INTERNATIONAL JOURNAL OF PHARMACEUTICAL RESEARCH AND BIOMEDICAL ANALYSIS | ISSN: 2278 –2664
| APR-JUN 2025 | VOLUME 14 | ISSUE 2 | 07-18
Available Online Through: www.ijprba.com

Review Article

PHARMACOGNOSY, PHYTOCHEMISTRY AND PHARMACOLOGICAL PROFILE OF *Cissus quadrangularis*

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ABSTRACT

Cissus quadrangularis, commonly known as Hadjod, is a popular folklore medicine used throughout India by bone setters. It is highly studied for its bone healing potential. Its remarkable properties are mentioned in Ayurveda and Unani medicine. Apart from the popular medicinal uses, many other aspects of this wonder plant are less popular. The present article provides the complete pharmacognostic, phytochemical, and pharmacological profiles of the Cissus quadrangularis.

KEY WORDS

Cissus quadrangularis, Cissus, Fracture, Bone healing, Osteoporosis

INTRODUCTION

Cissus quadrangularis, commonly known as Hadjod, is a perennial plant belonging to the family Vitaceae. It is also referred to by various names, including Adamant creeper, Square stalked vine, Veldt grape, Devil's backbone, Asthisamharaka, Pirandai, Sannalam, Nelleru, Vajra Velli, and Mangara Valli.[1] This species is native to India, Bangladesh, and Sri Lanka, and is also found across parts of Africa and Southeast Asia. It has been introduced to other regions such as Brazil and the southern United States.[1]

The plant typically grows up to 1.5 meters in height and is characterized by its distinct quadrangular stems, with internodes measuring approximately 8 to 10 cm in length and 1.2 to 1.5 cm in width. Each of the stem's four angles is edged with a leathery ridge.[1] The leaves, which are toothed and trilobed, measure around 2 to 5 cm in width and appear at the nodes. A tendril grows from the opposite side of each node. The plant produces racemes of small white, yellowish, or greenish flowers, and bears globular berries that turn red when ripe.[1]

Scientific research has shown that Cissus extract exhibits both cardiotonic and androgenic properties.[2] In addition to accelerating the bone remodeling process, Cissus significantly enhances the tensile strength of healing bone. Clinical trials have demonstrated that Cissus can reduce fracture healing time to approximately 33% to 55% of that observed in control groups. This accelerated healing rate may be particularly beneficial for individuals suffering from chronic conditions such as osteoporosis.[3]

Cissus also exhibits analgesic properties that are comparable, on a milligram-to-milligram basis, to those of aspirin and anti-inflammatory drugs such as ibuprofen. Extracts of *Cissus quadrangularis* (CQ) have been utilized for their antiviral and antibacterial activities, as well as for their ability to scavenge free radicals. *Cissus quadrangularis* has attracted global research interest due to its wide range of pharmacological activities, including analgesic [4], antiinflammatory [5], antioxidant and free radical scavenging effects [6], as well as its anti-osteoporotic and bone healing properties.[7] Cissus quadrangularis is commonly found

across the hotter regions of India, as well as in West Africa and Sri Lanka (formerly Ceylon). [8] The plant is reported to be rich in dietary antioxidants, including vitamin C, carotenoids, and polyphenols.

Fig 1: Cissus quadrangularis

Fig 2: Veld grape plant of cissus

Vernacular names: Vernacular names of cissus quadrangularis is given below in Table 1.

