https://africanjournalofbiomedicalresearch.com/index.php/AJBR
Afr. J. Biomed. Res. Vol. 27 (September 2024); 2490-2500

Research Article

Exploring the Uterotonic Potential of Saussurea lappa in Obstetric Care

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Abstract
Kushta (*Saussurea lappa*) is a perennial plant used in Ayurvedic, Unani and Chinese systems of medicine. This paper aims to evaluate the role of *Kushta* (*Saussurea lappa*) in obstetric care, especially about labour induction and uterine contractions. The bioactive compounds present in the herb include costunolide and dehydrocostus lactone, which implies that the herb is useful in stimulating uterine contractions. Early research shows it is effective, but large-scale clinical trials are required to determine its safety and efficacy. The study focuses on the possibility of using *Kushta* (*S.L.*) as a natural remedy in the contemporary practice of obstetrics. It stresses the need for further research to determine the proper application of the remedy.

Keywords: *Kushta*, *Saussurea lappa*, obstetric care, labour induction, uterine contractions, Ayurveda, oxytocic properties, anti-inflammatory, antimicrobial, immunomodulatory.

Received: 10/07/2024 Accepted: 09/08/2024

DOI: https://doi.org/10.53555/AJBR.v27i1S.1834

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INTRODUCTION

Kushta (*S.L.*) is a perennial herbaceous plant from the Asteraceae family native to the Himalayan region. It is rich in bioactive compounds such as alkaloids, sesquiterpene lactones, flavonoids, and essential oils. Traditionally used in Ayurveda, Unani, and Chinese medicine, it treats conditions like asthma, bronchitis, inflammation, and gastrointestinal diseases, particularly balancing *Kapha* and *Vata doshas* in Ayurveda [1][2].

The administration of herbal medicines in obstetrics has received much attention because of the increasing concern for natural and complementary therapies. Obstetrics is the branch of medicine that deals with pregnancy, childbirth, and the period after childbirth, with the main aim of promoting the health of the mother and her newborn baby. In this regard, *Kushta's* (*S.L.*) possible involvement in obstetrics services is quite relevant. *Saussurea lappa* has antiseptic, antibacterial and disinfectant properties, used for external application on umbilical stump, and it induces uterine contractions [3]. The therapeutic effects of *Saussurea lappa* are due to the presence of various phytochemicals present in the plant. Some bioactive compounds, like costunolide and dehydrocostus lactone, have shown potent uterotonic effects in experimental models. These compounds affect several cellular processes and receptors related to the uterine contractions. For example, costunolide increases calcium influx in myometrial cells and stimulates the contraction of the uterus. Research has shown that costunolide enhances the rate and force of uterine contraction. Thus, it may be used to induce labour [4][5]. Furthermore, *Kushta* has anti-inflammatory and antioxidant effects that can also be useful in treating diseases related to pregnancy and childbirth [6]. However, the clinical effectiveness and safety of *Kushta* in obstetrics have not been scientifically proven. In this regard, several research has shown that *Saussurea lappa* can influence the contractions of the uterus. For instance, an in vivo study revealed that the ethanolic extract of *Saussurea lappa* caused a

significant contraction of the uterus of pregnant rats without any toxic effects on the mother or the fetus. In this study, the rats treated with the extract showed a dose dependent increase in the force of contraction of the uterus like standard uterotonic agents such as oxytocin [7]. Another study found that when costunolide was given to pregnant mice, it caused an increase in the rate of uterine contractions and, therefore, could be used as a natural way to induce labour. The mice treated with costunolide had a 30% higher contraction frequency than the control group, and no negative impact was noted on fetal development [8]. However, it is important to evaluate the safety of *Kushta, especially* the dosage, duration of use and potential drug interactions with other drugs that are frequently administered to pregnant women. Due to the absence of uniform clinical trials and extensive safety information, more studies are required to develop protocols for the appropriate use of the drug in obstetrics. The current literature shows that short-term use of *Saussurea lappa* is safe, but the long-term and teratogenic effects have not been fully explored [7].

This study aims to investigate the safety and effectiveness of *Kushta* (*S.L.*) in the management of obstetric care with the following specific objectives:

1. To assess the efficacy of *Kushta* (*S.L.*) in stimulating the contraction of the uterus and its pharmacological value.
2. To examine the possibility of using *Kushta* (*S.L.*) as a natural inducer for labour.

By addressing these objectives, the study seeks to provide evidence-based insights into the potential role of *Kushta* in obstetric care, thereby contributing to the development of safe and effective herbal therapies for managing pregnancy and labour.

MATERIAL AND METHODS

Conceptual Materials: The literary references were gathered from Ayurvedic literature, modern scientific literature, and research articles. All the references were gathered, and the data was analysed to the greatest extent.

