RESEARCH PAPER

Unlocking the Therapeutic Potential of Vidarikanda (Pueraria tuberosa DC): A Holistic Review of Ayurvedic Principles, Phytochemistry, and Therapeutic Applications

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Abstract :

Vidarikanda (Pueraria tuberosa DC.) is a renowned medicinal plant in Ayurveda, valued for its rejuvenative, nourishing, and therapeutic properties. This review compiles classical Ayurvedic descriptions and contemporary scientific evidence regarding its historical significance, taxonomy, morphology, phytochemistry, pharmacological activities, and therapeutic applications. Classical texts describe *Vidarikanda* as having *Madhura Rasa*, *Guru-Snigdha Guna*, *Sheeta Veerya*, and *Balya*, *Brimhana*, *Rasayana*, and *Vrishya* actions. Phytochemical investigations have identified bioactive compounds such as puerarin, daidzein, genistein, genistin, and β-sitosterol, which contribute to its antioxidant, antidiabetic, cardioprotective, nephroprotective, anti-inflammatory, antimicrobial, and fibrinolytic activities. Integrating traditional knowledge with modern research, *Vidarikanda* emerges as a promising medicinal and nutraceutical plant with significant potential for preventive and therapeutic healthcare.

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Introduction

The Indian system of medicine, particularly Ayurveda, possesses a vast repository of therapeutic agents that are extensively described in classical texts such as Samhitas and Nighantus. These medicinal substances are derived from herbal, mineral, and Herbo-mineral sources and are utilized either as single drugs or in polyherbal and compound formulations for the management of various diseases.

Ayurveda, regarded as an ancient life science, emphasizes a holistic and individualized approach to treatment rather than focusing solely on disease-specific management. Therapeutic interventions are planned based on fundamental Ayurvedic principles such as *Nidana* (etiology), *Dosha* (body humors), *Kala* (time/season), *Adhisthana* (site of disease), and *Prakriti* (individual constitution). Owing to this comprehensive approach, Ayurveda has demonstrated potential in addressing emerging and contemporary health challenges.

In recent years, Ayurvedic medicines have gained increasing national and international acceptance due to their therapeutic efficacy and comparatively minimal adverse effects. Classical Ayurvedic literature extensively documents the properties, actions, and therapeutic applications of numerous medicinal plants. Among these, *Vidarikanda,* botanically identified as *Pueraria tuberosa*, is a tuberous root drug of significant medicinal importance. It has been described in various Samhitas and Nighantus for its wide range of therapeutic uses.

HISTORICAL REVIEW

Vidarikanda has been utilized since ancient times, particularly in the northeastern regions of India. The term *Vidari* generally denotes the plant itself, whereas *Vidarikanda* specifically refers to its tuberous roots. Historical and religious literature highlights the significance of this drug in various socio-cultural and ritual practices. It is mentioned as an item to be offered as a gift during funeral ceremonies and is also prescribed in *Pumsavana Karma*, as documented in sacred texts such as *Shankhalikhita Dharmasutra (220)*, *Ganaratnamahodadhi (57)*, and *Kaushika Sutra* (35/4). Furthermore, the reference to the

term in *Ashtadhyayi (4/3/166)* by Panini provides evidence for the antiquity and established nomenclature of the drug.

In the *Brihatrayi* texts, *Vidarikanda* is cited on numerous occasions and is referred to as *Kandashaka*, indicating its use as a vegetable. These classical Ayurvedic texts describe the drug as possessing Balya (strength-promoting), *Brimhana* (nourishing), and *Vajikarana* (aphrodisiac) properties. Sushruta Samhita includes *Vidarikanda* under the group *Vallipanchamoola*. In the *Rasayana* chapter of Ashtanga Sangraha (Uttara Sthana, Chapter 49), the drug is mentioned by the synonym *Vallipalasha*, a name that reflects the morphology of its leaves.

Numerous Nighantus and other Ayurvedic texts recognize *Vidarikanda* as an important nutritive and rejuvenative drug. It is widely employed both as a single therapeutic agent and as a constituent of several compound formulations intended to promote nourishment and vitality. The drug is also referred to as *Siyaali* in the Ain-i-Akbari (Ain 24). Additionally, Flora of Punjab describes *Vidarikanda* as a nutraceutical plant. Even today, tender tuberous roots of *Vidarikanda* are sold and consumed as a vegetable in several local markets, reflecting the continuation of its traditional dietary and medicinal use.

Taxonomy (Scientific Classification)[1]

Kingdom: Plantae

Subkingdom: Trachebionta

Super division: Spermatophyta

Division: Magnoliophyta

Subclass: Rosidae
Order: Fabales Family: Fabaceae
Genus: Pueraria DC.

