

Cissus Quadrangularis L - A Comprehensive Multidisciplinary Review

KNV Rao^{1*}, Bhargav Bhongiri², Atthapu Thirupathaiah³, Madireddy Mamata⁴, Santhosh Illendula⁵

¹Principal and Professor, N.S College of Pharmacy, Markapuram, Andhra Pradesh, India

²Associate Director, Synpharma Research Lab, 2nd Floor, Rajadhani Complex, Dilsukhnagar, Hyderabad, Telangana, India

³Department of pharmaceutical chemistry (5Yr IPC course) and University college of pharmaceutical science (Dept of pharmaceuticals Biotechnology), Mahatma Gandhi University Nalgonda Telangana state.

⁴Associate Professor & HOD, Department of Pharmaceutical Analysis, Trinity College of Pharmaceutical Sciences, Peddapalli, Bandarikunta, Telangana, India

⁵Associate Professor & HOD, Department of Pharmaceutical Analysis, Vijaya College of Pharmacy, Munaganoor (V), Hayathnagar, Hyderabad, Telangana, India

Corresponding Author Email ID: raoknv@yahoo.co.in

Received: 05/07/2026

Accepted: 18/07/2026

Published: 30/09/2026

Abstract

Cissus Quadrangularis L., a perennial succulent climber belonging to the family Vitaceae, is a well-known medicinal plant widely used in traditional systems of medicine such as Ayurveda, Siddha, and Unani. Commonly referred to as "Hadjod" or "Asthi-samharaka," the plant has been extensively utilized for the management of bone fractures and musculoskeletal disorders. In recent years, growing scientific interest has led to comprehensive investigations into its phytochemical composition and diverse pharmacological activities. Phytochemical studies have revealed that *Cissus Quadrangularis* contains a wide array of bioactive constituents, including flavonoids, triterpenoids, phytosterols (β -sitosterol), stilbene derivatives, iridoids, phenolic compounds, calcium, and vitamin C. These compounds contribute synergistically to its therapeutic effects. Experimental and preclinical studies have demonstrated significant osteogenic, anti-inflammatory, analgesic, antioxidant, anti-ulcer, hepatoprotective, antidiabetic, anti-obesity, antimicrobial, wound healing, and potential anticancer activities. Among its pharmacological properties, the osteogenic and fracture-healing effects are the most extensively documented, with evidence showing stimulation of osteoblast activity, enhanced collagen synthesis, and improved bone mineralization. Additionally, antioxidant and anti-inflammatory mechanisms play crucial roles in mediating its protective effects in various pathological conditions. Although preclinical findings are promising and some clinical studies suggest beneficial outcomes, variability in extract standardization and limited large-scale trials necessitate further rigorous research. *Cissus Quadrangularis* represents a multifunctional medicinal plant with significant therapeutic potential. This review highlights its botanical characteristics, phytochemical profile, pharmacological activities, and emerging clinical evidence, while emphasizing the need for standardized formulations and well-designed clinical studies to validate its efficacy and safety for broader therapeutic applications.

Keywords: *Cissus quadrangularis*; Hadjod; Asthi-samharaka; Vitaceae; Medicinal plant; Phytochemistry; Flavonoids; β -sitosterol; Osteogenic activity; Fracture healing; Anti-inflammatory activity; Antioxidant activity; Pharmacological activities; Herbal medicine; Nutraceuticals; Traditional medicine; Bone regeneration; Wound healing; Anti-obesity activity; Phytoconstituents.

Journal of Applied Pharmaceutical Sciences and Research, (2026);

DOI: 10.31069/japsr.v9i3.01

INTRODUCTION

Cissus Quadrangularis L. is a perennial succulent climber belonging to the Vitaceae family, widely distributed across tropical and subtropical regions of Asia and Africa. It is commonly known as "Hadjod" in Hindi and "Asthi-samharaka" in Ayurveda, which literally means "bone destroyer" or more appropriately "bone protector," reflecting its traditional use in fracture healing. The plant is characterized by its distinctive quadrangular, fleshy stems with nodes and internodes that store water, enabling it to thrive in dry climates.

For centuries, *Cissus Quadrangularis* has been an integral component of traditional medical systems such as Ayurveda,

Siddha, and Unani. In classical Ayurvedic texts like the Charaka Samhita and Sushruta Samhita, the plant is described for its therapeutic properties in managing bone fractures, joint disorders, and inflammatory conditions. Folk practitioners have also used it for gastrointestinal disturbances, wound healing, menstrual irregularities, and general debility, indicating its broad ethnomedicinal relevance.

Botanically, the plant is a fast-growing vine with opposite tendrils and small, inconspicuous flowers. The stem is the most commonly used medicinal part and is rich in calcium and bioactive secondary metabolites. Its adaptability to arid environments and ease of cultivation have contributed to its

widespread availability and use in rural healthcare systems. The plant's hardy nature and rapid regenerative capacity also align with its traditional association with tissue repair and regeneration.

Phytochemical investigations have revealed that *Cissus Quadrangularis* contains a diverse array of bioactive compounds, including flavonoids, triterpenoids, phytosterols, iridoids, stilbene derivatives, saponins, and ascorbic acid. These constituents are believed to be responsible for its pharmacological properties, particularly its osteogenic, anti-inflammatory, antioxidant, and analgesic effects. The synergistic action of these compounds may explain the plant's multi-target therapeutic potential.

In recent decades, growing interest in plant-based therapeutics has led to extensive pharmacological research on *Cissus Quadrangularis*. Experimental studies have demonstrated its role in enhancing osteoblast proliferation, promoting mineralization, and accelerating fracture healing in animal models. Additionally, the plant has shown promising results in anti-inflammatory, anti-ulcer, hepatoprotective, antidiabetic, anti-obesity, and antimicrobial studies, expanding its scope beyond traditional bone-related applications.

Clinical investigations have further supported some of these traditional claims, particularly in fracture management and metabolic disorders. Standardized extracts have been evaluated for their effects on bone turnover markers, pain reduction, and lipid metabolism. However, while preliminary findings are encouraging, variability in extract preparation, dosage, and study design necessitates more rigorous and

large-scale clinical trials to establish definitive therapeutic efficacy.

Given its rich ethnopharmacological background, diverse phytochemistry, and expanding experimental evidence, *Cissus Quadrangularis* represents a significant medicinal plant of multidisciplinary interest. A comprehensive review integrating botanical, phytochemical, pharmacological, toxicological, and clinical perspectives is essential to better understand its therapeutic potential, ensure quality standardization, and guide future research toward evidence-based applications.^[1-3]

Plant Profile of *Cissus Quadrangularis* L.

Botanical Description

Cissus Quadrangularis L. is a perennial succulent climber belonging to the family Vitaceae. The plant is characterized by its distinct quadrangular, fleshy, winged stems with swollen nodes and internodes. The stem is green, smooth, and succulent, functioning as the major photosynthetic and medicinal part of the plant. Tendrils arise opposite to the leaves and assist the plant in climbing.

The leaves are simple, broad, ovate to cordate, and usually appear at the nodes. Flowers are small, greenish-white, and arranged in cymes. The fruits are globose berries that turn reddish-purple upon ripening and contain seeds. The plant thrives well in tropical and subtropical climates and is highly drought resistant due to its water-storing succulent stem morphology.

Geographical Distribution and Cultivation

Cissus Quadrangularis is widely distributed in India, Sri Lanka, Malaysia, Indonesia, and several African countries. In India, it is commonly found in dry regions and cultivated in home gardens as a medicinal plant. The plant prefers warm climatic conditions, sandy or loamy soils, and moderate irrigation. Propagation is mainly carried out through stem cuttings due to easy rooting and rapid vegetative growth.