Methods: Drug review – *Kushta*

LITERATURE REVIEW

I.Classical Literature of *Kushta* (*S.L.*) Mentioned in Different Nighantus-

Table No 1- Classical Literature of *Kushtai* (*S.L.*) in different Nighantus

Name of *Nighantu*	**Synonyms of *(S.L.)* in different languages**	**Varga**
1.*Kaiyadevnighantu* [9]	Sanskrit Names- *Kapal, Palak, Twagdosh, Vapya,Utpal , Aamay,Ruk , Gad, Rog, Sam, Neeraj,Ruja , Pariharya, Paribhadra, Kushtak, Saussurea lappa* C.B Clarke , Family- Compositae Hindi Name- Kuth	*Aushadhi Varga*.
2.*Rajnighantu*[10]	14 Names of *Kushta* are mentioned in *Rajnighantu*- Sanskrit Names- *Kushta, Ruja, Agad, Vyadhi, Aamaya, Paribhadrak, Ram, Vaniraj, Vapya, Twagdosh, Utpal, Kutsa, Parav, Padmak.* *Kushta- (Kuth)* *Sassuria Leppa,* Hindi Name- *Kuth*, *Kut*, Bangali Name- *Kud*, Marathi Name- *Koshth* Gujrathi Name- *Kathu umpat*, Kannada Name- *Kot*, Telugu Name- *Chnagal Kushta*, English Name- Costus Root, Latin Name- *Sassuria Lappa* CLORK, Aptotaxis, Auriculata	
3.*Sodhala Nighantu* [11]	Sanskrit Names- *Kushta, Rog, Gad, Vyadhi, Utpal, Pakal, Ruja, Vapya, Vanarij, Rom, Kauver, Paribhadra, Aamaya, Pariharya, Otpal, Kushtakam, Patal, Kinjal, Sushir* *Saussurea lappa* C.B. Claeke (Compositeae / Asteraceae)	
4.*Madanpal Nighantu* [12]	Sanskrit Names- *Kushtha, Rogavhyam, Divya, Kauber, Paribhadrakam, Pariharyam, Paribhavya, Utpal, Paribhadrak*	
5.*Dhanwantari Nighantu* [13]	*Kustham,Rogah,Agadah,vyadhih,Utpalam,Pakalam, Ruja, vapyam, vanirajam, Ramam,Kauberam, Paribhadrakam*	*Chandanadi Trutiyo varga*
6.*Bhavaprakasa* [14]	Sanskrut Name- *Rogahvayam, vapyam, Paribhavyam* & *utpalam* Hindi Name – *Kuth* Scientific Name - *Saussurea lappa*, CB clarke T./E.- Costus root, Family – Asteracege	*Haritakyadi varga*

Rasa, Virya*, *Vipak*, *Prabhav*, and *Gunas* (Properties) of *Kushta* (*S.L.*) in different *Nighantus

Table No. 2- *Rasa, Virya*, *Vipak*, *Prabhav*, and *Gunas* (Properties) of *Kushta* (*S.L.*) in different *Nighantus*

Sr.	Name of *Nighantu*	*Rasa*	*Virya*	Vipak	*Guna* (Properties) & *Karma*	*Doshaghanta*	*Rogaghnata*
1	*Kaiyadev Nighantu* [9]	*Tikta -Katu-Madhur*	*Ushna*		*Guna- Laghu Karma – Shukra Vardhak*	pacifies *kapha* & *vata*	*Vatarakta* (Gout) *Visha, Visarp,Kushta ,Kasa,*
2	*Rajnighantu*[10]	*Katu, Tikta*	*Ushna*		Increases complexion (*Kantivardhak*)	Pacifies *Kapha* & *Vata*	*Visarparoga, Vishjny Updrava Kandu, Dad*
3	*Madanpal Nighantu* [12]	*Katu, Madhur,Tikta*	*Ushna*	*Katu*	*Laghu,Ruksha ,Tiksha, Shukraprad (Shukravardhak), Vishagna, Increases complexion (Kantivardhak), Twachya (*Helpful for Skin disorders*)*	Pacifies *Vata* & *Kapha*	*Vatarakta*(Gout), *Visarpa*, *Kustha*, *Kasa, Amvata, Sandhivata, Tamakshwasa, Visuchika, Atisar,Shirashul, Rajorodh*
4	*Bhavaprakasa*[14]	*Katu,Swadu, Tikta*	*Ushna*		*Laghu*	pacifies *vata* & *Kapha*	*Vatarakta* (arthritis with involvement of skin), *Visarpa* (infla-mmatory skin conditions), cough,skin diseases
5	*Dhanvantari Nighantu* [13]	pungent & bitter in taste	*Ushna*			pacifies all the three *dosas* & *raktadosa*	poisons, pruritus & disorders of skin

