



ISSN: 2278-2648

International Journal of Research in Pharmacology & Pharmacotherapeutics (IJRPP)

IJRPP | Vol.15 | Issue 1 | Jan - Mar -2026

www.ijrpp.com

DOI : <https://doi.org/10.61096/ijrpp.v15.iss1.2026.427-440>

Review



A Comprehensive Review of *Cissus quadrangularis*

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	Abstract
Published on: 17.03.2026	The plant's remarkable capacity to heal bones has earned it the nickname "Bone Setter." This publication covers in full the phytochemical composition, taxonomy, botanical description, and various pharmacological characteristics of <i>Cissus quadrangularis</i> . Among the plant's numerous bioactive components include flavonoids, triterpenoids, stilbenes, vitamins, minerals, phytosterols, and compounds that resemble anabolic steroids. Its wide range of biological activities, including as bone regeneration, anti-inflammatory, antioxidant, antibacterial, antiulcer, anti-diabetic, hepatoprotective, gastroprotective, anti-osteoporotic, and wound-healing properties, are caused by these ingredients. In addition, the overview discusses its traditional usage, marketed formulations, dosage forms, and future research opportunities. The therapeutic potential of <i>Cissus quadrangularis</i> as a useful herbal medication is highly supported by the available experimental and clinical data.
Published by: Futuristic Publications	
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Keywords: <i>Cissus quadrangularis</i> , Pirandai, Hadjod, Vitaceae, phytochemicals, pharmacological effects, osteoporosis, traditional medicine, and herbal remedies	

1. INTRODUCTION

The perennial plant *Cissus quadrangularis* belongs to the grape family. Veldt grape, winged tree bine, and adamant creeper are some of its common names. The Arabian Peninsula, tropical Asia, and a large portion of Africa are the species' native habitats. Nowadays, medicinal plants and herbs play a significant role as an alternative source of health for both individuals and communities.^[1] Numerous scientific investigations into the use of traditional herbal remedies to cure illnesses have been conducted in recent decades, and this has led to the creation of alternative medications and therapeutic approaches.^[2]



Fig 1. *Cissus quadrangularis*

It is intriguing to employ medicinal plants as an optional food source to get the essential elements required for bodily development, as their growth and medical significance are growing daily. *Cissus quadrangularis*, a member of the Vitaceae family, is generally recognized as (Hadjod). India, Bangladesh, and Sri Lanka are the native countries of this plant. [3]

1.1. Types of Cissus Quaddrangularis

We growth in 4 edible varieties of south India

- Cissusquadrangularis
- Cissustriangularis
- Cissusroundifolia
- Cissus round and edible stem

2. HISTORY

It has long been utilized in Ayurvedic medicine in Africa. Every portion of the plant is used in clinical settings to treat a variety of illnesses. *Cissus quadrangularis* is one of the ancient medicines that comes from Ayurveda, but because it grows in many different places, it appears to have a wide variety of sites that are utilized medicinally. It was formerly known as the "Bone Setter" since it was primarily used to treat bone diseases and female disorders. Other traditional uses include its purported anti-ulcer, anti-hemorrhoid, pain-relieving, and wound-healing qualities.^[4]

3. PLANT PROFILE

The grape family includes the climbing succulent *Cissus quadrangularis*. It grows four angled winged stems and broad ovate leaves, with scarlet flower buds that open to white petal. [5]

3.1. Phytochemical Profile

Numerous significant primary and secondary metabolites were found in the aerial component, especially in the stem of *Cissus quadrangularis*. Important primary metabolites, including lipids (cyclic and acyclic), fatty acids, methyl esters, protein, amino acids, iridoids, gums, and mucilage, were found in an extract prepared using several solvents.^[4,5] The purpose of the analysis was to determine whether preliminary phytoconstituents existed. On the other hand, the extracts prepared from the underground parts of the plant using different solvents showed a wide array of compounds when examined for phytochemical profile, namely alkaloids, saponins, tannins, flavonoids, and glycosides.^[6]

3.2. Plant Discription



Fig. 2. *Cissus quadrangularis* plant parts (a) flower and Inflorescence, (b) Typical leaf of the plant, (c) stem bearing all parts of the plant, (d) fruits of the plant.

