

HEALTH BENEFITS OF *SOLANUM TORVUM*- AN OVERVIEW

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Abstract

Solanum torvum can also be called as sundakai, turkey berry belongs to Solanaceae family with a variety of therapeutic benefits. The whole parts of the *Solanum torvum* plant is widely utilised in traditional medicine all throughout the world. The fruits of *Solanum torvum* are nutritious and valued as a fundamental component of the diet of the South Indian people. Plant extracts of *Solanum torvum* are used to treat fever, wounds, tooth decay, gastric ulceration, coughs, sore throat, stomach ache, colds, skin diseases, reproductive problems, hypertension and diabetes. The main focus of this review is to highlight the common names, description, nutrient composition, health benefits, phytochemicals of *Solanum torvum*.

Key Words: *Solanum torvum*, sundakai, turkey berry, nutrient composition, health benefit

Introduction

Solanum torvum (Solanaceae) is a tiny shrub generally known as "Turkey berry" that is found across India, Malaya, China, the Philippines, and tropical America (Barbosa et al., 2012), (Wannasiri et al., 2017). This plant's roots, stem, and leaves have been used for many years to cure a variety of illnesses. This plant is utilized as a herb in various Ayurveda therapies because of its sedative, diuretic, and digestive effects. It is also used to cure coughs (Sivapriya & Leela, 2007). Several pharmacological effects of *Solanum torvum* extracts include antioxidant, antihypertensive, cardiovascular, antiplatelet aggregation, antifungal, anti-inflammatory, antibacterial, and antiviral activity (Barbosa et al., 2012), (Wannasiri et al., 2017).

One type of plant that has the potential to be turned into a traditional medicine and is effective as a traditional medicinal component is *Solanum torvum*. The leaves, fruit, and roots of the *Solanum torvum* plant are used in medicine to treat stomach discomfort and menstruation, stiff

or bloated waists, persistent coughs, ulcers, heart pain, and high blood pressure. For therapeutic reasons, plant material is still collected from nature and used in the manner that has been done for centuries by boiling or eating raw. Since it is utilised for eye treatment, the plant has been used as traditional medicine in the community(Sirait, 2009). An indigenous *Solanum torvum* herb had been utilised as an alternative diabetes therapy. *Solanum torvum* help to reduce the incident of hypertension, lipid peroxidation, antiglycation, and radical scavenging(Nguelefack et al., 2009), (Mohan et al., 2009).

The fruits of *Solanum torvum* are commonly available in market. They are used as a vegetable and valued as a staple food for the South Indian populace. Fruit decoctions are prescribed for cough disorders and are thought to be helpful in situations of enlarged liver and spleen(Yuan et al., 2016),(Mohan et al., 2013),(Waghulde et al., 2011).

As an antihypertensive, *Solanum torvum* fruits are utilised. It contains anti-platelet aggregation, cardiovascular, and antioxidant properties. sedative, digestive, hemostatic, and diuretic properties as well as antimicrobial efficacy on clinical and human isolates(Agrawal et al., 2010).

Solanum torvum root and stem have antitumor, anti-inflammatory, antiviral, and antibacterial action(Abdulkadir et al., 2016). The main phenolic compounds found in *Solanum torvum* fruits are phenolic acids, flavonoids, stilbenes, hydrolysable and condensed tannins, and lignans, which have some beneficial actions like antioxidant, antimicrobial, anti-inflammatory, prebiotic, and vasodilation activities. *Solanum torvum* is known to be a rich source of phenolic acids, catechins, anthocyanins, and proanthocyanins(Said et al., 2014)(Begam, 2015)(Abhishek et al., 2015).

Common name of *Solanum Torvum*

Solanum torvum, also called sundakai in Tamil, is grown for its fruits, which constitute a staple of the diets of the South Indian populace. The fruits of *Solanum torvum* are edible and frequently offered in Tamil Nadu marketplaces as either fresh fruits or in dried form(Kumar et al., 2016).

In India, *Solanum torvum*, also known as Sundakai and Kodusonde, is a frequently used remedy for enhancing vision, treating spleen and liver enlargement, acting as an antimicrobial agent, and having digestive, sedative, and diuretic properties(Rammohan & Reddy, 2011). Common names for *Solanum torvum* include "Devil fig," "pea eggplant," "prickly nightshade," and "wild eggplant" (Amponsaa Brobbey et al., 2016), (Ningsih et al., 2021).

It is also known as turkey berry, susumber, gully-bean thai eggplant, or devil's fig. It is locally known as tit begoon, gota begoon, or hat begoon in Bengali. *Solanum torvum* fruit is used as a vegetable by the common people of Bangladesh, particularly the tribes (Bari et al., 2010a). *Solanum torvum* is known by a number of local names, including Terong pipit, Pokak (East Java), Cepoka (Central Java), Takokak (West Java), and Rimbang (Sumatra and Melayu) (Putri et al., 2023).

Description of *Solanum Torvum*

A perennial plant in the Solanaceae family called *Solanum torvum* is bushy, upright, and spiky. Although *Solanum torvum* is sometimes referred to be a common traditional vegetable, it cannot be grown like other vegetables. Full sunshine is ideal for its growth (Ramamurthy et al., 2012). It is a crucial medicinal plant in tropical and subtropical nations, and it is extensively utilised in cuisine and traditional medicine all over the world (Yousafa et al., 2013).

