



Exploring the Medicinal Benefits of Filfil Darāz (*Piper longum* L.): Insights from Unani Medicine and Modern Perspectives

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ABSTRACT

Background: *Filfil Darāz* (*Piper longum* L.) is an important medicinal plant belonging to the *Piperaceae* family, is therapeutically used in many traditional systems of medicine, such as Unani, Ayurveda, Siddha, etc.

Purpose of Review: This review's primary goal is to investigate data on *Piper longum* botanical description, Pharmacognostic characteristics, phytochemicals, and therapeutic uses. This information will ultimately help Unani and other scientists plan various studies for additional research on this significant medicinal plant.

Materials and Methods: This systemic review was done through an extensive literature survey of Unani classical and other ethnobotanical literature and published research work available on various search engines viz., Science Direct, PubMed, Google Scholar, etc.

Result: *Piper longum* L. is the accepted botanical name of *Filfil Darāz*, long pepper, Pīplamūl as referred in Unani and other traditional medicines. It is grown in Nepal, India, Indonesia, Malaysia, Sri Lanka, Bhutan, Philippines. In India, the plant is found in the lower hills of West Bengal, the Khasi hills, the evergreen forests of the Western Ghats from Konkan to Kerala, and the Nicobar Islands, it is also found in Assam, Tamil Nadu, Andhra Pradesh, Madhya Pradesh, Maharashtra, Kerala, and Karnataka. Usually, the fruit of this important medicinal plant is therapeutically used for various ailments, including indigestion, constipation, dysentery, neurogenic gastralgia, skin diseases, nervine weakness, weakness of stomach, flatulence, amenorrhea, dribbling of urine, etc. It contains many important secondary metabolites, including alkaloids, flavonoids, esters, piperine, steroids, and essential oils, etc., which have been reported to possess antimicrobial, antiparasitic, anthelmintic, mosquito-larvicidal, anti-inflammatory, analgesic, antioxidant, anti-asthmatic, cardioprotective, anti-snake-venom neuro-pharmacological, immunomodulation, antiarthritic and antiulcer and lipidemic agents.

Conclusion: Numerous bioactive chemicals that have been isolated and extracted from *piper longum* have been found to have potential therapeutic benefits for various bodily systems.

Keywords: *Piper longum*; *Filfil Darāz*; *piperlongumine*; *piperine*; *long pepper*.

1. INTRODUCTION

India has a wide range of meteorological conditions and seasons that are ideal for the growth of several plant species. Mostly found in tropical climates, the *Piperaceae* family consists of 12 genera and about 1400 species; more than 700 species are found in tropical and subtropical rainforests. Economically significant and prominent among the medicinal plants used in various systems of medicine are the piper species produced in South India. The Sanskrit word "Pippali" was the source of the Greek name "Peperi," the Latin "Piper," and the English "Pepper" (Joshi et al. 2013). Known as the "backbone of the traditional medical system," medicinal plants are used to treat a variety of illnesses by more than 3.3 billion people in underdeveloped nations. Hippocrates, first of all, described *Piper longum*, a plant as a remedy rather than a spice. The fruits (*Filfil Drāz/Pippali*) and roots (*Pippalimūl*) of this shrub are mostly used. This plant's primary applications in Europe during the Middle Ages and the 19th century were as spices and as a drug. *Piper longum* fruits have been used as a flavouring and

preservative in pickles, food, medicines, and traditional beverages since ancient times. It is an aromatic climber that may be found around the world in tropical and subtropical climes (Grover 2021). Unani medicine claims that the fruit has a strong and bitter flavour. It is used as *Kāsir-i-Riyāḥ* (carminative), *Muqawwī-i-Kabid* (liver tonic), *Muqawwī-i-Ām* (general tonic), *Muqawwī-i-Mi'da* (stomachic), *Muqawwī-i-Bāh* (aphrodisiac), *Hāḍim* (digestive), *Musqīt-i-Janīn* (abortifacient), *Mudirr-i-Bawl* (diuretic), and *Mudirr-i-Hayḍ* (emmenagogue) agent. It is found to be helpful in liver inflammation, joint pain, lumbago, snake bite, scorpion bite, and night blindness (Anjum Ara et al. 2021).

In Ayurveda, unripe fruit is considered to be pleasant and cooling, as well as beneficial for biliousness. The ripe fruits are sweetish, pungent, *Muqawwī* (tonic), *Muqawwī-i-Mi'da* (stomachic), and *Mulayyin* (laxative) in nature and are generally used in asthma, *Baraṣ* (vitiligo), tumours, *Bawāsīr* (haemorrhoids), spleen disorder, for strengthening cognition, insomnia, jaundice, *Ishāl* (diarrhoea), hiccups, anaemia, dysentery, pain, and inflammation. The

role of fruit milk extract is established and showed effective decline of passive cutaneous anaphylaxis in rats and also protects against antigen-induced bronchospasm in guinea pigs (Khare 2007).

