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A Review On The Medicinal Plants Of Kaayakam Lehyam: Nature's Hidden Healers For Postpartum Recovery

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Abstract
Kaayakam Lehyam is a traditional Ayurvedic polyherbal formulation. Which is employed in postpartum care. Yet its therapeutic basis remains underexplored in scientific literature. This review critically evaluates five core botanical constituents—*Piper longum* (long pepper), *Zingiber officinale* (ginger), *Terminalia chebula* (haritaki), *Curcuma longa* (turmeric), and *Withania somnifera* (ashwagandha). By integrating evidence on their ecological distribution, phytochemical composition, and pharmacological potential. Using a narrative review approach, we synthesize data from ethnobotanical records, recent pharmacological studies, and molecular-level investigations to explore their role in modulating inflammation, oxidative stress, hormonal balance, and tissue repair—key processes involved in postpartum recovery. Notably, bioactive compounds such as curcumin, gingerol, piperine, withanolides, and chebulic acid exhibit multi-target interactions, suggesting potential potential additive effects within the formulation. This review offers a novel perspective by linking traditional Ayurvedic knowledge with contemporary biomedical evidence, underscoring *Kaayakam Lehyam* as a promising integrative strategy for maternal health. Further pharmacological validation and clinical studies are warranted to standardize its use and translate its benefits into modern obstetric practice.
Keywords: *Ayurvedic formulation, Bioactive phytochemicals, Maternal health, Postpartum care, Pharmacological synergy, Traditional medicine.*

Article Highlights

What is Already Known

- Ayurvedic formulations like *Kaayakam Lehyam* are traditionally used for postpartum recovery in India.
- The major ingredients—*Piper longum*, *Zingiber officinale*, *Terminalia chebula*, *Curcuma longa*, and *Withania somnifera*—have documented pharmacological properties such as anti-inflammatory, antioxidant, immunomodulatory, and galactagogue effects.
- Prior studies focus largely on individual herbs without addressing their combined use in a postpartum-specific context.

What is New in This Study

- This is the first narrative review that integrates ecological, phytochemical, and pharmacological data on the specific herbs in *Kaayakam Lehyam* with relevance to postpartum care.
- The review uniquely highlights potential additive effects among the formulation's bioactive compounds and how these may act on key physiological pathways involved in maternal recovery.
- It bridges traditional Ayurvedic knowledge with modern biomedical evidence, offering a framework for further experimental validation and clinical research.
- The review also identifies critical gaps in current literature, particularly the lack of multi-herb, postpartum-targeted pharmacological evaluations, and provides directions for future studies.

Key Contributions

- Provides an updated and comprehensive scientific rationale for *Kaayakam Lehyam* as an integrative therapeutic for postpartum care.
- Serves as a foundation for the development of evidence-based Ayurvedic interventions in maternal health.
- Encourages interdisciplinary dialogue between ethnomedicine, pharmacognosy, and maternal health research communities.

INTRODUCTION

Ayurveda: A holistic medical science

The foundation of Ayurveda, an age-old medical system. Which dates back >5,000 years to India. It is the idea that maintaining health and preventing disease can be achieved by balancing the body's humors, or doshas—Pitta, Kapha, and Vata [1]. It promotes holistic well-being by integrating herbal medicine, therapies, diet, and lifestyle. Lehyams (medicated herbal pastes), one of the key components of Ayurvedic formulations. Which are essential for both disease prevention rejuvenation and mother's wellness [2].

A key component of Ayurveda is postpartum care, or Sutika Paricharya. Which emphasizes newborn care, lactation support, and maternal recuperation [3]. The goal is to prevent postpartum disorders and restore the mother's strength through a combination of lifestyle practices, herbal formulations, and dietary interventions. The importance of herbal remedies in postpartum recuperation, boosting immunity, and encouraging lactation is highlighted in Ayurvedic texts like Ashtanga Hridaya and Charaka Samhita [4].

Postpartum care: Global and Indian perspectives

During the critical postpartum recovery period, women undergo significant physiological and psychological changes. Worldwide, postpartum issues like bleeding, infections, depression, and hormone imbalances lead to maternal morbidity and mortality [5]. According to estimates from the World Health Organization (WHO), inadequate postpartum care played a significant role in nearly 295,000 maternal deaths that occurred worldwide in 2017 [6].

In India, postpartum care frequently receives less emphasis than prenatal care, which is consistent with global trends. While the number of births in institutions has grown, the quality and continuity of postpartum care continue to vary, particularly in rural and marginalized groups, according to the National Family Health Survey-5 (NFHS-5). India still contributes significantly to maternal fatalities worldwide, notwithstanding a decline in maternal mortality.

Only 72.3% of women in Andhra Pradesh obtained a postnatal checkup within two days after birth, which is crucial for identifying potentially fatal complications, according to data from NFHS-5 (2019–21). In addition, moms in the state's rural and tribal regions are increasingly concerned about postpartum anemia, undernutrition, and mental health issues. There are still gaps in culturally sensitive care, nutritional supplementation, and the incorporation of traditional practices like Ayurveda into mainstream postpartum health services, even with the National Health Mission's (NHM) numerous maternal health schemes and state-specific initiatives like Thalli Bidda Express and 102 services.

This situation highlights the critical need for evidence-based, integrative, and easily available postpartum therapies in Andhra Pradesh and elsewhere, particularly those that combine conventional knowledge with contemporary medical treatment, including Ayurvedic formulations like Kaayakam Lehyam.

