Exploring the Therapeutic Potential and Novel Properties of *Angelica sinensis* in Medicine

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ABSTRACT

Introduction: Angelica sinensis, known as Dong Quai or "female ginseng," is an integral part of Traditional Chinese Medicine (TCM), utilized for its wide range of therapeutic effects, particularly in women's health. This review aligns traditional uses with scientific research to expand the understanding of Angelica sinensis, fostering its integration into modern pharmacological applications.

Objective: To thoroughly examine the pharmacological properties and clinical potentials of Angelica sinensis, this paper aims to set a clear direction for future research and practical uses. The objective is to outline how Angelica sinensis can enhance TCM's role in contemporary healthcare, promoting further exploration and integration of this herb.

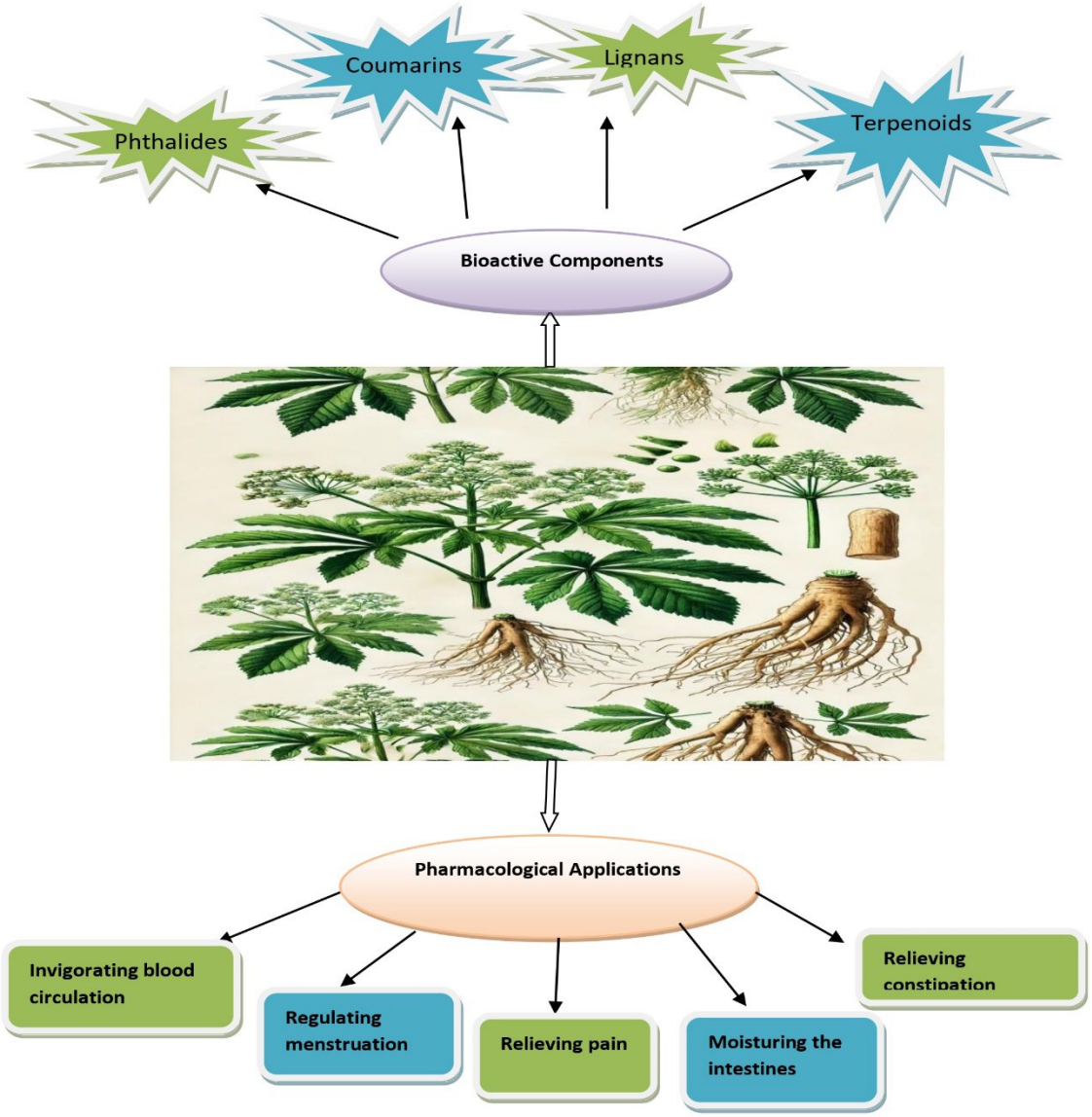
Methods: This systematic review scoured through key databases like PubMed, ScienceDirect, and Google Scholar. Keywords used included "Angelica sinensis," "therapeutic potential," and "modern applications in TCM." Studies were selected based on their relevance to pharmacological insights, clinical results, and novel applications of Angelica sinensis, focusing on those that provided substantial evidence of its health benefits.