Species: Pueraria tuberose

Vernacular Names of *Vidarikanda* [1]

- Sanskrit: *Bhumikusmanda, Gajavajipriya, Kandapalash, Svadukanda), Vidari), IksuGandha.*
- Assamese: *Bhedeleton, Bhuikumra*
- Bengali: *Bhuinkumra, Bhumikusmanda, Vidari*
- English: Indian kudzu
- Gujrati: *Bhoikolu, Bhonykoru, Eagio, Sakharvel, Vidarikanta*,
- Hindi: *Vidarikanda*
- Kannada: *Gumadi belli, Gumadigida, Nelagumbala Gudde, Nelagumbala, Nelagumbula*
- Malayalam: *Mudakku*
- Marathi: *Bhuikohala, Ghodvel*
- Oriya: *Bhuiankakharu*
- Punjabi: *Siali, Surala*
- Tamil: *Nilapoosani*
- Telugu: *Darigummadi, Nelagummuda*

Classification of *Vidarikanda* by Nighantus in different *Vargas* and *Ganas*

Madanpal Nighantu : Abhayadi Varga [(2)]

Shaligram nighantu: Shak varga [(3)]

Rajnighntu : Mulkadivarga [(4)]

Bhavprakash Nighantu : Guduchyadivarga [(5)]

Kaiydev Nighantu : Aushadhi Varga [(6)]

Dhanvantari Nighantu : Guduchyadi Varga[(7)]

Charak Samhita : Balya, Brimhaniy, Varnya, Kanthya, Snehopaga, Madhurskanda Gana[(8)]

Sushrut Samhita : Vidarigandhadi , Vallipanchmul, Pittatvashaman Gana[(9).]

Ashtang Hridayam : Vidaryadi varga[(10)].

Varieties [35]

No true botanical varieties of *Vidarikanda* have been described. However, another medicinal plant, *Ksheeravidari*, known by synonyms such as *Ksheeravalli* and *Payasvini*, is often regarded as a substitute or allied variety of *Vidarikanda. Ksheeravidari* is botanically identified as *Ipomoea digitata L*. (Family: Convolvulaceae). It is a perennial climbing plant characterized by distinctly digitate leaves with five palmately arranged lobes. Owing to the morphological resemblance and comparable therapeutic applications of its tuberous roots, the tubers of I. digitata are frequently used as substitutes for *Vidarikanda* in traditional medicinal practice. Additionally, the tubers of *Trichosanthes cordata Roxb*. (Family: Cucurbitaceae) are commonly

available in markets of Bengal and the northeastern regions of India under the vernacular name "*Bhumikumhdaa*" and are also occasionally employed as substitutes for *Vidarikanda*.

Other Species of *Pueraria*

The genus *Pueraria* comprises approximately 35 species, whose distribution is influenced by geographical and geomorphological factors. Among these, *Pueraria thunbergiana*, *Pueraria lobata*, and *Pueraria thomsonii* are widely distributed across Korea, Vietnam, China, and the northeastern regions of Russia. *Pueraria montana* is predominantly found in Thailand and Myanmar, whereas several species, including *Pueraria tuberosa*, are native to the Indian subcontinent. The diversity and geographical distribution of *Pueraria* species reflect their adaptation to varied ecological conditions across Asia.[38]

Description of *Vidarikanda*

Pueraria tuberosa (Family: Fabaceae) commonly known as Indian kudzu, consists of the sliced and dried tuberous roots of a perennial climbing plant characterized by large subterranean tubers. The species is widely distributed across India, except in extremely humid and arid regions, and occurs up to an altitude of approximately 1200 meters above sea level.

Morphology: A perennial climbing shrub characterized by large tuberous roots, widely distributed in Indian forests. Leaves are trifoliate with silky pubescence on the lower surface of the leaflets. Flowers are bluish-white, arranged in fascicles on elongated racemes. Fruits are linear pods with constrictions between the seeds.

Microscopic [12]

The mature tuberous root exhibits a cork region composed of approximately 20–30 layers of rectangular, thin-walled, tangentially elongated, and radially arranged cells containing dark reddish-brown substances, except for a few inner layers. The secondary cortex consists of 6–15 layers of circular, oval, rectangular, and tangentially elongated thin-walled parenchymatous cells. A distinct yellow band comprising 2–6 layers of compactly arranged stone cells is present on the inner side of the cortex. These stone cells are moderately thick-walled, variable in shape and size, and possess prominent striations and pits.

Numerous prismatic crystals of calcium oxalate are observed within the parenchymatous cells and, occasionally, within the stone cells. The secondary phloem is composed of sieve elements and phloem parenchyma, interspersed with several strands of phloem fibres and a few stone cells. In the outer region, the sieve elements are partially collapsed, forming tangential bands. The phloem fibres are elongated, heavily lignified, thick-walled, and possess narrow lumina. Numerous tanninccontaining ducts filled with brown contents are distributed throughout the phloem region.

The xylem occupies the entire inner white spongy zone and consists of several concentric rings containing one or a few xylem vessels associated with other xylem elements. The vessels are predominantly drum-shaped and exhibit reticulate thickening. The xylem rays are multiseriate, distinct, and composed of thin-walled, radially elongated cells. A few latex ducts are also present in this region.