It is a 2-4-metre-tall spreading, thin, evergreen shrub with few arms. The stems have branches with recurved reddish or pale-yellow prickles that are 2.5–10 mm long and 2–10 mm broad. It is mostly found in the tropics of Africa, as well as west India, Pakistan, Malaya, China, the Philippines, and the tropics of America (Amponsaa Brobbey et al., 2016) (Musarella, 2020), (Nguelefack, Feumebo, et al., 2008). The *Solanum torvum* has brownish-green stems covered in downy hair and sharp thorns, single-fingered leaves with lengths of 6 to 30 cm, wide ovoid shapes, pointed edges, pinched edges, light green, tightly threaded hands, and some with outboard spines. The flowers are white and arranged in clusters of 5 to 6 on a stalk. The pistils are yellow. The fruit is green when it is young and turns black when it is ripe (Rahmadiyah et al., n.d.)

The leaves of *Solanum torvum* are huge and green, with a leaf length of 10-15 cm and a breadth of 8-10 cm (Jaiswal & Mohan, 2012), (Musarella, 2020). *Solanum torvum* flowers all year, with peak blooming in April-May and fruiting until the shrub reaches a height of 1-1.5 m (Saha & Datta, 2017).

When the berries are fully mature, they turn from green to yellow to brown and form clusters of small green spheres that resemble green peas (Christi et al., 2018). They have thin flesh and a lot of dark, flat, rounded seeds. They are beneficial to provide several health advantages in either fresh or dried form, and they hang from the tree in cluster formations (Rahmatullah et al., 2009) (Darkwah et al., 2020b), (SATHYA et al., 2019a).

Solanum torvum fruit is a spherical, berry-shaped fruit with a diameter of between 1.0 and 1.15 cm. Around 300 to 400 flat, dark-brown seeds per fruit are present. The skin of the completely torn fruit is yellow, whereas the skin of the young berry is shiny green (Putri et al., 2023).

Nutrient Composition of *Solanum Torvum*

The micronutrients vitamin A, B1, B6, calcium (0.28 mg), copper, folic acid, iron (24.5 mg), magnesium, niacin, and potassium are all found in abundance in *Solanum torvum*. It also contains fat (1.7 mg) and fibre (56.9 mg) (Baksh-Comeau et al., 2016). Fresh *Solanum torvum* contains 100 g of vitamin A (12 mg), vitamin C (130.8 mg), vitamin E (10.77 mg), protein (3.54 g), and carbohydrate (2.204 g) per 100 g (Thenmozhi & US, 2012).

Solanum torvum (dry powdered) fruits include iron (76.869 mg/kg), manganese (19.466 mg/kg), calcium (221.583 mg/kg), copper (2.642 mg/kg), and zinc (21.460 mg/kg), as well as carbs (7.033%), proteins (2.322%), lipids (0.278%), ash (0.143%), and crude fibre (3.993%). The amounts of vitamins A and C were also examined, and were shown to be 0.078 mg and 2.686 mg, respectively, per 100 g (Akoto et al., 2015).

According to reports, the fruit of *Solanum torvum* is a good source of protein, fibre, calcium, magnesium, iron, vitamin A, B-complex, and C. Young fruit has 59.51% moisture, 11.9% carbohydrates, 9.52% total sugar, 1.46% protein, and 37.4 mg of ascorbic acid per 100 grammes. According to reports, 100 grammes of fruit include 5.22 mg iron, 31.98 mg sodium, 745.01 mg potassium, 146.57 mg calcium, 1.37 mg copper, 7.51 mg manganese, and 3.41 mg zinc per 100 g (Bishnoi, n.d.).

Young *Solanum torvum* fruit contains 85.4 g of water, 2.4 g of protein, 0.4 g of fat, 10.7 g of carbohydrate, 6.1 g of fibre, 104 mg of calcium, 70 mg of phosphorus, 4.6 mg of iron, 390 g of beta-carotene, and 4 g of ascorbic acid per 100 g (Otu Phyllis et al., 2017). Iron, magnesium, zinc, salt, potassium, and other critical minerals, as well as vitamins and proteins, are abundant in the leaves of *Solanum torvum* (Dickson et al., 2014).

Solasonine, a steroidal gluco-alkaloid, is said to be present in leaves. They also include steroidal sapogenins, such as solaspigenine, neochlorogenin, and neosolaspigenin. Furthermore, triacontanol, tetratriacontanic acid, z-tritriacontanone, sitosterol, stigmasterol, and campesterol have been discovered in them. Gluco-alkaloid solasonine, sterolin (sitosterol-Dglucoside), protein, lipids, and minerals are also present in fruits of *Solanum torvum* (Lu, Luo, Huang, et al., 2009).

Fruits from *Solanum torvum* are extremely high in vitamin C. Although being high in vitamin C, they also contain a lot of fibre and phytochemicals for food or pharmaceutical manufacturing, including alkaloids, saponins, sugars, phenols, and flavonoids. Alkaloids, flavonoids, saponins, glycosides, and tannins are abundant in *Solanum torvum* (Koomson et al., 2018).

Alkaloids, flavonoids, tannins, saponins, and glycosides are abundant in *Solanum torvum*. Solasonine and solamargine are two glycosylated solasodine-derived substances with total alkaloid contents of 0.12%, 0.038%, and 0.0028%, respectively (Darkwah et al., 2020b).

Nutritional Benefits of *Solanum Torvum*

Solanum torvum has traditionally been used to treat fevers, diarrhoea, and discomfort. Several researchers have discovered that *Solanum torvum* possesses analgesic and anti-inflammatory properties (Gaelle Djoueudam et al., 2019). *Solanum torvum* plant extracts have been claimed to be effective in the treatment of hyperactivity, colds and coughs, acne, skin illnesses, and leprosy, with methyl caffeate, isolated from the fruit of the *Solanum torvum*, exhibiting an anti-diabetic effect in streptozotocin-induced diabetic rats (Gandhi, Ignacimuthu, Paulraj, et al., 2011), (Panigrahi et al., 2014), (Salahuddin, 2020).

