Ethnomedicinal Plant Diversity, Traditional Knowledge, and Comparative Analysis Across Regions: A Study on Medicinal Plant Utilization in Chandpur District

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Abstract

Background: Ethnomedicinal knowledge plays a vital role in preserving traditional healthcare practices and identifying medicinal plants with potential pharmacological applications. This study documents the diversity, preparation methods, and cultural significance of medicinal plants used by local communities, analyzing their taxonomic diversity, informant consensus, and regional similarities. Methods: A total of 322 informants were interviewed to record traditional plant knowledge. Quantitative indices, including Informant Consensus Factor (ICF), Use Value (UV), and Fidelity Level (FL), were employed to assess the significance of medicinal plants for specific ailments. Jaccard Index (JI) analysis was used to compare the similarities in plant usage across regions. Data were further analyzed for demographic insights, preparation methods, and plant family distributions. Results: The study documented 116 plant species across 56 families, with Asteraceae, Solanaceae, and Malvaceae being the most represented. Informants were predominantly female (61.2%) and aged over 40 years (67.7%), reflecting their central role in traditional knowledge preservation. Herbs accounted for the largest proportion (41%) of medicinal plants, with juice preparation being the most common method (50%). Plants like Amaranthus spinosus and Myristica fragrans showed high ICF and FL values for ailments like leucorrhea and male sexual disorders. Jaccard Index analysis revealed substantial similarities between regions in Bangladesh, such as Noakhali (JI: 37.77), while regions like Swat, Pakistan (JI: 3.25) demonstrated minimal overlap, highlighting cultural and ecological variations. Conclusion: This study demonstrates the importance of traditional knowledge in healthcare and biodiversity conservation. High ICF and FL values validate the cultural and therapeutic significance of documented plants, while regional comparisons highlight the diversity and specificity of ethnomedicinal practices. Integrating traditional knowledge into modern pharmacological research and sustainable practices can preserve this heritage while enhancing global healthcare systems.

Keywords: Ethnobotany, Medicinal Plants, Informant Consensus Factor, Jaccard Index, Traditional Knowledge.

Significance | This study documents plant diversity, cultural significance, and regional ethnomedicinal similarities, promoting sustainable traditional knowledge preservation and pharmacological research

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1. Introduction

Plants have been indispensable to human survival, serving as vital sources of food, fuel, and shelter. As civilizations evolved, the advent of diseases likely spurred the exploration of plants, animals,

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insects, and minerals for medicinal purposes. Historical evidence of medicinal plant use dates back approximately 5,000 years, as revealed by a Sumerian clay slab from Nagpur. This ancient text documents the preparation of 12 drug formulations utilizing over 250 plant species, showcasing the early sophistication of medicinal practices and the centrality of botanical resources in ancient healthcare systems (Kelly, 2009).

Globally, medicinal plants are vital components of traditional and modern healthcare, with an estimated 72,000 to 77,000 species—approximately 17–18% of the world's flora—recognized for their medicinal value (Mazumder et al., 2022). The World Health Organization (WHO) highlights that approximately 65% of the global population relies on traditional medicine as their primary healthcare source (Raskin & Ripoll, 2004; WHO, 2023). This reliance is especially pronounced in underdeveloped and developing nations, where modern medical treatments are often prohibitively expensive. People in these regions frequently trust traditional practices employing locally available plants until critical health situations arise (Umair et al., 2019).

The increasing acceptance of medicinal plants in developed countries, including Australia, North America, and parts of Europe, underscores their global significance. Today, approximately 40% of pharmaceutical products are derived from natural sources and traditional knowledge (Calapai, 2008; Braun et al., 2010; Anquez-Traxler, 2011; WHO, 2023).

Southeast and South Asia are considered biodiversity hotspots for medicinal plants, which play a crucial role in traditional healthcare systems. In Bangladesh, a South Asian country where nearly 75% of the population resides in rural areas, approximately 80% of the population depends on ethnomedicine for primary healthcare. These remedies are widely used for treating common ailments, such as fever, colds, diarrhea, and dysentery, reflecting the critical role of medicinal plants in the country's healthcare system (Hossain et al., 2024; FAO, 2009).

Bangladesh's unique climatic and ecological conditions, including productive soils, a tropical climate, and seasonal diversity, support an exceptionally rich flora, comprising approximately 6,500 plant species, including bryophytes, pteridophytes, gymnosperms, and angiosperms. Of these, about 500 species possess recognized medicinal properties, demonstrating the country's botanical wealth and the importance of plants in traditional medicine (Zia Uddin, 2009).

The commercial production of plant-based medicines is well-established in Bangladesh. According to the Directorate General of Drug Administration (DGDA), the country has 528 manufacturers of plant-based medicines, including 272 Unani, 201 Ayurvedic, and 55 herbal producers. These manufacturers produce 11,290 registered medicinal products, comprising 6,630 Unani, 4,110 Ayurvedic, and 550 herbal formulations. Moreover, there are no legal restrictions on the sale of medicinal plant products in Bangladesh, further emphasizing their accessibility and integration into the healthcare system (DGDA, available at www.dgda.gov.bd).

Traditional medicinal practices have deep socio-cultural, spiritual, economic, and healthcare significance in Bangladesh, particularly among rural and forest-dependent communities. These communities depend on readily accessible and cost-effective plant-based herbal medicines for their healthcare needs (Chowdhury & Koike, 2010; Faruque et al., 2018). Traditional healers, known as *Kavirajes*, are the primary custodians of this knowledge. Their expertise, derived from oral traditions passed down through generations, plays a central role in rural healthcare practices (Rahmatullah et al., 2009).

However, indigenous knowledge of medicinal plants is under threat due to habitat destruction, cultural shifts, and the erosion of traditional practices in rural communities. This endangers the preservation of ethnobotanical knowledge, which has historically been maintained through shared experiences and oral transmission. Scientific studies and systematic documentation represent crucial approaches to conserving this valuable heritage (Rahmatullah et al., 2011).

This study investigates the ethnomedicinal practices of the Chandpur district in Bangladesh, focusing on documenting traditional knowledge, evaluating its therapeutic potential, and identifying plants that warrant further pharmacological research. The findings contribute to the growing body of literature on traditional medicine and highlight the importance of preserving cultural heritage and biodiversity for sustainable healthcare solutions.

2. Materials and methods

2.1 Study Area

The study was conducted in three villages within the Chandpur district of Bangladesh: Bharngachor (Chandpur Sadar Upazila), Deshgaon (Hajiganj Upazila), and Suchipara (Shahrasti Upazila). Chandpur, renowned as the "City of Hilsa" due to its role as a significant hub for selling, buying, and exporting Hilsa fish (*Tenualosa ilisha*), is situated on the banks of the Meghna River, with the Dakatia River also flowing through the district.

The district spans an area of 1,704.06 square kilometers, lying between latitudes 23°00' and 23°30' north and longitudes 90°32' and 91°02' east. Chandpur comprises eight sub-districts (Upazilas) and is primarily an agricultural region, with farming serving as the main livelihood for most residents. Of note is the Unani Tibia Medical College and Hospital, located in Puranbazar, Chandpur, which is the largest traditional Unani medical college in the area.

2.2 Data Collection

The ethnomedicinal survey was conducted between October 2022 and December 2023 across three sub-districts (Chandpur Sadar, Hajiganj, and Shahrasti) to systematically document traditional medicinal knowledge. The study employed well-established ethnobotanical methods to ensure reliability, accuracy, and ethical adherence.

Six experienced *Kavirajes* (folk practitioners) were selected through purposive sampling based on their reputation for extensive knowledge of medicinal plant use in their communities (Alexiades, 1996). Each *Kaviraj* was approached with a clear explanation of the study's objectives, the voluntary nature of participation, and confidentiality assurances. Written informed consent was obtained prior to interviews, and follow-up visits reaffirmed consent from individuals who had benefited from the treatments (Cunningham, 2001).

Data were collected using semi-structured and open-ended questionnaires in Bangla, which allowed the *Kavirajes* to freely share their knowledge while ensuring all essential information was captured (Martin, 1995). The interviews documented details such as plant local names, parts used, preparation methods, medicinal uses, application modes, and dosage forms. Additionally, *Kavirajes* provided a list of individuals who had benefited from their treatments, enabling home visits for cross-verification of efficacy through user testimonials and observational insights (Newing et al., 2011).

Voucher specimens of each reported plant species were collected, labeled with locality, informant names, and collection dates, and preserved for identification by botanists at the Bangladesh National Herbarium. This step ensured scientific accuracy and alignment with traditional uses. Medicinal plants identified were cross-referenced with existing scientific literature to determine associated phytochemical compounds and validate therapeutic claims (Heinrich et al., 1998).

A database was created to organize the collected data systematically, documenting each plant's medicinal applications, preparation methods, and informant contributions. This structure facilitated quantitative analysis, including assessments of plant use frequency and informant consensus, employing indices such as the use value (UV) and informant consensus factor (ICF) (Trotter & Logan, 2019). These methods provided a robust framework for evaluating the traditional medicinal knowledge of the Chandpur district.