Morphological Characteristics

- Stem

Table 1: Plant Profile

Parameter	Description
Scientific Name	<i>Cissus Quadrangularis</i> L.
Family	Vitaceae
Common Names	Hadjod, Asthi-samharaka, Veldt grape, Devil's backbone
Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Vitales
Genus	Cissus
Species	quadrangularis
Plant Type	Perennial succulent climber
Part Used	Stem (mainly), leaves, roots
Habitat	Dry and arid regions, tropical and subtropical climates
Geographical Distribution	India, Sri Lanka, Bangladesh, Southeast Asia, and Africa
Propagation	Stem cuttings
Traditional Systems of Medicine	Ayurveda, Siddha, Unani

Table 2: Taxonomical Classification

Taxonomic rank	Classification
Kingdom	Plantae
Subkingdom	Tracheobionta
Superdivision	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Rosidae
Order	Vitales
Family	Vitaceae
Genus	Cissus
Species	<i>Cissus Quadrangularis</i> L.

Table 3: Vernacular Names

Language	Name
English	Veldt grape, Devil's backbone
Sanskrit	Asthi-samharaka
Hindi	Hadjod
Telugu	Nalleru
Tamil	Pirandai
Malayalam	Changalamparanda
Kannada	Mangaraballi
Marathi	Kandvel

- Quadrangular, fleshy, winged, succulent, and green
- Possesses nodes and internodes
- Rich in mucilage and medicinal constituents
- Leaves
- Simple, broad, and ovate
- Arranged alternately at nodes
- Deciduous in dry conditions
- Flowers
- Small and greenish-white
- Arranged in cymose inflorescence
- Fruits
- Small berries turning red or purple on ripening
- Contain hard seeds

Ethnomedicinal Importance

Traditionally, *Cissus Quadrangularis* has been extensively used in Ayurveda and Siddha medicine for fracture healing, bone strengthening, wound healing, treatment of piles, ulcers, asthma, menstrual disorders, obesity, and inflammatory conditions. The stem paste is externally applied to fractures and wounds, while decoctions and extracts are administered orally for systemic therapeutic effects^[4-5]

Major Phytoconstituents and Chemical Structures of *Cissus Quadrangularis* L.

Cissus Quadrangularis contains a wide variety of bioactive phytoconstituents responsible for its pharmacological properties. The major classes of compounds reported include flavonoids, triterpenoids, phytosterols, stilbene derivatives, ketosteroids, phenolic compounds, tannins, saponins, vitamins, and minerals^[6]

Flavonoids

Flavonoids are important polyphenolic compounds possessing antioxidant and anti-inflammatory activities.

General Flavonoid Structure

The basic flavonoid skeleton consists of two benzene rings (A and B) linked through a heterocyclic pyran ring (C), represented as C6–C3–C6^[7]

Triterpenoids

Triterpenoids contribute significantly to anti-inflammatory and wound healing properties.

Table 4: General Flavonoid Structure

Phytoconstituent	Chemical nature	Pharmacological significance
Quercetin	Flavonol	Antioxidant, anti-inflammatory
Kaempferol	Flavonol	Bone protective, antioxidant
Luteolin	Flavone	Anti-inflammatory
Vitexin	Flavone glycoside	Antioxidant, cardioprotective
Orientin	C-glycosyl flavonoid	Free radical scavenging

Table 5: General Triterpenoid Structure

Phytoconstituent	Chemical class	Biological activity
Lupeol	Pentacyclic triterpenoid	Anti-inflammatory, anticancer
Friedelin	Triterpenoid ketone	Hepatoprotective
β-amyrin	Pentacyclic triterpenoid	Analgesic, anti-inflammatory
Taraxerol	Triterpenoid	Antimicrobial

General Triterpenoid Structure

Triterpenoids possess a pentacyclic hydrocarbon skeleton derived from six isoprene units with a molecular framework of C₃₀H₄₈.

Phytosterols

Phytosterols are steroid-like plant compounds important in bone metabolism and lipid regulation.

General Sterol Structure

Phytosterols possess a cyclopentanoperhydrophenanthrene nucleus with an aliphatic side chain attached at C-17.

Ketosteroids

Ketosteroids are considered important constituents contributing to fracture healing and anabolic effects.

Pharmacological Relevance of Phytoconstituents

The phytoconstituents present in *Cissus Quadrangularis* act synergistically to produce osteogenic, antioxidant, anti-inflammatory, antimicrobial, hepatoprotective, anti-obesity,

Table 6: Phytosterols

Phytoconstituent	Activity
β-sitosterol	Anti-inflammatory, osteogenic
Stigmasterol	Hypolipidemic, antioxidant

Table 7: Ketosteroids

Compound	Activity
4-Cholesten-3-one	Bone healing, anabolic action
3-Ketosteroids	Osteogenic activity

Table 8: Stilbene Derivatives and Phenolic Compounds

Compound	Activity
Resveratrol-like stilbenes	Antioxidant
Phenolic acids	Free radical scavenging
Tannins	Antimicrobial, wound healing

Table 9: Vitamins and Minerals

Nutrient	Importance
Vitamin C	Collagen synthesis
Calcium	Bone mineralization
Iron	Hematopoietic support
Magnesium	Enzymatic reactions

and wound healing activities. Flavonoids and phenolic compounds mainly contribute to antioxidant effects, while ketosteroids and phytosterols are involved in bone regeneration and metabolic regulation.^[8-9]

The phytochemical constituents reported in *Cissus Quadrangularis* include flavonoids (quercetin, kaempferol, luteolin, vitexin, and orientin), triterpenoids (β -amyrin, lupeol, friedelin, and taraxerol), phytosterols (β -sitosterol and stigmasterol), ketosteroids, stilbene derivatives, phenolic compounds, tannins, carotenoids, saponins, and vitamins such as ascorbic acid (vitamin C). These phytoconstituents contribute significantly to the antioxidant, anti-inflammatory, osteogenic, hepatoprotective, antimicrobial, and wound healing properties of the plant.^[36-40]

β -Sitosterol and ketosteroids are considered major bioactive compounds responsible for the osteogenic and fracture-healing properties of *Cissus Quadrangularis*. Flavonoids and phenolic compounds exhibit potent free

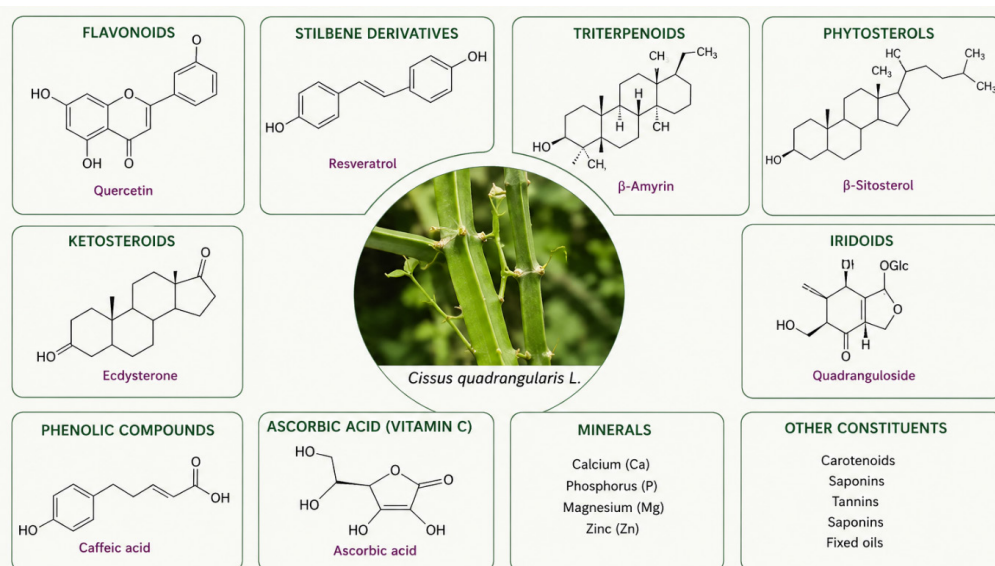
radical scavenging activity and reduce oxidative stress, while triterpenoids contribute to anti-inflammatory and analgesic effects [37–39].

The plant is also rich in essential minerals such as calcium, phosphorus, magnesium, and zinc, which further support bone mineralization and tissue regeneration. Vitamin C present in the stem enhances collagen synthesis and accelerates wound healing.^[36,38,40]

PHARMACOLOGICAL ACTIONS

Osteogenic and Fracture-Healing Activity of *Cissus Quadrangularis* L.