Dried leaf powder of *Solanum torvum* is utilized for diabetes treatment in India. The leaf juice is utilised to lower body heat, while the unripe fruits are used to boost the body's immunity (Gandhi, Ignacimuthu, Paulraj, et al., 2011). Since its fruit and leaves have anti-microbial properties, the leaf paste is used to treat cuts and wounds in Central America and India (Christi et al., 2018). The *Solanum torvum* leaves provide an abundant source of vitamins, proteins, and critical minerals including iron, magnesium, zinc and potassium (Dickson et al., 2014).

The *Solanum torvum* leaves can be dried, blended, and combined with hot water to form a cold or cough medication. In Malaysia, the seeds are smoked to alleviate toothaches, while the roots are utilised as a poultice to heal foot cracks. In China, the roots are said to disseminate blood that has spilled into the surrounding tissue and cure pain. In India, plant extracts are used as an antidote to insect stings, and the fruit is consumed to ease stomach problems. The fruit's root powder can be used to cure leg fractures and headaches, as well as asthma treatment and liver therapy (Yousafa et al., 2013), (Amponsaa Brobbey et al., 2016).

The *Solanum torvum* leaves are used as a haemostatic, sedative, and diuretic. The ripening fruits are used to make tonics and hemopoietic agents as well as pain relievers(SATHYA et al., 2019a). It is said that the fruits and leaves extract of *Solanum torvum* can be used to cure coughs as well as enlarged liver and spleen. Cracks in the foot can be treated with root paste. For toothaches, people breathe in the smoke from burning seeds(Bari et al., 2010a).

The juice of *Solanum torvum* is typically recommended for peoples to avoid anaemia since the fruit of this plant is abundant in nutrients that assist increase the volume of blood in the human body(Sundari et al., 2013). To treat coughs, the fruits are fried and consumed. Asthma, diabetes, and hypertension are also treated using the roots and leaves of *Solanum torvum*(Amponsaa Brobbey et al., 2016).

The *Solanum torvum* fruit is used to cure fever, cough, cold, diabetes, high blood pressure, asthma, tooth decay, cracked foot, reduce body heat, and microbial diseases, liver and spleen enlargement(Priyanka et al., 2014) (Kumar et al., 2016), (Yousafa et al., 2013) (Vijayakumari et al., 2012). Ripe fruits are employed in the formulation of tonics and hemopoietic agents, as well as in the treatment of pain(Kala, 2005). Steroidal glycosides, hydrocarbons, and steroids, antioxidant proteins utilised in traditional medicine, are present in the mature fruits of *Solanum torvum*(Abdulkadir et al., 2016). Moreover, it has been said that the fruits and seeds of *Solanum torvum* can treat conditions such as fever, cough, wounds, discomfort, liver issues, tooth decay, and reproductive disorders(Biney et al., 2021).

For the treatment of diabetes, hypertension, and asthma, *solanum torvum* root extract is utilized(Rahmatullah et al., 2009). The tribal people of Kerala, India, utilise root tea to treat cough and fever. Recently, it was shown that *Solanum torvum* root extract might inhibit bacterial quorum sensing(Vadakkan et al., 2018).

Phytochemicals of *Solanum Torvum*

There has been a lot of research done on the chemical components of *Solanum torvum*. Fruit, leaves, and roots are among the sections used to isolate a variety of chemicals. An excellent source of alkaloids, flavonoids, saponins, tannins, and glycosides is this *Solanum torvum*(Amponsaa Brobbey et al., 2016).

Whole alkaloid concentration in *Solanum torvum* is 0.12%, total glycoalkaloids are 0.038%, and solasonine and solamargine, two glycosylated compounds generated from solasodine, are

both 0.0043% and 0.0028% of the total composition of different compounds in *Solanum torvum* (Yousafa et al., 2013).

Solanum torvum is high in alkaloids, flavonoids, tannins, saponins, and glycosides. Overall alkaloid content (0.12%), total glycoalkaloids (0.038%), and glycosylated substances generated from solasodine, namely solasonine (0.0043%) and solamargine (0.0028%), were all determined (Darkwah et al., 2020a).

A steroid, terpenoid, saponin, tannin, alkaloid, fatty acid, 3-o-acetyl-stigmasta-5,25-diene-2,3-diol, methyl stearate, and 21,25-dimethylmelianodiol are among the phytochemical components of *Solanum torvum* (Karmakar et al., 2015) (Kayalvizhi et al., 2012).

Tannins, flavonoids, reducing sugars, saponin glycosides, alkaloids, phytosteroids, and terpenoids are among the primary secondary plant metabolites found in methanol extract of *Solanum torvum* leaves (Amponsaa Brobbey et al., 2016).

Alkaloids, flavonoids, saponins, tannins, glycosides, Vitamins E, B, and C, as well as iron, were detected in the methanolic extract of dried *Solanum torvum* fruits (Koffuor et al., 2011) (Sivapriya & Leela, 2007), (Yousafa et al., 2013), (Femi Ibikunle & Olofu Ogbadoyi, 2016). *Solanum torvum* also contains vitamins and other necessary organic components (Darkwah et al., 2020b).

Solanum torvum fruit has been observed to contain the phenolic substances catechin, gallic acid, pyrogallol, and caffeic acid (Gandhi, Ignacimuthu, & Paulraj, 2011), (Kalita et al., 2017). The fruit wall and seeds' phytochemical study revealed that they included glycosides, isoflavonoids, alkaloids, tannins, and carbohydrates (Kr Paul et al., 2017), (Abhishek et al., 2015), (Yousaf et al., 2013a), (Vargas-Magaña et al., 2014).

