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Phytochemical Composition, Pharmacology and Nutritional Potential of *Myrica Esculenta* Fruit

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Abstract: *Myrica esculenta is an important ethnomedicinal plant extensively used in traditional healthcare systems and valued for its nutraceutical properties. Various scientific studies have validated its traditional medicinal applications and highlighted its potential therapeutic benefits. The plant contains several biologically active compounds, including diarylheptanoids, flavonoids, terpenes, tannins, and glycosides, which contribute to its pharmacological significance. Among different plant parts, the fruits are considered highly nutritious and are rich sources of carbohydrates, proteins, fats, dietary fiber, and essential minerals such as sodium, potassium, calcium, manganese, iron, copper, and zinc. These nutritional and phytochemical constituents make the plant beneficial for health promotion and disease prevention. Research has also demonstrated its antioxidant, antimicrobial, anti-inflammatory, and other medicinal properties, supporting its role in alternative medicine. The present review aims to provide a detailed overview of the phytochemical profile, pharmacological activities, and nutritional potential of the plant. Furthermore, it emphasizes the importance of further isolation, characterization, and evaluation of its bioactive compounds for their possible applications in the management and treatment of various diseases.*

Keywords: Myrica esculenta; kaphal; ethnomedicinal; phytoconstituents; conservation; micro propagation; pharmacology

I. INTRODUCTION

Fruits rich in bioactive compounds have gained considerable attention because of their role in reducing oxidative stress and preventing chronic diseases, including cardiovascular disorders, cancer, stroke, and neurodegenerative diseases. These health-promoting effects are mainly associated with phytochemicals such as polyphenols, flavonoids, carotenoids, and vitamin C, which exhibit strong antioxidant, anti-inflammatory, antimicrobial, and neuroprotective activities. Oxidative stress and inflammation are major contributors to neuronal damage and are closely linked with disorders such as Alzheimer's disease, Parkinson's disease, and other neurodegenerative conditions. Therefore, consumption of antioxidant-rich fruits may play an important role in neuroprotection and maintenance of brain health. In recent years, wild edible fruits have emerged as valuable nutraceutical resources due to their rich phytochemical composition and therapeutic potential. Among these, Myrica esculenta, commonly known as "Kaphal," is an important wild fruit species of the Indian Himalayan Region. The species is highly appreciated for its delicious fruits and traditional medicinal uses. The fruits are known to contain significant amounts of phenolics, flavonoids, anthocyanins, and other antioxidant compounds that may help in scavenging free radicals and protecting neuronal cells from oxidative damage. Despite its nutritional and medicinal importance, limited information is available regarding the neuroprotective potential and antioxidant properties of M. esculenta fruits. Therefore, the present study focuses on evaluating the phytochemical composition, antioxidant activity, and possible neuroprotective significance of the fruit.

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II. REVIEW OF LITERATURE

Myrica esculenta, popularly known as Kaafal or Box Myrtle, is a medicinal plant commonly found in the Himalayan regions. Traditionally, its fruits have been utilized for treating fever, inflammation, gastrointestinal disorders, and several nervous system related conditions. In recent years, scientific interest in this plant has increased because of its rich phytochemical composition and therapeutic importance.

Rawat et al. (2011) reported that the fruits of *Myrica esculenta* contain a variety of phytoconstituents including flavonoids, phenolics, tannins, glycosides, and anthocyanins. These compounds are well recognized for their antioxidant properties and their ability to minimize oxidative stress by neutralizing free radicals. The authors also observed that methanolic extracts showed comparatively higher phenolic content than aqueous extracts.

Pandey et al. (2013) assessed the antioxidant activity of *Myrica esculenta* fruit extract using DPPH and FRAP assays. Their findings revealed remarkable free radical scavenging activity, which was mainly attributed to the presence of polyphenolic constituents. The study suggested that the fruit could be considered a promising natural antioxidant source for pharmaceutical and nutraceutical use. Sharma and coworkers (2015) carried out phytochemical screening of *Myrica esculenta* fruit extracts and identified the presence of alkaloids, flavonoids, saponins, tannins, steroids, and terpenoids. The study concluded that these secondary metabolites are responsible for the wide range of biological activities associated with the plant.

Kumar et al. (2017) emphasized the significance of antioxidant-rich medicinal plants in protecting neuronal cells against oxidative stress. Their research indicated that plants containing high phenolic and flavonoid content may help reduce neuronal damage linked with disorders such as Alzheimer's disease and Parkinson's disease. The authors proposed that such plants may contribute to neuroprotection and cognitive enhancement.