Cissus Quadrangularis L. has been extensively investigated for its osteogenic and fracture-healing potential, which constitutes its principal pharmacological property. Traditionally referred to as Asthi-samharaka in Ayurvedic literature, the plant has long been used for the management of bone fractures and skeletal disorders. Modern experimental research supports these traditional claims, demonstrating significant enhancement of bone regeneration following administration of its extracts. Preclinical studies conducted in various animal fracture models have shown that treatment with *Cissus Quadrangularis* accelerates the stages of bone repair, including inflammation, soft callus formation, hard callus formation, and remodelling. Radiological and histopathological analyses reveal earlier bridging of fractured bone ends, increased callus formation, and enhanced mineral deposition in treated groups compared to controls. Biomechanical studies further indicate increased tensile strength, stiffness, and load-bearing capacity of the healed bone, suggesting improved structural integrity. At the cellular level, the osteogenic effect is primarily attributed to



References: 1. Venkatesan K, Latha S. Phytochemical and pharmacological properties of *Cissus quadrangularis* L.: An overview. Int J Pharm Pharm Sci. 2012;4(4):8-12.
2. Rajashekar Y, et al. Phytochemistry and therapeutic potential of *Cissus quadrangularis* L. – A review. J Med Plants Res. 2011;5(3): 299-313.
3. Patil MB, et al. A review on *Cissus quadrangularis* L.: Phytochemistry and pharmacological activities. Pharmacogn Rev. 2014;8(16):80-87.

Figure 1: Major Phytoconstituents Of *Cissus Quadrangularis* L.

stimulation of osteoblastic proliferation and differentiation. Extracts of *Cissus Quadrangularis* have been reported to enhance alkaline phosphatase (ALP) activity, promote synthesis of type I collagen, and increase expression of bone matrix proteins. The plant also appears to influence bone turnover markers and may regulate calcium metabolism, contributing to improved bone density and mineralization. Its rich calcium content and presence of vitamin C further support collagen formation and matrix maturation. Phytochemical investigations have identified flavonoids, triterpenoids, phytosterols (such as β -sitosterol), iridoids, and stilbene derivatives as key bioactive constituents responsible for the osteogenic action. Some studies suggest that steroidal principles present in the plant may exert anabolic effects on bone tissue, thereby enhancing ossification. Additionally, antioxidant properties help mitigate oxidative stress at the fracture site, which is known to impair bone healing. Clinical evaluations, although limited in number, have demonstrated promising outcomes. Patients treated with standardized preparations of *Cissus Quadrangularis* have shown earlier radiological union, reduced pain and swelling, and improved functional recovery when compared with conventional management alone. However, variations in study design, dosage regimens, and extract standardization necessitate further well-designed randomized controlled trials to establish definitive therapeutic efficacy and optimal dosing guidelines.

the osteogenic and fracture-healing activity of *Cissus Quadrangularis* is supported by traditional knowledge, experimental evidence, and preliminary clinical findings. Its mechanism involves stimulation of osteoblast activity, enhancement of collagen synthesis, promotion of mineralization, and antioxidant protection. These multidimensional actions validate its traditional use and highlight its potential as a supportive therapeutic agent in fracture management and other bone-related disorders.^[10,11]

Anti-Inflammatory Activity

Cissus Quadrangularis L. possesses significant anti-inflammatory properties, which contribute substantially to its therapeutic value in bone disorders, arthritis, and soft tissue injuries. In traditional systems of medicine, the plant has been used to alleviate swelling, pain, and inflammatory conditions, and modern pharmacological studies provide experimental support for these claims. Preclinical investigations using various animal models, such as carrageenan-induced paw edema and formalin-induced inflammation, have demonstrated that extracts of *Cissus Quadrangularis* significantly reduce edema formation and inflammatory responses. The anti-inflammatory effect has been observed with aqueous, ethanolic, and methanolic extracts, suggesting the presence of multiple bioactive constituents contributing to this activity. The underlying mechanism of action is believed to involve inhibition of key inflammatory mediators. Studies indicate that *Cissus Quadrangularis* may suppress the activity of cyclooxygenase

(COX) and lipoxygenase (LOX) enzymes, thereby reducing the synthesis of prostaglandins and leukotrienes, which are central mediators of inflammation. Additionally, the extract has been reported to downregulate pro-inflammatory cytokines such as tumor necrosis factor-alpha (TNF- α) and interleukin-1 beta (IL-1 β), contributing to reduced tissue inflammation and cellular damage. Phytochemical constituents such as flavonoids, triterpenoids, and phytosterols are thought to be primarily responsible for the anti-inflammatory action. These compounds exhibit antioxidant properties, which further help in neutralizing reactive oxygen species generated during inflammatory processes. By reducing oxidative stress and inhibiting inflammatory pathways, the plant supports faster recovery in conditions involving tissue injury and swelling. The anti-inflammatory activity of *Cissus Quadrangularis* is particularly important in fracture healing, as excessive inflammation can delay bone regeneration. By modulating the inflammatory phase of healing, the plant may create a favourable environment for callus formation and tissue remodelling. Although promising, further well-designed clinical trials are required to establish its efficacy and safety in chronic inflammatory disorders.^[12,13]

Analgesic Activity

Cissus Quadrangularis L. has been reported to possess significant analgesic activity, which complements its well-established anti-inflammatory and osteogenic properties. Traditional systems of medicine have long utilized the plant for alleviating pain associated with fractures, joint disorders, and soft tissue injuries. Review articles summarizing preclinical investigations indicate that various extracts of the stem exhibit notable pain-relieving effects in experimental animal models.

Pharmacological evaluations described in review literature highlight that *Cissus Quadrangularis* reduces nociceptive responses in standard models such as the acetic acid-induced writhing test and thermal pain assays (hot plate and tail-flick methods). These findings suggest that the plant exerts both peripheral and central analgesic actions. The peripheral mechanism is primarily attributed to inhibition of cyclooxygenase (COX) enzymes and subsequent reduction in prostaglandin synthesis, while central effects may involve modulation of pain perception pathways. Additionally, suppression of pro-inflammatory cytokines and oxidative stress contributes to decreased sensitization of nociceptors.

The analgesic activity is believed to result from synergistic effects of its phytoconstituents, including flavonoids, triterpenoids, and phytosterols such as β -sitosterol. These compounds exhibit antioxidant and anti-inflammatory properties, which indirectly support pain relief. Review articles conclude that although preclinical evidence strongly supports the analgesic potential of *Cissus Quadrangularis*, further well-designed clinical studies are necessary to establish standardized dosing, safety, and therapeutic efficacy in human subjects.^[14-15]

Antioxidant Activity

Cissus Quadrangularis L. exhibits significant antioxidant activity, which plays an important role in its overall pharmacological profile. Oxidative stress is a key factor involved in the pathogenesis of inflammation, tissue injury, metabolic disorders, and delayed fracture healing. The antioxidant potential of *Cissus Quadrangularis* contributes to its protective effects in various experimental models and supports its traditional therapeutic applications. Review studies report that extracts of *Cissus Quadrangularis* demonstrate strong free radical scavenging activity in in vitro assays such as DPPH, superoxide radical scavenging, hydroxyl radical inhibition, and lipid peroxidation models. The plant has been shown to enhance endogenous antioxidant defense systems by increasing the activity of enzymes such as superoxide dismutase (SOD), catalase (CAT), and glutathione peroxidase (GPx), while reducing levels of malondialdehyde (MDA), a marker of lipid peroxidation. These effects indicate its capacity to neutralize reactive oxygen species (ROS) and prevent oxidative damage to cellular components.