2.3 Ethical Considerations

Before initiating interviews, informed consent was obtained from all participants, ensuring they fully understood the study's objectives and their voluntary involvement. Participants were guaranteed confidentiality, with all personal information protected, and their contributions were formally acknowledged in the research report to ensure transparency and respect for their input.

2.4 Statistical Analysis

To analyze the data systematically, key quantitative indices were employed:

Informant Consensus Factor (ICF): Used to measure the level of agreement among informants regarding the medicinal uses of plant species for specific ailments.

Use Value (UV): Calculated to identify the relative importance of each plant species based on its frequency of citation by informants.

Fidelity Level (FL): Applied to determine the percentage of informants affirming the use of a specific plant species for a particular ailment.

Informant Agreement Ratio (IAR): Evaluated to highlight plants with the highest consensus among the *Kavirajes* and informants, indicating their prominence in traditional practices.

To compare ethnobotanical data across regions, the **Jaccard Similarity Index (JI)** was calculated, enabling the identification of cultural and geographical variations in medicinal plant usage. These indices provided robust statistical insights into the medicinal plants' significance and consensus, enhancing the study's reliability and cross-regional contextual understanding.

2.4.1 Informant Consensus Factor (ICF)

The ICF measures the degree of consensus among informants about the medicinal use of plant species for a particular disease. It assesses how strongly a particular medicinal plant is agreed upon by the informants for treating a specific condition (Heinrich et al., 1998; *Canales et al., 2005*)

$$ICF = \frac{Nuc - Nt}{Nuc - 1}$$

Where "N_{uc} is the total number of citations for the particular disease (total number of reports for all plants used for the disease) and N_t is the number of species used to treat the disease.

2.4.2 Informant Agreement Ratio (IAR)

The IAR measures the level of agreement on the number of diseases treated by a particular medicinal plant. It assesses how many diseases a plant is reported to treat and how consistent this information is among informants (Esakkimuthu et al., 2016).

$$IAR = \frac{Nr - Na}{Nr - 1}$$

Where N_r is the Total number of citations for the species (total number of reports for the plant), and N_a is the number of diseases treated by the species.

2.4.3 Fidelity Level (FL)

FL Measures the proportion of informants who cited a particular use for a plant (*Bennett and* Prance, 2000) *higher FL indicates a stronger agreement among informants about the specific therapeutic use of a plant, reflecting its cultural significance and potential pharmacological relevance.*

$$FL = \left(\frac{Np}{N}\right) \times 100$$

Where, Np is the number of informants mentioning a specific use, and N is the total number of informants.

2.4.4 Use Value (UV)

UV quantifies the relative importance of each plant species as perceived by the informants (*Tardio and Pardo-de-Santayana, 2008*). A higher UV indicates that a plant is more frequently cited by informants, reflecting its perceived cultural and therapeutic significance within the community.

$$UV = \frac{\sum U}{N}$$

Where, U is the number of uses mentioned by all informants and N is the number of informants.

2.4.5 Jaccard Index (JI)

JI is a measure of similarity between two study areas, based on the number of shared species (Jaccard, 1902; Kayani et al., 2015). A higher JI value indicates greater overlap in the medicinal plant species used between two study areas, reflecting similarities in traditional knowledge or ecological characteristics.

$$JI = \left(\frac{C}{A + B - C}\right) \times 100$$

Where A and B are the total species in each area, and C is the number of species common to both areas.

3. Results and Discussion

3.1 Demographics of Informants

A total of 322 informants participated in this study (Supporting Information), with a majority being female (61.2%) and older, particularly those aged 40 or above (67.7%), reflecting the pivotal role of women and elders in preserving traditional medicinal knowledge (Table 1). Similar findings have been reported by Afnan et al. (2020) and Patrício et al. (2022). In contrast, younger generations appear less engaged, posing a potential risk to the continuity of this knowledge. Most informants were married (87.9%) and resided in rural areas (55.6%) (Table 1), suggesting that family responsibilities and proximity to nature support the continued use of medicinal plants. This observation aligns with Quinlan's (2011) findings that rural populations predominantly rely on traditional medicine.

A significant proportion of informants (68.3%) had only primary or no formal education (Table 1), which may indicate that traditional knowledge is less prevalent among more educated individuals. This underscores the need for educational initiatives that integrate traditional and modern medical practices. The widespread reliance on medicinal plants highlights their value as a cultural and healthcare resource, particularly in regions with limited access to medical services. To preserve and propagate this knowledge, targeted documentation and educational programs are essential for passing it to younger generations and ensuring its integration into modern healthcare systems.

3.2 Distribution of Medicinal Plant Habits

The study documented 116 plant species used in traditional medicine (Supporting Information). Herbs were the most commonly utilized, accounting for 47 species (41%) (Figure 2). Their prevalence in traditional medicine likely stems from their accessibility, simplicity of use, and diverse therapeutic properties, as noted by Matin et al. (2001). Shrubs and trees each contributed 25 species (22%) (Figure 2). While these plants may be less accessible than herbs, they remain critical for treating various ailments, often providing roots, bark, and leaves with significant medicinal properties.

Climbers comprised 12 species (10%) (Figure 2), possibly reflecting their specialized growth habits and limited availability. The "others" category, which included seven species (6%) (Figure 2), consisted of less common plant types such as aquatic or parasitic plants and ferns, highlighting their rare but specific applications in traditional medicine.

3.3 Methods of Preparation

The most frequently used preparation method was juice (50%) (Figure 3), favored for its simplicity and rapid absorption, aligning with a preference for straightforward remedies. Pastes (17%) were predominantly applied for skin ailments, showcasing a targeted approach in traditional practices. Tablets (10%), decoctions (6%), and extracts (7%) were less commonly employed, reflecting their use in specific conditions or preparation complexities (Figure 3). Other forms, such as ash, smoke, and latex, while rare, held cultural or therapeutic importance for specific ailments.

Single plants were often used to prepare remedies such as juice, paste, or powdered tablets. However, in some cases, supplementary ingredients like honey or milk were incorporated. For example, *Centella asiatica* mixed with honey was used to treat coughs, colds, and constipation, while goat milk and sugarcane molasses were combined with *Eclipta alba* and *Heliotropium indicum* to address urinary issues (Supporting Information).

Occasionally, multiple plants were combined to create treatments. For instance, immature fruits of *Aegle marmelos* and bark of *Punica granatum*, *Terminalia bellirica*, *Terminalia chebula*, and *Phyllanthus emblica* were powdered to address male sexual disorders. Crushed flowers of *Hibiscus rosa-sinensis* mixed with *Cinnamomum verum* were used for irregular menstrual cycles, and leaves of *Justicia gendarussa* combined with cloves (*Syzygium aromaticum*) and garlic (*Allium sativum*) treated abscesses and toothaches (Supporting Information).

3.4 Taxonomic Diversity

This study documented 116 plant species across 56 families (Supporting Information), highlighting significant taxonomic

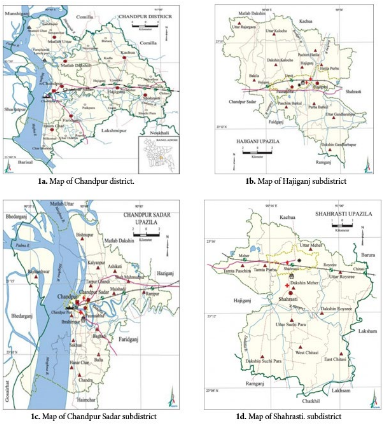

Figure 1. Map

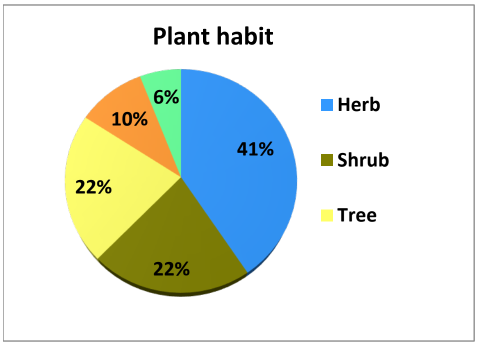

Figure 2. Distribution of medicinal plants habit based on percentage contribution

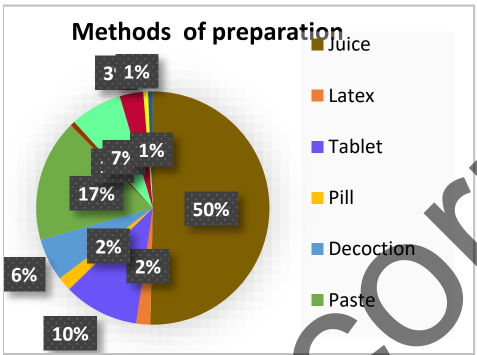

Figure 3. Distribution of methods of preparation for medicinal plant applications

