



Pharmacognosy And Phytochemistry of *Solanum Lycopersicum* (Tomato)

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Received: 18 Jan 2025 / Accepted: 27 Mar 2025 / Published online: 01 Apr 2025

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ABSTRACT

Tomato (*Solanum lycopersicum*, Solanaceae family) is a popular vegetable around the world. In some parts of the world, it is considered fruit. Medicinal properties of tomato are not very well known. This article is a comprehensive review about pharmacogenetic, phytochemical constituents and pharmacological profile of tomato.

KEY WORDS: *Solanum lycopersicum*, Tomato, *Solanum*,

INTRODUCTION

The tomato (*Solanum lycopersicum*, Solanaceae family) is a soft, spreading plant that belongs to the nightshade family. It's commonly called the love apple and is grown mainly for its fruit, which we usually treat and use as a vegetable.¹ Many plants are grown in tropical and subtropical regions of the world.² Among which tomato is one of them. It's a vital food source and a major crop. It is also widely used for its health benefits. A large percentage of the world's tomatoes, around 30-40%, are used to make products like canned tomatoes, tomato juice, ketchup, puree, paste, and dried tomatoes. In 2025, India's tomato production is expected to grow slightly, reaching an estimated 215.49 lakh tons, up from 213.23 lakh tons in the previous year. This reflects a 1.06% increase.³

The tomato is mentioned in various food and health guides, and it is used in traditional systems of medicine too. The tomato belongs to the *Solanum* genus, which includes around 1,500 species worldwide. This genus is important for health because many of its plants contain natural chemicals like lycopene, flavonoids, vitamins (like vitamin C), and antioxidants. In India, out of many *Solanum* species, the tomato is the most commonly used for food and traditional medicine.⁴ These species are used to effectively treat different types of cancer, such as lung, prostate, stomach, cervical, breast, mouth, colon, oesophagus, and pancreatic cancer. They are also used to lower high blood pressure, reduce swelling (oedema), and treat kidney and liver issues. Some are known for their antioxidant and cleansing (cathartic) effects. To maintain healthy skin, tomato juice can be used alone or combined with avocado, buttermilk, honey, lime, yogurt etc in a variety of DIY treatments.¹

Solanum lycopersicum (family Solanaceae) is commonly called Tamatar in Hindi, Tamati in Tamil, Thakkali in Malayalam, Tameta in Gujarati, Tomaato in Marathi, Tumat in Bengali, Tumat in Punjabi, Domato in Konkani, Tamator in Oriya, Tamatar in Kannada, Tamater in Assamese, Tometra in Sindhi, Toamato in Urdu.⁵

The tomato plant has some unique features, like its juicy fruit, branching shoot system, and complex leaves, which are not found in other model plants like rice. These traits are important for agriculture and can't be studied as easily in other plant models. Most tomato plants are bushy and spread out, usually growing 60 to 180 cm (2 to 6 feet) wide, though some types are more upright and compact. The leaves are big—up to 45 cm (18 inches) long—feathery, have a strong smell, and a bit hairy. The flowers are small, yellow, have five petals, and hang in clusters, each about 2 cm (0.8 inch) wide. The fruit, which is actually a type of berry, can be 1.5 to 7.5 cm (0.6 to 3 inches) wide or even larger.

**Fig 1: Image of tomato plant**

Tomatoes come in many shapes—round, oval, long, or pear-shaped—and are usually red, crimson, or yellow, but there are also green and purple kinds. Each tomato has at least two sections filled with tiny seeds surrounded by a jelly-like pulp. In cooler places, tomatoes are usually grown in greenhouses because they need plenty of sunlight and warm temperatures. To stop the stems and fruits from touching the ground, the plants are often supported with stakes, ties, or cages. They also need regular watering to avoid problems like dark spots on the bottom of the fruit (blossom-end rot) and the fruit cracking.^{1,6}

HISTORY

Tomatoes originally first came from South America, especially in what we now call Bolivia, Ecuador, and Peru. Thousands of years ago, people there found wild tomatoes and started using them. Around 500 BC, the Aztecs and other Native people in Mexico began growing tomatoes, and they even had a word for them: "tomatl." In the 1500s, Spanish explorers brought tomatoes back to Europe after their travels to the Americas. At first, Europeans were scared to eat tomatoes because they thought they might be poisonous. This was because tomatoes are part of the nightshade family, which includes some plants that are toxic.