Lehyams and other traditional Ayurvedic formulations are frequently used to aid in recovery; postpartum regimens often include polyherbal preparations such as Sowbhagya Shunti Lehyam and Kaayakam Lehyam [7]. In India, postpartum health problems are still a public health concern, particularly in rural areas where modern medicine and traditional knowledge systems coexist. India's National Health Mission (NHM) places a strong emphasis on maternal health initiatives, but there are still gaps in postpartum care and nutrition [8].

KAAYAKAM LEHYAM: A VITAL AYURVEDIC FORMULATION FOR POST PARTUM REVOCERY

Kaayakam Lehyam has been used for many years as a successful polyherbal treatment for postpartum recuperation. It consists of bioactive medicinal herbs like *Terminalia chebula* (haritaki), *Withania somnifera* (ashwagandha), *Zingiber officinale* (ginger), *Piper longum* (long pepper), and *Curcuma longa* (turmeric) [9].

Because of the numerous pharmacological qualities of these herbs, such as their anti-inflammatory, antioxidant, immunomodulatory, galactagogue, and neuroprotective effects, Kaayakam Lehyam is an essential formulation for thorough postpartum recovery [10].

Although traditional formulations like Kaayakam Lehyam are widely used in Ayurvedic postpartum care. A systematic evaluation of their efficacy and scientific rationale is noticeably lacking. Existing studies often suffer from methodological inconsistencies, limited sample sizes, and absence of control groups, making it difficult to draw evidence-based conclusions. Furthermore, the literature is largely fragmented—focusing either on individual herbs or general Ayurvedic principles—without consolidating phytochemical, pharmacological, and clinical evidence in the context of postpartum recovery. There is a critical gap in current research, including the absence of rigorous review protocols, lack of comprehensive inclusion criteria, and failure to assess potential additive effects among constituent herbs. Moreover, recent advances in pharmacognosy, ethnomedicine, and integrative health sciences have not been adequately incorporated into the existing reviews. This nerrative review seeks to address these limitations by employing a transparent, replicable methodology to synthesize ecological, phytochemical, and pharmacological data relevant to the use of Kaayakam Lehyam in postpartum health care. The review aims to provide an evidence-informed foundation for future clinical trials and integrative maternal health strategies.

DISTRIBUTION OF PLANT COMPONENTS OF KAAYAKAM LEHYAM

The plant parts of Kaayakam Lehyam are found in a variety of regions throughout South and Southeast Asia, Africa, and the Mediterranean, including tropical, subtropical, and temperate regions. The humid tropics of southern India, particularly Kerala, Karnataka, Tamil Nadu, and Andhra Pradesh, are home to important medicinal species like *Piper longum, Zingiber officinale, Curcuma longa*, and *Syzygium aromaticum*. Lakadong cardamom, ginger, and turmeric are well-known in the Northeastern states, such as Assam and Meghalaya. The Indian subcontinent, including central and northern areas like Madhya Pradesh, Bihar, and Uttar Pradesh, is home to *Terminalia chebula, Withania somnifera, Emblica officinalis*, and *Tinospora cordifolia*. The arid and semi-arid regions of Gujarat, Rajasthan, and Maharashtra are home to the cultivation of *Cuminum cyminum, Foeniculum vulgare*, and *Coriandrum sativum* (Figure 1 and Table 1). The broad ecological adaptation of these substances ensures their long-term availability for traditional recipes.

BOTANICAL DESCRIPTION

The medicinal plants in Kaayakam Lehyam exhibit diverse morphological and phytochemical traits that underpin its therapeutic efficacy. *P. longum* is a climbing vine with piperine-rich fruits known for digestive and bioenhancing effects. *Z. officinale* (Ginger) is a rhizomatous herb whose gingerol and shogaol offer anti-inflammatory benefits. *T. chebula*, a deciduous tree, provides antioxidant-rich fruits containing tannins and polyphenols. Curcuma longa (Turmeric) produces curcumin-rich rhizomes valued for anti-inflammatory and wound-healing actions. *W. somnifera* (Ashwagandha) is a shrub with withanolides that support stress reduction and immunity. *E. officinalis* (Amla) offers vitamin C and polyphenols that rejuvenate and protect against oxidative stress. *T. cordifolia* (Guduchi), a climbing shrub, has alkaloids and glycosides with immunostimulatory and hepatoprotective effects. *C. cyminum* (Cumin) and *C. sativum* (Coriander) are aromatic herbs with digestive and antimicrobial compounds like cuminaldehyde and linalool. *F. vulgare* (Fennel) contains anethole for carminative and galactagogue effects. *S. aromaticum* (Clove) offers eugenol with analgesic and antimicrobial action, while *E. cardamomum* (Cardamom) supports digestion with cineole and terpinene. Collectively, these botanicals promote postpartum recovery through synergistic digestive, anti-inflammatory, and rejuvenative properties (Figure 2 & 3; Table 3). Together, these botanicals demonstrate a synergistic pharmacological profile that supports postpartum recovery through enhanced digestion, immune support, inflammation resolution, and tissue repair.

PHYTOCHEMISTRY

The therapeutic efficacy of Kaayakam Lehyam stems from its diverse phytochemicals—alkaloids, flavonoids, tannins, phenolics, glycosides, terpenoids, and essential oils—each contributing to its pharmacological benefits. *P. longum* contains piperine, a bioenhancer and antioxidant [11]. *Z. officinale* offers gingerol, shogaol, and paradol with anti-inflammatory and gastroprotective effects [12]. *T. chebula* is rich in chebulic acid, tannins, and ellagic acid with antimicrobial and hepatoprotective properties [13]. *C. longa* provides curcumin,

a potent anti-inflammatory and antioxidant [14]. *W. somnifera* contains withanolides with adaptogenic and neuroprotective actions [15]. *E. officinalis* offers vitamin C, gallic acid, and ellagic acid for antioxidant and immune-boosting effects [16]. *T. cordifolia* contains berberine, tinosporin, and glycosides with immunomodulatory properties [17]. *C. cyminum* has cuminaldehyde [16], *C. sativum* contains linalool [18], *F. vulgare* has anethole and fenchone [19], *S. aromaticum* offers eugenol [20], and *E. cardamomum* provides cineole and terpinene [21]. These compounds may collectively support digestion, immunity, and postpartum recovery (Table 4).

