricular size with acute mountain sickness: Brian Cummins' results from the 1985 Kishtwar expedition. *Neurosurgery*, *63*(5), 970–975.
87. Windsor, J. S., & Rodway, G. W., (2007). Heights and hematology: The story of hemoglobin at altitude. *Postgraduate Medical Journal*, *83*(977), 148–151.
88. Winter, C. D., Whyte, T. R., Cardinal, J., & Rose, S. E., (2014). Elevated plasma S100B levels in high altitude hypobaric hypoxia do not correlate with acute mountain sickness. *Neurol Res* *36*(9), 779–785.

89. Xu, F., Liu, P., Pascual, J. M., Xiao, G., & Lu, H., (2012). Effect of hypoxia and hyperoxia on cerebral blood flow, blood oxygenation, and oxidative metabolism. *Journal of Cerebral Blood Flow & Metabolism*, *32*(10), 1909–1918.
90. Yasue, H., Obata, K., Okumura, K., & Kurose, M., (1989). Increased secretion of atrial natriuretic polypeptide from the left ventricle in patients with dilated cardiomyopathy. *Journal of Clinical Investigation*, *83*(1), 46–51.
91. Zell, S. C., & Goodman, P. H., (1988). Acetazolamide and dexamethasone in the prevention of acute mountain sickness. *West J. Med., 148*(5), 541–545.

1. Athanasiadou, S., Githiori, J., & Kyriazakis, I., (1392). Medicinal plants for helminth parasite control: Facts and fiction, *1*(9), 1392–1400.
2. Ayaz, E., Turel, I., Gul, A., & Yilmaz, O., (2008). Evaluation of the anthelmintic activity of garlic (Allium sativum) in mice naturally infected with *Aspiculuristetraptera*. *Recent Patents on Anti-Infective Drug Discovery*, *3*(2), 149–152.
3. Bensky, D., A., Gamble, A., & Kaptchuk, T. J., (1993). *Chinese Herbal Medicine: Materiamedica* (3rd edn., p. 1325). Eastland Press, New York.
4. Bhowmik, S., Chowdhury, S. D., Kabir, M. H., & Ali, M. A., (2008). Chemical composition of some medicinal plant products of indigenous origin. *Bangladesh Veterinarian*, *25*(1), 32–39.
5. Duke, J. A., (2002). *Handbook of Medicinal Herbs* (p. 896). CRC Press, Boca Raton–FL, 2002.
6. Eysker, M., & Ploeger, H., (2000). Value of present diagnostic methods for gastrointestinal nematode infections in ruminants. *Parasitology*, *120*(7), 109–119.
7. Fadzirayi, C., Masamha, B., & Mukutirwa, I., (2010). Efficacy of Allium sativum (garlic) in controlling nematode parasites in sheep. *International Journal of Research, Veterinary Medicine*, *8*(3), 161–169.
8. Fenwick, G. R., Hanley, A. B., & Whitaker, J. R., (1985). The genus Allium—part 1. *Critical Reviews in Food Science & Nutrition*, *22*(3), 199–271.
9. Gardzielewska, J., Pudyszak, K., Majewska, T., Jakubowska, M., & Pomianowski, J., (2003). Effect of plant-supplemented feeding on fresh and frozen storage quality of broiler chicken meat. *Electronic Journal of Polish Agricultural University (Series Animal Husbandry)*, *6*(2), Open Access, http://yadda.icm.edu.pl/yadda/element/bwmeta1.element.agro-article-6155736c-7827–4bd7-a039-f4d40a4cc8d3 (Accessed on 29 July 2019).
10. Gradé, J. T., Arble, B. L., Weladji, R. B., & Van Damme, P., (2008). Anthelmintic efficacy and dose determination of Albiziaanthelmintica against gastrointestinal nematodes in naturally infected Ugandan sheep. *Veterinary Parasitology 157*(3), 267–274.
11. Guarrera, P. M., (1999). Traditional antihelmintic, antiparasitic and repellent uses of plants in Central Italy. *Journal of Ethnopharmacology*, *68*(1), 183–192.
12. Hoste, H., Gaillard, L., & Le Frileux, Y., (2005). Consequences of the regular distribution of sainfoin hay on gastrointestinal parasitism with nematodes and milk production in dairy goats. *Small Ruminant Research*, *59*(2), 265–271.
13. Jackson, F., & Coop, R., (2000). The development of anthelmintic resistance in sheep nematodes. *Parasitology*, *120*(7), 95–107.
14. Knox, M., (2000). Nutritional approaches to nematode parasite control in sheep. *Feed Mix*, *8*(4), 12–15.
15. Koch, H. P., & Lawson, L. D., (1996). *Garlic: The Science and Therapeutic Application of Allium Sativum L. and Related Species* (Vol. XV, p. 329). Williams & Wilkins, Baltimore, Maryland.

16. Noon, J., (2003). *A Controlled Experiment to Measure the Effectiveness on Lambs of Wormers That Conform to the New Organic Standards*. FNE03–482 Farmer/Grower Northeast Sare Grant Report, Springvale, Maine, E-Report, http://www.garlicbarrier.com/2003_SARE_Report.html (Accessed on 29 July 2019).
17. Nwinuka, N., Ibeh, G., & Ekeke, G., (2005). Proximate composition and levels of some toxicants in four commonly consumed spices. *J. Appl. Sci. Environ. Mgt*., *9*(1), 150–155.
18. Okolo, S. C., Olajide, O. O., Idowu, D. I., Adebiyi, A. B., Ikokoh, P. P., & Orishadipe, A. T., (2012). Comparative proximate studies on some Nigerian food supplements. *Annals of Biological Research*, *3*(2), 773–779.
19. Sutton, G., & Haik, R., (1999). Efficacy of garlic as an anthelmintic in donkeys. *Israel Journal of Veterinary Medicine*, *54,* 23–27.
20. Toulah, F., & Al-Rawi, M., (2007). Efficacy of garlic extract on hepatic coccidiosis in infected rabbits (Oryctolagus cuniculus): Histological and biochemical studies. *Journal of the Egyptian Society of Parasitology*, *37*(3), 957–968.
21. Worku, M., Franco, R., & Baldwin, K., (2009). Efficacy of garlic as an anthelmintic in adult goats. *Archives of Biological Science Belgrade*, *61*(1), 135–140.
22. Zajac, A. M., & Conboy, G. A., (2012). *Veterinary Clinical Parasitology* (8th edn., p. 368). Wiley-Blackwell, New York.

1. Aboua, Y., Brooks, N., Mahfouz, R., Agarwal, A., & Du Plessis, S., (2012). Red palm oil diet can reduce the effects of oxidative stress on rat spermatozoa. *Andrologia, 44*, 32–40.
2. Abuasal, B. S., Qosa, H., Sylvester, P. W., & Kaddoumi, A., (2012). Comparison of the intestinal absorption and bioavailability of γ-tocotrienol and α-tocopherol: *In vitro*, *in situ* and *in vivo* studies. *Biopharmaceutics & Drug Disposition*, *33*(5), 246–256.
3. Agarwal, A., Gupta, S., & Sikka, S., (2006). The role of free radicals and antioxidants in reproduction. *Current Opinion in Obstetrics and Gynecology*, *18*(3), 325–332.
4. Al-Damegh, M. A., (*2014*). Stress-induced changes in testosterone secretion in male rats: Role of oxidative stress and modulation by antioxidants. *Open Source Online Journal of Animal Sciences*, *4*(2), 70–77.
5. Alinde, O. B. L., Esterhuyse, A. J., & Oguntibeju, O. O., (2012). Role of reactive oxygen species in the pathogenesis of cardiovascular disease. *Scientific Research and Essays*, *7*(49), 4151–4159.
6. Aquino, J. D. S., Pessoa, D. C. N. D. P., Oliveira, C. E. V. D., Cavalheiro, J. M. O., & Stamford, T. L. M., (2012). Making cookies with buriti oil (*Mauritia flexuosa* L.): Alternative source of dietary vitamin A in school meals. *Revista de Nutrição*, *25*(6), 765–774.
7. Awoniyi, D. O., Aboua, Y. G., Marnewick, J. L., Du Plesis, S. S., & Brooks, N. L., (2013). Protective effects of rooibos (*Aspalathuslinearis*), green tea (*Camellia sinensis*) and commercial supplements on testicular tissue of oxidative stress induced rats. *African Journal of Biotechnology*, *10*(75), 17317–17322.
8. Ayeleso, A. O., Oguntibeju, O. O., Aboua, Y. G., & Brooks, N. L., (2014). Effects of red palm oil and rooibos on sperm motility parameters in streptozotocin induced diabetic rats. *African Journal of Traditional, Complementary and Alternative Medicines*, *11*(5), 8–15.
9. Böhm, F., Edge, R., & Truscott, G., (2012). Interactions of dietary carotenoids with activated (singlet) oxygen and free radicals: Potential effects for human health. *Molecular Nutrition & Food Research*, *56*(2), 205–216.

10. Darnet, S. H., Silva, L. H. M. D., Rodrigues, A. M. D. C., & Lins, R. T., (2011). Nutritional composition, fatty acid and tocopherol contents of buriti (*Mauritia flexuosa*) and patawa (*Oenocarpusbataua*) fruit pulp from the amazon region. *Food Science and Technology (Campinas)*, *31*(2), 488–491.
11. Dorrington, J. H., Fritz, I. B., & Armstrong, D. T., (1978). Control of testicular estrogen synthesis. *Biology of Reproduction*, *18*(1), 55–64.
12. Everett, S. A., Dennis, M. F., Patel, K. B., Maddix, S., Kundu, S. C., & Willson, R. L., (1996). Scavenging of nitrogen dioxide, thiyl, and sulfonyl free radicals by the nutritional antioxidant-carotene. *Journal of Biological Chemistry*, *271*(8), 3988–3994.
13. Fairus, S., Nor, R. M., Cheng, H. M., & Sundram, K., (2006). Postprandial metabolic fate of tocotrienol-rich vitamin E differs significantly from that of alpha-tocopherol. *American Journal of Clinical Nutrition*, *84*(4), 835–842.
14. Falahati-Nini, A., Riggs, B. L., Atkinson, E. J., O'Fallon, W. M., Eastell, R., & Khosla, S., (2000). Relative contributions of testosterone and estrogen in regulating bone resorption and formation in normal elderly men. *Journal of Clinical Investigation*, *106*(12), 1553.
15. Garcia, T. X., Costa, G. M., Franca, L. R., & Hofmann, M. C., (2014). Sub-acute intravenous administration of silver nanoparticles in male mice alters Leydig cell function and testosterone levels. *Reproductive Toxicology*, *45*, 59–70.
16. Gee, P. T., (2011). Vitamin E - essential knowledge for supplementation. *Lipid Technology*, *23*(4), 79–82.
17. Harrison, E. H., (2012). Mechanisms involved in the intestinal absorption of dietary vitamin A and provitamin A carotenoids. *Biochimica et Biophysica Acta (BBA) Molecular and Cell Biology of Lipids*, *1821*(1), 70–77.
18. Hartman, T. J., Dorgan, J. F., Virtamo, J., Tangrea, J. A., Taylor, P. R., & Albanes, D., (1999). Association between serum α-tocopherol and serum androgens and estrogens in older men. *Nutrition and Cancer*, *35*(1), 10–15.
19. Heikal, T. M., Mossa, A. H., Ibrahim, A. W., & Abdel-Hamid, H. F., (2014). Oxidative damage and reproductive toxicity associated with cyromazine and chlorpyrifos in male rats: The protective effects of green tea extract. *Research Journal of Environmental Toxicology*, *8*(2), 53–67.
20. Ibrahim, R. Y. M., & Ghoneim, M. A. M., (2014). Study of some biochemical and molecular changes induced by radiation hormesis in testicular tissues of male rats. *International Journal*, *2*(7), 397–407.
21. Jargar, J. G., Yendigeri, S., Dhundasi, S. A., & Das, K. K., (2014). Protective effect of Vitamin E (a-tocopherol) on nickel-induced alteration of testicular pathophysiology in alloxan-treated diabetic rats. *International Journal of Clinical and Experimental Physiology*, *1*(4), 290.
22. Joseph, A., Shur, B. D., & Hess, R. A., (2011). Estrogen, efferent ductules, and the epididymis. *Biology of Reproduction*, *84*(2), 207–217.
23. Juntal, M. C., Krust, A., Chambon, P., & Mark, M., (2008). Sterility and absence of histopathological defects in non-reproductive organs of a mouse ERβ-null mutant. *Proceedings of the National Academy of Sciences 105*(7), 2433–2438.
24. Kanter, M., Aktas, C., & Erboga, M., (2012). Protective effects of quercetin against apoptosis and oxidative stress in streptozotocin-induced diabetic rat testis. *Food and Chemical Toxicology*, *50*(3), 719–725.

25. Karuppanapandian, T., Moon, J. C., Kim, C., Manoharan, K., & Kim, W., (2011). Reactive oxygen species in plants: Their generation, signal transduction, and scavenging mechanisms. *Australian Journal of Crop Science*, *5*(6), 230–235.
26. Kharwar, R. K., & Haldar, C., (2012). Daily variation in antioxidant enzymes and lipid peroxidation in lungs of a tropical bird *Perdiculaasiatica*: Role of melatonin and nuclear receptor RORα. *Comparative Biochemistry and Physiology Part A: Molecular & Integrative Physiology*, *162*(4), 296–302.
27. Khosla, S., Melton, L. J., & Riggs, B. L., (2011). The unitary model for estrogen deficiency and the pathogenesis of osteoporosis. *Journal of Bone and Mineral Research*, *26*(3), 441–451.
28. Krishnamoorthy, G., Selvakumar, K., & Elumalai, P., (2011). Protective role of lycopene on polychlorinated biphenyls (Aroclor 1254)-induced adult rat Sertoli cell dysfunction by increased oxidative stress and endocrine disruption. *Biomedical Preventative Nutrition, 1*, 116–125.
29. Lodhi, G. M., Latif, R., Hussain, M. M., Naveed, A. K., & Aslam, M., (2014). Effect of ascorbic acid and alpha tocopherol supplementation on acute restraint stress induced changes in testosterone, corticosterone and nor epinephrine levels in male Sprague Dawley rats. *Journal of Ayub Medical College, 26*(1), 7–10.
30. Luo, Q., Li, Z., Huang, X., Yan, J., Zhang, S., & Cai, Y. Z., (2006). Lyciumbarbarum polysaccharides: Protective effects against heat-induced damage of rat testes and H 2 O 2-induced DNA damage in mouse testicular cells and beneficial effect on sexual behavior and reproductive function of hemicastrated rats. *Life Sciences*, *79*(7), 613–621.
31. Maniam, S., Mohamed, N., Shuid, A. N., & Soelaiman, I. N., (2008). Palm tocotrienol exerted better antioxidant activities in bone than α-tocopherol. *Basic & Clinical Pharmacology & Toxicology*, *103*(1), 55–60.
32. Menke, A., Guallar, E., Rohrmann, S., Nelson, W. G., Rifai, N., Kanarek, N., & Platz, E. A., (2010). Sex steroid hormone concentrations and risk of death in US men. *American Journal of Epidemiology*. E-article: doi: 10.1093/aje/kwp415415.
33. Mithal, A., Bonjour, J. P., Boonen, S., Burckhardt, P., Degens, H., & Fuleihan, G. E. H., (2013). IOF-CSA Nutrition Working Group, Impact of nutrition on muscle mass, strength, and performance in older adults. *Osteoporosis International*, *24*(5), 1555–1566.
34. Muhammad, N., Luke, D. A., Shuid, A. N., Mohamed, N., & Soelaiman, I. N., (2013). Tocotrienol supplementation in postmenopausal osteoporosis: Evidence from a laboratory study. *Clinics*, *68*(10), 1338–1343.
35. Nishio, K., Horie, M., Akazawa, Y., Shichiri, M., Iwahashi, H., Hagihara, Y., & Niki, E., (2013). Attenuation of lipopolysaccharide (LPS)-induced cytotoxicity by tocopherols and tocotrienols. *Redox Biology*, *1*(1), 97–103.
36. Packer, L., Weber, S. U., & Rimbach, G., (2001). Molecular aspects of tocotrienol antioxidant action and cell signaling. *Journal of Nutrition*, *131*, 369S-373S.
37. Pantsi, W. G., Bester, D. J., Esterhuyse, A. J., & Aboua, G., (2014). Dietary antioxidant properties of vegetable oils and nuts: The race against cardiovascular disease progression, Chapter 9. In: Oluwafemi, O., (ed.), *Antioxidant-Antidiabetic Agents and Human Health* (pp. 209–238). ISBN 978–953–51–1215–0, IntechOpen.com.
38. Patel, V., Rink, C., Khanna, S., & Sen, C. K., (2011). Tocotrienols: The lesser known form of natural vitamin E. *Indian Journal of Experimental Biology*, *49*(10), 732–738.
39. Santos, M. F. G., Alves, R. E., & Ruíz-Méndez, M. V., (2013). Minor components in oils obtained from Amazonian palm fruits. *Grasas Aceites*, *64*(5), 531–536.

