

ISOLATION AND CHARACTERIZATION OF SEED OF *SPHAERANTHUS INDICUS* AND ITS THERAPEUTIC PROPERTIES

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ABSTRACT

Sphaeranthus indicus Linn.(Asteraceae), commonly known as *Gorakhmundi*, is highly reputed weed in traditional Indian systems of medicine, extensively utilized for treating diverse ailments. While the aerial parts and flower heads are widely studied, the phytochemical profile and therapeutic potential of its seed remain less explored.^[1] The plant found in India, Africa, Australia, Indo-Malesia and Srilanka, has numerous medicinal properties, including antitussive, wound healing, broncho dilatory, antioxidant and CNS depressant properties.^[2] *Sphaeranthus indicus* is rich in diverse secondary metabolites, including eudesmanolides, sesquiterpenoids, sesquiterpene lactones, sesquiterpene acids, flavone glycosides, flavonoids C-glycosides, is flavone glycoside, sterols, sterol glycosides, alkaloids, peptide alkaloids, amino acids, and sugars. Essential oils extracted from its flowers and whole plants contain monoterpene hydrocarbons, oxygenated monoterpenes, sesquiterpene hydrocarbons, oxygenated sesquiterpenes. *Sphaeranthus indicus* demonstrates a broad spectrum of pharmacological activities across its various formulations, making it a versatile herb in both traditional and modern medicinal practices. From cream and ointments for topical relief to syrups and capsules for systemic benefits, each formulation harnesses the herb's therapeutic potential supported by scientific evidence.^[2] Although extensively reviewed in previous literature, this review aims to explore its Siddha and Ayurvedic uses, in addition to its biological effects and botanical compounds characteristics. It encompasses the structure, botanical compounds composition, ethnobotanical uses, and pharmacological activities reported for *Sphaeranthus indicus*.^[2]

KEYWORDS: Pharmacological activities, Formulations, Ethnobotanical uses, Secondary metabolites.

INTRODUCTION

The medicinal plants have been a part of human healthcare system since ancient times and are still playing an important role in the modern therapeutics. Traditional medicine systems like Ayurveda, Unani, Traditional Chinese Medicine, and African ethnomedicine have significant dependence on plant-based remedies in preventing and treating diseases around the world. Thousands of plant species have been employed for medicinal use as a major source of therapeutic agents and drug discovery.

The rising popularity of medicinal plants is largely attributed to the rising demand for natural and safer alternatives of synthetic drugs. Phytochemicals have been found to have a wide variety of therapeutic actions such as antioxidants,

anti-inflammatory, antimicrobial, antidiabetic, hepatoprotective and anticancer. The biological activities of these medicinal plants are primarily believed to be due to secondary metabolites including alkaloids, flavonoids, tannins, terpenoids, phenols and glycosides that account for their therapeutic property.^[3]



In addition, the development of extraction, isolation and characterization methods has helped to have better knowledge of the chemical composition and biological activity of medicinal plants. New analytical techniques like chromatography, spectroscopy and molecular biology techniques have helped identify the active components and their action mechanisms. This scientific assessment has contributed to the acceptance of medicinal plants in evidence-based medicine, outing traditional medicine and modern pharmacology on the same footing.^[4]

Medicinal plants are an important and viable source of medicinal agents in general. Most of them are widely available, inexpensive and have a variety of pharmacological properties, which makes them an invaluable part of healthcare systems around the world. As a result, scientific research on medicinal plants is still flourishing and the bioactive compounds are being isolated, characterized and evaluated for their therapeutic properties.

Pharmacological Studies

1. Antioxidant Activity

Oxidative stress is a physiologic state caused by disequilibrium between the formation of reactive oxygen species (ROS) and the capacity of the biological system to detoxify these reactive intermediates or repair the damage caused by the ROS. Too much ROS production can result in damage to important cellular structures like DNA, proteins, and lipids and impair cellular function. This oxidative damage has been well linked to the development and progression of various chronic conditions such as cancer, diabetes mellitus, cardiovascular disorders and neurodegenerative disorders, like Alzheimer's and Parkinson's. Thus, prevention and management of oxidative stress has emerged as an important strategy in disease management.