PHARMACOLOGICAL POTENTIAL

The pharmacological efficacy of *Kaayakam Lehyam* is rooted in its diverse phytochemical profile, which collectively contributes to anti-inflammatory, antioxidant, immunomodulatory, antimicrobial, hepatoprotective, neuroprotective, and adaptogenic effects beneficial for postpartum recovery (Table 5). While individual constituents such as piperine, gingerol, curcumin, withanolides, and ellagic acid have been widely studied for their bioactivity, their combined presence in this formulation suggests a broad spectrum of therapeutic potential. Instead of reiterating compound-level details already discussed in the *Phytochemistry* section, the focus here is on how these properties may translate into postpartum benefits — such as reducing inflammation and oxidative stress, supporting immune function, promoting tissue repair, and enhancing overall maternal well-being

ANTIMICROBIAL ACTIVITY

The constituent herbs of Kaayakam Lehyam have demonstrated antimicrobial properties, suggesting potential efficacy of the formulation; however, direct formulation-level studies remain limited and require further investigation. *P. longum* (piperine) exhibits broad-spectrum antimicrobial action against *Escherichia coli* and *Staphylococcus aureus* [22,23]. *Z. officinale*, rich in gingerol and shogaol, inhibits *Helicobacter pylori*, implicated in gastrointestinal infections [24]. *T. chebula*, abundant in tannins, suppresses pathogens such as *Candida albicans* and *Klebsiella pneumonia* [13]. *C. longa* (curcumin) disrupts bacterial membranes and biofilm formation, effective against multidrug-resistant strains like MRSA [25]. *W. somnifera* exhibits antiviral activity against Herpes and Influenza viruses *via* withanolides [26], while *E. officinalis* (vitamin C, ellagic acid) targets *Pseudomonas aeruginosa* and *Bacillus subtilis* [15]. *T. cordifolia* enhances immune-mediated bacterial clearance [17]. Essential oils from *Cuminum cyminum* and *Coriandrum sativum* inhibit *Salmonella typhi* and *Listeria* monocytogenes [16, 18]. *F. vulgare* (anethole) acts against *Aspergillus* and *Candida* species [19], while *S. aromaticum* (eugenol) and *E. cardamomum* combat dental and fungal pathogens [20, 21]. Collectively, these compounds validate the antimicrobial potential of Kaayakam Lehyam in traditional therapeutics.

ANTI-INFLAMMATORY ACTIVITY

Because of the bioactive compounds that come from its plant-based ingredients, Kaayakam Lehyam has strong anti-inflammatory qualities. It is especially significant that *C. longa* (turmeric) contains curcumin, a well-established anti-inflammatory agent that modulates inflammatory pathways by reducing pro-inflammatory cytokines and blocking nuclear factor kappa B (NF-κB) activation [23]. In a similar vein, gingerol from *Z. officinale* has been shown to reduce postpartum inflammation and discomfort by inhibiting the synthesis of inflammatory mediators like prostaglandins and leukotrienes [27].

Furthermore, chebulic acid and ellagic acid, which are found in *T. chebula*, have strong anti-inflammatory properties by scavenging free radicals and blocking inflammatory enzymes [14]. Withanolides from *W. somnifera* have an immunomodulatory function that also helps to lower oxidative damage, stress-related inflammatory reactions, and systemic inflammation [28]. Together, these bioactive substances help KL control postpartum inflammation, encourage tissue healing, and aid in general recuperation. KL's significance in postpartum healthcare is highlighted by the combination of traditional knowledge and scientific validation, which calls for more study to fully explore its therapeutic potential.

ANTIOXIDANT ACTIVITY

With its polyphenols, flavonoids, and tannins, Kaayakam Lehyam (KL) exhibits strong antioxidant activity and aids in postpartum recuperation. Vitamin C and ellagic acid-rich *E. officinalis* effectively lowers oxidative damage and boosts immunity [29]. Curcumin, or *C. longa*, increases endogenous antioxidants like SOD and catalase and prevents lipid peroxidation [30]. Gingerrol, or Z. officinale, reduces cellular damage brought on

by oxidative stress [31]. Through its flavonoids and tannins, *T. chebula* helps scavenge free radicals [13]. The antioxidant potential of KL in conventional postpartum care is validated by these possible complementary actions theorized from individual herb data.

ANTI-DIABETIC ACTIVITY

The herbs that make up *Kaayakam Lehyam* (KL), such as *C. longa, E. officinalis, T. cordifolia,* and *T. chebula,* have been reported to possess anti-diabetic properties. Curcumin reduces blood glucose and increases insulin sensitivity by altering insulin signaling [32]. Through ellagic acid and vitamin C, *E. officinalis* promotes glycemic control and improves β-cell function [33]. *T. chebula* inhibits α-glucosidase and α-amylase to regulate postprandial glucose [35], while *T. cordifolia* promotes insulin secretion and glucose uptake [34]. These findings suggest that KL may have potential relevance in diabetes management; however, clinical validation of these effects at the formulation level is still awaited.