The antioxidant activity index of one gramme of concentrated *Solanum torvum* extract was reported to be 3.68 mg of Trolox and 360.53 mg of ascorbic acid equivalents. According to research on lipid peroxidation and superoxide anion activity, *Solanum torvum* is also a rich source of phenolic and flavonoid compounds that have the ability to inhibit the CYP2E1 enzyme and to scavenge free radicals (Kandimalla et al., 2015).

Triacotane derivatives, chlorogenone and neochlorogenone, isoflavonoid sulphate and steroidal glycosides, 22-b-ospirostanololigoglycosides, and 26-b-o-glucosidase have all been identified as chemical elements of *Solanum torvum* fruit (Balachandran et al., 2012). In the aqueous extracts of *Solanum torvum* fruits, phytochemicals such as alkaloids, saponins,

flavonoids, polyphenols, and reducing sugars are present(SATHYA et al., 2019b) (Salahuddin, 2020).

Extraction of phenolic and flavonoid contents from *Solanum torvum* seeds revealed a good amount of phenolic and flavonoid content, which might be a source of natural antioxidants(Waghulde et al., 2011). In *Solanum torvum* leaves, phytochemical analysis identified 32 chemical elements, mostly phenolic compounds, terpenoids, palmitic acid, palmitic acid ester, linoleic acid, linolenic alcohol, linolenic acid, and stearic acid(Naimon et al., 2015), (BERRY, 2021), (Balachandran et al., 2015),(Lu, Luo, & Kong, 2009). According to pharmaceutical research, the stem and root of *Solanum torvum* have beneficial medical benefits against tumours, germs, viruses, inflammation(Yousaf et al., 2013b).

Pharmacological Activities of *Solanum Torvum*

Antimicrobial activity

Solanum torvum fruit extracts in methanol have demonstrated antibacterial effectiveness against a range of clinical isolates from both humans and animals(Chah et al., 2000).

Anti-inflammatory and Analgesic activity

Solanum torvum aqueous extract has strong anti-inflammatory and analgesic effects. Aqueous extracts of tannins and phenols have anti-inflammatory and analgesic properties that are linked to a number of different mechanisms, including the inhibition of the production of inflammatory mediators like prostaglandin and cyclooxygenase as well as the production of prostaglandin E2 (PGE2) through the arachidonic acid cascade, a crucial inflammatory mediator(Darkwah et al., 2020b). *Solanum torvum* aqueous extract has strong anti-inflammatory and analgesic effects(Loganayaki et al., 2010).

Antibacterial and Antifungal

The phytochemicals behind the strong antibacterial and antifungal activity of the extracts include flavonoids and polyphenolic tannins. Compared to the results shown in the leaves, stems and inflorescence extracts, methanolic extracts of the roots of *Solanum torvum* showed promising antibacterial and antifungal actions on all species examined(Bari et al., 2010b).

Antihypertensive activity

Methanolic extract of *Solanum torvum* has been shown to lower blood pressure, modify vascular responsiveness to catecholamines, and reverse metabolic abnormalities caused by

fructose(Shaiq Ali et al., 2008). Intravenous injection of aqueous and methanol extracts of ripe *Solanum torvum* fruits lowered blood pressure(Nguelefack, Mekhfi, et al., 2008).

Anti-viral activity

On human and animal clinical isolates of Herpes Simplex Virus, methanolic extracts of sun-dried fruit of *Solanum torvum* including alkaloids, flavonoids, saponins, tannins, and glycosides were shown to have anti-viral effects(Darkwah et al., 2020a).

Antidiabetic activity

Blood glucose levels are significantly reduced with *Solanum torvum*. The presence of phytoconstituents comparable to alkaloids and flavanoid types in the extract may account for this anti-diabetic activity(Abdulkadir et al., 2016),(Kandimalla et al., 2015).

In the system of traditional medicine, the fruits of *Solanum torvum* are frequently used to treat diabetes mellitus. It has been reported that experimental rats were given oral doses of methyl caffeate (10, 20, and 40 mg/kg) derived from *Solanum torvum* plants for 28 days. As a result, *Solanum torvum* plants has antidiabetic activity(Gandhi, Ignacimuthu, Paulraj, et al., 2011).

Anti-ulcer activity

The anti-ulcer efficacy of *Solanum torvum* leaves against ethanol, indomethacin, pylorus ligation, and cold-restraint stress-induced stomach ulcer in rats was examined(Nguelefack, Feumebo, et al., 2008). The ethanolic extract of *Solanum torvum* inhibits the development of Ehrlich's Ascites Carcinoma (EAC) cells significantly(Khazir et al., 2014).

The anticancer potential of the ethanolic extract of *Solanum torvum* fruit was demonstrated by in vitro cytotoxicity data. Tests for cytotoxicity using extract concentrations between 50 g/ml and 1000 g/ml produced results ranging from 7.09% to 85.79%, respectively(Panigrahi et al., 2014).

Anticancer activity

Anticancer phenolic chemicals have also been identified from the *Solanum torvum* plant leaves and seeds. *Solanum torvum* was discovered to be particularly efficient in inhibiting cell growth in mammary gland breast cancer cell lines(Shanthi & Saravanan, 2021). *Solanum torvum* contains methyl caffeine molecules, which act as an anti-cancer agent(Balachandran et al., 2015).

