Chapter 9

Anti-Inflammatory Functional Foods

Charu Gupta
Amity University, India

Consuelo Pacheco
Universidad Nacional del Sur (UNS), Planta Piloto de Ingeniería Química (UNS - CONICET), Argentina

Dhan Prakash
Amity University, India

ABSTRACT

Chronic inflammation is caused by an over-expression or lack of control of the normal protective mechanisms and has been linked to heart disease, osteoporosis, cognitive decline and Alzheimer’s, type-2 diabetes and arthritis. Current medications include treatment with steroids that reduce inflammation or swelling. Long-term use of non-steroidal anti-inflammatory drugs can cause several side effects and in extreme cases can cause severe haemorrhage and renal effects. There are other various anti-inflammatory nutrients which reduce the level of these biomarkers. The polyphenols show significant anti-inflammatory, anti-oxidant and anti-DNA damaging effects. Anti-inflammatory foods such as whole grains, fruits and vegetables, which provide valuable antioxidant polyphenols, resveratrol, lycopene, phytosterols, curcuminoids, quercetin, epigallocatechin gallate, phenolic acids, alleviates inflammation, as well as strengthening the immune system. The present chapter would thus focus on the phytochemicals of nutraceutical importance for combating inflammation naturally.

INTRODUCTION

Inflammation is the immunological defense mechanism by which the body fights infection or injury from bacteria, viruses and other pathogens. The defining clinical features of inflammation are rubor (redness), calor (warmth), tumor (swelling) and dolor (pain). A tight regulation of the immune/inflammatory system is crucial for maintaining the balance between protective and tissue-damaging responses.

DOI: 10.4018/978-1-5225-7039-4.ch009
Systemic inflammatory response syndrome (SIRS) and sepsis are characterized by a loss of control over inflammatory responses, which can be provoked by a variety of causative agents and severe clinical insults. Sugar is the biggest enemy as it causes inflammation that destroys bodies and attaches to collagen, which results in stiff, inflexible, sagging skin.

Anti-inflammatory refers to the property of a substance or treatment that reduces inflammation. Anti-inflammatory drugs make up about half of analgesics, remedying pain by reducing inflammation as opposed to opioids, which affect the central nervous system (Koeberle, & Werz, 2009). Anti-inflammatory foods are those foods that play an important role in alleviating inflammation, as well as strengthening the immune system such as whole grains, fruits like acai and pomegranate; and vegetables, which provide valuable antioxidant polyphenols, resveratrol, lycopene, phytosterols, curcuminoids, quercetin, epigallocatechin gallate, phenolic acids, hydroxyl-cinnamic acids, hydroxyl-benzoic acids, and spices like cinnamon, clove, basil, parsley, rosemary, mint, thyme, oats and sunflower seeds. Besides, microalgae such as *Chlorella*, Astaxanthin and *Spirulina* have been found to have anti-inflammatory property.

**CHEMICAL ASPECTS OF THE INFLAMMATORY RESPONSE**

Inflammation is induced by the release of chemical mediators from damaged tissue and migratory cells. Mediators identified in the inflammatory process include vasoactive amines (histamine and serotonin), eicosanoids (metabolites of arachidonic acid, prostaglandins and leukotrienes), platelet aggregation factors, cytokines (interleukins and tumoral necrosis factor - TNF), kinins (bradykinin), and free oxygen radicals, among others (Ohishi, 2000). These substances are produced by inflammatory cells such as polymorphonuclear leukocytes (neutrophils, eosinophils, basophils), endothelial cells, mast cells, macrophages, monocytes, and lymphocytes (Fiala et al., 2002).

It is well established that main phenomenon activating the acute phase of inflammation is the local production of prostaglandins (especially PGE$_2$) and leukotrienes derived from arachidonic acid. These eicosanoids are relatively unstable and are notoriously non-selective in their interaction with various receptor subtypes (Hata, & Breyer, 2004).

Anti-inflammatory drugs make up about half of analgesics, remedying pain by reducing inflammation, as opposed to opioids, which affect the central nervous system. Current medications include treatment with steroids which are specific glucocorticoids that reduce inflammation or swelling by binding to glucocorticoid receptors. These drugs are often referred to as corticosteroids.

The other treatment includes non-steroidal anti-inflammatory drugs (NSAIDs), which alleviate pain by counteracting the cyclooxygenase (COX) enzyme. On its own, COX enzyme synthesizes prostaglandins, creating inflammation. In whole, the NSAIDs prevent the prostaglandins from ever being synthesized, reducing or eliminating the pain. Some common examples of NSAIDs are: aspirin, ibuprofen, and naproxen. NSAIDs are generally indicated for the symptomatic relief (Simone, 2006; Koeberle, & Werz, 2009). Long-term use of NSAIDs can cause several side effects like gastric erosions, which can become stomach ulcers and in extreme cases can cause severe hemorrhage and renal effects. There is an urgent need to find safer compounds and to develop mechanism-based approaches for the management of such diseases.

The polyphenols show significant anti-inflammatory, anti-oxidant and anti-DNA damaging effects. Based on the epidemiological evidence and laboratory studies conducted using *in vitro* and *in vivo* systems, it is suggested that routine consumption of these polyphenols may provide efficient protection.
Related Content

Importance of Biotechnology in the Development of Functional Foods in Emerging Countries: The Case of Chile
www.igi-global.com/chapter/importance-of-biotechnology-in-the-development-of-functional-foods-in-emerging-countries/211782?camid=4v1a

V2 Rhizotomy
Lucas W. Campos, Nicholas Telischak, Huy M. Do and Xiang Qian (2019). Chronic Illness and Long-Term Care: Breakthroughs in Research and Practice (pp. 610-630).
www.igi-global.com/chapter/v2-rhizotomy/213371?camid=4v1a

Chinese Herbal Medicine in the Management of Atherosclerosis-Related Chronic Conditions in an Aging Population
Enoch Chan, Sai Wang Seto, Tsoi Ming Au Yeung and Gabriel Hoi Huen Chan (2019). Chronic Illness and Long-Term Care: Breakthroughs in Research and Practice (pp. 218-240).
www.igi-global.com/chapter/chinese-herbal-medicine-in-the-management-of-atherosclerosis-related-chronic-conditions-in-an-aging-population/213348?camid=4v1a

Case Studies of Chronically Ill Children: Implications for Education Professionals
Thomas C. Gibbon, Christopher L. Schwilk, Jenifer Cline, Kimberly Matthews, Katie Sweigart, Emily Ferguson and David F. Bateman (2019). Chronic Illness and Long-Term Care: Breakthroughs in Research and Practice (pp. 303-336).
www.igi-global.com/chapter/case-studies-of-chronically-ill-children/213353?camid=4v1a