

Exploring the Ethnomedicinal Potential of Black Turmeric (*Curcuma Caesia* Roxb.): A Comprehensive Review

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ABSTRACT

This review aims to comprehensively explore the ethnomedicinal uses of Black Turmeric (*Curcuma caesia* Roxb.), an understudied yet culturally significant plant in traditional medicine. Plant's botanical characteristics, distribution across geographical regions, and its historical utilization among diverse indigenous communities are discussed in this paper. Additionally, the paper will conduct a critical analysis of Black Turmeric's phytochemical profile and pharmacological properties, emphasizing its potential therapeutic benefits in modern medical applications. By synthesizing findings from existing literature and ethnobotanical research, this review aims to connect existing gaps in knowledge and suggest directions for future research. The study underscores the importance of preserving and integrating traditional medicinal knowledge into contemporary healthcare practices.

KEYWORDS: Black turmeric, *Curcuma caesia* Roxb., ethnomedicine, traditional knowledge, phytochemistry, pharmacology

INTRODUCTION

Turmeric is a well-known medicinal herb because of its health benefits. While yellow turmeric has gained significant attention in the realms of health and culinary arts, black turmeric remains relatively unknown to many. Scientifically, black turmeric is called *Curcuma caesia* which belongs to the family Zingiberaceae under the order Zingiberales in the class Magnoliopsida. The perennial black-blue *C. caesia*, known by various regional names, releases an aromatic pungency due to its essential oils. In Kali Puja ceremonies held in West Bengal, the rhizome of this plant earns it the name Kali haldi. Native to northeast and central India, the plant is valued as a medicinal resource throughout Asia. In India, the plant grows in several states viz; Andhra Pradesh, West Bengal, Madhya Pradesh, North-East, Uttar Pradesh, Maharashtra, Gujarat, Telangana, Karnataka, Kerala, Orissa, Bihar, Jharkhand, Chattisgarh, Tamil Nadu, Bihar, Delhi, Punjab, Haryana, and Himachal Pradesh. Despite its wide distribution in India, this plant is now mainly grown commercially due to its rareness. It thrives in moist deciduous forests. In India, turmeric is used extensively for spiritual and

medicinal purposes. This species is endangered by piracy according to the central forest department of India. Black turmeric rhizomes are commercially valuable due to their medicinal properties. In Indian traditional medicine, black turmeric rhizomes have been employed to address leukoderma, snake and scorpion bites, asthma, tumors, piles, and bronchitis, among other ailments and metabolic disorders. The crop serves multiple purposes, including medicinal, social, and spiritual uses. In 1997, the Ministry of Environment identified over 112 Medicinal Plant species as crucially important, rendering their export illegal in the absence of necessary legal authorization. Black turmeric is also part of the mentioned component.

LITERATURE REVIEW

Mahato and Sharma (2018) conducted a review on the ethnomedicinal use of 'Kali Haldi' in Jharkhand State. The medicinal significance of *C. caesia* (kali haldi) was highlighted in the study. It has traditional uses, such as for treating leucoderma, asthma, tumors, and bruises, and has versatile medicinal properties. The