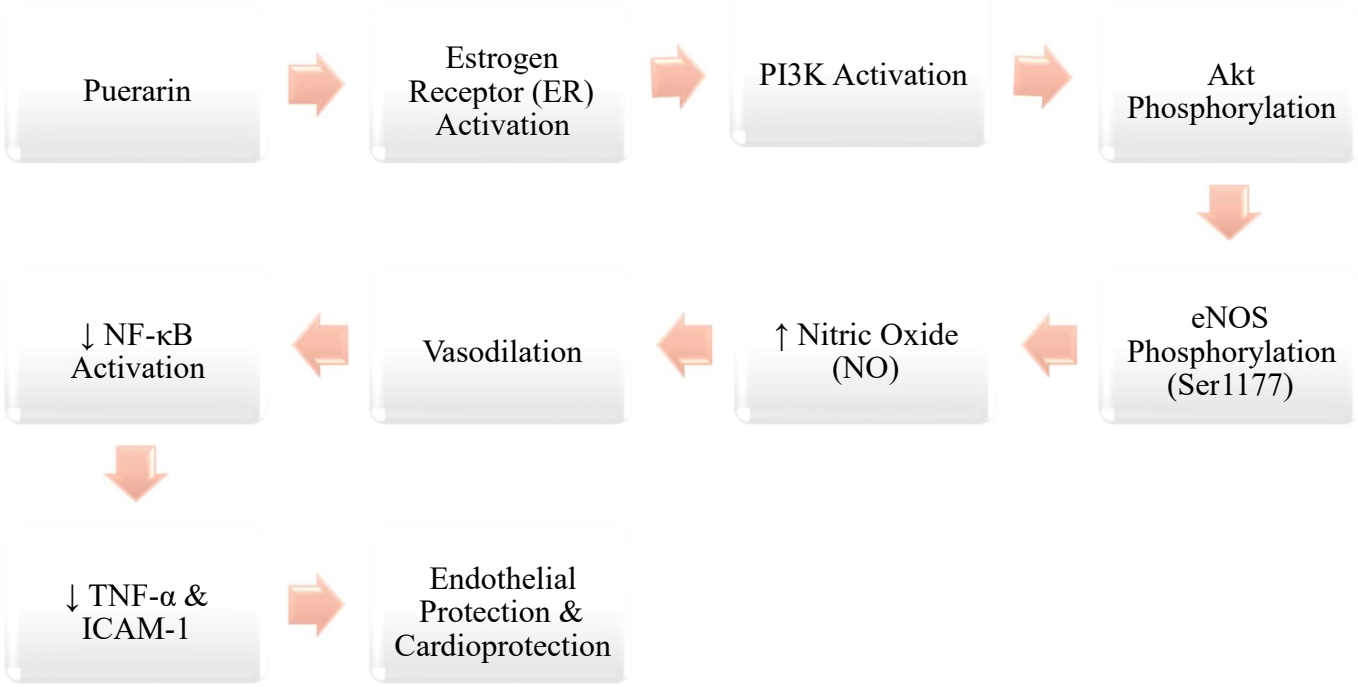
Abundant starch grains occur throughout the parenchymatous tissues. These grains are mostly simple, rounded to angular or oval in shape, with a central hilum and distinct striations, measuring approximately 5.5–13.75 μm in diameter.

Powder Characteristics[12]

The powdered drug is buff-coloured and is characterized by the presence of abundant starch grains with a central hilum and striations, measuring 5.5–13.75 μm in diameter. It also contains fragments of cork tissue, prismatic crystals of calcium oxalate, a few reticulately thickened xylem vessels, and phloem fibres**.**

Chemical Composition

The tubers of *Pueraria tuberosa* are rich in nutrients and bioactive constituents, containing approximately 85.1% dry matter, 64.6% carbohydrates, 28.4% crude fiber, 10.9% protein, and 0.5% ether-soluble extract. Phytochemical investigations have identified the presence of βsitosterol, sucrose, glucose, and fructose. Additionally, several bioactive secondary metabolites have been isolated from the tubers, including the pterocarpans tuberosin and hydroxytuberosone, the pterocarpenes anhydrotuberosin and 3-O-methylanhydrotuberosin, the coumestan tuberostan, the isoflavone puerarone, and the coumestan derivative puerarostan.[12] The tubers of *Pueraria tuberosa* are a rich source of isoflavonoids, with major constituents including puerarin, daidzein, genistein, and genistin. These phytochemicals are recognized for their diverse biological activities and contribute significantly to the therapeutic potential of the plant.[36]



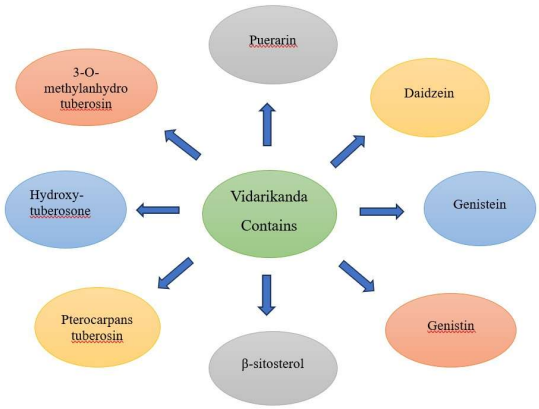


Fig.1 Chemical constituents of Vidarikanda

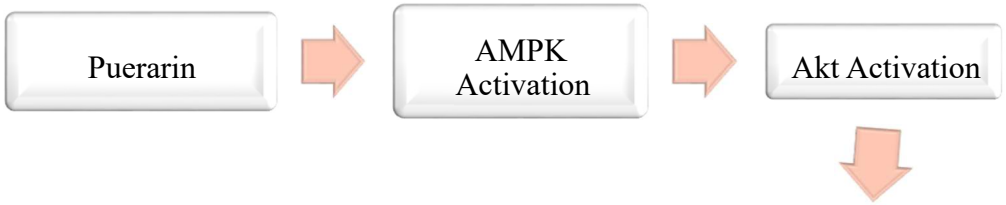
Puerarin : -

Puerarin is a naturally occurring isoflavone isolated from *Pueraria* species. Extensive experimental and clinical studies have demonstrated that puerarin exhibits diverse pharmacological activities, including lipid-lowering effects, vasodilatory properties, antiinflammatory actions, and hepatoprotective effects that contribute to the mitigation of alcoholinduced toxicity (anti-hangover activity)[13].

