

Review on the Explores the pharmacological potential of cinnamon bark Extract and plant profile of Ashwagandha root and licorice root powder for treatment on Insomnia

Vedika Vijay Gadge *, Reema Chandrakant Londhe, Vaishnavi Balasaheb Gugale, Swamini Balu Dukare, Shravani Dattatray Shitole and Vaishnavi Vikas Zaware

Samarth institute of Pharmacy, Belhe, Maharashtra, India.

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Abstract

This explores the pharmacological potential of cinnamon extract, Ashwagandha root powder, and licorice when used individually or in combination, particularly for treating and preventing insomnia, a condition marked by difficulty falling asleep, with licorice also acting as an immunity booster. When combined, cinnamon extract and Ashwagandha root powder exhibit synergistic pharmacological activity for treating and preventing insomnia, while licorice enhances immunity and further supports sleep through its hypnotic effects. Together, these herbs offer a multifaceted approach to improving sleep, metabolic health, and immune function, though further research is needed to fully elucidate their mechanisms and combined efficacy. Cinnamon bark extract, obtained via hot extraction from ground cinnamon bark powder containing cinnamaldehyde, is derived from four main varieties: **Cinnamomum verum**, **C. cassia**, **C. burmannii**, and **C. loureiroi**, each with distinct flavor profiles. As a nutraceutical, cinnamon exhibits health-promoting properties, including support for brain health, gut-friendly prebiotic functions, and cardiovascular benefits, particularly for hypertension. It reduces oxidative stress, inflammation, lipid metabolism issues, and vascular resistance. In rat studies (healthy controls, diabetic rats treated with probiotics, cinnamon extract, or both), cinnamon supplementation lowered blood glucose, cholesterol, and triglycerides. Ashwagandha (**Withania Somnifera**), a well-known adaptogenic herb, shows promise in alleviating stress, improving sleep quality, and enhancing physical performance. Clinical studies suggest benefits in muscular strength, power output, endurance, recovery, lean muscle gain, fat loss, reproductive health, anxiety reduction, metabolic function, and anti-aging, though its precise mechanisms remain under investigation.

Keywords: Cinnamon Extract; Cinnamonaldehyde; Ashwagandha Root Powder; *Withania Somnifera*; Licorice Root Powder; *Glycyrrhiza Glabra*; Insomnia

1. Introduction

Sleep is a temporary state of unconsciousness in which the brain responds less to external stimuli. During a sleep episode, the body cycles regularly between non-rapid eye movement (NREM) and rapid eye movement (REM) sleep. NREM sleep consists of four stages that form a continuum of increasing depth. A typical sleep period in adults starts with a short phase of the lightest stage, NREM stage 1, then progresses to stages 2, 3, and 4, with stage 4 being the deepest.

REM sleep, which follows NREM, is when the most intense dreams and body movements take place. Each full cycle repeats three to six times per night, with REM periods growing longer and NREM stages (especially the deeper ones) becoming shorter as the night progresses. Adequate sleep supports learning, memory consolidation, heart and

* Corresponding author: Vedika Vijay Gadge

metabolic health, and brain development. It also helps the body recover from daily activities and prepares it for optimal function during wakefulness.

The National Sleep Foundation advises healthy younger adults to get 7–9 hours of sleep nightly and older adults 7–8 hours. In general, total sleep time tends to decrease with age; one meta-analysis of 5,273 healthy individuals found an average reduction of nearly 10 minutes per decade of life.

There isn't a fixed amount of sleep everyone needs nightly. Most experts agree that if you wake up refreshed and function well throughout the day, your sleep has been sufficient. Insomnia disorder is defined by ongoing dissatisfaction with sleep quantity or quality. The DSM-5 describes it as a personal report of trouble initiating sleep, maintaining sleep, or waking too early occurring at least three nights per week for three months—and accompanied by daytime issues like fatigue, cognitive fog, or irritability.

The DSM-5 replaced the DSM-IV's categories of primary and secondary insomnia with a single "insomnia disorder" diagnosis, regardless of whether it's linked to other medical or mental health conditions. This shift recognizes insomnia as an independent condition.

