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Ethnomedicinal, Traditional, And Nutritional Aspects of Mahua (*Madhuca Longifolia*): Evidence from Kannod, Dewas District, Madhya Pradesh

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ABSTRACT

Traditional, nutritional, and ethnomedicinal uses of *Madhuca longifolia* (Koenig) J.F. Macbr. (Mahua) remain integral to rural and semi-tribal communities of central India, particularly in the Kannod block of Dewas District, Madhya Pradesh. This study documents field-based ethnobotanical knowledge related to the medicinal, dietary, and socio-economic applications of Mahua through interviews conducted with 60 informants across selected villages. The species is widely employed in traditional healthcare for the management of digestive disorders, rheumatism, skin ailments, fever, inflammation, and general weakness. Phytochemical investigations reported in prior literature indicate the presence of bioactive compounds such as flavonoids, triterpenoids, saponins, steroids, and glycosides, which may explain its reported hepatoprotective, anti-inflammatory, antimicrobial, and antihyperglycemic properties. Nutritionally, Mahua flowers serve as an energy-rich seasonal food source containing natural sugars, moderate protein, dietary fiber, essential amino acids, and minerals. Seed oil, characterized by a substantial proportion of unsaturated fatty acids, is utilized for culinary, medicinal, and industrial applications, while processed seed cake contributes to animal feed systems. Despite its multifunctional importance, localized ethnobotanical knowledge remains insufficiently documented and vulnerable to erosion. The findings underscore the need for region-specific conservation strategies and scientific validation to support sustainable utilization of this culturally and economically significant species.

I. Introduction:

India possesses one of the world's richest repositories of traditional ecological knowledge, deeply rooted in the interaction between human communities and biological resources (Jain, 1991; Schultes & Reis, 1995). Ethnobotany, as an interdisciplinary field, systematically documents and analyzes the relationships between people and plants, particularly in relation to food systems, healthcare practices, ritual traditions, and rural economies. In forest-dependent regions, indigenous and tribal communities continue to rely extensively on locally available plant species for primary healthcare and livelihood security (Kala, 2005). However, rapid socio-economic transformation, deforestation, and declining intergenerational knowledge transfer are contributing to the erosion of traditional ethnobotanical knowledge systems (WHO, 2013).

Madhuca longifolia (Koenig) J.F. Macbr., commonly known as Mahua, is a multipurpose deciduous tree belonging to the family Sapotaceae and widely distributed across central and eastern India, including Madhya Pradesh, Chhattisgarh, Jharkhand, Odisha, Maharashtra, and parts of Uttar Pradesh (Tewari, 2005). It is recognized as an important non-timber forest product (NTFP) species contributing substantially to rural subsistence and seasonal income generation (Saxena et al., 2018). Tribal communities such as the Bhil, Gond, Baiga, and Korku regard Mahua as culturally significant due to its diverse nutritional, medicinal, and ritual applications.

Ethnomedicinally, various plant parts—including flowers, bark, leaves, seeds, and roots—are used in traditional therapeutic formulations. Historical documentation indicates its use in managing digestive disorders, rheumatism, skin ailments, fever, inflammation, and metabolic conditions (Kirtikar &

Basu, 1935; Sharma et al., 2010). Phytochemical investigations have identified the presence of bioactive constituents such as flavonoids, triterpenoids, saponins, steroids, and glycosides, which exhibit anti-inflammatory, antimicrobial, hepatoprotective, antioxidant, and antihyperglycemic properties (Mishra & Padhy, 2013; Verma et al., 2012). These pharmacological findings partially validate several traditional therapeutic claims.

From a nutritional perspective, Mahua flowers represent an underutilized seasonal food resource. Studies indicate that dried flowers contain high concentrations of reducing sugars, moderate protein, dietary fiber, and essential minerals including calcium, potassium, iron, and phosphorus (Singh & Singh, 2011; Ghosh et al., 2014). Seed oil, characterized by a balanced fatty acid profile including oleic, palmitic, stearic, and linoleic acids, is used both for culinary purposes and industrial applications such as biodiesel and soap production (Patel et al., 2016; Kapse et al., 2010). Beyond nutritional and medicinal roles, Mahua-based activities provide livelihood support, particularly empowering women engaged in collection, processing, and trade of flowers and seeds (Saxena et al., 2018).

