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The Therapeutic Advantages of Lotus Stem: A Review

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Abstract

Lotuses are flowering plants of the species Nelumbo nucifera Gaertn. (Nymphaeaceae), commonly referred to as sacred lotuses. These phytoconstituents are useful for therapeutic applications because they have been isolated from various parts of the plant. Lotuses are aquatic perennial basal eudicots that belong to a small family of just two species and one genus. They are an essential horticultural plant that has been used extensively for medicinal, decorative, and nutritional purposes, especially in Southeast Asia. Parts of lotus plants, such as the flower, seed, root, leaf, and stem or rhizome, have great potential for both food and non-food packaging. Its particular bioactive ingredients, which include essential oils, flavonoids, alkaloids, and phenolic compounds, have been shown to be effective in enhancing health. Its high content of nutritive fibre, starch, nutrients, and minerals suggest that it has a good chance of being valorised in the future and used as a helpful component and addition in the food industry. It's interesting to note that lotus (Nelumbo nucifera) seeds are edible, have therapeutic properties, and are a key raw ingredient in ancient traditional scientific methods like Ayurvedic and folk medicine. Lotus seeds are high in protein and minerals, and their tender rhizomes, stems, and leaves are safe to consume. Lotus stem, which is high in antioxidants, minerals, and vitamins, has several health advantages, such as better immune system, heart, and digestive health. It is good for diabetics because of its high fibre content, which promotes regularity in the gut and helps control blood sugar levels. It also helps people lose weight, detoxify their bodies, maintain healthy skin, and reduce inflammation. As a wholesome and adaptable supplement to a well-balanced diet, lotus stem is additionally believed to improve mental health by lowering stress and elevating mood.

Keywords: *Lotus, Nutrition, Pharmaceutical, Alkaloids, Antioxidants, Anticancerous*

1. Introduction

Although its broad peltate leaves (60 to 90 cm and longer) rise above the water surface on 1- to 2-mlong petioles, the lotus (*Nelumbo nucifera* Gaertn.), also known by several popular names (such as Indian lotus, Chinese water lily, as well as sacred lotus), is a perennial large, herbaceous aquatic species with rhizomes (often called roots) that grow in the mud (Zhang et al., 2015b). The hermaphrodite, solitary, white to rose flowers have a diameter of 10 to 25 cm and ovoid, glabrous, mature carpels that are 12 mm long. Many ovoid seeds, including seed epicarp, are lodged in the seed heads or seed pods (also known as receptacles), which resemble the spout of a watering can.

The green embryo (also known as the seed plumule; Sridhar & Baht, 2007) is situated between the seed coat and the seed kernel (white cotyledon). Although practically every part of this plant is useful, the most commonly consumed components are the rhizomes and seeds (Rai, Wahile, Mukherjee, Saha, & Mukherjee, 2006). The high quantity of physiologically active chemicals in lotus seeds and rhizomes, together with their processing by-products, makes them popular throughout Asia (China, Japan, India, and other Southeast Asian countries), the Americas, and Oceania (Mukherjee, Mukherjee, Maji, Rai, & Heinrich, 2009). Crucially, lotus products—such as the plumule, stamen, pistil, and leaf—are utilised not only as food but also as herbal remedies.

The "Chinese Pharmacopoeia" lists the lotus's seedpod, root node, and other components (Miller et al., 2002). In an effort to enhance the lotus plant's classification system, research has been done. It is currently one of the ten most well-known traditional plants in China, with around 608 varieties classified by morphological traits (Wang & Zhang, 2004; Guo,2009;Lietal.,2010). It has long been recognised that lotuses have numerous health benefits. The entire plant has anti-oxidant, anti-neurodegenerative, psychopharmacological, immunomodulatory, and anti-advanced glycation end-products (AGEs) properties, as well as anti-obesity, anti-diabetic, cancer-preventing, and photoprotective properties. It is also an astringent, emollient, diuretic, and sudorific.