Treatment usually combines medication and non-drug approaches. Common medications include benzodiazepine receptor agonists, sedating antidepressants, antihistamines with sedative effects, melatonin agonists, and dual orexin receptor antagonists. Many of these carry risks of side effects or dependence, so non-pharmacological options are typically recommended first. These include cognitive-behavioral therapy for insomnia (CBT-I), sleep hygiene education, psychotherapy, and relaxation methods. Insomnia, commonly known as sleeplessness, is a widespread condition that affects millions of people globally and harms both mental and physical health. Clinically, it involves trouble falling asleep, staying asleep, or both, along with daytime functional impairment. Diagnostic benchmarks include sleep onset taking over 30 minutes, wakefulness after falling asleep exceeding 30 minutes, sleep efficiency below 85%, or total sleep time under 6.5 hours.

Typical symptoms include fatigue, low energy, poor concentration, and increased irritability. Research spanning decades shows that insomnia arises from multiple interacting factors: genetic, cognitive, behavioral, physiological, biochemical, and environmental. These elements often trigger secondary problems, such as irregular heart rate, unstable body temperature, altered metabolism, and disrupted hormonal systems, including the hypothalamic-pituitary-adrenal (HPA) axis.

One study examined cinnamon extract as a potential insomnia treatment in sleep-deprived animals by measuring related hormones and neurotransmitters. The extract reduced norepinephrine while increasing serotonin and melatonin levels. These changes suggest cinnamon may help regulate brain chemistry and stabilize the HPA axis, supporting its potential as an anti-insomnia agent in animal models. Ashwagandha extract, noted in related contexts, is generally well-tolerated. A study showed that ashwagandha is safe for blood parameters and organ function, even at high doses of 6–10 grams of coarsely ground root taken as an aqueous extract. The exact way it promotes sleep remains unclear. Earlier research suggested it might work by boosting GABA activity, based on sleep-deprived rats. Most of ashwagandha's effects are linked to withanolides, its primary active compounds in roots and leaves. However, Kaushik and colleagues found that mice given a withanolide-rich ethanol extract had trouble falling asleep, indicating these compounds may not aid sleep. A later study identified triethylene glycol (TEG) in the water extract as the component that induces sleep in mice.

TEG extends NREM sleep and increases the number of NREM episodes while prolonging wake periods. Human studies on ashwagandha for insomnia are still limited.

Licorice (*Glycyrrhiza Glabra*), a widely used herbal remedy, has been studied for various biological effects. It shows potential neurological benefits, including antidepressant, anxiety-reducing, and anticonvulsant properties. Its sleep-promoting effects and underlying mechanisms, however, are not well established. In this study, an ethanol extract of licorice (GGE) increased non-rapid eye movement sleep in mice in a dose-dependent manner, enhanced pentobarbital-induced sleep, and did so without reducing delta wave activity.

The sleep-inducing effects and mechanisms of licorice (*Glycyrrhiza Glabra*, GG) and its active compounds remain unconfirmed. In this study, however, the ethanol extract of GG (GGE) increased non-rapid eye movement (NREM) sleep in mice without reducing delta wave activity and enhanced pentobarbital-induced sleep in a dose-dependent manner.

Flumazenil, a selective GABA(A)-benzodiazepine receptor antagonist similar in action to diazepam and zolpidem, completely blocked GGE's hypnotic effects. A flavonoid-rich fraction of GGE contained glabrol, the primary active flavonoid, which showed a binding affinity (K_i) of 1.63 μ M and inhibited [^{3} H] flumazenil binding to GABA(A)-BZD receptors in rat brain cortex membranes.

Analysis of molecular structure and pharmacophore modeling suggests that glabrol's isoprenyl groups are essential for its interaction with GABA(A)-BZD receptors. Like GGE, glabrol's sleep-promoting effects were fully reversed by flumazenil. Administered at doses of 5, 10, 25, and 50 mg/kg, glabrol reduced sleep latency and extended sleep duration in a dose-dependent way.

These results indicate that both GGE and its key flavonoid, glabrol, promote sleep through positive allosteric modulation of GABA(A)-benzodiazepine receptors.

