Abstract Information

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Category :	Invited Speakers
Thematic Area :	Neuropharmacology, and Ethnopharmacology
Title :	Harnessing Phytochemicals for Neuroprotection

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Abstract :

Background and Objectives:

Neurodegenerative disorders such as Alzheimer?s, Parkinson?s, and stroke remain major challenges due to the limited regenerative capacity of the central nervous system (CNS). These diseases are driven by oxidative stress, neuroinflammation, and impaired glial support, leading to progressive neuronal loss. Research from our lab investigates the neuroprotective effects of phytochemicals isolated from indigenous Ghanaian plants, such as Cryptolepis sanguinolenta and Pseudospondias microcarpa. The objective is to elucidate how these compounds modulate neuroinflammation, oxidative stress, and neurotrophic mechanisms to support neuronal regeneration.

Methods:

Phytochemicals were isolated and characterized using chromatographic methods. Their antioxidant and anti-inflammatory properties were evaluated using in vitro assays, including ROS scavenging and cytokine inhibition tests. In vivo models of neurodegeneration and chronic stress were employed to assess behavioral, biochemical, and molecular outcomes. Zebrafish models were used to examine anxiolytic and anti-stress effects. Techniques such as immunohistochemistry and enzyme-linked immunosorbent assays (ELISA) were employed to analyze glial activation and neurotrophic factor expression. Key molecules like brain-derived neurotrophic factor (BDNF) and glial cell-derived neurotrophic factor (GDNF) were measured to validate neuroregenerative effects. NMR-based metabolomics were used to measure drug action.

Results:

Cryptolepine and flavonoid-rich extracts demonstrated significant antioxidative and anti-inflammatory effects, including downregulation of TNF-? and IL-6. Behavioral studies showed that Pseudospondias microcarpa extracts reversed stress-induced deficits and modulated GABAergic and serotonergic pathways, promoting anxiolytic effects. Enhanced glial activation created a favorable microenvironment for neuronal survival, while upregulated BDNF and GDNF expression facilitated synaptic repair and neurogenesis. These compounds improved the neuronal microenvironment, promoting axonal regeneration and reducing neuronal death.

Discussion:

Phytochemicals offer a multifaceted approach to neuroprotection by addressing oxidative stress, inflammation, and neurotrophic deficits. Their role in modulating glial and neuronal pathways underscores their potential as cost-effective, sustainable therapies for neurodegenerative diseases. These findings highlight the promise of integrating phytochemicals into therapeutic strategies, particularly in resource-constrained settings.

Keywords: Phytochemicals, Neuroprotection, Neuronal Regeneration, Oxidative Stress