3.3. Habitat

Cissus quadrangularis is a common plant in the arid habitat of tropical and subtropical regions and is very often found in coastal and lowland areas. The plant is very well known in Africa and India for its medicinal uses. In India and the subcontinent of India such as Pakistan and Bangladesh, the *Cissus* plant can be found in thickets, open forests, scrub jungles, along forest borders, on riverbanks, and wastelands at low and medium elevation.^[7]

3.4. Synonyms

This aggressively growing plant is identified by several international names and regional names; some important international names of *Cissus quadrangularis* are Veldt grape, adamant creeper, cactus vine, kangaroo vine, stemmed vine, veldt grape, and winged tree bine, and the Indian regional names are Had Joad, Asthi samharaka, Pirandai, and Hadsankal.^[8]

Table No: 1

Rank	Scientific Name And Common Name
Kingdom	Plantae-plants
Subkingdom	Tracheobionta-vascular plants
Superdivision	Spermatophyta -seed plants
Division	Magnoliophyta-flower plant
Class	Magnoliopsida dicotyledons
Subclass	Rosidae
Order	Rhamnales
Family	Vitaceae juss-grape family

Botanical Description

Perennial herbaceous climber comprising a thick quadrangular stem along with other aerial components such as tendrils, leaves, inflorescence, flowers, and fruits.^[9]

3.5. Leaves

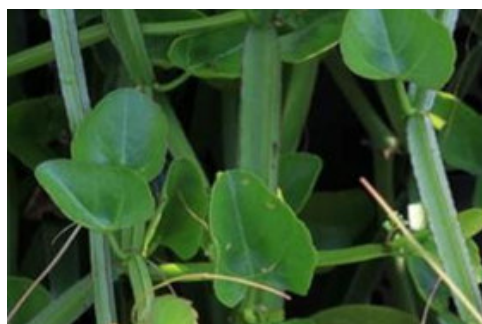


Fig 3. *cissusquadrangularis* leaves

Leaves on the stem of the plant are simple ovate or reniform; entire or cordate; serrulate dentate or crenate-serrate; 3–7 lobed; terminal lobe triangular or sub-spathulate; subacute or \pm cuspidate; membranous; glabrous on both sides; 3–5 \times 5–3 cm; and stipules ovate or cuneate, obtuse, and deciduous.^[9]

3.6. Inflorescence

The inflorescence found in the plant is umbellate cyme with peduncles that are 1–2.5 cm long. The stem shows the presence of tendrils that are long, slender, and simple.⁽¹⁰⁾

3.7. Flower



Fig 4. *cissusquadrangularis* flowers

Twig bears a flower comprising pink to white colors and is approximately 2 mm long. The hypanthium of the flower is cup-like, truncate or obscurely lobed, green in color, and 2 mm wide. Petals are four in number and distinct, ovate-oblong, acute, and hooded at the apex. The size of the petal is 1.5 mm in length. The flower is disc-shape and is longer than the ovary. The ovary present in the flower is glabrous, with a slender style and small stigma.^[10, 11]

3.8. Fruit



Fig 5. *cissusquadrangularis* fruit

The shrub produces globose, crimson, succulent, very acidic berries with a diameter of 6 to 10 mm and a solitary seed. The smooth, obovoid seeds have a diameter of 4–8 mm. The flowering and fruiting time is identified to take place in June–July.^[12]