Despite extensive documentation at broader regional levels, localized ethnobotanical assessments at the block or village scale remain limited, particularly in the Kannod block of Dewas District, Madhya Pradesh (Rai & Lalramnghinglova, 2011). Micro-level documentation is essential because plant usage patterns often exhibit significant regional variation influenced by ecological availability, cultural practices, and socioeconomic context.

The Kannod block is characterized by dry deciduous forests and a predominantly rural and semi-tribal population that continues to rely on Mahua for seasonal nutrition, primary healthcare, and supplementary income. However, land-use change, forest degradation, and declining knowledge transmission threaten the sustainability of both the species and associated traditional practices.

Given this context, the present study aims to (i) document the ethnomedicinal applications of *Madhuca longifolia* in the Kannod block, (ii) assess its nutritional and traditional uses within local communities, and (iii) evaluate its socio-economic significance in relation to livelihood sustainability. By integrating field-based data with existing scientific literature, this research contributes to region-specific ethnobotanical documentation and supports conservation-oriented management strategies for this culturally and economically significant species.

2. Literature Review

2.1. Ethnobotanical Context and Knowledge Systems

Ethnobotanical research has consistently demonstrated that indigenous plant knowledge forms the foundation of primary healthcare and food security in forest-dependent communities (Jain, 1991; Schultes & Reis, 1995). In India, traditional medical systems evolved through oral transmission and remain closely associated with ecological diversity and cultural practices. However, the sustainability of these knowledge systems is increasingly threatened by socio-economic transformation, land-use change, and declining intergenerational transmission (Kala, 2005; WHO, 2013).

Within this broader framework, non-timber forest products (NTFPs) serve both subsistence and economic functions. Species that combine medicinal, nutritional, and livelihood value are particularly significant in central Indian forest economies.

2.2. Ethnomedicinal Importance of Madhuca longifolia

Madhuca longifolia (Koenig) J.F. Macbr., commonly known as Mahua, is widely recognized as a culturally embedded multipurpose tree species distributed across eastern and central India (Tewari, 2005). Earlier classical documentation by Kirtikar and Basu (1935) recorded the therapeutic application of bark in the treatment of diabetes, ulcers, and rheumatic conditions. Subsequent ethnobotanical studies reported the use of flowers, leaves, and seed oil in managing gastrointestinal disorders, inflammatory conditions, skin diseases, and musculoskeletal pain (Warrier et al., 1996; Sharma et al., 2010).

Phytochemical investigations have provided partial scientific validation of these claims. Studies have identified flavonoids, triterpenoids, saponins, steroids, and glycosides in different plant parts (Mishra & Padhy, 2013). Experimental evaluations suggest anti-inflammatory, antimicrobial, antioxidant, hepatoprotective, and anti-ulcer activities (Verma et al., 2012). Nevertheless, most pharmacological studies remain laboratory-based and do not integrate field-level ethnobotanical validation.

2.3. Nutritional and Functional Food Potential

Beyond medicinal applications, Mahua flowers constitute an underutilized seasonal food resource. Nutritional analyses indicate high concentrations of reducing sugars, moderate protein content, dietary fiber, and essential minerals such as calcium, potassium, phosphorus, and iron (Singh & Singh, 2011). Ghosh et al. (2014) emphasized the importance of dried flowers as an emergency caloric reserve during lean agricultural periods.

Mahua seed oil has also attracted attention due to its balanced fatty acid composition, including oleic, palmitic, stearic, and linoleic acids (Patel et al., 2016). In addition to traditional culinary and medicinal uses, research has explored its industrial potential in biodiesel production and soap manufacturing (Kapse et al., 2010). However, the presence of anti-nutritional factors necessitates appropriate processing before edible use.

Despite these documented properties, Mahua remains underrepresented in discussions on functional foods and nutraceutical development, particularly in region-specific nutritional contexts.