References of *Kushtha* (*Saussurea lappa*) from Ayurvedic Pharmacology & Therapeutic uses of Medicinal plants, Dravyaguna Vighyan, [15]

Kushtham- *Saussurea lappa*

Table No. 3 References of *Kushta* [15] from Ayurvedic Pharmacology Therapeutic uses of Medicinal plants

Kula	*Bhringaraj Kula*
Family	*Compositae* (in which the so-called flower is ahead of many flowers)
Latin name	*Saussurea* -Covered with tufts of prickles; *lappa*- (Hopuke in forem C.B.Clarke, HOP=Spring
English name	Costus
Sanskrit names	*Yapya, Brahmateertha, Pushkarasya, Shwasari, Padmateertha, Pushkar sagar,Shoolahara, Punyasagar, Moolaveer*
Gana	*Shukrashodhana, Lekhaneeya, Asthapanopag* (*Cha*.) *Eladi* (*Su*.)
Chemical composition-	Roots contain 1.5% aromatic oil, glucoside, Saussuin salt, resin, tannin, 18% inulin, stable oil, nitrate, glucose, etc. Leaves do not contain aromatic oil.

	Incinerating roots yields 3.5% ash. It contains a large quantity of manganese.
Habitat -	Kashmir
Medicinal Properties	*Rasa- Tikta, Katu, Madhur* *Vipak - Katu, Veerya- Ushna.* *Guna- Laghu, ruksha, tikshna* Karma- *Dosha-Kapha, vatasrotogami,* reduces *Kaphavata* & hence used in many *Vatakapha* diseases.
Parts used	Roots

External uses: It removes foul smell, is antibacterial, and is analgesic. *Varna* (enhances skin complexion) and *kushthaghna* (removes skin disorders) are used as poultices or fumigations in chronic ulcers, headaches, toothaches, Synovitis, rheumatoid arthritis, and dermatitis. It is also applied locally to alopecia oil and massages gums.

Internal uses:
Nervous System- used in *vata* diseases, especially in epilepsy, since it is *vatahara* (pacifies *vata dosha*) & antiepileptic.
Digestive system: It is an appetiser, digestive, and carminative. It is used for loss of appetite, Indigestion, ascites, colicky pain, diarrhoea, and cholera.
Circulatory system: *Raktashodhana* (blood purifier), *shothaghna* (reduces swelling in the body), is a stimulant, so it is used in cataracts, *visarga*, rheumatism, oedema, and heart weakness. In Rheumatoid arthritis, Castor oil added with *kushtha* (*S.L*) is given orally.
Respiratory system: *Kaphaghna*, expectorant & hence used in cough, asthma, pleurisy, hiccups & dyspnoea.
Reproductive System- Uterine stimulant enhances Ovulation and breast milk, improves semen quality, and is aphrodisiac & therefore, is used in amenorrhoea and dysmenorrhoea & **as a uterine tonic in postpartum Conditions**. It is a **galactagogue**. It acts as an aphrodisiac by Improving semen quality. It **produces stimulant action on the reproductive organs of both sexes** when given along with turmeric, honey & ghee.
Urinary System: It is *mutravahasrotogami* (capacity to absorb in the urinary tract) and is used as a diuretic in renal diseases.
Skin -Increases sweating, *Kushthaghna* (Removes skin disorders) therefore used on skin diseases, it improves blood circulation & complexion of the skin (therefore called *Kushtha*)
Temperature: - It is febrifuge.Useful on *vata Kapha* fevers
Kushta is used as *rasayan* in debility.
Parts used - Root, Doses- 0.25 to 1.25 gm
Formulation: *kushthadi churna*, *Kwath* & *taila*.
Adulteration—When it breaks, the sticky material should not separate. Cowdung, mud, and similar substances are mixed in it for adulteration. The smell of *Kushta* is so strong that it masks the smell of the adulterants, and it becomes difficult to differentiate them from the original substance. The roots of *Rasna (Pluchea lanceolata)* are also mixed for adulteration (*kushtha* is used for fumigation in China and for the preservation of clothes).