CONCLUSION INSIGHTS

This review comprehensively highlights the therapeutic potential of Kaayakam Lehyam, an Ayurvedic polyherbal formulation, in promoting postpartum recovery. Because of its varied phytochemical composition and pharmacological qualities, Kaayakam Lehyam, a traditional Ayurvedic polyherbal formulation, shows great promise in postpartum recovery. The ecological distribution, phytochemistry, and therapeutic effects of its main medicinal ingredients—*Piper longum, Zingiber officinale, Terminalia chebula, Curcuma longa,* and *Withania somnifera*—are highlighted in this review. These plants' anti-inflammatory, antioxidant, immunomodulatory, and adaptogenic qualities are attributed to their abundance of bioactive substances, including piperine, gingerol, chebulic acid, curcumin, and withanolides. This review highlights the value of Kaayakam Lehyam in comprehensive postpartum care by fusing traditional wisdom with contemporary scientific findings. To confirm its effectiveness, safety, and mode of action, more preclinical and clinical research is necessary. Standardizing formulations, maximizing dosages, and investigating its potential should be the main goals of future research. However, to substantiate its clinical relevance, further research focusing on pharmacokinetics, standardized formulations, dose optimization, safety profiling, and randomized controlled trials is essential.

While earlier reviews on Ayurvedic polyherbal formulations in maternal health (e.g., Patwardhan et al., 2021; Joshi et al., 2020) provide important overviews, they mostly address Ayurveda at a broader level. In contrast, this narrative review is distinct in focusing specifically on *Kaayakam Lehyam*, a formulation that has received little dedicated scientific attention. By integrating ecological, phytochemical, and pharmacological evidence of its core herbs, this work offers a focused synthesis that adds value to the growing dialogue on evidence-informed postpartum care.

RECOMMENDATIONS FOR FUTURE RESEARCH

To advance the scientific validation and clinical integration of Kaayakam Lehyam in postpartum care, future research should focus on several key areas. Standardization of the formulation through advanced phytochemical profiling is essential to ensure consistency and therapeutic reliability. Detailed *in vitro* and *in vivo* studies are needed to elucidate the molecular mechanisms underlying its anti-inflammatory, immunomodulatory, and adaptogenic effects. Preclinical safety and toxicity assessments must be conducted to establish appropriate dosing and detect any potential adverse effects. Well-designed randomized controlled trials in postpartum populations are necessary to evaluate clinical efficacy, safety, and patient outcomes. Investigations into the pharmacokinetics and bioavailability of major bioactive compounds such as piperine, gingerol, curcumin, and withanolides will help optimize dosage and explore synergistic interactions. Additionally, innovative formulation strategies, including nano-encapsulation or sustained-release systems, may enhance bioavailability and patient adherence. Ethnopharmacological validation across diverse cultural contexts can further inform its appropriate use in maternal health. Finally, long-term studies and post-market surveillance are recommended to assess sustained impacts on maternal well-being, hormonal regulation, lactation, and immune function. Collectively, these research directions can strengthen the scientific foundation for incorporating Kaayakam Lehyam into integrative and evidence-based postpartum healthcare.

It is important to acknowledge certain limitations of the current evidence base. For instance, curcumin, a key constituent of *Curcuma longa*, has well-documented bioavailability challenges, which may reduce its therapeutic efficacy unless advanced formulations are used. Piperine in *Piper longum* can significantly enhance

the bioavailability of co-administered pharmaceuticals, raising the possibility of herb–drug interactions. Furthermore, specific safety data on the use of Kaayakam Lehyam in lactating mothers and neonates remain scarce, underscoring the urgent need for dedicated toxicological and clinical safety studies

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Table 1. Summarizes the wide-ranging distribution of key medicinal plants used in Kaayakam Lehyam across tropical, subtropical, and temperate regions.

Plant Name	Geographical Distribution
Piper longum (Long Pepper)	Humid tropics of India and Southeast Asia; major regions include Kerala, Karnataka, and Assam.
Zingiber officinale (Ginger)	Tropical and subtropical climates; major production in India, China, and Nigeria.
Terminalia chebula (Myrobalan)	Native to the Indian subcontinent; found in deciduous forests of India, Nepal, and Sri Lanka.
Curcuma longa (Turmeric)	Extensively cultivated in India (80% of global production); major regions include Andhra Pradesh, Tamil Nadu, Odisha.

Withania somnifera (Ashwagandha)	Arid and semi-arid regions of India, North Africa, and the Middle East; thrives in dry, stony soils.
Emblica officinalis (Amla)	Native to the Indian subcontinent; grows in wild and cultivated forms across Indian plains, foothills, and forests.
Tinospora cordifolia (Guduchi)	Tropical and subtropical regions of India, Myanmar, and Sri Lanka; grows as a climbing shrub in deciduous forests.
Cuminum cyminum (Cumin)	Extensively cultivated in India, Iran, and the Mediterranean; thrives in arid and semi-arid conditions.
Coriandrum sativum (Coriander)	Native to the Mediterranean; widely cultivated in India, Russia, and North Africa.
Foeniculum vulgare (Fennel)	Temperate and subtropical regions, including India, Iran, and the Mediterranean.
Syzygium aromaticum (Clove)	Indigenous to Maluku Islands, Indonesia; now cultivated in tropical regions like India, Madagascar, and Zanzibar.
Elettaria cardamomum (Cardamom)	Native to the Western Ghats of India and Sri Lanka; thrives in humid tropical rainforests.