4. CHEMICAL CONSTITUENTS OF THE PLANT

The plant consists many constituents such as flavonoids like quercetin, daidzein and genistein, triterpenoids like friedelin, vitamin ‘C’, stilbene derivatives like quadrangularin-A, resveratrol and piceatannol, iridoids like 6-O-meta-methoxy-benzoyl catapol, picroside and pallidol and phytosterols like β -sitosterol and calcium were identified as major constituents of the plant.^[13,14] The stem sections of plant contains A and β -amyrins, β -sitosterol, ketosterol, phenols, tannins, vitamin, carotene, Calcium oxalate, 31 methyl tritriacontanoic acid, taraxeryl acetate, taraxeroliso-pentadecanoic acid, Calcium ions and phosphorus. The Aerial parts of the plant include new asymmetric tetracyclic triterpenoid 7-Oxo-Onocer-8-ene-3 β 21- α diol. Leaves contain Resveratrol, piceatanon, pallidol,

parthenocissus and alicyclic lipids. Root powder often provides a continuous source of mineral elements like potassium 67.5 mg; calcium 39.5 mg, zinc 3.0 mg, sodium 22.5 mg, Iron 7.5 mg, lead 3.5 mg, cadmium 0.25 mg, copper 0.5 mg and magnesium.^[15]

4.1. taxonomy

Kingdom : Plantae
 Subkingdom : Tracheobionta
 Super division : spermatophyta
 Division : Magnoliophyta
 Class : Magnoliopsida
 Subclass : Rosidae
 Order : Vitales
 Family : Vitaceae
 Genus : Cissus
 Species : quadrangularis^[16]

Table: 02

Types of Compound	Compound	Plant Parts
Flavonol	Kacmpferol Quercetin	Stem
Tetracyclic triterpenoid saponin	Lupeol	Stem
Calcium oxalate	Calcium oxalate Pallidol Parthenocissin Quadrangularin A Quadrangularin BQuadrangulari	Stem Stem Stem Whole plant
Stilbene	n c Picetannol Oxo- steroid Steroid Keto-steroid	Whole plant Whole plant Whole plant Whole plant Whole plant
Potassium and phosphorus triterpene anabolic steroids	Amycin δ-amyrone β-sitosterol	Whole plant

4.2. Phytochemical analysis in Cissusquarancularis

Table No: 03

Secondary compounds	Aqueous	Methanol	Ethanol	Petroleum ether
Tannin	+	+	+	-
Phlobatannin	-	+	-	-
Saponin	+	+	+	+
Steroids	-	+	+	-
Terpenoids	+	+	+	+
Cardiac glucoside	-	-	-	-
Alkaloids	+	+	+	+
Phenols	+	+	+	+
Flavonoids	+	+	+	+

(+) Present (-) absent^[15]

5. PHARMACOLOGY



Fig 6. Pharmacological activities for *cissus quadrangularis*^[17]

5.1. Anti-Microbial and Anti-Bacterial Activity:

Methanol extract (90%) and dichloromethane extract of stems possess antibacterial activity against *S. aureus*, *E. coli*, and *P. aeruginosa* and mutagenicity against *Salmonella* microsome. Antimicrobial activity has also been reported from the stem and root extract.^[18] The alcoholic extract of the aerial part was found to possess antiprotozoal activity against *Entamoeba histolytica*. Alcoholic extract of the stem showed activity against *E. coli*. Methanol and dichloromethane extracts of the whole plant were screened for in vitro antiplasmodial activity. [17, 18]

5.2. Bone Healing Activity

Paste of alcoholic extract of the plant was used locally as well as intramuscularly, which facilitates the rapid healing of fractures in albino rats. Ethanol extract (95%) enhances the development of cortical bone and trabeculae in foetal femur, which may be related to rich content of calcium, phosphorous and phytoestrogenic steroids and shown to influence early regeneration and quick mineralisation of the bone fracture healing process.^[19,20]

Ethanol extract (95%) of whole plant possess anti osteoporotic activity in ovariectomized rat model of osteoporosis at two different dose levels of 500 and 750 mg per kg per weight. The anabolic steroid from the *Cissusquadrangularis* plant showed a influence in the rate of fracture healing by early generation of all connective tissue. *Cissusquadrangularis* contains vitamins and steroids, which are found to have specific effect on bone fracture healing.^[21]