The lotus's bioactivities have been linked to its distinctive chemical components, phenolic acids and flavonoids, which have attracted a lot of attention lately (Rai et al., 2006). Numerous studies have been conducted on the differences in the kind, quantity, and characteristics of the lotus's flavonoids and phenolic acids as well as those found in its processed food items. Due to the detrimental effects of phenolic compounds conjugating with food elements such peptides, proteins, lipids, and carbohydrates, a lot of research has been done on the nutritional properties of phenolic compounds (Alu'datt et al., 2017; Lu & Luthria, 2016). This could lessen food products' nutritional value and digestibility (Alu'datt, Rababah, Ereifej, & Alli, 2013, 2016).

Yang et al. Lotus (*Nelumbo nucifera*) Bioactive Parts

2.Value of nutrition

Lotus leaves, stems, and tender rhizomes can be pickled in vinegar (Phillips and Rix 1995), steeped in syrup, or cooked with other vegetables (Anon 1992). 1.7% protein, 0.1% fat, 9.7% carbohydrates, and 1.1% ash make up rhizomes (Reid 1977). Lotus leaves are used as a home cure to treat obesity in China and summer heart disease in Japan and China (Ono et al., 2006). Lotus stamens are used to flavour tea, while lotus petals are used as a garnish or in soups (Facciola, 1990). The seeds' green embryos have a harsh taste. The seeds can be used to make bread, crushed into a powder and eaten dry, or popped like popcorn.

The roasted seeds provide significant amounts of saponins, phenolics, and carbs and make a suitable coffee substitute (Anon., 1992; Ling et al., 2005). 10.5% moisture, 10.6-15.9% protein, 1.93-2.8% crude fat, 70-72.17% carbohydrate, 2.7% crude fibre, 3.9-4.5% ash, and 348.45 cal/100 gn are the components of N. nucifera seeds (Reid, 1977; Indrayan et al., 2005). Chromium (0.0042%), sodium (1%), potassium (28.5%), calcium (22.1%), magnesium (9.2%), copper (0.0463%), zinc (0.084%), manganese (0.356%), and iron (0.199%) are the minerals found in lotus seeds.

3. Value of pharmaceuticals

The lotus plant is primarily used medicinally. Antifungal, antipyretic, and anticancer properties are present in the entire plant. The lotus plant's many parts can be used to treat haemostasis, tissue inflammation, and diarrhoea. (Yu and Hu, 1997). Pharyngopathy, pectoralgia, spermatorrhea, leucoderma, smallpox, diarrhoea, dysentery, and cough are all treated using rhizomes. The stem is utilised in traditional Ayurvedic medications as an anthelmintic and diuretic, as well as to cure nervous weariness, vomiting, leprosy, strangury, and skin conditions. Young leaves can be used to treat diarrhoea with goat milk and rectal prolapse with sugar. In cases of fever and inflammatory skin diseases, leaf paste can be administered topically. Haematemesis, epistaxis, haemoptysis, haematuria, and metrorrhagia can all be effectively treated with leaves (Ou, 1989). Consuming flowers is advised to encourage pregnancy, and the leaves and blossoms can be used to cure a variety of bleeding conditions. Flowers can be used to treat cholera, fever, hepatopathy, diarrhoea, and hyperdipsia.

In traditional medicine, seeds are used to cure leprosy, cancer, skin conditions, inflammation of the tissue, poison antidote, and are typically administered to youngsters as a diuretic and refrigerant. Cough can be treated with a mixture of seed powder and honey (Chopra et al., 1956). Astringent lotus fruits and seeds are used to cure fever, leprocy, halitosis, hyperdipsia, dermatopathy, and menorrhagia (Nadkarni, 1982). While roots with ghee (melted fresh butter), milk, and gold increase strength, virility, and intellect, seed powder combined with honey is helpful for coughing. According to reports, lotus seeds offer a wealth of antibacterial qualities (Mukherjee et al., 1995; Mukherjee, 2002).