2. Plant profile

2.1. Cinnamon bark

The cinnamon (*Cinnamomum Burmanii*) is a plant which are well known for spices for cooking in the Indonesian people for overcoming the various problem related to the heart, including to help overcome **Insomnia**. The cinnamaldehyde is the main compound to play a role in improving sleep quality in Insomnia and have ability to improve neurotransmitter in the case of Insomnia.

2.1.1. Background

Due to these variations and the common mix-up between cassia and true cinnamon, it is essential to select the appropriate type for culinary purposes. Although essential oils can be extracted from multiple parts of the cinnamon tree, modern cooking mainly utilizes bark harvested from its side branches. In kitchens, cinnamon is typically used either as a ground spice or, in industrial food production, as an essential oil for flavor enhancement. Outside of food, its warm aroma makes it a frequent ingredient in holiday potpourri and scented products like perfumes.

2.1.2. Taxonomical classification

Cinnamomum verum is commonly called as cinnamon,

- Kingdom: Plantae (plants)
- Clade: Tracheophytes
- Clade: Angiosperms
- Clade: Magnoliids
- Order: Laurales
- Family: Lauraceae
- Genus: *Cinnamomum*
- Species: **C. Zeylanicum**.

2.2. Physical Characteristics of the Cinnamon bark plant

The cinnamon tree is an evergreen plant with a woody trunk and simple, alternately arranged leaves. When young, the leaves are reddish in color, turning green as they mature. It produces small, greenish-yellow blossoms. The spice known as cinnamon is obtained from the plant's inner bark, which is peeled, dried, and rolled into characteristic "quills." In natural conditions, the tree can grow between 8 and 10 meters tall, though it is commonly pruned or coppiced in cultivation to maintain a shorter, bush-like form.

2.3. Organoleptic Properties

- Color: Yellowish – brown to reddish – brown
- Aroma: Fragrant And Spicy
- Flavor: Sweet, Pungent, and slightly astringent
- Texture: Brittle, fibrous and Tubular pieces.

2.3.1. Synonym

Indian Language

- Marathi: Dalchini
- Hindi: Daruchini
- Sanskrit: Tvak, Darusita
- Kannada: Lavanga Chakke
- Tamil: Lavangapattai, Karuvapattai
- Telugu: Lavangama
- Bengali: Daruchini
- Malayalam: Ilavarngathely
- Gujarati: Taj

2.4. History of *Cinnamomum verum*

Among the earliest recognized spices was cinnamon. China supplied the majority of the world's cinnamon during the time of ancient Egypt. The Romans did not use cinnamon as a cooking spice, but they burnt it at funerals because they considered its scent to be sacred. Cinnamon became a popular taste in many banquet dishes throughout medieval Europe. Additionally, it was thought to be an aphrodisiac, digestive aid, appetite stimulant, and remedy for sore throats and coughs. Some claim that cinnamon indirectly contributed to the discovery of America because it was one of the first spices sought by European explorers in the fifteenth century. The Dutch and Portuguese engaged in bloody warfare to dominate Ceylon's (now Sri Lanka) cinnamon plantations between the sixteenth and eighteenth centuries.

2.5. Traditional medicine

Cinnamon has been used in traditional and herbal medicine for a very long time. It may improve blood flow in the uterus and encourage tissue regeneration because it has been shown to be a coagulant. There have also been reports of antibacterial, antifungal, antioxidant, and antidiabetic qualities in the essential oils and other components of cinnamon. In addition to these qualities, traditional use indicates that cinnamon may have insecticidal, anti-inflammatory, and anticancer potential. Long-term usage of coumarin, a fragrant chemical component that is present in trace amounts in true cinnamon but in much higher proportions in cassia cinnamon, is typically discouraged, especially for people who already have liver problems.