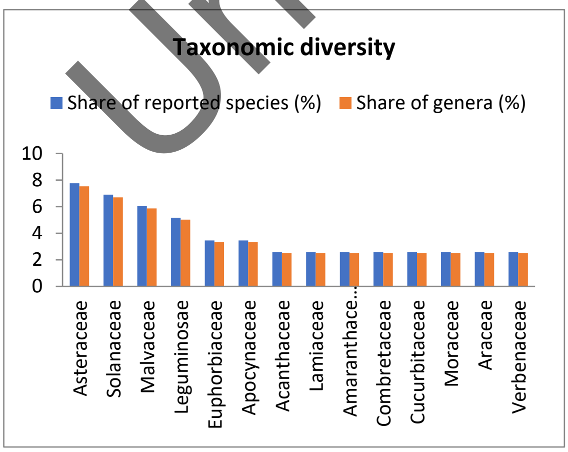

Figure 4. Taxonomic diversity of medicinal plants in the study area

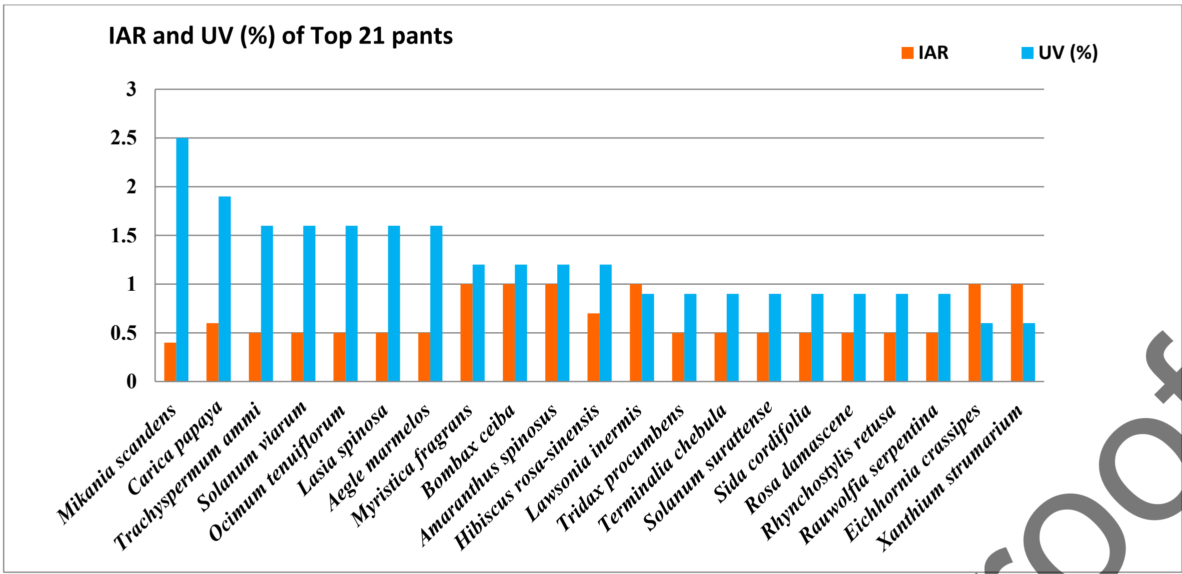

Figure 5. Ranking of most important medicinal plant species according to IAR and UV

Table 1. Demographic Profile of Respondents Based on Gender, Age, Marital Status, Residence, and Educational Status

Variable	Categories	Count	Percentage
Gender	Male	125	38.8
	Female	197	61.2
Age	Less than 20	12	3.7
	20-29	23	7.2
	30-39	68	21.1
	40-49	94	29.2
	above 50	125	38.8
Marital status	Married	283	87.9
	Single	35	10.9
	Divorced	4	1.2
Residence	City	12	3.7
	Urban	131	40.7
	Rural	179	55.6
Educational status	Primary	136	42.2
	Secondary	23	8.4
	Graduate	6	1.0
	None	153	26.1

Table 3. Jaccard Index (JI) analysis of ethnomedicinal plant similarities across various study areas (regional, neighboring and global level)

SL	Study area	study year	Number of reports	Plants with Similar	Plants with dissimilar
1	Madhupur forest region, Tangail, Bangladesh	2009	65	11	13
2	Natore and Rajshahi districts, Bangladesh	2010	87	14	14
3	Joypurhat District, Bangladesh	2015	95	21	19
4	Gopalganj District, Bangladesh	2024	60	7	4
5	Raipura Upazila,Narshingdi district, Bangladesh	2022	87	22	14
6	Region of Swat, North Pakistan	2013	106	1	6
7	Mid Hills of Solan District, Himachal Pradesh, India	2021	115	8	6
8	Kathua district, J&K, India	2015	197	17	22
9	Cumilla district, Bangladesh	2021	16	5	5
10	Joiun, Mithilapur, Aganagar, and Kharataia in Comilla district.	2014	25	7	9
11	Noakhali,Bangladesh	2014	143	67	14

Table 2. Ailment treated by different medicinal plants with high ICF and Fl values

Ailments	ICF	Plants name	FL value	References
Oligospermia	1.0	*Bombax ceiba*	100	Bhargava et al., 2011 and Hussain et al., 2018
Anemia	0.75	*Glycosmis pentaphylla*	100	Shoja et al., 2015
		Boerhavia diffusa	40	Mishra et al., 2014
Gallstone	0.67	*Mikania scandens*	12	**No report found**
		Ricinus communis	75	Arrout et al., 2024
Male sexual disorder	0.67	*Aegle marmelos*	40	Agrawal et al., 2012 and Chauhan and Agarwal, 2009
		Punica granatum	100	Guddeti et al., 2012
		Lawsonia inermis	100	Fischer et al., 2021
Oligomenorrhea	0.62	*Hibiscus rosa-sinensis*	50	Mehta, 2014
		Abroma augustum	80	**No report found**
		Rauwolfia serpentina	66	Kumari et al., 2013
		Rosa damascene	66	Bani et al., 2014; Koohpayeh et al., 2021 and Davaneghi et al., 2017
		Cissus quadrangularis	100	Singh et al., 2021
Hemorrhoids	0.60	*Trachyspermum ammi*	40	Asif et al., 2014; Korani and Jamshidi, 2020 and Danish et al., 2021
		Tagetes erecta	40	Esha et al., 2012
		Euphorbia prostrata	100	Porwal et al., 2024 and Yadav and Yadav, 2023
		Nicotiana plumbaginifolia	100	Mawla et al., 2012
		Datura metel	100	Erbay and Sarı, 2018
Tuberculosis	0.60	*Drynaria quercifolia*	50	Prasanna and Anuradha, 2016; Gupta and Bhandari, 2022 and Chaity et al., 2016
		Pterocarpus santalinus	66	**No report found**
		Piper longum	50	Lu et al., 2021
Asthma	0.58	*Justicia gendarussa*	50	Kumar et al., 2018
		Justicia adhatoda	50	Sobia et al., 2018 and Akbar, 2020
		Bryophyllum pinnatum	40	Salami et al., 2013; Ozoluaa et al., 2010 and Chibli et al., 2014
		Clerodendrum indicum	100	Arora et al., 2022 and Bhujbal et al., 2010
		Solanum surattense	66	Tekuri et al., 2019
		Piper longum	50	Yadav et al., 2020
Jaundice	0.57	*Mikania scandens*	37.5	Dons and Soosairaj, 2013
		Cuscuta europaea	70	Muhammad et al., 2021
		Eclipta prostrata	60	Timalsina and Devkota, 2021
		Justicia adhatoda	16.67	Raghuvanshi et al., 2021 Roshan et al., 2023
		Aegle marmelos	60	Bhar et al., 2019
		Blumea lacera	40	Sharma et al., 2014
		Oroxylum indicum	33	Begum et al., 2019: Jagetia, 2021 and Dinda et al., 2015
		Carica papaya	33	Ayeni et al., 2017and Friday et al., 2024
		Hedyotis corymbosa	50	Sadasivan et al., 2006
		Boerhavia diffusa	40	Mishra et al., 2014 and Beedimani and Jeevangi, 2015