Conclusion

This review highlights *Solanum torvum* common names, description, nutritional content, health benefits, and phytochemicals. This plant is widely available in local area and may be obtained for free. It offers several health benefits. *Solanum torvum* is abundant in macronutrients and micronutrients such as vitamins (A, E, C, B1, B6), copper, folic acid, carbohydrate, and iron. Fever, wounds, tooth decay, gastric ulcers, coughs, sore throat, stomach discomfort, colds, skin illnesses, reproductive issues, hypertension, and diabetes are all treated with *Solanum torvum*.

References

- Abdulkadir, A. R., Mat, N., Hasan, M. M., & Jahan, M. S. (2016). In vitro antioxidant activity of the ethanolic extract from fruit, stem, and leaf of *Solanum torvum*. *ScienceAsia*, 42(3), 184–189. <https://doi.org/10.2306/scienceasia1513-1874.2016.42.184>
- Abhishek, R. U., Thippeswamy, S., Manjunath, K., & Mohana, D. C. (2015). Antifungal and antimycotoxigenic potency of *Solanum torvum* Swartz. leaf extract: Isolation and identification of compound active against mycotoxigenic strains of *Aspergillus flavus* and *Fusarium verticillioides*. *Journal of Applied Microbiology*, 119(6), 1624–1636. <https://doi.org/10.1111/jam.12956>
- Agrawal, A. D., Bajpei, P. S., Patil, A. A., & Bavaskar, S. R. (2010). *Solanum torvum* Sw.—a phytopharmacological review. *Der Pharmacia Lettre*, 2(4), 403–407.
- Akoto, O., Borquaye, L. S., & Howard, A. S. (2015). *Nutritional and Mineral Composition of the Fruits of Solanum torvum from Ghana*. 1(4), 222–226.
- Amponsaa Brobbey, A., Kwarley Quartey, A., Otuo-Serebour, S., & Ayensu, I. (2016). Determination of the antimicrobial and antitussive activities of the leaves of *Solanum torvum*. *Planta Medica*, 81(S 01), S1–S381. <https://doi.org/10.1055/s-0036-1596619>
- Baksh-Comeau, Y. S., Maharaj, S. S., Adams, C. D., Harris, S. A., Filer, D. L., & Hawthorne, W. D. (2016). An annotated checklist of the vascular plants of Trinidad and Tobago with analysis of vegetation types and botanical ‘hotspots.’ *Phytotaxa*, 250(1), 1–431.
- Balachandran, C., Duraipandiyan, V., Al-Dhabi, N. A., Balakrishna, K., Kalia, N. P., Rajput, V. S., Khan, I. A., & Ignacimuthu, S. (2012). Antimicrobial and Antimycobacterial Activities of Methyl Caffeate Isolated from *Solanum torvum* Swartz. Fruit. *Indian Journal of Microbiology*, 52(4), 676–681. <https://doi.org/10.1007/s12088-012-0313-8>
- Balachandran, C., Emi, N., Arun, Y., Yamamoto, Y., Ahilan, B., Sangeetha, B., Duraipandiyan, V., Inaguma, Y., Okamoto, A., & Ignacimuthu, S. (2015). In vitro anticancer activity of methyl caffeate isolated from *Solanum torvum* Swartz. fruit. *Chemico-Biological Interactions*, 242, 81–90.
- Barbosa, Q. P. S., Da Camara, C. A. G., Silva, T. M. S., & Ramos, C. S. (2012). Chemical constituents of essential oils from *solanum torvum* leaves, stems, fruits, and roots. *Chemistry of Natural Compounds*, 48(4), 698–699. <https://doi.org/10.1007/s10600-012-0355-5>

- Bari, M. A., Islam, W., Khan, A. R., & Mandal, A. (2010a). Antibacterial and antifungal activity of *Solanum torvum* (Solanaceae). *International Journal of Agriculture and Biology*, 12(3), 386–390.
- Bari, M. A., Islam, W., Khan, A. R., & Mandal, A. (2010b). Antibacterial and antifungal activity of *Solanum torvum* (Solanaceae). *Int J Agric Biol*, 12(3), 386–390.
- Begam, A. K. U. S. R. (2015). Free Radical Scavenging Action of *Solanum Torvum* Fruit Extracts using in Vitro Antioxidant Methods. *International Journal for Scientific Research & Development*, 3(9), 1113–1117.
- BERRY, C. O. F. T. (2021). *THE CHEMICAL COMPOUNDS OF TURKEY BERRY (Solanum torvum Swartz) PLANTS THAT ARE EFFICACIOUS AS MEDICINE.*
- Biney, E. E., Nkoom, M., Darkwah, W. K., & Puplampu, J. B. (2021). High-Performance Liquid Chromatography Analysis and Antioxidant Activities of Extract of *Azadirachta indica* (Neem) Leaves. *Pharmacognosy Research*, 12(1).
- Bishnoi, S. K. (n.d.). *Solanum torvum Sw.: Towards development of a domestication strategy for the potential vegetable candidate crop Turkey berry (Solanum torvum Sw.) for commercial cultivation in India.*
- Chah, K. F., Muko, K. N., & Oboegbulem, S. I. (2000). Antimicrobial activity of methanolic extract of *Solanum torvum* fruit. *Fitoterapia*, 71(2), 187–189.
- Christi, I. V. E., Uma, P. T., Nagarajaperumal, G., & Mohan, S. (2018). Phytochemicals detection, antioxidant and antimicrobial activity study on berries of *Solanum torvum*. *Asian Journal Pharmaceutical and Clinical Research*, 11(11), 418–423.
- Darkwah, W. K., Koomson, D. A., Miwornunyuie, N., Nkoom, M., & Puplampu, J. B. (2020a). phytochemistry and medicinal properties of *Solanum torvum* fruits. *All Life*, 13(1), 498–506.
- Darkwah, W. K., Koomson, D. A., Miwornunyuie, N., Nkoom, M., & Puplampu, J. B. (2020b). Review: phytochemistry and medicinal properties of *Solanum torvum* fruits. *All Life*, 13(1), 498–506. <https://doi.org/10.1080/26895293.2020.1817799>
- Dickson, R. A., Amponsah, I. K., Annan, K., & Fleischer, T. C. (2014). *Nutritive potential of a polyherbal preparation from some selected Ghanaian herbs.*
- Femi Ibikunle, G., & Olofu Ogbadoyi, E. (2016). *In Vitro* Evaluation of Extracts of *Solanum torvum* (Solanaceae) Fruits for Anti-Trichomonas Activity. *British Journal of Pharmacology and Toxicology*, 7(2), 20–25. <https://doi.org/10.19026/bjpt.7.2859>
- Gaëlle Djouéudam, F., Bertrand Fowa, A., Pierre Chegaing Fodouop, S., Kodjio, N., Gatsing, D., & Donatien Gatsing, C. (2019). *Solanum torvum Sw. (Solanaceae): Phytochemical screening, antisalmonella and antioxidant properties of leaves extracts. ~ 5 ~ Journal of Medicinal Plants Studies*, 7(1), 5–12.
- Gandhi, G. R., Ignacimuthu, S., & Paulraj, M. G. (2011). *Solanum torvum Swartz. fruit containing phenolic compounds shows antidiabetic and antioxidant effects in*