The rich content of bioactive phytochemicals in medicinal plants makes them one of the most important natural sources of antioxidants. Flavonoids, phenolic acids, tannins and other polyphenols are important for their ability to scavenge free radicals and prevent oxidative chain reactions. These phytochemicals serve as hydrogen or electron donors to neutralize the unstable ROS and decrease the damage caused by ROS to the cell. Many plant antioxidants also have metal-chelating activity that enhances their ability to reduce catalytic activity of transition metals that promote the formation of free radicals. These mechanisms boost the body's natural antioxidant defenses, supporting cellular homeostasis.^[5]

2. Anti-inflammatory Activity

Inflammation is a multi-faceted and vital immune system reaction that is triggered in response to injury, infection or toxic substances. It is a protective mechanism that is supposed to remove the primary cause of cell damage, remove dead cells and start tissue repair. But chronic inflammation or dysregulated inflammation leads to the onset of a number of chronic diseases, such as arthritis, cardiovascular disease, diabetes, and other metabolic syndromes. Chronic inflammation can cause ongoing damage to tissues, and progressive organ dysfunctions, making control of inflammation a major therapeutic goal.^[6]

3. Antifungal Activity

Medicinal plants have antifungal properties and they contain a variety of phytochemical compounds including alkaloids, flavonoids, tannins, phenolic compounds and terpenoids. These compounds have antifungal activity via several mechanisms such as inhibiting the synthesis of fungal cell walls, altering membrane permeability, leakage of intracellular components and inhibition of spore germination and fungal growth. It makes plant-derived compounds very effective against a wide variety of pathogenic fungi, such as dermatophytes and opportunistic fungal species, because these compounds target multiple targets.

Natural antifungal agents are becoming more and more attractive to scientists in recent years because of their relatively low toxicity, higher biocompatibility, and lack of resistance development as compared with synthetic antifungal agents. Plant-derived compounds are safer and less harmful and are a promising alternative to many synthetic antifungal drugs that are linked to adverse effects and resistance. Thus, medicinal plants are a valuable source for the modern pharmacological research for the development of new antifungal agents.^[7]

4. Antihyperlipidemic activity

Serum TC and LDL-c levels increased, but cholesterol levels decreased. The animal fed an atherogenic diet had elevated HDL levels. The main risk factor for coronary heart disease (CHD) was elevated blood cholesterol, with HDL serving as a cardioprotective lipoprotein. The levels of TC and LDL-c are dramatically reduced by treatment with 500 mg/kg/day of *Sphaeranthus indicus* extract. Lecithin's increased activity might be the cause of the *Sphaeranthus indicus* extract's effects. The TG level decreased when *Sphaeranthus indicus* extract (500 mg/kg/day) was administered. LDL:HDL-c ratio and atherogenic index were significantly lower. Both high and low blood cholesterol levels may be predicted by the LDL:HDL-c ratio, and the most significant marker of coronary heart disease (CHD) is the atherogenic index. Strong antihyperlipidemic effects are demonstrated by the alcoholic extract of *Sphaeranthus indicus*.^[8]

Importance of Seeds of the Plant

Sphaeranthus indicus has been widely studied as a medicinal plant, with most scientific research focusing on leaves, flowers and aerial parts extracts, with very limited research focusing on the seeds. This is an important and promising research area, as there is little research conducted on the seeds. The phytochemical composition of various parts of medicinal plants is well documented and thus the study of the seeds could reveal unique phytochemical constituents, which are absent in other parts of the plant.^[9]

Medicinal plants are well known to contain abundant concentrations of various biologically active compounds in their seeds such as fixed oils, phenolic compounds, flavonoids, fatty acids and other secondary metabolites. These compounds are generally found in stable and concentrated form and the seeds are a great choice for extraction, isolation

and characterization studies. The stability of the phytochemicals obtained from seeds is also greater, making them more suitable for pharmacological studies and therapeutic use.^[10]