2.6. Chemical constituents

The essential oil extracted from the bark of *Cinnamomum zeylanicum* was investigated for its phytochemical composition as well as its antibacterial, antioxidant, and antiproliferative properties. Analysis using gas chromatography-mass spectrometry (GC-MS) identified (E)-cinnamaldehyde (71.50%), linalool (7.00%), β -caryophyllene (6.40%), eucalyptol (5.40%), and eugenol (4.60%) as the predominant constituents. The abundance of phenolic and other bioactive compounds was found to contribute significantly to the oil's potent antioxidant effect, particularly its ability to neutralize free radicals and prevent β -carotene oxidation. In terms of antimicrobial potential, the essential oil demonstrated strong inhibitory activity against Gram-positive bacterial strains such as *Listeria innocua*, *Staphylococcus aureus*, and *Bacillus cereus*, whereas Gram-negative species including *Salmonella typhi*, *Pseudomonas aeruginosa*, and *Escherichia coli* were less affected. Furthermore, scanning electron microscopy (SEM) analysis revealed distinct structural deformations in *L. innocua* and *E. coli* cells following treatment with the *C. zeylanicum* essential oil.

3. Extraction method of cinnamon and Bioactive compounds

3.1. Hot extraction method

Take 10 gm of cinnamon bark total dried powdered soak in the 150 ml water and boiled for 2 h and, then filtered it. Filtrate dried by heating the overnight at 80 °C in an oven. Then we get the cinnamon water extract concentration from *C. zeylanicum*, in that extract the cinnamaldehyde, cinnamic acid, and eugenol are present.

3.2. Ashwagandha root

In traditional Indian Ayurveda, ashwagandha, formally known as *Withania Somnifera* Dunal, is a revered plant that grows throughout India and South Asia. It belongs to the Solanaceae family. Ashwagandha has been used as an adaptogen and "Rasayana" in Ayurveda for generations. Numerous investigations have been carried out on

ashwagandha root extracts. The neuroprotective, anti-inflammatory, and chondroprotective properties of ashwagandha root extracts have been shown in in vitro experiments. Ashwagandha root extracts have been shown to have cardio-protective and neuroprotective benefits in animal model experiments. Clinical research under a variety of situations indicates that ashwagandha root extract helps manage and lessen stress and anxiety, and it enhances memory and cognition in both bipolar disorder patients and healthy persons.

3.2.1. *Oraganoleptic properties of Ashwagandha root*

- Color: Buff or creamy color
- Texture: A smooth, fine powder,
- Odour: Characteristic
- Taste: bitter

3.2.2. *Taxonomical classification of Ashwagandha:*

- Kingdom: Plantae (plants)
- Sub-divison: Tracheobionta (vascular plants)
- Super Vision: Spermatophyta (seed plants)
- Division: Angiosperma
- Class: Dicotyledons
- Order: Tubiflorae
- Family: Solanaceae
- Genus: Withania
- Species: Somnifera Dunal

3.3. History of *Withania Somnifera*

Its usage in traditional Indian medicine has been around for around 3,000 years. People have utilised its root as a stimulant, anthelmintic, diuretic, tonic, narcotic, and aphrodisiac. Although it is indigenous to India, it is also grown in regions including the Mediterranean, the Himalayas, Africa, the Canary Islands, the Cape of Good Hope, and Australia. Interest in Ashwagandha's possible health advantages has grown in recent years, especially in relation to stress reduction, mental clarity, and athletic performance. Numerous research have indicated that ashwagandha supplements may have anti-inflammatory, immunomodulatory, and antibacterial qualities in addition to neuroprotective action and potential benefits for obsessive-compulsive disorder. Ashwagandha may also aid in the treatment of cancer, diabetes, and infertility, according to some research.[25].

3.4. Traditional medicine

Ashwagandha is categorised as an adaptogen, which is a class of medicines that help the body cope with stress. Its withanolide-containing molecules are thought to play a major role in its therapeutic benefits. Ashwagandha has been used for centuries in Ayurvedic medicine to keep the body in balance, but it is currently being studied for its ability to treat a wide range of illnesses. Shwagandha for Anxiety Reduction and Stress Management Ashwagandha's capacity to reduce stress and anxiety is among its most well-known advantages. Stress levels are frequently elevated as a result of modern life's quick pace. Ashwagandha is believed to control the body's stress response by lowering cortisol production, which is referred to as the "stress bormone."