streptozotocin induced diabetic rats. *Food and Chemical Toxicology*, 49(11), 2725–2733. <https://doi.org/10.1016/j.fct.2011.08.005>

- Gandhi, G. R., Ignacimuthu, S., Paulraj, M. G., & Sasikumar, P. (2011). Antihyperglycemic activity and antidiabetic effect of methyl caffeate isolated from *Solanum torvum* Swartz. fruit in streptozotocin induced diabetic rats. *European Journal of Pharmacology*, 670(2–3), 623–631.
- Jaiswal, B. S., & Mohan, M. (2012). Effect of *solanum torvum* on the contractile response of isolated tissues preparation in fructose fed rat. *Int J Pharm Bio Sci*, 3(3), 161–169.
- Kala, C. P. (2005). Ethnomedicinal botany of the Apatani in the Eastern Himalayan region of India. *Journal of Ethnobiology and Ethnomedicine*, 1, 1–8.
- Kalita, L., Dash, B., Borah, U., Deka, J., & Dash, S. (2017). Preliminary phytochemical analysis and antimicrobial activity ethanolic extracts of dried fruits of *Solanum torvum* (Family-Solanaceae). *Int J Curr Pharm Res*, 9(3), 123–126.
- Kandimalla, R., Kalita, S., Choudhury, B., & Kotoky, J. (2015). a Review on Anti-Diabetic Potential of Genus *Solanum* (Solanaceae). *Journal of Drug Delivery and Therapeutics*, 5(1), 24–27. <https://doi.org/10.22270/jddt.v5i1.1026>
- Karmakar, K., Islam, M. A., Chhanda, S. A., Tuhin, T. I., Muslim, T., & Rahman, M. A. (2015). Secondary metabolites from the fruits of *Solanum torvum* SW. *Journal of Pharmacognosy and Phytochemistry*, 4(1), 160–163.
- Kayalvizhi, J., Bharathi, K., Vijayakumari, P., Kavitha, M., Bhuvaneshwari, T. S., Muruganandam, G., Sethuraman, M., & Thirumurugan, V. (2012). Studies on the physico-phytochemical properties and hepatoprotective effect of *solanum torvum* swartz in CCL4 induced experimental toxicity in albino rats. *International Journal of Pharmacy and Pharmaceutical Sciences*, 4(SUPPL. 5), 426–429.
- Khazir, J., Riley, D. L., Pilcher, L. A., De-Maayer, P., & Mir, B. A. (2014). Anticancer agents from diverse natural sources. *Natural Product Communications*, 9(11), 1934578X1400901130.
- Koffuor, G. A., Amoateng, P., & Andey, T. A. (2011). Immunomodulatory and erythropoietic effects of aqueous extract of the fruits of *Solanum torvum* Swartz (Solanaceae). *Pharmacognosy Research*, 3(2), 130.
- Koomson, D. A., Kwakye, B. D., Darkwah, W. K., Odum, B., Asante, M., & Aidoo, G. (2018). Phytochemical constituents, total saponins, alkaloids, flavonoids and vitamin C contents of ethanol extracts of five *Solanum torvum* fruits. *Pharmacognosy Journal*, 10(5).
- Kr Paul, P., Gohain, K., & Das, S. (2017). *Sedative and Hypnotic Activities of Ethanolic Leaves Extract of Solanum Torvum Sw. in Albino Mice*. 8(8), 52–67. www.ijppr.humanjournals.com
- Kumar, R. S. A. S., Raja, N. K., Vijay, M., & Raja, C. S. G. (2016). Anti-oxidant, anti-diabetic, antimicrobial and hemolytic activity of *Solanum torvum* and *Solanum trilobatum*. *Journal of Pharmaceutical Sciences and Research*, 8(8), 725.