Language	Vernacular names
Telugu	Nalleru, Nelleratiga, vajaravalli
Hindi	Hadjod, Hodjora, Hadsarihari, Harsankari, Kandvel
English	Edible stemmed vine, Adamant creeper, Bone setter
Bengali	Har, Harbhanga, Hasjora, Horjora
Kanada	Mangarahalli
Gujarati	Chodhari, Hadsand, Hadsankal, Vedhari
Malayalam	Cannalamparanta, Peranta
Urdu	Harjora, Hadsankal
Oriya	Hadavhanga
Tamil	Horjora, Harsankar, Kandavel, Nallar

Table 1: Vernacular names of Cissus quadrangularis

HISTORY

Cissus quadrangularis is a succulent climbing plant native to Asia and Africa and is among the most widely used medicinal plants in Thailand. Traditionally, it has been utilized in African herbal practices as well as in Ayurvedic medicine, with all parts of the plant being used for therapeutic purposes.

Although often associated with Ayurveda, *Cissus quadrangularis* has a long history of traditional use across various regions due to its widespread growth. It has been primarily employed for treating bone-related conditions such as enhancing bone mass and speeding up fracture healing earning it the common name "Bone Setter" or "Hadjod." Additionally, it has traditionally been used to address women's health issues, including menopause, libido, and menstrual disorders. Other traditional applications include its reported anti-ulcer, Anti hemorrhoidal, analgesic, and wound-healing properties. [9]

Traditional uses in ayurveda:

- **Krumighna** – Effective against worm infestations and beneficial for treating infected wounds.

- **Amaghna** – Helps eliminate *ama*, a toxic byproduct of improper digestion and disturbed metabolism.
- **Asthiyuk** – Enhances bone strength.
- **Sara** – Promotes mobility, acts as a laxative, and helps relieve constipation.
- **Pittala** – Increases *Pitta Dosha*.
- **Vrushya** – Acts as an aphrodisiac and boosts vitality.
- **Pachana** – Supports digestion and helps alleviate *Ama Dosha*.

Cissus quadrangularis is used to treat various conditions, including obesity, gout, syphilis, venereal diseases, leucorrhea, worm infestations, anorexia, diabetes, peptic ulcers, haemorrhoids, and high cholesterol. It is also utilized as a bodybuilding supplement. In the northeastern states of India, its stem is consumed as a vegetable. In the Siddha system of medicine, it is used for healing bone fractures, treating piles, as an anti-aging herb, and for conditions like asthma, cough, and gonorrhoea [10].

CLASSIFICATION

Cissus quadrangularis is a well-studied medicinal plant the taxonomical classification is given below in table 2. [11,12]

Taxonomic Rank	Scientific Name	Common Name
Kingdom	Plantae	Plants
Subkingdom	Tracheobionta	Vascular plants
Super division	Spermatophyta	Seed Plants
Division	Magnoliophyta	Flowering Plants
class	Magnoliopsida	Dicotyledons
Subclass	Rosidae	-
Order	Rhamnales	-
Family	Vitaceae Juss	Grape family
Genus	Cissus L.	Treebine
Species	Cissus quadrangularis L.	Veld grape

Table 2: Taxonomical classification of cissus quadrangularis.

PHARMACOGNOSY

Medicinal plants with great medicinal value are well studied such as cissus quadrangularis for its macroscopic and microscopic characters. [13,14]

Macroscopical characters

Characters	Cissus quadrangularis
Plant	Quadrangular-sectioned branches with internodes
Leaves	Simple 2.5-5cm long, broadly ovate or reniform, denticulate, glabrous, cordate, rounded, truncate or cuneate at the base, stipules small broadly ovate, obtuse.
Flowers	Small white, yellowish, or greenish flowers, shortly peduncle cymes with spreading umbellate branches
Calyx	Cup shaped, truncate or very obscurely lobed

Petals	Petals are 4, ovate-oblong, short, stout.
Stem	Quadrangular, 4-winged, internodes 4-15cm long and 1-2cm thick
Seed	Globular berries are red when ripe, obovoid or globose
Flowering and Fruiting time	June-December in Indian conditions

Table 3: Macroscopical characters of cissus quadrangularis Microscopical characters

Structure	Description
Epidermis	Single-layered with thick cuticle; made of small, tabular cells; may have a few multicellular trichomes.
Hypodermis	Made of 3–4 layers of collenchymatous cells below the ridges; provides mechanical strength
Cortex	Parenchymatous, with large intercellular spaces; contains mucilage cells and calcium oxalate crystals (raphides).
Pericycle	Continuous ring of sclerenchyma just outside vascular bundles.
Vascular Bundles	Numerous, collateral and open, arranged in a ring; xylem facing inward and phloem outward.
Cambium	Present between xylem and phloem, indicating secondary growth.
Pith	Large, made up of parenchymatous cells; centrally located; contains starch grains and sometimes crystals.