The antioxidant activity is primarily attributed to its rich phytochemical composition, including flavonoids (such as quercetin and kaempferol), phenolic compounds, triterpenoids, and vitamin C. These bioactive constituents act synergistically to donate hydrogen atoms or electrons to free radicals, thereby stabilizing them and interrupting oxidative chain reactions. This antioxidant property is particularly beneficial in bone healing and inflammatory conditions, where oxidative stress can impair cellular proliferation and tissue regeneration. Although substantial experimental evidence supports its antioxidant capacity, further clinical investigations are required to confirm its therapeutic relevance in human oxidative stress-related disorders.^[16-17]

Anti-Ulcer Activity

Cissus Quadrangularis L. has shown promising anti-ulcer activity in various experimental studies, supporting its traditional use in the treatment of gastrointestinal disorders such as dyspepsia and gastritis. In ethnomedicine, the plant has been administered to relieve gastric irritation and abdominal discomfort. Scientific validation through pharmacological investigations has demonstrated that stem extracts possess significant gastroprotective properties.

Preclinical studies using animal models, including pylorus ligation, ethanol-induced gastric ulcer, aspirin-induced ulcer, and stress-induced ulcer models, have revealed that administration of *Cissus Quadrangularis* extract significantly reduces ulcer index, gastric volume, and total acidity. Treated animals exhibit enhanced gastric mucus secretion and improved mucosal integrity. Histological examination further confirms reduced mucosal erosion, decreased inflammatory infiltration, and improved epithelial regeneration in comparison to untreated control groups.

The anti-ulcer mechanism is considered multifactorial. The plant contains flavonoids, triterpenoids, and phenolic

compounds that exhibit strong antioxidant activity, thereby reducing oxidative stress-induced mucosal damage. Additionally, the extract may enhance prostaglandin synthesis, promote mucosal blood flow, and strengthen defensive factors of the gastric lining while simultaneously reducing aggressive factors such as acid secretion and lipid peroxidation.^[18]

Hepatoprotective Activity

Cissus Quadrangularis L. has demonstrated notable hepatoprotective potential in experimental pharmacological studies. Although traditionally renowned for its osteogenic properties, emerging evidence indicates that the plant also exerts protective effects on hepatic tissue. Extracts of *Cissus Quadrangularis*, particularly ethanolic and aqueous stem extracts, have been evaluated in various models of chemically induced liver injury, providing scientific support for its possible role in hepatic protection.

Experimental investigations employing hepatotoxic agents such as paracetamol (acetaminophen), carbon tetrachloride (CCl₄), and ethanol have shown that administration of *Cissus Quadrangularis* significantly attenuates liver damage. Biochemical analyses reveal marked reductions in serum hepatic enzyme markers including alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), and total bilirubin levels in treated groups compared to toxic controls. Furthermore, restoration of total protein and albumin levels suggests improvement in hepatic synthetic function. Histopathological evaluations corroborate these findings, demonstrating preservation of hepatic architecture, reduced necrosis, decreased fatty degeneration, and minimized inflammatory infiltration.

The hepatoprotective mechanism of *Cissus Quadrangularis* appears to be primarily mediated through its antioxidant and membrane-stabilizing properties. The plant enhances endogenous antioxidant defense systems, including superoxide dismutase (SOD), catalase (CAT), and reduced glutathione (GSH), while significantly reducing lipid peroxidation products such as malondialdehyde (MDA). The presence of bioactive constituents such as flavonoids, triterpenoids, and phenolic compounds contributes to scavenging of reactive oxygen species and stabilization of hepatocyte membranes. Additionally, its anti-inflammatory action may further mitigate cytokine-mediated hepatic injury.^[19]

Anti-Diabetic and Anti-Obesity Effects

Cissus Quadrangularis L. has gained considerable attention for its potential role in the management of metabolic disorders, particularly diabetes mellitus and obesity. Although traditionally used for bone and inflammatory conditions, emerging pharmacological studies suggest that the plant may exert beneficial effects on glucose metabolism, lipid profile, and body weight regulation. These properties have been evaluated in both experimental animal models and limited human clinical trials.

Preclinical studies indicate that extracts of *Cissus Quadrangularis* produce significant hypoglycemic effects in streptozotocin- and alloxan-induced diabetic animal models. Administration of the extract has been shown to reduce fasting blood glucose levels, improve glucose tolerance, and enhance insulin sensitivity. These effects are often accompanied by improvements in lipid parameters, including reductions in total cholesterol, triglycerides, and low-density lipoprotein (LDL), along with increases in high-density lipoprotein (HDL). The antidiabetic mechanism is believed to involve enhancement of peripheral glucose utilization, stimulation of pancreatic β -cell function, inhibition of carbohydrate-digesting enzymes, and antioxidant-mediated protection against oxidative stress-induced pancreatic damage.

With regard to anti-obesity activity, *Cissus Quadrangularis* has demonstrated the ability to reduce body weight, waist circumference, and body fat mass in experimental and some clinical settings. The mechanism may involve modulation of adipogenesis, inhibition of lipid accumulation, improvement in lipid metabolism, and regulation of appetite-related hormones. Bioactive compounds such as flavonoids, triterpenoids, and phytosterols are thought to contribute to these metabolic effects through antioxidant, anti-inflammatory, and enzyme-modulating actions.

The anti-diabetic and anti-obesity effects of *Cissus Quadrangularis* appear to be mediated through multiple mechanisms, including improvement of insulin sensitivity, regulation of lipid metabolism, reduction of oxidative stress, and modulation of inflammatory pathways. While preliminary findings are promising, further large-scale, randomized controlled clinical trials are necessary to establish standardized dosing, long-term safety, and definitive therapeutic efficacy in metabolic syndrome and related disorders.^[20]

Antimicrobial Activity

Cissus Quadrangularis L. has been reported to exhibit moderate but significant antimicrobial activity against a range of pathogenic microorganisms. Traditional medicinal systems have utilized the plant in the treatment of infections, wounds, and skin disorders, suggesting its potential antimicrobial properties. Scientific investigations have provided experimental evidence supporting these ethnomedicinal claims.

In vitro studies have demonstrated that various extracts of *Cissus Quadrangularis* (aqueous, ethanolic, and methanolic) exhibit inhibitory effects against both Gram-positive and Gram-negative bacteria. Reported susceptible organisms include *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, and *Bacillus subtilis*. Some studies have also indicated antifungal activity against species such as *Candida albicans*. The antimicrobial activity is typically evaluated using agar well diffusion and broth dilution methods, where measurable zones of inhibition

and minimum inhibitory concentrations (MICs) confirm its bioactivity.

The antimicrobial mechanism is believed to involve disruption of microbial cell membranes, inhibition of protein synthesis, and interference with essential enzymatic processes. Phytochemical constituents such as flavonoids, tannins, triterpenoids, and phenolic compounds are primarily responsible for this activity. These compounds may alter membrane permeability, precipitate microbial proteins, and inhibit nucleic acid synthesis, ultimately leading to microbial growth suppression.

Although the antimicrobial activity of *Cissus Quadrangularis* is generally moderate compared to standard antibiotics, its broad-spectrum activity and low toxicity profile suggest potential utility as a complementary therapeutic agent. Further studies focusing on isolation of active compounds, determination of precise mechanisms, and evaluation in clinical settings are required to fully establish its antimicrobial efficacy and therapeutic applications.^[21]

Wound Healing Activity

Cissus Quadrangularis L. has demonstrated significant wound healing activity, which complements its traditional use in the management of fractures, cuts, and soft tissue injuries. In various traditional medical systems, the plant has been applied topically or administered orally to promote tissue repair and accelerate recovery. Modern experimental studies provide pharmacological evidence supporting these claims.

Preclinical investigations using excision, incision, and dead-space wound models in animals have shown that extracts of *Cissus Quadrangularis* significantly enhance wound contraction, reduce epithelialization time, and increase tensile strength of healed tissue. Treated groups exhibit faster closure of wound area compared to controls. Biochemical and histological evaluations reveal increased collagen synthesis, enhanced fibroblast proliferation, improved granulation tissue formation, and greater hydroxyproline content, indicating accelerated extracellular matrix remodeling.

The wound healing mechanism is believed to involve multiple pathways. The antioxidant activity of flavonoids and phenolic compounds reduces oxidative stress at the wound site, thereby preventing cellular damage. Anti-inflammatory effects help control excessive inflammatory responses that may delay healing. Additionally, stimulation of fibroblast activity and collagen deposition strengthens newly formed tissue and improves structural integrity. The presence of vitamin C and calcium may further support collagen maturation and tissue regeneration.