5.3. Anti-Ulcer Activity

Methanol extract showed significant antiulcer activity in experimentally induced ulcer in rat model by decreasing gastric secretions and by enhancing glycoprotein levels. Methanol extract produce healing effect on aspirin induced gastric mucosal damage in rats through its anti-oxidative mechanism. Tryptetropenoids and β - sitosterol present in methanol extract possess anti-lipid per oxidating effect and thus prevent gastric damage. The antiulcerative effect of *Cissusquadrangularis* extract on enzyme H+K+-ATPase that is deemed responsible for producing acidity in stomach is observed.^[21, 22]

5.4. Anti-Diabetic Activity

Anti-diabetic property of *Cissusquadrangularis* was noted in a study where dry powder of *Cissusquadrangularis* is obtained through ethyl acetate extraction. This is tested for diabetes induced in wister albino rats by administering alloxan.^[23, 24]

5.5. Analgesic, Anti- Inflammatory and Stimulatory Activity

Methanol extract possess analgesic, anti-inflammatory and venotonic effects associated with haemorrhoids, anti-inflammatory activity is due to flavonoids especially luteolin and by β sitosterol. (24) B-sitosterol present in methanol extract has ability to reduce the enzymes MPO indicating a reduction of neutrophils influx in the inflamed tissue. Ethanol extract exhibit protective effect on

neutrophils mediated tissue injury induced by aspirin in rats 34. Methanol extract (90%) and dichloromethane extract of stems possess anti-inflammatory activity against COX-2. The stimulatory effect of extract is probably due to vitamins and is greater than that of the anabolic hormone durabolin.^[25]

5.6. Antioxidant and Free Radical Scavenging Activity

Methanol extract of *Cissusquadrangularis* exhibits strong antioxidant and free radical scavenging activity in in vitro and in vivo systems mainly due to the presence of β -carotene.^[26]

5.7 CENTRAL NERVOUS SYSTEM ACTIVITY:

The root extract possess central nervous system depressant activity indicated by decrease in exploratory behaviour. Methanol extract of roots contains saponins which show potent sedative activity and also inhibit spontaneous motor activity in mice. The root extract possesses stimulant CNS function suggested by decreasing exploratory actions.^[27, 28]

5.8. Gastroprotective Activity

Cissusquadrangularis is well known for the treatment of gastric disorders in traditional medicine, owing to its rich source of carotenoids, triterpenoids and ascorbic acid, and has received considerable attention regarding its role in human nutrition.^[29] A number of studies have analysed and revealed the effect against gastric toxicity and the gastro protective effect of *Cissusquadrangularis* extract (CQE) along with its mechanism underlying the therapeutic action against the gastric mucosal damage induced by aspirin.^[30]

The studies have investigated the effect of CQE on the course of experimentally induced gastric ulcer by analyzing the levels of tumour necrosis factor- α (TNF- α), interleukins, micro vascular permeability, activity of nitric oxide synthase2 (NOS-2), mitochondrial antioxidants, lipid per oxidation and DNA damage.^[30]

In addition, the findings of the studies have shown that administration of aspirin increases lipid per oxidation status, xanthine oxidase (XO), myeloperoxidase and decrease in superoxide dismutase (SOD), catalase (CAT) and selenium– glutathione peroxidase activities in the gastric mucosa, resulting in mucosal damage at both cellular and sub cellular level which were reversed by CQE. In addition, CQE prevents oxidative damage of DNA by reducing DNA fragmentation indicating its block on cell death. Pre-treatment with CQE ameliorated the observed effect significantly in the gastric mucosa of ulcerated rats.^[30]

5.9. Actions Related to Bones

The *Cissus quadrangularis* plant is a well-established herb in the management of bone-related ailments, and in line with this fact, several studies were conducted using different animal models and even human subjects. All these studies now establish that the plant has a potential role in the management of bone fracture, osteoporosis, and the maintenance of bone density. The core understanding of all these studies proposes that the plant has unidentified anabolic steroids that are responsible for action via the estrogenic receptor of the bone.^[31]