- Loganayaki, N., Siddhuraju, P., & Manian, S. (2010). Antioxidant activity of two traditional Indian vegetables: *Solanum nigrum* L. and *Solanum torvum* L. *Food Science and Biotechnology*, *19*(1), 121–127. <https://doi.org/10.1007/s10068-010-0017-y>
- Lu, Y., Luo, J., Huang, X., & Kong, L. (2009). Four new steroidal glycosides from *Solanum torvum* and their cytotoxic activities. *Steroids*, *74*(1), 95–101.
- Lu, Y., Luo, J., & Kong, L. (2009). Structure elucidation and complete NMR spectral assignments of new furostanol glycosides from *Solanum torvum*. *Magnetic Resonance in Chemistry*, *47*(9), 808–812.
- Mohan, M., Attarde, D., Momin, R., & Kasture, S. (2013). Antidepressant, anxiolytic and adaptogenic activity of torvanol A: An isoflavonoid from seeds of *Solanum torvum*. *Natural Product Research*, *27*(22), 2140–2143. <https://doi.org/10.1080/14786419.2013.778853>
- Mohan, M., Jaiswal, B. S., & Kasture, S. (2009). Effect of *Solanum torvum* on blood pressure and metabolic alterations in fructose hypertensive rats. *Journal of Ethnopharmacology*, *126*(1), 86–89.
- Musarella, C. M. (2020). *Solanum torvum* Sw. (Solanaceae): a new alien species for Europe. *Genetic Resources and Crop Evolution*, *67*(2), 515–522. <https://doi.org/10.1007/s10722-019-00822-5>
- Naimon, N., Pongchairerk, U., & Suebkhampet, A. (2015). Phytochemical analysis and antibacterial activity of ethanolic leaf extract of *Solanum torvum* Sw. against pathogenic bacteria. *Agriculture and Natural Resources*, *49*(4), 516–523.
- Nguelefack, T. B., Feumebo, C. B., Ateufack, G., Watcho, P., Tatsimo, S., Atsamo, A. D., Tane, P., & Kamanyi, A. (2008). Anti-ulcerogenic properties of the aqueous and methanol extracts from the leaves of *Solanum torvum* Swartz (Solanaceae) in rats. *Journal of Ethnopharmacology*, *119*(1), 135–140. <https://doi.org/10.1016/j.jep.2008.06.008>
- Nguelefack, T. B., Mekhfi, H., Dimo, T., Afkir, S., Nguelefack-Mbuyo, E. P., Legssyer, A., & Ziyat, A. (2008). Cardiovascular and anti-platelet aggregation activities of extracts from *Solanum torvum* (Solanaceae) fruits in rat. *Journal of Complementary and Integrative Medicine*, *5*(1).
- Nguelefack, T. B., Mekhfi, H., Dongmo, A. B., Dimo, T., Watcho, P., Zoheir, J., Legssyer, A., Kamanyi, A., & Ziyat, A. (2009). Hypertensive effects of oral administration of the aqueous extract of *Solanum torvum* fruits in L-NAME treated rats: Evidence from in vivo and in vitro studies. *Journal of Ethnopharmacology*, *124*(3), 592–599.
- Ningsih, W. M., Zulharmita, Z., Asra, R., & Chandra, B. (2021). REVIEW: THE CHEMICAL COMPOUNDS OF TURKEY BERRY (*Solanum torvum* Swartz) PLANTS THAT ARE EFFICACIOUS AS MEDICINE. *International Journal of Pharmaceutical Sciences and Medicine*, *6*(8), 173–181. <https://doi.org/10.47760/ijpsm.2021.v06i08.013>
- Otu Phyllis, Naa, Yarley, Sarpong Frederick, Gidah Jeremiah, Erastus, Labanan Abdul-Mumuni, A. D. (2017). Characterization of turkey berry (*Solanum torvum*)- fresh, dry &

powder. *African Journal of Food and Integrated Agriculture*, 1(2), 9–14.
<https://doi.org/10.25218/ajfia.2017.01.001.02>

- Panigrahi, S., Muthuraman, M. S., Natesan, R., & Pemiah, B. (2014). Anticancer activity of ethanolic extract of *Solanum torvum* sw. *International Journal of Pharmacy and Pharmaceutical Sciences*, 6(1), 93–98.
- Priyanka, A., Yogananth, N., Ali, M. S., & Anuradha, V. (2014). Antibacterial and antifungal activity of *Solanum torvum* Sw. An ethnomedicinal plant. *International Journal of Comprehensive Research in Biological Sciences*, 1(3), 6–12.
- Putri, N. N. P., Anggriani, R., & Sukardi, S. (2023). Bioactive Compound in *Solanum torvum* and Its Potential as Functional Food and Drink: A Review. *Biology, Medicine, & Natural Product Chemistry*, 12(1), 205–213.
- Rahmadiyah, T., Muslim, M., & Sasanti, A. D. (n.d.). *Effect of turkey berry (Solanum torvum) leaf extract on feminization of common carp (Cyprinus carpio)*.
- Rahmatullah, M., Mukti, I. J., Haque, A., Mollik, M. A. H., Parvin, K., Jahan, R., Chowdhury, M. H., & Rahman, T. (2009). An ethnobotanical survey and pharmacological evaluation of medicinal plants used by the Garo tribal community living in Netrakona district, Bangladesh. *Advances in Natural and Applied Sciences*, 3(3), 402–418.
- Ramamurthy, C. H., Kumar, M. S., Suyavaran, V. S. A., Mareeswaran, R., & Thirunavukkarasu, C. (2012). Evaluation of Antioxidant, Radical Scavenging Activity and Polyphenolics Profile in *Solanum torvum* L. Fruits. *Journal of Food Science*, 77(8).
<https://doi.org/10.1111/j.1750-3841.2012.02830.x>
- Rammohan, M., & Reddy, C. S. (2011). *COMPARATIVE DIURETIC ACTIVITY OF SEED AND FRUIT WALL EXTRACT OF Solanum torvum*. 3(1), 50–53.
- Saha, M., & Datta, B. K. (2017). Observations on the reproductive biology of *Solanum torvum* Swartz (Solanaceae): an important medicinal plant in North-east India. *The International Journal of Plant Reproductive Biology*, 9(1), 25–27.
- Said, J., Walker, M., Parsons, D., Stapleton, P., Beezer, A. E., & Gaisford, S. (2014). An in vitro test of the efficacy of an anti-biofilm wound dressing. *International Journal of Pharmaceutics*, 474(1–2), 177–181.
- Salahuddin, K. (2020). *Micropropagation and Conservation of a Wild Species of Solanum through Organ Cultures*. July. <https://doi.org/10.13140/RG.2.2.35682.96962>
- SATHYA, R., DEVI, S., & RAMAMURTHY, V. (2019a). Phytochemical Screening and Gc-Ms Profiling of Ethanolic Fruits Extract of *Solanum Torvum*. *Infokara.Com*, 8(8), 287–294. <http://www.infokara.com/gallery/38-aug-2792.pdf>
- SATHYA, R., DEVI, S., & RAMAMURTHY, V. (2019b). Phytochemical Screening and Gc-Ms Profiling of Ethanolic Fruits Extract of *Solanum Torvum*. *Infokara.Com*, 8(8), 287–294. <http://www.infokara.com/gallery/38-aug-2792.pdf>