The root of the pepper plant (*Piper longum* L.) is used to treat a variety of conditions, including tumours, spleen illnesses, bronchitis, abdominal pain, ascites, palsy, gout, and lumbago. It is also used as a carminative, hepato-protective, stomachic, abortifacient, haematinic, diuretic, digestive, and stomachic (Joshi et al. 2013, Anjum et al. 2021, Yadav et al. 2020, Biswas et al. 2022). Integrating traditional knowledge of medicinal plants with conventional treatment is crucial for meeting healthcare requirements. Oil components of the herb have been reported to inhibit the rise in triton-induced serum total cholesterol in mice. Likewise, the antifertility activity is also documented with the use of powder of root (Khare 2007).

2. MATERIAL AND METHODS

We conducted this review utilizing all available textual, digital, and online resources. Both modern and Unani texts were studied for their descriptions, identification, temperament, pharmacological investigations, effects, medicinal applications, and so on. Published publications and research papers were searched in Science Direct, PubMed, Google Scholar, Scopus, and other sources. Additional information regarding the item was found using the keywords *Filfil Darāz*, *Piper longum*, Pippali, Long pepper, and Piperine. The Standard Unani Medical Terminology, produced by the Central Council for Research in the Unani System of Medicine in partnership with the World Health Organization, offered the necessary Unani terminology and WHO international standard terminologies on Unani medicine.

3. RESULTS AND DISCUSSION

3.1 Botanical Description

It is a tiny, scented climber that is a member of the *Piperaceae* family. The plant root is woody, wide oval, and have cordate leaves. The creeping, joined, and thickened nodes of the stem. The leaf blades have a wide range in size, are alternating, spreading, and stipule-free. The leaves range in size from 5-7 cm at the bottom to 2-3 cm at the top. Flowers have single, cylindrical spikes. The fruits are small, blunt, oblong,

blackish-brown and measuring 2.5–3.5 cm in length and 5 mm in breadth (Fig.1). They are borne on fleshy spikes (Grover 2021). The mature spikes are harvested and dried to create *pippali*, which is also sold as *pippalimula*, the root radix. *Piplamul* comes in three different grades, with grade I having the thickest roots and underground stems commanding the highest price and grades II or III having the thinnest roots, stems, or shattered fragments. The transversely sliced, cylindrical, straight, or slightly curved pieces that make up the commercial medication are virtually exclusively between 5 to 25 mm in length and 2 to 7 mm in diameter. Some of the pieces have prominent, swelling internodes that show a variety of leaf and rootlet scars. The exterior is a soiled light brown colour. The medicine has an odd smell and a bitter, acrid taste that makes the tongue numb (Osman Gani et al. 2019).

3.2 Scientific Classification

Kingdom	: Plantae
Subkingdom	: Tracheobionta
Super division	: Spermatophyta
Division	: Magnoliophyta
Class	: Magnoliopsida
Subclass	: Magnoliidae
Order	: Piperales
Family	: <i>Piperaceae</i>
Genus	: <i>Piper</i>
Species	: <i>Longum</i> (Osman Gani et al. 2019, Jarald et al. 2006).

3.3 Mutrādifāt (Vernacular Names)

Arabic : Dār-i-Filfil (Abdul Hakim 2015, Ghani 2010, Kabiruddin 2014, Anonymous 2006, Kabiruddin 2008).

Ayurveda : Pippali, Chapalaa, Krishna Kola (Khare 2007)

Bengali : Pīplamor (Pullaiah 2006) Pipli (Kabiruddin 2014)

Chinese : Pi Po (Kirtikar & Basu 2012)

Deccan : Pīpli, Pipulmul (Kirtikar & Basu 2012)

English : Indian Long Pepper, Jaborandi (Khare 2007) Long Pepper (Kabiruddin 2014, Khan 2013, Anonymous 1997).

German : Langer, Pfeffer (Kirtikar & Basu 2012)

Gujrati : Pīpal, Pīpli, Pipara (Singh & Panda 2005)

Hindi : Gazpīpal, Pīper, Pīpal (Anonymous 1997)

Kannada : Hipli (Pullaiah 2006)

Malayalam : Maghadi, Mulagu, Tippali (Jarald, & Jarald 2006) Pippali Chopala (Anonymous 1997)

Marathi : Pimpli (Jarald, & Jarald 2006)

Persian : Filfil Darāz (Ghani 2010, Kabiruddin 2014, Kabiruddin 2008, Khan 2013), Filfil Dray, Pīpal (Kirtikar & Basu 2012)

Punjabi : Maghaan (Pullaiah 2006)

Sanskrit : Chanchala, Granthika, Krishnapippali (Kirtikar & Basu 2012) Pippali (Singh & Panda 2005)