Table 4: Microscopical characters of cissus quadrangularis

PHYTOCHEMISTRY

Cissus quadrangularis is rich in a wide range of bioactive compounds, including alkaloids, resveratrol, piceatannol, pallidol, Parthenocissus quadrangularis, ascorbic acid, carotene, phytosterols, calcium, flavonoids, vitamins, enzymes, nicotinic acid, tyrosine, and various triterpenoids. It also contains several terpenoid compounds such as balsam ketone, amyrin, onocer-7-ene-3α,21-diol, taraxerol, acetyl taraxerol, and friedelin ketone. The primary chemical constituents are tetracyclic triterpenoids like onocer-7-ene-3α,21β-diol and onocer7ene-3β,21α-diol, along with two steroidal substances, α-sitosterol and δ-amyrin. The plant's stem is particularly rich in these components, also revealing unique stilbene derivatives known as quadrangularins A, B, and C. Furthermore, the presence of β-sitosterol, δ-amyrin, δamyrone, and flavonoids such as quercetin has been associated with various metabolic and physiological benefits.[15] In addition to various other lipids, *Cissus quadrangularis* contains numerous phytosterols such as heptadecyl octa decanoate, icosanyl icosanoate, 4-hydroxy-2-methyltricos-2-en-22-one, 9methyl-octadec-9-ene, α-amyrin, α-amyrone, taraxeryl acetate, friedelan-3-one, taraxerol, βsitosterol, and iso penta cosanoic acid. The plant is also a rich source of vitamin C and betacarotene. Analysis revealed that *Cissus quadrangularis* contains ascorbic acid at a concentration of 479 mg and carotene at 267 units per 100 grams of freshly prepared paste, along with the presence of calcium oxalate.[16]

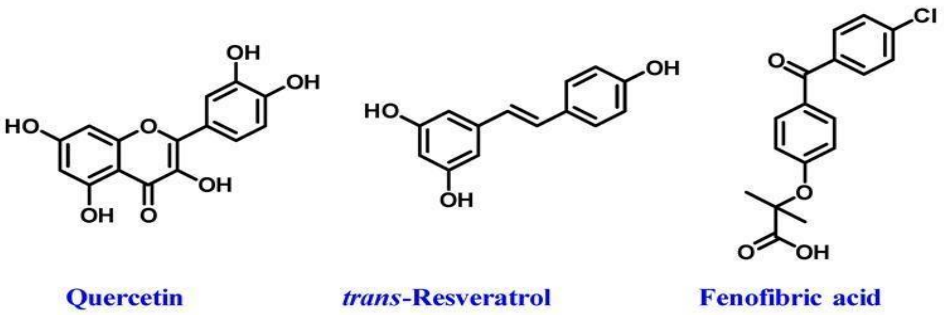

Fig 3: Structure of chemical constituents

Compound class	Examples	Activity
Flavonoids	Quercetin, Kaempferol	Antioxidant, anti-inflammatory
Triterpenoids	β-amyrin, α-amyrin	Anti-inflammatory, analgesic
Phytosterols	β-sitosterol	Bone healing, anti-osteoporotic
Iridoids	Picroside	Antioxidant, hepatoprotective
Ascorbic Acid	Vitamin C	Collagen synthesis, antioxidant
Carotenoids	Beta-carotene	Antioxidant
Calcium	Inorganic mineral	Bone formation
Phenolic compounds	Stilbene derivatives	Antioxidant, antimicrobial
Resveratrol	Found in stem extract	Cardioprotective, antiinflammatory
Ketosteroids	Present in ethanol extract	Anabolic and androgenic activity. [17]