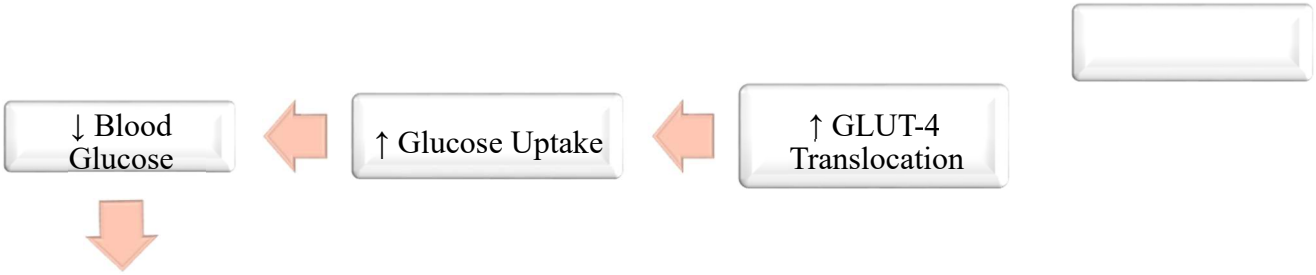
Puerarin has been extensively investigated and is widely utilized for the management of cardiovascular disorders, diabetes mellitus, and various liver diseases owing to its antioxidant, anti-inflammatory, vasoprotective, and metabolic regulatory effects. [14]

Extensive investigations have demonstrated that puerarin possesses potent antioxidant properties and exerts significant immunomodulatory and anti-inflammatory effects. These pharmacological activities contribute substantially to its therapeutic potential in the prevention and management of oxidative stress- and inflammation-associated disorders. [15,16]

Puerarin – Cardiovascular Protection [39]

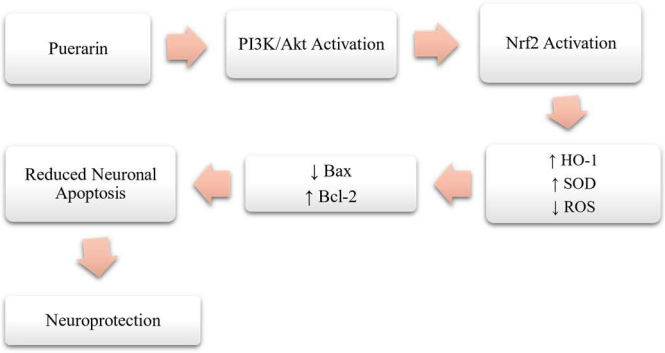


Puerarin – Antidiabetic Mechanism [19]



Improved Insulin Sensitivity

Puerarin – Neuroprotection[40]



Tuberosin : -

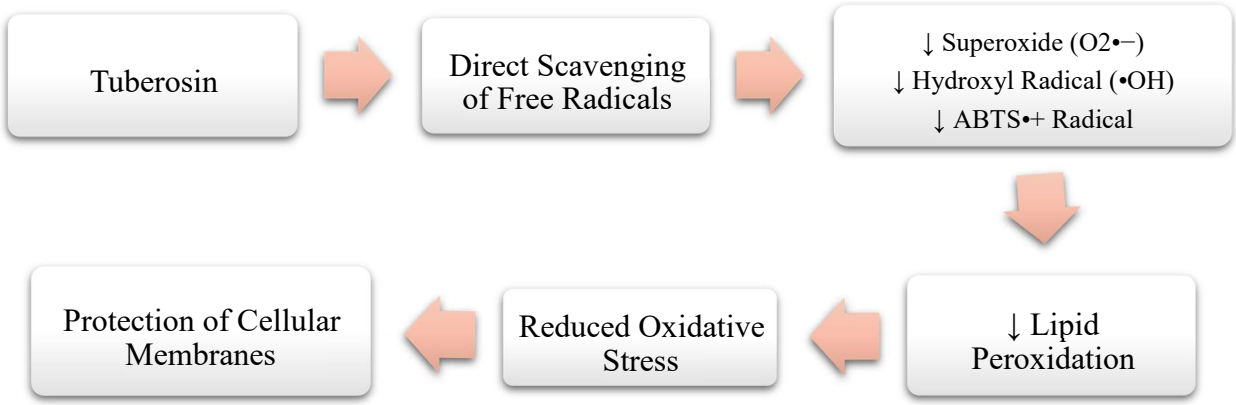
Anti-inflammatory activity: *Pueraria tuberosa* and its bioactive constituents exert significant anti-inflammatory effects by suppressing key inflammatory signaling pathways. They inhibit lipopolysaccharide (LPS)-induced production of nitric oxide (NO) and downregulate the expression of inducible nitric oxide synthase (iNOS) in activated macrophages, thereby attenuating inflammatory responses.[17,18]

Antioxidant activity: The phytoconstituents of *Pueraria tuberosa*, particularly puerarin and related isoflavonoids, exhibit potent antioxidant activity through efficient free radical scavenging and enhancement of endogenous antioxidant defense mechanisms.