- Shaiq Ali, M., Tabbasum, S., & Ahmed, S. (2008). Spirotrvoside: A new steroidal-glycoside from *Solanum torvum* (Solanaceae). *J. Chem. Soc. Pak*, 30, 494–498.
- Shanthi, D., & Saravanan, R. (2021). Evaluation of cytotoxicity of normal vero and anticancer activity of human breast cancer cell lines by aqueous unripe fruit extract of *Solanum torvum*. *Research Journal of Pharmacy and Technology*, 14(7), 3504–3508.
- Sirait, N. (2009). Eggplant Cepoka (*Solanum torvum*) Herbs that are efficacious as medicine. *Report on Research and Development of Industrial Plants*, 15(1), 11–13.
- Sivapriya, M., & Leela, S. (2007). Isolation and purification of a novel antioxidant protein from the water extract of Sundakai (*Solanum torvum*) seeds. *Food Chemistry*, 104(2), 510–517.
- Sundari, S. G., Rekha, S., & Parvathi, A. (2013). Phytochemical evaluation of three species of *Solanum* L. *International Journal of Research in Ayurveda and Pharmacy (IJRAP)*, 4(3), 420–425.
- Thenmozhi, A., & US, M. R. (2012). Comparative free radical scavenging potentials of different parts of *Solanum torvum*. *Free Radicals and Antioxidants*, 2(2), 24–29.
- Vadakkan, K., Vijayanand, S., Choudhury, A. A., Gunasekaran, R., & Hemapriya, J. (2018). Optimization of quorum quenching mediated bacterial attenuation of *Solanum torvum* root extract by response surface modelling through box-Behnken approach. *Journal of Genetic Engineering and Biotechnology*, 16(2), 381–386.
- Vargas-Magaña, J. J., Torres-Acosta, J. F. J., Aguilar-Caballero, A. J., Sandoval-Castro, C. A., Hoste, H., & Chan-Pérez, J. I. (2014). Anthelmintic activity of acetone–water extracts against *Haemonchus contortus* eggs: interactions between tannins and other plant secondary compounds. *Veterinary Parasitology*, 206(3–4), 322–327.
- Vijayakumari, P., Shanthi, K., Bharathi, K., Kayalvizhi, J., Muruganandham, G., Thirumurugan, V., & Sethuraman, M. (2012). Studies on the physico-phytochemical and Anti-diabetic properties of *Cissus quadrangularis* L and *Solanum torvum* swartz. *International J of Drug Discovery and Herbal Research January–March*, 2(1), 323–328.
- Waghulde, H., Kamble, S., Patankar, P., Jaiswal, B., Pattanayak, S., Bhagat, C., & Mohan, M. (2011). Antioxidant activity, phenol and flavonoid contents of seeds of *Punica granatum* (Punicaceae) and *Solanum torvum* (Solanaceae). *Pharmacologyonline*, 1, 193–202.
- Wannasiri, S., Chansakaow, S., & Sireeratawong, S. (2017). Effects of *Solanum torvum* fruit water extract on hyperlipidemia and sex hormones in high-fat fed male rats. *Asian Pacific Journal of Tropical Biomedicine*, 7(5), 401–405.
<https://doi.org/10.1016/j.apjtb.2017.01.027>
- Yousaf, Z., Wang, Y., & Baydoun, E. (2013a). Phytochemistry and pharmacological studies on *Solanum torvum* Swartz. *Journal of Applied Pharmaceutical Science*, 3(4), 152–160.
<https://doi.org/10.7324/JAPS.2013.3428>

- Yousaf, Z., Wang, Y., & Baydoun, E. (2013b). Phytochemistry and pharmacological studies on *Solanum torvum* Swartz. *Journal of Applied Pharmaceutical Science*, 3(4), 152–160. <https://doi.org/10.7324/JAPS.2013.3428>
- Yousafa, Z., Wang, Y., & Baydoun, E. (2013). Phytochemistry and pharmacological studies on *Solanum torvum* Swartz. *Journal of Applied Pharmaceutical Science*, 3(4), 152–160.
- Yuan, P. long, Wang, X. P., Jin, B. L., Yang, Y. F., Chen, K. X., Jia, Q., & Li, Y. M. (2016). Sesquiterpenes with immunosuppressive effect from the stems of *Solanum torvum*. *Phytochemistry Letters*, 17, 126–130. <https://doi.org/10.1016/j.phytol.2016.07.006>