Results: The herb demonstrates significant anti-inflammatory, antioxidant, and neuroprotective properties, primarily due to compounds such as ligustilide and ferulic acid. It has shown efficacy in traditional settings for treating gynecological disorders, with modern research supporting its broader application in treating cardiovascular diseases and potential anti-cancer properties. These results highlight the need for further in-depth studies to validate these benefits and explore new therapeutic areas.

Conclusion: Angelica sinensis holds considerable promise in modern medical applications, enhancing the interface between traditional practices and contemporary medical research. This review suggests that ongoing and future pharmacological studies are essential to fully leverage the therapeutic potential of Angelica sinensis. It calls for advanced clinical trials and pharmacokinetic studies aimed at establishing robust, standardized protocols for its use, ensuring it becomes a fundamental part of integrated healthcare solutions in the future.

Keywords: Angelica sinensis, Traditional Chinese Medicine (TCM), Phytochemical Composition, Gynaecological Health, Medicinal Properties, Modern Healthcare Applications.

Graphical Abstract:



1. Introduction

Angelica sinensis (AS), known as Dong Quai or female ginseng, is an important herb in Traditional Chinese Medicine (TCM). It has a great history of being used to improve the health and well-being of women. The plant is native to highland areas of China, Korea, and Japan, coming under the family Apiaceae. The plant has a peculiar smell, which provides unique health benefits (Table 1) [1]. Angelica sinensis has found application in the practice of Traditional Chinese Medicine for hundreds of years, mainly to restore balance in the menstrual cycle, alleviate pains associated with it, and enhance blood flow [2]. Besides gynecological applications, a plant is also used as a tonic for overall health and improvement in heart strength, immune function, and vigor. The whole plant is used in traditional medicine even to its roots since each part contributes to the work of the medicine [3]. Recent scientific studies have confirmed many of these traditional uses, including anti-inflammatory, immunomodulatory,

and antioxidant activities. The herb is known to possess numerous pharmacological effects based on the presence of different phytochemicals within it, such as polysaccharides, flavonoids, and essential oils. The important properties found due to which it is said to possess these effects are anti-inflammatory, antioxidant, and immune-modulating in nature [4]. Angelica sinensis maintains the balance of qi and blood within the body, which is very important for a person to stay healthy and not to become ill. It is combined with the other TCM components, to act better as medicine and help in the cure of some health problems [5]. The fact that it is used in TCM shows how historical knowledge and modern science knowledge can work together. This shows how important it is in both old and new health practices. This study explores the medical potential of Angelica sinensis in the context of Traditional Chinese Medicine. Attention is focused on the traditional uses, phytochemical makeup, pharmacological actions, and ways to treat different health problems using principles of Traditional Chinese Medicine. Within our discussion, we will also talk about the pros and cons of using Angelica sinensis in modern therapy, such as problems of quality control, standards, and culture change [6]. The main objective of this study is to provide a complete picture of how Angelica sinensis could enhance the growing part of TCM in overall health care and set more research and practical uses in the future *Angelica sinensis* includes a number of phytoconstituents belonging to diverse chemical classes, including phthalides, organic acids and their esters, and polysaccharides. The numerous phytoconstituents recovered from Angelica sinensis, which have varied bioactive effects, are represented in (Fig. 2).