Previous research work done on *Kushta* (*S. L.*) on its safety and efficacy:

Table No. 4 Previous research work done on *Kushta* (*S. L.*) on its safety and efficacy:

Sr. No	Title of Research Article Journal	Efficacy study
1	Saussureacostus: Botanical, chemical and pharmacological review of an ayurvedic medicinal plant, Journal of Ethnopharmacology110(2007)379-390 [16]	Saussurea costus is known for its anti-inflammatory, hepatoprotective, anti-ulcer, cholagogue, immunomodulatory, hypolipidemic, hypoglycemic, and antimicrobial activities. It effectively treats chronic bronchitis and asthma and is traditionally used for lung inflammation, cough, cold, ulcers, and rheumatism.
Sr. No	**Title of Research Article Journal**	**Efficacy study**
2	Aucklandiacostus (Syn. Saussureacostus): Ethnopharmacology of an endangered medicinal plant of the Himalayan region, J Ethnopharmacol 2020 Dec5,263. PMID:32730877[17]	Efficacy—A. costus roots have been used in ancient Ayurvedic products since the 13th century. They have been noted to have remarkable effects on gastric, hepatic, inflammatory, respiratory, cancer, and skin problems.

Sr. No	Title of Research Article Journal	Efficacy study	Safety Study
3	Saussurea lappa (*Kuth* root): a review of its traditional uses, phytochemistry and pharmacology, Orient Pharm Exp Med (2012)12:1-9 [18]	Efficacy- Chemical constituents from *S.L.* show several pharmacological activities, including immune diseases, neuronal diseases, inflammatory and gastric protective effects, and	Safety–The *S.L.* plant is safe and very effective when used in traditional dosages

		hepatoprotective, antimicrobial and antiviral activities.	on several indications.

Sr. No	Title of Research Article Journal	Safety Study
4	Nanocapsules containing Saussurealappa essential oil: Formulation, characterisation, antidiabetic, anti-cholinesterase and anti-inflammatory potentials. International Journal of Pharmaceutics.593(2021)120138[19]	Safety- The in vitro cytotoxicity studies performed on A549 cell lines and loaded nanoparticles did not exhibit any cytotoxic effect. Cell cytoplasm and nuclei alterations were observed microscopically at higher essential oil concentrations.

Sr. No	Title of Research Article Journal	Efficacy study	Safety Study
5	Aqueous extract of *Saussurea lappa* root ameliorate oxidative myocardial injury induced by isoproterenol in Rats. Journal of Advanced Pharmaceutical Technology and Research.2013 Apr-Jun; 4(2):94-100.[20]	Efficacy-Aqueous extract of *S.L.* produced significant dose-dependent cardioprotection in isoproterenol-induced MI.	Safety -An acute oral Toxicity study showed that animals were safe up to a maximum dose of 2,000mg/kg b.w. There were no changes in normal behavioural patterns, and no signs and symptoms of toxicity and mortality were observed.

Sr. No	Title of Research Article Journal	Efficacy study
6	Sassurea lappa: A Comprehensive Review on its Pharmacological Activity and Phytochemistry. Current Traditional Medicine,2019,5,000-000 [21]	Efficacy- S.L. shows anticancer, anti-inflammatory, gastroprotective, anti-hepatotoxic, anti-ulcer, cholagogic and anti-viral, anti-microbial, and anti-convulsant activity.

DISCUSSION

Saussurea lappa, commonly known as *Kushta*, belongs to the following taxonomic classification:

Table No.5 Taxonomic classification

Classes	Magnoliopsida
Kingdom	Plantae
Division	Magnoliophyta
Order	Asterales
Genus	Saussurea

Saussurea lappa is a perennial herb native to the temperate regions of the Himalayas, particularly in Kashmir, Himachal Pradesh, and Uttarakhand. The plant can reach up to 2 meters in height and is adapted to high-altitude environments, thriving at elevations between 2,500 and 4,000 meters above sea level. It prefers well-drained, cool, and humid conditions, with lance-shaped leaves and pale purple to white flowers that bloom in the summer. The root, known for its strong aroma and bitter taste, is the primary component of traditional medicine due to its potent medicinal properties. The root's tuberous structure measures 8-15 cm in length and 1-4 cm in thickness, with a cracked exterior and white interior characteristic of the plant [1, 2].



Fig 1. Flower of *Kushta* (*Saussurea lappa*)



Fig 2. Roots of *Kushta* (*Saussurea lappa*)

