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Review Article

ADHATODA VASICA (VASAKA) AND THE FEMALE REPRODUCTIVE SYSTEM WITH SPECIAL REFERENCE TO INDUCTION OF LABOUR: AN INTEGRATIVE AYURVEDIC AND MODERN PHARMACOLOGICAL REVIEW

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ABSTRACT

Adhatoda vasica (L.) Nees *(Vasaka)* is a well-known medicinal plant of Ayurveda, Unani, and Siddha systems, traditionally indicated in respiratory disorders, bleeding conditions, and gynaecological ailments. Classical Ayurvedic texts describe *Vasaka* as *Raktasangrahika* (hemostatic) and *Garbhapravartaka/ Garbhapatanakaraka* (uterine stimulant/abortifacient). Modern research attributes its uterotonic and abortifacient activities mainly to the alkaloid vasicine. **Objective:** To critically evaluate the role of *Adhatoda vasica* on the female reproductive system with special reference to induction of labour, integrating Ayurvedic principles with modern pharmacological evidence. **Materials and Methods:** A comprehensive literature search was conducted using PubMed, Google Scholar, ScienceDirect, and ResearchGate (1980–2025). Classical Ayurvedic texts including *Charaka Samhita, Sushruta Samhita, Bhavaprakasha Nighantu,* and *Dhanvantari Nighantu* were reviewed. Data from in vitro myometrial studies, in vivo animal experiments, ethnomedicinal reports, and pharmacological investigations were critically analyzed. **Results:** From an Ayurvedic perspective, *Vasaka* acts as a *Prasava-pravartaka dravya* by stimulating *Apana Vata* through its *Ushna Virya* and *Katu Vipaka*, while its *Kashaya Rasa* imparts a hemostatic effect. Modern studies confirm that vasicine induces strong uterotonic activity by stimulating prostaglandin (PGE_2, $PGF_2\alpha$) synthesis and increasing intracellular Ca^{2+} levels. At higher doses, *Vasaka* exhibits potent abortifacient activity. It also demonstrates significant anti-hemorrhagic effects due to tannins and flavonoids. **Conclusion:** *Adhatoda vasica* is a potent modulator of the female reproductive system with dual activity- labour induction and postpartum hemostasis. While it shows promise as a natural uterotonic at term, its strong abortifacient potential mandates cautious, supervised use. Large-scale controlled clinical trials are urgently required for standardization and validation.

INTRODUCTION

Induction of labour is one of the most frequently performed obstetric interventions in modern clinical practice and is indicated when the continuation of pregnancy poses a risk to the mother or fetus.[1,2] Common indications include post-term pregnancy, oligohydramnios, hypertensive disorders of pregnancy, fetal growth restriction, intrauterine fetal demise, and reduced fetal movements.[1,3] At present, labour induction primarily depends on synthetic oxytocin and prostaglandin analogues. Although highly effective, these agents are often associated with serious adverse outcomes such as uterine hyperstimulation, fetal distress, uterine rupture, and postpartum hemorrhage due to uterine fatigue.[2–4] These limitations have increased global interest in identifying safer, plant-based uterotonic agents that can induce labour in a more physiological manner.[5]

The female reproductive system is regulated through a complex interplay of neuroendocrine, vascular, and myometrial mechanisms governing

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ovulation, menstruation, conception, pregnancy, labour, and puerperium. [1,6] Disorders such as delayed and obstructed labour, uterine inertia, menorrhagia, dysfunctional uterine bleeding, and postpartum hemorrhage continue to be major contributors to maternal morbidity and mortality worldwide.[3,7] Therefore, the development of therapeutic agents capable of safely regulating uterine activity and bleeding remains a critical area of obstetric research.[4,8]

Traditional systems of medicine, particularly Ayurveda, have described several medicinal plants with a direct influence on uterine physiology and *Prasava* (labour) [9,10]. Among these, *Adhatoda vasica* (L.) Nees- commonly known as *Vasaka*, *Arusha*, or Malabar nut- occupies a significant place in both classical Ayurvedic literature and ethnomedicinal practice.[11–13] It is a perennial shrub of the family Acanthaceae widely distributed throughout India and has been traditionally indicated in *Kasa, Śvasa, Rajayakṣma, Raktapitta,* and various bleeding disorders. [10,12,14]

