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REVIEW ON VARIOUS ACTIVITIES EXHIBITED BY *SOLANUM MELONGENA* L.

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ABSTRACT
Solanum melongena L. (eggplant) of family Solanaceace is a widely cultivated, herbaceous vegetable valued for both its nutritional and medicinal properties. It is low in calories and rich in vitamins, minerals, dietary fibers, amino acids, and diverse bioactive compounds, including flavonoids, phenolic acids, glycoalkaloids, tropane, lanosterol, arginine, and sterols such as sitosterol. These phytochemicals contribute to its antioxidant, anti-inflammatory, antimicrobial, anti-urease, anti-asthmatic, analgesic, antipyretic, hypotensive, hypolipidemic, antiplatelet, and CNS-modulating activities. Chemical analyses, including Gas Chromatography-Mass Spectrometry and standard phytochemical assays, have identified key compounds such as quinic acid, chlorogenic acid, glutamate, aspartate, and fructose, with several reported for the first time in S. melongena. The methanolic and other extracts of eggplant demonstrate moderate to strong biological activities, including free radical scavenging, ferric reducing power, urease inhibition, and antimicrobial effects. Traditional herbal medicine has long utilized eggplant for health management, and modern research supports its potential as a functional food with therapeutic applications in disease prevention and health promotion.

KEYWORDS: Solanum melongena.L, Anti-inflammatory, Eggplant, Antimicrobial.

INTRODUCTION
Plants are remarkable producers of a wide array of metabolites that are crucial for their growth and survival, as well as for human health. These metabolites are broadly classified into primary and secondary metabolites. Primary metabolites, including proteins, carbohydrates, lipids, and vitamins, are essential for plant development and physiological processes and also form a vital component of the human diet. Secondary metabolites, on the other hand, are not directly involved in growth but play critical roles in plant defense against environmental stresses and pathogens. Importantly, these phytochemicals, such as flavonoids, phenolic acids, alkaloids, tannins, saponins, and phytosterols, are widely used in traditional and modern medicine and constitute the foundation of the pharmaceutical industry.[1]

Vegetables are among the richest dietary sources of these compounds, providing essential vitamins (A, B-complex, E), minerals, dietary fiber, and diverse phytochemicals. Regular consumption of vegetables has been linked to improved overall health, including reduced risk of cardiovascular diseases, diabetes, cancer, stroke, anaemia, gastric ulcers, and other chronic conditions. Globally, more than 400 vegetable species are cultivated, representing over 230 genera and 69 families, with leafy vegetables being the most frequently consumed, followed by root vegetables and fruits.[1]

Eggplant (*Solanum melongena* L.), also known as brinjal, aubergine, melongene, or patlican, is a widely cultivated vegetable of the Solanaceae family, valued for both its nutritional and medicinal properties. Native to South Asia, it has spread to China, Africa, Europe, and the Americas over centuries. Eggplant is a warm-season crop with bushy foliage, typically 60–95 cm in height, and produces fruits that vary widely in shape (from egg-

shaped to elongated) and color (white, green, yellow, purple, or nearly black).[1]

The fruit is low in calories but rich in minerals, vitamins, and bioactive phytochemicals, including phenolic compounds such as chlorogenic acid, flavonoids, and nasunin (delphinidin-3-(coumaroyl-rutinoside)-5-glucoside), which are concentrated in the peel. These compounds contribute to eggplant's antioxidant capacity and other health-promoting effects, making it one of the top ten healthiest vegetables. Over centuries, eggplant has gained global economic, nutritional, and medicinal significance, and continues to be a subject of extensive research for its phytochemical and therapeutic properties.[1]

The long-standing use of herbal medicines in India has greatly contributed to the evolution of Ayurveda, one of the oldest organized systems of medicine in the world. Beyond Ayurveda, traditional medicine throughout the country has relied on numerous common plants and plant products as household remedies for a variety of ailments. Among these, *Solanum melongena*.L, commonly known as eggplant or brinjal, is an economically and medicinally important flowering plant belonging to the Solanaceae family. The Solanaceae family comprises approximately 75 genera and over 2,000 species, most of which are herbaceous, producing berry-type fruits with seeds containing a large endosperm. Many members of this family are cultivated both as food and for their medicinal properties.[2]

Solanum melongena is widely distributed across India and other tropical and subtropical regions, primarily valued for its edible fruits. Various parts of the plant—including fruits, leaves, and seeds—have been traditionally used in the management of numerous health conditions, such as inflammatory disorders, cardiac weakness, neuralgias, nasal ulcers, cholera, bronchitis, and asthma. Beyond its traditional uses, modern research has highlighted the pharmacological potential of eggplant, demonstrating properties such as antioxidant, anti-inflammatory, hypolipidemic, antidiabetic, and antimicrobial activities. This dual significance of *S. melongena*—as both a nutritional vegetable and a medicinal plant—makes it a promising candidate for further studies aimed at exploring its bioactive compounds and therapeutic applications.[2]