Table 4: Phytoconstituents of cissus quadrangularis

PHARMACOLOGY ALONG WITH MEDICINAL VALUE

Pharmacological Activities of *Cissus quadrangularis:*

Cissus quadrangularis is a widely studied medicinal plant known for its broad spectrum of pharmacological properties. Scientific investigations have validated its traditional uses and identified numerous therapeutic potentials**:**

1. **Bone healing and Anti-osteoporotic Activity:**

Osteoporosis is a bone disease marked by reduced bone mass and deterioration of bone microarchitecture, leading to increased fragility and a higher risk of fractures. Bone healing is the biological process by which the body repairs a fractured or damaged bone, restoring its original structure and strength through a series of cellular and molecular events.[18] *Cissus quadrangularis* is traditionally referred to as “Hadjod” or "bone setter" due to its ability to accelerate fracture healing and enhance bone regeneration. Studies have shown that its extracts promote osteoblast proliferation and increase bone tensile strength, significantly reducing the healing time of fractures.[19]

2. **Anti-inflammatory and Analgesic Activity:**

Anti-inflammatory which reduces the inflammation, which is the body's response to injury or infection and Analgesic activity relieves the pain without causing loss of consciousness by acting on the peripheral or central nervous system. The plant has demonstrated significant anti-inflammatory effects, comparable to nonsteroidal anti-inflammatory drugs (NSAIDs). It also exhibits

analgesic properties, making it beneficial in pain management.[20]

3. Antioxidant and Free Radical Scavenging Activity:

Antioxidants that help to protect the body's cells from damage caused by free radicles and unstable molecules that can oxidative stress, leading to cell aging and various diseases. They are rich in polyphenols, flavonoids, vitamin C, and carotenoids, *C. quadrangularis* exhibits potent antioxidant activity, which helps combat oxidative stress and associated degenerative diseases.[21]

4. Anti-ulcer Activity:

They have an ability of a substance to prevent or heal ulcers, particularly in the stomach and intestines, by reducing acid secretions, and promoting the tissue repair. Methanolic extracts of the plant have shown protective effects against gastric ulcers by enhancing mucosal defense and reducing gastric acid secretion.[22]

5. Anti-obesity and Hypolipidemic Activity

Anti-obesity is the condition that reduces or prevents excessive body fat accumulation, often by regulating appetite, fat absorption, or metabolism, whereas hypolipidemic activity lowers the lipid levels, particularly cholesterol and triglycerides, in the blood, helping to prevent cardiovascular diseases. The extract helps in reducing body weight, body fat, and serum lipid levels, making it effective for managing obesity and high cholesterol.[23]

6. Antimicrobial and Antiviral Properties

Anti-microbial properties kill or inhibit the growth of wide range of microorganism, including bacteria, fungi, and parasites. Antiviral properties prevent the development or replication of viruses and helping to control viral infections. *Cissus quadrangularis* has been found effective against various bacterial and viral strains due to its antimicrobial phytochemicals.[24]

7. Aphrodisiac and Reproductive Health

Aphrodisiac refers to any substance that enhances desire, arousal, or performance by stimulating hormonal, neurological, or psychological responses. The plant is traditionally used to enhance libido and improve male reproductive performance due to its androgenic properties.[25]

8. Antidiabetic Activity

Anti diabetic activity helps to control blood glucose levels, improve insulin function, or reduce the symptoms and complications of diabetes. It has shown promising results in lowering blood glucose levels and improving insulin sensitivity, useful for managing diabetes.[26]