4.Anti-cancer properties

The ability of LSPCs and flavonoids, which are isolated from lotus leaves and roots, can inhibit the growth of tumours was accomplished by a variety of methods, such as cell-cycle arrest (Yang et al., 2011), tumour growth inhibition (Duan et al., 2010b), proliferation (Chang et al., 2016; Yang et al., 2011), and cell migration (Karki, Rhyu, & Kim, 2008). Additionally, MMPs secretion was suppressed (Ho et al., 2010; Karki et al., 2008), tumour cell death through apoptosis was induced (Duan et al., 2016; Guon & Chung 2016), and antioxidant enzyme and immunomodulatory activities were stimulated (Duan et al., 2010b). Hepatoma G2 cells (Duan et al., 2016) and breast cancer cell lines MDA-MB-231 cells (Chang et al., 2016) and MCF-7 cells (Yang et al., 2011) were among the cell lines under study. With an IC50 of 4.26 mg/mL, lotus leaf extracts can inhibit tumour cells by blocking the progression of cells from the G1 to S phases (Yang et al., 2011) and by knocking down the connective tissue growth factor in a concentration-dependent manner (Chang et al., 2016). Additionally, lotus leaf extracts reduced tumour weight, suppressed cell invasion, and somewhat inhibited cell growth at dosages of 0.5 to 2.0 mg/mL (Chang et al., 2016). With a protein carbonyl value of 17.18 nmol/mg protein, mice's skin protein oxidation was prevented by long-term use of lotus seed tea (Kim & Moon, 2015). In the meantime, lipid peroxidation was significantly inhibited by lotus leaf extract at a dose of 100 μg/mL. (Duan et al., 2010a; Huang et al., 2013). In addition to UV radiation, many individuals experience radiotherapy side effects. At a dose of 200 mg/kg bw, procyanidins that were isolated from the lo tus seedpod were successful in raising the median fatal dose of radiation from 8.9 to 10.5 Gy and decreasing radiation-induced mortality. Additionally, they shielded the irradiated mice's skin and spleen from harm (Duan et al., 2010a).

5. Lotus stem health benefits

In actuality, outside variables like the drying technique and particular processing circumstances may have an impact on the antioxidant properties of NLEs (Guo et al., 2020). NLEs processed by microwave vacuum drying showed higher total phenolic content (TPC) and flavonoid content (TFC), along with FRAP and ABTS's stronger antioxidant ability.

In contrast to hot air drying and electric ovens (Wang, Li, et al., 2019). In a study comparing the CAAs from 23 herb plant organ samples, NLEs showed a relatively higher CAA value (~75 μmol quercetin equivalent/100 g), according to evidence from the cellular antioxidant activity (CAA) assay, a cell-based assay used to evaluate active substance antioxidation (Wolfe & Liu, 2007). (Chen, Wang, et al., 2019). Furthermore, NLEs' protective effects against oxidative stressors, which arise when oxidation surpasses the body's antioxidant mechanisms, may potentially indicate their potential antioxidant activity.(Horng, Yang, Chen, Chang, & Wang, 2017; Huang et al., 2010b; Jung et al., 2008). By preventing internal reactive oxygen species generation, the soluble components of NLEs demonstrated a cytoprotective impact against oxidative stress (Lee, Kim, & Je, 2015; Xu & Wang, 2014). Fish given alcoholic extract of NLEs had a dose-dependent improvement in their serum antioxidant capacity, as evidenced by lower serum levels of malondialdehyde (MDA) and higher levels of superoxide dismutase (SOD), glutathione (GSH), and T-AOC (Zhu et al., 2019).

6. Conclusion

The lotus seeds looks promising as a potential source of alternate protein supplements and pharmaceuticals. The market is expected to expand due to increasing awareness of its nutritional benefits and demand for natural, gluten-free ingredients. Innovations in product development, particularly in functional foods and dietary supplements, are also driving the market.

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