



Original Article

Green Innovation from Nature: A Case Study of Caffeine-Free Chhind Herbal Coffee Innovation in Bastar, Chhattisgarh

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Abstract

Green innovation has emerged as a significant pathway toward sustainable development, especially in forest-based economies where indigenous knowledge and local biodiversity can be transformed into eco-friendly commercial products. The present study examines the innovative development of caffeine-free herbal coffee prepared from Chhind (Wild Date Palm: *Phoenix sylvestris*) seeds in Bastar, Chhattisgarh. Developed by young entrepreneur Vishal Haldar, this initiative demonstrates an effective “waste-to-wealth” model by converting discarded forest seeds into a nutritionally rich beverage. The research explores the phytochemical composition, pharmacological properties, production process, health benefits, sensory profile, and brewing techniques of Chhind herbal coffee. The study further evaluates its socio-economic implications for tribal livelihoods, youth entrepreneurship, and sustainable forest resource utilization. Secondary data from scientific journals, reports, ethnobotanical studies, and media documentation have been used for analysis. Findings indicate that Chhind seeds possess high antioxidant activity, low toxicity, antihyperglycemic properties, and essential micronutrients, making them a promising alternative to conventional caffeinated beverages. The innovation also contributes to circular economy practices, tribal empowerment, and environmentally sustainable entrepreneurship in Bastar. The paper concludes that indigenous-resource-based green innovations can create new models of rural development while preserving ecological balance and traditional knowledge systems.

Keywords: Green Innovation, Chhind Coffee, Bastar, Wild Date Palm, *Phoenix sylvestris*, Herbal Coffee, Tribal Entrepreneurship, Sustainability, Waste-to-Wealth, Indigenous Knowledge System

Introduction

The increasing global demand for sustainable and health-conscious products has encouraged innovators to explore alternative beverages derived from natural and indigenous resources. In India, forest-rich tribal regions possess enormous untapped biodiversity that can support environmentally sustainable enterprises. Bastar region of Chhattisgarh, known for its dense forests and tribal heritage, has recently emerged as a center of innovative eco-friendly experimentation through the development of Chhind-based herbal coffee. Chhind (*Phoenix sylvestris*), commonly known as Wild Date Palm, grows abundantly in the Bastar and Dantewada regions. Traditionally, the plant has been associated with local food practices and folk medicinal applications. However, its seeds were largely treated as waste material and discarded after fruit consumption. This pattern changed when Vishal Haldar developed a 100% caffeine-free herbal coffee using roasted Chhind seeds. The innovation gained major recognition after receiving first prize at the Innovation Mahakumbh organized at Shaheed Mahendra Karma University. The product was later appreciated by Vishnu Deo Sai and O. P. Choudhary for its nutritional and entrepreneurial significance. The innovation represents a unique convergence of green technology, indigenous knowledge, tribal participation, and sustainable entrepreneurship. Unlike conventional coffee, Chhind herbal coffee contains no caffeine and demonstrates high antioxidant potential along with multiple health-supportive properties. Furthermore, the initiative contributes toward waste minimization by transforming discarded forest resources into commercially viable products. This paper critically examines the scientific, economic, environmental, and socio-cultural dimensions of Chhind herbal coffee as a model of green innovation from nature.

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Objectives of the Study

The present research paper aims to achieve the following objectives:

1. To examine the emergence of Chhind herbal coffee as a green innovation in Bastar.
2. To analyze the phytochemical and nutritional composition of *Phoenix sylvestris* seeds.
3. To evaluate the health benefits of Chhind coffee in comparison with regular caffeinated coffee.
4. To study the production and brewing techniques associated with Chhind herbal coffee.
5. To understand the socio-economic and environmental significance of the innovation for tribal communities and sustainable development.

Research Methodology

The present study is qualitative and descriptive in nature. The research primarily relies on secondary data collected from scientific journals, ethnobotanical studies, government reports, online publications, innovation case studies, and newspaper articles related to Chhind herbal coffee and *Phoenix sylvestris*. Relevant pharmacological and phytochemical studies were analyzed to examine the medicinal and nutritional properties of Chhind seeds.

APA 7th edition referencing style has been followed throughout the paper. In-text citations have been incorporated to maintain academic authenticity and avoid plagiarism. The study also uses analytical and interpretative methods to examine the broader implications of this innovation in the context of sustainable development and tribal entrepreneurship.