MISELLANEOUS

1. Toxicity

- **Generally Recognized as Safe (GRAS):** In traditional doses and formulations, *Cissus quadrangularis* is considered safe with low toxicity.
- **High Dose Concerns:** Animal studies have indicated that excessive doses may lead to hepatotoxicity or mild gastrointestinal irritation.
- **Cytotoxic Activity:** Some extracts have shown cytotoxic effects in vitro at high concentrations, which may warrant caution in therapeutic use.
- **Kidney Stone Risk:** Due to the presence of oxalates, long-term use in large amounts may increase the risk of kidney stones, especially in people predisposed to oxalate metabolism disorders.[27]

2. Allergic Reactions

Rare but Possible: Allergic responses to *Cissus quadrangularis* are rare but may include symptoms such as o Skin rashes or itching o Mild respiratory discomfort

- People with known plant-based allergies, especially to other members of the Vitaceae family, should proceed with caution.

- Contact Dermatitis has been reported when handling fresh stems or leaves in sensitive individuals.[28]

3. Drug and Herb Interactions

Cissus quadrangularis may interact with certain medications or herbs due to its active constituents:

- **Antidiabetic Medications**: It may enhance hypoglycaemic effects, potentially leading to low blood sugar.
- **Antihypertensive Drugs**: It can lower blood pressure slightly, and when taken with such drugs, might cause hypotension.
- **Anti-inflammatory Drugs**: Combining it with NSAIDs may enhance pain relief but can increase gastrointestinal irritation in sensitive individuals.
- **Hormonal Supplements**: Due to its androgenic properties, it may interact with hormonal therapies or conditions sensitive to hormone levels (e.g., prostate issues).[29]

MARKET VALUE

Global Market Overview

- **Market Size & Growth:** In 2024, the global Cissus quadrangularis market was valued at approximately USD 18.88 million, with projections estimating a rise to USD 25.87 million by 2031, reflecting a compound annual growth rate (CAGR) of 4.6%.[30]

Regional Market Trends

- The Asia-Pacific region, especially India, holds a major share of the market. India is not only a key consumer but also the top exporter, with 787 recorded shipments, outperforming countries like China and South Korea.
- In 2025, Asia-Pacific is projected to contribute 44.3% of the global market revenue. India's leadership in this space is supported by its rich tradition of herbal medicine and a wellestablished supply chain for medicinal plants.[31]

Product Availability and Pricing

Cissus quadrangularis is sold globally in the form of powders, capsules, and extracts. Pricing varies depending on quality, brand, and region.

- **Retail (India)**: A 200g pack of Hadjod powder costs approximately INR 318 on major e-commerce platforms like Flipkart.
- **Bulk Extract**: Prices range from INR 400 to INR 850 per kg, depending on purity and supplier, according to listings on TradeIndia.[32]

Market value of cissus quadrangularis is given below in the table 5. [33]

Category	Details
Scientific Name	*Cissus quadrangularis*
Common Names	Hadjod, Veldt Grape, Asthisamhara
Global Market Value (2024)	USD 18.88 million
Projected Market Value (2031)	USD 25.87 million
Projected Market Value (2035)	USD 26.4 million
CAGR (2024–2031)	4.6%
CAGR (2025–2035)	14.6%
Top Exporting Country	India (787 export shipments recorded)
Major Market Regions	Asia-Pacific, North America, Europe
Asia-Pacific Revenue Share (2025)	~44.3% of global market
Retail Price in India (200g powder)	INR 318
Bulk Extract Price Range	INR 400–850 per kg (India)
Product Formats	Powder, capsules, extracts, tinctures

Primary Uses	Bone health, joint support, weight management
Growth Drivers	Herbal trends, export growth, research backed demand

Table 5: Market value of cissus quadrangularis

SUMMARY TABLE. [34- 43]

The summary table of cissus quadrangularis is given in the table 6.