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study also discussed its chemical composition, highlighting major constituents such as camphor and curcumin, which contribute to its medicinal benefits. Scientific evidence supporting its antifungal, antimicrobial, antioxidant, and anti-asthmatic activities was presented, confirming and validating its traditional uses with modern research findings. Tamang (2022) conducted a review of the medicinal properties of *Curcuma caesia* Roxb. The research revealed on the phytochemical composition and pharmacological effects of black turmeric, establishing its scientific basis for medicinal use. Kanglom et al. (2023) investigated the phytochemical makeup, antioxidant capabilities, and antibacterial potential of black turmeric in their paper titled 'Evaluation of Phytochemical Constituent, Antioxidant and Anti-Bacterial Activity of Black Turmeric (*Curcuma caesia* Roxb.)'. The study concluded that black turmeric is an abundant source of antioxidants, phytochemicals, and has antimicrobial properties, making it a valuable asset for health benefits and pharmaceutical and food industry applications. The research paper by Rathour et al. (2024), titled 'Black Turmeric: An Inclusive Study', explores the extensive properties and applications of black turmeric. Black turmeric's importance in ayurveda and traditional medicine is explored in this paper, detailing its uses across diverse cultures. Arya et al. (2018) emphasize Black Turmeric's importance in traditional medicine as a valuable medicinal herb from North-East India. Pandey and Agnihotri (2015) investigated the research, hurdles, and future possibilities of utilizing antimicrobials derived from medicinal plants in food and pharmaceutical industries. Shahinozzaman et al. (2013) used rhizome bud explants of black turmeric (*Curcuma caesia*) in vitro micropropagation by highlighting the potential for increasing black turmeric cultivation in natural soil conditions successfully. Venugopal et al. (2017) research identified extensive medicinal benefits for black turmeric, including antifungal, anti-asthmatic, anti-ulcer, analgesic, antioxidant, and smooth muscle relaxing properties, showcasing its broad medicinal scope. In 2023, Pandey et al. explore the botanical features, phytochemical composition, traditional applications, medicinal values, and prospective health advantages of Black Turmeric, while addressing obstacles in its cultivation and preservation. Gaikwad et al. (2023) identified a range of components including alkaloids, triterpenoids, steroids, saponins, tannins, flavonoids, cardiac glycosides, proteins, amino acids, carbohydrates, fats, and fixed oils in different extracts (methanolic, chloroform, petroleum ether, and water) of Black Turmeric (*Curcuma*

caesia). This herb's significant role in herbal medicine is emphasized by its traditional functions as an antiparasitic, diuretic, hepatoprotective, laxative, and sedative. Kumar et al. (2022) reported that rhizome extracts inhibit the growth of Gram-positive bacteria like, *Bacillus cereus*, *Bacillus subtilis*, and *Streptococcus agalactiae* having antibacterial activity.

OBJECTIVES OF THE STUDY

1. Systematically document and compile existing knowledge on the ethnomedicinal uses of black turmeric, drawing from traditional practices, folklore, and historical texts.
2. Identify research gaps in understanding black turmeric's ethnomedicinal uses, proposing future study directions and research priorities.
3. Explore the cultural significance and socioeconomic impact of black turmeric within local communities, emphasizing its traditional healing roles and economic opportunities.
4. Enhance education and awareness among researchers, healthcare professionals, policymakers, and the public about black turmeric's ethnomedicinal uses, highlighting its potential benefits and utilization challenges.

BOTANICAL DESCRIPTION

Rhizomes: The rhizomes of black turmeric are characterized by their unique appearance, with the inner part typically ranging from dark purple to bluish black. They are generally not consumed directly because of their intense, hot, sharp, sour, and earthy taste, often accompanied by a subtle turpentine-like flavor and bitterness. The size and shape of these tuberous rhizomes range from 2-6 cm in diameter.

Root: Rhizomes do not form during propagation. Adventitious roots, yellow-brown, long, fibrous, and tapering, cover the rhizome entirely.

Leaves: Black turmeric leaves are broad, lance-shaped, and arranged in groups of 10 to 25 along long petioles. These frogs have a typical appearance with a deep purple-brown cloud-like pattern that covers both sides. The upper leaf surface is slightly hairy. Ivory-colored petioles encircle one another, creating a pseudo axis. Monocots typically exhibit parallel venation.

Flowers: It is smaller than the bracts, pale yellow and reddish borders. The sepals (calyx), is about 10-15 mm long, has three obtuse teeth. Venugopal et al. (2017) describe the corolla as elongated, tubular, and 3-lobed, with a pale yellow, semi-elliptic lip.

Inflorescence: Black turmeric produces pale pink or white fragrant flowers in spikes having 15-20 cm long. The spike emerges before leaf opening which bears greenish-red bracts.

Fruits: Fruits are seed-bearing structures enclosed in a capsule (Pandey et al., 2023).



Figure 1: Photographs showing different parts of *Curcuma caesia* Roxb.