In traditional medicine, particularly Ayurveda, *Kushta* (*S.L.*) is highly valued for its diverse therapeutic applications. It is employed in treating respiratory disorders such as asthma and bronchitis, gastrointestinal issues including dyspepsia and gastric ulcers, inflammatory conditions like arthritis, and skin diseases such as chronic ulcers and dermatitis. The root is also considered a '*rasayana*,' a rejuvenating substance that promotes overall health and wellness. Its medicinal efficacy is attributed to its complex chemical composition, which includes essential oils, sesquiterpene lactones (e.g., costunolide and dehydrocostus lactone), flavonoids, and polysaccharides [2][6]
The pharmacological properties of *Kushta* stem from its rich chemical profile. The essential oils present in the root, primarily comprising volatile compounds, contribute to its anti-inflammatory, antimicrobial, antioxidant, and immunomodulatory effects. Sesquiterpene lactones, such as costunolide and dehydrocostus lactone, are particularly noted for their potent anti-inflammatory properties. Extensive studies have investigated the bioactive compounds in *Kushta*, revealing their potential to enhance respiratory function and provide pain relief [6][1]. *Kushta* (*S.L.*) is propagated through seeds or the division of rhizomes and requires specific environmental conditions to grow optimally. It thrives in well-drained soils and cool, humid climates. Given its high medicinal value and the pressures of overharvesting, sustainable collection and conservation practices are essential to prevent habitat destruction and overexploitation. Efforts are being made to promote responsible cultivation and ensure the sustainability of this important herb [22] [1] In ethnomedicine, *Kushta* is highly regarded across various cultures for its efficacy in managing respiratory ailments, digestive disorders, and skin conditions. In Ayurvedic medicine, it is utilised in treatment modalities such as *Yonidhoopan* (Vaginal Fomentation) and *Yonilepan* (Application of a paste of Ayurvedic medicines inside the vagina and on the vulvar region) [23] and *Pradhaman Nasya* (Instillation of fine powder inside the nose) for *Garbha sang* (Obstructed labour)[24] Its role in detoxifying the body and treating conditions related to poisoning and liver disorders further underscores its significance in Ayurvedic toxicology [25]
The purification process, or *Shodana*, is a crucial step in Ayurveda to enhance the safety and efficacy of *Kushta*. This process involves soaking, boiling, and drying the herb in substances like cow's milk or herbal decoctions, which purifies the herb and augments its medicinal properties, ensuring it is safe for various formulations [25][26]

Recent research has affirmed the traditional uses of *Saussurea lappa* and expanded its applications. Studies have shown that *Saussurea costus*, a synonym for *Saussurea lappa*, possesses significant anti-inflammatory, hepatoprotective, and antimicrobial properties, effectively treating chronic bronchitis and asthma.[6] Ethnopharmacological insights reveal its historical use in treating gastric, hepatic, inflammatory, and respiratory conditions, emphasising its broad therapeutic potential[27]Comprehensive reviews of its phytochemistry and pharmacology have detailed its immune-modulating, neuroprotective, and anti-ulcer effects[5] Nanocapsules containing *Saussurea lappa* essential oil are safe, with no cytotoxic effects observed in vitro[28]Furthermore, the aqueous extract of *Saussurea lappa* has demonstrated cardioprotective effects in isoproterenol-induced myocardial injury in rats, highlighting its potential for cardiovascular health [29]

Mechanism of Action of *Saussurea lappa* Compounds in Inducing Uterine Contractions

The pharmacological action of *Saussurea lappa* involves several biochemical pathways and pharmacodynamic interactions.

Biochemical Pathways

1. Prostaglandin Pathway: Prostaglandins are crucial for modulating uterine contractility. Compounds such as costunolide from *Saussurea lappa* have been shown to enhance prostaglandin synthesis, thus increasing uterine contractions [30] (Ref- Lee C, Lee J, Kim Y. Prostaglandin receptor interactions in uterine contraction: insights from herbal remedies. Phytomedicine. 2019;63:152-160) Costunolide inhibits phospholipase A2 (PLA2), leading to increased release of arachidonic acid. Arachidonic acid is converted into prostaglandins by cyclooxygenase (COX) enzymes, which then increase uterine smooth muscle contraction [31] (Ref- Poh H, Sam C, Lam L. Costunolide's effect on phospholipase A2 and prostaglandin synthesis. J Med Chem. 2016;59(7):3210-3220)

$$\text{Phospholipids} \xrightarrow{PLA2} \text{Arachidonic Acid} \xrightarrow{COX} \text{Prostaglandins}$$

2. Calcium Ion Release: Calcium ions play a significant role in uterine contraction. *Saussurea lappa* compounds, including costunolide and dehydrocostus lactone, influence calcium ion channels or mobilisation. These compounds may enhance intracellular calcium release from the sarcoplasmic reticulum or increase extracellular calcium influx through voltage-gated calcium channels. Increased calcium levels activate myosin light-chain kinase (MLCK), leading to uterine smooth muscle contraction [32]