S. NO	PLANT PART	ACTIVITY	EXTRACT	MODEL	STANDARD DRUG	DOSE	PARAMETERS	MECHANISM	STATS P VALUE	AUTHOR YEAR
1.	**Stem**	Bone fracture healing	Dried stem powder (capsules)	Human clinical trial (mandible fracture)	Placebo	300 mg/day	Osteopontin levels	Enhances bone protein synthesis	$p < 0.05$	Sampath Kumar, S., et al. (2015)[34]
2.	**Stem**	Osteoporosis is prevention	Dried stem powder	Human clinical trial (post menopausal osteopenia	Placebo	1.2 or 1.6 g/day	Bone mineral density	Inhibits osteoclast activity	Not significant	Benjawan, S., et al. (2022) [35]
3.	**Stem**	Antiarthritic	Methanolic extract	In vitro (protein denaturati on on assay)	Diclofenac	100– 500 µg/ml	Protein denaturation inhibition	Presence of phenolic acids, flavonoids, βsitosterol	Significant	Vaijayantimala et al., (2018) [36]
4.	**Stem**	Anti-inflammatory	Methanolic extract	In vitro (RAW 264.7 macrophage cells)	Not specified	50 mg/kg	NO production, iNOS expression, NF-κB translocation	Inhibits proinflammatory mediators	Significant	Srisook, K., et al. (2011)[37]
5.	**Stem**	Anti-ulcer	Methanolic extract	Wistar rats (aspirin induced gastric ulcer)	Omeprazole	500 mg/kg for 15 days	Mucus content, antioxidant enzymes	Proton pump inhibition, antioxidant activity	$p < 0.05$	Jainu, M., & Devi, C. S. S. (2004)[38]

6.	**Stem**	Antidiabetic	Ethyl acetate fraction	Diabetic rats	Not specified	100– 200 mg/kg	Blood glucose, insulin levels, and antioxidant markers	Enhances antioxidant defence, reduces inflammation	Significant	Jainu, M., et al. (2014)[39]
7.	**Stem**	Anticancer	Ethanolic extract	In vitro (MCF-7 breast cancer cells)	Not specified	2–50 µg/ml	Cell viability (MTT assay)	Induces apoptosis	IC_{50} = 40 µg/ml	Subramani, (2018) [40]
8.	Aerial parts	Antiepileptic, anxiolytic	Aqueous	Pilocarpineinduced epilepsy in mice	Sodium valproate	93, 186, 372	Seizure frequency and duration, open-arm entries in EPM test	GABAergic modulation	<0.001	Frontiers in Pharmacology (2018)[41]
9.	Aerial parts	Antioxidant, cytotoxic	Ethanolic, methanolic	In vitro assays (DPPH, MTT on HL-60 cells)	Not specified	IC_{50}: 36 (ethanolic) 40 (methanolic) µg/ml	Free radical scavenging, cell viability	Induction of apoptosis	Not specified	Dhanasekaran et al. (2020)[42]
10.	**Stem**	Peripheral neuropathy	Ethanolic extract	Vincristine induced neuropath y in rats	Pregabalin	180 & 360 mg/kg	Pain threshold, calcium levels, GABA, 5HT levels	Antioxidant, calcium inhibition, neuromodulati on	$p < 0.001$	Olga et al., (2024) [43]

Table 6: Summary table of cissus quadrangularis.