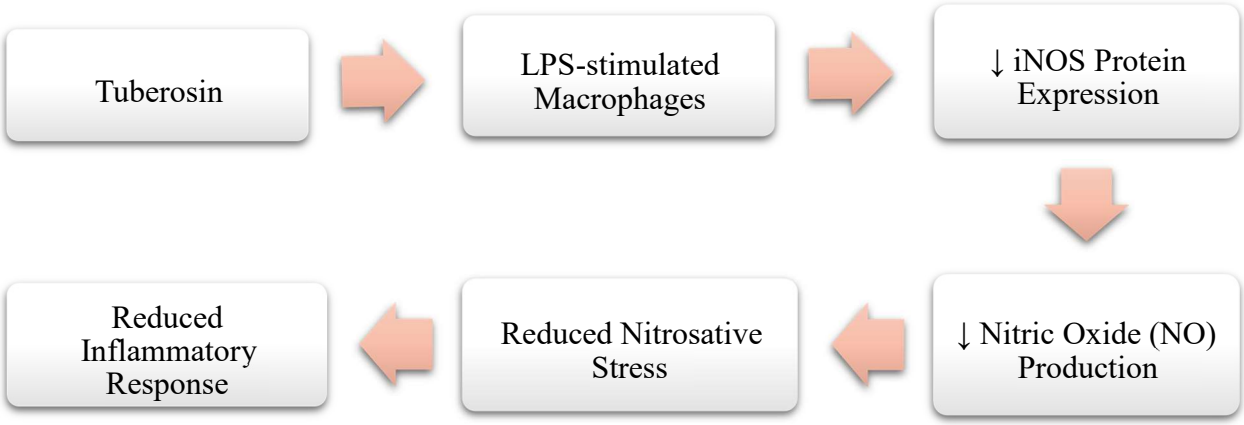
These effects protect cells against oxidative stress and have demonstrated nephroprotective potential in experimental models of drug-induced and diabetes-associated renal injury.[19,20.]

Estrogenic and anticancer activity: Isoflavonoids present in *Pueraria tuberosa* function as selective estrogen receptor modulators (SERMs), exhibiting phytoestrogenic properties. These compounds have shown promise in alleviating menopausal symptoms and are being extensively investigated for their potential role in the prevention and targeted treatment of hormone-dependent cancers, particularly breast cancer. [17,21.]

Metabolic and antidiabetic activity: Experimental studies have demonstrated that *Pueraria tuberosa* tuber extracts possess significant antidiabetic properties by inhibiting dipeptidyl peptidase-IV (DPP-IV), resulting in increased endogenous incretin activity and enhanced insulin secretion. These mechanisms contribute to improved glycemic control and highlight the therapeutic potential of the plant in the management of diabetes mellitus.[19,22.]



Tuberosin – Antioxidant Mechanism [43]



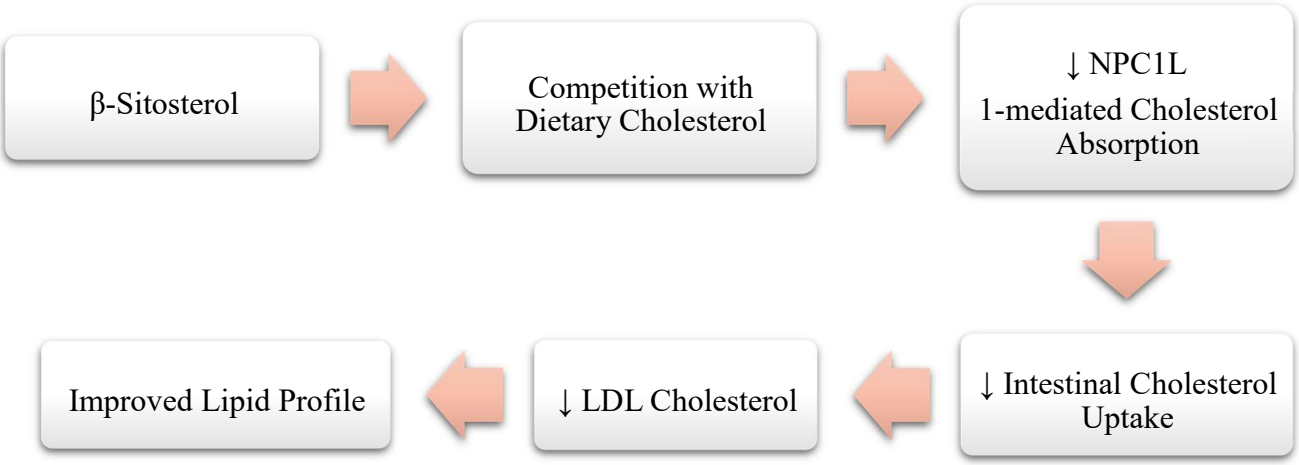
Tuberosin – Anti-inflammatory Mechanism[43]

β-sitosterol :-

β-Sitosterol (SIT), the predominant phytosterol naturally occurring in a wide variety of plantderived foods, has emerged as a promising bioactive compound with significant therapeutic potential. Extensive preclinical studies conducted over the past several decades have demonstrated that β-sitosterol possesses broad-spectrum anticancer properties against multiple malignancies, including hepatocellular, cervical, colorectal, gastric, breast, lung, pancreatic, and prostate cancers. These anticancer effects are mediated through diverse mechanisms, including inhibition of tumor cell proliferation, induction of apoptosis, suppression of

angiogenesis and metastasis, modulation of cell signaling pathways, and regulation of oxidative stress and inflammatory responses.[23.]