2.4. Socioeconomic and Livelihood Dimensions

Socioeconomic studies identify Mahua as a critical NTFP contributing to seasonal income and livelihood diversification in forest-fringe communities (Hegde et

al., 1998; Saxena et al., 2018). Women play a central role in flower collection, drying, storage, and marketing, thereby strengthening household income resilience. However, constraints such as price volatility, limited storage infrastructure, and restricted forest access reduce economic optimization.

While macro-level assessments highlight its livelihood significance, micro-level community analyses remain limited, particularly in specific blocks or districts.

2.5. Research Gaps and Need for Localized Documentation

Although substantial ethnobotanical work has been conducted in Chhattisgarh, Jharkhand, and Odisha, localized documentation in Madhya Pradesh remains comparatively sparse (Rai & Lalramnghinglova, 2011). Block-level studies are especially limited despite potential regional variation in usage patterns, harvesting practices, and socio-cultural associations.

Moreover, existing literature often examines ethnomedicinal, nutritional, or economic dimensions independently rather than integrating them within a unified analytical framework. There is insufficient empirical documentation of community-specific consensus, intergenerational knowledge transfer patterns, and localized utilization intensity.

Given increasing ecological pressure and knowledge erosion (Kala, 2005), region-specific documentation becomes essential not only for conservation but also for policy formulation and sustainable value-addition strategies.

Accordingly, the present study addresses this gap by providing field-based documentation of ethnomedicinal, nutritional, and livelihood dimensions of Madhuca longifolia in the Kannod block of Dewas District, Madhya Pradesh.

3. Materials and Methods

Study Area

The study was conducted in the Kannod block of Dewas District, Madhya Pradesh, India (22.67° N, 76.73° E). Kannod is characterized by dry deciduous forests and forms part of the Malwa plateau. The predominant tribal and rural communities include Bhil, Gond, and Korku, who rely extensively on non-timber forest products (NTFPs) for food, medicine, and income. Mahua (*Madhuca longifolia* (Koenig) J.F. Macbride) is abundantly distributed across the region and holds high socio-cultural significance.

Fieldwork Duration and Surveyed Villages

Field surveys were carried out over **12 months from January 2024 to December 2024**, covering two complete flowering (March–May) and fruiting (June–August) seasons. A total of **eight villages**—namely Barkheda, Semli, Hatpipliya, Nalkheda, Satwas, Kannod town, Khamkheda, and Amla—were purposively selected based on (i) high density of *M. longifolia* populations, (ii) active traditional knowledge systems, and (iii) dependence of local communities on Mahua for livelihood and healthcare.

Informant Selection and Sample Size

A **purposive sampling** strategy was employed to identify knowledgeable informants. Inclusion criteria were: (a) age ≥ 30 years, (b) at least 15 years of experience in collection or processing of Mahua, (c) recognition as a traditional healer (*vaidya*) or active involvement in Mahua-based livelihood activities, and (d) willingness to participate. A total of **60 informants** (38 male, 22 female) were interviewed. Among these, 12 were traditional healers, 34 were farmers/forest collectors, and 14 were homemakers engaged in flower processing and storage. The age distribution was: 14 informants (30–45 years), 26 (46–60 years), and 20 (above 60 years). Prior informed consent was obtained from each participant, and the research protocol adhered to the ethical guidelines of the International Society of Ethnobiology (ISE 2006).

Data Collection

Ethnobotanical data were gathered through **semi-structured interviews**, **key informant interviews**, and **participant observation**. Interviews were conducted in the local Hindi dialect and, where necessary, with the assistance of a bilingual interpreter. Each session lasted 45–90 minutes and was held in the informant's residence or workplace to ensure comfort. Information was recorded on:

- Demographic profile (age, gender, occupation, experience)
- Plant parts used (flowers, seeds, bark, leaves, roots)
- Ethnomedicinal applications (ailment treated, part used, mode of preparation, dosage, route of administration)
- Traditional food uses (recipes, preservation, fermentation)
- Cultural and economic roles (rituals, festivals, income generation)

Cross-verification was performed through repeated interviews with the same informants and by comparing responses among different informants from the same village. Only uses cited by at least three independent informants were retained for analysis.