Sindhi : Pīri (Kabiruddin 2014) Fil, Fil Dray (Singh & Panda 2005)

Tamil : Argadi, Kolagam, Kalidi (Anonymous 1997) Tippali, Pippili (Pullaiah 2006) Pippli (Anonymous 2006)

Telugu : Modi, Pippali, Pippallu (Anonymous 1997)

Urdu : Pīpal (Anonymous 2006)

Uriya : Krykola, Mogodha, Pippoli (Kirtikar & Basu 2012)

Unani : Filfil Dārāz (Anonymous 1997) Dār-i-Filfil (Khare 2007) Peperi Makron (Kirtikar & Basu 2012)

3.4 Habit and Habitat

India is the country of origin for several herbal medications that are used to treat a variety of diseases. It is a significant medicinal plant utilised in traditional Asian and Pacific Islander remedies. The genus is thought to have 700 species worldwide, with about 30 species documented in India. It is primarily grown in regions with considerable rainfall, limestone soil, and high humidity. Plant is found throughout the hotter parts of India from Central to the North-Eastern Himalayas. In Odisha it is found in

Koraput, Ganjam, Phulbani, Kalahandi, Khurda, Keonjhar, Mayurbhanj, Puri, Angul. *Piper longum* is distributed throughout tropical and subtropical regions of the world. In India, the plant is found in the lower hills of West Bengal, the Khasi hills, the Mikir hills, the evergreen forests of the Western Ghats from Konkan to Kerala, and the Nicobar Islands. It is also found in Assam, Tamil Nadu, Andhra Pradesh, Madhya Pradesh, Maharashtra, Kerala, and Karnataka. Most of the world's tropical rainforests, including those in Nepal, India, Indonesia, Malaysia, Sri Lanka, Bhutan, Philippines, and Timor, include the plant (Grover 2021, Pandey 2018).

3.5 Cultivation and Collection

Indian the majority of long pepper comes from wild plants, and the main supply regions are Assam, West Bengal, and Uttar Pradesh. The species has become extremely scarce in Kerala forests as a result of the plants over extraction from their natural habitat. Long pepper prefers shady, wet circumstances, well-drained sandy soil with a pH range of 5.5 to 8.5, and rich humus. It is generally found in tropical, humid climates. It is grown in Andhra Pradesh, Tamil Nadu, and Assam. *Piper longum* is extensively grown in limestone soil in regions with high rainfall and relative humidity. Kerala's mountainous hills provide successful growing grounds for the *piper longum* plant. It is a shade-loving plant; however, 50% shade is ideal for better fruiting. It thrives under the shadow of trees in regions with lots of rainfall and may also be grown as an intercrop in coconut plantations on the lowlands, though it is advised to grow



Fig. 1. *Filfil Drāz* (fruits of *Piper longum* Linn.)

it between 900 and 1500 meters above sea level (Pandey 2018, Manoj et al. 2004). After six months from the time of planting, vines are ready for their first harvest. Two months after the spikes develop on the plants, they are ready for harvest. When spikes are most aromatic and blackish green, they are harvested. For four to five days in the sun, the gathered spikes are dried until they are completely dry (Joshi et al. 2013).

3.6 Description in Unani Literature

Dār-i-Filfil (Piper longum) is climber and its fruits are cylindrical in shape (thick in the middle and pointed at the edges) three meters or less in length. They have pimple-like bumps on their outer surface. Its fruits and roots are used medicinally. The leaves of which are like betel (*Piper betel*) leaves but equal to the leaves of *lobial/Farīqa (Vigna unguiculata)*, their taste is sharp and bitter; its branches have knots on which a leaf emerges, At the root of each leaf is a green *pepper* like a raw mulberry and it is smaller than mulberry and turns black after drying, it contains small and combined grains like *Rai/Khardal (Brassica nigra)*, these grains have a thin membrane over them and between the grains there are black membranes. The taste of *pepper* is very sharp, slightly bitter and burning sensation. Its bark is more bitter and pungent than the seeds. Its root has nodules and produces fine fibers the bark of the root is leathery and its pulp is white fibrous and has a strong taste. According to *Jalinūs (Galen)*, the first thing that comes out of the pepper tree is this fruit and then the *black pepper* comes out, if it is broken after it is fully ripe, then it is called black pepper, and if it is broken before it is ripe, then it is called white pepper. In *Sharh-i-Qanun*, Hakim Ali Gilani stated that studies have shown that *long pepper* trees are currently as large as mulberry trees. According to Sharif Khan the *long pepper* is inside the pod which is like a *Lobia* pod. According to *Shaikh (Ibn-Sina)*, *Dār-i-Filfil* is the first fruit of the pepper. Some people say that *Dār-i-filfil* is the bud of white pepper. A well-stuffed and unadulterated pepper is best it is excellent and insoluble in water, and its pungent taste is quite similar to that of pepper (Abdul Hakim 2015, Ghani 2010, Khan 2013).