Table 2. Continues

Leukorrhea	0.56	*Myristica fragrans*	100	**No report found**
		Amaranthus spinosus	100	Tanmoy et al., 2014 and Ruth et al., 2021
		Abroma augustum	80	**No report found**
		Achyranthes aspera	50	Choudhary, 2020
		Ludwigia prostrata	100	Bhowmik et al., 2014
		Gmelina arborea	66	Warrier et al., 2021, Rahmatullah et al., 2011
Kidney stone	0.50	*Mikania scandens*	25	Ahammed et al., 2020
		Mangifera indica	25	Khandare, 2016; Swaroop et al., 2018 and Bahmani et al., 2016
		Typhonium giganteum	100	Bhowmik et al., 2014
		Kalanchoe pinnata	66	Samantha et al., 2023 and Priya et al., 2021
Gonorrhea	0.50	*Urena lobata*	66	Su et al., 2018 and Bach et al., 2018
		Solanum nigrum	100	Ngbolua et al., 2020
		Achyranthes aspera	50	Vasudeva and Sharma, 2006
		Phyllanthus fraternus	50	Prajapati, 2024 and Patel et al., 2011
		Ficus religiosa	50	Sharma et al., 2022 and Akhtar et al., 2020
		Boerhavia diffusa	20	Nayak et al., 2016; Bahiram et al., 2023 and Dora et al., 2018
Digestive disorder	0.50	*Abroma augustum*	20	Bhattacharya et al., 2023
		Tagetes erecta	40	Mishra et al., 2024
Diabetes	0.45	*Hibiscus rosa-sinensis*	50	Afiune et al., 2017; Sachdewa and Khemani, 2003 and Kumar et al., 2012
		Mangifera indica	50	Aderibigbe et al., 1999; Rodríguez-González et al., 2017; Gondi and Prasada, 2015 and Bhowmik et al., 2009
		Catharanthus roseus	66	Nammi et al., 2003; Desireddy et al., 2010; Al-Shaqha et al., 2015 and Oguntibeju et al., 2019
		Mikania micrantha	33	Khan et al., 2023; Sumantri et al., 2021; Das et al., 2023 and Ibrahim et al., 2020
		Coccinia grandis	100	Munasinghe et al., 2011 and Waisundara et al., 2015
		Drynaria quercifolia	50	Prasanna et al., 2019; Mani et al., 2023 and Chaity et al., 2016
		Momordica charanita	100	Peter et al., 2019; Leatherdale et al., 1981 and Mahajan and Pandey, 2015
		Syzygium samarangense	100	Rashied et al., 2022; Khamchan et al., 2018; Resurreccion-Magno et al., 2005 and Shen and Chang, 2013
		Alstonia scholaris	66	Arulmozhi et al., 2010 and Mishra et al., 2023
Rheumatic pain	0.42	*Sida cordifolia*	66	Rajeev, 2020 and Sutradhar et al., 2006
		Trachyspermum ammi	40	Qamar and Bhatti, 2020
		Persicaria hydropiper	50	Khatun et al., 2015
		Nyctanthes abor-tristis	66	Rawat et al., 2021
		Moringa oleifera	66	Kapil et al., 2021and Mansour et al., 2021
		Alocasia macrorrhizos	33	Srivastava et al., 2012
		Lasia spinosa	40	Hossain et al., 2021
		Ageratum conyzoides	66	Harfiani et al., 2017and Kotta et al., 2020
		Phyllanthus fraternus	25	Chopade and Sayyad, 2014
		Streblus asper	50	Kadir et al., 2014
		Cissus quadrangularis	00	Bhujade and Talmale, 2015
		Rhynchostylis retusa	66	Rohani et al., 2018
Allergy	0.40	*Solanum viarum*	60	Patel et al, 2013
		Ziziphus jujuba	50	Jiang et al., 2019 and Naik et al., 2013
		Azadirachta indica	25	Chew et al., 2022

Table 2. Continues

Ailments	ICF	Plants name	FL value	References
Indigestion	0.33	*Mikania scandens*	12.5	Khatun et al., 2020
		Euphorbia hirta	33	Ali et al., 2020
		Glinus oppositifolius	25	Das et al., 2024
		Carica papaya	50	Ayodipupo Babalola et al., 2024 and Anjum et al., 2017
		Litchi chinensis	33	Kejing et al., 2022
Constipation	0.31	*Euphorbia hirta*	66	Ali et al., 2020
		Centella asiatica	20	Peters et al., 2021
		Urena lobata	33	**No report found**
		Trachyspermum ammi	20	Razzak, 2020 and Jabeen et al., 2023
		Abroma augustum	0	**No report found**
		Aphanamixis polystachya	100	Hossain et al., 2023
		Ficus religiosa	50	Singh et al., 2011; Panchawat and Sunita, 2012
		Gmelina arborea	33	Warrier et al., 2021
		Corchorus capsularis	66	Zakaria et al., 2008 and Biswas et al., 2022
		Cassia fistula	66	Mozaffarpur et al., 2012 and Sepehr et al., 2022
Cough & cold	0.29	*Centella asiatica*	20	Kusnul et al., 2023 and Suprianto et al., 2023
		Ocimum tenuiflorum	40	Bhattarai et al., 2024
		Justicia adhatoda	16	Barth et al., 2015
		Bryophyllum pinnatum	20	Salami et al., 2013 and Okwara et al., 2024
Loss of appetite	0.25	*Cuscuta europaea*	20	Kaur et al., 2019
		Glinus oppositifolius	25	Sahu et al., 2012 and Behera et al., 2010
		Corchorus capsularis	33	Biswas et al., 2022
		Litchi chinensis.	66	Rajan et al., 2023 and Xiang et al., 2022
Eczema	0.25	*Solanum viarum*	40	Leelaveni et al., 2018
		Eichhornia crassipes	100	Maisha et al., 2024
		Leea indica	33	Rahman, 1970
		Glycosmis pentaphylla	00	Jha et al., 2009
Helminthiasis	0.20	*Cuscuta europaea*	20	**No report found**
		Acalypha indica	100	Mutiarawati, 2020
		Eclipta prostrata	**20**	Sirama et al., 2014
		Catharanthus roseus	33	Padmaa et al., 2019
		Terminalia chebula	33	Shankara et al., 2014, Kalpana et al., 2018
		Persicaria hydropiper	33	Nagi et al., 2022
		Ananas comosus	100	Azevedo da Paixão et al., 2021, Damiyati et al., 2021
		Leonurus sibiricus	100	Saha et al., 2012
		Cassia fistula	33	Saha et al., 2012
Gastric ulcer	0.13	*Mikania scandens*	12.5	Siddiqui et al., 2018 and Wijaya et al., 2020
		Centella asiatica	20	Cheng et al., 2004; Wannasarit et al., 2020 and Gohil et al., 2010
		Ziziphus jujuba	50	Hamedi et al., 2015 and Alsayari & Wahab, 2021
		Mikania micrantha	66	Banarase et al., 2022 and Cheng et al., 2024
		Moringa oleifera	66	Hessah, 2018; Devaraj et al., 2007 Abo-Elsoud et al., 2022

diversity. The family Asteraceae was the most represented, comprising 9 species (7.76% of the total) and 7 genera (7.53% of the total genera) (Figure 4). Asteraceae is globally renowned for its ecological versatility and medicinal applications, making it one of the most extensively studied plant families (Funk et al., 2009). Solanaceae ranked second with 8 species (6.90%) and 5 genera (6.70%) (Figure 4). This family includes plants of immense medicinal and agricultural importance, such as *Withania somnifera* (Mikulska et al., 2023) and *Solanum nigrum* (Mohyuddin et al., 2022).

The Malvaceae family contributed 7 species (6.03%) and 6 genera (5.86%) (Figure 4), underscoring its dual importance in traditional medicine and industrial applications. Species like *Hibiscus rosa-sinensis* have been extensively studied for their medicinal value (Shivram, 2021). Similarly, Fabaceae (Leguminosae) accounted for 6 species (5.17%) and 6 genera (5.02%) (Figure 4), reflecting its role in nitrogen fixation and ethnomedicine (Bera and Sourabh, 2024).

Euphorbiaceae and Apocynaceae were each represented by 4 species (3.45%) and 4 genera (3.35%) (Figure 4). Euphorbiaceae is widely used in treating inflammation and skin disorders (Ernst, 2015), while Apocynaceae is known for its alkaloid-rich plants frequently utilized in pharmaceuticals (Patil et al., 2023).

Many families, such as Pontederiaceae, Boraginaceae, Bromelioideae, Rhamnaceae, and Orchidaceae, were represented by only one or two species. Despite their limited representation, these families contribute unique ecological and medicinal properties, underscoring the importance of biodiversity in ethnobotanical practices.

3.5 Informant Agreement Ratio (IAR) and Use Value (UV)

Medicinal plants serve a dynamic role in ethnomedicine, addressing various health conditions. Two key metrics were used in this study: Use Value (UV), which quantifies the importance of a plant species to informants, and Informant Agreement Ratio (IAR), which measures the consensus among informants regarding the use of specific plants. These metrics indicate cultural significance and therapeutic efficacy (Trotter and Logan, 2019; Thomas et al., 2009; Heinrich et al., 1998).

Species such as *Amaranthus spinosus*, *Myristica fragrans*, and *Bombax ceiba* achieved the highest IAR (1.00) and notable UVs (1.2%), reflecting strong agreement among informants about their medicinal uses. For instance, *Amaranthus spinosus* and *Myristica fragrans* were widely used for treating leucorrhea, while *Bombax ceiba* was applied for male sexual disorders (Figure 5).

Other plants, including *Hibiscus rosa-sinensis* and *Carica papaya*, exhibited slightly lower IARs (0.67 and 0.60, respectively) but remained significant due to their medicinal applications. *Carica papaya* is well known for its enzymatic benefits in digestion, while *Hibiscus rosa-sinensis* is widely used for hair care and wound healing (Figure 5).

Some species, such as *Eichhornia crassipes* and *Xanthium strumarium*, demonstrated high IARs (1.00) but relatively low UVs (0.6%). These plants were specific to localized treatments, such as eczema (*Eichhornia crassipes*) and hair fall (*Xanthium strumarium*). Multipurpose plants, including *Phyllanthus emblica* and *Moringa oleifera*, were highly prioritized due to their versatile applications. Conversely, species such as *Aegle marmelos* (used for jaundice and gastrointestinal issues) and *Rauwolfia serpentina* (used for enhancing female fertility) displayed balanced IAR and UV scores, indicating both specialized and broad therapeutic applications (Figure 5).

These results highlight the deep integration of medicinal plants into cultural practices. However, some species remain underutilized despite their recognized potential, emphasizing the need for further research and documentation.

