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Ferula assafoetida as a Multi-Target Therapeutic Candidate for Parkinson's Disease: A Narrative Review

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Abstract

Parkinson's disease (PD) presents a complex challenge in neurodegenerative research due to the persistent lack of disease-modifying therapies, prompting exploration of natural compounds with multi-target capabilities to modulate multiple pathways. Hence, this review evaluates the therapeutic potential of the ayurvedic plant, *Ferula assafoetida*, as a candidate for PD treatment. The phytochemical profile of *F. assafoetida*, rich in bioactive sulfur volatiles, phenolic acids, coumarins, and terpenes, aligns with mechanisms implicated in PD pathogenesis, including oxidative stress, inflammation, and mitochondrial dysfunction. Critically, recent activity-guided isolation studies have successfully identified specific sesquiterpene coumarins, such as karatavicinol and farnesiferol C, as potent monoamine oxidase-B (MAO-B) inhibitors, demonstrating efficacy in ameliorating motor deficits and protecting dopaminergic neurons in a murine 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP) model of PD. This breakthrough provides the first direct experimental evidence for *F. assafoetida* in a PD model, transitioning its status from a traditional remedy to a source of validated, bioactive lead compounds. While mammalian models offer crucial translational validation, zebrafish, with their conserved dopaminergic pathways, genetic tractability, and suitability for high-throughput screening, emerge as an ideal complementary platform for accelerating future research. Advanced phytochemical profiling, integrating chromatographic methods and in silico molecular docking, could prioritize lead compounds for further investigation. The integration of gene expression analysis in zebrafish models, alongside behavioral assays, enables a comprehensive understanding of the impact of this plant on PD-related pathways. This pertinent evidence now positions *F. assafoetida* as a viable preclinical candidate. Future research should prioritize chemical standardization across different plant sources and in vivo mechanistic studies in zebrafish. By illustrating the synergy between phytochemistry and innovative model systems, this review lays the groundwork for exploring *F. assafoetida* as a promising candidate for novel PD therapies and related neurodegenerative disorders. © 2026, Brawijaya University. All rights reserved.

Author keywords

Ferula assafoetida; molecular docking; neurodegeneration; neuroprotection; Parkinson's disease; phytochemicals; zebrafish model

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