3.6.1 Ajzā-i-Musta'malā (Parts used)

Different parts of *Filfil darāz (Piper longum L.)* used for the medicinal purpose are

- Root (Anonymous 1997)
- Fruits (Anonymous 1997)

3.6.2 Mizāj (Temperament)

The temperament of *Filfil Dāraz (Piper longum L.)* given by different Unani scholars in literature are-

- *Hār 2^o wa Yābis 2^o* (Hot 2^o and dry 2^o) (Abdul Hakim 2015, Kabiruddin 2014, Anonymous 1997, Goswami 2019)
- *Hār 0^o wa Yābis 0^o* (Hot 0^o and dry 0^o) (Khan 2013, Safiuddin Ali 2013)
- *Hār 3^o wa Yābis 2^o* (Hot 3^o and dry 2^o) (Baghdadi 2005, Ibn-i-Sina 2010)

3.6.3 Af'āl (Pharmacological action)

Long Pepper has *Haḍim* (Digestive), *Idrār-i-Bawl* (Diuretic), *Muḥallil* (Resolvent), *Muqawwī-i-Mi'da* (Stomachich), *Kāsir-i-Riyāh* (Carminative), *Muḥarrīk* (Stimulants), *Musakhkhin* (Calorific), *Muqawwī-i-Bah* (Aphrodisiac), *Musqit-i-Janīn* (Abortifacient), *Mudirr-i-Hayḍ* (Emmenagogue), *Musaffī-i-Dam* (Blood purifier), *Mufattiḥ* (Deobstruent), *Da'f-i-Qai* (Anti-emetic), *Mughalliz-i-Manī* (Increase viscosity of semen), etc. properties (Abdul Hakim 2015, Ghani 2010, Kabiruddin 2014, Khan 2013, Anonymous 1997, Goswami 2019, Razi 2007).

3.6.4 Isti 'mālāt (Therapeutic uses)

It is used for the treatment of *Amrād-i-Jigar* (Liver disorders), *Amrād-i-Mi'da* (Stomach disorders), *Waja' al-Shikam* (Abdominal pain), *Nafkh al-Shikam* (Flatulence), *Su'āl-i-Balghamī* (Phlegmatic cough), *Ḍīq al-Nafas/Dama/Nafas Ḍayyīq* (Bronchial asthma), *Waja' al-Mafāṣil* (Polyarthritis), *Niqris* (Gout), *'Irq al-Nasā* (Sciatica), *Amrād-i-Balghamī* (Phlegmatic disorders), *Amrād Sawdāwiyya* (Diseases of melancholic humour), *Shabkorrī/Ashā'* (Night blindness/Nyctalopia), *Gazīdgī-i-'Aqrab* (Scorpion bite), *Fālij* (Paralysis), *Laqwa* (Facial palsy), *Ṣar' Mirgī* (Epilepsy), *I'yā'ī* (Fatigue), *Amrād-i-Dimāghī* (Brain disorders), *Waram al-Ṭiḥāl* (Splentitis), *Judhām / Al-'illa al-Kubrā* (Leprosy), *Istisqā'* (Oedema), *Jarayān* (Spermatorrhoea), *Mulayyin* (Laxative), *Su'āl* (Cough), *Du'f al-Ishtiha'* (Anorexia) (Abdul Hakim 2015, Ghani 2010, Kabiruddin 2014, Khan 2013, Anonymous 1997, Goswami 2019, Razi 2007).

3.6.5 *Tarkīb-i-Isti'mal* (Mode of administration)

3.6.5.1 *Amrāḍ-i-Ra's-o-Nizām-i-A'sāb-o-Dimāgh* (diseases of head and nervous system)

- Grind the *Piper longum* with water and apply on fore head to relieve headache (Ghani 2010).
- *Piper longum* powder can be inhaled through the nose to treat cold headaches (Ghani 2010).
- Powder of *Piper longum*, *Piper nigrum*, and *Zingiber officinale* is useful in the numbness of hand, feet and weakness are eliminated by licking the powder (Ghani 2010).

3.6.5.2 *Amrāḍ-i-'Ayn* (diseases of eye)

- Grinding the *Piper longum* and applying it to the eye with a suitable apparatus is beneficial for corneal opacity and also gives benefit in strabismus and night blindness (Ghani 2010).

3.6.5.3 *Amrāḍ-i-'Izām-o-Mafāṣil* (diseases of bones and joints)

- If the *piper longum* is mixed with *Zaft/Qatran/Coal tar* and applied topically, it dissolves the scrofula, and if it is used mixed with *Natrūn*, it is eliminated *Bahaq* (Pityriasis) (Razi 2007).
- Oil prepared with *Piper longum* and *Zingiber officinale* is used locally to cure gout (Ghani 2010).