3.6 Informant Consensus Factor (ICF) and Fidelity Level (FL)

This study recorded 75 ailments treated with medicinal plants, of which 23 major conditions involving 88 plant species were highlighted based on high Informant Consensus Factor (ICF) and Fidelity Levels (FL) (Supporting Information, Table 2). High ICF and FL values signify strong agreement among informants regarding the use of particular plants for specific ailments, underscoring the reliability and cultural importance of this traditional knowledge (Heinrich et al., 1998; Idm'hand et al., 2020). Ailments such as oligospermia (ICF 1.0) and male sexual disorders (ICF 0.67) showed the highest consensus, with plants like *Bombax ceiba* and *Punica granatum* being widely acknowledged for their efficacy (Table 2). Similarly, conditions like anemia (ICF 0.75), gallstones (ICF 0.67), and jaundice (ICF 0.57) demonstrated moderately high ICF values, indicating a focused reliance on species such as *Glycosmis pentaphylla*, *Mikania scandens*, and *Ricinus communis* (Table 2). These findings validate the cultural prominence and perceived effectiveness of these plants.

Broad-spectrum plants were frequently employed for multiple ailments, showcasing their versatility in traditional medicine.

For instance, *Mikania scandens* was utilized to treat five conditions, including kidney stones, gallstones, jaundice, indigestion, and gastric ulcers. Similarly, *Aegle marmelos* was used for jaundice and male sexual disorders, while *Carica papaya* addressed ailments such as jaundice and indigestion (Table 2). This wide applicability highlights their therapeutic importance.

High FL values, approaching 100%, for certain plants emphasize their specific application. Notable examples include *Typhonium giganteum* for kidney stones, *Aphanamixis polystachya* for constipation, *Euphorbia prostrata* and *Nicotiana plumbaginifolia* for hemorrhoids, and *Curcuma longa* for allergies (Table 2). These results underscore the informants' confidence in the targeted efficacy of these plants.

Conversely, ailments like gastric ulcers (ICF 0.13) and constipation (ICF 0.31) had lower ICF values (Table 2), suggesting either diverse traditional knowledge or experimentation with various species. Plants with high FL values for specific conditions, such as *Ludwigia prostrata* (FL 100 for leukorrhea) and *Ananas comosus* (FL 100 for helminthiasis), highlight their potential for focused pharmacological exploration.

Among the 75 ailments (Supporting Information), 23 conditions treated with 88 plant species stand out, validated through comparisons with global studies. Notably, six plant species used for eight ailments are newly reported. These include *Mikania scandens* for gallstones, *Abroma augustum* for oligomenorrhea, constipation, and helminthiasis, *Myristica fragrans* for leukorrhea, *Pterocarpus santalinus* for tuberculosis, *Urena lobata* for constipation, and *Cuscuta europaea* for helminthiasis (Table 2).

These findings underscore the cultural and therapeutic value of traditional medicinal plants. Plants with high ICF and FL values, combined with widespread use, warrant further pharmacological research to validate their efficacy and explore their potential as drug candidates. Ensuring sustainable use and preserving traditional knowledge are essential for integrating these resources into global healthcare systems.

3.7 Jaccard Index (JI) Analysis of Ethnomedicinal Plant Similarities Across Study Areas

Comparative analysis of ethnomedicinal studies across regions reveals significant variations in the use, knowledge, and documentation of medicinal plants. The results, measured using the Jaccard Index (JI), demonstrate the degree of similarity or divergence in plant usage among communities, emphasizing the influence of regional and cultural specificity on ethnomedicinal practices.

Studies from Noakhali, Bangladesh, and Joypurhat District, Bangladesh, recorded relatively high JI values of 37.77 and 23.39, respectively (Table 3). In Noakhali, 67 species were identified as similar out of 143 total reports, suggesting strong inter-community communication or shared ecological zones that facilitate the preservation of traditional knowledge. Joypurhat's similarity percentage indicates comparable patterns, potentially reflecting overlapping cultural and ecological contexts.

Moderate JI values were observed in the Madhupur Forest Region (15.29) and the Natore and Rajshahi Districts (16) (Table 3). These areas showed a balance between similar and dissimilar species, pointing to semi-distinct yet related ethnobotanical traditions. The moderate overlap likely arises from shared ecosystems coupled with varying cultural influences or differences in plant availability.

Regions such as Swat, North Pakistan, and Solan District, India, exhibited low JI values of 3.25 and 6.45, respectively (Table 3). This minimal similarity highlights distinctive ethnomedicinal practices in these areas. Swat reported only seven shared species out of 106 documented, which may reflect unique ecological settings or limited documentation of overlapping knowledge. Similarly, the limited overlap in Solan District suggests distinct ethnobotanical knowledge influenced by localized ecological and cultural factors.

The lowest reported JI value, 6.66 (Tekuri et al., 2019), underscores a narrow overlap despite a moderate total number of plant reports (Table 3). This limited similarity could be attributed to localized medicinal practices or underrepresentation in comparative datasets.

These findings highlight the dynamic nature of ethnomedicinal knowledge and its dependence on both ecological and cultural factors. Higher JI values often correlate with regions sharing ecological similarities or cultural ties, whereas lower values indicate greater differentiation due to geographic, cultural, or methodological discrepancies.

Further research should aim to bridge gaps in ethnomedicinal documentation to better understand the extent of shared and unique traditional knowledge. This can support the conservation of valuable medicinal plants and promote collaboration across regions to harness their therapeutic potential.

4. Conclusion

This study demonstrates the richness and cultural significance of ethnomedicinal knowledge, documenting 116 plant species across diverse ailments. High Informant Consensus Factor (ICF) and Fidelity Level (FL) values validate the reliability of traditional practices, while Use Value (UV) highlights plants' versatility. Taxonomic diversity reflects ecological adaptability, with prominent families like Asteraceae and Solanaceae.

Regional comparisons using the Jaccard Index (JI) emphasize shared and distinct traditions, influenced by ecological and cultural factors. This research provides a foundation for preserving traditional knowledge, fostering sustainable use of medicinal plants, and exploring their potential for integrative healthcare and pharmacological innovation.

Author contributions

M.S.A., S.J.O., F.R., R.B., M.H., M.N.M., N.R., S.A., and S.D. contributed to the conceptualization and design of the study. M.S.A., S.J.O., and F.R. were responsible for data collection. R.B., M.H., and M.N.M. performed data analysis and interpretation. N.R., S.A., and S.D. provided critical revisions and ensured the methodological rigor of the manuscript. M.A.R. supervised the entire research process, reviewed the manuscript critically, and finalized it for submission. All authors reviewed and approved the final manuscript.

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Competing financial interests

The authors have no conflict of interest.

References

Abo-Elsoud, R. A. E. A., Ahmed Mohamed Abdelaziz, S., Attia Abd Eldaim, M., & Hazzaa, S. M. (2022). Moringa oleifera alcoholic extract protected stomach from bisphenol A–induced gastric ulcer in rats via its antioxidant and anti-inflammatory activities. Environmental Science and Pollution Research.

Aderibigbe, A. O., Emudianughe, T. S., & Lawal, B. A. S. (1999). Antihyperglycaemic effect of Mangifera indica in rats. Phytotherapy Research, 13(6), 504–507.

Afiune, L. A. F., Leal-Silva, T., Sinzato, Y. K., Moraes-Souza, R. Q., Soares, T. S., Campos, K. E., Fujiwara, R. T., Herrera, E., Damasceno, D. C., & Volpato, G. T. (2017). Beneficial effects of Hibiscus rosa-sinensis L. flower aqueous extract in pregnant rats with diabetes. PLOS ONE, 12(6), e0179785.

Agrawal, S. S., Kumar, A., Gullaiya, S., Dubey, V., Nagar, A., Tiwari, P., Dhar, P., & Singh, V. (2012). Antifertility activity of methanolic bark extract of Aegle marmelos (L.) in male Wistar rats. DARU Journal of Pharmaceutical Sciences, 20(1).

Ahammed, K., Joardar, M. H. H., Islam, M. U., Yameen, M. B., Rahman, S. M., & Sharmin, R. (2020). Evaluation of nephroprotective and cytotoxic effect of ethanolic extract of Mikania scandens leaves by using alloxan-induced diabetic nephropathy mice. Clinical Phytoscience, 6, 1–8.

Akbar, S. (2020). Justicia adhatoda L. (Acanthaceae). Handbook of 200 Medicinal Plants, 1059–1066.

Akhtar, N., Iqbal, S., Shahzad, M. F., Latif, M., & Iqbal, F. (2020). Oral supplementation of Ficus religiosa leaf extract adversely affects the selected behavioral aspects of male albino mice. Biologia, 75(12), 2295–2300.

Akhtar, N., Rashid, A., Murad, W., & Bergmeier, E. (2013). Diversity and use of ethno-medicinal plants in the region of Swat, North Pakistan. Journal of Ethnobiology and Ethnomedicine, 9(1), 25.

Alexiades, M. N., & Sheldon, J. W. (Eds.). (1996). Selected guidelines for ethnobotanical research: a field manual (pp. xx+-306).