Table 1: Taxonomy of *Angelica sinensis*

Synonyms	*Angelica sinensis* (Oliv.) Diels Angelica dahurica (Fisch.) Benth. & Hook. f. ex Franch. & Sav.	[8] [9]
Vernacular Names	English: Dong Quai, Female Ginseng Chinese: 当归 (Dāng Guī) Japanese: 当帰 (Tōki) Korean: 당귀 (Danggui) Vietnamese: Đương quy	
Species	*Angelica sinensis* (Oliv.) Diels *Angelica archangelica* L. *Angelica gigas* Nakai *Angelica pubescens* (Wall.) Lag. *Angelica root* (as a general term for roots of various Angelica species used in TCM)	[10]

2. Methodology

Angelica sinensis (Oliv.) Diels was the subject of an extensive literature search that made use of Google Scholar, Scopus, PubMed, and Internet of Science. To make sure the results were relevant and up-to-date, we only looked at publications published between 2000 and 2023. The search includes keywords such as "*Angelica sinensis* and phytochemistry," "*Angelica sinensis* and pharmacological properties," "*Angelica sinensis* and gynecological health," "Angelica sinensis and anti-inflammatory effects," along with "Angelica sinensis and antioxidant

activity." As a result of this search, 320 articles were located. The evaluation process began with the selection of 90 papers based on inclusion and exclusion criteria. Studies addressing the traditional applications, phytochemical composition, and pharmacological effects of Angelica sinensis were given priority throughout the selection process. All attempts were made to include research publications, review papers, and clinical trials that offered thorough understanding of the traditional and present uses of Angelica sinensis as a medicinal herb.

3. Morphology of Angelica sinensis

Angelica sinensis (Oliv.) Diels, commonly known as Dong Quai, is a perennial herbaceous plant renowned for its medicinal properties. It is native to the high-altitude regions of China, Korea, and Japan and is adapted to temperate climates (Table 2) (Fig. 1) [11].

Stem: The plant features a hollow, smooth stem that is typically green to reddish in color. The stem can reach a height of 1–1.5 meters and is often branched, supporting the large, compound leaves.

Branches: The branches are coarse and grow in a rosette pattern. They are covered with a fine, hairy texture and support the plant's large, divided leaves. The branching pattern is usually sympodial, giving the plant a bushy appearance.

Leaf: The leaves of *Angelica sinensis* are large, compound, and highly divided, generally featuring 3–4 pinnate leaflets. They are dark green and can reach up to 30 cm in length, with each leaflet being lanceolate to ovate in shape. The leaflets are serrated along the edges.

Flower: The plant produces umbels of small, white to yellowish-green flowers. These flowers are arranged in large, terminal umbels that can span up to 20 cm in diameter. Each flower has a characteristic five-petaled structure and is fragrant, attracting pollinators.

Fruit: The fruit of *Angelica sinensis* is a dry, schizocarp that splits into two mericarps. The fruits are small, oval-shaped, and are typically brown or beige when mature. They are covered with fine ridges and are about 4–6 mm in length.

Root: The most valuable part of the plant is its root, which is thick, tuberous, and cylindrical. It can reach a length of 30–40 cm and is covered with a thin, brownish skin. The root is aromatic and contains the majority of the plant's active phytochemicals [12].

Fig. 1. *Angelica sinensis* leaf, root and flowers [55]

Table 2: Taxonomical Classification

Binomial Name	*Angelica sinensis* (Oliv.) Diels
Kingdom	Plantae
Order	Apiales
Family	Apiaceae
Genus	Angelica

4. Phytomedical and Nutraceutical Applications of Angelica Sinensis

Chinese medicine has traditionally utilized *Angelica sinensis*, sometimes referred to as Dong Quai or "female ginseng," for its wide range of medicinal benefits, especially with regard to gynecological health. This herb is well known for improving fertility, managing menstruation problems, and easing menopausal symptoms. Pharmacological benefits of Angelica sinensis include hepatoprotective, anti-inflammatory, antioxidant, and immunomodulatory actions. The root's many health advantages are attributed to the presence of bioactive substances such phthalides, polysaccharides, ferulic acid, and essential oils. It has been shown that these substances enhance blood circulation, boost immunity, and control hormone levels. Additionally, current studies are focused on identifying certain active components in Angelica sinensis in order to create innovative remedies for a range of illnesses, such as cancer, cognitive decline, and cardiovascular ailments [13]. With potential benefits that go beyond its traditional usage, the plant's medicinal adaptability has won it a considerable position in both traditional and contemporary medicine. *Angelica sinensis* has also shown promise in the protection against high-altitude hypoxia, which is linked to its ability to improve blood circulation and enhance oxygen utilization in the body. In clinical studies, it has been found to support cognitive function and memory, and may have potential applications in the management of neurodegenerative conditions such as Alzheimer’s disease [14]. Ongoing research focuses on isolating and characterizing the active chemical constituents of *Angelica sinensis*, including ferulic acid, ligustilide, and various polysaccharides. These components are being studied for

their efficacy in treating a range of conditions and developing therapeutic interventions [15]. The herb's broad spectrum of medicinal uses and the beneficial properties of its phytochemical constituents contribute to its reputation as a valuable and versatile therapeutic agent.