Chhind Herbal Coffee as a Green Innovation

Green innovation refers to the development of environmentally sustainable products, processes, and technologies that minimize ecological degradation while generating economic and social benefits. Chhind herbal coffee represents a remarkable example of such innovation because it transforms forest waste into a healthy commercial beverage.

The innovation was initiated by Vishal Haldar, a young entrepreneur from Dantewada district, who spent nearly two years researching local forest resources and experimenting with Chhind seeds. The final product is prepared by roasting and grinding discarded wild date palm seeds into a fine powder that resembles conventional coffee in aroma and appearance but remains completely caffeine-free. The project operates under a “waste-to-wealth” framework. Traditionally discarded seeds are now economically valuable, creating livelihood opportunities for local tribal communities engaged in collection, drying, sorting, and processing activities. The initiative also encourages youth entrepreneurship through collaborations with local institutions and developmental organizations. From an environmental perspective, the innovation supports circular economy practices by reducing forest waste and promoting sustainable utilization of indigenous biodiversity. Unlike industrial coffee cultivation, which often requires large-scale agricultural resources, Chhind coffee relies on naturally available forest products with minimal ecological disturbance.

Scientific Profiling of Chhind (*Phoenix sylvestris*) Seeds

Scientific studies on *Phoenix sylvestris* seeds reveal a rich phytochemical and nutritional composition. The seeds contain several bioactive compounds responsible for their medicinal and antioxidant properties.

Phytochemical Composition

Research findings indicate that Chhind seeds contain high concentrations of phenols, flavonoids, tannins, alkaloids, steroids, and terpenoids (Khan et al., 2021). Total phenolic content has been reported at approximately 91.32 mg Gallic Acid Equivalent per gram, while flavonoid concentration reaches nearly 21.99 mg Quercetin Equivalent per gram. These compounds play an important role in reducing oxidative stress and protecting cellular structures from free radical damage. Gas Chromatography-Mass Spectrometry (GC-MS) analysis further identifies bioactive constituents such as 8-methylisoquinoline N-oxide as a dominant compound with pharmacological significance.

Pharmacological Properties

The antioxidant activity of Chhind seeds demonstrates strong radical scavenging properties against DPPH and nitric oxide radicals. Such activity helps prevent lipid peroxidation and supports cellular protection mechanisms. Traditional ethnomedicinal use of Chhind seeds in diabetes management has also gained scientific support. Studies indicate that methanol extracts of the seeds contribute to improved glucose tolerance and reduced blood sugar levels (Sharma & Patel, 2020). Toxicological studies further show that oral administration of the extract up to 3000 mg/kg body weight produces no significant adverse effects, suggesting a broad safety margin.

Nutritional Profile

The seeds contain essential dietary fibers, proteins, amino acids, and fatty acids. They are also rich in important micronutrients including potassium, magnesium, calcium, phosphorus, and iron. These minerals contribute toward electrolyte balance, metabolic regulation, and enzymatic functioning within the human body.

Health Benefits of Chhind Herbal Coffee

Antioxidant Protection Without Caffeine Effects

Unlike conventional coffee, Chhind herbal coffee delivers antioxidant benefits without caffeine-induced side effects. Conventional coffee contains caffeine that may overstimulate the nervous system and cause anxiety, insomnia, or heart palpitations when consumed excessively. In contrast, Chhind coffee provides antioxidant protection without affecting heart rate or sleep patterns.

Digestive and Gut Health Benefits

Chhind coffee possesses low acidity and is gentler on the gastrointestinal tract. The presence of dietary fibers and prebiotic components may support gut microbiome health and improve digestion. Regular coffee, by contrast, often increases gastric acid secretion and contributes to acid reflux or stomach irritation.

Stable Energy and Glycemic Balance

The beverage provides a gradual and sustained energy effect because it lacks caffeine-induced hormonal spikes. The presence of potassium and magnesium contributes to metabolic balance and stable energy release. Its low glycemic profile may also support blood sugar management.

Detoxification Support

The amino acids and antioxidants present in Chhind seeds may assist liver and kidney functions by promoting safe elimination of metabolic waste products. The absence of caffeine further reduces metabolic burden on hepatic detoxification pathways.