But over time, people in places like Italy started using tomatoes in their cooking once they found out how tasty they were. By the 1700s, tomatoes were a big part of Italian food, especially in pasta sauces and later on pizza. After that, tomatoes spread to many other countries and became popular all over the world. Even though most people think of them as vegetables, tomatoes are actually fruits and are now one of the most used ingredients in cooking.⁷

CLASSIFICATION:

Tomato is a widely studied plant for its properties and its scientific classification is given in Table 1 below.⁸

Taxonomic Rank	Scientific Name	Common Name
Kingdom	Plantae	Plants
Subkingdom	Tracheophyta	Vascular plants
Superdivision	Spermatophyta	Seed plants
Division	Angiosperms	Flowering plants
Class	Magnoliopsida	Dicotyledons
Subclass	Asteridae	Asterids
Order	Solanales	—
Family	Solanaceae	Nightshades

Genus	Solanum	—
Species	Solanum lycopersicum	Garden tomato

Table 1: Taxonomical classification of Tomato.

PHARMACOGNOSY

Solanum lycopersicum is widely studied in various fields of science including the macroscopic and microscopic characteristics which are briefly described in Table 2 & 3.5,9.

Macroscopical Characters

Parts	Description
Fruit Type	Fleshy, berry-type fruit.
Shape	Usually round or slightly flattened; can vary (oval, oblong, pear-shaped).
Size	Varies widely depending on variety (from cherry-sized to large beefsteak types).
Color	Typically, red when ripe; can also be yellow, orange, green, or purple varieties.
Surface	Smooth, sometimes slightly ribbed.
Skin	Thin but tough; easily peelable when blanched.
Flesh	Juicy and soft; divided into chambers filled with seeds and pulp.
Seeds	Small, flat, yellowish-white, and embedded in the pulp.
Taste	Slightly sweet and tangy.

Table 2: Macroscopic description of Solanum lycopersicum

Part	Microscopic characters
Outer layer (epidermis)	A single layer of cells with a thin waxy cover; may have tiny hairs (trichomes) on it.
Pulp cells	Big, soft cells that store water and red pigment (lycopene).
Support cells (collenchyma)	Found under the skin; give strength to the fruit.
Veins (vascular bundles)	Tiny tubes (xylem and phloem) that carry water and food through the fruit.
Crystals	Sometimes small needle-like or star-shaped crystals (calcium oxalate) are seen.
Tiny hairs (trichomes)	May be single or many-celled; some can produce a sticky or oily substance.
Seed coat	Thick outer layer of the seed that protects it.
Inside the seed	Has two food-storing parts (cotyledons) and a baby plant (embryo).

Table3: microscopic characters of Solanum lycopersicum.

PHYTOCHEMISTRY

The medicinal properties of Solanum lycopersicum are mainly due to the phytochemical constituents in Solanum lycopersicum which are briefly described in the table below.¹¹⁻¹⁹

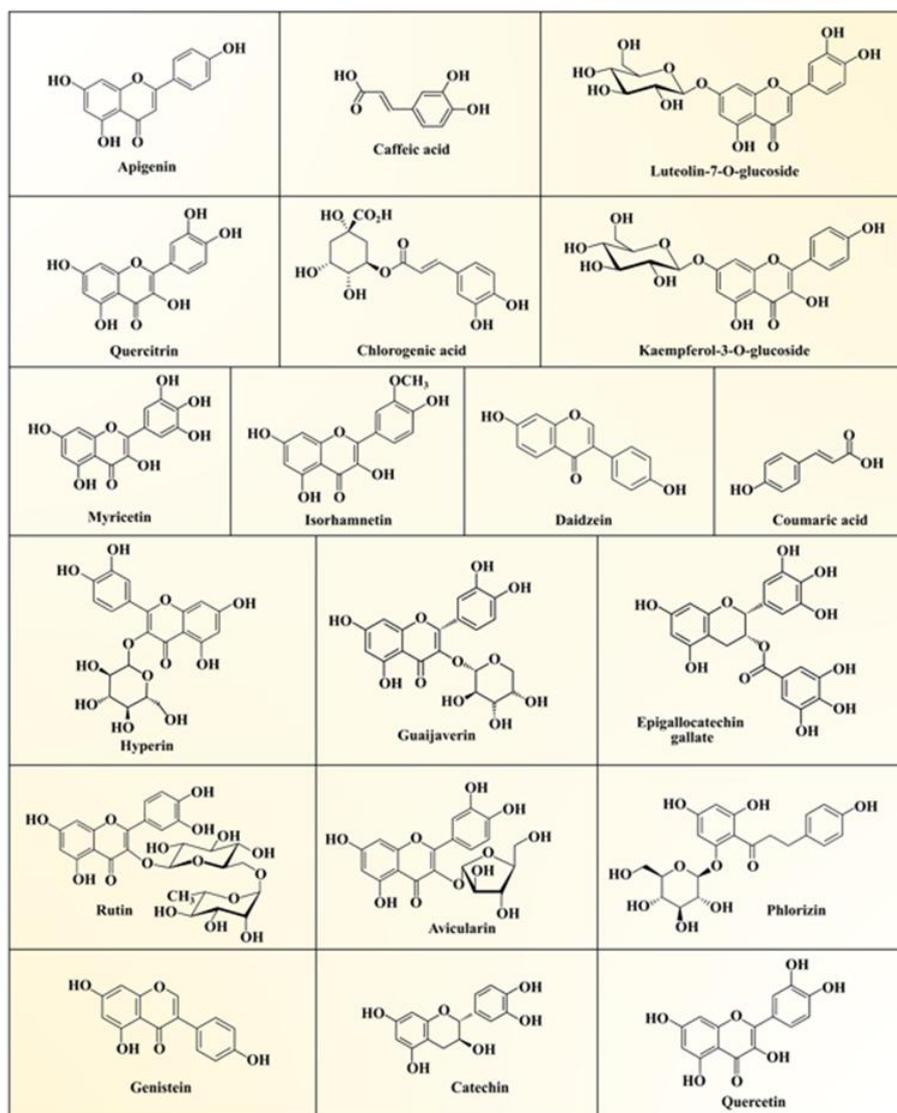
S.NO	Phytochemical Group	Main Compounds	Parts of Plant Found	Key Functions
1.	Steroidal Alkaloids	Solanine, Solasodine	Green fruits, seeds, young leaves	Found as glycoalkaloids (with sugars); help in plant defense and used in pharma.