3.6.5.4 *Amrāḍ-i-Niswān-o-Qabālāt* (diseases of gynaecology and obstetrics)

- Licking the *Piper longum* with honey increases digestion, brings more urine, removes menstrual bleeding if it comes from obstruction (Ghani 2010).
- *Piper longum* powder combined with ghee is used to be licked, it stops post-partum haemorrhage (Ghani 2010).
- *Piper longum* powder is taken with lukewarm milk to increase milk production (Ghani 2010).

3.6.5.5 *Amrāḍ-i-Nizām-i-Tanaffus* (diseases of respiratory system)

- To clear the throat, the mixture of *Piper longum* powder with honey is used to lick (Ghani 2010).

- If the *piper longum* is mixed with honey and applied on the neck, it is useful for diphtheria (Razi 2007).

3.6.5.6 *Amrāḍ-i-Litha-o-Dandān* (diseases of gums and teeth)

- To cure toothache, keep its powder combined with ghee and honey in the mouth (Ghani 2010).

3.6.5.7 *Amrāḍ-i-Nizām-i-Haḍm* (diseases of digestive system)

- A large amount of pepper induces urination while a small amount causes diarrhoea (Razi 2007).
- *Piper longum* juice by adding ghee and milk and heating it before feeding improves stomach ailments and appetite (Ghani 2010).
- In buttermilk, pipal powder dissolves when added honey and used to feed splenomegaly (Ghani 2010).

3.6.6 *Maḍarrat* (harmful effects)

- *Ṣudā'* (Headache) (Abdul Hakim 2015, Ghani 2010, Kabiruddin 2014, Khan 2013)
- *Kabid* (Liver) (Ghani 2010)

3.6.7 *Muslih* (corrective)

- *Babūl Gond* (*Acacia arabica*), *Sandal* (*Santalum alba*), *Gulab* (*Rosa damascena*) (Abdul Hakim 2015, Ghani 2010, Kabiruddin 2014, Anonymous 1997) *Shakar* (Sugar) (Khan 2013)
- Toxic effect for Liver *Zarishk* (*Berberis vulgaris*) and *Aspaghhol* (*Plantago ovata*) (Ghani 2010)

3.6.8 *Badal* (substitute)

Filfil Safaid (*Piper longum*), *Zanjabil* (*Zingiber officinale*), *Zaranbād* (*Zingiber zerumbet*) (Abdul Hakim 2015, Ghani 2010, Kabiruddin 2014, Khan 2013, Anonymous 1997), *Khulanjān* (*Alpinia galanga*) (Ghani 2010, Khan 2013)

3.6.9 Contraindication

It is not recommended for liver diseases, according to Unani physicians. Additionally, it is advisable to avoid it during headaches (Ghani 2010).

3.6.10 *Miqdār-i-Khūrāk* (Therapeutic dose)

The mentioned therapeutic doses in various unani classical textbooks are as follows:

- about 4.5 g (Abdul Hakim 2015)
- 1.75-4.5 g (Ghani 2010, Khan 2013)
- up to 5 g (Anonymous 1997)

3.6.11 *Murakkabāt* (Compound formulations)

Dār-i-Filfil /*Filfil Drāz* (fruits of *Piper longum* Linn.) is one of the most ingredient used in the preparation of various compound formulations in the Unani system of medicine (Table 1).

3.7 Phytochemical Constituents

Alkaloids are widely distributed in the plant, along with other associated substances such volatile oils, starches, gums, resins, fatty oils, and inorganic debris. There have previously been reports of more than 50 different alkaloids from this plant. The plant contains significant amounts of lignans and esters, such as sesamin, tridecyldihydro-pcoumarate, etc. Three main substances, namely caryophyllene (17%), pentadecane (15.8%), and 139 bisabolene (11.2%), make up the essential oil found in fruits. The fruit contains a variety of alkaloids and related substances, with piperine being the most prevalent. Other alkaloids and related compounds found in the fruit include methyl piperine, piperonaline, piperettine, asarinine, pellitorine, piperundecalidine, piperlongumine, and piperlonguminine, as well as retrofractamide A, pergumidiene, brachystamide-B, a dimer of desmeth. The root contains the compounds piperine, tetrahydropiperlongumine, trimethoxy cinnamoyl-piperidine, and piperlonguminine. 1-(3-,4-methylenedioxyphenyl)-1E-tetradecene and 3-(3-,4-methylenedioxyphenyl) are recently discovered chemical components, piperic acid, propenal 3 ,4 -di-hydroxy-bisabola 1, 10, and eudesmic-4 (15) 6-alpha-diol, 7-epi-eudesm-4, and -ene1beta (15) guineesine, ene-1beta, 6beta-diol, and 2E,4E dienamide (2E, 4E, 8E) 2,4,8-trienamide of nisobutyl. Sesamin, pluviatilol, and fargesin are the three primary lignans found in the fruits. The fruits include Z-12 octadecenoicglycerol monoester, and tridecyl-dihydro-p-coumarate. Tetrahydropiperic acid (THPA) and palmitic acid are the two main organic acids found (Jarald & Jarald 2006, Gajurel et al. 2021, Kumar et al. 2011).

