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Solanine: A discussion in brinjal by biochemical way

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Abstract
Solanum melongena (eggplant) is a vegetable crop. It has been grown in India for over 4,000 years. Brinjal fruit contains a variety of nutrients and is low in calories. Among them, one of the alkaloids is present in brinjal. The name is solanine. Solanine is a phytoalkaloid. Solanine is naturally produced in various crops such as potatoes, tomatoes, brinjal, berries, and capsicum. Alpha solanine is synthesized for plant protection in the nightshade family of Solanaceous. Steroidal glycoalkaloid is a poisonous substance when its quantity is higher. For example, in brinjal, 60 mg/100 g is considered poisonous. Normally, brinjal has less than 10 mg/100 g in its fruit. Solanine is present in fruits, tubers, and leaves. More than 10 mg/100 g alpha solanine produces a bitter taste and it may cause an allergic reaction in some people. It produces reversible cholinesterase activity (neuro damage) in human beings. Solanine has many beneficial effects on plants as well as on human beings. Sometimes it may cause ill effects on human beings. Solanine may be reduced in brinjal by different cooking processes, which are discussed below.

Keywords: Brinjal, Solanine, beneficial effect, ill effect

Introduction
Solanum melongena (Eggplant) is a solanaceous vegetable crop. It originated in Indo-Burma. The first eggplant was cultivated in the fifteenth century in Europe. The name was derived from the white egg-like fruits. The important eggplant (brinjal) growing countries are India, Indonesia, Japan, China, Bulgaria, Italy, France, the USA, and many African countries. The second largest producer of brinjal is India, after China. Brinjal-producing states in India are West Bengal, Orissa, Karnataka, Bihar, Maharashtra, Uttar Pradesh, and Andhra Pradesh. Brinjal (eggplant) has many nutritional benefits, including low-calorie content as well as important minerals (calcium, magnesium, iron) and vitamins.

Table 1: Composition per 100 g of edible portion

Calories	24.0	Sodium (mg)	3.0
Moisture content (%)	92.7	Copper (mg)	0.12
Carbohydrates (%)	4.0	Potassium (mg)	2.0
Protein (g)	1.4	Sulphur (mg)	44.0
Fat (g)	0.3	Chlorine (mg)	52.0
Fiber (g)	1.3	Vitamin A (I.U.)	124.0
Oxalic acid (mg)	18.0	Folic Acid (µg)	34.0
Calcium (mg)	18.0	Thiamine (mg)	0.04
Magnesium (mg)	15.0	Riboflavin (mg)	0.11
Phosphorus (mg)	47.0	B-carotene (µg)	0.74
Iron (mg)	0.38	Vitamin C (mg)	12.0
Zinc (mg)	0.22	Amino Acids	0.22

***Source*:** National Institute of Nutrition, 2007

Vegetative growth in eggplant
Brinjal is a warm-season crop. It requires a temperature of 13–21 °C. It is mainly a rabi crop. Brinjal thrives in a clayey or loamy soil. It requires a pH range of slightly acidic, i.e., 5.5–6.6. The immature fruits are used as a vegetable in food preparation. Brinjal is a hardy vegetable crop. So it may successfully grow in a dry area with low irrigation. Brinjal vegetative growth mainly depends on the presence of nitrogen elements in soils. This type of crop requires less water during its vegetative growth stage.

Reproductive growth in eggplant

In eggplant, reproductive growth has five stages from bud formation to the whole flowering stage. The duration of reproductive growth may be influenced by genotype and temperature. The first flowers in brinjal may start two to three months after sowing. Brinjal is a cross-pollinated crop.

Solanine – Alkaloid

Solanine is an alkaloid. It is a toxic substance. It is naturally synthesized in the nightshade family of Solanaceous. Solanine is present in potatoes (*Solanum tuberosum*), tomatoes (*Solanum lycopersicum*), and brinjal (*Solanum melongena*). Solanine occurs in leaves, fruits, and tubers. Solanine is a glycoalkaloid poison first extracted from berries.

Solanine's role in brinjal

Solanine is one of the plant's defense biomolecules. Solanine acts as a defensive agent against fungi, bacteria, and insects. Solanine is present in low levels. Alpha solanine is found in brinjal fruits at a concentration of 11 mg/100 g. Solanine is a steroidal glycoalkaloid. African society uses this glycoside in brinjal and potato for the treatment of human immunodeficiency diseases. Brinjal is recommended for diabetic patients and also for people with liver complaints. It may reduce the severity of diseases.

Solanine-in terms of the biochemistry

Solanine is a tri-glycoside compound. It contains a nitrogen compound in a steroidal structure (aglycone) and a carbohydrate side chain at the 3–OH position. The steroidal structure was derived from cholesterol. The carbohydrate in alpha solanine is a trisaccharide composed of glucose, galactose, and rhamnose. C45H73NO15 is the overall molecular formula of solanine. In humans, alpha-solanine absorption in the gastrointestinal tract is lower in humans. Alpha solanine is immediately transferred into the spleen in the highest concentration and then into the liver, kidney, heart, lung, brain, and blood in a lower concentration. The stomach hydrolyses the toxic glycoalkaloid of alpha solanine into less toxic solanidine. The final metabolite, solanidine, is eliminated through faeces immediately, and less quantity is eliminated through urine. The highest quantities of solanine may produce gastrointestinal and neurologic disorders in some people. It may cause vomiting and diarrhea. Solanine poisoning may be avoided by using a different method of cooking, maybe deep frying. Fluid balance in human beings may reduce the severity of solanine poisoning.

How to reduce solanine in a natural way?

Solanine is a bitter-tasting steroidal alkaloid that has been isolated from all nightshade crops, including tomatoes, capsicum, tobacco, berries, and eggplant. Cooking, baking, and other processes never destroys the solanine content. The boiling process may decrease the solanine content by up to 3%. The microwave cooking process may decrease the solanine content by up to 15%. Solanine is not fully removed by boiling, but it can be destroyed by frying. Brinjal deep frying may destroy the solanine content by a higher percentage.

Conclusion

Solanine is naturally synthesized in brinjal fruits for plant protection from fungi and insects. Solanine is a secondary metabolite product. It is an alkaloid substance. Consuming brinjal with low quantities of Solanine may have some beneficial effects on human beings. It may be recommended for diabetes and liver patients. When we consume brinjal in high quantities of Solanine, it may cause ill effects in human beings. Reducing the allergy component in brinjal or destroying the alpha-Solanine in brinjal by the effective cooking process may be done by overheating or deep frying.

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