40. Sönmez, M., Türk, G., & Yüce, A., (2005). The effect of ascorbic acid supplementation on sperm quality, lipid peroxidation and testosterone levels of male Wistar rats. *Theriogenology*, *63*(7), 2063–2072.
41. Selvakumar, K., Banu, L. S., Krishnamoorthy, G., Venkataraman, P., Elumalai, P., & Arunakaran, J., (2011). Differential expression of androgen and estrogen receptors in PCB (Aroclor 1254)-exposed rat ventral prostate: Impact of alpha-tocopherol. *Experimental and Toxicologic Pathology*, *63*(1), 105–112.
42. Sen, C. K., Khanna, S., Roy, S., & Packer, L., (2000). Molecular basis of vitamin E action tocotrienol potently inhibits glutamate-induced pp60c-Src Kinase activation and death of ht4 neuronal cells. *Journal of Biological Chemistry*, *275*(17), 13049–13055.
43. Singh, V. K., Beattie, L. A., & Seed, T. M., (2013). Vitamin E: Tocopherols and tocotrienols as potential radiation countermeasures. *Journal of Radiation Research*, *54*(6), 973–988.
44. Sinha, I., Sinha-Hikim, A. P., Wagers, A. J., & Sinha-Hikim, I., (2014). Testosterone is essential for skeletal muscle growth in aged mice in a heterochronic parabiosis model. *Cell and Tissue Research*, *357*(3), 815–821.
45. Smith, L. B., & Saunders, P. T., (2011). The skeleton: New controller of male fertility? *Cells*, *144*(5), 642–643.
46. Smith, L. B., & Walker, W. H., (2014). The regulation of spermatogenesis by androgens. *Seminars in Cellular & Developmental Biology, 30*, 2–13.
47. Thamahane-Katengua, E. T. M., (2013). *Effect of Rooibos and Red Palm Oil Supplementation, Alone or in Combination, on Cardiac Function After Exposure to Hypertension and Inflammation in an Ischaemia/Reperfusion Injury Model* (p. 243). Unpublished DTech Thesis, Cape Peninsula University of Technology, Cape Town.
48. Türk, G., Sönmez, M., Aydin, M., Yüce, A., Gür, S., Yüksel, M., & Aksoy, H., (2008). Effects of pomegranate juice consumption on sperm quality, spermatogenic cell density, antioxidant activity and testosterone level in male rats. *Clinical Nutrition*, *27*(2), 289–296.
49. Wildman, R. P., Wang, D., Fernandez, I., Mancuso, P., Santoro, N., Scherer, P. E., & Sowers, M. R., (2013). Associations of testosterone and sex hormone binding globulin with adipose tissue hormones in midlife women. *Obesity*, *21*(3), 629–636.
50. Yüce, A., Türk, G., Çeribaşi, S., Sönmez, M., Çiftçi, M., & Güvenç, M., (2013). Effects of cinnamon (*Cinnamomumzeylanicum*) bark oil on testicular antioxidant values, apoptotic germ cell and sperm quality. *Andrologia*, *45*(4), 248–255.
1. Ahmed, A., Arshad, M. U., Saeed, F., Ahmed, R. S., & Chatha, S. A. S., (2016). Nutritional probing and HPLC profiling of roasted date pit powder. *Pak. J. Nutr*., *15*(3), 229–237.
2. Alagesaboopathi, C., (2011). Ethnobotanical studies on useful plants of Kanjamalaihills of Salem district of Tamil Nadu, Southern India. *Ar. App. Sci. Res*., *3*(5), 532–539.
3. Al-kataan, M. A., Ibrahim, M. A., Al-jammas, M. H. H., Shareef, Y. S., & Sulaiman, M. A., (2010). Serum antioxidant vitamins changes in women with polycystic ovarian syndrome. *J. Bahrain Med. Sci*., *22*, 68–71.
4. Allahbadia, G. N., & Merchant, R., (2008). Polycystic ovary syndrome in the Indian subcontinent. *Semin. Reprod. Med*., *26*(1), 22–34.
5. Altieri, P., Cavazza, C., Pasqui, F., Morselli, A. M., Gambineri, A., & Pasquali, R., (2013). Dietary habits and their relationship with hormones and metabolism in overweight and obese women with polycystic ovary syndrome. *Clin. Endocrinol (Oxf.)*, *78*, 52–59.

8. Atmaca, M., Seven, I., Ucler, R., Alay, M., Barut, V., Dirik, Y., & Sezgin, Y., (2014). An interesting cause of hyperandrogenemic hirsutism. *Case Rep. Endocrinol*., 987272.
9. Azziz, R., Carmina, E., Dewailly, D., & Kandarakis, E. D., (2009). The Androgen excess and PCOS society criteria for the polycystic ovary syndrome: The complete task force report. *Fertil. Steril*., *91*(2), 456–488.
10. Azziz, R., Woods, K. S., Reyna, R., Key, T. J., Knochenhauer, E. S., & Yildiz, B. O., (2004). The prevalence and features of the polycystic ovary syndrome in an unselected population. *J. Clin. Endocrinol. Metab*., *89*(6), 2745–2749.
11. Badawy, A., & Elnashar, A., (2011). Treatment options for polycystic ovary syndrome. *Int. J. Women Health*, *3*, 25–35.
12. Balaji, A. B., Kulkarni, P. K., Farees, N., & Deepthi, M., (2014). Life style exercise modification effect in infertility women with PCOS diseases. *Ind. J. App. Res*., *4*(9).
13. Baldani, D. P., Skrgati, L., & Ougouag, R., (2015). Polycystic Ovary syndrome: Important under recognized cardiometabolic risk factor in reproductive-age women. *Int. J. Endocrin*., 17–21.
14. Balen, A., (2001). Polycystic ovary syndrome and cancer. *Hum. Reprod*., *7*, 522–525.
15. Baqai, Z., Khanam, M., & Parveen, S., (2010). Prevalence of PCOS in infertile patients. *Med. Chanel*, *16*(3), 255–260.
16. Barber, T. M., & Franks, S., (2012). The link between polycystic ovary syndrome and both type 1 and Type 2 diabetes mellitus: What do we know today? *Womens Health (Lond)*., *8*(2), 147–154.
17. Barber, T. M., McCarthy, M. I., Wass, J. A., & Franks, S., (2006). Obesity and polycystic ovary syndrome. *Clin. Endocrinol. (Oxf)*., *65*(2), 137–145.
18. Barr, S., Hart, K., Reeves, S., Sharp, K., & Jeans, Y. M., (2011). Habitual dietary intake, eating pattern and physical activity of women with polycystic ovary syndrome. *Eur. J. Clin. Nutr*., *65*(10), 1126–1132.
19. Barry, J. A., Azizia, M. M., & Hardiman, P. J., (2014). Risk of endometrial, ovarian and breast cancer in women with polycystic ovary syndrome: A systematic review and meta-analysis. *Hum Reprod Update., 20*(5), 748–758.
20. Bates, G. W. J., & Propst, A. M., (2012). Polycystic ovarian syndrome management options. *Obstet. Gynecol. Clin. North Am., 39*(4), 495–506.
21. Bazzano, L. A., Hu, T., Reynolds, K., & Yao, L., (2014). Effects of low-carbohydrate and low-fat diets: a randomized trial. *Ann. Intern. Med., 161*(5), 309–318.
22. Boomsma, C. M., Fauser, B. C., & Macklon, N. S., (2008). Pregnancy complications in women with polycystic ovary syndrome. *Semin. Reprod. Med*., *26*, 72–84.
23. Boyle, J., & Teede, H. J., (2012). Polycystic ovary syndrome-an update. *Aust. Fam. Physician*., *41*(10), 752–756.
24. Bozdag, G., Mumusoglu, S., Zengin, D., Karabulut, E., & Yildiz, B. O., (2016). The prevalence and phenotypic features of polycystic ovary syndrome: A systematic review and meta-analysis. *Hum Reprod*. *31*(12): 2841–2855.
25. Brahm, J., Brahm, M., & Segovia, R., (2011). Acute and fulminant hepatitis induced by flutamide: Case series report and review of the literature. *Ann. Hepatol*., *10*, 93–98.
26. Brassard, M., AinMel, Y., & Baillargeon, J. P., (2008). Basic infertility including polycystic ovary syndrome. *Med. Clin. North Am*., *92*, 1163–1192.
27. Bruner, B., Chad, K., & Chizen, D., (2006). Effects of exercise and nutritional counseling in women with polycystic ovary syndrome. *Appl. Physiol. Nutr. Metab*., *31*(4), 384–391.

28. Buzney, E., Sheu, J., Buzney, C., & Reynolds, R. V., (2014). Polycystic ovary syndrome: A review for dermatologists: Part II, Treatment. *J. Am. Acad. Dermatol*., *71*(5), 859, 1–859.
29. Caldwell, A. S., Middleton, L. J., & Jimenez, M., (2014). Characterization of reproductive, metabolic, and endocrine features of polycystic ovary syndrome in female hyperandrogenic mouse models. *Endocrin*., *155*(8), 3146–3159.
30. Cascella, M., Magistrato, A., Tavernelli, I., Carloni, P., & Rothlisberger, U., (*2006*). Role of protein frame and solvent for the redox properties of azurin from *Pseudomonas aeruginosa. PNAS., 103(52), 19641–19646.*
31. Chittenden, B. G., Fullerton, G., Maheshwari, A., & Bhattacharya, S., (2009). Polycystic ovary syndrome and the risk of gynecological cancer: a systematic review. *Reprod Biomed Online., 19*(3), 398–405.
32. Cui, L., Li, G., Zhong, W., Bian, Y., & Su, S., (2015). Polycystic ovary syndrome susceptibility single nucleotide polymorphisms in women with a single PCOS clinical feature. *Hum. Reprod., 30*(3), 732–736.
33. Dewailly, D., Lujan, M. E., Carmina, E., Cedars, M. I., Laven, J., Norman, R. J., & Morreale, E. H. F., (2014). Definition and significance of polycystic ovarian morphology: A task force report from the androgen excess and polycystic ovary syndrome society. *Hum. Reprod. Update*., *20*(3), 334–352.
34. Diamanti-Kandarakis, E., Spina, G., Kouli, C., & Migdalis, I., (2001). Increased endothelin-1 levels in women with polycystic ovary syndrome and the beneficial effect of metformin therapy. *J. Clin. Endocrinol. Metab., 86,* 3595–3598.
35. Dikensoy, E., Balat, O., Pence, S., Akcali, C., & Cicek, H., (2009). The risk of hepatotoxicity during long-term and low-dose flutamide treatment in hirsutism. *Arch. Gynecol. Obstet*., *279*, 321–327.
36. Dumesic, D. A., & Lobo, R. A., (2013). Cancer risk and PCOS. *Steroids., 78*(8), 782–785.
37. Dumitrescu, R., Mehedintu, C., Briceag, I., Purcarea, V. L., & Hudita, D., (2015). The polycystic ovary syndrome: An update on metabolic and hormonal mechanisms. *J. Med. Life*., *8*(2), 142–145.
38. Dunaif, A., (2016). Perspectives in polycystic ovary syndrome: From hair to eternity. *J. Clin. Endocrinol. Metab., 101*(3), 759–768.
39. Dunne, N., & Slater, W., (2006). The natural diet solution for PCOS and Infertility: How to manage polycystic ovary syndrome naturally. *Natural Solutions for PCOS* (p. 552). Health Solutions Press, New York.
40. Ecklund, L. C., & Usadi, R. S., (2015). Endocrine and reproductive effects of polycystic ovarian syndrome. *Obstet. Gynecol. Clin. North Am*., *42*(1), 55–65.
41. Eleftheriadou, M., Stefanidis, K., Lykeridou, K., Iliadis, I., & Michala, L., (2015). Dietary habits in adolescent girls with polycystic ovarian syndrome. *Gynecol. Endocrinol., 31*(4), 269–271.
42. Esfahanian, F., Zamani, M. M., Heshmat, R., & Moini, F., (2013). Effect of metformin compared with hypocaloric diet on serum C-reactive protein level and insulin resistance in obese and overweight women with polycystic ovary syndrome. *J. Obstet. Gynaecol. Res., 39*(4), 806–813.
43. Essah, P. A., Wickham, E. P., Nunley, J. R., & Nestler, J. E., (2006). Dermatology of androgen-related disorders. *Clin. Dermatol., 24*, 289–298.
44. Farrell, K., & Antoni, M. H., (2010). Insulin resistance, obesity, inflammation, and depression in polycystic ovary syndrome: Biobehavioral mechanisms and interventions. *Fertil. Steril., 94*(5), 1565–1574.

45. Farrell-Turner, K. A., (2011). Polycystic ovary syndrome: Update on treatment options and treatment considerations for the future. *Clinical Medicine Insights: Women's Health, 4*, 67–81.
46. Farshchi, H., Rane, A., Love, A., & Kennedy, R. L., (2007). Diet and nutrition in polycystic ovary syndrome (PCOS): Pointers for nutritional management. *J. Obstet. Gynaecol., 27*(8), 762–773.
47. Fauser, B., Tarlatzis, B., & Rebar, R., (2012). Consensus on women's health aspects of polycystic ovary syndrome (PCOS): The Amsterdam ESHRE/ASRM. Sponsored 3rd PCOS consensus workshop group. *Fertile Steril., 97*(1), 28–38.
48. Fenkci, V., Fenkci, S., Yilmazer, M., & Serteser, M., (2003). Decreased total antioxidant status and increased oxidative stress in women with polycystic ovary syndrome may contribute to the risk of cardiovascular disease. *Fertil Steril., 80*, 123–127.
49. Fogel, R. B., Malhotra, A., Pillar, G., Pittman, S. D., Dunaif, A., & White, D. P., (2001). Increased prevalence of obstructive sleep apnea syndrome in obese women with polycystic ovary syndrome. *J. Clin. Endocrinol. Metab., 86*, 1175–1180.
50. Franks, S., (2002). Adult polycystic ovary syndrome begins in childhood. *Best Pract Res Clin Endocrinol Metab., 16*, 263–272.
51. Gallo, M. F., Lopez, L. M., Grimes, D. A., Schulz, K. F., & Helmerhorst, F. M., (2011). Combination contraceptives: Effects on weight. *Cochrane Database Syst. Rev*., *9,* CD003987.
52. Garg, D., & Tal, R., (2016). The role of AMH in the pathophysiology of polycystic ovarian syndrome. *Reprod. Biomed Online, 33*(1), 15–28.
53. Glueck, C., Phillips, H., Cameron, D., Sieve-Smith, L., & Wang, P., (2001). Continuing metformin throughout pregnancy in women with polycystic ovary syndrome appears to safely reduce first-trimester spontaneous abortion: a pilot study. *Fertil. Steril., 75*(1), 46–52.
54. Goodman, N. F., Cobin, R. H., & Futterweit, W., (2015). American association of clinical endocrinologists, american college of endocrinology, and androgen excess and pcos society disease state clinical review: Guide to the best practices in the evaluation and treatment of polycystic ovary syndrome--Part 1. *Endocr. Pract., 21*(11), 1291–1300.
55. Gopal, M., Duntley, S., Uhles, M., & Attarian, H., (2002). The role of obesity in the increased prevalence of obstructive sleep apnea syndrome in patients with polycystic ovarian syndrome. *Sleep Med., 3*, 401–404.
56. Gottschau, M., Kiaer, S. K., Jensen, A., Munk, C., & Mellemkjaer, L., (2015). Risk of cancer among women with polycystic ovary syndrome: A Danish cohort study. *Gynecol Oncol., 136*(1), 99–103.
57. Gower, B. A., Chandler-Laney, P. C., & Ovalle, F., (2013). Favourable metabolic effects of a eucaloric lower-carbohydrate diet in women with PCOS. *Clin. Endocrinol. (Oxf)., 79*, 550–557.
58. Grantham, J. P., & Henneberg, M., (2014). The estrogen hypothesis of obesity. *PLoS One., 9*(6), e99776.
59. Hannaford, P. C., Iversen, L., & Macfarlane, T. V., (2010). Mortality among contraceptive pill users: Cohort evidence from Royal College of General Practitioners' Oral Contraception Study. *BMJ*., *340*, c927.
60. Hannaford, P. C., Selvaraj, S., Elliott, A. M., Angus, V., Iversen, L., & Lee, A. J., (*2007*). Cancer risk among users of oral contraceptives: Cohort data from the Royal College of General Practitioner's oral contraception study. *BMJ., 335*, 651.

61. Haoula, Z., Salman, M., & Atiomo, W., (2012). Evaluating the association between endometrial cancer and polycystic ovary syndrome. *Hum. Reprod., 27*(5), 1327–1331.
62. Haqq, L., McFarlane, J., Dieberg, G., & Smart, N., (2014). Effect of lifestyle intervention on the reproductive endocrine profile in women with polycystic ovarian syndrome: A systematic review and meta-analysis. *Endocr Connect., 3*(1), 36–46.
63. Hardiman, P., Pillay, O. C., & Atiomo, W., (2003). Polycystic ovary syndrome and endometrial carcinoma. *Lancet., 362*, 1082–1089.
64. Hart, R., Hickey, M., & Franks, S., (2004). Definitions, prevalence and symptoms of polycystic ovaries and polycystic ovary syndrome. *Best Pract. Res. Clin. Obstet Gynaecol., 18*(5), 671–683.
65. Homburg, R., (2008). Polycystic ovary syndrome. *Best Pract. Res. Clin. Obstet. Gynaecol., 22*, 261–274.
66. Hu, T., Mills, K. T., Yao, L., & Demanelis, K., (2012). Effects of low-carbohydrate diets versus low-fat diets on metabolic risk factors: A meta-analysis of randomized controlled clinical trials. *Am. J. Epidemiol., 176*(7), S44–S54.
67. Ibanez, I., Valls, C., Potau, N., Marcos, M. V., & De Zegher, F., (2001). Polycystic ovary syndrome after precocious pubarche: Ontogeny of the low birthweight effect. *Clin. Endocrinol. (Oxf)., 55*, 667–672.
68. Ibanez, L., & Zegher, F., (2003). Low-dose combination of flutamide, metformin and an oral contraceptive for non-obese, young women with polycystic ovary syndrome. *Hum. Reprod*., *18*, 57–60.
69. Isikoglu, M., Ozgur, K., & Oehninger, S., (2007). Extension of GnRH agonist through the luteal phase to improve the outcome of intracytoplasmic sperm injection. *J. Reprod. Med., 52*, 639–644.
70. Jakubowicz, D. J., Iuorno, M. J., Jakubowicz, S., Roberts, K., & Nestler, J. E., (2002). Effects of metformin on early pregnancy loss in the polycystic ovary syndrome. *J. Clin. Endocrinol. Metab., 87*(2), 524–529.
71. Jeans, Y. M., Barr, S., Smith, K., & Hart, K. H., (2009). Dietary management of women with polycystic ovary syndrome in the United Kingdom: The role of dietitians. *J. Hum. Nutr. Diet., 22*(6), 551–558.
72. Joham, A. E., Nanayakkara, N., & Ranasinha, S., (2016). Obesity, polycystic ovary syndrome and breastfeeding: An observational study. *Acta Obstet. Gynecol. Scand., 95*(4), 458–466.
73. Joham, A. E., Palomba, S., & Hart, R., (2016). Polycystic ovary syndrome, obesity, and pregnancy. *Semin. Reprod. Med., 34*(2), 93–101.
74. Jonard, C. S., & Dewailly, D., (2013). Pathophysiology of polycystic ovary syndrome: The role of hyperandrogenism. *Front. Horm. Res., 40*, 22–27.
75. Kemmeren, J. M., Algra, A., & Grobbee, D. E., (2001). Third generation oral contraceptives and risk of venous thrombosis: Meta-analysis. *BMJ., 323*, 131–134.
76. Kim, J., Mersereau, J. E., Khankari, N., & Bradshaw, P. T., (2016). Polycystic ovarian syndrome (PCOS), related symptoms/sequelae, and breast cancer risk in a population-based case-control study. *Cancer Causes Control., 27*(3), 403–414.
77. Ko, H., Teede, H., & Moran, L., (2016). Analysis of the barriers and enablers to implementing lifestyle management practices for women with PCOS in Singapore. *BMC Res Notes*., *9*, 311–318.
78. Lakkakula, B. V., (2013). Genetic variants associated with insulin signaling and glucose homeostasis in the pathogenesis of insulin resistance in polycystic ovary syndrome: A systematic review. *J. Assist. Reprod. Genet*., *30*(7), 883–895.