Table 2. State-wise & District-wise Distribution of *Kaayakam Lehyam* Plants in India with Climatic Conditions

State	Major Districts/Regions	Key Medicinal Plants	Climatic Conditions
Jammu & Kashmir	Jammu, Kathua, Udhampur	*Withania somnifera (Ashwagandha), Emblica officinalis (Amla)*	Temperate, cold winters, moderate rainfall
Himachal Pradesh	Kangra, Mandi, Kullu	*Terminalia chebula (Haritaki), Withania somnifera*	Cool temperate, high-altitude forests
Uttarakhand	Dehradun, Chamoli, Almora	*Terminalia chebula, Curcuma longa (Turmeric), Withania somnifera*	Subtropical to temperate, moderate rainfall
Punjab	Hoshiarpur, Amritsar, Ludhiana	*Foeniculum vulgare (Fennel), Coriandrum sativum (Coriander), Cuminum cyminum (Cumin)*	Semi-arid, hot summers, cold winters
Haryana	Karnal, Hisar, Rohtak	*Cuminum cyminum, Foeniculum vulgare, Coriandrum sativum*	Arid to semi-arid, extreme temperatures
Uttar Pradesh	Lucknow, Varanasi, Bareilly	*Piper longum, Cuminum cyminum, Coriandrum sativum*	Subtropical, hot summers, moderate rainfall
Bihar	Nalanda, Gaya, Bhagalpur	*Terminalia chebula, Cuminum cyminum, Emblica officinalis*	Humid subtropical, hot summers, heavy monsoon
Jharkhand	Ranchi, Palamu, Singhbhum	*Terminalia chebula, Tinospora cordifolia, Emblica officinalis*	Tropical, hot summers, moderate rainfall
West Bengal	Darjeeling, Malda, Jalpaiguri	*Curcuma longa, Zingiber officinale, Piper longum*	Humid subtropical, high rainfall
Odisha	Koraput, Mayurbhanj, Kandhamal	*Terminalia chebula, Emblica officinalis, Curcuma longa*	Tropical monsoon, humid, heavy rainfall
Chhattisgarh	Bastar, Raipur, Bilaspur	*Terminalia chebula, Tinospora cordifolia, Piper longum*	Tropical, hot summers, high humidity
Madhya Pradesh	Jabalpur, Chhindwara, Rewa	*Terminalia chebula, Emblica officinalis, Withania somnifera*	Semi-arid to tropical, moderate rainfall

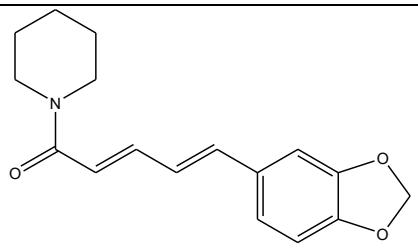
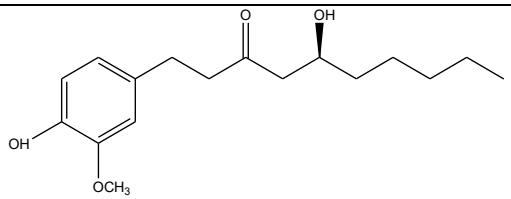
Rajasthan	Jodhpur, Barmer, Udaipur	*Cuminum cyminum, Foeniculum vulgare, Withania somnifera*	Arid desert, extreme summers, low rainfall
Gujarat	Banaskantha, Kutch, Ahmedabad	*Cuminum cyminum, Foeniculum vulgare, Coriandrum sativum*	Semi-arid, hot summers, minimal rainfall
Maharashtra	Pune, Nashik, Satara	*Terminalia chebula, Piper longum, Zingiber officinale*	Tropical monsoon, moderate rainfall
Goa	North & South Goa	*Piper longum, Elettaria cardamomum, Syzygium aromaticum*	Coastal humid, heavy monsoon rains
Karnataka	Kodagu, Chikkamagaluru, Mysuru	*Elettaria cardamomum, Piper longum, Curcuma longa*	Tropical wet, high humidity, heavy rainfall
Kerala	Wayanad, Idukki, Malappuram	*Piper longum, Elettaria cardamomum, Syzygium aromaticum*	Tropical wet, high rainfall, humid
Tamil Nadu	Coimbatore, Dindigul, Nilgiris	*Piper longum, Withania somnifera, Terminalia chebula*	Tropical to temperate (in hills), moderate rainfall
Andhra Pradesh	Visakhapatnam, Chittoor, East Godavari	*Curcuma longa, Emblica officinalis, Piper longum*	Tropical, warm climate, moderate rainfall
Telangana	Khammam, Adilabad, Nalgonda	*Terminalia chebula, Tinospora cordifolia, Withania somnifera*	Tropical, semi-arid, hot summers
Assam	Tinsukia, Sonitpur, Kamrup	*Zingiber officinale, Piper longum, Terminalia chebula*	Humid subtropical, high rainfall
Meghalaya	East Khasi Hills, West Garo Hills	*Curcuma longa (Lakadong), Piper longum, Tinospora cordifolia*	Subtropical highland, heavy rainfall
Arunachal Pradesh	Lohit, West Kameng, Changlang	*Zingiber officinale, Piper longum, Elettaria cardamomum*	Subtropical to temperate, high rainfall
Nagaland	Kohima, Mokokchung, Tuensang	*Zingiber officinale, Piper longum, Syzygium aromaticum*	Humid subtropical, high rainfall
Manipur	Imphal, Churachandpur, Senapati	*Zingiber officinale, Piper longum, Curcuma longa*	Humid subtropical, heavy monsoon
Mizoram	Aizawl, Lunglei, Champhai	*Terminalia chebula, Zingiber officinale, Foeniculum vulgare*	Humid subtropical, high rainfall
Tripura	West Tripura, South Tripura	*Zingiber officinale, Piper longum, Elettaria cardamomum*	Humid subtropical, heavy monsoon
Sikkim	East Sikkim, North Sikkim	*Elettaria cardamomum, Withania somnifera, Piper longum*	Cool temperate, high-altitude rainfall