5.10. Female Health Hygiene

Traditionally, *Cissusquadrangularis* was used to treat bone abnormalities as well as female ovarian health issues like menopause, libido, and monthly problems (Siddiqua & Mittapally).^[31]

5.11. Antiosteoporotic Activity

Osteoporosis is a chronic, degenerative condition that results in decreased bone mass because of the deterioration of micro-architectural bone structure. The primary reasons of osteoporosis in postmenopausal women include a lack of certain hormones, particularly androgen in men and estrogen in women, as well as an imbalance in the activity of osteoblast and osteoclast cells. (31)Osteoporosis weakens the bones due to a calcium deficiency. *Cissus quadrangularis* significantly reduces anabolic effects and has some beneficial effects on the recovery of bone mineral density in postmenopausal osteoporosis. In an ovariectomized rat model of osteoporosis, the anti-osteoporotic qualities of *Cissus quadrangularis* ethanol extract were evaluated at two different dose levels of 500 and 750 mg/kg daily.^[32]

5.12. Antihemorrhoidal Activity

A phytochemical investigation revealed that the primary compounds in *C. quadrangularis* are flavonoids. Bioflavonoids, particularly diosmin, hesperidin, and oligomeric proanthocyanidin complexes, have demonstrated promise in the treatment of hemorrhoids and varicose veins. These bioflavonoids exhibit phlebotonic activity, vasculoprotective properties, and antagonistic effects on the biochemical mediators of inflammation. The anti-inflammatory properties of the crude extract of *C. quadrangularis* may be attributed to the flavonoids, specifically luteolin and β -sitosterol. The venotonic action of *C. quadrangularis* may possibly be caused by the extract's flavonoids, which work similarly to diosmin and hesperidin.^[31, 32, 33]

5.13. Hepatoprotective Activity

C. quadrangularis methanol extract protects rats' livers against rifampicin-induced hepatotoxicity. It was found that the hepatoprotective mechanism might be attributed to its antioxidant activity, namely the presence of β -carotene. Hepatoprotection is provided by the plant's antioxidant and insulin-sensitizing qualities. It also showed anti-lipid peroxidative and free-radical scavenging qualities, and it reduced liver damage by increasing the activity of antioxidant enzyme.^[33, 34]

6. UTILITY OF THE PLANT

Diabetes, obesity, high cholesterol, bone fractures, allergies, cancer, stomach distress, painful menstruation, asthma, malaria, wound healing, peptic ulcer disease, weak bones, osteoporosis, and body building supplements are among the conditions for which *Cissusquadrangularis* is used. [33, 34, 35]

6.1. Traditional uses in Ayurvedic

Asthiyuk: fortifies bones.

- Sara: promotes movement, generates purging, diarrhea, and relieves constipation
- Krumighna: Helps with infected wounds and relieves worm infestation
- Amana: Alleviates Alma, a byproduct of abnormal metabolism and indigestion.
- Vrushya, an aphrodisiac that increases energy
- Pechanga: relieves Ama Dosha and is digestive
- Patiala: Raises Pitta Dosha

It is used in the treatment of obesity, gout, syphilis, Venereal diseases, leucorrhea, worm infestation, anorexia, diabetes, peptic ulcer, hemorrhoids and high cholesterol. It is also used as a body building supplement.^[33] In North eastern states of India, its stem is used as a vegetable. In Siddha system of medicine, it is used for healing bone fracture, piles, as an antiaging herb, in Asthma, cough and gonorrhoea. The stem of Harjo or *Cissusquadrangularis* is used for the treatment of gastritis, bone fractures, skin infections, constipations, eye diseases, piles, anemia, asthma. The stem juice is useful in scurvy and in irregular menstruation. The powder of dried shoot is useful in digestive problems and wound healing property. Stem paste is useful for muscular pains, burns, wounds, bites of poisonous insects and sores. When a bone fracture occurs, the stem is fried in oil and applied to the fracture site prior to the splint or cast being applied. The ability to fuse shattered bones has been demonstrated by Harjo, also known as Bone Setter. Research has demonstrated the existence of vitamins and anabolic steroids, which may influence the bone's estrogenic receptors. The plant aids in the early remodeling and ossification of bones. By boosting metabolism and increasing the uptake of calcium, sulfur, and strontium by the osteoblasts in fractured bone, oral plant consumption aids in the rapid healing of fractures.^[34]