3.8 Scientific Studies

Scientifically validated studies of *Filfil Drāz* (*Piper longum* L.) are as follows;

3.8.1 Antioxidant and antimycobacterial activity

Invitro antioxidant and antimycobacterial activity of extracts of *Piper longum* (PC) seeds made from chloroform, ethyl acetate, hexane, ethanol, hydro-ethanol, and water. In order to verify the folklore claims about the extract effectiveness against non-tuberculous bacteria, the extracts were also tested for antimycobacterial properties against *Mycobacterium smegmatis*. The Minimum Inhibitory Concentrations (MICs) of PC, PH, PE, and PEA were determined to be 8, 16, 16 and 32 mg/mL, respectively, and Minimum Bactericidal Concentration (MBC) were calculated to be 20.23, 33.43, 36.23, and 64.09 mg/mL, respectively. The highest in vitro antioxidant activity as well as antimycobacterial activity was found in PC chloroform extract (Barua et al. 2014).

3.8.2 Antiviral activities and cytotoxicity assay

Here, we draw the conclusion that, when compared to other extracts of both *Piper nigrum* and *P. longum*, the chloroform extract of *P. nigrum* has the highest activity. This can be because there are more alkaloids present than usual. The MTT or (3-[4,5-dimethylthiazol-2-yl]-2,5-diphenyl tetrazolium bromide) experiment that we performed supported the aforementioned finding by demonstrating a lower lethal dosage for 50% death. Finally, we draw the conclusion that the alkaloids found in the chloroform extract are what cause the aforementioned effects (Priya & Kumari 2017).

3.8.3 Hepatoprotective activity

The research conducted by Patel and Shah (2009), the hepatoprotective properties of *Piper longum* milk extract. To cause the chronic reversible type of liver necrosis, carbon tetrachloride (CCl₄) was administered as a hepatotoxin at a dose of 0.5 ml/kg per orally with olive oil (1:1) three times each week for 21 days. A significant hepatoprotective effect was seen in CCl₄-induced liver damage after treatment with *Piper longum* milk extract (200 mg/day per orally for 21 days). *Piper longum* hepatoprotective effects are equivalent to those of the commonly

prescribed medication silymarin (25 mg/kg/day per orally for 21 days). The findings of the current investigation showed that *Piper longum* milk extract significantly hepatoprotective and antioxidant properties (Patel and Shah 2009).

3.8.4 Anti-rheumatoid activity

In rats with Freund's Adjuvant Induced Arthritis, an aqueous extract of the *Piper longum* fruit was examined for its anti-rheumatoid action at doses of 200 and 400 mg/kg p. o. On the fourth, 18th, 14th, and 21st day following sub-plantar administration of complete Freund's adjuvant, the administration of extract reported a significant reduction in paw swelling. A digital Plethysmometer was used to measure the volume displacement of the paw oedema. According to the findings of the current study, the aqueous extract of *P. longum* exhibits potential anti-arthritis efficacy in the complete Freund's Adjuvant model (Yende et al. 2010).

3.8.5 Anti-inflammatory activity

The purpose of this study was assessing the anti-inflammatory properties of two *Pippali* types in albino rats used in acute and sub-acute experimental models of inflammation. Animals that were chosen at random were divided into four groups, six animals in each. Oral administration of 200 mg/kg of the test drug was used, and in both models, the activity was compared with normal anti-inflammatory drug therapy. Between the two distinct test samples analysed, it was discovered that the Badi variation of pippali only inhibited acute phase inflammation, whereas the Chhoti type of pippali lowered both acute and subacute phase inflammation. Therefore, the Chhoti variant of Pippali may be preferred above the Badi variety in terms of medicinal value (Kumari et al. 2012).

3.8.6 Spermicidal activity

This research was done to evaluate the spermicidal effects of hexane extract from *Piper longum* Linn fruits. According to studies on sperm immobilization, 20 mg/mL of hexane extract can totally immobilize sperm within 20 seconds. The sperm revival test demonstrated that the effects were spermicidal since the effect of sperm immobilization was permanent. Additionally, the treatment group's sperm viability was significantly lower than the control groups.

These sperms' hypo-osmotic swelling was dramatically decreased, suggesting that the hexane extract may likely harm the sperm plasma membrane. Therefore, our investigation demonstrated that *P. longum* hexane extract has potential spermicidal contraceptive action (Golam Sarwar et al. 2015).