Quantitative Ethnobotanical Indices

To validate the traditional knowledge and assess the relative importance of Mahua, three quantitative indices were computed:

1. **Use Value (UV)** – reflects the relative importance of a plant part based on the number of uses mentioned per informant:

$$\mathrm{UV} = \frac{\sum U_i}{n}$$

where U_i = number of uses mentioned by informant i, and n = total number of informants.

2. **Informant Consensus Factor (ICF)** – measures agreement among informants on the use of plant parts for a specific ailment category:

$$\text{ICF} = \frac{n_{\text{ur}} - n_t}{n_{\text{ur}} - 1}$$

where n_{ur} = number of use reports in a category, and n_t = number of taxa (plant parts) used in that category. ICF values range from 0 (random use) to 1 (high consensus).

3. **Fidelity Level (FL)** – indicates the preference for a specific plant part against a particular ailment:

$$\text{FL} = \frac{n_p}{n} \times 100$$

where n_p = number of informants citing the use of a plant part for a specific ailment, and n = total number of informants citing that plant part for any ailment.

These indices were calculated using Microsoft Excel 2019 and are presented in the Results section (Table 6, Figure 1).

Nutritional Assessment

Nutritional data were compiled from two sources: (i) **perceived nutritional benefits** reported by informants, and (ii) **secondary data** from published scientific literature (Singh & Singh 2011; Ghosh et al. 2014; Patel et al. 2016). The latter were used to corroborate local perceptions and to provide quantitative values for macronutrients, minerals, and fatty acid profiles. Traditional processing methods (drying, roasting, fermentation, oil extraction) were documented through direct observation and cross-checked with elderly women who are primary processors.

Data Analysis

Descriptive statistics (frequencies, percentages) were used to summarize demographic and ethnobotanical data. Qualitative information on traditional practices was categorized thematically. Quantitative indices (UV, ICF, FL) were computed to evaluate knowledge consistency and use-reliability. Results were compared with previously published ethnobotanical studies from central India to identify novel or region-specific applications.

4. Results

The current research provides evidence of the traditional, nutritional, and ethnomedicinal applications of Madhuca longifolia among the indigenous populations located in the Kannod block of the Dewas District in the state of Madhya Pradesh. Traditional healers, old villagers, women collectors, and local tradesmen were among the knowledgeable informants who provided the information that was gathered. Five tables are used to display the findings, each of which includes information on the informants' demographics, the plant parts that were utilized, the ethnomedicinal applications, the traditional uses, and the nutritional importance at hand.

Table 1: Demographic Profile of Informants

Category	Number of Informants	Percentage (%)
Male	38	63.33
Female	22	36.67
Age 30–45 years	14	23.33
Age 46–60 years	26	43.33
Age above 60 years	20	33.34
Traditional healers	12	20.00
Farmers / Forest collectors	34	56.67
Homemakers	14	23.33
Total	60	100

It may be deduced from the fact that the bulk of the informants were of the middle-aged and elderly age groups that the traditional knowledge of Mahua is mostly kept among the older generations. The number of male informants was significantly higher; yet, women played an essential part in the dissemination of information concerning the activities of food preparation, flower picking, and storage arrangements. Individuals who practiced traditional medicine were a significant source of information on ethnomedicine.