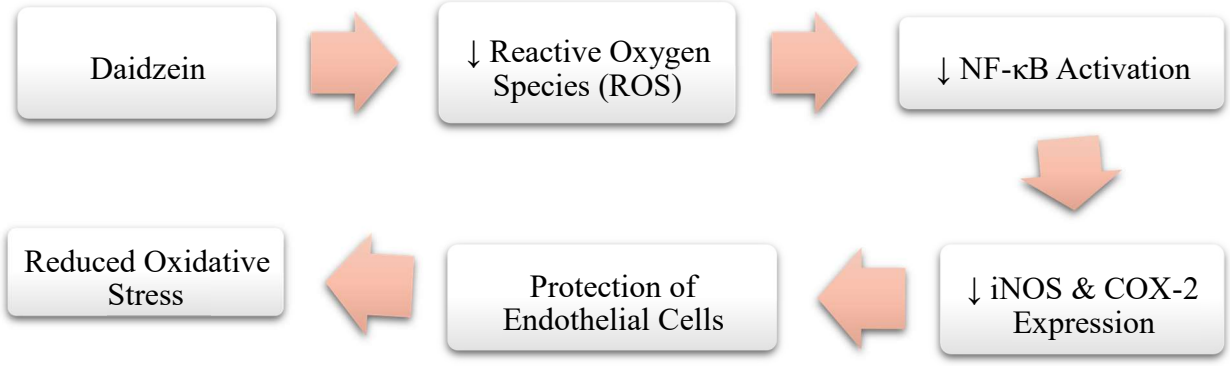
β-Sitosterol – Hypolipidemic Effect [19]



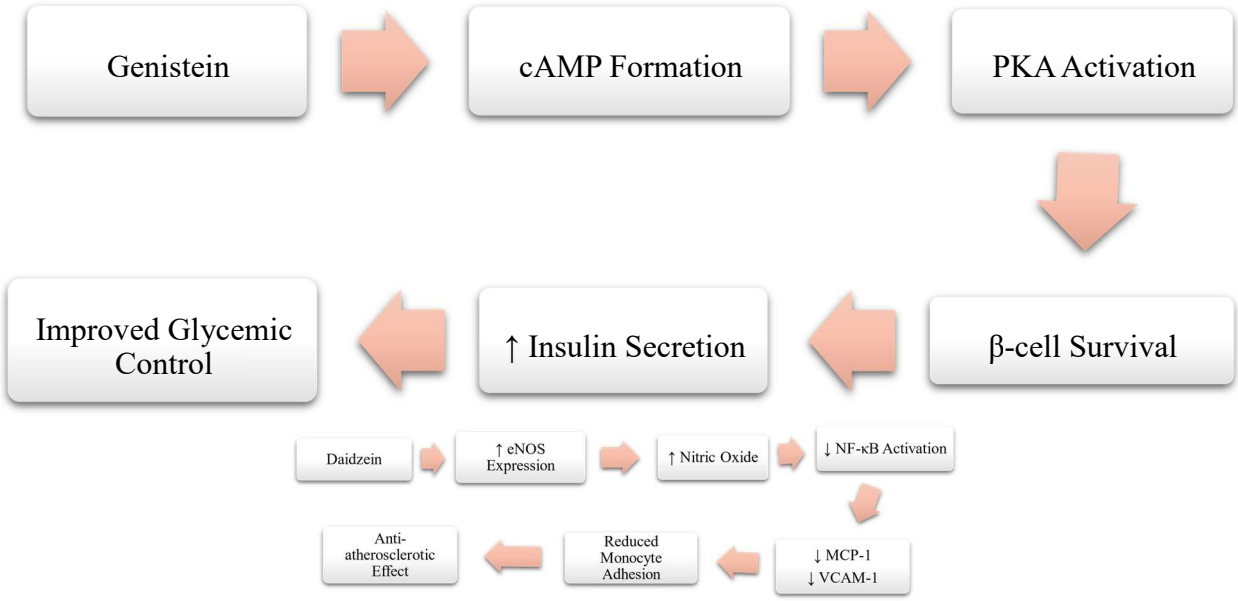
Daidzein : -

Daidzein, a naturally occurring isoflavone predominantly found in *Pueraria* species and other legumes, has attracted considerable scientific interest because of its diverse pharmacological activities and therapeutic potential. Accumulating experimental and clinical evidence suggests that daidzein exerts beneficial effects in the prevention and management of several chronic diseases, including cancer, osteoporosis, cardiovascular disorders, and neurodegenerative diseases. Its biological activities are primarily mediated through modulation of estrogen receptor signaling, enhancement of endogenous antioxidant defense systems, and suppression of inflammatory pathways. Furthermore, daidzein has been shown to inhibit the proliferation of cancer cells, improve bone mineral density by promoting bone metabolism, and attenuate oxidative stress associated with cardiovascular diseases. Emerging evidence also indicates that its neuroprotective properties may have therapeutic potential in delaying the progression of neurodegenerative disorders, particularly Alzheimer's disease and Parkinson's disease. These findings highlight daidzein as a promising natural bioactive compound for the prevention and adjunctive management of chronic diseases.[24]