Phytochemical investigations reveal that *Adhatoda vasica* is chemically rich, containing bioactive alkaloids such as vasicine, vasicinone, and vasicinol, along with flavonoids and tannins.[15–17] These constituents exhibit diverse pharmacological activities including bronchodilatory, antitussive, anti-inflammatory, antioxidant, anti-hemorrhagic, and reproductive-modulating effects.[16–18] Modern pharmacological studies have demonstrated that vasicine possesses potent uterotonic and abortifacient activity, comparable to oxytocin, mediated through prostaglandin synthesis and intracellular calcium mobilization.[19–22]

Beyond its well-established respiratory applications, *Vasaka* has been extensively recognized in Ayurvedic literature for its significant effects on the female reproductive system. Classical texts describe it as *Raktasaṅgrahika* (hemostatic), *Garbhapravartaka* (labour-inducing), and *Garbhapatanakaraka* (abortifacient).[9,12,23–26] Ethnomedicinal practices across different regions of India also document its traditional use in facilitating labour, inducing abortion, managing menorrhagia, and controlling postpartum hemorrhage. [11,27–29]

This unique dual nature- simultaneously stimulating uterine contractions and arresting excessive uterine bleeding- makes *Vasaka* a pharmacologically powerful yet potentially hazardous obstetric drug if used without proper knowledge of dose and gestational timing.[22,30] While at term it may support physiological *Prasava* (labour), its administration during early pregnancy carries a high risk of abortion [21,22].

With the increasing global emphasis on integrative and evidence-based traditional medicine, *Vasaka* has re-emerged as a promising candidate for development as a natural uterotonic and postpartum hemostatic agent.[8,31,32] Its ability to induce rhythmic uterine contractions while simultaneously supporting post-delivery hemostasis offers a potential therapeutic advantage over many conventional agents. [3,19]

The present review aims to critically integrate and evaluate the available Ayurvedic and modern scientific evidence on the role of *Adhatoda vasica* in female reproductive physiology, with special emphasis on its uterine-stimulant, abortifacient, and anti-hemorrhagic actions, and its potential application in the induction of labour.[9,12,19,21,30,33–35]

Ayurvedic Identity and Classical References

Table 1: Ayurvedic Identity and Classical References of *Adhatoda vasica*

Parameter	Details	Reference
Botanical Name	*Adhatoda vasica* (L.) Nees	[15,16]
Family	Acanthaceae	[15]
Sanskrit Synonyms	*Vasaka, Vasa, Siṁhasya, Aruṣa, Aṭarūṣaka*	[12–14]
Vernacular Names	Malabar nut (English), *Basak* (Hindi), *Adosa* (Gujarati/Marathi)	[15,27,28]
Varga (Classical Group)	*Kasa-hara Varga, Raktapitta-hara Dravya*	[12,14]
Charaka Saṁhita	*Cikitsa Sthana* 7/102 – Indicated in *Raktapitta*	[9]
Suśruta Saṁhita	*Cikitsa Sthana* 4/8 – Indicated in *Yoni-Raktasrava*	[10]
Bhavaprakaśa Nighaṇṭu	Describes *Vasaka* as *Raktasaṅgrahika* and *Garbhapravartaka*	[12]
Dhanvantari Nighaṇṭu	Mentions uterine stimulatory action of Vasiaka	[13]
Chakradatta	*Strīroga Prakaraṇa* 63/16 – Use in *Mūḍhagarbha*	[23]
Gadanigraha	*Strīroga Prakaraṇa* 64/28 – *Mūḍhagarbha Chikitsa*	[24]

Ayurvedic Physiology of *Prasava*

In Ayurveda, normal labour (*Sukha Prasava*) is described as a highly coordinated physiological event governed primarily by *Apana Vata,* along with the balanced function of *Rakta Dhatu, Artava Dhatu*, and the rhythmic contractile activity of *Garbhaśaya* (uterus).[9,10,14] *Apana Vata* is the principal force responsible for fetal descent, cervical dilatation, and expulsion of the fetus, thereby playing a central role in the mechanism of childbirth.[9,23]