Cissus Quadrangularis promotes wound healing through antioxidant, anti-inflammatory, and collagen-enhancing mechanisms. Although substantial experimental evidence supports its efficacy, further clinical studies are required to establish standardized formulations, dosing regimens, and safety profiles for therapeutic application in human wound management.^[22]

Potential Anticancer Activity

Cissus Quadrangularis L. has attracted research interest for its potential anticancer properties, although this area remains in the preliminary stage of investigation. Traditional systems of medicine have utilized the plant for various chronic ailments, and modern in vitro studies suggest that it may possess cytotoxic and antiproliferative effects against certain cancer cell lines.

Experimental studies have demonstrated that extracts of *Cissus Quadrangularis* exhibit growth inhibitory activity against selected human cancer cell lines, including breast, cervical, and colon carcinoma models. These effects are generally dose-dependent and have been evaluated using assays such as MTT and cell viability studies. The observed cytotoxicity is attributed to induction of apoptosis, cell cycle arrest, and suppression of tumor cell proliferation. Some reports also suggest modulation of key signaling pathways involved in cell survival and inflammation.

The anticancer mechanism is believed to involve the plant's rich phytochemical profile, particularly flavonoids, triterpenoids, stilbene derivatives, and phenolic compounds. These bioactive constituents may exert antioxidant effects, reduce oxidative DNA damage, inhibit angiogenesis, and regulate pro-inflammatory mediators associated with tumor progression. Additionally, suppression of reactive oxygen species and modulation of apoptotic proteins may contribute to programmed cell death in malignant cells.

Despite promising in vitro findings, the anticancer activity of *Cissus Quadrangularis* remains largely exploratory. There is a lack of comprehensive in vivo tumor model studies and well-designed clinical trials to confirm its efficacy and safety in cancer therapy. Therefore, while preliminary evidence suggests potential anticancer properties, further detailed mechanistic studies and clinical evaluations are required before it can be considered a therapeutic candidate in oncology.^[23]

Weight loss

Several clinical studies have investigated the effects of *Cissus Quadrangularis* extracts on body weight and fat measures. In one double-blind, placebo-controlled trial involving 67 overweight adults, a 300 mg daily dose of a standardized extract (CQR-300) for eight weeks resulted in significant reductions in body fat (up to ~12.8% measured by DEXA), waist and hip circumferences, and improvements in blood lipids compared with placebo. Participants also saw favourable changes in leptin and adiponectin, hormones that regulate appetite and metabolism. Another randomized study in 123 overweight and obese individuals showed that a *Cissus* formulation significantly lowered total body weight and central obesity (waist circumference) over 8 weeks, along with reductions in fasting glucose and cholesterol levels, regardless of whether participants were on a calorie-controlled diet.^[24]

CLINICAL STUDIES ON DIFFERENT DISEASES

Bone Health & Osteoporosis

A 24-week randomized; placebo-controlled study evaluated the effects of *Cissus Quadrangularis* (CQ) on bone health in 134 postmenopausal women with osteopenia. Participants received CQ at 1.2 g/day (CQ1.2), 1.6 g/day (CQ1.6), or placebo, with primary outcomes being % change in bone mineral density (BMD) at the lumbar spine, femoral neck, and total hip, and secondary outcomes including bone turnover markers (BTMs) such as CTX and P1NP. Of the 108 participants who completed the study, CQ treatment did not result in significant BMD changes compared to placebo, though small within-group changes were noted at the lumbar spine (CQ1.6) and femoral neck (CQ1.2) without exceeding the least significant change (LSC). Notably, CQ administration significantly reduced P1NP levels at weeks 12 and 24, indicating a slowed bone remodelling process, while the placebo group showed continuous increases in BTMs. No differences in adverse events were observed across groups. These findings suggest that while CQ may not increase BMD over 24 weeks, it has a promising effect in delaying bone loss by reducing bone turnover in postmenopausal women with osteopenia.^[25]

Weight Loss & Metabolic Effects

A pilot double-blind, placebo-controlled study evaluated the efficacy of *Cissus Quadrangularis* extract (CQR-300, 300 mg/day) in reducing body fat and improving metabolic parameters in 67 overweight individuals over 8 weeks. Participants maintained their usual diet and exercise routines and were randomly assigned to receive either CQR-300 or placebo. Body fat was assessed using bioelectrical impedance and DEXA, while blood samples were analyzed for lipid and metabolic markers. Results demonstrated that the CQR-300 group experienced a significant reduction in body fat-8.9% by impedance and 12.8% by DEXA-compared with minimal changes in the placebo group. Additionally, CQR-300 significantly improved waist and hip circumferences, blood pressure, fasting glucose, triglycerides, total cholesterol, leptin, and increased HDL-cholesterol and adiponectin levels. These findings indicate that daily supplementation with CQR-300 effectively reduces body fat and positively modulates key parameters associated with metabolic syndrome.^[26]

Antiinflammatory

Cissus Quadrangularis Linn. (CQ) is traditionally used for bone healing. Recent preclinical studies suggest its potential for managing osteoporosis and arthritis due to its bioactive compounds. This review evaluates CQ's therapeutic mechanisms, optimal dosage, and long-term effects in animal models. A systematic literature search was conducted CQ's bone-healing properties are attributed to β -sitosterol, lupeol, and vitamin C. Different formulations,

such as bone-strengthening polyherbal supplements and sustained-release tablets (SRTs), demonstrated significant bone-protective effects. A dosage of 25 mg CQ in 100 mg SRT increased serum alkaline phosphatase, calcium, and phosphorus levels, while 405 mg/kg enhanced trabecular thickness and reduced osteoclastogenesis. CQ extracts (300–500 mg/kg) improved joint health by mitigating oxidative stress and pro-inflammatory cytokines. CQ exhibits promising anti-osteoporotic and anti-arthritic effects in preclinical models. However, well-designed clinical trials are necessary to confirm its efficacy and safety in humans for potential therapeutic applications.^[27]

Phytoconstituents on *Cissus Quadrangularis* L

Cissus Quadrangularis L., a succulent climber of the family Vitaceae, is rich in diverse phytoconstituents that contribute to its wide range of therapeutic activities. The plant contains flavonoids such as quercetin, kaempferol, luteolin, vitexin, and orientin, which exhibit antioxidant, anti-inflammatory, and bone-protective effects. It is also a source of triterpenoids including friedelin, β -amyrin, lupeol, and Taraxerol, known for their anti-inflammatory, analgesic, hepatoprotective, and wound-healing properties. Phytosterols like β -sitosterol and stigmasterol support lipid regulation, anti-inflammatory activity, and bone health. The presence of ketosteroids such as 4-cholesten-3-one contributes to anabolic activity and fracture healing, while glycosides like cissoside A and B demonstrate cardioprotective and anti-ulcer effects. Additionally, the plant contains saponins, alkaloids, tannins, and phenolic compounds, which enhance its hepatoprotective, immunomodulatory, antimicrobial, and antioxidant activities. Rich in vitamins and minerals such as vitamin C, calcium, iron, and magnesium, *Cissus Quadrangularis* provides nutritional support that complements its pharmacological benefits, making it a valuable plant in traditional and modern medicine.^[28-30]

Food industry

Cissus Quadrangularis has limited but growing applications in the food industry, mainly as a functional and nutraceutical ingredient rather than a conventional food crop. Traditionally, the young, tender stems are consumed as a vegetable in parts of India and Sri Lanka. They are cooked in curries, chutneys, soups, and pickles after removing the fibrous outer layer and reducing the sour taste through proper preparation. In the modern food sector, *Cissus Quadrangularis* is incorporated into functional foods and dietary supplements aimed at promoting bone health, joint support, and weight management. Standardized stem extracts are added to health drinks, fortified powders, protein blends, nutrition bars, and herbal formulations. Its richness in vitamin C, carotenoids, calcium, and polyphenols enhances its value as a nutraceutical ingredient. The plant's antioxidant properties also make it a potential natural additive to improve nutritional quality and oxidative stability in certain formulations. As consumer demand for plant-based and health-promoting

ingredients increases, *Cissus Quadrangularis* is gaining recognition in the food and nutraceutical industries for its therapeutic and functional benefits.^[31-33]