2.	Steroidal Saponins	Diosgenin, Tigogenin, Yamogenin, Solagenin, Neochlorogenin, Hispigenin	Fruits, roots	Some have anti-cancer potential; known for forming foam-like solutions in water.
3.	Flavonoids	Naringenin, Chalconaringenin, Rutin, Quercetin, Kaempferol, α -Tocopherol	Mainly in leaves	Strong antioxidants; support immune system and reduce inflammation.
4.	Polyphenols & Acids	Caffeic acid, Ferulic acid, p-Coumaric acid	Leaves	Protect against oxidative stress; also have antimicrobial effects.
5.	Carotenoids	Lycopene, Lutein, Zeaxanthin, β -Carotene	Fruits (especially red tomatoes).	Provide red/orange color; protect heart, skin, and eyes.
6.	Glycosides & Fatty Acids	Esculoside A, 9-oxo-octadecadienoic acid	Fruits and leaves	Lesser-known compounds; may help in stress response and disease resistance.
7.	Tannins	Condensed and hydrolyzable tannins	Leaves and stems	Have antimicrobial properties; can reduce pest damage.
8.	Alkaloids (non-steroidal)	Tomatine	Unripe fruits, leaves	Bitter-tasting; helps deter insects and pathogens; some are toxic in large amounts.
9.	Vitamins	Vitamin C, Vitamin E (α -tocopherol), Folate, Vitamin A (from β -carotene)	Fruits and leaves	Essential nutrients for humans; boost immunity and act as antioxidants.

10.	Organic Acids	Citric acid, Malic acid, Ascorbic acid (Vitamin C)	Fruits	Provide tart flavor; help in digestion and preservation.
11.	Volatile Compounds	Hexanal, 6-methyl-5-hepten-2-one, Geranial, Linalool	Fruits (especially ripe ones)	Responsible for the aroma and flavor of fresh tomatoes.
12.	Amino Acids & Derivatives	Glutamic acid, GABA (γ -aminobutyric acid)	Fruits and seeds	Influence taste (umami flavor) and may help regulate blood pressure.

Table 4: Phytochemical constituents in Solanum lycopersicum.

The images of the phytochemical constituents are given in figure 2 below.