Ali, M. Z., Mehmood, M. H., Saleem, M., & Gilani, A.-H. (2020). The use of Euphorbia hirta L. (Euphorbiaceae) in diarrhea and constipation involves calcium antagonism and cholinergic mechanisms. BMC Complementary Medicine and Therapies, 20(1).

Alsayari, A., & Wahab, S. (2021). Genus Ziziphus for the treatment of chronic inflammatory diseases. Saudi Journal of Biological Sciences, 28(12), 6897–6914.

Al-Shaqha, W. M., Khan, M., Salam, N., Azzi, A., & Chaudhary, A. A. (2015). Anti-diabetic potential of Catharanthus roseus Linn. and its effect on the glucose transport gene (GLUT-2 and GLUT-4) in streptozotocin-induced diabetic Wistar rats. BMC Complementary and Alternative Medicine, 15(1).

Anjum, J., Lone, R., & Khursheed Alam Wani. (2017). Lychee (Litchi chinensis): Biochemistry, panacea, and nutritional value.

Anquez-Traxler, C. (2011). The legal and regulatory framework of herbal medicinal products in the European Union: A focus on the traditional herbal medicines category. Drug Information Journal, 45(1), 15–23.

Arora, P., Ansari, S. H., & Nainwal, L. M. (2022). Clerodendrum serratum extract attenuates production of inflammatory mediators in ovalbumin-induced asthma in rats. Turkish Journal of Chemistry, 46(2), 330–341.

Arrout, A., El Ghallab, Y., Yafout, M., Lefriyekh, M. R., & Ait, A. (2024). Medicinal plants for gallstones: A cross-sectional survey of Moroccan patients. Phytomedicine Plus, 4(1), 100524–100524.

Arulmozhi, S., Mazumder, P. M., Lohidasan, S., & Thakurdesai, P. (2010). Antidiabetic and antihyperlipidemic activity of leaves of Alstonia scholaris Linn. R. Br. European Journal of Integrative Medicine, 2(1), 23–32.

Asif, H. M., Sultana, S., & Akhtar, N. (2014). A panoramic view on phytochemical, nutritional, ethanobotanical uses, and pharmacological values of Trachyspermum ammi Linn. Asian Pacific Journal of Tropical Biomedicine, 4, S545–S553.

Ayeni, M. I., Akanmu, M. A., Bolaji, O. O., Osasan, S. A., Olayiwola, G., Afolabi, M. O., & Morohunfola, A. M. (2017). Bilirubin lowering potential of aqueous Carica papaya extract in induced jaundice in rats. Journal of Pharmacy and Pharmacology, 5(7).

Ayodipupo Babalola, B., Ifeolu Akinwande, A., Otunba, A. A., Ebenezer Adebami, G., Babalola, O., & Nwuofo, C. (2024). Therapeutic benefits of Carica papaya: A review on its pharmacological activities and characterization of papain. Arabian Journal of Chemistry, 17(1), 105369.

Azevedo da Paixão, J., Fernando de Araújo Neto, J., Oliveira do Nascimento, B., Mota da Costa, D., Brandão, H. N., Duarte Souza, F. V., Hilo de Souza, E., Lovatti Alves, Q., Lima Erling, S. B., & Pereira de Lima David, J. (2021). Pharmacological actions of Ananas comosus L. Merril: Revision of the works published from 1966 to 2020. Pharmacognosy Reviews, 15(29), 57–64.

Aziz, A., Ullah, Z., & Pieroni, A. (2020). Wild food plant gathering among Kalasha, Yidgha, Nuristani, and Khowar speakers in Chitral, NW Pakistan. Sustainability, 12(21), 9176.

Bach, T., Anh, T., & Phuong. (2018). Improving hairy root induction of Urena lobata L. by Agrobacterium rhizogenes ATCC 15834 by some factors. Khoa học Công nghệ, 21(3), 90–97.

Bahiram, D. N., Wagh, S. A., Yeole, R. R., Ahmad, S., Shaikh, H., Deo, S. D., & Dhamane, P. S. (2023). Boerhaavia diffusa Linn (Punarnava)–Phytochemistry & pharmacological effects on various diseases in condition.

Bahmani, M., Baharvand-Ahmadi, B., Tajeddini, P., Rafieian-Kopaei, M., & Naghdi, N. (2016). Identification of medicinal plants for the treatment of kidney and urinary stones. Journal of Renal Injury Prevention, 5(3), 129–133.

Banarase, N. B., Mukesh Kr Singh, Gurdeep Singh, Ritesh Patel, & Pawan Tiwari. (2022). A comprehensive review on some species of Mikania. YMER 21, 299–309.

Bani, S., Hasanpour, S., Mousavi, Z., Mostafa Garehbaghi, P., & Gojazadeh, M. (2014). The effect of Rosa damascena extract on primary dysmenorrhea: A double-blind cross-over clinical trial. Iranian Red Crescent Medical Journal, 16(1).

Barth, A., Hovhannisyan, A., Jamalyan, K., & Narimanyan, M. (2015). Antitussive effect of a fixed combination of Justicia adhatoda, Echinacea purpurea, and Eleutherococcus senticosus extracts in patients with acute upper respiratory tract infection: A comparative, randomized, double-blind, placebo-controlled study. Phytomedicine, 22(13), 1195–1200.

Beedimani, R., & Jeevangi, S. (2015). Evaluation of hepatoprotective activity of Boerhaavia diffusa against carbon tetrachloride-induced liver toxicity in albino rats. International Journal of Basic & Clinical Pharmacology, 4(1), 153.

Begum, Mst. M., Islam, A., Begum, R., Uddin, Md. S., Rahman, Md. S., Alam, S., Akter, W., Das, M., Rahman, Md. S., & Imon, A. H. M. R. (2019). Ethnopharmacological inspections of organic extract of Oroxylum indicum in rat models: A promising natural gift. Evidence-based Complementary and Alternative Medicine, 2019, 1562038.

Behera, G. M., Satish Kumar, B. N., Malay Baidya, M., & Panigrahi, G. H. A. N. S. H. Y. A. M. (2010). Antihyperglycemic, antihyperlipidemic and antioxidant activity of Glinus oppositifolius (L.) Aug. DC. Pharmacologyonline, 3, 915–936.

Bennett, B. C., & Prance, G. T. (2000). Introduced plants in the indigenous pharmacopoeia of Northern South America. Economic Botany, 54(1), 90–102.

Bera, A., & Lodh, C. (2019). Therapeutic evaluation of Cajanus cajan for the management of hepatic disorder in canine. Indian Journal of Canine Practice, 11(1), 005.

Bera, J., & Sourabh, P. (2024). Ethnomedicinal insights into the Fabaceae family in coastal Purba Medinipur and Balasore: A study of traditional plant uses and conservation perspectives. Applied Ecology and Environmental Sciences, 12(3).

Bhar, K., Mondal, S., & Suresh, P. (2019). An eye-catching review of Aegle marmelos L. (Golden Apple). Pharmacognosy Journal, 11(2), 207–224.

Bhargava, C., Thakur, M., & Yadav, S. K. (2011). Effect of Bombax ceiba L. on spermatogenesis, sexual behavior, and erectile function in male rats. Andrologia, 44, 474–478.

Bhattacharya, D., Singha, P. S., Firdaus, S. B., & Ghosh, D. (2023). Medicinal plants in the daily diet of the indigenous people of Bhagabanbasan village: A study in the Paschim Midnapore district of West Bengal. Pharmaceutical and Medical Research, 8(3), 273–278.

Bhattarai, K., Bhattarai, R., Pandey, R. D., Paudel, B., & Bhattarai, H. D. (2024). A comprehensive review of the phytochemical constituents and bioactivities of Ocimum tenuiflorum. The Scientific World Journal, 2024(1).

Bhowmik, A., Khan, L. A., Akhter, M., & Rokeya, B. (2009). Studies on the antidiabetic effects of Mangifera indica stem-barks and leaves on nondiabetic, type 1, and type 2 diabetic model rats. Bangladesh Journal of Pharmacology, 4(2).

Bhowmik, R., Saha, M. R., Rahman, M. A., & Islam, M. A. U. (2014). Ethnomedicinal survey of plants in the Southern District Noakhali, Bangladesh. Bangladesh Pharmaceutical Journal, 17(2), 205–214.

Bhujade, A., & Talmale, S. (2015). In vivo studies on antiarthritic activity of Cissus quadrangularis against adjuvant-induced arthritis. Journal of Clinical & Cellular Immunology, 6(3).

Bhujbal, S. S., Nanda, R., Ganu, G. P., Jadhav, S. W., Dongre, P. R., Choudhary, B., Pokale, D., & Patil, M. J. (2010). Protective effects of icosahydropicenic acid isolated from the roots of Clerodendrum serratum on experimental allergic asthma. Journal of Complementary and Integrative Medicine, 7(1).

Biswas, A., Dey, S., Huang, S., Deng, Y., Birhanie, Z. M., Zhang, J., Akhter, D., Liu, L., & Li, D. (2022). A comprehensive review of C. capsularis and C. olitorius: A source of nutrition, essential phytoconstituents, and pharmacological activities. Antioxidants, 11(7), 1358.