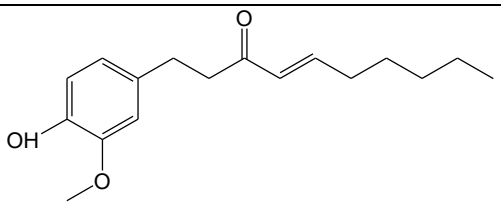
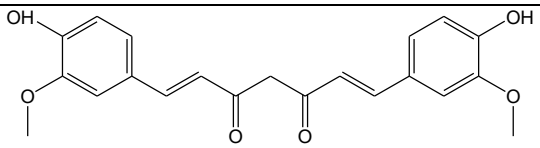
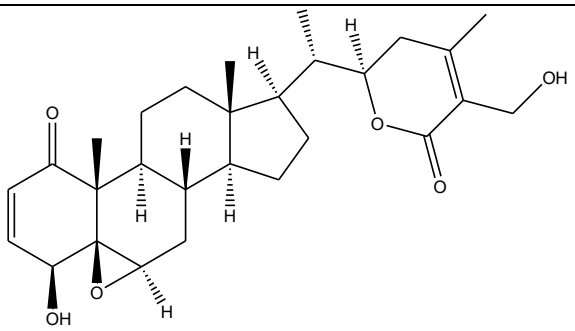
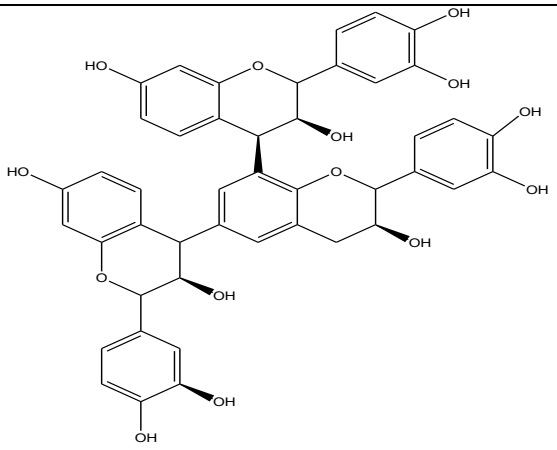
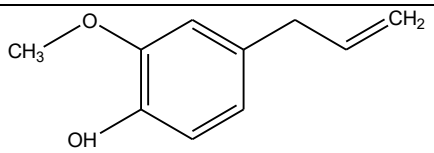
Table 3. The morphological and phytochemical characteristics of the medicinal plants used in Kaayakam Lehyam, highlighting their role in promoting postpartum health through diverse therapeutic actions.

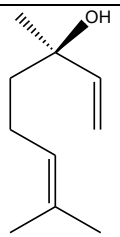
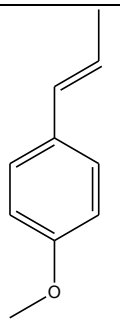
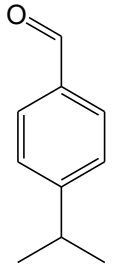
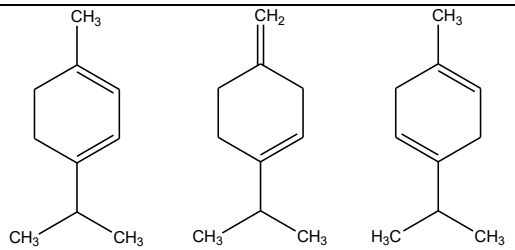
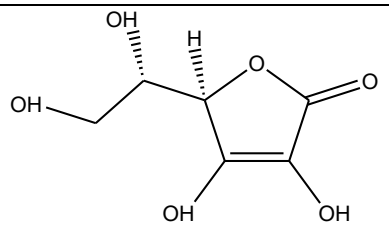
Plant Name	Morphological Characteristics	Phytochemical Properties
Piper longum (Long Pepper)	Perennial climbing vine, ovate leaves, catkin-like spikes bearing small fruits.	Contains piperine, an alkaloid known for digestive and bioenhancing effects[11]
Zingiber officinale (Ginger)	Rhizomatous herb, thick aromatic underground stems.	Rich in gingerol and shogaol, known for anti-inflammatory and carminative properties [12]

Terminalia chebula (Myrobalan)	Deciduous tree, oval leaves, small yellowish-white flowers, ellipsoidal fruits.	Contains tannins, flavonoids, and polyphenols, offering antioxidant and antimicrobial effects[13]
Curcuma longa (Turmeric)	Rhizomatous plant, broad leaves, vibrant yellow rhizomes.	Contains curcumin, a polyphenol with anti-inflammatory, antioxidant, and wound-healing properties[23]
Withania somnifera (Ashwagandha)	Woody shrub, ovate leaves, small greenish-yellow flowers, berry-like red fruits.	Contains withanolides, known for adaptogenic and immunomodulatory effects[14].
Emblica officinalis (Amla)	Medium-sized deciduous tree, feathery leaves, round greenish-yellow fruits.	Rich in vitamin C, polyphenols, and flavonoids with antioxidant and rejuvenating properties[15].
Tinospora cordifolia (Guduchi)	Climbing shrub, heart-shaped leaves, greenish-yellow flowers.	Contains alkaloids and glycosides, known for immunostimulatory and hepatoprotective effects[17].
Cuminum cyminum (Cumin)	Small annual herb, finely divided leaves, delicate white or pink flowers.	Contains cuminaldehyde, offering digestive and antimicrobial properties[16].
Coriandrum sativum (Coriander)	Aromatic annual herb, delicate pinnate leaves, round seeds.	Rich in linalool, known for gastroprotective and anti-inflammatory activities[18].
Foeniculum vulgare (Fennel)	Tall aromatic herb, feathery leaves, clusters of yellow flowers.	Contains anethole, used for galactagogue and carminative properties[19].
Syzygium aromaticum (Clove)	Evergreen tree, dark green leaves, aromatic flower buds.	Contains eugenol, known for analgesic, antimicrobial, and antioxidant effects [20].
Elettaria cardamomum (Cardamom)	Tropical plant, lance-shaped leaves, pale green pods.	Contains cineole and terpinene, supporting digestion and offering antioxidant properties[21].

