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The antioxidant potential of *Centella asiatica*: A review

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Abstract

Plants as a source of food, herbs, and medicines have been used for thousands of years in many traditional medicine systems. Growth and development in research on medicinal plant products has increased exponentially both in developed and developing nations. Possible reasons for this could include its therapeutically safe and effective action against mild and chronic diseases, and also its increased use as a dietary supplement. Since ancient times the traditional communities have been practicing precious knowledge about the use of the rich bio-sources of herbal remedies. In recent times, there has been a trend to use natural substances present in fruits, vegetables, oilseeds and herbs as antioxidants and rational foods. *Centella Asiatica* is one of the traditionally used as a medicinal herb and alternative medicine in treating numerous kinds of diseases. In food technology and food industry, the use of *centella asiatica* in food and beverages has increased over the years basically due to its beneficial functional properties. The present review is an comprehensive literature of the antioxidant potential in *centella asiatica*.

Keywords: *Centella asiatica*, medicinal properties, antioxidants

Introduction

In recent years, there has been increased effort to identify foods with high antioxidant content and health-promoting properties. Medicinal plants that have been traditionally used in medicine again recently started attracting the consumer interest because of their long history of being consumed and their ready acceptability. Medicinal plants have gained popularity all over the world due to their antioxidant activity, which are thought to exert a calming effect on the mind. The intake of herbs for the cure or prevention of diseases, to promote good health or merely to quench thirst is a traditional and daily practice in many communities. Nowadays, there is an increasing interest in the biochemical functions of natural antioxidant extracts from vegetables, fruits, and medicinal plants, which can become candidates to prevent oxidative damage, promoting health. The phenolic constituents found in medicinal plants have received considerable attention for being the main components of antioxidant activity, in spite of not being the only ones. The antioxidant activity of phenolic constituents has been attributed to its oxide-reduction properties, which play an important role in the adsorption or neutralization of free radicals [1].

Centella asiatica L. is important herbal medicinal plant used for various applications [5] and used in Indian Ayurvedic medicine as a nerve tonic [15]. Utilization of *Centella asiatica* (Centella) have been known for many years in treating all kind of diseases such as gastrointestinal disease, gastric ulcer, asthma, wound healing and eczema [2]. The use of Centella in food and beverages has increased over the years basically due to its health benefits such as antioxidant [4], as anti-inflammatory, wound healing [10] memory enhancing property [15, 16] and many others. The potential of Centella as an alternative natural antioxidant especially of plant origin and its protection against age-related changes in brain antioxidant defense system, have notably increased in recent years [16]. Free radicals have been claimed to play an important role in ageing process and capable of damaging many cellular components [3]. These changes will affect the brain as it is particularly vulnerable to oxidative damage as such many studies on its neuroprotection activity have been reported. The *Centella asiatica* L. belongs to the family Apiaceae or Umbelliferae, a small creeping perennial herbal plant that flourishes in wet areas of Malaysia, Indonesia, India, and other parts of Asia including China. The herb is also known as pegaga in Malaysia, Indian pennywort and Gotu Kola in Europe and America, mandoakaparni in India, pegagan or kaki Kuda in Indonesia, Luei Gong Gen or Tung Chain in China [17].

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Centella asiatica is used in Indian Ayurvedic medicine and in herbal medicine in Malaysia and China, and other part of Asia for hundreds of years [2]. Besides being used as a traditional and alternative medicine, *Centella* is commonly used in these countries as vegetables and drinks as in tea or juice [5].

Antioxidant properties

Currently there has been an increased interest globally to identify antioxidant compounds that are pharmacologically potent and have low or no side effects for use in preventive medicine and the food industry. As plants produce significant amount of antioxidants to prevent the oxidative stress caused by photons and oxygen, they represent a potential source of new compounds with antioxidant activity. A lot of medicinal plants have been traditionally used for thousands of years since they possess interesting antioxidant activities.

Oxidative stress is defined as an imbalance between oxidants and antioxidants, which results in subsequent damage to cell molecules constituting to the production of reactive oxygen species (ROS). ROS such as hydroxyl ions (OH⁻), superoxide radicals (O₂^{•-}), peroxide (ROO[•]) and nitric oxide radicals are produced in living organisms during excessive metabolism; causing several pathophysiological states such as cardiovascular diseases, neurodegenerative diseases, cancer, inflammatory conditions and aging. The most effective way to eliminate and suppress the action of ROS is with the help of antioxidants. Antioxidants both endogenous and exogenous, whether natural or synthetic can prove effective in counteracting free radicals by scavenging or suppressing them. The use of antioxidants was initiated by ancient Egyptians; they used plants having high content of phenolic compounds to preserve dead bodies. In India plants are being used as a source of traditional medicine since the times of Charaka and Shushruta. Medicinal plants have global importance due to the presence of phytoconstituents with effective pharmacological action. Today several synthetic antioxidants like Butylated hydroxytoluene (BHT) and Butylated hydroxyanisole (BHA) are available commercially and are being used as Nutraceutical formulations are cost effective and have minimum side effects and this is one of the major reasons that the quest for formulating a prime natural

antioxidant has become a major scientific research and industrial challenge.