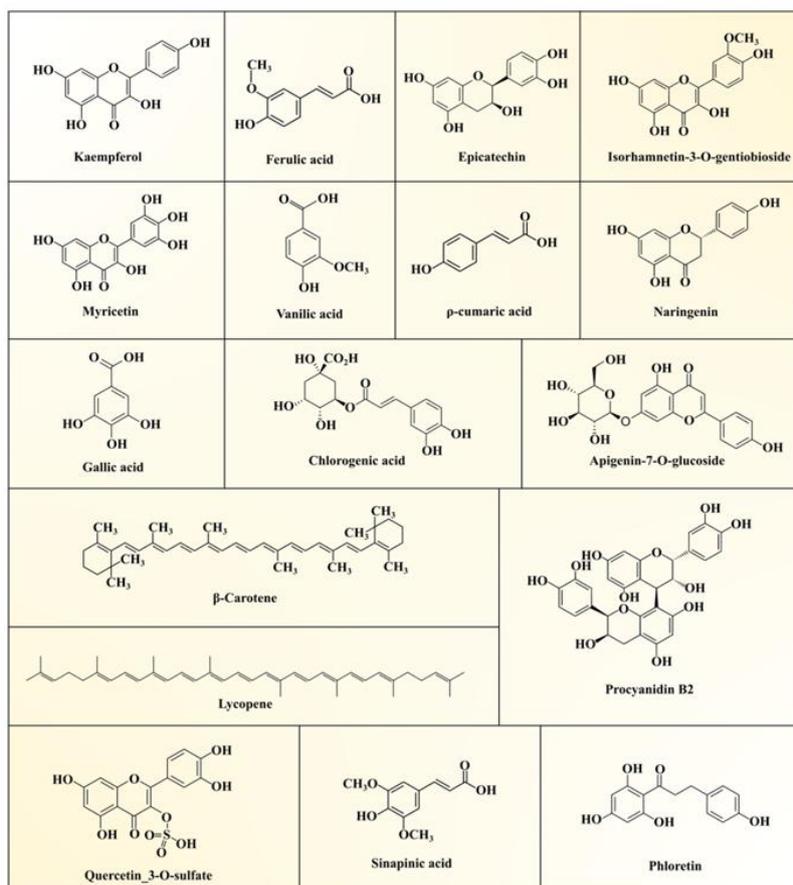


Fig 2: Structure of various phytochemical constituents of Tomato.²⁴

PHARMACOLOGY

There are numerous health advantages to the tomato plant, *Solanum lycopersicum*. It can function as an antioxidant, prevent blood clots (platelet anti-aggregation), lessen inflammation, prevent cancer, aid in the body's battle against worms (anthelmintic), and combat fungal infections. Gene isolation, enzyme activity, and support for cellular processes including kinase and invertase activity are among its further impacts. It has even been demonstrated to cause chromosomal alterations in certain investigations. Numerous ailments can be treated using tomato plants, including: Rheumatism, Flu or influenza, Problems with the head, breathing, eyes, and nose, lowering the chance of head, neck, and breast cancers, defending the brain against conditions like Alzheimer's, reducing urinary issues, reducing the risks of heart disease in individuals with type 2 diabetes, Hay fever, Watery diarrhea.

Tomato leaves' Worm-Fighting (Anthelmintic) Properties:

When tested, the tomato leaf methanol extract (a sort of solution) proved to be highly successful at killing worms (the test employed earthworms). This extract outperformed albendazole, a typical worm medication, even at modest dosages. This implies that natural substances found in tomato leaves may aid in the removal of parasitic worms.

Kinase Activity in Tomato Leaves and Its Role in Disease Resistance:

A specific protein in tomato leaves, known as a kinase, helps the plant defend itself against harmful bacteria like *Pseudomonas syringae*, which produce proteins called AvrPto and AvrPtoB. The Pto kinase in tomatoes is important for this defense process. This kinase becomes active through a process called autophosphorylation, which helps it

stay in the right shape to interact with the bacterial proteins. However, this activity is not directly involved in passing the defense signals within the plant. Certain small molecules can strongly block the activity of this kinase by competing with ATP (the energy molecule), which stops it from functioning. These specially designed molecules target the kinase activity of the Pto protein without affecting other parts of the plant's defense system.¹

Anti-Cancer Properties:

Several research studies have shown that tomatoes may help lower the risk of developing certain types of cancer. This benefit is mostly due to a compound found in tomatoes called lycopene, which is a powerful natural antioxidant. Lycopene has been linked to a reduced risk of prostate, colorectal, and stomach cancers. It works by slowing down the growth of cancer cells in the body. Interestingly, cooked tomatoes contain even higher levels of lycopene compared to raw ones.¹⁴

Brain-Protecting (Neuroprotective) Effects:

Tomatoes contain natural plant compounds like lycopene, vitamin C, and flavonoids, which have strong antioxidant properties. These antioxidants help protect brain cells (neurons) from damage caused by harmful molecules known as oxidative stress. This protection may help lower the risk of brain-related diseases such as Alzheimer's and Parkinson's.

Anti-Diabetic Properties:

“Diabetes is a chronic metabolic disorder of carbohydrate, fat & protein metabolism characterized by high blood sugar levels because the pancreas does not produce enough insulin, or cells do not respond to insulin produced”²⁷. Some natural substances in tomatoes, especially polyphenols and flavonoids, may help in managing diabetes. These compounds might - Improve how the body responds to insulin, Help control blood sugar levels, Lower the chances of problems related to diabetes.