3.8.7 Antifertility activity

Female rats were used as test subjects to determine whether the crude extract, its various fractions, and the main pure chemical from the active fraction of the powdered fruits of *Piper longum* had an antifertility effect. Days 1–7 post-coitum (p.c.) schedule showed 100 and 86% efficacy for the crude extract and its hexane fraction, respectively. The 1-butanol soluble, 1-butanol insoluble, and chloroform fractions, on the other hand, exhibited no activity (Lakshmi et al. 2006).

3.8.8 Anti-asthmatic activity

Most asthma medications are steroidal in nature. The *Piper longum* fruit extract underwent phytochemical examination, which revealed the presence of alkaloids, steroids, glycosides, flavonoids, and carbohydrates. With the exception of alcoholic extract in milk-induced leukocytosis, the PF, AF, and DF are efficacious in all asthma models in the sequence of PF>AF>DF. Thus, it can be inferred that the Plant *Piper longum* is reputed to have anti-asthmatic properties (Kaushik et al. 2012).

3.8.9 Antidiabetic and antihyperlipidemic activity

According to the current investigation, oil from *Piper longum* (PLO) demonstrated significant promise in the management of hyper-lipidaemia and diabetic mellitus. Diabetes mellitus and hyper-lipidaemia may both be caused by the inhibition of α -glucosidase, aldose reductase (AR), and pancreatic lipase, respectively. This study shows that the PLO can be used as a natural source for effects that are antihyperlipidemic and antidiabetic. However, because preclinical and clinical beings share many structural similarities, the study was conducted at the preclinical level and using in vitro techniques that may be useful for clinical application. Furthermore, the researchers might carry out the clinical examination (Kumar et al. 2013).

Table 1. Compound preparations containing *Piper longum* Linn

S. N.	Compound formulation	Dose	Action and uses
1.	Habb-i-Bīsh	150 mg	Nervine tonic, analgesic, its used for weakness of nerve and hysteria (Anonymous 2007).
2.	Habb-i-Kibrīt-i-Kabīr	250-500 mg	Digestion, antiseptic, epidemic, helps in dyspepsia and diarrhoea with vomiting (Anonymous 2007).
3.	Habb-i-Nārmushk	250 mg to 1 g	Purgative, carminative, its used in intestinal colitis gastralgia (Anonymous 2007).
4.	Kohal-i-Asha	For ophthalmic use	It's used in eye diseases (Anonymous 2007).
5.	Kohal-i-Bāsaliqūn Kabīr	For ophthalmic use	Resolvent, helps in eye disease (Anonymous 2007).
6.	Kohal-i-Kāfūr	For ophthalmic use	Resolvent, it's used in conjunctivitis (Anonymous 2007).
7.	Burūd-i-Hasram	For ophthalmic use	Repellent constipation, helps in eye diseases (Anonymous 2007).
8.	Ma'jūn-i-Bhangra	10-20 g	Carminative, used in flatulence (Anonymous 2007).
9.	Ma'jūn-i-Misri	5-10 g	Aphrodisiac, nervine tonic, its used in anaphrodisiac and weakness of nerve (Anonymous 2007).
10.	Ma'jūn-i-Yahya Bin Khālid	5 g	Resolvent, analgesic, helps in gout and arthralgia (Anonymous 2007).
11.	Jawārish Kāfūr	5-10 g	Stomachic, carminative, its used in dyspepsia, perverted digestion and flatulence (Anonymous 2007).
12.	Jawārish Safarjali Mushil	5-10 g	Digestion, analgesic, its used in colitis and anorexia (Anonymous 2007).
13.	Jawārish Zar'ūni Ambari	5 g	Strengthen of bladder, kidneys and liver, helps in incontinence of urine, headache, gout and chronic kidney diseases (Anonymous 2007).
14.	Itrīfal Muqawwī-i-Basar	5-10 g	Carminative, analgesic, liver tonic, its used in flatulence, gastralgia and perverted digestion (Anonymous 2007).
15.	Halwa-i-Suparipāk	10-20 g	Semen inspissant, aphrodisiac, semen retentive, helps in spermatorrhoea and anaphrodisiac (Anonymous 2007).
16.	Sadri	3 g with lukewarm water twice a day	Broncho-relaxant, expectorant, its used in cough and asthma (Anonymous 2011).
17.	Shababi	6 g twice a day	General tonic, strengthen of aphrodisiac and nerve, helps in weakness of nerve and aphrodisiac (Anonymous 2011).
18.	Sharbat-i-Faulād	Adult–20 ml, Child–10 ml twice a day	Blood producing, strengthen of stomach and liver (Anonymous 2011).
19.	Habb-i-Rādi'	Ophthalmic use	Resolvent, helps in repellent (Anonymous 2006).
20.	Jawārish Nārmushk Mushil	3-5 g	Carminative, its used in flatulence and colitis (Anonymous 2006).
21.	Jawārish Anjadān	5-10 g	Deobstruent, carminative, anti-acidity, helps in colitis, flatulence (Anonymous 2006).
22.	Barūd Banafshāji	For ophthalmic use	Eye tonic, its used in epiphora, itching of eye and weakness of eyes (Anonymous 2006).