Braun, L. A., Tiralongo, E., Wilkinson, J. M., Spitzer, O., Bailey, M., Poole, S., & Dooley, M. (2010). Perceptions, use, and attitudes of pharmacy customers on complementary medicines and pharmacy practice. BMC Complementary and Alternative Medicine, 10(1).

Calapai, G. (2008). European legislation on herbal medicines: A look into the future. Drug Safety, 31(5), 428–431.

Canales, M., Hernández, T., Caballero, J., Vivar, A. R. de, Avila, G., Duran, A., & Lira, R. (2005). Informant consensus factor and antibacterial activity of medicinal plants used by the people of San Rafael Coxcatlán, Puebla, México. Journal of Ethnopharmacology, 97(3), 429–439.

Chaity, F. R., Khatun, M., & Rahman, M. S. (2016). In vitro membrane stabilizing, thrombolytic, and antioxidant potentials of Drynaria quercifolia, a remedial plant of the Garo tribal people of Bangladesh. BMC Complementary and Alternative Medicine, 16(1).

Chauhan, A., & Agarwal, M. (2009). Assessment of the contraceptive efficacy of the aqueous extract of Aegle marmelos leaves in male albino rats. Human Fertility, 12(2), 107–118.

Cheng, C. L., Guo, J. S., Luk, J., & Koo, M. W. L. (2004). The healing effects of centella extract and asiaticoside on acetic acid-induced gastric ulcers in rats. Life Sciences, 74(18), 2237–2249.

Cheng, Q., Lyu, B., Hu, J., Zhang, Z., Huang, Y., & Wang, Z. (2024). Research on the antipruritic active ingredients of Mikania micrantha. Fitoterapia, 174, 105837.

Chew, Y.-L., Khor, M.-A., Xu, Z., Lee, S.-K., Keng, J.-W., Sang, S.-H., Akowuah, G. A., Goh, K. W., Liew, K. B., & Ming, L. C. (2022). Cassia alata, Coriandrum sativum, Curcuma longa, and Azadirachta indica: Food ingredients as complementary and alternative therapies for atopic dermatitis—a comprehensive review. Molecules, 27(17), 5475.

Chibli, L. A., Rodrigues, K. C. M., Gasparetto, C. M., Pinto, N. C. C., Fabri, R. L., Scio, E., Alves, M. S., Del-Vechio-Vieira, G., & Sousa, O. V. (2014). Anti-inflammatory effects of Bryophyllum pinnatum ethanol extract in acute and chronic cutaneous inflammation. Journal of Ethnopharmacology, 154(2), 330–338.

Chopade, A. R., & Sayyad, F. J. (2014). Antifibromyalgic activity of standardized extracts of Phyllanthus amarus and Phyllanthus fraternus in acidic saline-induced chronic muscle pain. Biomedicine & Aging Pathology, 4(2), 123–130.

Choudhary, S. K. (2020). Biochemical analysis of Achyranthes aspera used in fever and diabetes in Santal Parganas, Jharkhand. Biospectra, 15(2), 155–158.

Chowdhury, M. S. H., & Koike, M. (2010). Therapeutic use of plants by local communities in and around Rema-Kalenga Wildlife Sanctuary: Implications for protected area management in Bangladesh. Agroforestry Systems, 80(2), 241–257.

Cunningham, A. A. (2001). Applied Ethnobotany; Informa.

Damiyati, S. Y., Pratama, I. S., & Tresnani, G. (2021). In vitro anthelmintic activity of pineapple peel juice (Ananas comosus (L.) Merr.) against Paramphistomum sp. Communications in Science and Technology, 6(1), 49–54.

Danish, M., Altaf, M., Robab, M. I., Shahid, M., Manoharadas, S., Hussain, S. A., & Shaikh, H. (2021). Green synthesized silver nanoparticles mitigate biotic stress induced by Meloidogyne incognita in Trachyspermum ammi (L.) by improving growth, biochemical, and antioxidant enzyme activities. ACS Omega, 6(17), 11389–11403.

Das, C., Ghosh, G., Rath, G., Das, D., Kar, B., Pradhan, D., Rai, V. K., Rajwar, T. K., Halder, J., & Dash, P. (2024). Chemometric profiling and anti-arthritic activity of aerial parts of Glinus oppositifolius (L.) Aug. DC. Journal of Ethnopharmacology, 328, 117991.

Das, G., Farhan, M., Sinha, S., Bora, H. K., Singh, W. R., & Meeran, S. M. (2023). Mikania micrantha extract enhances cutaneous wound healing activity through the activation of FAK/Akt/MTOR cell signaling pathway. Injury, 54(8), 110856.

Davaneghi, S., Tarighat-Esfanjani, A., Safaiyan, A., & Fardiazar, Z. (2017). The effects of N-3 fatty acids and Rosa damascena extract on primary dysmenorrhea. Progress in Nutrition, 19, 34–40.

Desireddy, S., Rasineni, K., Bellamkonda, R., & Singareddy, S. (2010). Antihyperglycemic activity of Catharanthus roseus leaf powder in streptozotocin-induced diabetic rats. Pharmacognosy Research, 2(3), 195.

Devaraj, V. C., Asad, M., & Prasad, S. (2007). Effect of leaves and fruits of Moringa oleifera on gastric and duodenal ulcers. Pharmaceutical Biology, 45(4), 332–338.

Dinda, B., SilSarma, I., Dinda, M., & Rudrapaul, P. (2015). Oroxylum indicum (L.) Kurz, an important Asian traditional medicine: From traditional uses to scientific data for its commercial exploitation. Journal of Ethnopharmacology, 161, 255–278.

Dons, T., & Soosairaj, S. (2013). Treatment of jaundice by traditional healthcare system. International Journal of Biology, Pharmacy and Allied Sciences, 2(6), 1373–1378.

Dora, B. B., Gupta, S., Sital, S., & Pastore, A. (2018). Punarnava (Boerhavia diffusa): A promising indigenous herbal drug and its effect on different disease conditions. Research and Reviews: Journal of Herbal Science, 4, 21–24.

Ekor, M. (2013). The growing use of herbal medicines: Issues relating to adverse reactions and challenges in monitoring safety. Frontiers in Pharmacology, 4, 177.

Esakkimuthu, S., Mutheeswaran, S., Arvinth, S., Paulraj, M. P., Pandikumar, P., & Ignacimuthu, S. (2016). Quantitative ethnomedicinal survey of medicinal plants given for cardiometabolic diseases by the non-institutionally trained Siddha practitioners of Tiruvallur District, Tamil Nadu, India. Journal of Ethnopharmacology, 186, 329–342.

Esha, R. T., Chowdhury, M. R., Adhikary, S., Haque, A., Acharjee, M., Nurunnabi, M., Khatun, Z., YongKyu, L., & Rahmatullah, M. (2012). Medicinal plants used by tribal medicinal practitioners of three clans of the Chakma tribe residing in Rangamati District, Bangladesh. American-Eurasian Journal of Sustainable Agriculture, 6(2), 74–84.

Eva, S. A., Mouri, T. I., Sheela, S. A., Noshine, M. N., Sultana, F. S., Rahman, T. R., & Rahmatullah, M. R. (2014). Folkloric knowledge of medicinal plants: An account of eight folk herbalists in Comilla district, Bangladesh. American-Eurasian Journal of Sustainable Agriculture, 8(9), 75–82.

FAO. (2009). The state of Food and Agriculture 2009: Livestock in the balance. Food and Agriculture Organization of the United Nations: Rome.

Farooq, A., Amjad, M. S., Ahmad, K., Altaf, M., Umair, M., & Abbasi, A. M. (2019). Ethnomedicinal knowledge of the rural communities of Dhirkot, Azad Jammu and Kashmir, Pakistan. Journal of Ethnobiology and Ethnomedicine, 15(1).

Faruque, M. O., Uddin, S. B., Barlow, J. W., Hu, S., Dong, S., Cai, Q., Li, X., & Hu, X. (2018). Quantitative ethnobotany of medicinal plants used by indigenous communities in the Bandarban district of Bangladesh. Frontiers in Pharmacology, 9.

Fischer, C. E., Ujah, W., Fischer, V. A., & Agaba, E. A. (2021). Fertility potential of Lawsonia inermis on hormone profile and semen analysis in Wistar rat model. Pharmacologyonline, 3, 1642–1662.

Friday, A., Adakole, S., Dickson, N., & Adeniyi, S. (2024). Prophylactic efficacy of aqueous extract of unripe pawpaw (Carica papaya) fruit on hematological and biochemical parameters in induced hyperbilirubinemia Wistar rats. GSC Biological and Pharmaceutical Sciences, 27(2), 23–43.

Funk, V. A., Sussana, A., Stuessy, T. F., & Bayer, R. J. (2009). Systematics, evolution, and biogeography of Compositae. International Association for Plant Taxonomy: Vienna, Australia.

Gohil, K., Patel, J., & Gajjar, A. (2010). Pharmacological review on Centella Asiatica: A potential herbal cure-all. Indian Journal of Pharmaceutical Sciences, 72(5), 546.

Gondi, M., & Prasada Rao, U. J. S. (2015). Ethanol extract of Mango (Mangifera Indica L.) peel inhibits α-amylase and α-glucosidase activities, and ameliorates diabetes-related biochemical parameters in streptozotocin (STZ)-induced diabetic rats. Journal of Food Science and Technology, 52(12), 7883–7893.