Table 4. The chemical structures of some important phytochemicals isolated from the medicinal plants used in Kaayakam Lehyam:

Phytochemical	Source Plant	Chemical Structure Description	Structure
Piperine	*Piper longum (Long Pepper)*	An alkaloid with a pyridine and piperidine ring linked by a methylenedioxy bridge.	
Gingerol	*Zingiber officinale (Ginger)*	A phenolic ketone with a hydroxy group on the benzene ring and a long hydrocarbon chain.	

Shogaol	*Zingiber officinale (Ginger)*	Similar to gingerol but contains an α, β-unsaturated carbonyl group (dehydrated form of gingerol).	
Curcumin	*Curcuma longa (Turmeric)*	A polyphenol with two aromatic rings, each containing a methoxy and hydroxy group.	
Withanolides	*Withania somnifera (Ashwagandha)*	Steroidal lactones with a steroidal nucleus and a lactone ring at C-22 and C-26.	
Tannins	*Terminalia chebula (Myrobalan)*	Polyphenolic compounds with galloyl groups linked to glucose units.	
Eugenol	*Syzygium aromaticum (Clove)*	A phenylpropanoid with a methoxy group and allyl side chain on the benzene ring.	

Linalool	*Coriandrum sativum (Coriander)*	A monoterpene alcohol with a hydroxy group on a linaloyl backbone.	
Anethole	*Foeniculum vulgare (Fennel)*	A phenylpropene with a methoxy group and a propenyl side chain.	
Cuminaldehyde	*Cuminum cyminum (Cumin)*	A benzaldehyde derivative with an isopropyl group on the benzene ring.	
Terpinene	*Elettaria cardamomum (Cardamom)*	A cyclic monoterpene with multiple double bonds in a six-membered ring.	 α β γ
Ascorbic Acid (Vitamin C)	*Emblica officinalis (Amla)*	A six-carbon lactone with two enediol groups contributing to its antioxidant property.	

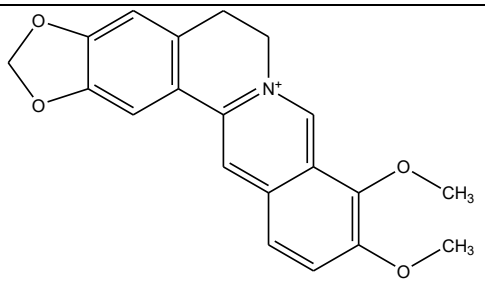
Berberine	*Tinospora cordifolia (Guduchi)*	An isoquinoline alkaloid with a quaternary ammonium structure.	

Table 5. Pharmacological Potential of Medicinal Plants used in Kaayakam Lehyam

Plant Name	Key Phytochemicals	Pharmacological Properties	Reference
Piper longum (Long Pepper)	Piperine	Enhances bioavailability, anti-inflammatory, neuroprotective	[11]
Zingiber officinale (Ginger)	Gingerol, Shogaol	Anti-inflammatory, gastroprotective	[12]
Terminalia chebula (Myrobalan)	Tannins, Chebulic acid	Antimicrobial, hepatoprotective, wound-healing	[13]
Curcuma longa (Turmeric)	Curcumin	Anti-inflammatory, antioxidant, neuroprotective	[23]
Withania somnifera (Ashwagandha)	Withanolides	Adaptogenic, stress-reducing, immunomodulatory, cognitive enhancement	[14]
Emblica officinalis (Amla)	Vitamin C, Ellagic acid	Antioxidant, cardioprotective	[15]
Tinospora cordifolia (Guduchi)	Alkaloids, Glycosides	Immunomodulatory, infection protection	[17]
Cuminum cyminum (Cumin)	Cuminaldehyde	Antimicrobial, digestive, hepatoprotective	[16]
Coriandrum sativum (Coriander)	Linalool	Antimicrobial, digestive, hepatoprotective	[18]
Foeniculum vulgare (Fennel)	Anethole	Gastrointestinal health, antispasmodic	[19]
Syzygium aromaticum (Clove)	Eugenol	Antispasmodic, analgesic, antimicrobial	[20]
Elettaria cardamomum (Cardamom)	Cineole, Terpinene	Anti-inflammatory, digestive-supporting	[21]

