



Healing with Herbs

Herbal Therapies for Disease Prevention and Treatment

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Healing with Herbs: Herbal Therapies for Disease Prevention and Treatment

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Chapter 4: Neuroprotective Interventions with *Camellia sinensis* and *Withania somnifera*: Molecular and Antioxidant Strategies Against Cognitive Decline and Neurodegeneration

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Abstract

Neurodegenerative disorders, including Alzheimer's and Parkinson's disease, are characterized by progressive neuronal loss, oxidative stress, mitochondrial dysfunction, and impaired synaptic signaling. Among natural phytotherapeutics, *Camellia sinensis* (green tea) and *Withania somnifera* (Ashwagandha) have emerged as promising neuroprotective agents due to their potent antioxidant, anti-inflammatory, and cognitive-enhancing properties. Bioactive polyphenols such as epigallocatechin-3-gallate (EGCG) from *C. sinensis* and withanolides from *W. somnifera* modulate key molecular pathways, including Nrf2/ARE, NF- κ B, PI3K/Akt, and MAPK, thereby attenuating oxidative stress and neuroinflammation. Preclinical and clinical studies suggest that these phytochemicals enhance neuronal survival, promote synaptic plasticity, reduce amyloid- β aggregation, and restore mitochondrial homeostasis. Also, their synergistic antioxidant and immunomodulatory effects offer perspectives for integrative approaches to cognitive decline. This chapter provides an overview of the molecular areas, therapeutic potential and translational follow-up of *C. sinensis* and *W. somnifera* on neurodegeneration as a neuroprotective agent in this area.

Keywords: *Camellia sinensis*, *Withania somnifera*, neuroprotection antioxidants cognitive decline neurodegeneration molecular pathways oxidative stress polyphenols withanolides..

1. Introduction

Neurodegenerative diseases (NDs) such as Alzheimer's disease (AD), Parkinson's disease (PD), Huntington's disease (HD) and amyotrophic lateral sclerosis (ALS) are a serious challenge for global health caused by their progressive course and the absence of curative drugs. The incidence and prevalence of these diseases are growing, largely driven by the increase in life expectancy, thus becoming one of the most urgent problems in neurology and public health (Feigin et al., 2019). Dementia alone is estimated to be affecting more than 55 million people worldwide and almost 10 million new cases occur annually most of which are AD related (WHO, 2021). PD also has a prevalence of over 8.5 million people worldwide and is expected to increase by two-fold before 2040 (Dorsey et al., 2018). The central pathological feature