Charaka clearly states that expulsion of the fetus is produced by the action of *Apana Vata* (*Apana vayu garbha niṣkramanam karoti*), establishing *Apana Vata* as the primary physiological driver of labour [9]. Suśruta further emphasizes that effective uterine contraction along with cervical patency *(Yoni-mukha viśodhana)* is essential for the smooth progression of labour [10]. Any disturbance in *Apana Vata* results in delayed, painful, weak, or obstructed labour, which is classically described as *Mūḍha, Kṛcchra*, or *Baddha Prasava* in Ayurvedic obstetrics [23,24,25].

From the modern physiological viewpoint, the initiation and progression of labour depend upon a complex biochemical cascade involving:

- Increased sensitivity of the uterus to oxytocin.[1,33]
- Enhanced production and local release of prostaglandins (PGE_2, $PGF_2\alpha$).[3,4,19]
- Rise in intracellular Ca^{2+} concentration within myometrial smooth-muscle cells, triggering coordinated uterine contractions. [6,19,21]

These modern mechanisms collectively result in sustained rhythmic myometrial contractions, cervical ripening, and fetal expulsion.[1,3,33]

Thus, the Ayurvedic concept of *Apana Vata* activation can be functionally and mechanistically correlated with the prostaglandin–calcium mediated uterine activation described in modern obstetrics, establishing a clear integrative bridge between classical Ayurvedic physiology and contemporary biomedical science. [19–21,33]

Ayurvedic Basis of Labour Induction by *Vasaka*

The labour-inducing activity of *Vasaka* (*Adhatoda vasica*) can be clearly understood on the basis of its classical *Rasa–Guṇa–Vīrya–Vipaka–Karma–Prabhava* profile as described in *Bhavaprakaśa Nighaṇṭu, Dhanvantari Nighaṇṭu, Dravyaguṇa Vijñana*, *Chakradatta* and *Gadanigraha* [12–14,23–25]. These pharmacodynamic attributes collectively explain its *Prasava-pravartaka* (labour-inducing) and *Raktasaṅgrahika* (hemostatic) actions.

Table 2: Ayurvedic Parameter and Its Functional Role

Ayurvedic Parameter	Property of Vasaka	Functional Role in Labour
Rasa (taste)	*Tikta, Kaṣaya*	Astringent, anti-hemorrhagic; supports post-delivery hemostasis [9,12,14]
Guṇa (quality)	*Laghu, Rūkṣa*	Reduces *Kapha*-induced uterine inertia and sluggish myometrial activity [14,25]
Vīrya (potency)	*Uṣṇa*	Activates uterine contractility and stimulates *Garbhaśaya* [23,25]
Vipaka (post-digestive effect)	*Kaṭu*	Enhances *Adhobhaga pravṛtti* and *Apana Vata pravartana*[14,16]
Karma (therapeutic action)	*Raktasaṅgrahika*	Controls excessive uterine bleeding after delivery [9,12]
Prabhava (specific effect)	*Garbhapravartaka*	Direct labour-inducing and expulsion-promoting action [23,24]

On the basis of these properties, *Vasaka* is classically designated as a *Prasava-pravartaka dravya*, capable of stimulating *Apana Vata*, activating uterine contractions, facilitating cervical ripening, and promoting smooth fetal descent [23–25]. Simultaneously, its *Kaṣaya Rasa* and *Raktasaṅgrahika Karma* ensure effective post-delivery hemostasis, thereby preventing excessive postpartum bleeding [9,12,14].

Thus, *Vasaka* acts as a balanced obstetric drug, exhibiting a dual functional role- induction and regulation of labour at term, along with control of postpartum hemorrhage, making it a unique and highly valuable *Prasava-pravartaka dravya* in Ayurvedic obstetrics. [12–16,23–26]

Fig 1



MATERIALS AND METHODS

A systematic literature search was conducted using PubMed, Google Scholar, ScienceDirect, and ResearchGate databases to identify relevant studies published between 1980 and 2025 [15–22,30–35].