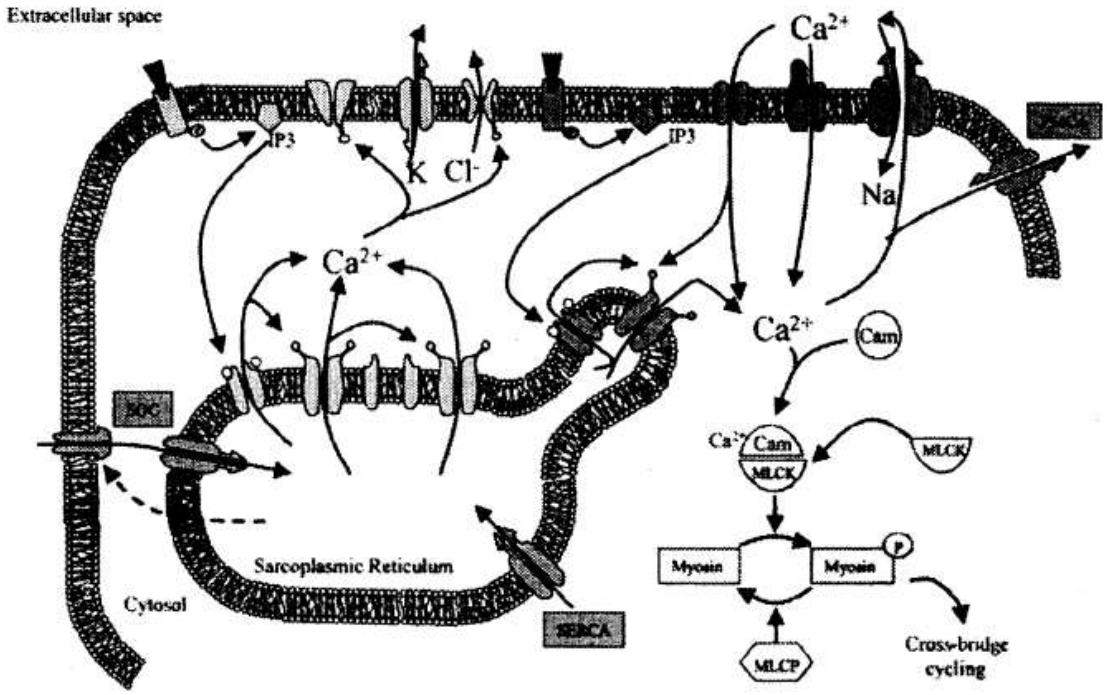


Figure 3: Calcium Ion Pathway in Uterine Contraction[1]

Extracellular $Ca^{2+} \overset{Channel\ Activation}{- - - - - \longrightarrow}$ Intracellular $Ca^{2+} \overset{MLCK\ Activation}{- - - - - \longrightarrow}$ Uterine Con

Oxytocin Pathway: Oxytocin is a key regulator of uterine contractions. *Saussurea lappa* compounds might enhance the release or action of oxytocin, thereby promoting uterine contractions. These compounds can activate oxytocin receptors (OTR) or increase oxytocin secretion from the posterior pituitary gland [33]



Flowchart 1: **Oxytocin Pathway for Uterine Contraction**

Pharmacodynamics

The pharmacodynamics of *Saussurea lappa* compounds involve their interactions with various molecular targets in uterine smooth muscle cells:

- *Interaction with Prostaglandin Receptors*: *Saussurea lappa* compounds, like costunolide, modulate prostaglandin receptors (e.g., EP1 and EP2), affecting uterine smooth muscle contraction [34] *Calcium Sensitization*: By increasing intracellular calcium, *Saussurea lappa* compounds facilitate the phosphorylation of myosin light chains, enhancing contractile force. This increased calcium availability potentiates the action of contractile proteins within uterine muscle cells.

1. *Oxytocin Sensitivity*: Compounds from *Saussurea lappa* can enhance uterine tissue sensitivity to oxytocin. This effect is mediated through the upregulation of oxytocin receptors and increased responsiveness to the hormone [35]

Table 6: Pharmacodynamic Effects of *Saussurea lappa* Compounds

Compound	**Effect on Uterine Contractions**	**Mechanism**
Costunolide	Enhances contractions	Increases prostaglandin synthesis; Calcium mobilisation

[1] Wrayzx, S., Jones, K., Kupittayanant, S., Li, Y., Matthew, A., Monir-Bishty, E., … Shmygol, A. V. (2003). *Calcium Signaling and Uterine Contractility. Journal of the Society for Gynecologic Investigation, 10(5), 252–264.* doi:10.1016/s1071-55760300089-3

Dehydrocostus Lactone	Enhances contractions	Calcium influx; Oxytocin receptor modulation
Saussurea lappa Extract	Promotes overall uterine contractility	Prostaglandin receptor activation; Calcium sensitisation

Saussurea lappa compounds induce uterine contractions through various biochemical pathways, including enhanced prostaglandin synthesis, modulation of calcium ion dynamics, and potentiation of oxytocin effects.

