

Advanced Structured Materials

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Bioactive Natural Products for Pharmaceutical Applications

 Springer

Editors

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Chapter 6

Natural Compounds Extracted from Medicinal Plants and Their Immunomodulatory Activities

Vinod Kumar Gurjar and Dilipkumar Pal

Abstract The fight against cancer cells in the human body involves a defense system that is comprised of the innate and adaptive immunities which are controlled by a series of immune responses mediated by different immune cells (ICs) and their secretory substances including cytokines and chemokines. Natural substances, synthetic compounds, and antibody elements are used as immunostimulating and immunosuppressive agents. But here are certain restrictions to the overall use of these compounds, such as the increased risk of infection and generalized effect throughout the immune system. The use of plants and plant products as immunomodulators is still in a developing stage. At non-cytotoxic concentrations, the phytoconstituents exhibited three types of immunomodulation including type 1 of PHA, ConA, and quercetin (increased lymphocyte activation and IFN- γ secretion); type 2 of isopimpinellin (enhanced lymphocyte activation) and type 3 of rutin, bergapten and xanthotoxin (elevated IFN- γ secretion). The augmentation of lymphocyte proliferation was closely correlated to an increase in the number of lymphocyte cells including T-helper lymphocytes (CD4⁺), CD8⁺ T cells and activated PBMC, whereas elevation of IFN- γ secretion was due to the activated CD8⁺ T cells. The present chapter revealed the immunomodulating activity, which could be explained the traditional use of medicinal plant extract worldwide.

Keywords Immunomodulatory activities · T-helper lymphocytes · IFN- γ · CD8⁺ T cells · CD4⁺ T cells

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Abbreviations

ABCG2	ATP-binding cassette super-family G member-2
ADA	Adenosine deaminase
ADCC	Antibody-Dependent Cellular Cytotoxicity
AINFLCs	Anti-inflammatory Cytokine
AL	Alkaline Phosphatase
APCs	Antigen-Presenting Cells
BAOECs	Bovine Aortic Endothelial Cells
BRMs	Biological Response Modifiers
CAMs	Cell Adhesion Molecules
CMCs	Cortical Microglia Cells
COX-2	Cyclooxygenase
Tc	Cytotoxic T Cells
DCs	Dendritic cells
DP	Dopamine
EGCG	Epigallocatechin-3-gallate
ELAM-1	Endothelial Leukocyte Adhesion Molecule
eIF 2	Eukaryotic Initiation Factor 2
ERK	Extracellular Signal-Regulated Kinases
GM-CSF	Granulocyte-Macrophage Colony-Stimulating Factor
HBMECs	Human Brain Microvascular Endothelial Cells
HECs	Human Mammary Cells
Hsp90	Heat Shock Protein 90
HMECs	Human Mammary Epithelial Cells
HSAECs	Human Primary Small Airway Epithelial Cells
HUVECs	Human Umbilical Vein Endothelial Cells
ICAM)	Intracellular Adhesion Molecule
ICAM-1	Intercellular Adhesion Molecule 1
ICs	Immune Cells
iNOS	Inducible Nitric Oxide Synthase
INFLCs	Inflammatory Cytokine
LOXs	Lipoxygenases
LPS	Lipopolysaccharide
MAPKs	Mitogen-Activated Protein Kinase
MCs	Mast Cells
MC3T3	E1 Mouse Osteoblastic Cells
MCP-1	Monocyte Chemoattractant Protein-1
MIECs	Murine Intestinal Epithelial Cells
MIP-1 β	Macrophage Inflammatory Protein
MMP-2	Matrix Metalloproteinase-2
MMPs	Matrix Metalloproteinases
MNGCs	Mesencephalic Neuron Glial Cells
mPGES-1	Microsomal Prostaglandin E Synthase-1
MPO	Myeloperoxidase

MSU	Monosodium Urate
NFAT	Nuclear Factor Of Activated T-Cells
NK	Natural Killer
NLGP	Neem Leaf Glycoprotein
NO	Nitric Oxide
NOX	NADPH oxidase
NTP	Nitro Tyrosine-Protein
PBMCs	Peripheral Blood Mononuclear Cells
PBMCs	Peripheral Blood Mononuclear Cells
PCNA	Proliferating Cell Nuclear Antigen
PINFLCs	Pro-inflammatory Cytokine
PINFLMs	Pro-inflammatory mediators
PHA	Pulmonary Arterial Hypertension
PhI	Phagocytic Index
PMA	Phorbol 12-Myristate 13-Acetate
PPARs	Peroxisome proliferator-activated receptors
RA	Rheumatoid Arthritis
ROS	Reactive Oxygen Species
SOCS3	Suppressor of Cytokine Signaling 3
STAT3	Signal Transducers And Activators of Transcription 3
TGF- β	Transforming Growth Factor
TLR4	Toll-Like Receptor 4
TREM2	Triggering Receptor Expressed on Myeloid Cells 2
VCAM-1	Vascular Cell Adhesion Molecule 1
VEGF-A	Vascular Endothelial Growth Factor A

6.1 Introduction

The immune system is the body's defense mechanism against numerous common pathogens. The elements which activate the immune system include earlier infections, vaccination, and several outside stimuli. Also, immunity is accomplished of discerning between the proteins of the body, cells and foreign invaders. Once the external element is recognized, the cumulative and corresponding counter of precise cells and arbitrator against different elements establishes the immune response (Baxter 2007). Role-based immune mechanisms classified into two main classes, i.e., nonspecific defense mechanisms and the specific immune system, (Vesely et al. 2011). The physicochemical and microbiological hurdles further seldom counted in the nonspecific immune system, but, the key intermediaries of the immune mechanism which transfer immediate shield comprise macrophages, acute phase proteins, monocytes, cytokines, neutrophils and complement. Entire stages of innate immunity comprise APCs and macrophages that have a crucial function in