For the classical Ayurvedic component, authoritative texts including Charaka Saṁhita, Suśruta Saṁhita, Bhavaprakaśa Nighaṇṭu, Dhanvantari Nighaṇṭu, Chakradatta, and Gadanigraha were critically reviewed to extract traditional references related to *Prasava* (labour), *Mūḍhagarbha*, *Raktapradara*, and *Yonivyapada* [9–14,23–25].

Relevant data were extracted from:

- In vitro experimental studies on isolated human and animal myometrial tissues, evaluating uterotonic responses and contractility patterns. [19–21,33]
- In vivo animal studies conducted on rats, rabbits, guinea pigs, and hamsters, assessing abortifacient and reproductive toxicity outcomes. [7,8,21,22,30]
- Ethnomedicinal and clinical usage reports, documenting traditional obstetric, gynecological, and postpartum applications of *Vasaka*. [11,27–29,34,35].

All the extracted data were systematically screened, categorized, and critically analyzed, and the findings from Ayurvedic and modern scientific sources were synthesized in an integrative manner to draw comprehensive conclusions regarding the uterotonic, abortifacient, and anti-hemorrhagic potential of *Adhatoda vasica.* [15–22,30–35]

RESULTS

Ayurvedic Results

1. Ethnomedicinal Evidence of *Vasaka* in Labour Facilitation

Traditional practices documented across various regions of India demonstrate the empirical use of *Adhatoda vasica (Vasaka)* in obstetric practice [11,27–29,34,35]. Ethnomedicinal reports describe:

- Administration of *Vasaka* decoction in delayed labour. [11,27]
- Use of *Vasaka* after fetal demise to promote expulsion.[29,35]
- Use in cases of weak or inefficient uterine contractions. [27,34]

These applications clearly reflect the traditional empirical recognition of *Vasaka* as a labour-facilitating drug with *Prasava-pravartaka* activity. [11,27–29,34,35]

2. Effect of *Vasaka* on *Prasava* (Labour)

Classical Ayurvedic literature identifies *Vasaka* as a *Prasava-pravartaka dravya* [12,23–25]. It stimulates *Apana Vata*, strengthens uterine contractions, promotes cervical ripening, and facilitates smooth fetal descent, thereby supporting the physiological progression of labour [9,10,23,24].

3. *Rasa–Guṇa–Vīrya–Vipaka* Based Functional Action

Vasaka exhibits the following classical pharmacodynamic properties as described in Dravyaguṇa and Nighaṇṭu literature [12–16]:

- *Uṣṇa Vīrya* and *Kaṭu Vipaka* initiate the downward movement (*Pravartana*) of *Apana Vata.* [14,16,23]
- *Kaṣaya Rasa* prevents excessive bleeding by imparting astringent and hemostatic action. [9,12,14]
- *Laghu* and *Rūkṣa Guṇa* reduce *Kapha*-induced uterine inertia and sluggish myometrial activity [14,25].

Thus, *Vasaka* simultaneously supports uterine activation and bleeding control, a rare and highly valuable obstetric pharmacological combination.[12–16,23–26]

4. *Doṣa–Dhatu–Srotas* Based Action

The Ayurvedic action of *Vasaka* on the reproductive system can be summarized as follows [9,10,14,23–25]:

- *Doṣa: Apana-Vata pravartaka* and *Kapha-śamaka*
- *Dhatu*: Regulation of *Rakta* and *Artava*
- *Srotas*: Activation of *Artavavaha* and *Garbhavaha Srotas.*

These actions explain its therapeutic role in:

- Initiation of labour [23,24],
- Expulsion of retained products. [24,25]
- Regulation of menstrual flow. [9,12]
- Maintenance of postpartum uterine tone. [10,12]

5. Role in *Artava* and *Garbha* Physiology

From a functional Ayurvedic standpoint [9,12,14,23]

- At term gestation: *Vasaka* supports *Prasava-pravartana* (initiation and progression of labour).
- After delivery: *Vasaka* supports *Raktasaṅgrahaṇa* (post-delivery hemostasis).