The medicinal properties of eggplant are closely linked to its rich nutrient and phytochemical composition. It contains bioactive compounds such as flavonoids, phenolic acids, alkaloids, tannins, saponins, anthraquinones, and phytosterols, which exhibit protective or disease-preventing activities. These compounds have been associated with the prevention of major chronic diseases, including cancer, diabetes, cardiovascular disorders, and hypertension, and often act synergistically with dietary nutrients to enhance their health benefits. Phenolic acids, for example, are potent antioxidants synthesized via the phenylalanine ammonia-lyase (PAL) pathway and play critical roles in plant defence, while also offering protective effects against oxidative stress in humans. Phytosterols, structurally similar to cholesterol, contribute to lowering LDL-cholesterol and improving cardiovascular health.[3]

Solanum melongena L., commonly known as eggplant, is a widely consumed vegetable with round or oval fruits, available in white, green, or purple shades. It is an important dietary component and a source of income in regions like West Africa. Eggplant is rich in nutrients and bioactive compounds, including flavonoids, phenolic acids, alkaloids, tannins, saponins, and phytosterols, which contribute to its antioxidant, anti-inflammatory, hypoglycemic, and hypolipidemic properties. Phenolic acids and phytosterols play key roles in human health by preventing oxidative stress and reducing cholesterol levels. Additionally, eggplant provides essential amino acids and sugars that support protein synthesis and energy metabolism. Nutritional and phytochemical profiling highlights its significance as both a dietary and therapeutic plant, underscoring its value in promoting health and preventing chronic diseases.[3]

Among plant families, Solanaceae has been widely recognized for its medicinal properties, including anticancer potential, due to the presence of diverse bioactive compounds. *Solanum melongena* L., commonly known as eggplant, is a member of this family and has been reported to exhibit various biological activities. The fruit is rich in phenolic compounds, including chlorogenic acid, saponins, terpenes, flavonoids, and alkaloids, which contribute to its potent antioxidant and anti-inflammatory effects.[4]

Lignanamides from eggplant have been shown to inhibit nitric oxide production and reduce vascular permeability, while some extracts exhibit antiviral activity.Importantly, recent studies suggest that eggplant extracts may possess anticancer properties. Ethanolic and methanolic extracts of *S. melongena* have demonstrated cytotoxic activity against colon cancer cells in vitro, largely attributed to compounds such as solasodine, nasunin, chlorogenic acid, delphinidin derivatives, and caffeic acid conjugates. These bioactive molecules induce apoptosis, inhibit cancer cell proliferation, and may modulate signaling pathways involved in tumour growth. However, despite promising preliminary findings, the activity of eggplant-derived compounds in different tumour types, their molecular mechanisms, and potential side effects remain largely unexplored.[4]

Investigating their phytochemical composition, evaluating their effects in vitro and in vivo, and elucidating the underlying mechanisms of action may provide valuable insights for developing natural, effective, and safer interventions for colorectal cancer.[4]

AIM

This review article aims to comply the various activities exhibited by plant *Solanum melongena*. L.

DESCRIPTION

Taxonomical Classification[5]

Kingdom: Plantae
Phylum: Tracheophyta
Class: Magnoliopsida
Order: Solanales
Family: Solanaceae
Genus: *Solanum*
Species: *S.melongena*.L

Scientific name: *Solanum melongena* L.[1]

BRINJAL FLOWER 6

GREEN BRINJAL AND LEAVES7

ACTIVITIES EXHIBITED[2]

Analgesic Activity

Vohora *et.al*, tested the effect of crude alkaloidal fraction isolated from leaves of *Solanum melongena* on the central nervous system. It exhibited significant analgesic effect. Mutalik *et.al*, evaluated the analgesic effect of leaves of *Solanum melongena* in albino mice with the doses of 100 mg, 250 mg and 500 mg/kg body weight. It showed significant dose-dependant analgesic activity in acetic acid-induced writhing test.

Anti-inflammatory Activity

Han *et.al*, studied the anti–inflammatory effect of the water extract of *Solanum melongena* (SMWE) in PAR–2-mediated mouse paw oedema, induced by injecting trypsin or transcinnamoyl – LIGRLO–NH (2) 1 hour after oral administration of SMWE at the doses of 1, 5, 10 and 100 mg/kg. It showed significant inhibition of both paw oedema and vascular permeability.

Anti-asthmatic Activity

Bello *et.al*., carried out a randomized double-blind placebo control, clinical trial of *Solanum melongena* fruit at a dose of 89 ± 0.6 g of fruit/day in moderate to severe asthmatics. It was found that after 2 weeks of daily intake, the fruit of Solanum melongena significantly improved asthma symptoms and signs and disease severity score. It was found to have a salbutamol sparing effect.