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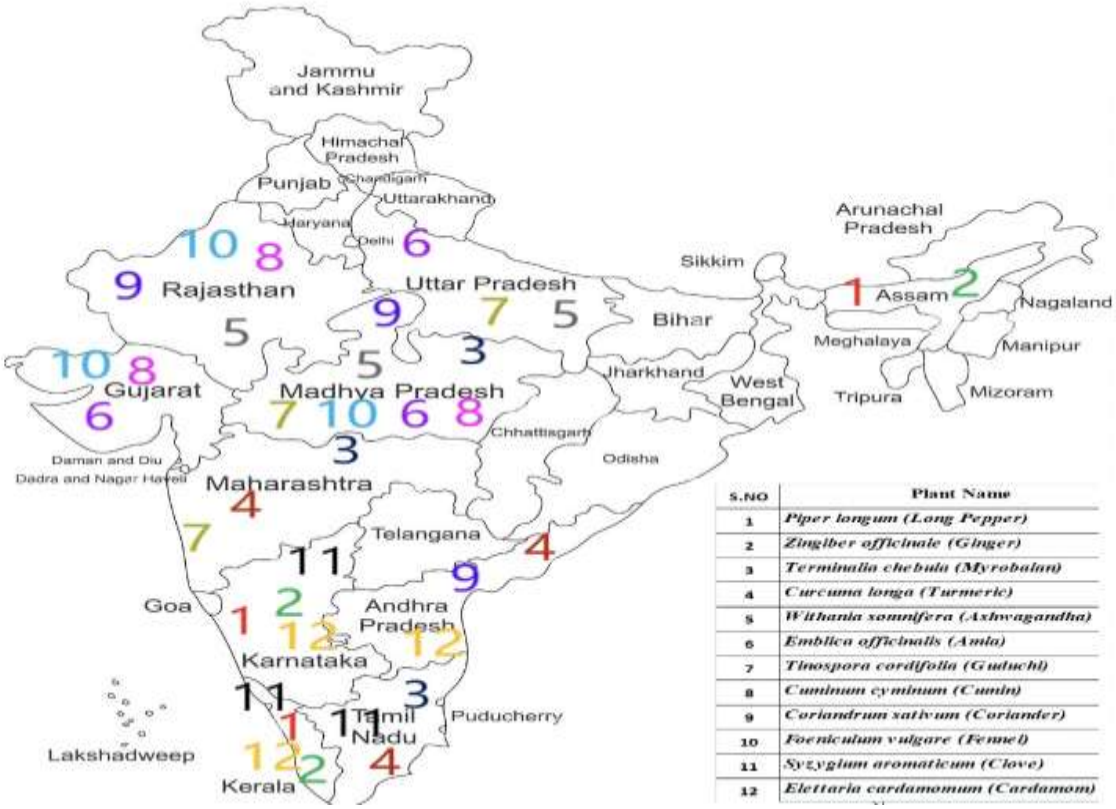

S.NO	Plant Name
1	*Piper longum (Long Pepper)*
2	*Zingiber officinale (Ginger)*
3	*Terminalia chebula (Myrobalan)*
4	*Curcuma longa (Turmeric)*
5	*Withania somnifera (Ashwagandha)*
6	*Emblica officinalis (Amla)*
7	*Tinospora cordifolia (Guduchi)*
8	*Cuminum cyminum (Cumin)*
9	*Coriandrum sativum (Coriander)*
10	*Foeniculum vulgare (Fennel)*
11	*Syzygium aromaticum (Clove)*
12	*Elettaria cardamomum (Cardamom)*

Figure 1 Distribution of Major Plant Species Used in Kaayakam Lehyam in India: A map of India highlighting the major geographical regions where these medicinal plants grow. The highlighted areas will correspond to states known for cultivating or naturally growing the species used in Kaayakam Lehyam.

Figure 2 This figure showcases twelve key medicinal plant species used in the formulation of Kaayakam Lehyam, a polyherbal preparation designed to support postpartum recovery. Each plant, labeled from A to L, plays a vital role in maternal health by aiding digestion, lactation, immunity, hormonal balance, and tissue repair.

(A) Piper longum (Long Pepper) – Enhances metabolism, relieves postpartum indigestion, and boosts immunity.
(B) Zingiber officinale (Ginger) – Acts as an anti-inflammatory, reduces postpartum pain, and supports lactation.
(C) Terminalia chebula (Myrobalan/Haritaki) – Aids digestion, detoxifies the body, and promotes tissue healing.
(D) Curcuma longa (Turmeric) – Speeds up wound healing, reduces inflammation, and strengthens the immune system**.**
(E) Withania somnifera (Ashwagandha) – Helps combat postpartum stress, fatigue, and hormonal imbalance.
(F) Emblica officinalis (Amla) – Rich in vitamin C, enhances iron absorption, and promotes overall rejuvenation**.**
(G) Tinospora cordifolia (Guduchi) – Strengthens immunity, detoxifies, and supports liver function.
(H) Cuminum cyminum (Cumin) – Aids digestion, relieves bloating, and improves lactation.
(I) Coriandrum sativum (Coriander) – Supports gut health, detoxification, and hormonal balance.
(J) Foeniculum vulgare (Fennel) – Enhances breast milk production and relieves postpartum digestive discomfort.
(K) Syzygium aromaticum (Clove) – Possesses antimicrobial properties, aids digestion, and relieves pain.
(L) Elettaria cardamomum (Cardamom) – Helps in digestion, detoxification, and respiratory health.
These medicinal plants, when combined in Kaayakam Lehyam, offer a holistic approach to postnatal care, promoting faster recovery, enhanced immunity, and overall well-being for new mothers.

Figure 3 Medicinal Plant Ingredients in Kaayakam Lehyam for Postpartum Recovery. This figure illustrates twelve key medicinal plants used in the formulation of Kaayakam Lehyam, a traditional polyherbal preparation designed to support postpartum recovery. The selected plant species exhibit a range of therapeutic properties, including digestive support, lactation enhancement, immune modulation, anti-inflammatory effects, hormonal balance, and tissue repair. Each plant is labeled (A–L) with its botanical identity and corresponding image. The integration of these medicinal plants in Kaayakam Lehyam aligns with Ayurvedic principles, providing a comprehensive approach to maternal health by addressing nutritional, physiological, and psychological well-being during the postnatal period.