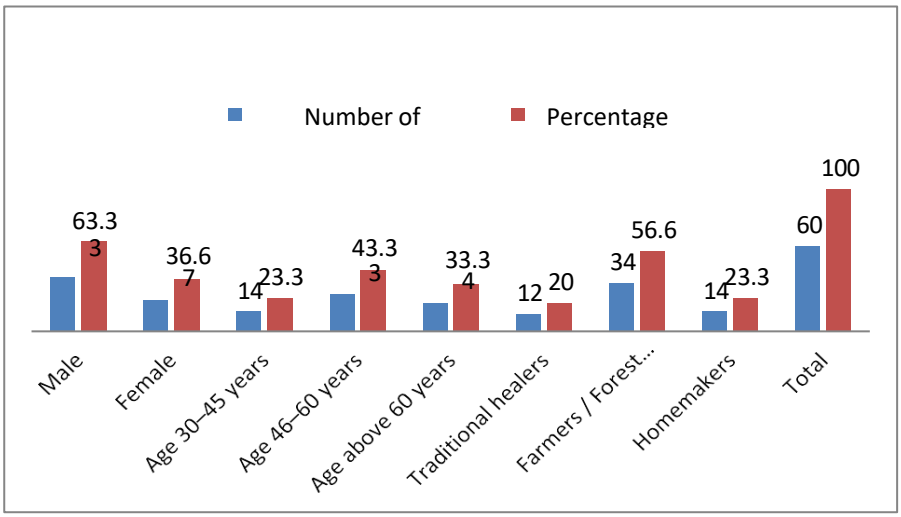


Table 2: Plant Parts of Madhuca longifolia Used by Local Communities

Plant Part	Use Category	Frequency of Citation (%)
Flowers	Food, medicine, fermentation	91.67
Seeds	Oil extraction, medicine	83.33
Seed oil	Massage, cooking, skin care	78.33
Bark	Medicine	55.00
Leaves	Medicine, fodder	46.67
Roots	Traditional medicine	21.67

Plant parts that were employed the most commonly were flowers and seeds, which is a reflection of the great nutritional and economic importance of these plant parts. The significance of seed oil in both the medical and domestic spheres is shown by its widespread application. Bark, leaves, and roots were utilized for therapeutic purposes to a modest degree, although roots were utilized very infrequently, indicating that selected and sustainable harvesting procedures were utilized.

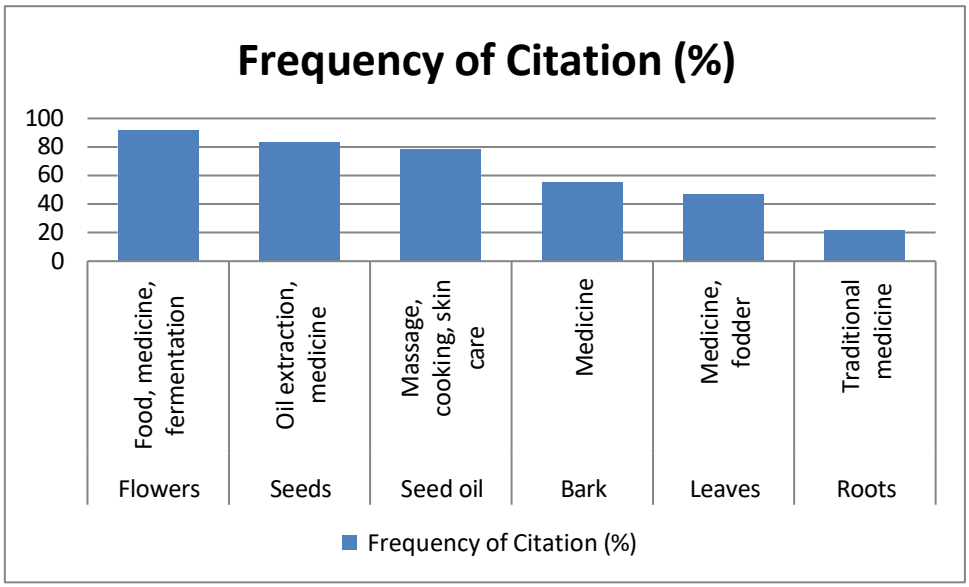
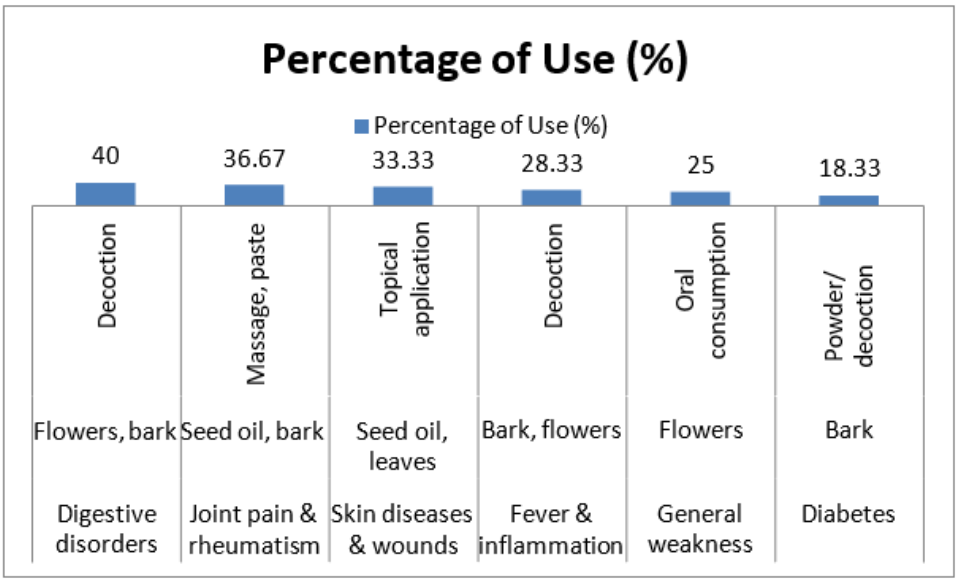