Table 3: Clinical and Preclinical Findings of Angelica sinensis

Study	AIM	Findings	Reference
Clinical	Anti-menopausal Symptoms	In a double-blind, placebo-controlled study, *Angelica sinensis* significantly alleviated menopausal symptoms including hot flashes, mood swings, and sleep disturbances in postmenopausal women.	[21]
Clinical	Anti-diabetic Effects	Clinical trials demonstrated that *Angelica sinensis* supplementation led to improved fasting blood glucose levels and enhanced insulin sensitivity in patients with type 2 diabetes.	[22]
Clinical	Cardiovascular Benefits	Supplementation with *Angelica sinensis* showed improvements in cardiovascular risk factors, such as reduced blood pressure and improved lipid profiles in patients with hypertension and hyperlipidemia.	[23]
Clinical	Immune System Modulation	Enhanced immune responses were observed, with increased lymphocyte proliferation and higher levels of immunoglobulins in patients taking *Angelica sinensis* extract.	[24]
Clinical	Gynecological Health	*Angelica sinensis* was shown to improve symptoms of dysmenorrhea and irregular menstruation in clinical studies, with effects attributed to its influence on hormonal balance and uterine health.	[25]
Clinical	Cognitive Function	*Angelica sinensis* supplementation led to improvements in cognitive function and memory in elderly patients, suggesting potential benefits for neurodegenerative diseases.	[26]
Clinical	Menstrual Health and Fertility	Clinical research indicated that *Angelica sinensis* may improve menstrual regularity and enhance fertility outcomes by balancing hormones and improving uterine health.	[27]

Preclinical	Anti-inflammatory Activity	*Angelica sinensis* root extract significantly reduced markers of inflammation such as TNF-α and IL-6 in rodent models, demonstrating its potent anti-inflammatory effects.	[16]
Preclinical	Antioxidant Activity	The root extract exhibited high antioxidant activity by increasing the activity of endogenous antioxidant enzymes like SOD and catalase, and decreasing oxidative stress markers.	[17]
Preclinical	Hepatoprotective Effects	Administration of *Angelica sinensis* extracts effectively protected against liver damage induced by CCl4 and acetaminophen in animal models, showing its hepatoprotective properties.	[18]
Preclinical	Anti-cancer Effects	Extracts of *Angelica sinensis* demonstrated anticancer effects in vitro by inducing apoptosis and inhibiting proliferation in cancer cell lines, such as breast and lung cancer cells.	[19]
Preclinical	Analgesic Activity	*Angelica sinensis* exhibited significant analgesic effects in pain models, such as the formalin test and tail-flick test, indicating its potential as a natural pain reliever.	[20]

4.1 Activity against Inflammation

Inflammation is the root cause of many long-term ailments, including arthritis, heart disease, and metabolic disorders. Angelica sinensis possesses potent anti-inflammatory qualities, which are mostly attributable to its beneficial compounds, such as ferulic acid and ligustilide. It has been shown that these compounds inhibit the generation of cytokines that induce inflammation, including IL-6, TNF-α, and IL-1β [28]. Angelica sinensis lowers inflammation by inhibiting the NF-κB signalling pathway. This route is critical for regulating immunity and inflammatory responses. Angelica sinensis inhibits NF-κB, resulting in decreased levels of COX-2 and iNOS, which are enzymes that contribute to the production of inflammation-causing chemicals. Because of these advantages, Angelica sinensis may be effective in treating inflammatory diseases such as rheumatoid arthritis, inflammatory bowel disease, and other autoimmune disorders [29].