79. Legro, R. S., Brzyski, R. G., Diamond, M. P., & Coutifaris, C., (2014). Letrozole versus clomiphene for infertility in the polycystic ovary syndrome. *N. Engl. J. Med*., *371*(2), 119–129.
80. Legro, R. S., Dodson, W. C., Kunselman, A. R., & Stetter, C. M., (2016). Benefit of delayed fertility therapy with preconception weight loss over immediate therapy in obese women with PCOS. *J. Clin. Endocrinol. Metab., 101*(7), 2658–2666.
81. Legro, R. S., Kunselman, A. R., & Demers, L., (2002). Elevated dehydroepiandrosterone sulfate levels as the reproductive phenotype in the brothers of women with polycystic ovary syndrome. *J. Clin. Endocrinol. Metab., 87*, 2134–2138.
82. Li, L., & Baek, K. H., (2015). Molecular genetics of polycystic ovary syndrome: An update. *Curr. Mol. Med., 15*(4), 331–342.
83. Lindh, I., Ellstrom, A. A., & Milsom, I., (2011). The long-term influence of combined oral contraceptives on body weight. *Hum. Reprod., 26*, 1917–1924.
84. Lujan, M. E., Jarrett, B. Y., & Brooks, E. D., (2013). Updated ultrasound criteria for polycystic ovary syndrome: Reliable thresholds for elevated follicle population and ovarian volume. *Hum. Reprod., 28*(5), 1361–1368.
85. Lumachi, F., & Basso, S. M., (2010). Medical treatment of hirsutism in women. *Curr. Med. Chem., 17*(23), 2530–2538.
86. Lundgren, K. M., Romundstad, L. B., & During, V. V., (2016). Exercise prior to assisted fertilization in overweight and obese women (FertilEX): Study protocol for a randomized controlled trial. *Trials., 17*(1), 268–276.
87. Macut, D., Bacevic, M., Antic, I. B., Macut, J. B., & Civcic, M., (2015). Predictors of subclinical cardiovascular disease in women with polycystic ovary syndrome: Interrelationship of dyslipidemia and arterial blood pressure. *Int. J. Endocrinol.*, 812610.
88. Macut, D., Pfeifer, M., & Yildiz, B. O., (2013). Polycysticovary syndrome: Novel insights into causes and therapy. *Front Horm. Res. Basel Karger., 40*, 1–21.
89. Mani, H., Kkunti, K., Daly, H., Barnett, J., & Davies, M., (2015). Education and self-management for women with polycystic ovary syndrome, a narrative review of literature. *Ibn. J. Med. Biomed Sci.*, *7*(1), 213–218.
90. March, W. A., Moore, V. M., & Willson, K. J., (2010). The prevalence of polycystic ovary syndrome in a community sample assessed under contrasting diagnostic criteria. *Hum. Reprod., 25*(2), 544–551.
91. Marsh, K., & Miller, J. B., (2005). The optimal diet for women with polycystic ovary syndrome? *Br. J. Nutr., 94*(2), 154–165.
92. Marsh, K. A., Steinbeck, K. S., Atkinson, F. S., Petocz, P., & Miller, J. C. B., (2010). Effect of a low glycemic index compared with a conventional healthy diet on polycystic ovary syndrome. *Am. J. Clin. Nutr., 92*, 83–92.
93. Mascarenhas, M. N., Flaxman, S. R., & Boerma, T., (2012). National, regional, and global trends in infertility prevalence since 1990: A systematic analysis of 277 health surveys. *PLoS Med., 9*, e1001356.
94. McCartney, C. R., & Marshall, J. C., (2016). Polycystic ovary syndrome. *Eng. J. Med*., *375*, 54–64.
95. McGrievy, G. T., Davidson, C. R., & Billings, D. L., (2015). Dietary intake, eating behaviors, and quality of life in women with polycystic ovary syndrome who are trying to conceive. *Hum. Fertil. (Camb)., 18*(1), 16–21.
96. Mehrabani, H. H., Salehpour, S., Amiri, Z., Farahani, S. J., Meyer, B. J., & Tahbaz, F., (2012). Beneficial effects of a high-protein, low-glycemic-load hypocaloric diet in

overweight and obese women with polycystic ovary syndrome: A randomized controlled intervention study. *J. Am. Coll. Nutr., 31*(2), 117–125.
97. Mehrabian, F., Khani, B., Kelishadi, R., & Ghanbari, E., (2011). The prevalence of polycystic ovary syndrome in Iranian women based on different diagnostic criteria. *Endokrynol. Pol., 62*(3), 238–242.
98. Merkin, S. S., Phy, J. L., Sites, C. K., & Yang, D., (2016). Environmental determinants of polycystic ovary syndrome. *Fertil. Steril., 106*(1), 16–24.
99. Mirza, S. S., Shafique, K., Shaikh, A. R., Khan, N. A., & Qureshi, M. A., (2014). Association between circulating adiponectin levels and polycystic ovarian syndrome. *J. Ovarian Res., 7*, 18–24.
100. Mobeen H, Afzal N, Kashif M. Polycystic Ovary Syndrome May Be an Autoimmune Disorder. *Scientifica (Cairo).* 2016;2016; E-article ID: 4071735; doi:10.1155/2016/4071735.
101. Mofid, A., Alinaghi, S. A. S., Zandieh, S., & Yazdani, T., (2008). Hirsutism. *Int. J. Clin. Pract., 62*, 433–443.
102. Mohan, S. K., & Priya, V. V., (2009). Lipid peroxidation, glutathione, ascorbic acid, vitamin E, antioxidant enzyme and serum homocysteine status in patients with polycystic ovary syndrome. *Biol. Med., 1*, 44–49.
103. Moran, L., & Norman, R. J., (2004). Understanding and managing disturbances in insulin metabolism and body weight in women with polycystic ovary syndrome. *Best Pract. Res. Clin. Obstet. Gynaecol., 18*(5), 719–736.
104. Moran, L. J., Brinkworth, G. D., & Norman, R. J., (2008). Dietary therapy in polycystic ovary syndrome. *Semin. Reprod. Med., 26*(1), 85–92.
105. Moran, L. J., Hutchison, S. K., Norman, R. J., & Teede, H. J., (2011). Lifestyle changes in women with polycystic ovary syndrome. *Cochrane Database Syst. Rev*., 7, CD007506.
106. Moran, L. J., Ko, H., & Misso, M., (2013). Dietary composition in the treatment of polycystic ovary syndrome: A systematic review to inform evidence-based guidelines. *J. Acad. Nutr. Diet., 113*(4), 520–545.
107. Moran, L. J., Noakes, M., Clifton, P. M., Wittert, G. A., Williams, G., & Norman, R. J., (2006). Short-term meal replacements followed by dietary macronutrient restriction enhance weight loss in polycystic ovary syndrome. *Am. J. Clin. Nutr., 84*(1), 77–87.
108. Moran, L. J., Pasquali, R., Teede, H. J., Hoeger, K. M., & Norman, R. J., (2009). Treatment of obesity in polycystic ovary syndrome: A position statement of the androgen excess and polycystic ovary syndrome society. *Fertil. Steril., 92*, 1966–1982.
109. Morenga, L. A. T., Levers, M. T., Williams, S. M., Brown, R. C., & Mann, J., (2011). Comparison of high protein and high fiber weight-loss diets in women with risk factors for the metabolic syndrome: A randomized trial. *Nutr. J., 10*, 40–46.
110. Motta, A. B., (2012). The role of obesity in the development of polycystic ovary syndrome. *Curr. Pharm. Des., 18*(17), 2482–2491.
111. Murri, M., Luque-Ramırez, M., Insenser, M., Ojeda-Ojeda, M., & Escobar-Morreale, H. F., (2013). Circulating markers of oxidative stress and polycystic ovary syndrome (PCOS): A systematic review and meta-analysis. *Hum. Reprod. Update., 19*, 268–288.
112. Nagarathna, P. K. M., Rajan, P. R., & Koneri, R., (2013). A detailed study on poly cystic ovarian syndrome and its treatment with natural products. *Int. J. Toxi. Pharma. Res., 5*(4), 109–120.

113. Namsa, N. D., Mandal, M., Tangjang, S., & Mandal, S. C., (2011). Ethnobotany of the Monpa ethnic group at Arunachal Pradesh, India. *J. Ethnobio. Ethnomed., 7*, 31–37.
114. Nelson, V. L., Qin, K. N., & Rosenfield, R. L., (2001). The biochemical basis for increased testosterone production in theca cells propagated from patients with polycystic ovary syndrome. *J. Clin. Endocrinol. Metab., 86*, 5925–5933.
115. Nidhi, R., Padmalatha, V., Nagarathna, R., & Amritanshu, R., (2011). Prevalence of polycystic ovarian syndrome in Indian adolescents. *J. Pediatr. Adolesc. Gynecol., 24*(4), 223–227.
116. Norman, R. J., Dewailly, D., Legro, R. S., & Hickey, T. E., (2007). *Polycystic Ovary Syndrome*, *370* (9588), 685–697.
117. Nybacka, A., Carlstrom, K., Stahle, A., Nyren, S., Hellstrom, P. M., & Hirschberg, A. L., (2011). Randomized comparison of the influence of dietary management and/or physical exercise on ovarian function and metabolic parameters in overweight women with polycystic ovary syndrome. *Fertil. Steril., 96*, 1508–1513.
118. Parahuleva, N., Pehlivanov, B., Orbecova, M., Deneva, T., & Uchikova, E., (2013). Serum levels of anti-muller hormone in women with polycystic ovary syndrome and healthy women of reproductive age. *Akush. Ginekol (Sofiia)., 52*(1), 16–23.
119. Pasquali, R., Gambineri, A., & Pagotto, U., (2006). The impact of obesity on reproduction in women with polycystic ovary syndrome. *BJOG: Int. J. Obs. Gynae*., *113*(10), 116–126.
120. Peigne, M., & Dewailly, D., (2014). Long term complications of polycystic ovary syndrome (PCOS). *Ann Endocrinol (Paris)*. *75*(4), 194–199,
121. Petrikova, J., Lazurova, I., Dravecka, I., Vrbikova, J., Kozakova, D., Figurova, J., Vaczy, Z., & Rosocha, J., (2015). The prevalence of non-organ specific and thyroid autoimmunity in patients with polycystic ovary syndrome. *Biomed Pap. Med. Fac. Univ. Palacky. Olomouc Czech Repub., 159*(2), 302–306.
122. Platt, A. M., (2015). Insulin resistance, metabolic syndrome, and polycystic ovary syndrome in obese youth. *NASN., 30*(4), 213–218.
123. Rajaeieh, G., Marasi, M., Shahshahan, Z., Hassanbeigi, F., & Safavi, S. M., (2014). The relationship between intake of dairy products and polycystic ovary syndrome in women who referred to Isfahan University of Medical Science Clinics in 2013. *Int. J. Prev. Med., 5*(6), 687–694.
124. Ramanand, S. J., Ghongane, B. B., & Ramanand, J. B., (2013). Clinical characteristics of polycystic ovary syndrome in Indian women. *Ind. J. Endocrinol. Metab.*, *17*(1), 138–145.
125. Ravn, P., Haugen, A. G., & Glintborg, D., (2013). Overweight in polycystic ovary syndrome. An update on evidence based advice on diet, exercise and metformin use for weight loss. *Minerva Endocrinol., 38*(1), 59–76.
126. Roessler, K. K., Birkebaek, C., Ravn, P., Andersen, M. S., & Glintborg, D., (2013). Effects of exercise and group counseling on body composition and VO2max in overweight women with polycystic ovary syndrome. *Acta Obstet. Gynecol Scand., 92*(3), 272–277.
127. Romero, G. G., & Morreale, H. F. E., (2006). Hyperandrogenism, insulin resistance and hyperinsulinemia as cardiovascular risk factors in diabetes mellitus. *Curr. Diabetes Rev., 2*(1), 39–49.
128. Rutkowska, A. Z., & Kandarakis, E. D., (2016). Polycystic ovary syndrome and environmental toxins. *Fertil. Steril. 106* (4), 948–958.

129. Salpeter, S. R., Greyber, E., Pasternak, G. A., & Salpeter, E. E., (2010). Risk of fatal and nonfatal lactic acidosis with metformin use in type 2 diabetes mellitus. *Cochrane Database Syst. Rev*., CD002967.
130. Seirfi, H., Farnaghi, F., & Vasheghani-farahani, A., (2007). Assessment of androgens in women with adult-onset acne. *Int. J. Dermatol., 46*, 1188–1191.
131. Sekhon, L. H., Sajal, G., Yesul, K., & Ashok, A., (2010). Female infertility and antioxidants. *Curr. Women's Health Rev., 6*, 84–95.
132. Sharman, M. J., Gomez, A. L., Kraemer, W. J., & Volek, J. S., (2004). Very low-carbohydrate and low-fat diets affect fasting lipids and postprandial lipemia differently in overweight men. *J. Nutr., 134*(4), 880–885.
133. Shen, C. C., Yang, A. C., Hung, J. H., Hu, L. Y., & Tsai, S. J., (2015). A nationwide population-based retrospective cohort study of the risk of uterine, ovarian and breast cancer in women with polycystic ovary syndrome. *Oncologist., 20*(1), 45–49.
134. Shlomo, B. I., & Younis, J. S., (2014). Basic research in PCOS: Are we reaching new frontiers? *Reprod Biomed Online., 28*(6), 669–683.
135. Sim, S. Y., Chin, S. L., Tan, J. L., Brown, S. J., Cussons, A. J., & Stuckey, B. G., (2016). Polycystic ovary syndrome in type 2 diabetes: Does it predict a more severe phenotype? *Fertil. Steril*., *106*(5), 1258–1263.
136. Sirmans, S. M., & Pate, K. A., (2013). Epidemiology, diagnosis, and management of polycystic ovary syndrome. *Clin. Epid., 6*, 1–13.
137. Somani, N., & Turvy, D., (2014). Hirsutism: an evidence-based treatment update. *Am. J. Clin. Dermatol.*, *15*(3), 247–266.
138. Sorensen, L. B., Soe, M., Halkier, K. H., Stigsby, B., & Astrup, A., (2012). Effects of increased dietary protein-to-carbohydrate ratios in women with polycystic ovary syndrome. *Am. J. Clin. Nutr., 95*(1), 39–48.
139. Soulter, I., Sanchez, l., Perez, M., Bartolucci, A., & Azziz, R., (2004). The prevalence of androgen excess among patients with minimal unwanted hair growth. *Am. J. Obstet. Gynecol*., *191*, 1914–1920.
140. Spritzer, P. M., Motta, A. B., Petermann, S. T., & Kandarakis, D. E., (2015). Novel strategies in the management of polycystic ovary syndrome. *Minerva Endocrinol*., *40*(3), 195–212.
141. Sprung, V. S., Cuthbertson, D. J., Pugh, C. J., Aziz, N., Kemp, G. J., Daousi, C., Green, D. J., Cable, N. T., & Jones, H., (2013). Exercise training in polycystic ovarian syndrome enhances flow-mediated dilation in the absence of changes in fatness. *Med. Sci. Sports Exerc*., *45*(12), 2234–2242.
142. Stepto, N. K., Cassar, S., Joham, A. E., Hutchison, S. K., Harrison, C. L., Goldstein, R. F., & Teede, H. J., (2013). Women with polycystic ovary syndrome have intrinsic insulin resistance on euglycaemic-hyperinsulaemic clamp. *Hum. Reprod*., *28*(3), 777–784.
143. Sterling, L., Liu, J., Okun, N., Sakhuja, A., Sierra, S. A., & Greenblatt, E., (2016). Pregnancy outcomes in women with polycystic ovary syndrome undergoing *in vitro* fertilization. *Fertil. Steril*., *105*(3), 791.e2–797.e2.
144. Tang, T., Lord, J. M., Norman, R. J., Yasmin, E., & Balen, A. H., (2012). Insulin-sensitizing drugs (metformin, rosiglitazone, pioglitazone, D-chiro-inositol) for women with polycystic ovary syndrome, oligo amenorrhoea and subfertility. *Cochrane Database Syst Rev*., 5, CD003053.
145. Taponen, S., Ahonkallio, S., & Martikainen, H., (2004). Prevalence of polycystic ovaries in women with self-reported symptoms of oligomenorrhoea and/or hirsutism: Northern Finland Birth Cohort 1966 Study. *Hum. Reprod.*, 1–6.