Indian traditional medicine, including Ayurveda, Siddha, and Unani, has a lengthy history. A popular Rasayana herb, ashwagandha (WS) is one of the most common Indian herbs used in Ayurvedic medicine. For reviving the reproductive system, bone marrow, and nerves, it is very well-liked. During the Samhita period, the Indian Traditional Ayurvedic System of Medicine elaborated on the use of ashwagandha in the treatment of tumours, heart illnesses, ulcers, rheumatic pain, arthritis, and inflammation of the joints, nerve disorders, and epilepsy. The species' roots are useful, as are its powder and paste. The ground leaves of WS are used to relieve pubic pain, inflammation, and external pain.

3.5. Chemical constituents

Alkaloids (isopelletierine, anaferine, cuseohygrine, anahygrine, etc.), steroidal lactones (withanolides, withaferins), and saponins are among the chemical components of *Withania Somnifera* (WS) that are biologically active. Ashwagandha contains acylsterylglucosides and sitoindosides, which have anti-stress properties. It has been demonstrated that ashwagandha's active ingredients, such as the sitoindosides VII-X and Withaferin-A, exhibit strong anti-stress properties against acute models of experimental stress. Although WS contains a wide variety of phytochemicals, its main bioactive phytoconstituents include phenolics, alkaloids, flavonoids, sterols, withanolides (steroidal lactones), and

withanositides. Withanolides are a chemical class of naturally occurring steroidal lactones that have an ergostane structure and are classified as polyoxygenated steroids. As the primary chemical constituents of WS, withanolides normally contain oxygen atoms at locations C-1, C-22, and C-26.

3.6. Licorice root

This study explores the sleep-promoting effects of licorice root extract and its main compound, glycyrrhizin (GCZ), in insomnia. The research focuses on how these agents may improve sleep by influencing key neurotransmitters, namely GABA and serotonin.

Licorice is obtained from the dried roots and rhizomes of three legume species: *Glycyrrhiza uralensis* Fisch., *Glycyrrhiza inflata* Bat., and *Glycyrrhiza Glabra* L. In traditional medicine, it is used to strengthen the body, enhance energy flow, ease muscle tension, reduce pain, clear internal heat, eliminate toxins, suppress cough, and balance the effects of other herbs.

Modern studies confirm that licorice exhibits antioxidant, anti-inflammatory, and mood-stabilizing properties. Building on these findings, the current work examines its potential role in promoting sleep through the regulation of GABA and serotonin systems.

3.6.1. Taxonomical classification

- Kingdom: Plantae (plants)
- Division: Angiosperms (Flowering Plants)
- Phylum: Tracheophyta
- Class: Mangoliopsida
- Order: Fabales
- Family: Fabaceae
- Genus: Glycyrrhiza
- Species: *Glycyrrhiza Glabra*

3.7. History of Licorice Root

Licorice, mainly from the species *Glycyrrhiza Glabra* L. (family Leguminosae), has served as a medicinal plant throughout recorded history. Its therapeutic use spans numerous cultures and eras, with some of the earliest documented applications appearing in ancient Assyrian, Egyptian, Chinese, and Indian medical practices. In Europe, the initial written references to licorice as a medicine trace back to Greek texts. The botanist and pharmacologist Theophrastus—successor to Plato and Aristotle—suggested that Greek understanding of licorice’s healing properties likely originated with the Scythians, a nomadic people who lived north and east of Greece in the area now known as Ukraine, between the Black Sea and the Caspian Sea.[20] Licorice is cultivated as a perennial plant in regions of the Middle East, Asia, and Europe. Its root is commonly used to flavor candies, tobacco products, and various foods.

In the United States, however, many products labeled as "licorice" do not contain actual licorice root. Instead, they often rely on anise oil, which mimics the distinctive taste and aroma of licorice.

For thousands of years, licorice root has been employed in traditional medicine across diverse cultures, including Assyrian, Egyptian, Greek, Arab, Chinese, Tibetan, and Indian societies. It has been used to support respiratory health, alleviate cough and asthma, aid liver and arterial function, and promote wound healing. [21] [22].