Cardioprotective Effects:

Eating tomatoes can be good for your heart health. This is mainly because they contain lycopene and other nutrients that support the heart. Lycopene may help - Lower blood pressure, reduce cholesterol levels, Prevent blood clots. These effects can help lower the risk of heart disease and stroke.⁵

Anti-Inflammatory Benefits:

Tomatoes contain natural compounds that may help lower inflammation in the body. This can be helpful for people dealing with inflammation-related issues like arthritis and asthma. Research from lab and animal studies shows that tomato extracts might affect how the body reacts to inflammation, making them a potential natural remedy for reducing it.¹⁶

Antioxidant Activity:

Oxidative stress, defined as an imbalance between reactive oxygen species production and breakdown by endogenous antioxidants, is closely associated with aging and a number of diseases including inflammation, carcinogenesis, diabetes and atherosclerosis.²⁸ Tomatoes are rich in natural antioxidants like lycopene, vitamin C, beta-carotene, and flavonoids. These compounds help protect the body from damage caused by harmful molecules called free radicals. By reducing oxidative stress, tomato antioxidants may help prevent diseases such as heart problems, diabetes, cancer, and aging-related issues. They work by stopping or slowing down harmful reactions in the body, and their effects are often tested using scientific methods like DPPH and FRAP assays.²⁰

Antimicrobial Activity of Tomatoes:

Tomatoes contain natural compounds that can help fight harmful bacteria and fungi. These bioactive compounds, such as phenolics, flavonoids, and organic acids, have been shown to slow down or stop the growth of certain microbes. This makes tomatoes potentially useful in preventing infections and supporting overall health.¹⁷

Tomatoes for Healthy Skin:

Studies suggest that eating tomatoes or using tomato-based products on the skin may help improve skin health. Nutrients like lycopene and vitamin C in tomatoes act as antioxidants, protecting the skin from sun damage, helping build collagen, and making the skin look smoother and healthier.⁵

Liver Protection (Hepatoprotective Activity):

Hepatoprotective activity is ability to avoid liver damage by hepatotoxic agents.²⁹ Tomatoes contain bioactive compounds, including lycopene, phenolics, and flavonoids, which have antioxidant and anti-inflammatory properties. These compounds help neutralize free radicals, which can cause oxidative damage to liver cells. By reducing oxidative stress and inflammation, tomatoes help protect the liver from conditions like fatty liver disease, hepatitis, and cirrhosis. Some studies also suggest that tomato extracts might enhance the liver's detoxification processes, improving its ability to eliminate toxins and maintain healthy liver function.

Anti-Obesity Effects:

Tomatoes play a role in weight management through several mechanisms. The antioxidants in tomatoes, particularly lycopene, can reduce fat accumulation by inhibiting fat cell formation and promoting fat breakdown. Additionally, the high-water content and low-calorie count of tomatoes make them a healthy, filling food that can help with portion control. Studies also suggest that certain compounds in tomatoes, like flavonoids and fiber, may improve metabolism by regulating glucose and insulin levels, which are crucial in preventing obesity and metabolic disorders. Furthermore, tomatoes can reduce inflammation associated with obesity, which is linked to the development of various chronic diseases, including heart disease and type 2 diabetes.¹

Gastroprotective Effects:

Tomato extracts have gastroprotective properties, which can help prevent or reduce the risk of gastric ulcers and other digestive issues. The antioxidants, especially lycopene and flavonoids, reduce oxidative stress in the stomach lining and promote the healing of damaged tissue. Tomatoes also possess anti-inflammatory effects that can decrease the production of harmful gastric acids, preventing acid reflux and ulcers. Moreover, the fiber in tomatoes promotes regular bowel movements, which helps maintain a healthy digestive tract and prevent constipation, further supporting gastrointestinal health.²⁰

Immunomodulatory Activity:

Tomatoes support the immune system through their rich content of vitamins, minerals, and antioxidants. Vitamin C, a key nutrient in tomatoes, is essential for the proper functioning of immune cells like white blood cells, which are responsible for fighting infections. Additionally, flavonoids and other bioactive compounds in tomatoes help regulate the immune response by enhancing the activity of immune cells while preventing excessive inflammation. This immunomodulatory effect not only helps in protecting against infections but also in managing autoimmune conditions by balancing the immune system's activity.¹⁶

MEDICINAL VALUE

Solanum lycopersicum L. (tomato) has been used for many medicinal purposes across the world. Indigenous cultures often used tomatoes to treat stomach problems, reduce inflammation, and heal skin issues. They also applied tomato extracts to wounds and to soothe sunburns. Modern science has confirmed some of these traditional uses.