Joshi et al. (2019) explained that oxidative stress is one of the major contributing factors in neurodegenerative diseases. According to their study, plant-derived antioxidants are capable of reducing reactive oxygen species and protecting neuronal tissues from cellular damage. Medicinal fruits rich in flavonoids and phenolic compounds were therefore considered beneficial in neuroprotective therapy.

Singh et al. (2021) further highlighted the growing importance of natural antioxidants as safer alternatives to synthetic agents. Their findings demonstrated that fruits rich in polyphenols possess both antioxidant and anti-inflammatory activities, which may be valuable in the prevention and management of neurological disorders.

Despite the availability of studies related to the antioxidant and phytochemical properties of Myrica esculenta, limited information is available regarding its specific neuroprotective activity. Therefore, further research is necessary to investigate its neuroprotective potential and identify the active phytoconstituents involved.

Conclusion of Literature Review

The literature indicates that Myrica esculenta fruit is a rich source of important phytochemicals such as flavonoids, phenols, tannins, and anthocyanins, which are associated with significant antioxidant activity. Since oxidative stress is closely linked with neurodegenerative disorders, the antioxidant properties of the fruit may contribute to neuroprotection. However, detailed studies focusing specifically on its neuroprotective effects remain limited, creating the need for further scientific evaluation.

Research Gap

Aim

To review the phytochemical composition, pharmacological activities, and nutritional potential of *Myrica esculenta* fruit and evaluate its therapeutic significance and future applications in pharmaceutical and nutraceutical fields.

Objectives

- To study the botanical profile and traditional uses of *Myrica esculenta* fruit.
- To review the phytochemical constituents present in *Myrica esculenta* fruit.
- To evaluate the nutritional composition and health benefits of the fruit.
- To analyze the pharmacological activities of the fruit such as:

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- Antioxidant activity
- Antimicrobial activity
- Anti-inflammatory activity
- Neuroprotective activity
- Antidiabetic activity

To review the toxicological and safety profile of the fruit.
To study available pharmacokinetic information related to active phytoconstituents.
To summarize extraction and analytical methods used for phytochemical investigation.
To identify research gaps and future prospects related to *Myrica esculenta* fruit.

III. METHODOLOGY

Collection of Plant Material

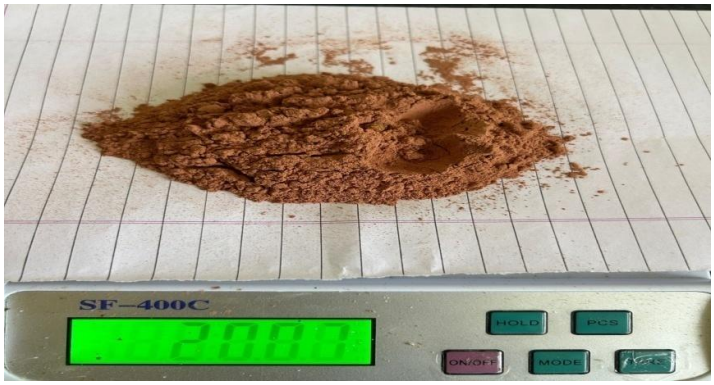
Fresh fruits of *Myrica esculenta* were collected from the local Chail-Chowk region and authenticated based on morphological characteristics.

Preparation of Plant Material

The collected fruits were washed thoroughly with distilled water to remove impurities and shade dried at room temperature. The dried material was powdered using a mechanical grinder and stored in an airtight container for further analysis.

Extraction Procedure

The powdered fruit material (20g) was subjected to solvent extraction using solvents methanol (150 ml) solvent by Soxhlet extraction method.



Procedure:

Accurately weighed powdered material was taken (20g).
The powder was extracted with solvent for a specific duration (12-15 hours).
The extract was filtered using Whatman filter paper.
Filtrate was concentrated using water bath.
The dried extract was stored for phytochemical screening.

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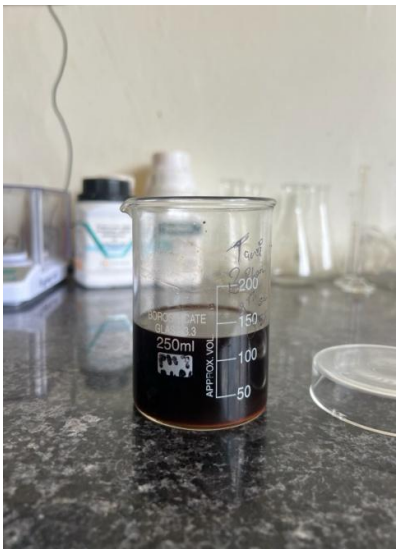

Preliminary Phytochemical Screening

The extract was subjected to qualitative phytochemical tests for identification of different phytoconstituents.

