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Short Communication

Consumption of Herb with Neuroprotective Property

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Neurons and brain are lipid-rich and oxygen-rich organs. The oxygen metabolism in the brain leads to the formation of free radicals as by-products, thus both neurons and brain are prone to oxidative and nitrosative stresses. Formation of free radicals in the brain is inevitable from mitochondrial activity that involves transport chain, neurotransmitter synthesis, and routine process of defense mechanism by phygocytic cells and oxidative cells responses that play important roles in maintaining the brain health and functionality. Free radicals are primarily categorized into reactive oxygen species (ROS) and reactive nitrogen species RNS. The example of ROS is superoxide radical, hydrogen peroxide and hydroxyl radical, whereas the example of RNS includes nitric oxide radical and peroxynitrite. Free radicals are highly reactive molecules or atoms that contain unpaired electrons. They react with molecules such as proteins, nucleic acids, and fatty acids to get electrons and stabilize themselves but resulting in structural and functional abnormalities to the molecules. Furthermore, aldehydes derived from lipid peroxidation such as malondialdehyde and 4-hydroxynonenal further react with DNA and proteins to form adducts which contribute to pathogenesis.

Apparently, generation of free radicals are part of normal physiology, but the imbalance between ROS/RNS production and the removal leads to oxidative stress and nitrosative stress. The accumulation of free radicals, aldehydes and other adducts are responsible for the functional decline in aged brains. Accordingly, the involvement of oxidative stress in Parkinson's disease, Alzheimer's disease, Huntington's disease and multiple sclerosis have been reported. In healthy brain tissue, there is a dynamic balance between free radicals and antioxidants. The presence of antioxidants helps to neutralize and control the levels of free radicals, minimizing oxidative damage and maintaining cellular health. Antioxidants have been suggested to be able to protect neurons and the brain. For instance, antioxidant therapies play role in traumatic brain injury (TBI) by promoting better sensory, motor, and cognitive functional recovery after TBI [1]. The antioxidants found in the brain and neuronal cells comprise of antioxidant enzyme and non-enzyme. The antioxidant enzymes such as glutathione, superoxide dismutase, catalase and glutathione peroxidase scavenge free radicals during various steps of free radicals' generation [2].

Non- enzyme antioxidants are a variety of compounds with ability to scavenge and neutralize free radicals by donating electron or metal chelation. These antioxidants can be obtained from dietary sources. The chemical structure of antioxidant structures is diverse. Basically, any compounds that can donate electrons but are not being turned to reactive intermediates or products are good antioxidant compounds, and plants extracts have been found as valuable sources of antioxidant compounds. The biological activities of plants such as those spices used for culinary purposes or herbs used in traditional medicines have long been studied and are still receiving interest. Most studies are trying to discover or justify the use and health beneficial effects of such plants in the community. Neurodegenerative diseases and neurological disorders are often associated with oxidative stress, inflammation, and neuronal cell death. Efforts to prevent or reduce damage to the nervous system and brain by investigating the neuroprotective, neuroplasticity and cognitive enhancement of herbs, spices, vegetables, and fruits are important to public health and quality of life.

Several plants or herbs have effects on the central nervous system such as stimulants or enhancing cognitive thus able to alter mind, brain and behavior. For example, plants with stimulant

effects include coffee, and cocoa, whereas the example of cognitive enhancers are Gingko biloba and *Centella asiatica*. The neurotropic and neuroprotective properties of *Centella asiatica* have been associated with the triterpene compounds; asiatic acid, asiaticoside and madecassoside [3]. Physiologically based pharmacokinetic (PBPK) models for central nervous system have been used to predict exposure profiles in the brain, in particular the rate and extent of compound distribution. Nevertheless, studies using target are found more promising, especially molecular docking that helps to view the interaction and predict the biological effects of the phytochemical [4]. Results from numerous pharmacological studies showed neuroprotective effects of plants have been contributed by the phytochemicals present in the plants. Known phytochemical classes such as flavonoids, terpenoids and alkaloids are synthesized by the plants as secondary metabolites. Plants produce these phytochemicals for themselves where the main functions of these metabolites are to protect and assist in the physiological functions.

As the name implies, plants are planted on the grown and cannot go anywhere. If there is any danger or exposed to unfavorable situations such as drought and flood, they are unable to move and seek protection like animals. Plants are generally exposed to sunlight, which is a known exogenous factor stimulating formation of free radicals, therefore it is no surprise that phytochemical compounds exhibit antioxidant properties. Frequently, further research on neuroprotective agents from plant extracts suggesting strategies such as extraction of phytochemicals using more efficient techniques and solvent systems, identification of exact bioactive ingredients based on their target mechanisms in neuroprotection. Unfortunately, the therapeutic use of most antioxidant compounds is limited since they do not cross the blood brain barrier. Furthermore, the nervous system is a complex system. Thus, there is a need of antioxidant that can penetrate the blood brain barrier. The intake of herbs such as *Centella asiatica*, has been demonstrating health benefits irrespective of their specific mechanism of action or pharmacokinetics [5].

Interestingly, the key distinction between modern pharmaceuticals and herbal knowledge lies in their application. For instance, Memantine is prescribed to regulate glutamate; a neurotransmitter involved in learning and memory. It is used to manage symptoms and slow the decline of cognitive function of Alzheimer patients or individuals who already have the condition and are cautioned against for healthy individuals. Such medication must be used under the guidance and prescription of a qualified medical practitioner due to their potential for side effects. This is in contrast to C. *asiatica*, which has historical culinary use and can be consumed as vegetables. Incorporating C. asiatica in daily diet is an important effort to take care of the brain and neuron's health which can be started from a younger age. C. *asiatica* can be consumed in various forms, including herbal teas, decoctions, powders, capsules, and tinctures. In Ayurveda, C. *asiatica* is often included in specialized herbal formulations known as rasayanas. These formulations are considered rejuvenating and are believed to enhance overall well-being, including cognitive function. The rasayanas are typically used as a part of daily health maintenance, even when a person is not acutely ill.

They are intended to be taken regularly over an extended period to promote balance, vitality, and optimal health. Rasayanas are categorized as part of the preventive and promotive aspect of Ayurveda. Comprehensive toxicology research indicates that C. *asiatica* is safe for consumption. Most of the literature results indicate high safety in C. asiatica from plant parts to whole plants [6]. As a conclusion, casual consumption of C. *asiatica* by a healthy person as salad or tea can be an approach to protect the brain and neurons, regardless of how the active phytochemical arrives to the brain or react with neurotransmitter or with any receptors of nervous system. The herb has high nutritious value due to its antioxidant properties and is generally easy to cultivate in tropical settings which can be available at low cost. Nevertheless, there is an instance where the chromium (Cr), cadmium (Cd), and lead (Pb) concentrations recorded from roots and leaves of C. *asiatica* were higher than the safe limits for consumption established by the European Union. The health risk analysis indicated a potential of hyper-accumulating chromium in the roots of C. *asiatica* [7], hence promoting the urban gardening activity of C. *asiatica* for sustainable agriculture, local food production, and self-sufficiency. At the end, it is crucial to note that making self-care decisions should be a balanced approach, involving professional guidance, evidence-based information, and the individual's personal research. Active participation by patients in their health decisions is vital to ensure informed choices [8].

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