PHYTOCHEMICAL COMPOSITIONS

The unique color of black turmeric rhizomes is a result of the anthocyanins found in them, specifically cyaniding Pandey et al. (2023). Apart from anthocyanins, other phytochemical substances found in black turmeric include:

- 1. Curcuminoid:** Although black turmeric is not as well known for its curcumin content as yellow turmeric, it does contain curcuminoid, which are known for their potential health benefits. This
- 2. Essential oils:** Rhizomes contain essential oils with complex aromas and are often used in perfumery and traditional medicines.
- 3. Starch:** Rhizomes are rich in starch, making them an energy source.

BIOACTIVE COMPOUNDS

Many bioactive chemicals found in black turmeric are known to have therapeutic properties. These compounds can operate singly, in combination, or in combination to promote health (Omprakash et al. 2018). Curcumin, which has medicinal benefits shared by other *Curcuma species*, is the plant's most notable characteristic (Chadalavada et al. 2017). Antimicrobial, antitumor, anxiolytic, anti-inflammatory, anti-ulcer, and antioxidant properties are recognized, which include curcuminoids, essential oil, flavonoids, phenolics, amino acids, proteins and high alkaloids (Karmakar et al. 2013, Devi et al. 2015, Vineela et al. 2017, Omprakash et al. 2018).

Black turmeric has been utilized historically in traditional medicine and exhibits potential as a source of potent medicinal compounds. Its industrial and pharmacological relevance may increase with more research on isolating these active components. Black turmeric, which belongs to the *Curcuma* genus and has been known for millennia for its antibacterial qualities, is a valuable plant-based substitute for microbe-based antimicrobials, which are becoming more and more associated to side effects and drug resistance (Pandey et al., 2015, Tamang S 2022).

IMPORTANCE AND USES

1. Therapeutic Uses: Black turmeric is very important for general health in rural areas. According to Chadalavada et al. (2017), if technology advances, the species may contribute significantly to the production of novel medications. Rhizomes are utilized for wound cleaning, stimulation, anti-diarrheal, diuretic, anti-emetic, and skin problems (Vairappan et al., 2013). Black turmeric rhizome paste is used in Manipur to treat aching symptoms and repair wounds. The ENVIS Center for Himalayan Studies suggests using fresh rhizome paste for snake and scorpion stings and fresh rhizome decoction for diarrhea in Arunchal Pradesh (Chadalavada et al. 2017).

2. Use in Disease Treatment: The tribal communities utilize this treatment for pneumonia, coughs, and common colds. It treats fever and asthma in both children and adults. Rhizome powder functions as a face mask. Apply a fresh rhizome paste on the forehead. This treatment is used to relieve migraines and heal brain injuries. Rhizome paste effectively treats snake and scorpion bites. According to Israr et al. (2012), black turmeric extract is also used to treat fever, allergies, inflammation, cancer, and asthma. An antidiarrheic medication for stomach pain is fresh rhizome decoction (Kagyung et al. 2010). Leukoderma, epilepsy, cancer, and HIV/AIDS are all prevented by it. Both cholesterol and skin irritation are decreased with black turmeric. Soak a cotton ball in black turmeric milk and apply to the skin for 15 minutes to prevent rashes. It will further illuminate and brighten the complexion as well. Healing a sick person is an achievable goal. The paste relieves gastric pain, including stomach ache and dysentery. It effectively stops bleeding and promotes swift recovery from cuts, wounds, and snake bites. Turmeric in its black form could alleviate inflamed tonsils.

3. Anti-bacterial activity: Oleoresins extracted from nine *Curcuma* species namely; C.

aeruginosa, *C. amada*, *C. aromatica*, *C. brog*, *C. caesia*, *C. malabarica*, *C. rakthakanta*, *C. sylvatica*, and *C. zedoaria* were found to possess antioxidant and antibacterial effects by Rajamma et al. (2012).

- 4. Anti-ulcer activity:** The study conducted by Das et al. (2022) demonstrated that the ethanol extract of *C. caesia* rhizome reduce gastric acid, free acidity while simultaneously enhancing mucus production.
- 5. Effects on smooth muscle relaxation and asthma prevention:** *C. caesia* was found to provide both of these benefits by Arulmozhi et al. (2006).
- 6. Anti-fungal activity:** The anti-fungal characteristics of *C. caesia* rhizomes were identified by Banerjee and Nigam (1976). Its essential oil has antifungal qualities.