Market values

The global *Cissus Quadrangularis* market has emerged as a steadily growing segment within the broader herbal and nutraceutical industry. Traditionally known in Ayurveda for its bone-healing and anti-inflammatory properties, *Cissus Quadrangularis* has gained modern commercial relevance due to increasing consumer preference for plant-based and natural health products. Rising awareness regarding lifestyle disorders and preventive healthcare has significantly contributed to its expanding global demand. Market growth is primarily driven by its application in dietary supplements formulated for bone health, joint support, weight management, and sports nutrition. The plant's extracts are widely incorporated into capsules, tablets, powders, and functional food formulations. Increasing participation in fitness and wellness activities has also boosted its popularity in sports recovery and musculoskeletal health supplements. Regionally, Asia-Pacific—particularly India—dominates production due to abundant raw material availability and its long-standing role in traditional medicine systems. North America and Europe represent significant consumer markets, supported by strong nutraceutical industries and growing acceptance of botanical supplements. Expansion of e-commerce platforms has further accelerated product accessibility and global distribution. The market is segmented based on product type (raw powder, standardized extract), application (nutraceuticals, pharmaceuticals, functional foods, cosmetics), and distribution channels (online and offline retail). Standardized extracts with defined phytochemical content are gaining preference due to improved quality control and regulatory compliance. Despite positive growth trends, challenges remain, including variability in raw material quality, regulatory differences across countries, and the need for stronger large-scale clinical evidence to support health claims. However, with increasing research focus and standardization efforts, the *Cissus Quadrangularis* market is expected to witness sustained growth and wider global acceptance in the coming years.^[34-35]

Marketed Products of *Cissus Quadrangularis* L.

Cissus Quadrangularis is commercially available in the form of capsules, tablets, powders, nutraceutical formulations, bone-health supplements, and sports nutrition products. These products are mainly marketed for bone healing, joint support, osteoporosis management, fracture recovery, weight management, and anti-inflammatory benefits.

Commercial Importance

Most marketed products of *Cissus Quadrangularis* are standardized for ketosteroids or phytosterol content because

Table 10: Common Commercial Formulations

Product Name	Manufacturer/Brand	Dosage Form	Major Indications
BestSource Nutrition <i>Cissus Quadrangularis</i> Extract	BestSource Nutrition	Capsules	Bone density improvement, connective tissue healing
StoPorus CQ	EBC Pharma	Tablets	Osteoporosis, fracture healing, bone regeneration
Nutricost <i>Cissus Quadrangularis</i>	Nutricost	Veg Capsules	Joint support, recovery, antioxidant support
Raskam Healthcare <i>Cissus Quadrangularis</i>	Raskam Healthcare	Veg Capsules	Bone strength, inflammation management
Fitbal <i>Cissus Quadrangularis</i> Capsule	1mg	Capsules	Weight management, bone and joint support
Nutridom <i>Cissus Quadrangularis</i> 300	Aviva Health	Vegetable Capsules	Weight loss, fracture healing, osteoarthritis support

these compounds are considered responsible for osteogenic and anabolic activities. Commercial formulations are commonly promoted as: Bone and joint health supplements Sports recovery formulations Weight-management nutraceuticals Osteoporosis support products Connective tissue healing supplements Several marketed formulations combine *Cissus Quadrangularis* with calcium, collagen peptides, vitamin D3, magnesium, zinc, and boron to enhance bone mineralization and fracture repair. StoPorus CQ is an example of a combination formulation containing *Cissus Quadrangularis* extract along with collagen type II, calcitriol, calcium citrate malate, magnesium, zinc, and boron for osteoporosis prevention and fracture recovery.

BestSource Nutrition and Raskam Healthcare products are standardized to ketosteroids and marketed primarily for bone healing, tendon repair, ligament recovery, and joint support in athletes and bodybuilders.

Nutricost and Nutridom products are internationally marketed nutraceutical supplements used for musculoskeletal health, anti-inflammatory support, and weight management.

Market Trends

The global market for *Cissus Quadrangularis*-based nutraceuticals is growing due to increasing consumer preference for herbal and plant-based supplements. Rising awareness regarding osteoporosis, arthritis, sports injuries, obesity, and preventive healthcare has significantly increased the commercial demand for *Cissus Quadrangularis* formulations. Recent research also focuses on nano-formulations and enhanced bioavailability products for better therapeutic outcomes.

CULTIVATION ASPECTS OF CISSUS QUADRANGULARIS L.

Cultivation Aspects

Cissus quadrangularis L. is a perennial succulent medicinal climber widely cultivated in tropical and subtropical regions due to its high medicinal value and adaptability to dry climatic conditions. The plant grows well in warm environments with temperatures ranging between 25–35°C and prefers well-drained sandy loam or red soils with a

neutral to slightly alkaline pH. It is highly drought tolerant because of its fleshy water-storing quadrangular stems. Propagation is mainly carried out through stem cuttings, as vegetative propagation provides rapid growth and better survival compared to seeds. Healthy stem cuttings containing 3–4 nodes are planted directly in prepared fields, usually during the monsoon season. Prior to planting, the land is well ploughed and enriched with farmyard manure or compost to improve soil fertility and growth. Although the plant can survive under low moisture conditions, moderate irrigation at regular intervals enhances biomass production and stem yield. Weed management is generally achieved through manual weeding and mulching during the early stages of growth. The plant is relatively resistant to pests and diseases; however, excessive moisture may cause fungal infections and root rot. Harvesting is usually carried out 6–8 months after planting, when the fleshy stems attain maturity. The harvested stems are washed, shade dried, and processed into powders or extracts for pharmaceutical, nutraceutical, and herbal medicinal applications. Due to increasing demand from Ayurvedic industries and health supplement markets, cultivation of *Cissus quadrangularis* is gaining significant commercial importance as a profitable medicinal crop [47–50].

Climate Requirements

Cissus quadrangularis grows well under warm tropical and subtropical climatic conditions. The plant prefers:

Temperature: 25–35 °C

Moderate sunlight to full sunlight

Low to moderate rainfall

Dry and semi-arid environmental conditions

Cissus quadrangularis Stem Powder

The stem powder of *Cissus quadrangularis* is widely used in traditional medicine, nutraceuticals, and herbal pharmaceutical formulations because of its rich content of bioactive phytoconstituents and minerals. The fresh succulent stems are collected, washed thoroughly to remove impurities, cut into small pieces, and shade dried to preserve heat-sensitive compounds such as vitamin C and flavonoids.

After complete drying, the material is pulverized into a fine powder and stored in airtight containers to protect it from moisture and microbial contamination. The powder possesses a characteristic greenish color, slightly sour taste, and fibrous texture. It contains important phytoconstituents including flavonoids, triterpenoids, ketosteroids, β -sitosterol, phenolic compounds, calcium, and ascorbic acid, which contribute to its osteogenic, anti-inflammatory, antioxidant, anti-obesity, and wound-healing activities. *Cissus quadrangularis* powder is commonly incorporated into capsules, tablets, health drinks, functional foods, nutraceutical supplements, and traditional Ayurvedic formulations for bone strengthening, fracture healing, joint support, and weight management. Recent studies have also explored the incorporation of stem powder into bakery and food products to enhance nutritional value and functional properties [49–52].

Analytical Studies of *Cissus quadrangularis* L.