Culinary Uses:

Tomatoes are a popular ingredient in many kitchens worldwide. They are key in dishes like sauces, soups, salads, and more. Traditional cuisines, such as Italian, Mediterranean, Mexican, and Indian, include tomatoes in a wide range of recipes.⁵

Eye Health:

The Vitamin A found in tomatoes is excellent for improving your vision. Consuming tomatoes is one of the most effective ways to prevent night blindness.

Hair Health:

Vitamin A in tomatoes helps to maintain your hair silky and firm, while also promoting healthy growth and preventing dryness. The antioxidants in tomatoes also help protect your hair from damage caused by environmental factors, leaving it shiny and vibrant. The high vitamin C content supports collagen production and essential for strong and healthy hair.¹⁴

Medicinal Uses in Traditional Systems:

In traditional medicine systems like Ayurveda and Traditional Chinese Medicine (TCM), tomatoes have been used for their healing properties. They are believed to have a cooling effect on the body and are used to help with problems like inflammation, digestion issues, and urinary tract infections.

Home Remedies:

Tomatoes are often used in home remedies for common skin problems. People use them to soothe sunburn, calm skin irritations, and improve overall skin health. These simple treatments have been passed down through generations and are still used in many households today.

Cultural Symbolism and Rituals:

In some cultures, tomatoes are more than just food—they have special meanings and are part of rituals. They may represent things like fertility and prosperity and are sometimes used during harvest festivals or in religious ceremonies.⁵

MISCELLANEOUS

In spite of many beneficial properties of *Solanum lycopersicum* there are certain instances where it was found to have certain unwanted effects few of them are mentioned in the table below.^{20,21}



Category	Information
Toxicity	Ripe tomatoes are safe to eat. But the leaves, stems, and unripe green tomatoes have a natural toxin called tomatine. Eating a lot of these can cause stomach pain or vomiting, especially in kids or pets. Cooking removes most of the toxin.
Allergy	Some people are allergic to tomatoes. They might feel itching or swelling in the mouth, or get skin rashes and stomach problems. This happens more often in people allergic to things like grass or birch pollen.
Drug Interactions	Tomatoes have a lot of vitamin K, which can affect how blood-thinning medicines like warfarin work. Their acidity can also lower the effect of some medicines like antacids or iron tablets. People with acid reflux may feel worse after eating tomatoes.

MARKET VALUE

The global tomato market value is estimated to be \$217.03 billion in 2025 and projected to reach 273.84 billion by 2030.

Pharmacological activities summary

S.No	Plant Part	Activity	Extract	Model	Standard Drug	Dose	Parameters	Mechanism	Stats P Value	Author Year
1.	Fruit (pulp)	Anticancer	Lycopene – rich extract	<i>In vitro</i> (MCF-7 cell line)	Doxorubicin	2–3 μ M	Cell viability, apoptosis markers	Induction of apoptosis via mitochondrial pathway	P < 0.01	Amir et al., 1999 ²²
2.	Whole Fruit	Cardioprotective	Aqueous extract	<i>In vivo</i> (Wistar rats)	Atorvastatin	500 mg/kg body wt	Lipid profile, antioxidant enzymes	Reduction of LDL, enhancement of antioxidant defense	P < 0.01	Karas et al., 2000 ²²
3.	Leaf	Antimicrobial	Acetone extract	<i>In vitro</i> (Rhizoctonia solani)	N/A	0.31 mg/mL	Mycelial growth inhibition	Linolenic and caffeic acids disrupt fungal growth	P < 0.05	Kim et al., 2019 ²³
4.	Stem	Antimicrobial	Acetone extract	<i>In vitro</i> (Fusarium oxysporum)	N/A	0.62 mg/mL	Mycelial growth inhibition	Lower activity due to fewer bioactive compounds	P < 0.05	Kim et al., 2019 ²³
5.	Seed	Antioxidant	Methanolic extract	<i>In Vitro</i> (DPPH Assay)	Ascorbic acid	100 μ g/ml	DPPH radical scavenging activity	Electron donation to neutralize free radicals	P < 0.05	Manoj Kumar et al., 2021 ²⁴
6.	Root	Antioxidant	Methanolic extract	<i>In vitro</i> (DPPH assay)	Ascorbic acid	100 μ g/mL	DPPH radical scavenging activity	Electron donation to neutralize free radicals	P < 0.05	Manoj Kumar et al., 2021 ²⁴
7.	Seed	Antimicrobial	Ethanollic extract	<i>In Vitro</i> (E. coli, S. aureus)	Ciprofloxacin	200 μ g/mL	Zone of inhibition	Disruption of microbial cell membranes	P < 0.05	Tania Laranjeira et al., 2022 ²⁵
8.	Seed	Neuroprotective	Hydroalcoholic extract	<i>In vivo</i> (Mice)	Donepezil	300 mg/kg body wt	Behavioral tests, oxidative markers	Inhibition of AChE, reduction of oxidative stress	P < 0.05	Allaqaband et al., 2022 ²⁶