S. N.	Compound formulation	Dose	Action and uses
23.	Roghan Hindi	For local use	Nervine tonic and stimulant of nerves, its used in ball's palsy and tremors (Anonymous 2006).
24.	Itrīfal Kabīr	7 g with 'Arq Gaozabān 10 tola at the bedtime	Strengthen of stomach, brain, eyes and aphrodisiac, its used in haemorrhoids and weakness of eyes and brain (Anonymous 2005).
25.	Anqrūya-i-Kabīr	4 g with 'Arq Bādiyān 12 tola before breakfast	Aphrodisiac, digestion, it helps in paralysis, bell's palsy, epilepsy and dementia (Anonymous 2005).
26.	Bāsaliqūn Kabīr	Used as Surma at bedtime	Cataract, itching of eye, weakness of eye (Anonymous 2005)
27.	Jawārish Basbasah	7 g with 'Arq Bādiyān in the morning & evening	Resolving of flatulence, digestion, its used in haemorrhoids and flatulence (Anonymous 2005).
28.	Jawārish Safarjali Mushil	7 g use with 'Arq Bādiyān	Stomachic, digestive, helps in dysentery, colitis and stomach pain (Anonymous 2005).
29.	Jawārish Falafali	3 g use with 'Arq Bādiyān	It is used in stomach pain and flatulence (Anonymous 2005).
30.	Habb-i-Azarāqi	One pill uses with 'Arq Bādiyān and 'Arq Gaozabān 60 ml	Nervine tonic, helps in phlegmatic disorders (Anonymous 2005).
31.	Habb-i-Tursh Mushtahi	Two pills use after meals	Stomachic, digestion, appetizer, it is used in accumulation of thick gas in elementary canal (Anonymous 2005).
32.	Kohal Byaz	Kohl	It is used in cataract, pterygium (Anonymous 2005).
33.	Ma'jūn-i-Alkali	12 g use with milk	It is beneficially for strengthening the kidneys, bladder and aphrodisiac (Anonymous 2005).
34.	Ma'jūn-i-Sa'lab	7-12 g use with milk in the morning	These are beneficially for aphrodisiac and strengthen nerves, helps in spermatorrhoea (Anonymous 2005).
35.	Mufarrih Mu'tadil	9 g use in the morning	Strengthen of heart, brain, liver and appetizer, helps in uterine disorders and diarrhoea (Anonymous 2005).
36.	Habb-i-Shītraj	Two dirhams with warm water	It is beneficial in paralysis, bel's palsy, arthritis and menorrhagia (Arzani 2009)
37.	Jawārish Utraj	Two dirhams	Appetizer, resolving of flatulence and strengthen of stomach (Arzani 2009).
38.	Jawārish Amber	4.5 g	Indigestion, palpitation and uterine pain, and it's beneficial for old age (Arzani 2009).
39.	Jawārish Falafali	One dirham (3.5 g) with warm water.	Stomach pain, coldness of stomach and liver, excessive phlegm and humours, resolvent of flatulence (Arzani 2009).
40.	Ma'jūn Pudina	Two dirhams	Digestion and resolving of flatulence (Arzani 2009).
41.	Ma'jūn Habb-ul-Nīl	6-7 dirhams	Evacuate of morbid humours of body (Arzani 2009)
42.	Dawa-ul-Buzūr	Five dirhams in the morning and evening	More effective of aphrodisiac (Arzani 2009)

4. CONCLUSION

Modern science lacks a cure for many unique diseases, creating a desire for alternative treatments worldwide. Alternative and traditional medicine have significant promise for disease management due to their high efficacy, safety, and cost benefits. Now is the time to capitalize on them. There are maximum Unani formulations that use *P. longum* as a key ingredient. This research highlights the widespread use of *P. longum* in Unani medicine, especially for respiratory and neurological diseases. In traditional medicine, the plant is used to treat a variety of ailments, including epilepsy, pleural effusion, spleen disorders, dementia, diarrhoea, dysentery, and sleeplessness. The *P. longum* plant has been reported to have pharmacological actions such as antiulcer, anti-inflammatory, anticancer, neuroprotective, and others. Still, the plant requires further attention from researchers because the data on its pharmacological qualities has not been well investigated. According to the literature, this plant promises to treat a variety of ailments, although there is no recorded data to support its efficacy. As a result, further experimental and clinical research is needed to examine the mechanism of action of plant extracts in the animal body in order to demonstrate the plant's major effects in treating a variety of ailments.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declares that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

CONSENT AND ETHICAL APPROVAL

It is not applicable.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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