146. Teede, H., Deeks, A., & Moran, L., (2010). Polycystic ovary syndrome: A complex condition with psychological, reproductive and metabolic manifestations that impacts on health across the lifespan. *BMC Med*., *8*, 41.
147. Thathapudi, S., Kodati, V., Erukkambattu, J., Katragadda, A., Addepally, U., & Hasan, Q., (2014). Anthropometric and biochemical characteristics of polycystic ovarian syndrome in south indian women using AES-2006 Criteria. *Int. J. Endocrinol. Metab*., *12*(1), e12470.
148. Thomson, R. L., Buckley, J. D., Noakes, M., Clifton, P. M., Norman, R. J., & Brinkworth, G. D., (2008). The effect of a hypocaloric diet with and without exercise training on body composition, cardiometabolic risk profile, and reproductive function in overweight and obese women with polycystic ovary syndrome. *J. Clin. Endocrinol. Metab.*, *93*, 3373–3380.
149. Vgontzas, A. N., Legro, R., Bixler, E. O., Grayev, A., Kales, A., & Chrousos, G. P., (2001). Polycystic ovary syndrome is associated with obstructive sleep apnea and daytime sleepiness: Role of insulin resistance. *J. Clin. Endocrinol. Metab.*, 517–520.
150. Vipin, V. P., Dabadghao, P., Shukla, M., Kapoor, A., Raghuvanshi, A. S., & Ramesh, V., (2016). Cardiovascular disease risk in first-degree relatives of women with polycystic ovary syndrome. *Fert Ster.*, *105*(5), 1338.e3–1344.e3.
151. Volek, J. S., Sharman, M. J., Gomez, A.L, Scheett, T. P., & Kraemer, W. J., (2003). An isoenergetic very low carbohydrate diet improves serum HDL cholesterol and triacylglycerol concentrations, the total cholesterol to HDL cholesterol ratio and postprandial pipemic responses compared with a low-fat diet in normal weight, normolipidemic women. *J. Nutr*., *133*(9), 2756–2761.
152. Wang, F., Pan, J., Liu, Y., Meng, Q., Lv, P., Qu, F., et al., (2015). Alternative splicing of the androgen receptor in polycystic ovary syndrome. *Proc. Natl. Acad. Sci. USA*., *112*(15), 4743–4748.
153. Williams, T., Mortada, R., & Porter, S., (2016). Diagnosis and treatment of polycystic ovary syndrome. *Am. Fam. Phys.*, *94*(2), 106–113.
154. Witchel, S. F., Oberfield, S., Rosenfield, R. L., & Coder, E., (2015). The diagnosis of polycystic ovary syndrome during adolescence. *Horm. Res. Paediatr*., *83*, 376–389.
155. Wong, J. M., Gallagher, M., Gooding, H., Feldman, H. A., Gordon, C. M., Ludwig, D. S., & Ebbeling, C. B., (2016). A randomized pilot study of dietary treatments for polycystic ovary syndrome in adolescents. *Pediatr. Obes*., *11*(3), 210–220.
156. Yildiz, B. O., Bozdag, G., Yapici, Z., Esinler, I., & Yarali, H., (2012). Prevalence, phenotype and cardiometabolic risk of PCOS under different diagnostic criteria. *Hum. Reprod.*, *27*(10), 3067–3073.
157. Zandi, S., Farajzadeh, S., & Safari, H., (2010). Prevalence of polycystic ovary syndrome in women with acne: Hormone profiles and clinical findings. *J. Pak. Assoc. Dermat.*, *20*, 194–198.
158. Zuuren, E. J. V., & Pijl, H., (2007). Hirsutism. *Ned Tijdschr. Geneeskd.*, *151*(42), 2313–2318.
159. Zuuren, E. J. V., Fedorowicz, Z., Carter, B., & Pandis, N., (2015). Interventions for hirsutism (excluding laser and photoepilation therapy alone). *Cochrane Database Syst Rev.*, 4, CD010334.

1. Achema, G., Emmanuel, A., & Oguche, M., (2012). Evaluation of the use of herbal drugs by pregnant women in Nigeria. *African Journal of Midwifery & Women's Health, 6*, 78–83.
2. Adams, J., Chi-Wai, L., Sibbritt, D., Broom, A., Wardle, J., Homer, C., & Beck, S., (2009). Women's use of complementary and alternative medicine during Pregnancy: A critical review of the literature. *Birth Issues in Perinatal. Care, 36*, 237–245.
3. Al-Ramahi, R., Jaradat, N., & Adawi, D., (2013). Use of herbal medicines during pregnancy in a group of Palestinian women. *Journal of Ethnopharmacology, 150*, 79–84.
4. Bayisa, B., Tatiparthi, R., & Mulisa, E., (2014). Use of herbal medicine among pregnant women on antenatal care at Nekemte Hospital, Western Ethiopia. *Jundishapur Journal of Natural Pharmaceutical Products, 9*, e17368–e17368.
5. Born, D., & Barron, M. L., (2005). Herb use in pregnancy: What nurses should know? *MCN: The American Journal of Maternal Child Nursing, 30*, 201–208.
6. Borokini, T. I., Ighere, D. A., & Clement, M., (2013). Ethnobiological survey of traditional medicine practice for women's health in Oyo State. *Journal of Medicinal Plants Studies, 1*, 17–29.
7. Broussard, C. S., Louik, C., Honein, M. A., & Mitchell, A. A., (2010). Herbal use before and during pregnancy. *American Journal of Obstetrics and Gynecology, 202*, 443, e1–443.e6.
8. Chuang, C., Chang, P., Hsieh, W., Tsai, Y., Lin, S., & Chen, P., (2009). Chinese herbal medicine use in Taiwan during pregnancy and the postpartum period: A population-based cohort study. *International Journal of Nursing Studies, 46*, 787–795.
9. Cuzzolin, L., Francini-Pesenti, F., & Verlato, G., (2010). Use of herbal products among 392 Italian pregnant women: Focus on pregnancy outcome. *Pharmacoepidemiology and Drug Safety*, *9*, 1151–1158.
10. De Boer, H., & Lamxay, V., (2009). Plants used during pregnancy, childbirth and postpartum healthcare in Lao PDR: A comparative study of the Brou, Saek and Kry ethnic groups. *Journal of Ethnobiology and Ethnomedicine, 5*, 25–27.
11. El-Dakdoky, M. H., (2009). Evaluation of the developmental toxicity of artemether during different phases of rat pregnancy. *Food Chem. Toxicol*., *47*, 1437–1441.
12. Facchinetti, F., Pedrielli, G., Benoni, G., Joppi, M., Verlato, G., Dante, G., Balduzzi, S., & Cuzzolin, L., (2012). Herbal supplements in pregnancy: Unexpected results from a multicenter study. *Human Reproduction, 27*, 3161–3167.
13. Fakeye, T., Adisa, R., & Musa, I. E., (2009). Attitude and use of herbal medicines among pregnant women in Nigeria. *BMC Complementary and Alternative Medicine, 9*, 53–57.
14. Gardiner, P., Kemper, K. J., Legedza, A., & Phillips, R. S., (2007). Factors associated with herb and dietary supplement use by young adults in the United States. *BMC Complementary and Alternative Medicine, 7*, 39–41.
15. Gbadamosi, I. T., & Otobo, E. R., (2014). Assessment of the nutritional qualities of ten botanicals used in pregnancy and child delivery in Ibadan, Nigeria. *International Journal of Phytomedicine, 6*, 16–22.
16. Golalipour, M. J., Ghafari, S., Maleki, A., Kiani, M., Asadu, E., & Farsi, M., (2011). Study of embryotoxicity of *Mentha piperita* L. during organogenesis in Balb/c mice. *Int. J. Morphol*., *29*, 862–867.
17. Hall, H., & Jolly, K., (2014). Women's use of complementary and alternative medicines during pregnancy: A cross-sectional study. *Midwifery, 30*, 499–505.

18. Hall, H. G., Griffiths, D. L., & McKenna, L. G., (2011). The use of complementary and alternative medicine by pregnant women: Literature review. *Midwifery, 27*, 817–824.
19. Han, J., Liang, A., & Yi, Y., (2011). Developmental toxicity of retrorsive on mouse embryos *in vitro*. *Zhongguo Zhong Yao Za Zhi*, *36*, 1901–1904.
20. Holst, L., Wright, D., Haavik, S., & Nordeng, H., (2009). The use and the user of herbal remedies during pregnancy. *Journal of Alternative & Complementary Medicine, 15*, 787–792.
21. Holst, L., Nordeng, H., & Haavik, S., (2008). Use of herbal drugs during early pregnancy in relation to maternal characteristics and pregnancy outcome. *Pharmaco Epidemiology and Drug Safety, 17*, 151–159.
22. Ifeoma, O., & Oluwakanyinsola, S., (2013). Screening of herbal medicines for potential toxicities. *New Insights into Toxicity and Drug Testing*, *CC-BY*, e-article: doi: 10.5772/54493.
23. Kalder, M., Knoblauch, K., Hrgovic, I., & Münstedt, K., (2011). Use of complementary and alternative medicine during pregnancy and delivery. *Archives of Gynecology & Obstetrics, 283*, 475–482.
24. Kennedy, D. A., Lupattelli, A., Koren, G., & Nordeng, H., (2013). Herbal medicine use in pregnancy: Results of a multinational study. *BMC Complementary and Alternative Medicine, 13*, 355–355.
25. Ko, R. J. U. S., (2004). Perspective on the adverse reactions from traditional Chinese medicines. *Journal of the Chinese Medical Association, 67*, 109–116.
26. Kochhar, K., Saywell, R. J., Zollinger, T. W., Mandzuk, C. A., Haas, D. M., Howell, L. K., Martir, J., & Reger, M. K., (2010). Herbal remedy use among Hispanic women during pregnancy and while breastfeeding: Are physicians informed? *Hispanic Health Care International, 8*, 93–106.
27. Lanini, J., Duarte-Almeida, J. M., Nappo, S. A., & Carlini, E. A., (2012). Are medicinal herbs safe?: The opinion of plant vendors from Diadema. *Revista Brasileira de Farmacognosia, 22*, 102–105.
28. Li, L. Y., Cao, F. F., Su, Z. J., Zhang, Q. H., Dai, X. Y., Xiao, X., Huang, Y. D., Zheng, Q., & Xu, H., (2015). Assessment of the embryo toxicity of four Chinese herbal extracts using the embryonic stem cell test. *Mol Med Rep*., E-pub., doi: 10.3892/mmr.2015.3598.
29. Low, T., (2009). The use of botanicals during pregnancy and lactation. *Alternative Therapies, 15*, 54–58.
30. Mabina, M. H., Moodley, J., & Pitsoe, S. B., (1997). The use of traditional herbal medication during pregnancy. *Tropical Doctor, 27*, 84–86.
31. Malan, D. F., & Neuba, D., (2011). Traditional practices and medicinal plants use during pregnancy by Anyi-Ndenye women (Eastern Côte d'Ivoire). *African Journal of Reproductive Health March*, *15*, 85–94.
32. Maliwichi-Nyirenda, C. P., & Maliwichi, L. L., (2010). Traditional methods used in family planning and conception in Malawi: A case study of Mulanje district. *Indilinga–African Journal of Indigenous Knowledge Systems, 9*, 230–237.
33. Maliwichi-Nyirenda, C. P., & Maliwichi, L. L., (2010). Medicinal plants used for contraception and pregnancy-related cases in Malawi: A case study of Mulanje district. *Journal of Medicinal Plants Research, 4*, 3024–3030.
34. Moallen, S. A., & Niapour, M., (2008). Study of embryotoxicity of Perovskiaabrotanoides, an adulterant in folk-medicine, during organogenesis in Mice. *J. Ethnopharmacol*., *117*, 108–114.

35. Mothupi, M. C., (2014). Use of herbal medicine during pregnancy among women with access to public healthcare in Nairobi, Kenya: A cross-sectional survey. *BMC Complementary and Alternative Medicine, 14*, 432–436.
36. Moussally, K., & Bérard, A., (2010). Exposure to herbal products during pregnancy and the risk of preterm birth. *European Journal of Obstetrics & Gynecology and Reproductive Biology, 150*, 107–108.
37. Nordeng, H., & Havnen, G. C., (2005). Impact of socio-demographic factors, knowledge and attitude on the use of herbal drugs in pregnancy. *Acta Obstetricia Et Gynecologica Scandinavica, 84*, 26–33.
38. Olowokere, A. E., & Olajide, O., (2013). Women's perception of safety and utilization of herbal remedies during pregnancy in a local government area in Nigeria. *Clinical Nursing Studies, 1*, 1–14.
39. Peltzer, K., & Mngqundaniso, N., (2008). Patients consulting traditional health practitioners in the context of HIV/AIDS in urban areas in Kwazulu-Natal, South Africa. *African Journal of Traditional, Complementary and Alternative Medicines, 5*, 370–379.
40. Rahman, A. A., Sulaiman, S. A., Ahmad, Z., Daud, W. N. W., & Hamid, A. M., (2008). Prevalence and pattern of use of herbal medicines during pregnancy in Tumpat district, Kelantan. *The Malaysian Journal of Medical Sciences, 15*, 40–48.
41. Rasenack, R., Muller, C., Kleinschmidt, M., Rasenack, J., & Wiedenfeld, H., (2003). Veno-occlusive disease in a fetus caused by pyrrolizidine alkaloids of food origin. *Fetal Diagn. Ther., 18*, 223–225.
42. Refuerzo, J. S., Blackwell, S. C., Sokol, R. J., Lajeunesse, L., Firchau, K., & Kruger, M., (2005). Use of over-the-counter medications and herbal remedies in pregnancy. *American Journal of Perinatology, 22*, 321–324.
43. Sawalha, A. F., (2007). Consumption of prescription and non-prescription medications by pregnant women: Cross sectional study in Palestine. *The Islamic University Journal, 15*, 41–57.
44. Shinde, P., Patil, P., & Bairagi, V., (2012). Herbs in pregnancy and lactation: Review appraisal. *International Journal of Pharmaceutical Sciences and Research*, *12*, 3001–3006.
45. Sooi, L. K., & Keng, S. L., (2013). Herbal medicines: Malaysian women's knowledge and practice. *Evidence-Based Complementary and Alternative Medicine, 13*, 43–49.
46. Steel, A., Adams, J., Sibbritt, D., Broom, A., Frawley, J., & Gallois, C., (2014). Relationship between complementary and alternative medicine use and incidence of adverse birth outcomes: An examination of a nationally representative sample of 1835 Australian women. *Midwifery, 30*, 1157–1165.
47. Tiran, D., (2005). NICE guideline on antenatal care: Routine care for the healthy pregnant woman–recommendations on the use of complementary therapies do not promote clinical excellence: National Institute for Clinical Excellence (NICE). *Complementary Therapies in Clinical Practice, 11*, 127–129.
48. Tiran, D., (2003). The use of herbs by pregnant and childbearing women: Risk-benefit assessment. *Complementary Therapies in Nursing & Midwifery, 9*, 176–181.
49. Tovar, R. T., & Petzel, R. M., (2009). Herbal toxicity. *Disease-a-Month, 55*, 592–641.
50. Tripathi, V., Stanton, C., & Anderson, F., (2013). Traditional preparations used as uterotonics in Sub-Saharan Africa and their pharmacological effects. *International Journal of Gynecology and Obstetrics, 120*, 16–22.
51. UNAIDS, (2006). *Collaborating with Traditional Healers for HIV Prevention and Care in Sub-Saharan Africa: Suggestions for Program Managers and Field Workers* (p. 120). UNAIDS, Geneva.

52. Verissimo, L. F., Bacchi, A. D., Zaminelli, T., De Paula, G. H., & Moreira, E. G., (2011). Herbs of interest to the Brazilian Federal Government: Female reproductive and developmental toxicity studies. *Revista Brasileira de Farmacognosia, 21*, e-article: http://dx.doi.org/10.1590/s0102–695x2011005000146 (Accessed on 30 July 2019).
53. Westfall, R. E., (2001). Herbal medicine in pregnancy and childbirth. *Advances in Therapy, 18*, 47–55.
54. Wiebrecht, A., Gaus, W., Becker, S., Hummelsberger, J., & Kuhlmann, K., (2014). Safety aspects of Chinese herbal medicine in pregnancy-re-evaluation of experimental data of two animal studies and the clinical experience. *Complementary Therapies in Medicine, 22*, 954–964.
55. Xiao, K., Yan, G. Y., Wang, L., Liu, Y. Q., Peng, C., Duan, J. C., Fu, Z. T., & Li, H. X., (2008). Toxicity of Caowu on *in vivo* cultured rat embryos. *Sichuan Da Xue Xue Bao Yi Xue Ban (Journal of Sichuan University, Medical Science Edition)*, *39*, 441–444.

1. Andrew, M., & Piggott, P., (2004). Quality, not quantity: The role of natural products and chemical proteomics in modern drug discovery. *Combinatorial Chemistry & High Throughput Screening*, *7*, 607–630.
2. Arulrayan, N., Rangasamy, S., James, E., & Pitchai, D., (2007). A database for medicinal plants used in the treatment of diabetes and its secondary complications. *Bioinformation*, *2*, 22–23.
3. Berggren, K., Steinberg, T. H., & Lauber, W. M., (1999). A luminescent ruthenium complex for ultrasensitive detection of proteins immobilized on membrane supports. *Annals of Biochemistry*, *276*(2), 129–143.
4. Bie, V., Günter, K., & Liesbet, V., (2015). Using transcriptomics to guide lead optimization in drug discovery projects: Lessons learned from the QSTAR project. *Drug Discovery Today*, *20*(5), 505–513.
5. Chen, C., Gonzalez, F. J., & Idle, J. R., (2007).LC–MS-based metabolomics in drug metabolism. *Drug Metabolism Review*, *39*, 581–597.
6. Claudino, W. M., Quattrone, A., Biganzoli, L., Pestrin, M., Bertini, I., & Di Leo, A., (2007). Metabolomics: Available results, current research projects in breast cancer, and future applications. *Journal of Clinical Oncology*, *25*, 2840–2846.
7. Cordwell, S. J., Nouwens, A. S., Verrills, N. M., Basseal, D. J., & Walsh, B. J., (1094). Subproteomics based upon protein cellular location and relative solubilities in conjunction with composite two-dimensional electrophoresis gels. *Electrophoresis*, *21*(6), 1094–1103.
8. Deng, Y., Ai, J., & Xiao, P., (2010). Application of bioinformatics and systems biology in medicinal plant studies. *Chinese Herbal Medicines*, *2*(3), 170–179.
9. Dopazo, J., (2013). Genomics and transcriptomics in drug discovery. *Drug Discovery Today*, http://dx.doi.org/10.1016/j.drudis.2013.06.003 (Accessed on 30 July 2019).
10. Dunn, W. B., & Ellis, D. I., (*2005*). Metabolomics: Current analytical platforms and methodologies. *Trend Anal. Chem., 24*, 285–294.
11. Ellis, D. I., Dunn, W. B., Griffin, J. L., Allwood, J. W., & Goodacre, R., (2007). Metabolic fingerprinting as a diagnostic tool. *Pharmacogenomics*, *8*, 1243–1266.
12. Fiehn, O., Kopka, J., Dormann, P., Altmann, T., Trethewey, R. N., & Willmitzer, L., (2000). Metabolite profiling for plant functional genomics. *Nature Biotechnology*, *18*, 1157–1161.