Research Methodology

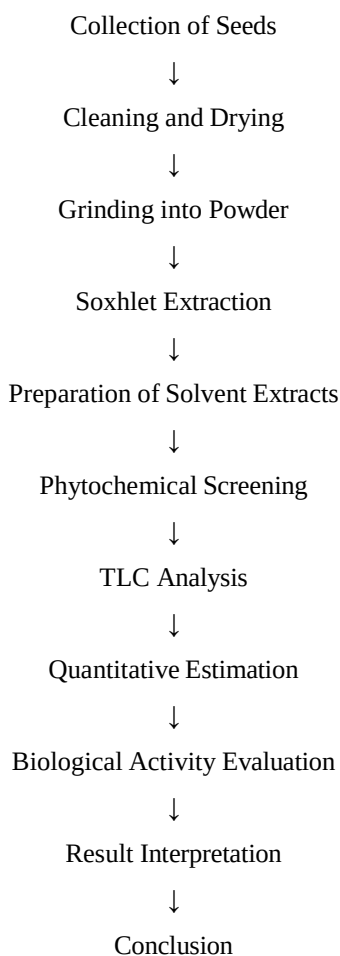
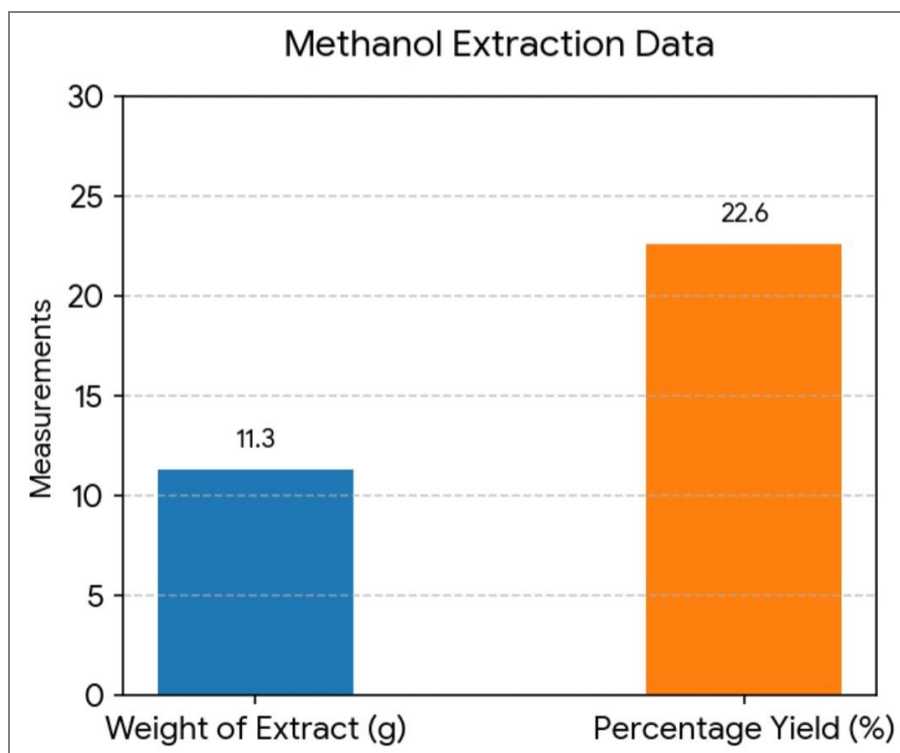


Table 1: Organoleptic Characteristics of Seed Powder.

S. No.	Parameter	Observation
1	Colour	Brown
2	Odour	Characteristic
3	Taste	Slightly Bitter
4	Texture	Coarse Powder
5	Appearance	Free Flowing

Table 2: Percentage Yield of Different Seed Extracts.

S. No.	Solvent Extract	Weight of Extract (g)	Percentage Yield (%)
1	Methanol	11.3	22.6



CONCLUSION

The present work successfully established the phytochemical composition and its therapeutic potential of the seeds of *Sphaeranthus indicus*. Methanol was determined to be the best solvent as it gives the largest percentage of extract (22.6%) and highest phytochemical profile. The methanolic seed extract exhibited high percentage of total phenolic content (62.48 mg GAE/g), total flavonoid content (44.83 mg QE/g) and high antioxidant activity ($IC_{50} = 42.8 \mu\text{g/mL}$) with strong correlation. Moreover, the extract had moderate to strong antimicrobial property against both bacterial and fungal strains and had moderate to strong concentration dependent anti-inflammatory property (76.2% at $200 \mu\text{g/mL}$).

By chromatographic and spectroscopic techniques (TLC, UV, FTIR and HPLC) two bioactive compounds, SI-1 and SI-2, have been successfully isolated and preliminary characterized as a flavonoid glycoside and a phenolic compound, respectively. The physicochemical analysis confirmed good quality and purity of the seed material and the brine shrimp lethality test showed a good safety profile ($LC_{50} > 1000 \mu\text{g/mL}$).

In general, results of this research give scientific support to the traditional uses of medicinal plants *Sphaeranthus indicus* seeds and showed that *Sphaeranthus indicus* seeds could be one of the natural bioactive sources to make herbal medicine.

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