

Preface

Phytochemicals are a heterogeneous non-nutritive group of chemical compounds with numerous biological effects in animals and men. They are derived from plants and form the backbone of traditional medicine, which uses plant preparations (seeds, fruits, leaves, stems and roots) as a source of drugs. Phytochemicals have been classified into five major families, carotinoids, alkaloids, nitrogen-containing phytochemicals, sulfur-containing phytochemicals and phenolics.

Phytochemicals have been used in various ancient medicinal systems (Indian, Chinese, Egyptian, Babylonian, and Greek), as potential drugs against numerous diseases. They exert specific medicinal actions without serving a nutritional role in the human diet and may be used in response to specific health problems over short- or long-term intervals. In recent years, research on phytochemicals has increased all over the world and new terms such as “functional food” and “nutraceutical” have been introduced. These terms illustrate the high expectations associated with current phytochemical research. However, the precise molecular mechanisms through which specific phytochemicals exert their beneficial biological effects still remain the subject of intense investigations. Health benefits of phytochemicals on visceral tissue and brain are due to their anti-inflammatory, antioxidant, anticarcinogenic, antiproliferative, hypocholesterolemic, and cellular repair properties. In addition, effects of phytochemicals are mediated through signal transduction processes, which not only involve various transcription factors, growth factors and inhibition of inflammatory cytokines expression, but also regulation of enzymes, such as phospholipases, cyclooxygenases, protein kinases, and protein phosphatases. Phytochemicals also mediate their effects through the modulation of immune function. Regular consumption of phytochemicals from childhood to adulthood may be associated with reduced risks of neurotraumatic (stroke, traumatic brain injury, and spinal cord injury), neurodegenerative (Alzheimer disease, Parkinson disease, and cataracts), neuropsychiatric (depression, Schizophrenia, and bipolar disorders) diseases, osteoporosis, diabetes, and some of the functional decline associated with normal aging. Antioxidant and anti-inflammatory properties of phytochemicals mitigate the damaging effect of oxidative stress, neuroinflammation, and apoptosis. The chemical structures of phytochemicals are often used as “privileged structures”

for creating their synthetic analogs, which have improved pharmacological activities through optimized bioavailability and pharmacokinetic profiles. Recently, there have been considerable developments in defining the molecular mechanisms associated with beneficial effects of phytochemicals on neurological disorders. The effects of phytochemicals on visceral and brain tissues can be conductive, additive, synergistic, and antagonistic. Through these properties, phytochemicals regulate neuronal and glial cell differentiation, proliferation, and apoptosis. Among phytochemicals, polyphenols, phenolic acids, and flavonoids scavenge reactive oxygen species (ROS), singlet molecular oxygen, and peroxy radicals generated during lipid peroxidation. In addition, the use of polyphenols and flavonoids may not only result in improvements of memory acquisition and consolidation, but also in storage and retrieval of memory. These phytochemicals are highly effective in reversing age-related declines in memory via their ability to interact with the cellular and molecular architecture of the brain responsible for memory related processes. Phytochemicals produce their effects through their ability to modulate signal transduction pathways critical in controlling synaptic plasticity, and inducing neurogenesis in the hippocampus. The ability of many phytochemicals to activate the extracellular signal-regulated kinase (ERK1/2) and the protein kinase B (PKB/Akt) signaling pathways, leading to the activation of the cAMP response element binding protein (CREB), a transcription factor responsible for increasing the expression of a number of growth factors (neurotrophins) important in defining memory, a process by which knowledge is encoded, stored, and later retrieved.

Although, many original papers, reviews, and edited books have been published on the effects of phytochemicals on visceral organs, but information on the effect of phytochemicals on brain is scattered throughout the literature in the form of original papers, and reviews. I have decided to provide readers with a comprehensive and cutting-edge description on metabolism and molecular mechanism associated with the beneficial effects of phytochemicals in neurological disorders in a manner that is useful not only to students and teachers but also to researchers and physicians. This monograph has 11 chapters. The first chapter describes the effect of lifestyle, aging, and phytochemicals on the onset of neurological disorders. Chapters 2 and 3 cover beneficial effects of extra virgin olive oil and flaxseed oil on signal transduction processes in neurological disorders. Chapter 4 provides information on the beneficial effects of flavonoids in neurological disorders. Chapter 5 describes beneficial effects of green tea catechins on neurological disorders. Chapters 6 and 7 present beneficial effects of curcumin and resveratrol in neurological disorders, respectively. Chapters 8 and 9 discuss the beneficial effects of Ginkgo biloba and garlic in neurological disorders. Chapter 10 describes beneficial effects of propolis in neurological disorders. Finally, Chapter 11 focuses on my view on the importance of phytochemicals in diet and direction for future research on neurological disorders. Studies on the effect of phytochemicals on brain fall in a fast-paced research area of neurological disorders. This monograph presents information on the metabolism, bioavailability, and proposed molecular mechanism of action in the brain, along with some pharmacokinetics. This monograph also provides information on delaying the onset and target-based treatment of neurological disorders by

using phytochemicals. This monograph can be used as supplemental text for a range of phytotherapeutics courses. Clinicians and pharmacologists will find this book useful for understanding molecular aspects of phytochemicals in neurological disorders.

I have tried to ensure uniformity in mode of presentation along with extensive bibliography. For the sake of simplicity and uniformity a large number of figures with chemical structures of phytochemicals that produce beneficial effects in neurological disorders and signal transduction diagrams showing the site of action of phytochemicals have also been included. I hope that my attempts to integrate and consolidate the knowledge on beneficial effects of phytochemicals on signal transduction processes associated with pathogenesis of neurological disorders will initiate more studies on molecular mechanisms associated with beneficial effects of phytochemicals in neurotraumatic, neurodegenerative, and neuropsychiatric diseases.

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