13. Griffin, J. L., & Kauppinen, R. A., (2007). Tumor metabolomics in animal models of human cancer. *Journal of Proteomics Research*, *6*, 498–505.
14. Griffin, J. L., (2006). Understanding mouse models of disease through metabolomics. *Current Opinion in Chemical Biology*, *10*, 309–315.
15. Gygi, S. P., Rist, B., Gerber, S. A., Turecek, F., Gelb, M. H., & Aebersold, R., (1999). Quantitative analysis of complex protein mixtures using isotope-coded affinity tags. *Nature Biotechnol*ogy, *17*(10), 994–999.
16. James, R. H., Antoni, R., & Paul, S. M., (2016). Single cell analytic tools for drug discovery and development. *Nature Review of Drug Discovery, 15*(3), 204–216.
17. Jarayaman, K. S., (2000). India pushes ahead with plant database. *Nature*, *405*, 267–277.
18. Kann, M. G., (2010). Advances in translational bioinformatics: Computational approaches for the hunting of disease genes. *Briefing in Bioinformatics*, *11*(1), 96–110.
19. Kasirajan, M., & Gopalakrishnan, R., (2007). A database for medicinal plants used in treatment of asthma. *Bioinformation*, *2*, 105–106.
20. Kell, D. B., (2006). Systems biology, metabolic modeling and metabolomics in drug discovery and development. *Drug Discovery Today*, *11*, 1085–1092.
21. Lie-Fen, S., & Ning-Sun, Y., (2008). Metabolomics for phytomedicine research and drug development. *Current Opinion in Chemical Biology*, *12*, 66–71.
22. Lindon, J. C., Holmes, E., & Nicholson, J. K., (2007). Metabonomics in pharmaceutical R&D. *FEBS J*., *274*, 1140–1151.
23. Liu, Q. Z., & Sung, A. H., (2009a). Feature selection and classification of MAQC-II breast cancer and multiple myeloma microarray gene expression data. *PLoS One*, *4*(12), e8250.
24. Lowe, R., Shirley, N., Bleackley, M., Dolan, S., & Shafee, T., (2017). Transcriptomics technologies. *PLoS Computational Biology*, *13*(5), e1005457.
25. Mackintosh, J. A., Choi, H. Y., & Bae, S. H., (2273). Fluorescent natural product for ultra-sensitive detection of proteins in one-dimensional and two-dimensional gel electrophoresis. *Proteomics*, *3*(12), 2273–2288.
26. Pirooznia, M., Yang, J. Y., Yang, M. Q., & Deng, Y. P., (2008). Comparative study of different machine learning methods on microarray gene expression data. *BMC Genomics*, *9,* S1–S13.
27. Ray, L. B., Chong, L. D., & Gough, N. R., (2002). Computational biology. *Sci. STKE*, *148*, 10–18.
28. Sumner, L. W., Mendes, P., & Dixon, R., (2003). Plant metabolomics: Large-scale phytochemistry in the functional genomics era. *Phytochemistry*, *62*, 817–836.
29. Ulrich-Merzenich, G., Zeitler, H., Jobst, D., & Panek, D., (2007). Application of the "-omic-" technologies in phytomedicine. *Phytomedicine*, *14*, 70–82.
30. Uwe, R., (2009). Target profiling of small molecules by chemical Proteomics. *Nature Chemical Biology*, *5*(9), 617–625.
31. Walhout, A. J. M., & Vidal, M., (2001). Protein interaction maps for model organisms. *Nature Review of Molecular Cell Biol*ogy, *2*(1)**,** 55–62.
32. Washburn, M. P., Wolters, D., & Yates, J. R., (2001). Large-scale analysis of the yeast proteome by multidimensional protein identification technology. *Nature Biotechnol*ogy, *19*(3), 242–247.
33. Williams, K. L., & Hochstrasser, D. F., (1997). *Proteome Research: New Frontiers in Functional Genomics* (pp. 1–12). Springer-Verlag: Berlin.
34. Xu, Z. N., (2003). Relationship between development of bioinformatics and study of Chinese herbal medicine. *Chinese Traditional Herbal Drugs*, *34*(6), 481–486.

35. Zhang, C. Y., & Li, P., (2006). Parallelization of multicategory support vector machines (PMC-SVM) for classifying microarray data. *BMC Bioinformatics*, *7*, S4–S15.
1. Fan, S., (2008). *Gelsemiumelegan* – An intangible killer. *Medpharm & Health*, *4*, 36.
2. Gao, L., & Lin, X., (2012).A study on the automatic recognition system of medicinal plants. *Consumer Electronics, Communications and Networks (CECNet)*: *IEEE 2nd International Conference Proceedings, 2*, 101–103.
3. Gopal, A., (2015). Comparison procedure for the authentication of basil (*Ocimum tenuiflorum*) leaf using image processing technique. *Communications and Signal Processing (ICCSP), IEEE International Conference Proceedings,* 75–78.
4. Herdiyeni, Y., & Kusmana, I., (2013). Fusion of local binary patterns features for tropical medicinal plants identification. *Advanced Computer Science and Information Systems (ICACSIS): IEEE International Conference Proceedings,* 353–357.
5. Herdiyeni, Y., & Santoni, M., (2012). Combination of morphological, local binary pattern variance and color moments features for Indonesian medicinal plants identification. *Advanced Computer Science and Information Systems (ICACSIS): IEEE International Conference Proceedings,* 255–259.
6. Janani, R., & Gopal, A., (2013). Identification of selected medicinal plant leaves using image features and ANN. *Advanced Electronic Systems (ICAES): IEEE International Conference Proceedings,* 238–242.
7. Kumar, E., & Talasila, V., (2014). Leaf features approach for automated identification of medicinal plants. *Communications and Signal Processing (ICCSP): IEEE International Conference Proceedings,* 210–214.
8. Lewis, W. H., & Elvin-Lewis, M. P., (2003). *Medical Botany: Plants Affecting Human Health* (p. 832). John Wiley & Sons, New York.
9. Mao, J., & Xu, J., (2006). Discrimination of herbal medicines by molecular spectroscopy and chemical pattern recognition. *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy*, *65*(2), 497–500.
10. Maulana, O., & Herdiyeni, Y., (2013). Combining image and text features for medicinal plants image retrieval. *Advanced Computer Science and Information Systems (ICACSIS): IEEE International Conference Proceedings,* 273–277.
11. Meng, Q., & Hu, C., (2011). Transmission spectrum imaging analysis of Uncaria leaves from Guangdong. *Bioinformatics and Biomedical Engineering, (iCBBE): IEEE International Conference Proceedings, 5*, 1–4.
12. Odugbemi, T. O., Akinsulire, O. R., Akinsulire, I. E., & Fabeku, P. O., (2007). Medicinal plants useful for malaria therapy in Okeigbo, Ondo State, Southwest Nigeria. *African Journal of Traditional, Complementary and Alternative Medicines*, *4*(*2*), 191–198.
13. Rajesh, P. K. S, Kumaravelu, C., Gopal, A., & Suganthi, S., (2013). Studies on identification of medicinal plant variety based on NIR spectroscopy using plant leaves. *Advanced Computing Technologies (ICACT): IEEE 15th International Conference Proceedings, 15*, 1–4.
14. Ramakrishnan, S., & El-Emary, I. M., (2009). Comparative study between traditional and modified probabilistic neural networks. *Telecommunication Systems*, *40*(1/2), 67–74.
15. Rega, P. K., & Emantoko, S., (2013). Microplate luminescence automated digital analyzer for medicinal plants evaluation on quorum sensing inhibition. *QiR (Quality in Research): IEEE International Conference Proceedings,* 31–34.
16. Salima, A., Herdiyeni, Y., & Douady, S., (2015). Leaf vein segmentation of medicinal plant using the Hessian matrix. *Advanced Computer Science and Information Systems (ICACSIS): IEEE International Conference Proceedings,* 275–279.

17. Sathwik, T., Yasaswini, R., Venkatesh, R., & Gopal, A., (2013). Classification of selected medicinal plant leaves using texture analysis. *Computing, Communications, and Networking Technologies (ICCCNT): IEEE Fourth International Conference Proceedings*, 1–6.
18. Udantha, M. G., & Jayamaha, A. D., (2014). Leaf recognition and classification algorithm to be used by indigenous medicine. *Advances in ICT for Emerging Regions (ICTer): IEEE International Conference Proceedings,* 258–258.

1. Abrol, S., Trehan, A., & Katare, O., (2004). Formulation, characterization, and *in vitro* evaluation of silymarin-loaded lipid microspheres. *Drug Delivery*, *11*(3), 185–191.
2. Aderibigbe, B., Owonubi, S., Jayaramudu, J., Sadiku, E., & Ray, S., (2014). Targeted drug delivery potential of hydrogel biocomposites containing partially and thermally reduced graphene oxide and natural polymers prepared via green process. *Colloid and Polymer Science*, 1–12.
3. Aderibigbe, B., Sadiku, E., Jayaramudu, J., & Sinha-Ray, S., (2015). Controlled dual release study of curcumin and a 4-aminoquinoline analog from gum acacia containing hydrogels. *Journal of Applied Polymer Science*, *132*, 41613.
4. Aderibigbe, B. A., & Mhlwatika, Z., (2016). Dual release kinetics of antimalarials from soy protein isolate-carbopol-polyacrylamide based hydrogels. *Journal of Applied Polymer Science*, *133*(37), 43918.
5. Agasti, S. S., Chompoosor, A., You, C. C., Ghosh, P., Kim, C. K., & Rotello, V. M., (2009). Photoregulated release of caged anticancer drugs from gold nanoparticles. *Journal of the American Chemical Society*, *131*(16), 5728–5729.
6. Ahamed, M., (2011). Toxic response of nickel nanoparticles in human lung epithelial A549 cells. *Toxicology In Vitro*, *25*(4), 930–936.
7. Ahamed, M., Akhtar, M. J., Raja, M., Ahmad, I., Siddiqui, M. K. J., AlSalhi, M. S., & Alrokayan, S. A., (2011). ZnO nanorod-induced apoptosis in human alveolar adenocarcinoma cells via p53, survivin and bax/bcl-2 pathways: Role of oxidative stress. *Nanomedicine: Nanotechnology, Biology and Medicine*, *7*(6), 904–913.
8. Ahamed, M., Akhtar, M. J., Siddiqui, M. A., Ahmad, J., Musarrat, J., Al-Khedhairy, A. A., AlSalhi, M. S., & Alrokayan, S. A., (2011). Oxidative stress mediated apoptosis induced by nickel ferrite nanoparticles in cultured A549 cells. *Toxicology*, *283*(2/3), 101–108.
9. Ahmed, S., Anuntiyo, J., Malemud, C. J., & Haqqi, T. M., (2005). Biological basis for the use of botanicals in osteoarthritis and rheumatoid arthritis: A review. *Evidence-Based Complementary and Alternative Medicine*, *2*(3), 301–308.
10. Ajazuddin, & Saraf, S., (2010). Applications of novel drug delivery system for herbal formulations. *Fitoterapia*, *81*(7), 680–689.
11. Akerman, M. E., Chan, W. C., Laakkonen, P., Bhatia, S. N., & Ruoslahti, E., (2002). Nanocrystal targeting *in vivo. Proceedings of the National Academy of Sciences of the United States of America*, *99*(20), 12617–12621.
12. Allen, T. M., & Cullis, P. R., (2013). Liposomal drug delivery systems: From concept to clinical applications. *Advanced Drug Delivery Reviews*, *65*(1), 36–48.
13. Alvarez, G. S., Helary, C., Mebert, A. M., Wang, X., Coradin, T., & Desimone, M. F., (2014). Antibiotic-loaded silica nanoparticle-collagen composite hydrogels with prolonged antimicrobial activity for wound infection prevention. *Journal of Materials Chemistry B*, *2*(29), 4660–4670.
14. Annaka, M., Mortensen, K., Matsuura, T., Ito, M., Nochioka, K., & Ogata, N., (2012). Organic-inorganic nanocomposite gels as an *in-situ* gelation biomaterial for injectable accommodative intraocular lens. *Soft Matter 8*(27), 7185–7196.

15. Ansari, S. H., Islam, F., & Sameem, M., (2012). Influence of nanotechnology on herbal drugs: A Review. *Journal of Advanced Pharmaceutical Technology & Research*, *3*(3), 142–146.
16. Asadishad, B., Vossoughi, M., & Alemzadeh, I., (2010). Folate-receptor-targeted delivery of doxorubicin using polyethylene glycol-functionalized gold nanoparticles. *Industrial & Engineering Chemistry Research*, *49*(4), 1958–1963.
17. Baker, S., Rakshith, D., Kavitha, K. S., Santosh, P., Kavitha, H. U., Rao, Y., & Satish, S., (2013). Plants: Emerging as nanofactories towards facile route in synthesis of nanoparticles. *Bioimpacts: BI*, *3*(3), 111–117.
18. Balunas, M. J., & Kinghorn, A. D., (2005). Drug discovery from medicinal plants. *Life Sciences*, *78*(5), 431–441.
19. Beer, C., Foldbjerg, R., Hayashi, Y., Sutherland, D. S., & Autrup, H., (2012). Toxicity of silver nanoparticles—nanoparticle or silver ion? *Toxicology Letters*, *208*(3), 286–292.
20. Bernardi, R. J., Lowery, A. R., Thompson, P. A., Blaney, S. M., & West, J. L., (2008). Immunonanoshells for targeted photothermal ablation in medulloblastoma and glioma: An *in vitro* evaluation using human cell lines. *Journal of Neuro-Oncology*, *86*(2), 165–172.
21. Bhagwat, R., & Vaidhya, I., (2013). Novel drug delivery systems: An overview. *International Journal of Pharmaceutical Sciences and Research*, *4*(3), 970.
22. Bhalekar, M. R., Pokharkar, V., Madgulkar, A., Patil, N., & Patil, N., (2009). Preparation and Evaluation of miconazole nitrate-loaded solid lipid nanoparticles for topical delivery. *AAPS Pharm. Sci. Tech.*, *10*(1), 289–296.
23. Bhargav, E., & Madhuri, N., (2013). Targeted drug delivery-a review. *World Journal of Pharmacy and Pharmaceutical Sciences*, *3*(1), 150–159.
24. Bhatia, S., (2016). Nanotechnology and its drug delivery applications. In: *Natural Polymer Drug Delivery Systems: Nanoparticles, Plants, and Algae* (pp. 1–32). Springer International Publishing, New York.
25. Boundless, (2018). *Primary and Secondary Metabolites*. https://courses.lumenlearning.com/boundless-microbiology/chapter/industrial-microbiology/ (Accessed on 30 July 2019).
26. Bresee, J., Bond, C. M., & Worthington, R. J., (2014). Nanoscale structure-activity relationships, mode of action, and biocompatibility of gold nanoparticle antibiotics. *Journal of the American Chemical Society*, *136*(14), 5295–5300.
27. Brewer, E., Coleman, J., & Lowman, A., (2011). Emerging technologies of polymeric nanoparticles in cancer drug delivery. *Journal of Nanomaterials*, 1–10.
28. Brown, A. N., Smith, K., Samuels, T. A., Lu, J., Obare, S. O., & Scott, M. E., (2012). Nanoparticles functionalized with ampicillin destroy multiple-antibiotic-resistant isolates of *pseudomonas aeruginosa* and *enterobacter aerogenes* and methicillin-resistant staphylococcus aureus. *Applied and Environmental Microbiology*, *78*(8), 2768–2774.
29. Cavalli, R., Gasco, M. R., Chetoni, P., Burgalassi, S., & Saettone, M. F., (2002). Solid lipid nanoparticles (SLN) as ocular delivery system for tobramycin. *International Journal of Pharmaceutics*, *238*(1/2), 241–245.
30. Chacko, R. T., Ventura, J., Zhuang, J., & Thayumanavan, S., (2012). Polymer nanogels: A versatile nanoscopic drug delivery platform. *Advanced Drug Delivery Reviews*, *64*(9), 836–851.
31. Chan, J. M., Valencia, P. M., Zhang, L., Langer, R., & Farokhzad, O. C., (2010). Polymeric nanoparticles for drug delivery. *Methods in Molecular Biology*, *624*, 163–175.
32. Chang, C., Peng, J., Zhang, L., & Pang, D. W., (2009). Strongly fluorescent hydrogels with quantum dots embedded in cellulose matrices. *Journal of Materials Chemistry*, *19*(41), 7771–7776.