6.2. Pirandai Thailam



Fig 7. Pirandai thailam

Pirandai is well-known in traditional medicine for its powerful anti-inflammatory properties, which help reduce joint pain and swelling. It can be especially beneficial for individuals suffering from arthritis or age-related joint stiffness.^[36]

6.3. Pirandai Powder



Fig 8. Pirandai powder

It's packed with essential nutrients and boasts anti-inflammatory and antioxidant properties. Pirandai helps promote heart health, improve digestion, and support bone health. The plant can be used in a variety of ways in daily cooking, such as in chutneys or powders.^[37]

6.4. Pirandai Chutney



Fig 9. Pirandai chutney

Pirandai helps promote heart health, improve digestion, and support bone health. The plant can be used in a variety of ways in daily cooking, such as in chutneys or powders. Before incorporating Pirandai into your diet, be aware of potential precautions and side effect.^[38]

6.5. Pirandai Juice



Fig 10. Pirandai juice

Health: Packed with substances that could prevent osteoporosis and strengthen bones
 Antiinflammatory Properties: Promotes healing from injuries and joint discomfort by lowering inflammation. Supports Digestion: Historically used to treat gastrointestinal problems and enhance digestive health. Antioxidant Properties: Contains antioxidants that aid in preventing cell damage. Encourages Weight Loss: By increasing metabolism, this may aid with weight management. Wound Healing:^[29] Traditionally employed due of its propensity to accelerate wound healing. *Cissus quadrangularis* wound's phytochemical components and pharmacological activity.^[38, 39]

7. MARKETED FORMULATIONS

7.1. Formulation and Dosage

Table No: 4

Formulation	Dosage
Decoction of dried stalks	10-30ml bid
Juice	10-20ml bid
Powder	3-6g bid

7.2. Ayurvedic Preparations

- Flexi-Muv Oil (Anti-inflammatory, Anti-arthritis)
- Boneforte Capsule (Calcium supplement)
- Laksha Gogglu (Analgesic, anti-inflammatory)^[39]

7.3. Classical Ayurveda Formulations

Ayurveda medicines originated in the early evolution of India about 3000–5000 years ago. The Ayurveda formulations are present in the ancient religious texts or ancient Vedic text (books of Ayurveda) and philosophical texts, the oldest surviving literature in the World. Classical Ayurveda formulations are taken from traditional Ayurveda text-books. The drug manufacturing companies go along with the same formula to develop the medicines. Such classical formulations of CQ are also known which are listed in these formulations are available with Ayurveda names such as churna (finned powder), taila (medicated oil), leap (topical application of Ayurveda), kasahaya (decoction), and bhasma (purified calcination).^[38, 39, 40]

7.4. Conventional Formulations

In modern India, the Ayurveda medicines are mostly practiced and becoming popular gradually throughout the World compared with allopathic medicines because these are safe and have no side effects. Modern Ayurveda medicines are known as proprietary medicines or patent medicines. The formula and dosage forms of patent medicines are decided by manufacturing company and ingredients used in these preparations are not found in traditional Ayurvedic textbooks. Each of these manufacturing companies has a recipe that is tested in clinical settings to determine its effectiveness. These kinds of

traditional CQ formulations are also sold under various brand names under various corporate brands, which are mentioned in Table 4. The majority of the excipients utilized in the formulation of such dosage forms are traditional, and no scientific background has been documented in the public domain.^[35,36,39,40]