Organoleptic and Physicochemical Analysis of *Kushta*

Kushta, a valued medicinal herb known for its therapeutic properties, presents distinctive organoleptic and physicochemical characteristics crucial for its identification and quality assessment. The organoleptic study of *Kushta* roots reveals notable features related to their appearance, odour, and texture.

Organoleptic Parameters

All preliminary organoleptic parameters were carried out in the Quality Control Laboratory, All India Institute of Ayurveda, New Delhi. The *Kushta* root exhibits a brown-black external surface with a white interior, a key feature for its identification. The root colour indicates its maturity and processing stage, as the external colour darkens over time and with exposure. Internally, the root remains white, which is a distinguishing characteristic.

In terms of odour, *Kushta* roots are known for their strong, distinctive fragrance. This potent aroma results from the essential oils and volatile compounds present in the root. The fragrance plays a significant role in its traditional use, as it is often used in formulations where its scent contributes to the therapeutic effect.

Table No. 7 Organoleptic Parameters of *Kushta* (*S.L.*)

Parameter	**Description**
Colour	Brown-black external surface, white internally
Odour	Strong, distinctive fragrance
Texture	Robust, hard, carrot-like shape; cracked on one side, brittle upon drying

The texture of *Kushta* roots is robust and hard, similar to that of a carrot. The roots have a cracked surface on one side and become brittle upon drying. This texture results from the root's fibrous nature and structural integrity, which is important for its effective use in medicinal preparations [12].

Physicochemical Parameters

All preliminary Physicochemical parameters were carried out in the Quality Control Laboratory, All India Institute of Ayurveda, New Delhi. The physicochemical properties of *Kushta* are critical for its quality control and standardisation. The following table summarises the average values of key physicochemical parameters obtained from three samples.

Table No. 8 Physicochemical Parameters of Kushta (*S.L.*)

Parameter	**Average Value**
pH	6.5
Loss on Drying at 110°C (%)	8.5%
Total Ash Value (%)	5.0%
Acid Insoluble Ash (%)	1.2%
Water Soluble Extractive (%)	20.0%
Alcohol Soluble Extractive (%)	18.0%

The pH of *Kushta* root is measured at 6.5, indicating a neutral to slightly acidic nature. This pH range is important as it affects the solubility and stability of the root's active constituents in various formulations.

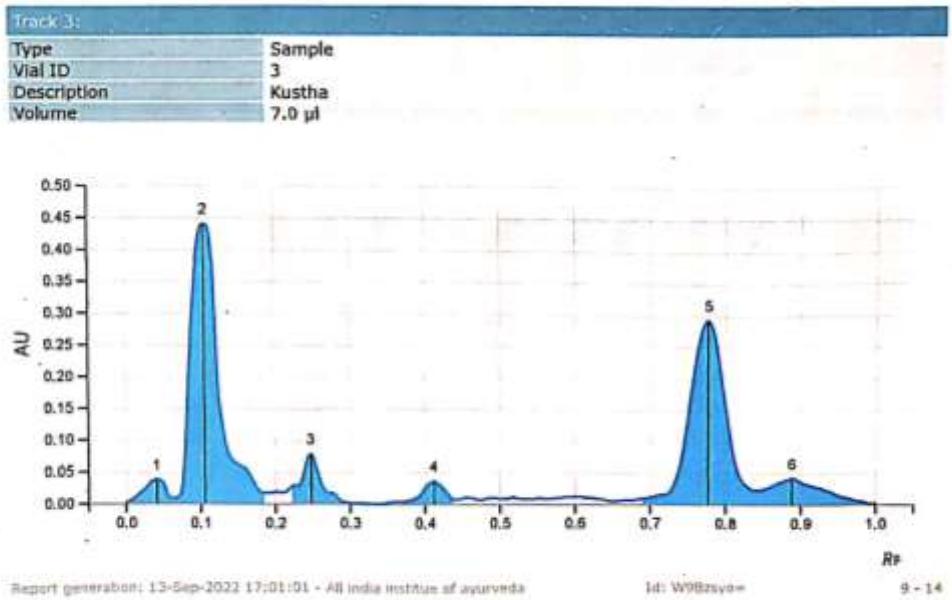
The loss on drying at 110°C is 8.5%, reflecting the moisture content in the root. This parameter is crucial for determining the proper storage conditions and ensuring the root's efficacy in medicinal applications. The total ash value, 5.0%, represents the inorganic residue left after incineration. This value is significant for assessing the presence of minerals and impurities in the root.