33. Chang, C. H., Huang, W. Y., Lai, C. H., Hsu, Y. M., Yao, Y. H., Chen, T. Y., Wu, J. Y., Peng, S. F., & Lin, Y. H., (2011). Development of novel nanoparticles shelled with heparin for berberine delivery to treat Helicobacter pylori. *Acta Biomaterialia*, *7*(2), 593–603.
34. Chaturvedi, M., Kumar, M., Sinhal, A., & Saifi, A., (2011). Recent development in novel drug delivery systems of herbal drugs. *International Journal of Green Pharmacy (IJGP)*, *5*(2), 156–165.
35. Chauhan, A. S., Sridevi, S., Chalasani, K. B., Jain, A. K., Jain, S. K., Jain, N. K., & Diwan, P. V., (2003). Dendrimer-mediated transdermal delivery: Enhanced bioavailability of indomethacin. *Journal of Controlled Release*, *90*(3), 335–343.
36. Chaúque, E., Zvimba, J., Ngila, J., & Musee, N., (2016). Fate, behavior, and implications of ZnO nanoparticles in a simulated wastewater treatment plant. *Water SA*, *42*, 72–81.
37. Chen, Y. H., Tsai, C. Y., Huang, P. Y., & Chang, M. Y., (2007). Methotrexate conjugated to gold nanoparticles inhibits tumor growth in a syngeneic lung tumor model. *Molecular Pharmaceutics*, *4*(5), 713–722.
38. Cheng, Y., Man, N., Xu, T., Fu, R., Wang, X., Wang, X., & Wen, L., (2007). Transdermal delivery of nonsteroidal anti-inflammatory drugs mediated by polyamidoamine (PAMAM) dendrimers. *Journal of Pharmaceutical Sciences*, *96*(3), 595–602.
39. Cheng, Y., Qu, H., Ma, M., Xu, Z., Xu, P., Fang, Y., & Xu, T., (2007). Polyamidoamine (PAMAM) dendrimers as biocompatible carriers of quinolone antimicrobials: An *in vitro* study. *European Journal of Medicinal Chemistry*, *42*(7), 1032–1038.
40. Choi, J. E., Kim, S., Ahn, J. H., Youn, P., Kang, J. S., Park, K., Yi, J., & Ryu, D. Y., (2010). Induction of oxidative stress and apoptosis by silver nanoparticles in the liver of adult zebrafish. *Aquatic Toxicology*, *100*(2), 151–159.
41. Choi, J. Y., Kim, K. H., Choy, K. C., Oh, K. T., & Kim, K. N., (2007). Photocatalytic antibacterial effect of TiO(2) film formed on Ti and TiAg exposed to Lactobacillus acidophilus. *Journal of Biomedical Materials Research, Part B: Applied Biomaterials*, *80*(2), 353–359.
42. Chopra, I., (2007). The increasing use of silver-based products as antimicrobial agents: A useful development or a cause for concern? *Journal of Antimicrobial Chemotherapy*, *59*(4), 587–590.
43. Coradeghini, R., Gioria, S., García, C. P., Nativo, P., Franchini, F., Gilliland, D., Ponti, J., & Rossi, F., (2013). Size-dependent toxicity and cell interaction mechanisms of gold nanoparticles on mouse fibroblasts. *Toxicology Letters*, *217*(3), 205–216.
44. Cortesi, R., Esposito, E., Maietti, A., Menegatti, E., & Nastruzzi, C., (1997). Formulation study for the antitumor drug camptothecin: Liposomes, micellar solutions and a microemulsion. *International Journal of Pharmaceutics*, *159*(1), 95–103.
45. Cragg, G. M., & Newman, D. J., (2005). Plants as a source of anti-cancer agents. *Journal of Ethnopharmacology*, *100*(1/2), 72–79.
46. Crane, F. A., Mohammed, K., Blake, M. I., Uphaus, R. A., & Katz, J. J., (1970). Effects of deuteriation on alkaloid production in Atropa belladonna. *Lloydia*, *33*(1), 11–14.
47. Daoud, S. S., Fetouh, M. I., & Giovanella, B. C., (1995). Antitumor effect of liposome-incorporated camptothecin in human malignant xenografts. *Anti-Cancer Drugs*, *6*(1), 83–93.

48. Dembinski, A., Warzecha, Z., Konturek, S. J., Ceranowicz, P., Dembinski, M., Pawlik, W. W., Kusnierz-Cabala, B., & Naskalski, J. W., (2004). Extract of grapefruit-seed reduces acute pancreatitis induced by ischemia/reperfusion in rats: Possible implication of tissue antioxidants. *Journal of Physiology and Pharmacology*, *55*(4), 811–821.
49. Devi, V. K., Jain, N., & Valli, K. S., (2010). Importance of novel drug delivery systems in herbal medicines. *Pharmacognosy Reviews*, *4*(7), 27–31.
50. Donaldson, K., Aitken, R., Tran, L., Stone, V., Duffin, R., Forrest, G., & Alexander, A., (2006). Carbon nanotubes: A review of their properties in relation to pulmonary toxicology and workplace safety. *Toxicological Sciences*, *92*(1), 5–22.
51. Dreaden, E. C., Mwakwari, S. C., Sodji, Q. H., Oyelere, A. K., & El-Sayed, M. A., (2009). Tamoxifen-poly(ethylene glycol)-thiol gold nanoparticle conjugates: Enhanced potency and selective delivery for breast cancer treatment. *Bioconjugate Chemistry*, *20*(12), 2247–2253.
52. Duncan, R., & Izzo, L., (2005). Dendrimer biocompatibility and toxicity. *Advanced Drug Delivery Reviews*, *57*(15), 2215–2237.
53. Dutta, T., & Jain, N. K., (2007). Targeting potential and anti-HIV activity of lamivudine loaded mannosylated poly (propyleneimine) dendrimer. *Biochimica et Biophysica Acta*, *1770*(4), 681–686.
54. Eghtedari, M., Liopo, A. V., Copland, J. A., Oraevsky, A. A., & Motamedi, M., (2009). Engineering of hetero-functional gold nanorods for the *in vivo* molecular targeting of breast cancer cells. *Nano Letters*, *9*(1), 287–291.
55. El-Samaligy, M. S., Afifi, N. N., & Mahmoud, E. A., (2006). Increasing bioavailability of silymarin using a buccal liposomal delivery system: preparation and experimental design investigation. *International Journal of Pharmaceutics*, *308*(1/2), 140–148.
56. Elmi, F., Alinezhad, H., Moulana, Z., & Salehian, F., (2014). The use of antibacterial activity of ZnO nanoparticles in the treatment of municipal wastewater. *Water Science and Technology*, *70*(5), 763–770.
57. Elmowafy, M., Viitala, T., Ibrahim, H. M., Abu-Elyazid, S. K., & Samy, A., (2013). Silymarin loaded liposomes for hepatic targeting: *In vitro* evaluation and HepG2 drug uptake. *European Journal of Pharmaceutical Sciences*, *50*(2), 161–171.
58. Emmelius, M., Hörpel, G., Ringsdorf, H., & Schmidt, B., (1986). Polymeric micelles and liposomes as potential drug carriers. In: Chiellini, E., Giusti, P., Migliaresi, C., & Nicolais, L., (eds.), *Polymers in Medicine II: Biomedical and Pharmaceutical Applications* (pp. 313–331). Springer US: Boston, MA.
59. Eom, H. J., & Choi, J., (2009). Oxidative stress of CeO2 nanoparticles via p38-Nrf-2 signaling pathway in human bronchial epithelial cell, Beas-2B. *Toxicology Letters*, *187*(2), 77–83.
60. Erlund, I., Meririnne, E., Alfthan, G., & Aro, A., (2001). Plasma kinetics and urinary excretion of the flavanones naringenin and hesperetin in humans after ingestion of orange juice and grapefruit juice. *Journal of Nutrition*, *131*(2), 235–241.
61. Fang, J. Y., Hwang, T. L., Huang, Y. L., & Fang, C. L., (2006). Enhancement of the transdermal delivery of catechins by liposomes incorporating anionic surfactants and ethanol. *International Journal of Pharmaceutics*, *310*(1/2), 131–138.
62. Fayaz, A. M., Balaji, K., Girilal, M., Yadav, R., Kalaichelvan, P. T., & Venketesan, R., (2010). Biogenic synthesis of silver nanoparticles and their synergistic effect with antibiotics: A study against gram-positive and gram-negative bacteria. *Nanomedicine: Nanotechnology, Biology, and Medicine* *6*(1), 103–109.

63. Flaten, G. E., Chang, T. T., Phillips, W. T., Brandl, M., Bao, A., & Goins, B., (2013). Liposomal formulations of poorly soluble camptothecin: Drug retention and biodistribution. *Journal of Liposome Research*, *23*(1), 70–81.
64. Fratoddi, I., Venditti, I., Cametti, C., & Russo, M. V., (2015). The puzzle of toxicity of gold nanoparticles. The case-study of HeLa cells. *Toxicology Research*, *4*(4), 796–800.
65. Freiberg, S., & Zhu, X. X., (2004). Polymer microspheres for controlled drug release. *International Journal of Pharmaceutics*, *282*(1/2), 1–18.
66. Fukuda, K., Hibiya, Y., Mutoh, M., Koshiji, M., Akao, S., & Fujiwara, H., (1999). Inhibition by berberine of cyclooxygenase-2 transcriptional activity in human colon cancer cells. *Journal of Ethnopharmacology*, *66*(2), 227–233.
67. Fukuda, K., Hibiya, Y., Mutoh, M., Koshiji, M., Akao, S., & Fujiwara, H., (1999). Inhibition of activator protein 1 activity by berberine in human hepatoma cells. *Planta Medica*, *65*(4), 381–383.
68. Gao, X., Cui, Y., Levenson, R. M., Chung, L. W., & Nie, S., (2004). *In vivo* cancer targeting and imaging with semiconductor quantum dots. *Nature Biotechnology*, *22*(8), 969–976.
69. Garg, R., & Gupta, G., (2010). Gastroretentive floating microspheres of silymarin: Preparation and *in vitro* evaluation. *Tropical Journal of Pharmaceutical Research*, *9*(1), 110–116.
70. Ghazani, A. A., Lee, J. A., Klostranec, J., Xiang, Q., Dacosta, R. S., Wilson, B. C., Tsao, M. S., & Chan, W. C., (2006). High throughput quantification of protein expression of cancer antigens in tissue microarray using quantum dot nanocrystals. *Nano Letters*, *6*(12), 2881–2886.
71. Goldberg, D. S., Vijayalakshmi, N., Swaan, P. W., & Ghandehari, H., (2011).G3.5 PAMAM dendrimers enhance transepithelial transport of SN38 while minimizing gastrointestinal toxicity. *Journal of Controlled Release*, *150*(3), 318–325.
72. Goyal, A., Kumar, S., Nagpal, M., Singh, I., & Arora, S., (2011). Potential of novel drug delivery systems for herbal drugs. *Indian Journal of Pharmaceutical Education and Research*, *45*(3), 225–235.
73. Hackenberg, S., Scherzed, A., Kessler, M., Hummel, S., Technau, A., Froelich, K., Ginzkey, C., Koehler, C., Hagen, R., & Kleinsasser, N., (2011). Silver nanoparticles: Evaluation of DNA damage, toxicity and functional impairment in human mesenchymal stem cells. *Toxicology Letters*, *201*(1), 27–33.
74. Haniu, H., Matsuda, Y., Usui, Y., Aoki, K., Shimizu, M., Ogihara, N., Hara, K., Okamoto, M., Takanashi, S., Ishigaki, N., Nakamura, K., Kato, H., & Saito, N., (2011). Toxicoproteomic evaluation of carbon nanomaterials in vitro. *Journal of Proteomics*, *74*(12), 2703–2712.
75. Hardman, R., (2006). A toxicologic review of quantum dots: Toxicity depends on physicochemical and environmental factors. *Environmental Health Perspectives*, *114*(2), 165–172.
76. Hartwell, J. L., (1971). Plants used against cancer: A survey. *Lloydia*, *34*(2), 204–255.
77. Harvey, A. L., (2008). Natural products in drug discovery. *Drug Discovery Today*, *13*(19/20), 894–901.
78. He, L., Liu, Y., Mustapha, A., & Lin, M., (2011). Antifungal activity of zinc oxide nanoparticles against *Botrytis cinerea* and *Penicillium expansum. Microbiological Research*, *166*(3), 207–215.
79. He, Z. F., Liu, D. Y., Zeng, S., & Ye, J. T., (2008). Study on preparation of ampelopsin liposomes. *Zhongguo Zhong Yao Za Zhi. Zhongguo Zhongyao Zazhi*. *China Journal of Chinese Materia Medica*, *33*(1), 27–30.

80. Hillery, A. M., Lloyd, A. W., & Swarbrick, J., (2008). *Drug Delivery and Targeting: For Pharmacists and Pharmaceutical Scientists* (p. 632). Taylor & Francis, Boca Raton–FL.
81. Hoshino, A., Hanada, S., & Yamamoto, K., (2011). Toxicity of nanocrystal quantum dots: The relevance of surface modifications. *Archives of Toxicology*, *85*(7), 707–720.
82. Hosta, L., Pla-Roca, M., Arbiol, J., Lopez-Iglesias, C., Samitier, J., Cruz, L. J., Kogan, M. J., & Albericio, F., (2009). Conjugation of Kahalalide F with gold nanoparticles to enhance *in vitro* antitumoral activity. *Bioconjugate Chemistry*, *20*(1), 138–146.
83. Hsueh, Y. H., Ke, W. J., Hsieh, C. T., Lin, K. S., Tzou, D. Y., & Chiang, C. L., (2015). ZnO nanoparticles affect bacillus subtilis cell growth and biofilm formation. *PloS One*, *10*(6), e0128457.
84. Hu, X., Cook, S., Wang, P., Hwang, H. M., Liu, X., & Williams, Q. L., (2010). *In vitro* evaluation of cytotoxicity of engineered carbon nanotubes in selected human cell lines. *Science of the Total Environment*, *408*(8), 1812–1817.
85. Hu, X., Hao, X., Wu, Y., Zhang, J., Zhang, X., Wang, P. C., Zou, G., & Liang, X. J., (2013). Multifunctional hybrid silica nanoparticles for controlled doxorubicin loading and release with thermal and pH dual response. *Journal of Materials Chemistry B*, *1*(8), 1109–1118.
86. Hussain, M. S., Fareed, S., Ansari, S., Rahman, M. A., Ahmad, I. Z., & Saeed, M., (2012). Current approaches toward production of secondary plant metabolites. *Journal of Pharmacy & Bioallied Sciences*, *4*(1), 10–20.
87. Jain, A., Jain, S. K., Ganesh, N., Barve, J., & Beg, A. M., (2010). Design and development of ligand-appended polysaccharidic nanoparticles for the delivery of oxaliplatin in colorectal cancer. *Nanomedicine: Nanotechnology, Biology, and Medicine*, *6*(1), 179–190.
88. Jain, D., & Banerjee, R., (2008). Comparison of ciprofloxacin hydrochloride-loaded protein, lipid, and chitosan nanoparticles for drug delivery. *Journal of Biomedical Materials Research, Part B: Applied Biomaterials*, *86*(1), 105–112.
89. Jantzen, G. M., & Robinson, J. R., (1996). Sustained and controlled release drug delivery systems. In: Banker, G. S., & Rhodes, C. T., (eds.), *Modern Pharmaceutics* (p. 575). Marcel Dekker: New York.
90. Jevprasesphant, R., Penny, J., Jalal, R., Attwood, D., McKeown, N. B., & D'Emanuele, A., (2003). The influence of surface modification on the cytotoxicity of PAMAM dendrimers. *International Journal of Pharmaceutics*, *252*(1/2), 263–266.
91. Ji, P., Yu, T., Liu, Y., Jiang, J., Xu, J., Zhao, Y., Hao, Y., Qiu, Y., Zhao, W., & Wu, C., (2016). Naringenin-loaded solid lipid nanoparticles: Preparation, controlled delivery, cellular uptake, and pulmonary pharmacokinetics. *Drug Design, Development and Therapy 10*, 911–918.
92. Jiang, H. L., Cui, Y. L., & Qi, Y., (2013). Microencapsulation of rutin in chitosan-coated alginate microspheres through internal gelation technique. *Advanced Materials Research: Trans Tech Publ*., *716*, 455–458.
93. Jimenez-Garcia, S. N., Vazquez-Cruz, M. A., Guevara-Gonzalez, R. G., Torres-Pacheco, I., Cruz-Hernandez, A., & Feregrino-Perez, A. A., (2013). Current approaches for enhanced expression of secondary metabolites as bioactive compounds in plants for agronomic and human health purposes – a review. *Polish Journal of Food and Nutrition Sciences*, *63*(2), 67–77.
94. Jo, M. R., Bae, S. H., Go, M. R., Kim, H. J., Hwang, Y. G., & Choi, S. J., (2015). Toxicity and biokinetics of colloidal gold nanoparticles. *Nanomaterials 5*(2), 835–840.