Daidzein – Antioxidant / Endothelial Protection[41]



Daidzein – Anti-atherosclerotic Mechanism[42]

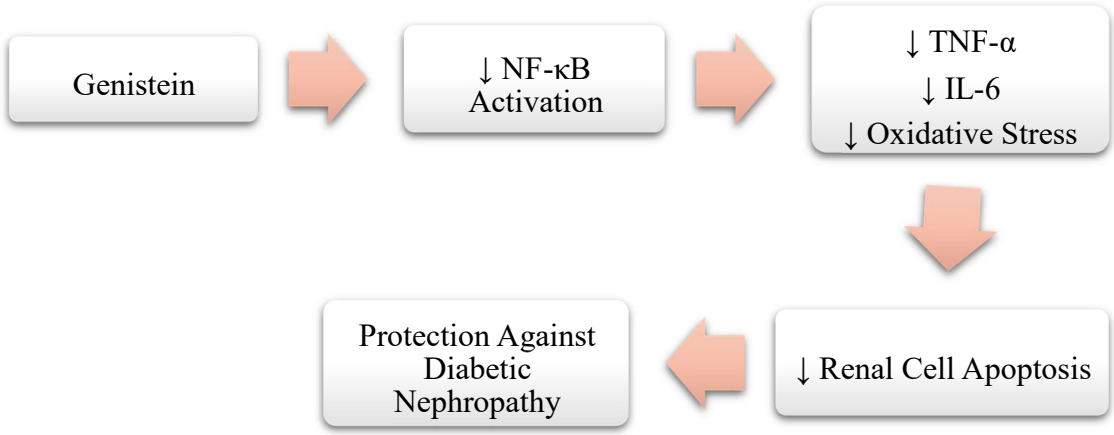


Genistein:-

Genistein, a naturally occurring isoflavone, has demonstrated significant cardioprotective potential in both experimental and preclinical studies. Evidence indicates that genistein improves cardiac function by attenuating ischemia–reperfusion injury, reducing cardiotoxicity, favorably modulating lipid metabolism, and lowering blood pressure. These beneficial effects are primarily attributed to its potent antioxidant, anti-inflammatory, and immunomodulatory properties, which collectively protect the myocardium from oxidative stress and inflammatory damage. Furthermore, genistein has been shown to improve lipid profiles and support cardiovascular homeostasis, highlighting its potential as a promising therapeutic agent for the prevention and management of cardiovascular diseases (CVDs)[25].

Genistein – Pancreatic β-cell Protection [19]

Genistein – Nephroprotection[19]



IDENTITY, PURITY AND STRENGTH[12]

Foreign matter	Not more than 2 per cent
Total Ash	Not more than 17 per cent
Acid-insoluble ash	Not more than 4.5 per cent
Alcohol-soluble extractive	Not less than 4 per cent
Water-soluble extractive	Not less than 24 per cent

***Vidarikanda* and its properties**

According to classical Ayurvedic literature, every medicinal substance possesses specific pharmacodynamic attributes collectively known as *Rasapanchaka*, which include *Rasa* (taste), *Guna* (physical properties), *Veerya* (potency), *Vipaka* (post-digestive effect), and *Prabhava* (specific therapeutic action). *Vidarikanda* has been described under different *Vargas* or *Ganas* in various Ayurvedic Nighantus and classical texts; however, its fundamental properties and therapeutic attributes remain consistently described across all the Nighantus

Sr.No	***Nighantu***	***Ras***	***Gun***	***Vipak***
1.	Bhav Prakash Nighantu	*Madhura*	*Guru* *Snihdha*	*Sheeta*
2.	Raj Nighantu	*Madhura*	*Guru,* *Snigdha*	*Sheeta*
3.	Dhanvantari Nighantu	*Madhura*	*Guru,* *Snigdha*	*Sheeta*
4.	Madan pal Nighantu	*Madhura*	*Guru, Snigda*	-----
5.	Kaiyadeva Nighantu	*Madhura*	*Guru, Snigda*	*Sheeta*
6.	Shaligram Nighantu Bhushanam	*Madhur*	*Snigdha*	*Sheeta*

Therapeutic effect of *Vidarikanda*

Vidarikanda is a well-recognized medicinal plant possessing a wide spectrum of pharmacological and therapeutic properties. It is extensively utilized in Ayurvedic medicine for the management of various pathological conditions, enhancement of physical strength, improvement of vitality, and maintenance of overall health. The therapeutic attributes and clinical applications of *Vidarikanda* have been comprehensively documented in various classical Ayurvedic Nighantus and texts.

Karma	**B.P.N**	**RAJ. N**	**KAI. N**	**DH. N**	**S. N. B**	**M.P. N**
Jivaniya	+	-	+	-	-	-
Brihaniya	+	+	+	-	-	+

Vrishya	-	-	+	+	+	-
Rasayana	+	-	+	-	-	+
Balya	+	+	+	+	+	-
Shukrala	+	+	-	-	-	+
Stanya	+	-	+	-	-	+
Varnya	+	-	+	-	-	-
Dahahara	+	-	+	-	-	+
Mutrala	+	-	+	-	-	-
Kanthya	+	-	+	-	-	-

B.P.N. = Bhavprakash Nighantu; M.P.N = Madanpal Nighantu; Raj.N. = Raj Nighantu; Kai.N. = Kaiyadeva Nighantuh; DH.N. =Dhanvantari Nighantu.