Analytical studies of *Cissus quadrangularis* L. have been extensively carried out to evaluate its phytochemical composition, quality control parameters, and standardization of herbal formulations. Various pharmacognostic, physicochemical, chromatographic, and spectroscopic techniques are employed for identification and characterization of the plant and its bioactive constituents. Pharmacognostic evaluation includes macroscopic and microscopic examination of the stem, determination of foreign matter, ash values, extractive values, moisture content, and powder microscopy. These parameters help establish the identity, purity, and quality of the crude drug. Physicochemical studies have reported significant levels of calcium, vitamin C, flavonoids, triterpenoids, phytosterols, and phenolic compounds in the stem extract. Preliminary phytochemical screening confirms the presence of alkaloids, tannins, saponins, ketosteroids, and glycosides responsible for various pharmacological activities. Chromatographic techniques such as Thin Layer Chromatography (TLC), High Performance Thin Layer Chromatography (HPTLC), High Performance Liquid Chromatography (HPLC), and Gas Chromatography–Mass Spectrometry (GC–MS) are widely used for fingerprint profiling and quantitative estimation of marker compounds including β -sitosterol, quercetin, and ketosteroids. Spectroscopic methods such as UV–Visible spectroscopy, Fourier Transform Infrared Spectroscopy (FTIR), Nuclear Magnetic Resonance (NMR), and Mass Spectrometry (MS) are employed for structural elucidation of isolated phytoconstituents. Analytical studies also include antioxidant assays such as DPPH and FRAP methods, mineral analysis using Atomic Absorption Spectroscopy (AAS), and microbial load determination for quality assurance. These analytical evaluations are essential for authentication, standardization, safety assessment, and development of pharmaceutical and nutraceutical formulations containing *Cissus quadrangularis*.^[53]

CONCLUSION

Cissus Quadrangularis L. is a medicinally important plant with a strong foundation in traditional systems of medicine and growing scientific validation. Historically recognized for its bone-healing properties and referred to as Asthi-samharaka in Ayurveda, the plant has been widely utilized for the management of fractures, joint disorders, and inflammatory conditions. Modern pharmacological research has substantiated many of these traditional claims through experimental and limited clinical investigations.

Phytochemical analyses reveal that *Cissus Quadrangularis* contains diverse bioactive constituents, including flavonoids, triterpenoids, phytosterols, stilbene derivatives, phenolic compounds, calcium, and vitamin C. These compounds collectively contribute to its broad spectrum of pharmacological activities. Experimental evidence supports its osteogenic, anti-inflammatory, analgesic, antioxidant, anti-ulcer, hepatoprotective, antidiabetic, anti-obesity, antimicrobial, wound-healing, and potential anticancer properties. Among these, the bone regenerative and fracture-healing effects are the most extensively studied and scientifically supported. The therapeutic actions of *Cissus Quadrangularis* appear to be mediated through multiple mechanisms, including stimulation of osteoblastic activity, enhancement of collagen synthesis, modulation of inflammatory mediators, antioxidant defense augmentation, and stabilization of cellular membranes. Such multifactorial mechanisms highlight its potential as a complementary therapeutic agent in the management of musculoskeletal and metabolic disorders.

Cissus quadrangularis L. is a highly valuable medicinal plant with extensive therapeutic potential supported by traditional usage and modern scientific investigations. The plant is rich in diverse phytoconstituents such as flavonoids, triterpenoids, phytosterols, ketosteroids, phenolic compounds, vitamins, and minerals, which collectively contribute to its broad spectrum of pharmacological activities. Among its various medicinal properties, the osteogenic and fracture-healing effects are the most extensively studied and scientifically validated. Experimental and clinical studies have demonstrated its significant anti-inflammatory, antioxidant, analgesic, hepatoprotective, anti-ulcer, antimicrobial, anti-obesity, wound-healing, and potential anticancer activities. The plant also possesses considerable nutritional and commercial importance, leading to its incorporation into nutraceuticals, functional foods, and herbal pharmaceutical products. Analytical and phytochemical studies have further strengthened the scientific basis for standardization, quality control, and development of effective formulations containing *Cissus quadrangularis*. In addition, its easy cultivation, drought tolerance, rapid propagation, and increasing market demand make it an economically important medicinal crop. Despite

encouraging pharmacological and clinical evidence, further large-scale randomized clinical trials, toxicity evaluations, and molecular studies are necessary to establish standardized dosage regimens, long-term safety, and precise mechanisms of action. Overall, *Cissus quadrangularis* represents a promising medicinal plant with significant potential for future applications in pharmaceutical, nutraceutical, and healthcare industries

REFERENCES

1. Khatri, R. (2025). A review on the phytochemical and pharmacological characteristics of *Cissus Quadrangularis* L. *Annual Research & Review in Biology*, 40(10), 63–71.
2. Nesur, K., Nadaf, A., & Mareguddi, S. (2025). A review on the phytochemistry, pharmacology, and therapeutic potentials of *Cissus Quadrangularis* (Asthi Shrinkhala). *Journal of Pharmacognosy and Phytochemistry*, 14(5), 535–543.
3. Stohs, S. J., & Ray, S. D. (2013). A review and evaluation of the efficacy and safety of *Cissus Quadrangularis* extracts. *Phytotherapy Research*, 27(8), 1107–1114.
4. Gupta V, Sharma R. *Cissus Quadrangularis* L.: A review on its pharmacological and phytochemical properties. *Pharmacognosy Reviews*. 2015;9(17):124–129.
5. Shetty S, Udupa S, Rao S, et al. Traditional uses, phytochemistry and pharmacology of *Cissus Quadrangularis*. *Pharmacognosy Reviews*. 2016;10(20):1–12.
6. Stohs SJ, Ray SD. A review and evaluation of the efficacy and safety of *Cissus Quadrangularis* extracts. *Phytotherapy Research*. 2013;27(8):1107–1114.
7. Khatri R. A review on the phytochemical and pharmacological characteristics of *Cissus Quadrangularis* L. *Annual Research & Review in Biology*. 2025;40(10):63–71.
8. Chidambara Murthy KN, Jayachandra, Ravishankar GA. Phytochemical analysis of *Cissus Quadrangularis* stem. *Phytochemistry*. 2003;62(4):643–647.
9. Bafna, P. S., & Mishra, S. H. (2004). Effect of *Cissus Quadrangularis* on fracture healing: A systematic review. *Journal of Ethnopharmacology*, 92(2–3), 273–278.
10. Stohs, S. J., & Ray, S. D. (2013). A review and evaluation of the efficacy and safety of *Cissus Quadrangularis* extracts. *Phytotherapy Research*, 27(8), 1107–1114.
11. Bhutani, K. K., & Kapoor, R. (1998). Anti-inflammatory activity of *Cissus Quadrangularis* L. extract. *Indian Journal of Experimental Biology*, 36(3), 255–258.
12. Chidambara Murthy, K. N., Vanitha, A., Rajesha, J., Mahadeva Swamy, M., Sowmya, P. R., & Ravishankar, G. A. (2003). In vivo antioxidant and anti-inflammatory activity of *Cissus Quadrangularis* stem extract. *Journal of Medicinal Food*, 6(2), 99–105.
13. Singh, V., & Udupa, K. N. (1963). Studies on the fracture healing property of *Cissus Quadrangularis*. *Journal of Research in Indian Medicine*, 1(3), 7–13.
14. Jainu, M., & Devi, C. S. S. (2006). The effect of *Cissus Quadrangularis* on gastric mucosal defense and its anti-inflammatory properties: A review. *Journal of Ethnopharmacology*, 104(1–2), 123–126.
15. Chidambara Murthy, K. N., Vanitha, A., Rajesha, J., Mahadeva Swamy, M., Sowmya, P. R., & Ravishankar, G. A. (2003). In vivo antioxidant activity of *Cissus Quadrangularis* stem extract. *Journal of Medicinal Food*, 6(2), 99–105.
16. Shirwaikar, A., Khan, S., & Malini, S. (2003). Antiosteoporotic effect of ethanol extract of *Cissus Quadrangularis* Linn. on ovariectomized rat. *Journal of Ethnopharmacology*, 89(2–3), 245–250.
17. Jainu, M., & Devi, C. S. S. (2004). Effect of *Cissus Quadrangularis* on gastric mucosal defensive factors in experimentally induced gastric ulcer. *Journal of Ethnopharmacology*, 90(2–3), 271–276.
18. Viswanatha Swamy, A. H. M., Kulkarni, R. V., Thippeswamy, A. H. M., Koti, B. C., & Gore, A. (2010). Evaluation of hepatoprotective activity of *Cissus Quadrangularis* stem extract against isoniazid-induced liver damage in rats. *Indian Journal of Pharmacology*, 42(6), 397–400.
19. Kim JW, Jeong JS, Kim JH, Chung EH, Kim CY, Lee DR, Choi BK, Lim JH, Ko JW, Kim TW. Anti-hyperglycaemic effects of *Cissus Quadrangularis* extract via regulation of gluconeogenesis in type 2 diabetic db/db mice. *Frontiers in pharmacology*. 2024 Jul 10;15:1415670.
20. arekh, J., & Chanda, S. V. (2007). In vitro antimicrobial activity and phytochemical analysis of some Indian medicinal plants including *Cissus Quadrangularis*. *Brazilian Journal of Microbiology*, 38(3), 391–397.
21. Shirwaikar, A., Khan, S., & Malini, S. (2003). Antiosteoporotic and cytotoxic evaluation of *Cissus Quadrangularis* Linn. *Journal of Ethnopharmacology*, 89(2–3), 245–250.
22. Carvalho, J. C. T., de Oliveira Silva, F., Matias, E. F. F., Cearê, C. G. de A., & de Sousa, D. P. (2019). Natural products from Vitaceae species with potential anticancer bioactivity: A review. *Molecules*, 24(14), 2549.
23. Oben J, Kuate D, Agbor G, Momo C, Talla X. The use of a *Cissus Quadrangularis* formulation in the management of weight loss and metabolic syndrome. *Lipids in Health and Disease*. 2006 Sep 2;5(1):24.
24. Benjawan S, Nimitphong H, Tragulpiankit P, Musigavong O, Prathanturug S, Pathomwichaiwat T. The effect of *Cissus Quadrangularis* L. on delaying bone loss in postmenopausal women with osteopenia: a randomized placebo-controlled trial. *Phytomedicine*. 2022 Jul 1; 101:154115.
25. Nash R, Azantsa B, Kuate D, Singh H, Oben J. The use of a stem and leaf aqueous extract of *Cissus Quadrangularis* (CQR-300) to reduce body fat and other components of metabolic syndrome in overweight participants. *The Journal of Alternative and Complementary Medicine: Paradigm, Practice, and Policy Advancing Integrative Health*. 2019 Jan;25(1):98–106.
26. Parinam PS, Hedao RP, Patil M, Mohile A, Khatwani N, Aainapure A. Therapeutic potential of *Cissus*