This dual regulatory activity enhances both effective labour initiation and stable postpartum uterine tone with bleeding control. [12,14,23,26]

6. *Ṣaḍvidha Upakrama* Based Ayurvedic Action

Vasaka operates through the following Ṣaḍvidha *Upakrama* principles: [14,23,25]

- *Svedana*- Due to *Uṣṇa Vīrya*, promoting uterine activation.
- *Rūkṣaṇa*- Through *Kapha-śoṣaṇa*, removing uterine inertia.
- *Stambhana*- Through *Kaṣaya Rasa*, arresting excessive bleeding.

Thus, *Vasaka* therapeutically supports: Labour induction and post-delivery bleeding control.[12,14,23–26]

7. Important Classical Ayurvedic Formulations of *Vasaka*

The following classical formulations of Vasaka are described in Ayurveda for reproductive and bleeding disorders [12,23,26]:

Formulation	Classical Indication
Vasavaleha	*Raktapitta*
Vasakasava	Rakta disorders
Lodhra–Vasa Yoga	*Asṛgdara* (menorrhagia)
Vasaka Kvatha	*Prasava-pravartana*

Modern Pharmacological Results

1. Phytochemical Constituents Relevant to Reproductive Activity

Phytochemical investigations of *Adhatoda vasica* reveal the presence of several bioactive constituents responsible for its reproductive pharmacological actions, including the pyrroloquinazoline alkaloids vasicine, vasicinone, and vasicinol, along with flavonoids and tannins.[15–18,32] Among these, vasicine is the primary compound responsible for uterotonic and abortifacient effects, while flavonoids and tannins contribute significantly to antioxidant and anti-hemorrhagic activities [15,17,18].

2. Uterotonic Activity

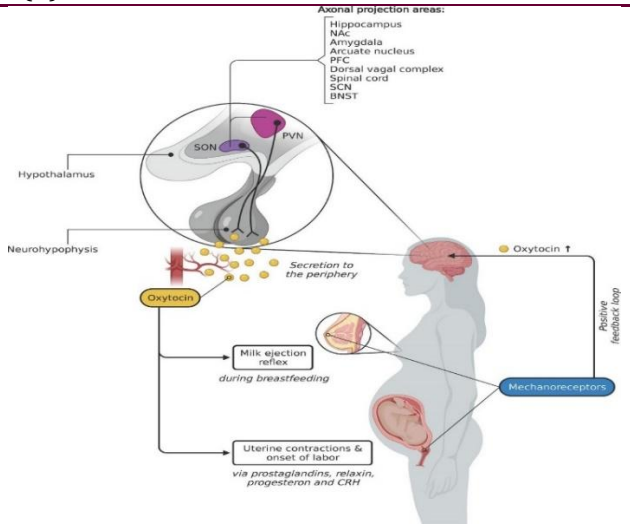
Experimental pharmacological studies demonstrate that vasicine produces strong, rhythmic, and sustained uterine contractions in both pregnant and non-pregnant uterine muscle preparations.[19,20,33] The contractile response induced by vasicine closely resembles the physiological uterine contraction pattern produced by oxytocin.[1,19,33] Unlike abrupt pharmacological hyperstimulation, vasicine induces coordinated and sustained uterine contractions, making it a potential candidate for physiological labour induction. [19,33]

3. Mechanism of Action - FIG2

The uterotonic activity of *Adhatoda vasica* is primarily mediated through a prostaglandin-dependent pathway [19–21]:

- Vasicine stimulates prostaglandin synthesis, particularly PGE_2 and $PGF_2\alpha$,
- Enhances intracellular Ca^{2+} influx in myometrial smooth-muscle cells, and
- Activates calcium-dependent contractile proteins, leading to effective uterine contraction. [19–21]

This mechanism closely mimics the natural biochemical cascade involved in initiation and progression of labour. [1,3,19,33]



4. Abortifacient Activity

Experimental animal studies have established the potent abortifacient activity of *Adhatoda vasica.* [21,22] Administration of aqueous leaf extract at a dose of 175mg/kg produced a 100% abortion rate in albino rats when administered during early gestation. [22] The abortifacient effect:

- Was enhanced by estrogen
- Was inhibited by aspirin

This confirms that the abortifacient action is prostaglandin-mediated and dose-dependent [21,22]. Similar abortifacient activity has been reported in guinea pigs, hamsters, and rabbits, indicating cross-species consistency [7,21,30].