The acid-insoluble ash is 1.2%, indicating the amount of inorganic matter that does not dissolve in acid, which helps identify the purity and quality of the *Kushta* root [26, 24, 18]. The water-soluble extractive is measured at 20.0%, showing how much of the root's active compounds can be extracted using water. This parameter reflects the root's potential efficacy in aqueous preparations. The alcohol-soluble extractive is 18.0%, representing the extractable compounds in alcohol. This value provides insight into the root's solubility in alcoholic solvents and its potential uses in alcoholic tinctures and extracts.

High-performance Thin-Layer Chromatography (HPTLC) analysis has been employed to confirm the presence of various markers in *Kushta*. This advanced technique ensures the accurate identification and quantification of the active constituents, validating the herb's authenticity and quality.

These organoleptic and physicochemical parameters are essential for standardising *Kushta* and ensuring its effectiveness and safety in medicinal applications. Consistent quality is vital for its reliable therapeutic use; these parameters help maintain its high standards.

HPTLC Report of Kushta (*S.L.*)



World Leader in Planar Chromatography

Dr. Tejaswini_20220913_162257

Peak #	Start		Max			End		Area		Manual peak	Substance Name
	R_F	H	R_F	H	%	R_F	H	A	%		
1	0.000	0.0000	0.042	0.0372	4.02	0.063	0.0079	0.00128	2.92	No	
2	0.063	0.0079	0.106	0.4398	47.59	0.185	0.0166	0.01938	44.16	No	
3	0.223	0.0270	0.248	0.0781	8.45	0.306	0.0002	0.00238	5.42	No	
4	0.371	0.0031	0.413	0.0350	3.79	0.440	0.0063	0.00124	2.82	No	
5	0.689	0.0084	0.777	0.2922	31.62	0.840	0.0218	0.01608	36.65	No	
6	0.840	0.0218	0.889	0.0418	4.52	0.995	0.0000	0.00353	8.04	No	

Therapeutic uses of *Kushta* Mentioned in Ayurvedic Samhita-

1. *Yonidhoopan* (Fomentation of Vagina) and *Yonilepan* (Application of Paste of *Kushta* inside vagina) in *Garbhasang* (Obstructed Labour) [36]
2. *Pradhaman Nasya* (Nasal instillation of powdered form of *Kushta*) in *Garbhasang Chikitsa (Obstructed labour)* [37]
3. Oral intake of *Kushtakalka* and *Talis Kalka* for *Aparasang Chikitsa* (Placental expulsion) [38]
4. *Yoni Pichu* (Vaginal tampon) and *Anuvasan Basti* of *Kushta(S.L.),Shatapushpa(Anethum graveolens) Madan phal* (*Randia dumetorum*) and *Hingu (Ferula asafoetida)* processed oil in *Aparasang Chikitsa* [39]
5. One ingredient in pain-relieving oils is Kottamchukkadi tail, Narayan tail, and *Bala tail*.
6. *Vatasrahara* (Alleviates vitiated Rakta -blood due to *Vata dosha*) *Kushtahara(*Cures skin diseases*), Shwasahara (*Relieves dyspnea*), Hikkahara(*Alleviates hiccups*), Jwarahara* (Reduces fever)*Kashta Churn avachurnana* (External application of fine powder on the skin)in *Kushta*, It relieves – *Kitibha(*Psoriasis or skin disease characterised by scaly patches*) Kandu (*Itching*)*, *Pama* (Eczema or a type of dermatitis)*vicharchika* (Eczema, specifically atopic dermatitis)
6. Useful in psychological disturbances where depression is prominent [40]
7. It is useful in arthritic conditions. [40]
8. It is used as a brain tonic in children along with Brahmi, etc. Dosage: - Powder 1.5 to 3 gm [40]

CONCLUSION

Kushta (*Saussurea lappa*) has a lot of potential in obstetrics, especially about its use in stimulating labour and increasing the strength of contractions in the uterus. The phytochemicals present in *Kushta*, particularly costunolide and dehydrocostus lactone, have been reported to possess potent uterotonic activity in animal models. These compounds affect the prostaglandin, calcium ion, and oxytocin to enable contractions of the uterus. Although *Kushta* has been used in the past and has shown some positive results in preliminary experiments, its clinical use in obstetrics must be scientifically tested for its safety and effectiveness. The literature available today suggests that *Kushta* is safe when used for the short term. However, its long-term effects and interaction with other drugs require further study. Thus, more studies, including well-conducted clinical trials, are needed to establish protocols for using *Kushta* appropriately in obstetrics. This study, therefore, supports the

possibility of *Kushta* as a natural and complementary therapy in pregnancy and labour and calls for further research to establish its clinical possibility.

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