4.2 Activity as an Antioxidant

Oxidative stress occurs when the body's antioxidant defences are ineffective, resulting in the generation of reactive oxygen species. This may cause a variety of conditions, including neurological issues, cardiovascular diseases, and cancer. It has been shown that Angelica sinensis contains potent antioxidants that may help lessen reactive stress and the harm it causes [30]. *Angelica sinensis* is a potent antioxidant due to its high ferulic acid and carbohydrate content. These molecules eliminate free radicals, preventing lipid breakdown and protecting cell membranes from oxidative stress. Furthermore, Angelica sinensis increases the activity of natural antioxidant enzymes such as superoxide dismutase (SOD) and glutathione peroxidase

(GSH-Px), which are critical for removing ROS [31]. Animal studies have shown that *Angelica sinensis* may reduce oxidative damage in the liver, brain, and heart cells. This shows that it might protect against illnesses caused by oxidative stress. These antioxidant actions also contribute to its neuroprotective and cardioprotective properties, which we shall discuss in further detail below [32].

4.3 Influence on the Immune System

The immune system is critical for keeping healthy and combating illnesses and infections. Angelica sinensis has long been used to enhance the immune system, and recent research confirms that it does so. Researchers discovered that the plant can affect both innate and adaptive immune responses. This implies it can assist with a variety of immune-related disorders [33]. Researchers discovered that polysaccharides from Angelica sinensis may improve macrophage function, which plays a vital role in the normal immune response. Interferon-gamma (IFN-γ) and interleukin-2 (IL-2) are immune-stimulating cytokines that produce more of these sugars. They strengthen the body's defences against diseases and tumours. Angelica sinensis also promotes lymphocyte proliferation, which is a crucial aspect of the adaptive immune response [34]. Researchers also discovered that Angelica sinensis may alter the proportion of T helper 1 (Th1) and T helper 2 (Th2) cells. These cells play a critical role in regulating the immune system. This balance is especially crucial in autoimmune illnesses and allergy disorders because a mismatch may lead the immune system to respond in an unhealthy manner. By restoring this equilibrium, Angelica sinensis may benefit persons suffering from asthma, allergic rhinitis, and autoimmune illnesses such as multiple sclerosis [35].

4.4 Activities to Protect Neurones

Alzheimer's disease, Parkinson's disease, and stroke are all neurodegenerative disorders in which neurones die and cease to function correctly over time. Angelica sinensis has been demonstrated to have neuroprotective properties, suggesting that it may be utilised to treat certain illnesses [36]. One of the primary therapeutic components of Angelica sinensis, liggustilide, has been demonstrated to pass the blood-brain barrier and protect the brain and spinal cord. Several studies have shown that ligustilide reduces oxidative stress and neuronal apoptosis, two major causes of neurodegeneration. Furthermore, ligustilide suppresses pro-inflammatory hormone levels and inhibits the function of microglia, which are brain-based defence cells [37]. In animal models of ischaemic stroke, Angelica sinensis was demonstrated to enhance cerebral blood flow and reduce infarct size. This implies that it may be utilised to cure strokes. Angelica sinensis may also boost memory and brain function, making it a promising candidate for Alzheimer's disease prevention and treatment [38].

4.5 Good for the Heart

Heart disease and stroke are the leading causes of mortality across the globe, and Angelica sinensis has long been used to treat heart issues. Modern research has shown that it functions in this region, indicating its potential as a heart-protective drug [39]. Herb *Angelica sinensis* possesses vasodilatory properties that help decrease blood pressure and improve blood circulation. It expands blood arteries by preventing calcium from entering vascular smooth

muscle cells while boosting nitric oxide (NO) production, which relaxes blood vessels. These advantages result in improved blood flow and reduced blood pressure, which are critical for avoiding and treating heart disease [40]. Angelica sinensis has also been demonstrated to inhibit platelet adhesion, a critical component of clotting that may lead to heart attacks and strokes. Angelica sinensis prevents platelets from adhering together, reducing the incidence of thrombotic events [41]. Also protecting the heart, Angelica sinensis reduces cardiac ischemia-reperfusion damage, which occurs when the heart receives blood after a period of ischaemia, or lack of oxygen. The plant achieves this because it has anti-inflammatory and antioxidant properties that protect cells and improve cardiac function [42].