Prayojya Anga

The tuberous root is the officially recognized medicinal part of *Vidarikanda* (*Pueraria tuberosa* DC.) [12]

TRADITIONAL USES

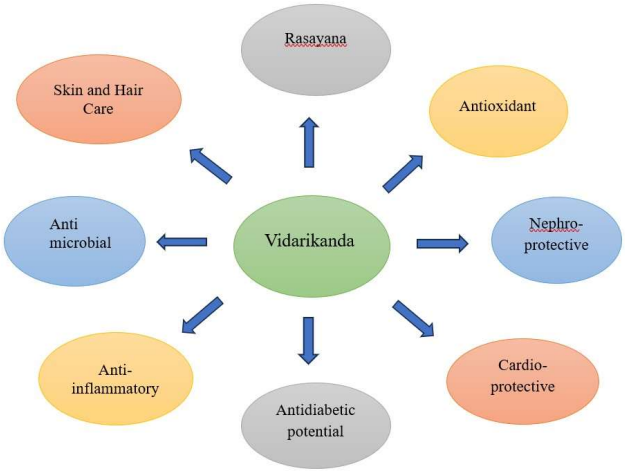


Fig. 2 Properties of *Vidarikanda*

considered beneficial in conditions such as childhood emaciation, general debility, and impaired digestion.[27,28].

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[1]. The tuberous root, characterized by its brown coloration and slightly curved morphology, is widely utilized in clinical practice as a rejuvenative (Rasayana) therapeutic agent [26]

2. The powdered root tubers of Vidari are traditionally used in clinical practice as a rejuvenative (Rasayana) agent and as a tonic. They are recognized for their aphrodisiac, demulcent, galactagogue (lactagogue), mild purgative, and cholagogue properties, and have also been employed in the management of scorpion stings. Additionally, Vidari is

3. Among its bioactive constituents, puerarin has been recognized for its antidiabetic potential and therapeutic relevance in glucose metabolism regulation[29]
4. Vidarikand possesses significant cardioprotective properties, contributing to the maintenance of cardiovascular health and protection against cardiac dysfunction[30]
5. Experimental investigations have revealed that *Pueraria tuberosa* possesses potent fibrinolytic properties. Since increased fibrinogen concentration is an established independent risk factor for coronary artery disease and cerebrovascular accidents, the fibrinogen-lowering effect of Indian Kudzu may play a beneficial role in reducing cardiovascular and thromboembolic risk.[31]
6. Several experimental studies have demonstrated the nephroprotective potential of *Pueraria tuberosa*. Oral administration of its methanolic tuber extract to cisplatin-induced nephrotoxic rats (8 mg/kg body weight) exhibited a dose-dependent protective effect, indicating its ability to attenuate renal damage and preserve kidney function.[32]
7. In vitro studies have shown that both methanolic and hexane tuber extracts of *Pueraria tuberosa* exhibit concentration-dependent antioxidant activity. However, the methanolic extract demonstrated greater effectiveness in hydroxyl radical scavenging and suppression of lipid peroxidation compared to the hexane extract, suggesting its superior antioxidant potential.[33]
8. Ethyl acetate and methanolic extracts of *Pueraria tuberosa* tubers exhibited significant anti-inflammatory activity in the rat paw edema model. The extracts demonstrated considerable efficacy in reducing inflammation when compared with the control group and showed effects comparable to the standard anti-inflammatory agents, ibuprofen and nitrofurazone ointment.[34]
9. Studies have reported that ethanolic and methanolic extracts of the leaves, tubers, and roots of *Pueraria tuberosa* exhibit antibacterial activity against several clinically important pathogens, including *Bacillus cereus*, *Escherichia coli*, *Salmonella paratyphi*, and *Staphylococcus aureus*. These findings provide scientific evidence supporting its traditional use in the treatment of infectious disorders and highlight its potential as a source of natural antimicrobial agents[37]
10. Vidarikand (Pueraria tuberosa) in Skin and Hair Care :Vidarikand possesses significant antioxidant activity, primarily attributed to its bioactive constituent puerarin. Due to its antioxidant potential, it has promising applications in cosmetic and dermatological formulations, including anti-wrinkle, anti-ageing, and dark-circle reduction products. Its skin-rejuvenating properties further support its incorporation into moisturizing creams, blemish-control formulations, skin-lightening preparations, antiseptic products, and antiacne formulations. These properties suggest that Vidarikand may contribute to maintaining skin health, improving skin texture, and protecting against oxidative damage.In hair care, Vidarikand is valued for its anti-inflammatory, cooling, and nourishing properties. As a natural tonic, it can be incorporated into hair oils to provide a soothing and cooling effect

    on the scalp. Its ability to prevent dryness makes it a useful ingredient in anti-dandruff shampoos. Additionally, Vidarikand may be utilized in hair tonics and hair serums to promote scalp health, nourish hair follicles, and support overall hair care.[38]

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