REFERENCE:

1. Priya Shukla, Katyani Bajpai, Shalini Tripathi, Sunil kumar, Girendra Kumar Gautam, A Review on the Taxonomy, Ethnobotany, Chemistry and Pharmacology of Solanum Lycopersicum Linn, IJCPS, 2013, Vol.1(8), 521-527.
2. Asha Jyothi. V, Dr. Rao. S. Pippalla and Dr. D. Satyavati, Asparagus Racemosus – A Phytoestrogen, IJPT, 2009, 1(1), 36-47.
3. Muriel Quinet, Trinidad Angosto, Fernando J. Yuste-Lisbona, Rémi Blanchard-Gros 1, Servane Bigot, Juan-Pablo Martinez and Stanley Lutts, Frontiers in Plant Science, Tomato Fruit Development and Metabolism, 2019, 10, 1554.
4. Canene-Adams, Jessica K. Campbell, Susan Zaripheh, Elizabeth H. Jeffery, and John W. Erdman, The Tomato as a Functional Food1,2, Jr.3, 0022-3166/05, 2005, American Society for Nutritional Sciences.
5. Alka Rawat, Meenakshi Upadhyay and Om Singh, Exploring the pharmacological potential and traditional use of Solanum lycopersicum L. (Tomato): A review, Journal of Pharmacognosy and Phytochemistry 2024; 13(2): 768-771.
6. Seisuke Kimura and Neelima Sinha, Tomato (Solanum lycopersicum): A Model Fruit-Bearing Crop, Cold Spring Harbor Laboratory Press, 2008, 3(11).
7. Ravi Mehta (PCS), History of Tomato (Poor Man's Apple), IOSR-JHSS, 2017, 22(8) PP:31-34.
8. Debjit Bhowmik, K.P. Sampath Kumar, Shravan Paswan, Shweta Srivastava, Tomato-A Natural Medicine and Its Health Benefits, Journal of Pharmacognosy and Phytochemistry, 2012, Vol. 1 No. 1,
9. M. Mahbubar Rahman Salim, M. Harunur Rashid, M. Mofazzal Hossain, Mohammad Zakaria, Morphological characterization of tomato (Solanum lycopersicum L.) genotypes, 2020, 19(3) p. 233-240.
10. Patricia Segado, Eva Domínguez, Antonio Heredia, Ultrastructure of the Epidermal Cell Wall and Cuticle of Tomato Fruit (Solanum lycopersicum L.) during Development, Plant Physiology, 2016, 170(2), p.935–946.
11. Kirstie Canene-Adams, Jessica K. Campbell, Susan Zaripheh, Elizabeth H. Jeffery, and John W. Erdman, The Tomato as a Functional Food1,2, Jr.3, 0022-3166/05, 2005, American Society for Nutritional Sciences.
12. Poonam Chaudhary1, Ashita Sharma1, Balwinder Singh2, Avinash Kaur Nagpal, Bioactivities of phytochemicals present in tomato, J Food Sci Technol, 2018, 55(8):2833–2849.
13. Luigi Frusciante1, Paola Carli1, Maria R. Ercolano1, Rita Pernice2, Antonio Di Matteo1, Vincenzo Fogliano2 and Nicoletta Pellegrini3, Antioxidant nutritional quality of tomato, Mol. Nutr. Food Res. 2007, 51, 609-617.
14. Anita Devi Chauhan, S. Prakash Rao, A Pharmacological Action and Therapeutic Uses of Lycopersicum Esculentum, International Journal for Research in Applied Science & Engineering Technology, 2020, 8(5).
15. Mohammed Rafiq Khan, Ranjini K, Godan T K, Srinivasapuram Natarajan Suresh, Uma Devi Pongiya and Yalaga Rama Rao, Pharmacognostic Study and Phytochemical Investigation of Lycopersicon esculentum (Tomato), Research Journal of Pharmaceutical, Biological and Chemical Sciences, 2014, 5(3), 1691-1698.
16. Edward J. Collins, Cressida Bowyer, Audrey Tsouza and Mridula Chopra, Tomatoes: An Extensive Review of the Associated Health Impacts of Tomatoes and Factors That Can Affect Their Cultivation, Biology 2022, 11, 239.