CHALLENGES IN CULTIVATION AND CONSERVATION

Cultivating black turmeric poses several challenges:

- 1. Low yield:** Black turmeric typically has lower rhizome yields (fresh rhizome yield is 50-60 q/acre) than yellow turmeric (fresh rhizome yield is 80-100 q/acre), making it less economically viable for large-scale cultivation.
- 2. Market demand:** Despite its rich cultural heritage and potential health benefits, black turmeric struggles to gain traction in global markets.
- 3. Lack of awareness:** Limited market demand for black turmeric primarily stems from consumer unawareness, particularly in regions beyond its native habitat. Many people are more familiar with yellow turmeric because of its widespread culinary use and extensive marketing.
- 4. Color preference:** In culinary applications, yellow turmeric is often preferred, especially in dishes like curry. The dark color of black turmeric can be perceived as less appealing for certain culinary uses, thereby affecting its marketability.
- 5. Competition with yellow turmeric:** Yellow turmeric, with its well established market presence and health benefits, faces tough competition with black turmeric.
- 6. Limited processing and product development:** Consumers may opt for a more familiar and readily available yellow variety. Black turmeric has fewer processed products and commercial offerings compared to yellow turmeric. Limited product diversity limits its market potential.

- 7. Lack of marketing and promotion:** Insufficient marketing and promotion efforts for black turmeric also contributed to its limited market demand. It is essential to educate consumers about its unique characteristics and potential health benefits.

In addition to cultivation challenges, black turmeric faces conservation concerns due to over harvesting and habitat destruction; therefore it has been reported as “endangered”. To ensure the long-term survival of the plant for culture and medicine, conservation measures and sustainable production practices are needed.

MAJOR FINDINGS OF THE STUDY

- 1. Rich Ethnomedicinal Knowledge:** Black turmeric has a rich history of ethnomedicinal use documented across various traditional practices, folklore, and historical texts.
- 2. Bioactive Compounds:** Identification of bioactive compounds present in black turmeric, contributing to its medicinal properties, such as curcuminoids and other phytochemicals.
- 3. Therapeutic Potential:** Evidence supporting the traditional uses of black turmeric for various health conditions, including its anti-inflammatory, antioxidant, and potentially anticancer properties.
- 4. Cultural and Socioeconomic Significance:** Exploration of black turmeric's cultural significance within local communities, highlighting its role in rituals, traditional healing practices and economic opportunities.
- 5. Research Gaps and Future Directions:** Identification of gaps in current research and understanding, suggesting directions for future studies to further explore the pharmacological and therapeutic potentials of black turmeric.
- 6. Challenges in Utilization:** Discussion on challenges related to the utilization of black turmeric in modern healthcare practices, including issues related to standardization, cultivation and conservation.
- 7. Awareness and Education:** Recommendations for enhancing awareness and education among stakeholders about black turmeric's ethnomedicinal uses, aiming to promote its sustainable utilization and conservation.

DISCUSSION AND CONCLUSION

Black turmeric is a rare herb with major cultural and therapeutic value that is extracted from the rhizome of the plant. The health advantages of black turmeric are comparable to those of its more popular yellow

version, but it stands out due to its significantly higher curcumin content when compared to other *Curcuma* species. Because of this herb's spiritual and physiological benefits, it is widely utilized throughout India. Despite its potential therapeutic value, black turmeric remains underexplored in scientific research, particularly regarding its pharmacological properties and medicinal potential. There is a pressing need for comprehensive studies on its phytochemical composition and therapeutic benefits, including investigations into its efficacy in treating various diseases. Utilizing advanced breeding techniques such as in vitro propagation with growth promoters could aid in conserving this valuable medicinal plant. Local efforts to cultivate and preserve its germplasm are essential for its sustained availability. As scientific interest grows, it is crucial to balance the preservation of black turmeric's cultural heritage with sustainable cultivation practices. This approach not only supports human health but also contributes to biodiversity conservation. A wide range of medicinal uses for the plant, such as antifungal, antioxidant, analgesic, and anticancer properties, seem promising. Its medicinal potential is highlighted by pharmacological investigations, which also highlight the need for more research into the effects of its bioactive components.

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