3.8. Traditional medicinal use

Licorice has a long history of medicinal use for treating numerous conditions, such as rheumatism, skin disorders, acidity, leucorrhea, bleeding disorders, jaundice, cough, stomach ulcers, heartburn, colic, inflammation, asthma, tonsillitis, sore throat, excessive thirst, flatulence, epilepsy, fever, sexual weakness, and paralysis.

Due to its ability to inhibit monoamine oxidase (MAO), it has also been applied as an insecticide, laxative, anti-inflammatory, anti-ulcer, antimicrobial, anti-arthritis, antiviral, memory enhancer, cholesterol-lowering, cough suppressant, anticholinergic, antifungal, estrogen-like, antioxidant, anticancer, and diuretic agent.

Beyond medicine, licorice is widely used in the food and beverage industry for flavoring candies, soft drinks, and alcoholic beverages, as well as in tobacco products.

3.9. Chemical Constituents

Secondary metabolites, including alkaloids, glycosides, flavonoids, phenolics, saponins, tannins, terpenes, anthraquinones, essential oils, and steroids, along with their derivatives, serve as the primary sources of bioactive compounds. Licorice extract contains sugars, starches, tannins, essential oils, resins, bitters, and inorganic salts, as well as small amounts of nitrogenous components such as proteins, amino acids, and nucleic acids. According to Scientists, Zhang and Ye, more than 400 compounds have been isolated from various *Glycyrrhiza* species, among which flavonoids and triterpene saponins are the dominant bioactive constituents. Over 300 flavonoids have been identified across different species of *Glycyrrhiza*, with the most common subclasses including flavanones, chalcones, isoflavanes, isoflavones, flavones, and isoflavones.[26] [27].

4. Result

Studies on *Cinnamomum verum*, *Withania Somnifera*, and *Glycyrrhiza Glabra* demonstrate that these medicinal plants possess significant pharmacological potential for improving sleep quality, managing insomnia, and supporting overall health.

Cinnamon extract (rich in cinnamaldehyde, cinnamic acid, and eugenol) exhibited strong antioxidant, anti-inflammatory, and neuroprotective activities. Experimental models showed that it reduces norepinephrine and increases serotonin and melatonin levels—neurotransmitters crucial for sleep regulation. It also improved metabolic parameters such as blood glucose, cholesterol, and triglyceride levels, indicating benefits beyond sleep, including cardiovascular and metabolic health.

Ashwagandha root powder (*Withania Somnifera*) showed potent adaptogenic and stress-relieving properties. Clinical and preclinical evidence indicates it enhances sleep quality, reduces cortisol levels, and improves resilience to stress. The active components particularly triethylene glycol (TEG) and withanolides play key roles in promoting non-rapid eye movement (NREM) sleep, neuroprotection, and overall vitality

Licorice root extract (*Glycyrrhiza Glabra*) demonstrated hypnotic and anxiolytic properties through modulation of the GABA(A)-benzodiazepine receptor complex. Its active compound, glabrol, significantly increased NREM sleep and reduced sleep latency in mice in a dose-dependent manner. These effects were fully reversed by flumazenil, confirming GABAergic pathway involvement. Additionally, licorice offers antioxidant and immune-boosting effects, contributing to overall homeostasis and recovery.

When combined, cinnamon and ashwagandha showed synergistic activity in improving sleep quality and regulating neurotransmitters involved in sleep-wake balance. The addition of licorice further enhanced this combination by supporting immune function and reinforcing hypnotic effects via GABAergic modulation.

5. Conclusion

The combined use of cinnamon extract, ashwagandha root powder, and licorice root extract presents a promising multifunctional approach to managing and preventing insomnia.

- Cinnamon primarily contributes neurochemical balance and metabolic stability.
- Ashwagandha acts as an adaptogen, alleviating stress and promoting restorative sleep.
- Licorice enhances immune function and induces sleep through GABA receptor modulation.

Together, these herbs demonstrate complementary pharmacological actions antioxidant, adaptogenic, neuroprotective, and hypnotic that may holistically improve sleep quality, stress resilience, and systemic health.

However, despite strong experimental and preliminary clinical evidence, further research particularly controlled human trials is needed to confirm their combined efficacy, safety profile, optimal dosing, and precise molecular mechanisms.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

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