17. Manoj Kumar, Maharishi Tomar, Deep Jyoti Bhuyan, Sneha Punia, Simona Grasso, Amanda Gomes Almeida Sa, Bruno Augusto Mattar Carciofi, Fatima Arrutia, Tomato (Solanum lycopersicum L.) seed: A review on bioactives and biomedical activities, Biomedicine & Pharmacotherapy 2021, 142, 112018.
18. Giuseppina Pace Pereira Lima1, Héctor Alonzo Gómez Gómez, Santino Seabra Junior, Marcelo Maraschin, Marco Antonio Tecchio and Cristine Vanz Borges, Functional and Nutraceutical Compounds of Tomatoes as Affected by Agronomic Practices, Postharvest Management, and Processing Methods: A Mini Review, Frontiers in Nutrition, 2022, 9, 868492.
19. Ke Tian Yong, Phaik Har Yong, Zhi Xiang Ng, Tomato and human health: A perspective from post-harvest processing, nutrient bio-accessibility, and pharmacological interaction, Food Frontiers, 2023, 4(1), 702–1719.
20. Md Yousuf Ali, Abu Ali Ibn Sina, Shahad Saif Khandker, Lutfun Neesa, E. M. Tanvir Alamgir Kabir, Md Ibrahim Khalil and Siew Hua Gan, Nutritional Composition and Bioactive Compounds in Tomatoes and Their Impact on Human Health and Disease: A Review, Foods 2021, 10, 45
21. Valeri V. Mossine, Pankaj Chopra, Thomas P. Mawhinney, Interaction of tomato lycopene and ketosamine against rat prostate tumorigenesis, Cancer Res, 2008 Jun 1;68(11):4384-91.
22. Hadar Amir, Michael Karas, Judith Giat, Michael Danilenko, Rachel Levy, Tikva Yermiahu, Joseph Levy, Yoav Sharoni, Lycopene and 1,25-dihydroxyvitamin D3 cooperate in the inhibition of cell cycle progression and induction of differentiation in HL-60 leukemic cells, Nutrition and Cancer, Volume 33, 1999 – Issue 1
23. Kim Dong Sub, Kwack Yurina, Lee Jung Heon, Chun Changhoo, Antimicrobial Activity of Various Parts of Tomato Plants Varied with Different Solvent Extracts, the Plant Pathology Journal, 2019, Volume 35, Issue 2, Pages 149–155
24. Manoj Kumar, Maharishi Tomar, Deep Jyoti Bhuyan, Sneha Punia, Simona Grasso, Amanda Gomes Almeida Sá, Bruno Augusto Mattar Carciofi, Fátima Arrutia, Sushil Changan, Radha, Surinder Singh, Sangram Dhumal, M Senapathy, Varsha Satankar, T Anitha, Anshu Sharma, R Pandiselvam, Ryszard Amarowicz, Mohamed Mekhemar, Tomato (Solanum lycopersicum L.) seed: A review on bioactives and biomedical activities, Biomed Pharmacother, 2021 Oct; 142:112018
25. Tania Laranjeira, Ana Costa, Catarina Faria-Silva, Daniela Ribeiro, Jose Miguel P Ferreira de Oliveira, Sandra Simoes, Andreia Ascenso, Sustainable Valorization of Tomato By-Products to Obtain Bioactive Compounds: Their Potential in Inflammation and Cancer Management, Molecules. 2022 Mar 4; 27(5):1701.



26. Shumyla Allaqaband, Aamir Hussain Dar, Ulpa Patel, Navneet Kumar, Gulzar Ahmad Nayik, Shafat Ahmad Khan, Mohammad Javed Ansari, Nadiyah M. Alabdallah, Pradeep Kumar, Vinay Kumar Pandey, Bela Kovacs, Ayaz Mukarram Shaikh, Utilization of Fruit Seed-Based Bioactive Compounds for Formulating the Nutraceuticals and Functional Food: A Review, *Frontiers in Nutrition*, May 2022 | Volume 9 | Article 902554.
27. Asha Jyothi. V, Giridhar Vedantam and Shahnaz Taskeena, What do you know about diabetes mellitus? *IJPBCS*, 13 (3), 2024, 06-19.
28. Asha Jyothi. V, Giridhar Vedantam I and Shahnaz Taskeena, Role of oxidative stress and diabetes, *IJPBS* (2024) 14 (3): 79-85.
29. V. Asha Jyothi* and K. Amtul Raouf Qazi, Hepatoprotective activity: recent update, *IJPBCS*, 2025, 14 (2), 01-19.