4.6 Activity Against Cancer

In recent years, Angelica sinensis' capacity to combat cancer has received a lot of attention. Studies have revealed that Angelica sinensis may prevent cancer cells from spreading and developing in a variety of ways [43]. One of the primary ways Angelica sinensis fights cancer is by inducing apoptosis, or "programmed cell death." This is induced by the activation of proteins that aid in cell death and the inhibition of proteins that prevent cell death. This destroys cancer cells while leaving healthy cells alone [44]. *Angelica sinensis* has also been proven to inhibit cancer angiogenesis, the process of creating new blood vessels to feed tumours. This prevents tumours from developing. Aside from that, the herb alters key signalling pathways such as the PI3K/Akt and MAPK pathways, which aid in cell survival, growth, and death [45]. Angelica sinensis has been demonstrated to be successful in preclinical studies for breast cancer, liver cancer, and leukaemia, among others. Based on these findings, Angelica sinensis may be effective as an adjunct treatment for cancer, particularly when combined with conventional chemotherapy or radiation therapy [46].

4.7 Effects on Haematopoiesis

Angelica sinensis has long been used in traditional Chinese medicine to "feed the blood" and alleviate anaemia. Modern pharmacological testing has shown that it has haematopoietic properties, indicating that it might be effective in treating haematological illnesses [47]. Angelica sinensis increases the release of erythropoietin (EPO), a hormone that regulates red blood cell formation. This finding is particularly beneficial for patients who do not have enough red blood cells, such as those with anaemia [48]. Furthermore, Angelica sinensis has been demonstrated to promote the formation and development of haematopoietic stem cells, which are responsible for producing all kinds of blood cells. This makes Angelica sinensis an excellent candidate for treating myelosuppression, a common adverse effect of therapy that causes the bone marrow to operate less and produce fewer blood cells [49].

4.8 Effects on Genital-related Problems

Angelica sinensis is often used in traditional Chinese medicine to address uterine issues. This is why it is sometimes referred to as "female ginseng." For hundreds of years, women have used this herb to regulate their menstrual cycles, relieve period discomfort (dysmenorrhea), and cure menopausal symptoms. Modern pharmacological research has improved our understanding of how these systems function [50]. Angelica sinensis contains phytoestrogens, which are plant-derived compounds that act similarly to oestrogen in the body. These

phytoestrogens may bind to oestrogen receptors and assist women in regulating their hormone levels, particularly during menopause. This oestrogenic exercise relieves menopausal symptoms such as hot flashes, mood swings, and dry vaginal regions [51]. It has been shown that Angelica sinensis may alter the levels of prostaglandins, which are fatty molecules that function as hormones and are associated with menstruation disorders. Angelica sinensis may help alleviate menstrual cramps and other period-related issues by reducing the levels of prostaglandins, particularly those that induce pain and inflammation [52]. Angelica sinensis is also frequently used to enhance blood flow and nourish the blood, which may explain why it works so well for treating illnesses like amenorrhoea (no periods) and anaemia caused by heavy periods. Another reason the plant is utilised in gynaecology is that it helps increase uterine health and function [53]. There have also been clinical trials investigating how Angelica sinensis impacts gynaecological issues. For example, the plant has been combined with other herbs to create Danggui Shaoyao San, which has been demonstrated to help cure dysmenorrhea and other menstrual issues. Angelica sinensis is also often found in postpartum healing formulations, which assist women in regaining their health and balance after giving birth [54].

6. Conclusion

Angelica sinensis (AS), often known as Dong Quai or Female Ginseng, has a high therapeutic potential and various pharmacological qualities, according to a thorough study in Traditional Chinese Medicine (TCM). This herb, which is native to China, Korea, and Japan, is well-known for its effectiveness in gynaecological health, as well as a variety of other medical properties such as anti-inflammatory, antioxidant, and immunomodulatory actions. The comprehensive phytochemical profile of AS, which is high in polysaccharides, flavonoids, and essential oils, contributes to its many health advantages. Despite the encouraging preclinical and clinical results, additional rigorous and extensive clinical studies are required to develop standardised doses and quality control procedures, as well as to properly integrate its usage into modern medicine. The combination of traditional knowledge and current scientific methodologies has the potential to make Angelica sinensis a cornerstone in both preventive and therapeutic health initiatives, expanding its use in modern pharmacopoeia. This study advocates for a coordinated research effort to bridge the gap between traditional applications and scientific confirmation, therefore assuring Angelica sinensis' position in promoting herbal

medicine and improving healthcare outcomes throughout the world.