5. Anti-Hemorrhagic (Hemostatic) Activity

The tannins and flavonoids present in *Adhatoda vasica* exert a pronounced anti-hemorrhagic effect through:

- Local vasoconstriction
- Stabilization of blood clots
- Reduction in capillary permeability. [15,17,18]

These effects provide strong scientific validation for the traditional use of *Vasaka* in the management of menorrhagia and postpartum hemorrhage, where control of excessive uterine bleeding is critical. [9,12,15]

Modern Pharmacological Result Summary

Adhatoda vasica exhibits a triple pharmacological action on the female reproductive system:

Physiological uterotonic activity, potent abortifacient activity at higher doses and significant anti-hemorrhagic (hemostatic) activity.

These effects are primarily mediated through the prostaglandin–calcium uterine activation pathway, conclusively validating its traditional obstetric applications.

Phytochemical Constituents

The major bioactive principles responsible for the reproductive pharmacological activity of *Adhatoda vasica* include the quinazoline alkaloids vasicine, vasicinone, and vasicinol, along with flavonoids and tannins.[15–18,32] Vasicine is the primary constituent mediating uterotonic and abortifacient effects, whereas flavonoids and tannins contribute significantly to antioxidant and anti-hemorrhagic activities. [15,17,18]

2. Uterotonic Activity

Experimental pharmacological studies demonstrate that vasicine produces rhythmic, sustained uterine contractions in both pregnant and non-pregnant uterus. [19,20,33] The contractile effect of vasicine is comparable to oxytocin, producing coordinated and physiological uterine contractions rather than abrupt hyperstimulation. [1,19,33]

3. Mechanism of Action

The uterotonic action of *Adhatoda vasica* is mediated primarily through a prostaglandin-dependent calcium signaling pathway [19–21]

- Vasicine stimulates prostaglandin synthesis, especially PGE_2 and $PGF_2\alpha$
- Enhances intracellular Ca^{2+} influx
- Activates calcium-dependent contractile proteins in myometrial smooth muscle, resulting in effective uterine contraction [19–21,33].

This mechanism closely mimics the natural biochemical cascade involved in initiation and progression of labour. [1,3,19]

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DISCUSSION

The integrative analysis clearly establishes that *Adhatoda vasica* exerts a profound and dose-dependent influence on the female reproductive system through converging Ayurvedic and modern pharmacological mechanisms.[12–16,19–21,23–26] The Ayurvedic explanation based on *Apana Vata uddīpana, Uṣṇa Vīrya,* and *Kaṭu Vipaka* shows a remarkable functional correspondence with the modern prostaglandin–calcium mediated uterine activation pathway. [14,16,19–21,33]

Unlike the abrupt pharmacological hyperstimulation often observed with high-dose oxytocin, *Vasaka* produces rhythmic, coordinated, and physiological uterine contractions, which may reduce the risk of uterine fatigue and subsequent postpartum hemorrhage.[1,3,4,33] Its intrinsic *Raktasaṅgrahika* property further supports postpartum uterine tone and effective hemostasis. [9,12,15]

However, the same uterotonic mechanism also renders *Vasaka* a powerful abortifacient during early pregnancy[21,22,30]. Therefore, its use is strictly contraindicated in the first and second trimesters, and even at term its therapeutic window remains narrow and highly dose-sensitive, necessitating precise dosing, gestational timing, and expert supervision.[21,22,30,31]

CONCLUSION

Adhatoda vasica is a pharmacologically potent and Ayurvedically validated medicinal plant with a dual role in the female reproductive system. It acts as:

- A natural uterotonic at term
- A potent abortifacient at higher doses
- An effective hemostatic in menorrhagia and postpartum hemorrhage

Its use in induction of labour holds promise as a safer plant-based alternative when used strictly under expert supervision. However, controlled clinical trials, dose standardization, and toxicity profiling are essential before its routine obstetric application.

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