95. Katsumiti, A., Gilliland, D., Arostegui, I., & Cajaraville, M. P., (2015). Mechanisms of toxicity of Ag nanoparticles in comparison to bulk and ionic Ag on mussel hemocytes and gill cells. *PloS One*, *10*(6), e0129039.
96. Kewal, K. J., (2008). *Methods in Molecular Biology* (p. 425). Humana Press, New York.
97. Khairnar, G. A., Chavan-Patil, A. B., Palve, P. R., & Bhise, S. B., (2010). Dendrimers: Potential tool for enhancement of antifungal activity. *International Journal of Pharm. Tech. Research*, *2*(1), 736–739.
98. Khemani, M., Sharon, M., & Sharon, M., (2012). Encapsulation of berberine in nano-sized PLGA synthesized by emulsification method. *ISRN Nanotechnology*, 9–18.
99. Kim, S. A., Kwon, Y., Kim, J. H., Muller, M. T., & Chung, I. K., (1998). Induction of topoisomerase II-mediated DNA cleavage by a protoberberine alkaloid, berberrubine. *Biochemistry*, *37*(46), 16316–16324.
100. Kinghorn, A. D., Chin, Y. W., & Swanson, S. M., (2009). Discovery of natural product anticancer agents from biodiverse organisms. *Current Opinion in Drug Discovery & Development*, *12*(2), 189–196.
101. Kolhatkar, R. B., Kitchens, K. M., Swaan, P. W., & Ghandehari, H., (2007). Surface acetylation of polyamidoamine (PAMAM) dendrimers decreases cytotoxicity while maintaining membrane permeability. *Bioconjugate Chemistry*, *18*(6), 2054–2060.
102. Kuhn, K. P., Chaberny, I. F., Massholder, K., Stickler, M., Benz, V. W., Sonntag, H. G., & Erdinger, L., (2003). Disinfection of surfaces by photocatalytic oxidation with titanium dioxide and UVA light. *Chemosphere*, *53*(1), 71–77.
103. Kukowska-Latallo, J. F., Candido, K. A., Cao, Z., Nigavekar, S. S., Majoros, I. J., Thomas, T. P., Balogh, L. P., Khan, M. K., & Baker, J. R., Jr., (2005). Nanoparticle targeting of anticancer drug improves therapeutic response in animal model of human epithelial cancer. *Cancer Research*, *65*(12), 5317–5324.
104. Kumari, A., Yadav, S. K., & Yadav, S. C., (2010). Biodegradable polymeric nanoparticles based drug delivery systems. *Colloids and Surfaces B: Biointerfaces*, *75*(1), 1–18.
105. Lam, C. W., James, J. T., McCluskey, R., & Hunter, R. L., (2004). Pulmonary toxicity of single-wall carbon nanotubes in mice 7 and 90 days after intratracheal instillation. *Toxicological Sciences*, *77*(1), 126–134.
106. Lamartiniere, C. A., Murrill, W. B., Manzolillo, P. A., Zhang, J. X., Barnes, S., Zhang, X., Wei, H., & Brown, N. M., (1998). Genistein alters the ontogeny of mammary gland development and protects against chemically-induced mammary cancer in rats. *Proceedings of the Society for Experimental Biology and Medicine*, *217*(3), 358–364.
107. Lara, H. H., Ayala-Núñez, N. V., Ixtepan, T. L. D. C., & Rodríguez, P. C., (2010). Bactericidal effect of silver nanoparticles against multidrug-resistant bacteria. *World Journal of Microbiology and Biotechnology*, *26*(4), 615–621.
108. Lee, C. C., Gillies, E. R., Fox, M. E., Guillaudeu, S. J., Frechet, J. M., Dy, E. E., & Szoka, F. C., (2006). A single dose of doxorubicin-functionalized bow-tie dendrimer cures mice bearing C-26 colon carcinomas. *Proceedings of the National Academy of Sciences of the United States of America*, *103*(45), 16649–16654.
109. Lee, J. H., Park, J. H., Eltohamy, M., Perez, R., Lee, E. J., & Kim, H. W., (2013). Collagen gel combined with mesoporous nanoparticles loading nerve growth factor as a feasible therapeutic three-dimensional depot for neural tissue engineering. *RSC Advances*, *3*(46), 24202–24214.
110. Leo, E., Scatturin, A., Vighi, E., & Dalpiaz, A., (2006). Polymeric nanoparticles as drug controlled release systems: A new formulation strategy for drugs with small or large molecular weight. *Journal of Nanoscience and Nanotechnology*, *6*(9/10), 3070–3079.

111. Li, G. L., Mohwald, H., & Shchukin, D. G., (2013). Precipitation polymerization for fabrication of complex core-shell hybrid particles and hollow structures. *Chemical Society Reviews*, *42*(8), 3628–3646.
112. Li, J., Wang, X., Wang, C., Chen, B., Dai, Y., Zhang, R., Song, M., Lv, G., & Fu, D., (2007). The enhancement effect of gold nanoparticles in drug delivery and as biomarkers of drug-resistant cancer cells. *Chem. Med. Chem.*, *2*(3), 374–378.
113. Li, J. J., Hartono, D., Ong, C. N., Bay, B. H., & Yung, L. Y. L., (2010). Autophagy and oxidative stress associated with gold nanoparticles. *Biomaterials*, *31*(23), 5996–6003.
114. Li, X., Lu, X., Xu, H., Zhu, Z., Yin, H., Qian, X., Li, R., Jiang, X., & Liu, B., (2012). Paclitaxel/tetrandrine coloaded nanoparticles effectively promote the apoptosis of gastric cancer cells based on "oxidation therapy."*Molecular Pharmaceutics*, *9*(2), 222–229.
115. Li, X., Robinson, S. M., Gupta, A., Saha, K., & Jiang, Z., (2014). Functional gold nanoparticles as potent antimicrobial agents against multi-drug-resistant bacteria. *ACS Nano*, *8*(10), 10682–10686.
116. Lim, Y. T., Kim, S., Nakayama, A., Stott, N. E., Bawendi, M. G., & Frangioni, J. V., (2003). Selection of quantum dot wavelengths for biomedical assays and imaging. *Molecular Imaging*, *2*(1), 50–64.
117. Lin, J. G., Chung, J. G., Wu, L. T., Chen, G. W., Chang, H. L., & Wang, T. F., (1999). Effects of berberine on arylamine N-acetyltransferase activity in human colon tumor cells. *American Journal of Chinese Medicine*, *27*(2), 265–275.
118. Lin, W., Huang, Y. W., Zhou, X. D., & Ma, Y., (2006). *In vitro* toxicity of silica nanoparticles in human lung cancer cells. *Toxicology and Applied Pharmacology*, *217*(3), 252–259.
119. Lin, W., Huang, Y. W., Zhou, X. D., & Ma, Y., (2006). Toxicity of cerium oxide nanoparticles in human lung cancer cells. *International Journal of Toxicology*, *25*(6), 451–457.
120. Lipovsky, A., Tzitrinovich, Z., Friedmann, H., Applerot, G., Gedanken, A., & Lubart, R., (2009). EPR study of visible light-induced ROS generation by nanoparticles of ZnO. *The Journal of Physical Chemistry C*, *113*(36), 15997–16001.
121. Liu, C. B., Zhang, D., Li, D. G., Jiang, D., & Xia, C., (2008). Preparation and characterization of biodegradable polylactide (PLA) microspheres encapsulating ginsenoside Rg3. *Chemical Research in Chinese Universities*, *24*(5), 588–591.
122. Liu, M. X., Dong, J., Yang, Y. J., Yang, X. L., & Xu, H. B., (2004). Preparation and toxicity of triptolide-loaded poly lactic acid nanoparticles. *Yao Xuexue Bao (Acta Pharmaceutica Sinica)*, *39*(7), 556–560.
123. Liu, S., Xu, L., Zhang, T., Ren, G., & Yang, Z., (2010). Oxidative stress and apoptosis induced by nanosized titanium dioxide in PC12 cells. *Toxicology*, *267*(1–3), 172–177.
124. Liu, Y., He, L., Mustapha, A., Li, H., Hu, Z. Q., & Lin, M., (2009). Antibacterial activities of zinc oxide nanoparticles against Escherichia coli O157:H7. *Journal of Applied Microbiology*, *107*(4), 1193–1201.
125. Liu, Z., Fan, A. C., Rakhra, K., Sherlock, S., Goodwin, A., Chen, X., Yang, Q., Felsher, D. W., & Dai, H., (2009). Supramolecular stacking of doxorubicin on carbon nanotubes for *in vivo* cancer therapy. *Angewandte Chemie. International Ed. in English*, *48*(41), 7668–7672.
126. Lo, C. W., Zhu, D., & Jiang, H., (2011). An infrared-light responsive graphene-oxide incorporated poly(N-isopropylacrylamide) hydrogel nanocomposite. *Soft Matter*, *7*(12), 5604–5609.

127. Lobenberg, R., Maas, J., & Kreuter, J., (1998). Improved body distribution of 14C-labelled AZT bound to nanoparticles in rats determined by radioluminography. *Journal of Drug Targeting*, *5*(3), 171–179.
128. Lowery, A. R., Gobin, A. M., Day, E. S., Halas, N. J., & West, J. L., (2006). Immunonanoshells for targeted photothermal ablation of tumor cells. *International Journal of Nanomedicine*, *1*(2), 149–154.
129. Luanpitpong, S., Wang, L., Davidson, D. C., Riedel, H., & Rojanasakul, Y., (2016). Carcinogenic Potential of high aspect ratio carbon nanomaterials. *Environ. Sci. Nano*, *3*(3), 483–493.
130. Mahajan, S. D., Roy, I., Xu, G., Yong, K. T., Ding, H., Aalinkeel, R., et al., (2010). Enhancing the delivery of anti retroviral drug "Saquinavir" across the blood brain barrier using nanoparticles. *Current HIV Research*, *8*(5), 396–404.
131. Makarov, V. V., Love, A. J., Sinitsyna, O. V., Makarova, S. S., Yaminsky, I. V., Taliansky, M. E., & Kalinina, N. O., (2014). "Green" nanotechnologies: Synthesis of metal nanoparticles using plants. *Acta Naturae*, *6*(1), 35–44.
132. Malik, N., Wiwattanapatapee, R., & Klopsch, R., (2000). Relationship between structure and biocompatibility *in vitro*, and preliminary studies on the biodistribution of 125I-labelled polyamidoamine dendrimers *in vivo*. *Journal of Controlled Release*, *65*(1/2), 133–148.
133. Martin, C. R., (2006). Welcome to nanomedicine. *Nanomedicine: Nanotechnology, Biology, and Medicine*, *1*(1), 5–10.
134. Martinez-Gutierrez, F., Olive, P. L., & Banuelos, A., (2010). Synthesis, characterization, and evaluation of antimicrobial and cytotoxic effect of silver and titanium nanoparticles. *Nanomedicine: Nanotechnology, Biology, and Medicine*, *6*(5), 681–688.
135. McChesney, J. D., Venkataraman, S. K., & Henri, J. T., (2007). Plant natural products: Back to the future or into extinction? *Phytochemistry*, *68*(14), 2015–2022.
136. Mei, Z., Chen, H., Weng, T., Yang, Y., & Yang, X., (2003). Solid lipid nanoparticle and microemulsion for topical delivery of triptolide. *European Journal of Pharmaceutics and Biopharmaceutics*, *56*(2), 189–196.
137. Mei, Z., Li, X., Wu, Q., Hu, S., & Yang, X., (2005). The research on the anti-inflammatory activity and hepatotoxicity of triptolide-loaded solid lipid nanoparticle. *Pharmacological Research*, *51*(4), 345–351.
138. Mohanraj, V. J., & Chen, Y., (2006). Nanoparticles – A review. *Tropical Journal of Pharmaceutical Research*, *5*(1), 3–15.
139. Monteiro-Riviere, N. A., Nemanich, R. J., Inman, A. O., Wang, Y. Y., & Riviere, J. E., (2005). Multi-walled carbon nanotube interactions with human epidermal keratinocytes. *Toxicology Letters*, *155*(3), 377–384.
140. Morimoto, Y., Horie, M., Kobayashi, N., Shinohara, N., & Shimada, M., (2013). Inhalation toxicity assessment of carbon-based nanoparticles. *Accounts of Chemical Research*, *46*(3), 770–781.
141. Moughton, A. O., Hillmyer, M. A., & Lodge, T. P., (2012). Multicompartment block polymer micelles. *Macromolecules*, *45*(1), 2–19.
142. Mukherjee, A. K., Basu, S., Sarkar, N., & Ghosh, A. C., (2001). Advances in cancer therapy with plant based natural products. *Current Medicinal Chemistry*, *8*(12), 1467–1486.
143. Mukherjee, S., Ray, S., & Thakur, R. S., (2009). Solid lipid nanoparticles: A modern formulation approach in drug delivery system. *Indian Journal of Pharmaceutical Sciences*, *71*(4), 349–358.

144. Mukherjee, S., Sushma, V., Patra, S., Barui, A. K., Bhadra, M. P., Sreedhar, B., & Patra, C. R., (2012). Green chemistry approach for the synthesis and stabilization of biocompatible gold nanoparticles and their potential applications in cancer therapy. *Nanotechnology*, *23*(45), E-article: 455103.
145. Muller, J., Huaux, F., Moreau, N., Misson, P., Heilier, J. F., Delos, M., Arras, M., Fonseca, A., Nagy, J. B., & Lison, D., (2005). Respiratory toxicity of multi-wall carbon nanotubes. *Toxicology and Applied Pharmacology*, *207*(3), 221–231.
146. Muller, R. H., & Keck, C. M., (2004). Challenges and solutions for the delivery of biotech drugs--a review of drug nanocrystal technology and lipid nanoparticles. *Journal of Biotechnology*, *113*(1–3), 151–170.
147. Muranyi, P., Schraml, C., & Wunderlich, J., (2010). Antimicrobial efficiency of titanium dioxide-coated surfaces. *Journal of Applied Microbiology*, *108*(6), 1966–1973.
148. Musthaba, S. M., Baboota, S., Ahmed, S., Ahuja, A., & Ali, J., (2009). Status of novel drug delivery technology for phytotherapeutics. *Expert Opinion on Drug Delivery*, *6*(6), 625–637.
149. Natarajan, V., Krithica, N., Madhan, B., & Sehgal, P. K., (2011). Formulation and evaluation of quercetin polycaprolactone microspheres for the treatment of rheumatoid arthritis. *Journal of Pharmaceutical Sciences*, *100*(1), 195–205.
150. Nevozhay, D., Kanska, U., Budzynska, R., & Boratynski, J., (2007). Current status of research on conjugates and related drug delivery systems in the treatment of cancer and other diseases. *Postepy. Hig. Med. Dosw*. *(Online)*, *61*, 350–360.
151. Nirmala, M. J., Samundeeswari, A., & Sankar, P. D., (2011). Natural plant resources in anti-cancer therapy-A review. *Research in Plant Biology*, *1*(3), 199–204.
152. Nishimori, H., Kondoh, M., Isoda, K., Tsunoda, S. I., Tsutsumi, Y., & Yagi, K., (2009). Silica nanoparticles as hepatotoxicants. *European Journal of Pharmaceutics and Biopharmaceutics*, *72*(3), 496–501.
153. Nuengchamnong, N., Hermans-Lokkerbol, A., & Ingkaninan, K., (2004). Separation and detection of the antioxidant flavonoids, rutin and quercetin, using HPLC coupled on-line with colorimetric detection of antioxidant activity. *Naresuan University Journal*, *12*(2), 25–37.
154. Owonubi, S., Aderibigbe, B., Mukwevho, E., Sadiku, E., & Ray, S., (2018). Characterization and *in vitro* release kinetics of antimalarials from whey protein-based hydrogel biocomposites. *International Journal of Industrial Chemistry*, 1–14.
155. Owonubi, S. J., Agwuncha, S. C., & Mukwevho, E., (2017). Application of hydrogel biocomposites for multiple drug delivery. In: Kumar, T., Manju, K. T., & Kessler, M. R., (eds.), *Handbook of Composites from Renewable Materials* (pp. 139–166). Wiley-Scrivener Publishing: New York.
156. Paciotti, G. F., Kingston, D. G. I., & Tamarkin, L., (2006). Colloidal gold nanoparticles: A novel nanoparticle platform for developing multifunctional tumor-targeted drug delivery vectors. *Drug Development Research*, *67*(1), 47–54.
157. Pacurari, M., Lowe, K., Tchounwou, P. B., & Kafoury, R., (2016). A review on the respiratory system toxicity of carbon nanoparticles. *International Journal of Environmental Research and Public Health*, *13*(3), 90–99.
158. Pandey, R., & Khuller, G. K., (2005). Solid lipid particle-based inhalable sustained drug delivery system against experimental tuberculosis. *Tuberculosis (Edinb)*, *85*(4), 227–234.
159. Pandey, V. P., Manavalan, R., Sundar, R. T., & Ganesh, K. S., (2003). Formulation and release characteristics of sustained release diltiazem hydrochloride tablet. *Indian Journal of Pharmaceutical Sciences*, *65*(1), 44–48.

160. Panga, X., Cui, F., Tian, J., Chen, J., Zhou, J., & Zhou, W., (2009). Preparation and characterization of magnetic solid lipid nanoparticles loaded with ibuprofen. *Asian Journal of Pharmaceutical. Science*, *4*(2), 132–137.
161. Parak, W. J., Boudreau, R., Le Gros, M., Gerion, D., Zanchet, D., Micheel, C. M., Williams, S. C., Alivisatos, A. P., & Larabell, C., (2002). Cell motility and metastatic potential studies based on quantum dot imaging of phagokinetic tracks. *Advanced Materials*, *14*(12), 882–885.
162. Park, E. J., & Park, K., (2009). Oxidative stress and pro-inflammatory responses induced by silica nanoparticles *in vivo* and *in vitro. Toxicology Letters*, *184*(1), 18–25.
163. Park, E. J., Yi, J., Kim, Y., Choi, K., & Park, K., (2010). Silver nanoparticles induce cytotoxicity by a Trojan-horse type mechanism. *Toxicology in Vitro*, *24*(3), 872–878.
164. Parveen, R., Baboota, S., Ali, J., Ahuja, A., Vasudev, S. S., & Ahmad, S., (2011). Oil based nanocarrier for improved oral delivery of silymarin: *In vitro* and *in vivo* studies. *International Journal of Pharmaceutics*, *413*(1/2), 245–253.
165. Pathak, S., Choi, S. K., Arnheim, N., & Thompson, M. E., (2001). Hydroxylated quantum dots as luminescent probes for in situ hybridization. *Journal of the American Chemical Society*, *123*(17), 4103–4114.
166. Patra, C. R., Bhattacharya, R., Wang, E., Katarya, A., Lau, J. S., Dutta, S., et al., (2008). Targeted delivery of gemcitabine to pancreatic adenocarcinoma using cetuximab as a targeting agent. *Cancer Research*, *68*(6), 1970–1978.
167. Petros, R. A., & DeSimone, J. M., (2010). Strategies in the design of nanoparticles for therapeutic applications. *Nature Reviews: Drug Discovery*, *9*(8), 615–627.
168. Piao, M. J., Kang, K. A., Lee, I. K., Kim, H. S., Kim, S., Choi, J. Y., Choi, J., & Hyun, J. W., (2011). Silver nanoparticles induce oxidative cell damage in human liver cells through inhibition of reduced glutathione and induction of mitochondria-involved apoptosis. *Toxicology Letters*, *201*(1), 92–100.
169. Podsiadlo, P., Sinani, V. A., Bahng, J. H., Kam, N. W., Lee, J., & Kotov, N. A., (2008). Gold nanoparticles enhance the anti-leukemia action of a 6-mercaptopurine chemotherapeutic agent. *Langmuir*, *24*(2), 568–574.
170. Popli, H., & Sharma, S. N., (1989). Trends in oral sustained release formulations. *Eastern Pharmacist*, 99–103.
171. Radomski, A., Jurasz, P., Alonso-Escolano, D., Drews, M., Morandi, M., Malinski, T., & Radomski, M. W., (2005). Nanoparticle-induced platelet aggregation and vascular thrombosis. *British Journal of Pharmacology*, *146*(6), 882–893.
172. Raghupathi, K. R., Koodali, R. T., & Manna, A. C., (2011). Size-dependent bacterial growth inhibition and mechanism of antibacterial activity of zinc oxide nanoparticles. *Langmuir*, *27*(7), 4020–4028.
173. Rai, M., Yadav, A., & Gade, A., (2009). Silver nanoparticles as a new generation of antimicrobials. *Biotechnology Advances*, *27*(1), 76–83.
174. Rai, M. K., Deshmukh, S. D., Ingle, A. P., & Gade, A. K., (2012). Silver nanoparticles: The powerful nanoweapon against multidrug-resistant bacteria. *Journal of Applied Microbiology*, *112*(5), 841–852.
175. Rajananthanan, P., Attard, G. S., Sheikh, N. A., & Morrow, W. J. W., (1999). Evaluation of novel aggregate structures as adjuvants: Composition, toxicity studies and humoral responses. *Vaccine*, *17*(7/8), 715–730.
176. Ranga, R. P., Varaprasad, K., Narayana, R. N., Mohana, R. K., & Reddy, N. S., (2012). Fabrication of Au and Ag Bi-metallic nanocomposite for antimicrobial applications. *Journal of Applied Polymer Science*, *125*(2), 1357–1362.