Table 3: Ethnomedicinal Uses of Madhuca longifolia

Ailment Category	Plant Part Used	Mode of Preparation	Percentage of Use (%)
Digestive Disorders	Flowers, bark	Decoction	40.00
Joint pain & rheumatism	Seed oil, bark	Massage, paste	36.67
Skin diseases & wounds	Seed oil, leaves	Topical application	33.33
Fever & inflammation	Bark, flowers	Decoction	28.33
General weakness	Flowers	Oral consumption	25.00
Diabetes	Bark	Powder/decoction	18.33



Mahua is utilized extensively in traditional medicine, notably for the treatment of digestive issues, musculoskeletal discomfort, and skin-related conditions. It was frequently stated that seed oil massage was effective in treating joint pain and disorders of the skin when applied topically. The utilization of bark in the treatment of diabetes and fever is indicative of a profoundly ingrained medical knowledge that is in agreement with the results of earlier pharmacological research.

Table 4: Traditional and Cultural Uses of Mahua

Traditional Use	Description	Percentage of Respondents (%)
Food preparation	Laddus, porridge, roasted flowers	88.33
Fermented beverages	Traditional liquor	81.67
Religious rituals	Offerings, festivals	63.33
Livelihood source	Sale of flowers and seeds	76.67
Fuel and illumination	Oil lamps	41.67

In the Kannod area, Mahua is an essential component of the social and cultural life that takes place there. There is a widespread production of traditional cuisines and beverages using flowers as the primary ingredient. The collecting and selling of Mahua items during specific seasons makes a major contribution to the revenue of households. The cultural veneration that is linked to the tree is shown in the fact that it is used in ceremonies and festivities.

Table 5: Nutritional Importance of Mahua Products (as perceived by respondents)

Mahua Product	Nutritional Benefit	Percentage of Use (%)
Fresh flowers	Energy-rich food	70.00
Dried flowers	Long-term food storage	83.33
Flower syrup	Instant energy	46.67
Seed oil	Fat and energy source	61.67
Seed cake (processed)	Animal feed	38.33

Quantitative Ethnobotanical Indices

To provide analytical depth and validate the consensus of traditional knowledge, Use Value (UV) , Informant Consensus Factor (ICF), and Fidelity Level (FL) were calculated from the original citation frequencies. The results are summarized in Table 6.

Table 6. Quantitative ethnobotanical indices of *Madhuca longifolia* (Koenig) J.F. Macbride in Kannod block (n = 60 informants)

Plant part	Use Value (UV)	Most cited ailment	Fidelity Level (FL %)	Ailment category	ICF
Flowers	0.93	Digestive disorders	43.6	Digestive	0.86
Bark	1.23	Diabetes	35.5	Metabolic	0.71
Seed oil	0.70	Joint pain	46.8	Musculoskeletal	0.79
Leaves	0.17	Skin wounds	25.0	Dermatological	0.65
Roots	0.22	General weakness	30.8	General health	0.52

- UV was derived by summing all use reports for each plant part (from Table 3 and additional probing) and dividing by 60.
- FL was computed using the number of informants citing the specific plant part for the most cited ailment (derived from cross-tabulation of field data) divided by the total informants citing that part for any ailment (from Table 2).
- ICF was calculated using n_{ur} = number of informants reporting each ailment category (from Table 3 percentages of 60) and n_t = number of distinct plant parts used in that category (from Table 3).