REFERENCES

1. Frank S, Hubner G, Breier G, Longaker MT, Greenhalgh DG, Werner S. Regulation of Vascular Endothelial Growth Factor Expression in Cultured Keratinocytes, The J Biological Chemistry. 1995; 270(21):2607-12613.
2. Chopra R.N., Nayar S.L. and Chopra I.C., Glossary of Indian Medicinal Plants, National Institute of Science and Communication, CSIR, New Delhi, 1986, 66-67.
3. Shirwaikar A, Khan S, Malini S. Antiosteoporotic effect of ethanol extract of Cissus quadrangularis Linn. on ovariectomized rat. J Ethnopharmacol. 89(2-3), 2003, 245-50.
4. Jaiswal S, Singh SV, Singh B, Singh HN. Plants used for tissue healing of animals. Natural Products Radiance. 2004; 3: 284-92.
5. Luseba D, Elgorashi EE, Ntloedibe DT, Staden JV. Antibacterial, anti-inflammatory and mutagenic effects of some medicinal plants used in South Africa for the treatment of wounds and retained placenta in livestock. South African Journal of Botany. 2007; 73: 378-83.
6. Mallika J, Shyamala Devi CS. In vitro and In vivo evaluation of free radical scavenging potential of Cissus quadrangularis. African Journal of Biomedical Research. 2005; 8: 95 99.
7. Shirwaikar A, Khan S, Malini S. Antiosteoporotic effect of ethanol extracts of Cissus quadrangularis Linn on ovariectomized rat. Journal of Ethnophramacology. 2003; 89:245-50.
8. Udupa, K.N., Chaturvedi, G.N., Tripathi, S.N.: Advances in research in Indian medicine: Banaras Hindu University, Varanasi, 12:165–96 (1970).
9. Dr. Mohd. Ataullah Shareef, Kitabul Advia Mufarradaath. Best Printers and Publishers-Hyderabad, First edition. 2012, 511-512.
10. Barzini P, Mazzucco I. Platelet-rich plasma (PRP) and platelet derivatives for topical therapy. What is true from the biologic viewpoint, ISBT Science Series, 2007; (2):272281.
11. Rastogi RP, Mehrotra BN. Compendium of Indian Medicinal Plants, Part I, Publication and information directorate 1995, 104.
12. Chopra N.N., Chopra I.C., Handa K.L., Kapur L.D., Cissus quadrangularis. Indigenous Drugs of India, 1958, 669–670.
13. Rajpal V. Standardization of Botanicals. Eastern Publishers 2005. Vol 1, p. 77-81.
14. Warrier, P.K., Nambiar, V.P.K., & Raman Kutty**, C.** (1995). *Indian Medicinal Plants: A Compendium of 500 Species*, Vol. 2. Orient Longman.
15. Jainu M., Devi CS. "Effect of Cissus quadrangularis on gastric mucosal defensive factors in experimentally induced gastric ulcer- a comparative study with Sucralfate". Journal of medicinal food. 2004; 7(3):372-376.
16. Chidambara Murthy KN, Vanitha A, Mahadeva Swamy M, Ravishankar GA. Antioxidant and antimicrobial activity of Cissus quadrangularis L. J Med Food. 2003;6(2):99-105.
17. Panthong, A., Kanjanapothi, D., Taesotikul, T., et al. (2007). Anti-inflammatory activity of *Cissus quadrangularis* extract in rats. *Fitoterapia*, 78(6), 453–458.
18. **Asha Jyothi. V*** and Sneha Chittari, Role of Nutrition in Osteoporosis, JCHPS (2025) 18 (2): 01-05.
19. Udupa KN et al., 1964; Paris and Moyse, 1971
20. Jainu M & Devi CS, Journal of Ethnopharmacology, 2005.
21. Chidambara Murthy KN et al., 2003 (Plant Foods for Human Nutrition)
22. Ashajyothi.V, Dr. Rao. S. Pippalla and Dr. Satyavati D, Antioxidant Activity of Few Phytoestogens by Dpph Assay, IJPT, 2013, 5 (3), 5868-5872.
23. Oben J et al., 2006. *Lipids in Health and Disease*, 5(1): 24.
24. Panthong A et al., 2007; Balasubramanian T et al., 2010.
25. Panda S et al., 2008. *Indian Journal of Pharmacology*, 40(3): 129–132.
26. Prasad GC et al., 1993. *Journal of Ethnopharmacology*, 40(2): 131–136.
27. Panthong et al., 2007; Chidambara Murthy et al., 2003
28. Chidambara Murthy, K. N., Vanitha, A., Mahadeva Swamy, M., Ravishankar, G. A. (2003). *Antioxidant and antimicrobial activity of Cissus quadrangularis L.* Journal of Medicinal Food, 6(2), 99–105.
29. Udupa, K. N., Prasad, G. C. (1964). *Further studies on the effect of Cissus quadrangularis in accelerating fracture healing.* Indian Journal of Medical Research, 52, 26–35.
30. Reanin Research (2024). *Global Cissus Quadrangularis Market Report*. https://www.reanin.com
31. Future Market Insights (2024). *Cissus Quadrangularis Market Forecast*. https://www.futuremarketinsights.com
32. Reanin Research. (2024). *Global Cissus Quadrangularis Market Report (2024–2031)*.