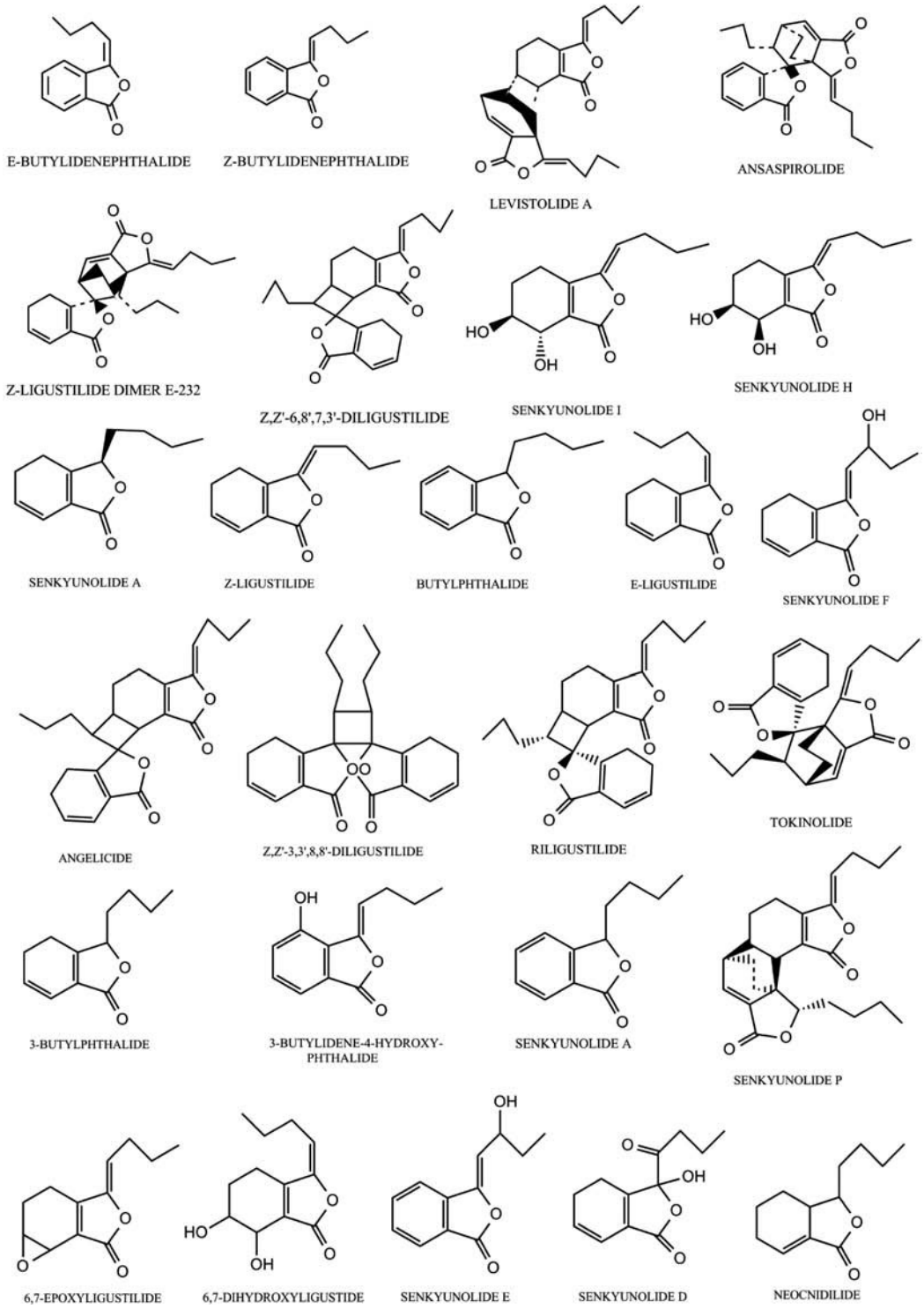


Fig. 2. Chemical structures of the identified Phytoconstituents present in *Angelica sinensis* [55]

Credit authorship contribution

Dr. Ravindra Chandrakant- Give outline, Shubham Singh: Writing – Review & editing, Validation, Formal analysis. Sanjesh Rathi: Writing original draft, Supervision, Methodology, Data curation, Sakshi Singh: Visualization, Validation, and Supervision.

Declaration of competing interest

The authors have no conflict of interest for the publication of this work.

Data availability

All the collected articles and their data's are enclosed in this article in the reference section.

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