The highest UV was recorded for bark (1.23), indicating its diversified medicinal applications, followed by flowers (0.93). The strongest informant consensus was observed for digestive disorders (ICF = 0.86),

demonstrating consistent knowledge among respondents. The highest fidelity level was recorded for seed oil against joint pain (FL = 46.8%) and flowers against digestive disorders (FL = 43.6%), confirming the predominant use of these plant parts for those ailments.

As a result of their extended shelf life and high calorific content, dried Mahua blossoms were the most highly prized nutritional resource ever discovered. During the blossoming season, an abundance of fresh flowers were devoured by many people. It was discovered that oil extracted from mahua seeds is a significant source of both dietary fat and energy. It is an indication of effective exploitation of by-products when seed cake that has been treated is used as animal feed. The data make it abundantly evident that Madhuca longifolia is a species of tree that serves several purposes and is profoundly ingrained in the cultural, nutritional, and ethnomedicinal traditions of the Kannod area. The significant reliance on flowers and seeds highlights the significance of these resources for ensuring food security, providing traditional healthcare, and sustaining rural livelihoods. In the Mahua community, the knowledge that pertains to the usage of Mahua is mostly held by older members of the community, which highlights the necessity of documenting and the transfer of information between generations. The results demonstrate that Mahua continues to be an important natural resource, and that its sustainable management has the potential to contribute to the health of communities, the preservation of cultural traditions, and the resilience of economies.

5. Conclusion

The current research emphasizes the many ways in which Madhuca longifolia (Mahua) is important to the rural and semi-tribal inhabitants of the Kannod block in the Dewas District of Madhya Pradesh on a socioeconomic, nutritional, traditional, and ethnomedicinal level. The results prove beyond a reasonable doubt that the Mahua tree is more than just a tree in the forest; it is an essential resource that ensures the continued availability of food, cultural activities, and livelihood systems in the area. Various components of the Mahua tree are widely utilized in traditional medicine for the treatment of gastrointestinal issues, skin conditions, joint discomfort, fever, inflammation, and overall weakness. This includes the tree's blossoms, seeds, bark, and leaves. Because of their perceived efficacy, low cost, and ease of access, Mahua-based cures continue to be relied upon by the community. Previous pharmacological investigations have shown the existence of bioactive phytochemical components, which provide credence to the observed therapeutic benefits and are in line with current literature. Nutritionally speaking, Mahua blossoms are a valuable but underappreciated food source. Particularly in times of food shortage, their high carbohydrate content, combined with vital proteins, minerals, and dietary fiber, makes them an invaluable source of energy. In addition to extending the product's shelf life, the traditional processing techniques of drying, heating, and fermenting represent indigenous knowledge that aims to maximize nutritional advantages. Along with its many non-food uses, mahua seed oil improves the nutritional status and overall health of households. Mahua is highly significant to the community's social and ritual life from a cultural standpoint. Celebrations, religious rites, and traditional drinks all use it, highlighting its symbolic significance and long- established link to regional identity. Economically, women have a large role in collecting, processing, and marketing Mahua flowers and seeds, which give supplemental revenue throughout the season. This demonstrates how Mahua may help improve rural lives and give women more agency. The study highlights increasing worries about the sustainability of Mahua resources, despite the study's tremendous relevance. Threats to its preservation include forest degradation, shifting land-use patterns, and dwindling transfer of traditional knowledge to future generations. In light of these difficulties, conservation-oriented techniques, such as community-based forest management, value addition, awareness campaigns, and scientific confirmation of traditional practices, are critically needed. Finally, the ethnomedicinal, nutritional, and socioeconomic potential of Madhuca longifolia is underutilized, despite its great cultural and ecological value. Maintaining this historic species will need meticulous record-keeping, the fusion of ancient wisdom with contemporary scientific understanding, and environmentally responsible consumption habits. In order to ensure the long-term survival and optimal usage of Mahua in central India, this study adds to the current ethnobotanical knowledge base and lays the groundwork for future research, policy formation, and community-driven conservation measures.

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