8. MARKETED AVAILABLE PRODUCTS

Table No: 5

Product Name	Form	Strength	Approx.Price	Uses
Best source nutrition cissus hadjod veggie capsules	Veg capsules	Cissus extract(mg varies)	₹702	Bone joint health, connective tissue support
Hadjod tablets cissusquadrangulatis 500	Tablet	500mg per tablet	₹226	Traditional herbal supplement for bone support
Cesvila cissusquadrangulatis (hadjod)	Veg tablets	500mg,60 tablets	₹499	Bone healing, joint flexibility.
Ayushya cissusquadrangulatis capsule	Capsules	Higher strength herbal formula	₹3,191	Premium extract supplement

- Extract from *Cissusquadrangulatis* (hadjod): Use in medicine.
- 500 mg of *Cissusquadrangulatis*. *Cissus quadrangulatis*, or Pirandai.
- Vitamin D3 Tablets with Milk Calcium *Cissusquadrangulatis* Withania Somnifera.
- Softgel capsules containing *Cissusquadrangulatis* and Withania somnifera.^[41]

9. FUTURE STUDY

Cissusquadrangulatis (CQ) is well known for bone healing and traditional medicinal uses, but many areas remain underexplored. Below are key future research directions suitable for undergraduate projects, postgraduate theses, or grant proposals.^[42]

9.1. Molecular & Mechanistic Studies

Identify exact molecular pathways involved in bone regeneration (e.g., Wnt/ β -catenin, BMP, RUNX2 signaling). Study its effects on osteoblast–osteoclast balance at gene and protein levels. Explore anti-inflammatory and antioxidant mechanisms using omics approaches (genomics, proteomics metabolomics).^[41, 42]

9.2. Phytochemical Exploration

Isolation and characterization of novel bioactive compounds beyond keto steroids and flavonoids. Comparative phytochemical profiling of different plant parts (stem, leaf, root) Influence of geographical location and cultivation conditions on phytochemical composition. [43, 44]

9.3. Pharmacological Expansion

Evaluate neuroprotective, hepato protective, cardio protective, and anti-diabetic potentials. Investigate anti-obesity and metabolic syndrome mechanisms in long-term studies. Study synergistic effects with other medicinal plants or modern drugs.^[42]

9.4. Clinical Research

Well-designed randomized controlled trials (RCTs) for:

- Osteoporosis
- Fracture healing
- Arthritis

Establish optimal dosage, duration, and safety for chronic use.

Study gender- and age-specific responses.

9.5. Drug Delivery & Formulation

Development of nanoformulations (nanoparticles, liposomes) to improve bioavailability. Design of topical formulations for wound healing and bone injuries. [42, 43]

9.6. Toxicology and safety studies

Long-term toxicity and herb-drug interaction studies. Reproductive and developmental toxicity assessments. Establishment of international safety guidelines. [45]

9.7. Biotechnology and sustainable use

In vitro propagation and tissue culture for conservation. Metabolic engineering to enhance bioactive compound production. [45]

9.8. Research titles

Molecular mechanisms of osteogenic activity of *Cissus quadrangularis*. Nanoformulations. Clinical evaluations in osteoporotic patients. [45]

10. CONCLUSION

Traditional medical systems like Ayurveda and Siddha medicine make extensive use of *Cissus quadrangularis* (Pirandai/Hadjod), a significant medicinal plant. Its extensive medicinal potential is highlighted by a discussion of its botanical characteristics, phytochemical elements, pharmacological activities, and both traditional and contemporary applications. The plant's many biological activities, such as bone healing, anti-inflammatory, antioxidant, antimicrobial, anti-ulcer, anti-diabetic, hepatoprotective, gastro protective, and anti-osteoporotic effects, are attributed to its abundance of bioactive compounds, which include flavonoids, triterpenoids, stilbenes, vitamins, minerals, and phytosterols. Its capacity to expedite fracture healing and encourage bone regeneration is its most important characteristic, which has earned it the traditional moniker "Bone Setter." Its usefulness in managing osteoporosis and increasing bone mineral density, particularly in postmenopausal settings, is supported by scientific research.

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