33. Jainu, M., & Devi, C. S. S. (2004). *Gastroprotective action of Cissus quadrangularis extract against aspirin-induced gastric mucosal injury*. *Journal of Ethnopharmacology*, 93(2-3), 261–266.
34. Sampath Kumar, S., et al. (2015). Clinical evaluation of *Cissus quadrangularis* as osteogenic agent in mandibular fracture. *Journal of Natural Science, Biology and Medicine*, 6(2), 333–336.
35. Benjawan, S., et al. (2022). The effect of *Cissus quadrangularis* L. on delaying bone loss in postmenopausal women with osteopenia: A randomized placebo-controlled trial. *Phytomedicine*, 101, 154115.
36. Vaijayanthimala, R., et al. (2018). In vitro anti-arthritic activity of *Cissus quadrangularis* stem extract. *Asian Journal of Pharmaceutical and Clinical Research*, 11(1), 273–275.
37. Srisook, K., et al. (2011). Anti-inflammatory effect of ethyl acetate extract from *Cissus quadrangularis* Linn may be involved with induction of heme oxygenase-1 and suppression of NF-κB activation. *Journal of Ethnopharmacology*, 133(3), 1008–1014.
38. Jainu, M., & Devi, C. S. S. (2004). Gastroprotective action of *Cissus quadrangularis* extract against aspirin-induced gastric mucosal damage in rats. *Journal of Ethnopharmacology*, 93(2–3), 261–266.
39. Jainu, M., et al. (2014). *Cissus quadrangularis* extract attenuates hyperglycaemiamediated oxidative stress in streptozotocin-induced diabetic rats. *Journal of Pharmacy and Pharmacology*, 66(6), 829–838.
40. Subramani, R., et al. (2018). Analysis of potential toxicological, phytochemical, and anticancer activity of *Cissus quadrangularis* extract. *Research Journal of Life Sciences, Bioinformatics, Pharmaceutical and Chemical Sciences*, 4(1), 241–252.
41. Moto, F. C. O., Arsa'a, A., Ngoupaye, G. T., Taiwe, G. S., Njapdounke, J. S. K., Kandeda, A. K., Nkantchoua, G. C. N., Omam Omam, J. P., Pale, S., Kouemou, N. E., Ayissi Mbomo, E. R., Pahaye, D. B., Ojong, L., Mairara, V., & Ngo Bum, E. *Frontiers in Pharmacology*, 2018, 9, 751.
42. Dhanasekaran, S. (2020). Phytochemical characteristics of aerial part of *Cissus quadrangularis* (L) and its *in-vitro* inhibitory activity against leukemic cells and antioxidant properties. *Saudi Journal of Biological Sciences*, 27(5), 1302–1309.
43. Olga, M., et al. (2024). Ethanolic extracts of *Cissus quadrangularis* Linn. attenuate vincristine-induced peripheral neuropathy in rats: An evidence of the antioxidant, calcium inhibitory, and neuromodulatory properties. *Advances in Pharmacological and Pharmaceutical Sciences*, 2024, 8822369.