Antioxidants are the substances which can protect the human body from free radicals and the ROS effects and retard the progress of many chronic diseases [18]. Apart from their biological functions in plants, these antioxidants are widely present in food products and agricultural raw materials. As the name antioxidant indicates that these compounds participate in oxidation-reduction processes, which have complex reaction mechanisms, so there is no single testing method capable of providing a comprehensive picture of the antioxidant profile of a studied sample. Many compounds in food have antioxidant properties, which are capable of interacting with reactive molecules. Antioxidants are free radical scavengers that provide protection to living organisms from damage caused by reactive oxygen species. Although almost all organisms possess antioxidant defense and repair systems, these systems are insufficient to cope over entire damage. Therefore, dietary antioxidant supplementation is promising in strengthening the antioxidant defense and repair systems. Polyphenol, flavonoid, (3-carotene, tannin, vitamin C, and DPPH (2, 2-diphenyl-1-picrylhydrazyl) compounds are readily found in *C. asiatica* contributing to significantly higher antioxidant activity in the herb. *C. asiatica* leaves showed the highest antioxidant activity which also contains highest phenolic contents, when compared to other plant parts. This result suggested that phenolic compounds are the major contributors to the antioxidative activities of *C. asiatica* [20].

C. asiatica extracts have comparable level of antioxidant activities to rosemary extracts, sage extracts [6], vitamin C [11] and grape seed extract [12], and hence they are a good target to be investigated to produce natural antioxidants. Interestingly, extraction method has an effect on the level of antioxidant activity. It was found that among three solvents, including water, ethanol and light petroleum, ethanol showed the highest antioxidant activities, followed by water, while light petroleum yielded negative activities. The antioxidant activity of *C. asiatica* was hypothesized to be the result of the reduction of hydro peroxide that inactivates free radicals and/or chelates metal ions.

Table 1: Significant compounds which provide antioxidant activity in *Centella Asiatica*

Main Group	Active Compound
Polyphenols & Flavonoids	Quercitin, Quercitrin, Kaempferol, Luteolin, Chlorogenicacid, Castilliferol, Apigenin, Rutin
Carotenoids	Neoxanthin, Violaxanthin, Lutein, Beta Carotene
Tannins	Tannin and Phlobatannin
Vitamin-C	Ascorbic acid

As in table 1 Polyphenols are available plant secondary metabolites and a critical index for determining the antioxidant capacity [9]. The antioxidant activity of polyphenols are mainly due to their redox properties, which allow them to act as reducing agents, hydrogen donors, singlet oxygen quenchers and metal chelators [7]. The mechanisms of action of flavonoids are exerted through scavenging or chelating process. Vitamin C directly interacts with a broad spectrum of ROS and terminates chain reaction initiated by these free radicals through electron transfer while involved in the regeneration of vitamin E. β-carotene is an excellent scavenger of singlet oxygen. Carotenoids are one of the most important phytonutrients found in *C. asiatica*. Carotenoids, the colorful plant pigment, some of which the body can turn into vitamin A, are powerful antioxidants that can help prevent some forms of cancer and heart disease and act to enhance

your immune response to infections. Tannins act as an antioxidant, thus provides a significant value for phytonutrient content.

Centella asiatica possesses potent antioxidant activity, which can exerted neuroprotective effect and effect against age related oxidative damage in rats brain [16]. The anti-oxidant enzymes, like superoxide dismutase (SOD), catalase and glutathione peroxidase (GSHPx) were significantly increased, and anti-oxidants like glutathione (GSH) and ascorbic acid were decreased in lymphoma-bearing mice after oral treatment with 50mg/kg of body weight per day of crude methanol extract of *C. asiatica* for 14 days [8]. Administration of aqueous extracts of *Centella asiatica* showed to counteract lead-induced oxidative stress male rats [14]. Flavonoid compounds were present in aqueous extract of *C. asiatica*, showed highest antioxidant property [13]. The antioxidant

properties of essential oils and various extracts of this plant may be a great interest in food industry, since their possible use as natural additives.

Conclusion

Centella asiatica is a reputed medicinal plant for its various pharmacological effects favorable for human health. Besides its potent wound healing property, a number of studies described the noteworthy protective effect of the plant against several diseases. *Centella asiatica* is a very important herbal plant in food and beverages. Its potential as a natural antioxidant extract reflects its capability to become a entrant to prevent oxidative damage, hence promoting health benefits. Many studies especially in animal experiments and in human interventions have shown its wide pharmacological activities in brain improvement and neuroprotection effect. With a very low toxicity as attested by its long popular use as a natural product, Centella can be a potential herbal plant in many healthcare applications.

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