Phytoconstituent	Test Performed	Procedure	Inference	Result
Alkaloids	Mayer's test	Add Mayer's reagent to the extracted solution	Cream Precipitate	positive
Flavonoids	Alkaline Reagent Test	Add NaOH solution to the extracted solution	Yellow color	Positive
Tannins	Ferric chloride test	Add Ferric chloride to the extracted solution	Black color	Positive
Saponins	Foam test	Add water and extracted solution and then shake it	Stable foam formation	Positive
Terpenoids	Salkowski test	Add Chloroform + Sulphuric acid + Extract	Reddish Brown layer	Positive

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Evaluation of Nutritional Parameters

Nutritional analysis of the fruit was performed for:

- Carbohydrates
- Proteins
- Fats
- Vitamins
- Mineral content
- Moisture and ash values

using standard analytical methods.

IV. DATA COLLECTION AND ANALYSIS

The obtained phytochemical and nutritional data were compiled and interpreted to evaluate the medicinal and nutritional potential of *Myrica esculenta* fruit.

(Alkaloid test)

(Flavanoid test)

(Tannins test)

(Saponin test)

(Terpinoids test)

Pharmacological Activities

Myrica esculenta possesses a wide range of pharmacological activities due to the presence of bioactive phytoconstituents such as flavonoids, phenols, tannins, glycosides, and terpenoids. Various experimental studies have demonstrated its therapeutic potential in the management of different disorders.

Antioxidant Activity

The fruit extract exhibits significant antioxidant activity by scavenging free radicals and reducing oxidative stress. The presence of phenolic compounds and flavonoids contributes to its strong reducing and radical scavenging properties.

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Neuroprotective Activity

Myrica esculenta has shown potential neuroprotective effects by protecting neuronal cells from oxidative damage. Its antioxidant constituents may help in reducing neuronal degeneration associated with disorders such as Alzheimer's disease and Parkinson's disease.

Anti-inflammatory Activity

The plant possesses anti-inflammatory properties that may help reduce inflammation and swelling. Bioactive constituents present in the extract inhibit inflammatory mediators responsible for tissue damage.

Antimicrobial Activity

Extracts of Myrica esculenta have demonstrated antimicrobial activity against various bacterial and fungal strains. This activity supports its traditional use in treating infections and throat disorders.

Analgesic Activity

Studies suggest that the plant exhibits analgesic activity by reducing pain sensation. The bark and fruit extracts have been traditionally used for relieving body pain and discomfort.

Antidiabetic Activity

The plant has shown potential antidiabetic effects by helping regulate blood glucose levels and improving antioxidant defense mechanisms associated with diabetes.

Hepatoprotective Activity

Myrica esculenta may provide protective effects against liver damage due to its antioxidant and anti-inflammatory properties. The extract helps reduce oxidative stress and supports normal liver function.

Pharmacokinetic Overview

Detailed pharmacokinetic studies on *Myrica esculenta* fruit are limited. However, phenolic and flavonoid compounds present in the fruit are generally absorbed through the gastrointestinal tract and exert antioxidant effects by scavenging free radicals and reducing oxidative stress in tissues, including neuronal cells.

Toxicological Profile

Available studies suggest that Myrica esculenta fruit extract is relatively safe at therapeutic doses. No significant toxicity has been reported in preliminary experimental studies. However, excessive consumption or high doses may require further toxicological evaluation for long-term safety.

V. CONCLUSION

The available studies indicate that Myrica esculenta possesses significant pharmacological potential due to the presence of various bioactive phytoconstituents such as flavonoids, phenols, tannins, glycosides, and terpenoids. These compounds contribute to its antioxidant, neuroprotective, anti-inflammatory, antimicrobial, analgesic, antidiabetic, and hepatoprotective activities. Among these, the antioxidant and neuroprotective properties are particularly important because they may help in reducing oxidative stress and neuronal damage associated with neurodegenerative disorders. Although several pharmacological activities have been reported, further detailed studies are still required to establish its exact mechanism of action, therapeutic efficacy, and clinical safety. Therefore, Myrica esculenta may serve as a promising natural source for future pharmaceutical and nutraceutical applications.

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