CNS Depressant Activity

Vohora *et.al*, studied the effect of crude alkaloid fraction of *Solanum melongena* leaves on the central nervous system (CNS). The result showed that it has some CNS depressant activity.

Antiplatelet and Calcium Channel Blocking Activities

Gul *et.al*, studied antiplatelet, calcium channel blocking activity of *Solanum melongena*. Different solvents were

used to extract the fractions. Antiplatelet activity was monitored using dual channel Lumi aggregometer, calcium channel blocking activity was tested on guinea pig ileum using isolated organ bath assembly. The results showed that aqueous fraction, ethylacetate fraction and chloroform fraction potently inhibited platelet aggregation and calcium channel blocking activity.[2]

PHENOLIC ACIDS, AMINO ACIDS AND SUGARS IN EGGPLANT[3]

In the phenolic acid profile of unripe *Solanum melongena*.L (round variety), phenol and chlorogenic acid were the most abundant. Phenols are important antioxidants that help prevent disease, and chlorogenic acid has multiple health benefits, including anti-inflammatory, anti-diabetic, cardioprotective, and neuroprotective effects. It is also highly bioavailable in humans. Cinnamic acid contributes to flavour, and both phenols and sugars influence the fruit's taste.

The fruit contains nine essential amino acids needed for body functions, with glutamate and aspartate being the most abundant. Leucine, important for muscle building, meets dietary standards, and arginine is present at beneficial levels for children. Eggplants are therefore a good source of both essential and non-essential amino acids.

Fructose was the predominant sugar, while glucose and other sugars like rhamnose, maltose, lactose, and ribose were low, making the fruit suitable for diabetics and those on weight-loss diets.

Overall, the phytosterols, phenolic acids, amino acids, and sugars in unripe eggplant contribute significantly to its nutritional and medicinal value.[3]

HEALTH BENEFITS OF EGGPLANT[1]

Eggplant is not only nutritionally important but also rich in therapeutic compounds. Studies show that eggplant extracts can help treat burns, warts, inflammation, gastritis, stomatitis, and arthritis. Its secondary metabolites—especially chlorogenic acid—provide strong anti-obesity, anti-inflammatory, anti-diabetic, cardio-protective, and anticancer effects. Chlorogenic acid can trigger apoptosis in cancer cells and shows antimicrobial activity against bacteria such as *E. coli*, *S. aureus*, *B. subtilis*, and *V. cholerae*.

Eggplant is also a major source of anthocyanins, which help prevent diabetes, neurological disorders, cardiovascular diseases, and cancer. The anthocyanin nasunin, abundant in purple eggplant, protects cells from oxidative damage caused by excess iron. Anthocyanins also improve heart health by reducing LDL oxidation, lowering triglycerides, increasing HDL levels, and preventing obesity. They also aid in ulcer treatment and vision protection.

Carotenoids in eggplant support immune function and reduce cancer risk. Since the body cannot produce carotenoids, eggplant can help prevent Vitamin A deficiency in developing countries. Glycoalkaloids like solasodine show anticancer and anti-inflammatory activity and may lower cholesterol. Eggplant's fiber improves digestion, removes toxins, and helps reduce colon and stomach cancer risk. Its phytonutrients protect cell membranes, support memory, and may help prevent brain tumours.

Minerals such as magnesium, manganese, potassium, copper, and iron contribute to healthy bones and blood. Eggplant acts as an iron chelator and is recommended for pregnant women, nursing mothers, and adolescent girls to help manage anemia and menstrual issues.

Eggplant has traditional medicinal uses for asthma, dysentery, high blood pressure, diabetes, arthritis, heart disease, bronchitis, and osteoporosis. Mature fruits treat stomach issues and swelling, while root and leaf juices are used for skin diseases, cough, burns, inflammation, and throat or stomach problems. Iron-deficient individuals benefit from varieties like Turkey berry and Thai eggplant. Fresh fruits strengthen bones and control diabetes, while dried eggplant helps relieve bloating, gas, and piles.[1]

CONCLUSION

In conclusion, *Solanum melongena*.L (eggplant) is a nutritionally rich and medicinally valuable plant containing a wide range of bioactive compounds that contribute to its significant therapeutic potential. Its phenolic acids, flavonoids, glycoalkaloids, phytosterols, amino acids, and essential minerals collectively provide strong antioxidant, anti-inflammatory, antimicrobial, antidiabetic, hypolipidemic, neuroprotective, and anticancer effects. Traditional and modern studies alike highlight eggplant's effectiveness in managing conditions such as asthma, arthritis, cardiovascular disorders, diabetes, and digestive problems, while compounds like chlorogenic acid and nasunin offer notable protective roles at the cellular level. With its diverse health benefits, low calorie content, and beneficial sugar profile, eggplant stand out as both a functional food and a promising natural therapeutic agent. Continued research on its phytochemical composition and biological activities may further enhance its applications in promoting human health and preventing chronic diseases.

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