177. Rani, K., & Paliwal, S., (2014). A review on targeted drug delivery: Its entire focus on advanced therapeutics and diagnostics. *Sch. J. App. Med. Sci.*, *2*(1C), 328–331.
178. Rao, J. P., & Geckeler, K. E., (2011). Polymer nanoparticles: Preparation techniques and size-control parameters. *Progress in Polymer Science*, *36*(7), 887–913.
179. Reverchon, E., & Adami, R., (2006). Nanomaterials and supercritical fluids. *The Journal of Supercritical Fluids*, *37*(1), 1–22.
180. Rolland, J. P., Maynor, B. W., Euliss, L. E., Exner, A. E., Denison, G. M., & DeSimone, J. M., (2005). Direct fabrication and harvesting of monodisperse, shape-specific nanobiomaterials. *Journal of the American Chemical Society*, *127*(28), 10096–10100.
181. Ruckmani, K., Sivakumar, M., & Ganeshkumar, P. A., (2006). Methotrexate loaded solid lipid nanoparticles (SLN) for effective treatment of carcinoma. *Journal of Nanoscience and Nanotechnology*, *6*(9/10), 2991–2995.
182. Rusin, A., Krawczyk, Z., Grynkiewicz, G., Gogler, A., Zawisza-Puchalka, J., & Szeja, W., (2010). Synthetic derivatives of genistein, their properties and possible applications. *Acta Biochimica Polonica*, *57*(1), 23–34.
183. Salcher, A., Nikolic, M. S., Casado, S., Velez, M., Weller, H., & Juarez, B. H., (2010). CdSe/CdS nanoparticles immobilized on pNIPAm-based microspheres. *Journal of Materials Chemistry*, *20*(7), 1367–1374.
184. Samanta, S. K., Pal, A., Bhattacharya, S., & Rao, C. N. R., (2010). Carbon nanotube reinforced supramolecular gels with electrically conducting, viscoelastic and near-infrared sensitive properties. *Journal of Materials Chemistry*, *20*(33), 6881–6890.
185. Sambale, F., Wagner, S., Stahl, F., Khaydarov, R. R., Scheper, T., & Bahnemann, D., (2015). Investigations of the toxic effect of silver nanoparticles on mammalian cell lines. *Journal of Nanomaterials*, 9–17.
186. Samori, C., Ali-Boucetta, H., Sainz, R., Guo, C., Toma, F. M., Fabbro, C., Da Ros, T., Prato, M., Kostarelos, K., & Bianco, A., (2010). Enhanced anticancer activity of multi-walled carbon nanotube-methotrexate conjugates using cleavable linkers. *Chemical Communications (Cambridge, England)*, *46*(9), 1494–1496.
187. Sanna, V., Gavini, E., Cossu, M., Rassu, G., & Giunchedi, P., (2007). Solid lipid nanoparticles (SLN) as carriers for the topical delivery of econazole nitrate: *In-vitro* characterization, *ex-vivo* and *in-vivo* studies. *Journal of Pharmacy and Pharmacology*, *59*(8), 1057–1064.
188. Sarmento, B., Martins, S., Ferreira, D., & Souto, E. B., (2007). Oral insulin delivery by means of solid lipid nanoparticles. *International Journal of Nanomedicine*, *2*(4), 743–749.
189. Sayes, C. M., Gobin, A. M., Ausman, K. D., Mendez, J., West, J. L., & Colvin, V. L., (2005). Nano-C60 cytotoxicity is due to lipid peroxidation. *Biomaterials*, *26*(36), 7587–7595.
190. Serpe, L., Catalano, M. G., Cavalli, R., Ugazio, E., Bosco, O., Canaparo, R., Muntoni, E., Frairia, R., Gasco, M. R., Eandi, M., & Zara, G. P., (2004). Cytotoxicity of anticancer drugs incorporated in solid lipid nanoparticles on HT-29 colorectal cancer cell line. *European Journal of Pharmaceutics and Biopharmaceutics*, *58*(3), 673–680.
191. Sharma, R. A., Euden, S. A., Platton, S. L., Cooke, D. N., Shafayat, A., Hewitt, H. R., et al., (2004). Phase I clinical trial of oral curcumin: Biomarkers of systemic activity and compliance. *Clinical Cancer Research*, *10*(20), 6847–6854.
192. Sharma, R. A., McLelland, H. R., Hill, K. A., Ireson, C. R., Euden, S. A., Manson, M. M., Pirmohamed, M., Marnett, L. J., Gescher, A. J., & Steward, W. P., (2001). Pharmacodynamic and pharmacokinetic study of oral Curcuma extract in patients with colorectal cancer. *Clinical Cancer Research* *7*(7), 1894–1900.

193. Sharma, V., Singh, P., Pandey, A. K., & Dhawan, A., (2012). Induction of oxidative stress, DNA damage and apoptosis in mouse liver after sub-acute oral exposure to zinc oxide nanoparticles. *Mutation Research/Genetic Toxicology and Environmental Mutagenesis*, *745*(1/2), 84–91.
194. Shvedova, A. A., Castranova, V., Kisin, E. R., Schwegler-Berry, D., Murray, A. R., Gandelsman, V. Z., Maynard, A., & Baron, P., (2003). Exposure to carbon nanotube material: Assessment of nanotube cytotoxicity using human keratinocyte cells. *Journal of Toxicology and Environmental Health. Part A*, *66*(20), 1909–1926.
195. Singh, D., (2015). Application of novel drug delivery system in enhancing the therapeutic potential of phytoconstituents. *Asian Journal of Pharmaceutics*, *9*(4), 200–210.
196. Singh, P., Kim, Y. J., Zhang, D., & Yang, D. C., (2016). Biological synthesis of nanoparticles from plants and microorganisms. *Trends in Biotechnology*, *34*(7), 588–599.
197. Singla, A. K., Garg, A., & Aggarwal, D., (2002). Paclitaxel and its formulations. *International Journal of Pharmaceutics*, *235*(1/2), 179–192.
198. Sintubin, L., Verstraete, W., & Boon, N., (2012). Biologically produced nanosilver: Current state and future perspectives. *Biotechnology and Bioengineering*, *109*(10), 2422–2436.
199. Soppimath, K. S., Aminabhavi, T. M., Kulkarni, A. R., & Rudzinski, W. E., (2001). Biodegradable polymeric nanoparticles as drug delivery devices. *Journal of Controlled Release*, *70*(1/2), 1–20.
200. Souto, E. B., & Muller, R. H., (2005). SLN and NLC for topical delivery of ketoconazole. *Journal of Microencapsulation*, *22*(5), 501–510.
201. Souto, E. B., Wissing, S. A., Barbosa, C. M., & Muller, R. H., (2004). Development of a controlled release formulation based on SLN and NLC for topical clotrimazole delivery. *International Journal of Pharmaceutics*, *278*(1), 71–77.
202. Srivastava, V., Negi, A. S., Kumar, J. K., Gupta, M. M., & Khanuja, S. P., (2005). Plant-based anticancer molecules: A chemical and biological profile of some important leads. *Bioorganic and Medicinal Chemistry*, *13*(21), 5892–5908.
203. Stiti, M., Cecchi, A., Rami, M., Abdaoui, M., Barragan-Montero, V., Scozzafava, A., Guari, Y., Winum, J. Y., & Supuran, C. T., (2008). Carbonic anhydrase inhibitor coated gold nanoparticles selectively inhibit the tumor-associated isoform IX over the cytosolic isozymes I and II. *Journal of the American Chemical Society*, *130*(48), 16130–16138.
204. Sun, L., Li, Y., Liu, X., Jin, M., Zhang, L., Du, Z., Guo, C., Huang, P., & Sun, Z., (2011). Cytotoxicity and mitochondrial damage caused by silica nanoparticles. *Toxicology In Vitro*, *25*(8), 1619–1629.
205. Suseela, P., Premkumar, K., & Saraswathy, S. D., (*2015*). Formulation, characterization and pharmacokinetic evaluation of naringenin- loaded gastroretentive mucoadhesive polymeric nanosystem for oral drug. *Journal of Drug Delivery and Therapeutics, 5*(2), 107–114.
206. Tagboto, S., & Townson, S., (2001). Antiparasitic properties of medicinal plants and other naturally occurring products. *Advances in Parasitology*, *50*, 199–295.
207. Tamber, H., Johansen, P., Merkle, H. P., & Gander, B., (2005). Formulation aspects of biodegradable polymeric microspheres for antigen delivery. *Advanced Drug Delivery Reviews*, *57*(3), 357–376.
208. Tan, M., Qiu, G., & Ting, Y. P., (2015). Effects of ZnO nanoparticles on wastewater treatment and their removal behavior in a membrane bioreactor. *Bioresource Technology*, *185*, 125–133.

209. Thakur, L., Ghodasra, U., Patel, N., & Dabhi, M., (2011). Novel approaches for stability improvement in natural medicines. *Pharmacognosy Reviews*, *5*(9), 48–54.
210. Tian, Q., Wang, W., He, X., Zhu, X., Huang, W., Zhang, C., Yuan, Z., & Chen, X., (2009). Glycyrrhetinic acid-modified nanoparticles for drug delivery: Preparation and characterization. *Chinese Science Bulletin*, *54*(18), 3121–3126.
211. Tong, W., Wang, L., & D'Souza, M. J., (2003). Evaluation of PLGA microspheres as delivery system for antitumor agent-camptothecin. *Drug Development and Industrial Pharmacy*, *29*(7), 745–756.
212. Toyokuni, S., (2013). Genotoxicity and carcinogenicity risk of carbon nanotubes. *Advanced Drug Delivery Reviews*, *65*(15), 2098–2110.
213. Umehara, K., Nemoto, K., Ohkubo, T., Miyase, T., Degawa, M., & Noguchi, H., (2004). Isolation of a new 15-membered macrocyclic glycolipid lactone, Cuscutic Resinoside a from the seeds of Cuscutachinensis: A stimulator of breast cancer cell proliferation. *Planta Medica*, *70*(4), 299–304.
214. Uner, M., & Yener, G., (2007). Importance of solid lipid nanoparticles (SLN) in various administration routes and future perspectives. *International Journal of Nanomedicine*, *2*(3), 289–300.
215. Varde, N. K., & Pack, D. W., (2004). Microspheres for controlled release drug delivery. *Expert Opinion on Biological Therapy*, *4*(1), 35–51.
216. Vyas, S. P., Sihorkar, V., & Mishra, V., (2000). Controlled and targeted drug delivery strategies towards intraperiodontal pocket diseases. *Journal of Clinical Pharmacy and Therapeutics*, *25*(1), 21–42.
217. Wagner, V., Dullaart, A., Bock, A. K., & Zweck, A., (2006). The emerging nanomedicine landscape. *Nature Biotechnology*, *24*(10), 1211–1217.
218. Wang, B., Ma, L., Tao, X., & Lipsky, P. E., (2004). Triptolide, an active component of the Chinese herbal remedy Tripterygium wilfordii Hook F, inhibits production of nitric oxide by decreasing inducible nitric oxide synthase gene transcription. *Arthritis and Rheumatism*, *50*(9), 2995–2303.
219. Warheit, D. B., Laurence, B. R., Reed, K. L., Roach, D. H., Reynolds, G. A., & Webb, T. R., (2004). Comparative pulmonary toxicity assessment of single-wall carbon nanotubes in rats. *Toxicological Sciences*, *77*(1), 117–125.
220. Wiener, E. C., Konda, S., Shadron, A., Brechbiel, M., & Gansow, O., (1997). Targeting dendrimer-chelates to tumors and tumor cells expressing the high-affinity folate receptor. *Investigative Radiology*, *32*(12), 748–754.
221. Wilczewska, A. Z., Niemirowicz, K., Markiewicz, K. H., & Car, H., (2012). Nanoparticles as drug delivery systems. *Pharmacological Reports 64*(5), 1020–1037.
222. Wong, H. L., Rauth, A. M., Bendayan, R., Manias, J. L., Ramaswamy, M., Liu, Z., Erhan, S. Z., & Wu, X. Y., (2006). A new polymer-lipid hybrid nanoparticle system increases cytotoxicity of doxorubicin against multidrug-resistant human breast cancer cells. *Pharmaceutical Research*, *23*(7), 1574–1585.
223. Wong, M. S., Sun, D. S., & Chang, H. H., (2010). Bactericidal performance of visible-light responsive titania photocatalyst with silver nanostructures. *PloS One*, *5*(4), e10394.
224. Woo, J. S., Kim, T. S., Park, J. H., & Chi, S. C., (2007). Formulation and biopharmaceutical evaluation of silymarin using SMEDDS. *Archives of Pharmacal Research*, *30*(1), 82–89.
225. Xie, Y., He, Y., Irwin, P. L., Jin, T., & Shi, X., (2011). Antibacterial activity and mechanism of action of zinc oxide nanoparticles against *Campylobacter jejuni. Applied and Environmental Microbiology*, *77*(7), 2325–2331.

226. Xu, H., Hou, Z., Zhang, H., Kong, H., Li, X., Wang, H., & Xie, W., (2014). An efficient Trojan delivery of tetrandrine by poly(N-vinylpyrrolidone)-block-poly(ε-caprolactone) (PVP-b-PCL) nanoparticles shows enhanced apoptotic induction of lung cancer cells and inhibition of its migration and invasion. *International Journal of Nanomedicine*, *9*, 231–242.
227. Xu, X., & Burgess, D. J., (2012). Liposomes as carriers for controlled drug delivery. In: Wright, J. C., & Burgess, D. J., (ed.), *Long Acting Injections and Implants* (pp. 195–220). Springer US, Boston, MA.
228. Yadav, D., Suri, S., Choudhary, A., Sikender, M., Hemant, B. N., & Beg, N., (2011). Novel approach: Herbal remedies and natural products in pharmaceutical science as nano drug delivery systems. *International Journal of Pharm. Tech. Research*, *3*(3), 3092–3116.
229. Yang, J., Han, C. R., Duan, J. F., Xu, F., & Sun, R. C., (2013). In situ grafting silica nanoparticles reinforced nanocomposite hydrogels. *Nanoscale*, *5*(22), 10858–10863.
230. Yang, Q., & Ma, Y., (2014). Irradiation enhanced cytotoxicity of Zinc Oxide nanoparticles. *International Journal of Toxicology*, *33*(3), 187–203.
231. Ye, Y., Liu, J., Xu, J., Sun, L., Chen, M., & Lan, M., (2010). Nano-SiO_2 induces apoptosis via activation of p53 and Bax mediated by oxidative stress in human hepatic cell line. *Toxicology In Vitro*, *24*(3), 751–758.
232. Yen, F. L., Wu, T. H., Lin, L. T., Cham, T. M., & Lin, C. C., (2009). Naringenin-loaded nanoparticles improve the physicochemical properties and the hepatoprotective effects of naringenin in orally-administered rats with CCl(4)-induced acute liver failure. *Pharmaceutical Research*, *26*(4), 893–902.
233. Zhang, H., Patel, A., Gaharwar, A. K., Mihaila, S. M., Iviglia, G., Mukundan, S., Bae, H., Yang, H., & Khademhosseini, A., (2013). Hyperbranched polyester hydrogels with controlled drug release and cell adhesion properties. *Biomacromolecules*, *14*(5), 1299–1310.
234. Zhigaltsev, I. V., Maurer, N., Akhong, Q. F., Leone, R., Leng, E., Wang, J., Semple, S. C., & Cullis, P. R., (2005). Liposome-encapsulated vincristine, vinblastine and vinorelbine: A comparative study of drug loading and retention. *Journal of Controlled Release*, *104*(1), 103–111.
235. Zhong, S., & Yung, L. Y. L., (2009). Enhanced biological stability of collagen with incorporation of PAMAM dendrimer. *Journal of Biomedical Materials Research Part A*, *91*(1), 114–122.
236. Zhuo, R. X., Du, B., & Lu, Z. R., (1999). *In vitro* release of 5-fluorouracil with cyclic core dendritic polymer. *Journal of Controlled Release*, *57*(3), 249–257.