- Quadrangularis* Linn. (Veldt grape) in osteoporosis and arthritis: A scoping review of preclinical evidence. *Journal of Applied Pharmaceutical Science*. 2025 Oct 5;15(11):008-20.
27. Shetty S, Udupa S, Rao S, et al. Traditional uses, phytochemistry, and pharmacology of *Cissus Quadrangularis*. *Pharmacogn Rev*. 2016;10(20):1–12.
 28. Gupta V, Sharma R. *Cissus Quadrangularis* L.: A review on its pharmacological and phytochemical properties. *Pharmacogn Rev*. 2015;9(17):124–129.
 29. Chidambara Murthy KN, Jayachandra, Ravishankar GA. Phytochemical analysis of *Cissus Quadrangularis* stem. *Phytochemistry*. 2003;62(4):643–647.
 30. Tsegaye Kelbore et al., "Value addition of *Cissus Quadrangularis* stem powder in Ethiopian flat bread: Injera and its effect on Nutritional composition, Sensory attributes and Microbial load," *J Food Sci Technol*, 2022.
 31. Khushbu Singh et al., "Formulation of *Cissus Quadrangularis* stem powder and its nutritional and phytochemical analysis," *Int. J. Adv. Biochem. Res.*, 2025;9(7):1444–1446.
 32. Jae-Joon Lee et al., "Effects of *Cissus Quadrangularis* L. Powder on Proximate Composition, Physicochemical and Textural Properties of Tteokgalbi," *Food Sci Anim Resour*, 2024;44(3):684–698.
 33. Global *Cissus Quadrangularis* market size, growth forecasts, and trends, including projections of market value increase from USD 19.75 million in 2025 to USD 27.06 million by 2032 (CAGR ~4.6%).
 34. Industry analysis showing the global *Cissus Quadrangularis* market projected to grow from about USD 16.9 million in 2025 to USD 26.4 million by 2035 driven by rising demand for natural supplements.
 35. Future Market Insights Report — estimates the global *Cissus Quadrangularis* market value at around USD 15.6 million in 2023, growing to USD 26.4 million by 2035 with a projected CAGR of ~14.6 %.
 36. Pharmacognosy Reviews Gupta V, Sharma R. *Cissus Quadrangularis* L.: A review on its pharmacological and phytochemical properties. *Pharmacogn Rev*. 2015;9(17):124–129.
 37. Pharmacognosy Reviews Shetty S, Udupa S, Rao S, et al. Traditional uses, phytochemistry and pharmacology of *Cissus Quadrangularis*. *Pharmacogn Rev*. 2016;10(20):1–12.
 38. Phytotherapy Research Stohs SJ, Ray SD. A review and evaluation of the efficacy and safety of *Cissus Quadrangularis* extracts. *Phytother Res*. 2013;27(8):1107–1114.
 39. Phytochemistry Chidambara Murthy KN, Jayachandra, Ravishankar GA. Phytochemical analysis of *Cissus Quadrangularis* stem. *Phytochemistry*. 2003;62(4):643–647.
 40. Annual Research & Review in Biology Khatri R. A review on the phytochemical and pharmacological characteristics of *Cissus Quadrangularis* L. *Annual Research & Review in Biology*. 2025;40(10):63–71.
 41. BestSource Nutrition *Cissus Quadrangularis* Extract Capsule.
 42. StoPorus CQ – EBC Pharma.
 43. Nutricost *Cissus Quadrangularis*.
 44. Raskam Healthcare *Cissus Quadrangularis* Veg Capsule.
 45. Fitbal *Cissus Quadrangularis* Capsule.
 46. Nutridom *Cissus Quadrangularis* 300.
 47. Pharmacognosy Reviews Gupta V, Sharma R. *Cissus quadrangularis* L.: A review on its pharmacological and phytochemical properties. *Pharmacogn Rev*. 2015;9(17):124–129.
 48. Pharmacognosy Reviews Shetty S, Udupa S, Rao S, et al. Traditional uses, phytochemistry and pharmacology of *Cissus quadrangularis*. *Pharmacogn Rev*. 2016;10(20):1–12.
 49. Phytotherapy Research Stohs SJ, Ray SD. A review and evaluation of the efficacy and safety of *Cissus quadrangularis* extracts. *Phytother Res*. 2013;27(8):1107–1114.
 50. Annual Research & Review in Biology Khatri R. A review on the phytochemical and pharmacological characteristics of *Cissus quadrangularis* L. *Annual Research & Review in Biology*. 2025;40(10):63–71.
 51. *Journal of Food Science and Technology* Tsegaye Kelbore et al. Value addition of *Cissus quadrangularis* stem powder in Ethiopian flat bread: Injera and its effect on nutritional composition, sensory attributes and microbial load. *J Food Sci Technol*. 2022.
 52. *International Journal of Advanced Biochemistry Research* Khushbu Singh et al. Formulation of *Cissus quadrangularis* stem powder and its nutritional and phytochemical analysis. *Int J Adv Biochem Res*. 2025;9(7):1444–1446.
 53. Annual Research & Review in Biology Khatri R. A review on the phytochemical and pharmacological characteristics of *Cissus quadrangularis* L. *Annual Research & Review in Biology*. 2025;40(10):63–71.

How to cite this article: Rao KNV, Bhongiri B, Thirupathaiah A, Mamata M, Illendula S. *Cissus Quadrangularis* L - A Comprehensive Multidisciplinary Review. *Journal of Applied Pharmaceutical Sciences and Research*. 2026; 9(3):1-13 Doi : 10.31069/japsr.v9i3.01