

Nanophytoformulation: Treatment for Neurodegenerative Disease

Pallavi Saxena, Research Scholar (Pharmacy), Glocal University, Saharanpur (U.P.)

Abstract

Neurodegenerative diseases, including Alzheimer's disease, Parkinson's disease, Huntington's disease, and amyotrophic lateral sclerosis, are characterized by progressive neuronal dysfunction and loss, creating significant therapeutic challenges. Conventional treatments often provide symptomatic relief but may have limitations related to bioavailability, systemic side effects, and inadequate delivery of therapeutic agents to the brain. Nanophytoformulations have emerged as a promising approach that combines the therapeutic potential of plant-derived bioactive compounds with nanotechnology-based drug delivery systems. This study reviews the potential of nanophytoformulations in the management of neurodegenerative diseases, with particular emphasis on improving the solubility, stability, bioavailability, and targeted delivery of phytoconstituents. Natural compounds such as curcumin, resveratrol, quercetin, and other polyphenols possess antioxidant, anti-inflammatory, and neuroprotective properties, but their clinical application can be restricted by poor absorption and rapid metabolism. Incorporating these compounds into nanoparticles, liposomes, nano emulsions, or other nanoscale carriers may enhance their therapeutic effectiveness and facilitate delivery across the blood–brain barrier. The study further discusses potential mechanisms, including reduction of oxidative stress, modulation of neuroinflammation, inhibition of abnormal protein aggregation, and protection of neuronal cells. Despite promising preclinical findings, challenges remain regarding formulation stability, toxicity, pharmacokinetics, large-scale production, standardization, and clinical validation. The study concludes that nanophytoformulations represent a promising research avenue for neurodegenerative disease management, while emphasizing the need for rigorous preclinical and clinical studies to establish their safety and therapeutic efficacy.

Keywords: Nanophytoformulation, Neurodegenerative Diseases, Nanotechnology, Phytoconstituents, Drug Delivery, Neuroprotection, Blood–Brain Barrier, Curcumin, Antioxidants, Neuroinflammation, Nanoparticles, Phytotherapy.