Comparative Taste Profile of Chhind Herbal Coffee

The sensory profile of Chhind coffee differs significantly from standard Arabica or Robusta coffee.

Flavor Characteristics

Chhind coffee exhibits naturally sweet, nutty, earthy, and mildly caramelized flavor notes. Roasting enhances subtle chocolate-like undertones and roasted grain flavors. Standard coffee generally contains stronger fruity, acidic, or smoky characteristics depending on roasting patterns and geographical origin.

Acidity and Bitterness

The absence of caffeine and reduced chlorogenic acid concentration makes Chhind coffee smoother and less bitter. Traditional coffee usually possesses higher bitterness and acidity levels.

Aroma

Chhind coffee produces a warm and cereal-like aroma with lighter olfactory intensity. Standard coffee contains stronger aromatic compounds such as pyrazines and sulfur-containing molecules that create a more pungent “coffee-shop” fragrance.

Texture and Mouthfeel

The beverage offers a cleaner and lighter mouthfeel compared with the heavier and oil-rich texture associated with conventional coffee.

Brewing Techniques for Chhind Herbal Coffee

Brewing methods significantly influence the extraction and flavor profile of Chhind herbal coffee.

South Indian Filter Method

This method utilizes slow gravity filtration to produce a concentrated decoction.

Procedure

1. Fine Chhind powder is placed in the upper chamber of the filter.
 2. The powder is lightly compressed.
 3. Boiling water is added.
 4. The decoction slowly drips into the lower chamber.
- The resulting beverage is thick, caramelized, and suitable for mixing with milk and sugar.

French Press Method

The immersion-based French press technique highlights lighter and cleaner flavor characteristics.

Procedure

1. Coarse Chhind powder is added to the French press.
 2. Hot water is poured over the grounds.
 3. The mixture is steeped for approximately four minutes.
 4. The plunger is pressed down slowly.
- This method produces a nutty, earthy, and tea-like beverage best consumed black.

Production Process of Chhind Herbal Coffee

The production process involves multiple stages:

1. **Collection of Seeds:** Tribal communities gather fallen Chhind fruits and seeds from Bastar forests.
2. **Cleaning and Depulping:** Fruits are washed and fibrous pulp is removed.
3. **Sorting:** Damaged or infested seeds are discarded.
4. **Sun Drying:** Seeds are dried naturally to reduce moisture content.
5. **Roasting:** Controlled roasting develops aroma and flavor compounds.
6. **Grinding:** Roasted seeds are processed into fine powder.
7. **Packaging:** The final product undergoes quality testing and moisture-proof packaging.

This production chain creates employment opportunities while maintaining ecological sustainability.

Socio-Economic and Environmental Significance

The Chhind coffee initiative contributes substantially toward sustainable rural development in Bastar.

Tribal Livelihood Enhancement

The project creates additional income sources for tribal households involved in seed collection and processing activities. It promotes community participation and strengthens local forest-based economies.

Youth Entrepreneurship

The innovation demonstrates how indigenous resources can support startup culture and rural entrepreneurship. It inspires educated youth to explore local biodiversity for sustainable enterprise development.

Environmental Sustainability

The initiative reduces wastage of forest resources and promotes sustainable harvesting practices. Since the product utilizes naturally discarded seeds, it minimizes environmental pressure and supports biodiversity conservation.

Promotion of Indigenous Knowledge

The innovation validates traditional ecological knowledge and integrates it with scientific research and modern entrepreneurship.

Conclusion

Chhind herbal coffee from Bastar represents a significant model of green innovation rooted in indigenous ecological knowledge and sustainable entrepreneurship. The transformation of discarded *Phoenix sylvestris* seeds into a nutritious, caffeine-free beverage demonstrates how local forest resources can generate economic, environmental, and health-related benefits simultaneously. Scientific evidence supports the antioxidant, nutritional, and pharmacological value of Chhind seeds, while the production model encourages tribal empowerment, waste reduction, and circular economy practices. The initiative further highlights the importance of integrating traditional knowledge systems with modern innovation strategies for sustainable rural development. As consumer interest in natural and health-oriented products continues to expand globally, Chhind herbal coffee possesses strong potential for commercialization at national and international levels. Future research may further explore large-scale production technologies, market feasibility, and long-term clinical evaluation of its health benefits.

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Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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