Guddeti, V., Sambasivarao, P., & Praveen, T. (2012). Effect of Punica granatum Linn ripe fruit extract on stress-modulated sexual behavior in male rats. International Journal of Pharmacology & Biological Sciences, 6(2).

Gupta, S. K., & Bhandari, J. B. (2022). A review on the ecological distribution, antioxidant properties and antimicrobial activity of ethnomedicinal fern Drynaria quercifolia (L.) J. Smith. Environment and Ecology, 40(2), 279–287.

Guria, T., Mondal, A., Singha, T., Singh, J., & Kumar, M. T. (2014). Pharmacological actions and phytoconstituents of Amaranthus spinosus Linn: A review.

Hamedi, S., Arian, A. A., & Farzaei, M. H. (2015). Gastroprotective effect of aqueous stem bark extract of Ziziphus jujuba L. against HCl/ethanol-induced gastric mucosal injury in rats. Journal of Traditional Chinese Medicine, 35(6), 666–670.

Harfiani, E., Suci, R. N., Arsianti, A., Bahtiar, A., & Basah, K. (2017). Functional analysis of Ageratum conyzoides L. (Babandotan) leaves extract on rheumatoid arthritis model rat. Asian Journal of Pharmaceutical and Clinical Research, 10(3), 429.

Heinrich, M., Ankli, A., Frei, B., Weimann, C., & Sticher, O. (1998). Medicinal plants in Mexico: Healers' consensus and cultural importance. Social Science & Medicine, 47(11), 1859–1871.

Hessah, M. A. (2018). Effect of Moringa oleifera leaves extract on the oxidative stress and gastric mucosal ulcer induced by indomethacin in rats. African Journal of Biotechnology, 17(3), 51–56.

Hossain, M. I., Saiyem, Md. A., Begum, Mst. F., & Begum, Mst. E. A. (2024). Farmers' motivational factors for medicinal plant production in the southwestern region of Bangladesh. Discover Agriculture, 2(1).

Hossain, Md. S., Islam, M., Jahan, I., & Hasan, Md. K. (2023). Aphanamixis polystachya: Pharmacological benefits, health benefits and other potential benefits. Phytomedicine Plus, 100448.

Hossain, R., Quispe, C., Herrera-Bravo, J., Islam, Md. S., Sarkar, C., Islam, M. T., Martorell, M., Cruz-Martins, N., Al-Harrasi, A., Al-Rawahi, A., Sharifi-Rad, J., Ibrayeva, M., Daştan, S. D., Alshehri, M. M., Calina, D., Cho, W. C. (2021). Lasia spinosa chemical composition and therapeutic potential: A literature-based review. Oxidative Medicine and Cellular Longevity, 1–12.

Hossain, S., Khatun, A., & Miajee, U. (2010). Medicinal plants used by folk medicinal practitioners in three villages of Natore and Rajshahi districts, Bangladesh. American-Eurasian Journal of Sustainable Agriculture, 4(2), 211–218.

Hussain, S. A., Hameed, A., Nasir, F., Wu, Y., Suleria, H. A. R., & Song, Y. (2018). Evaluation of the spermatogenic activity of polyherbal formulation in oligospermic males. BioMed Research International, 2018, 1–10.

Ibrahim, A., Shafie, N. H., Mohd Esa, N., Shafie, S. R., Bahari, H., & Abdullah, M. A. M. (2020). Mikania micrantha extract inhibits HMG-CoA reductase and ACAT2 and ameliorates hypercholesterolemia and lipid peroxidation in high cholesterol-fed rats. Nutrients, 12(10), 3077.

Idm'hand, E., Msanda, F., & Cherifi, K. (2020). Ethnobotanical study and biodiversity of medicinal plants used in the Tarfaya Province, Morocco. Acta Ecologica Sinica, 40(2), 134–144.

Islam, B., Deb, P., & Rahmatullah, M. (2021). Ethnomedicinal survey in two villages of Cumilla district, Bangladesh. Current Research in Complementary & Alternative Medicine, 5(1).

Islam, S., & Uddin, M. Z. (2022). Study of ethnomedicinal plants used by the local people of Raipura Upazila of Narsingdi District. Bangladesh Journal of Plant Taxonomy, 29(1), 137–156.

Jabeen, R., Ali, T., Naeem, M., Hussain, F., Danish, S., Tahani Awad Alahmadi, Mohammad Shahzad Samdani, & Mohammad Javed Ansari. (2023). An insight into biochemical characterization and explorations of antioxidant, antibacterial, cytotoxic, and antidiabetic activities by Trachyspermum ammi nanosuspensions. Frontiers in Bioscience, 28(12), 340–340.

Jaccard, P. (1902). Lois de distribution florale dans la zone alpine. Bulletin Société Vaudoise Sciences Naturelles, 38, 67–130.

Jagetia, G. C. (2021). A review on the medicinal and pharmacological properties of traditional ethnomedicinal plant Sonapatha, Oroxylum indicum. Sinusitis, 5(1), 71–89.

Jha, M., Sharma, V., Nema, N., & Hussain, T. (2009). Effect of the topical application of the extract of Glycosmis pentaphylla on excisional wound model in mice. Pharmacologyonline, 3, 356–360.

Jiang, T., He, F., Han, S., Chen, C., Zhang, Y., & Che, H. (2019). Characterization of CAMP as an anti-allergic functional factor in Chinese jujube (Ziziphus jujuba Mill.). Journal of Functional Foods, 60, 103414.

Kadir, M. F., Bin Sayeed, M. S., Setu, N. I., Mostafa, A., & Mia, M. M. K. (2014). Ethnopharmacological survey of medicinal plants used by traditional health practitioners in Thanchi, Bandarban Hill Tracts, Bangladesh. Journal of Ethnopharmacology, 155(1), 495–508.

Kalpana, T., Madhavi, M., Mounika Rani, P., Kavitha, R., Manisha, M., & Kalyani, K. (2018). In-vitro antibacterial and anthelmintic activity of Terminalia chebula, Moringa oleifera, and Allium sativum. International Journal of Advances in Pharmacy and Biotechnology, 4(2), 25–29.

Kapil, M. J., Deka, D., Lahkar, M., Sharma, N., Sarma, D., Kalita, P., & Deka, S. (2021). Formulation, optimization and evaluation of niosomes containing leaf extract of Moringa oleifera and pharmacological screening of the extract against rheumatoid arthritis. Journal of Pharmaceutical Research International, 236–245.

Kaur, A., Behl, T., Makkar, R., & Goyal, A. (2019). Effect of ethanolic extract of Cuscuta reflexa on high fat diet-induced obesity in Wistar rats. Obesity Medicine, 14, 100082.

Kayani, S., Ahmad, M., Sultana, S., Khan Shinwari, Z., Zafar, M., Yaseen, G., Hussain, M., Bibi, T. (2015). Ethnobotany of medicinal plants among the communities of alpine and sub-alpine regions of Pakistan. Journal of Ethnopharmacology, 164, 186–202.

Kejing, A., Wu, J., Xiao, H.-W., Hu, T.-G., Yu, Y., Yang, W., Xiao, G., & Qian, M. C. (2022). Effect of various drying methods on the physicochemical characterizations, antioxidant activities, and hypoglycemic activities of lychee (Litchi chinensis Sonn.) pulp polysaccharides. International Journal of Biological Macromolecules, 220, 510–519.

Kelly, K. (2009). History of medicine. New York: Facts on File, pp. 29–50.

Khamchan, A., Paseephol, T., & Hanchang, W. (2018). Protective effect of wax apple (Syzygium samarangense (Blume) Merr. & L.M. Perry) against streptozotocin-induced pancreatic β-cell damage in diabetic rats. Biomedicine & Pharmacotherapy, 108, 634–645.

Khan, A. M., El-Kersh, D. M., Islam, M. S., Ara Khan, S., Kamli, H., Sarkar, C., Bhuia, M. S., Islam, T., Chandra Shill, M., Gobe, G. C., Sönmez Gürer, E., Setzer, W. N., Sharifi-Rad, J., & Torequl Islam, M. (2023). Mikania micrantha Kunth: An ethnopharmacological treasure trove of therapeutic potential. Chemistry & Biodiversity, 20(11), e202300392.

Khandare, M. S. (2016). Mango (Mangifera indica Linn) a medicinal and holy plant. Journal of Medicinal Plants Studies, 4(4), 44–46.

Khatun, A., Imam, M. Z., & Rana, M. S. (2015). Antinociceptive effect of methanol extract of leaves of Persicaria hydropiper in mice. BMC Complementary and Alternative Medicine, 15(1).

Khatun, R., Rashid, M., Alam, A. K., Lee, Y.-I., & Rahman, A. A. (2020). Evaluation of comparative phenolic contents and antioxidant activity of Mikania species available in Bangladesh. Frontiers in Science, 10(1), 1–6.

Koohpayeh, S. A., Hosseini, M., Nasiri, M., & Rezaei, M. (2021). Effects of Rosa damascena (Damask rose) on menstruation-related pain, headache, fatigue, anxiety, and bloating: A systematic review and meta-analysis of randomized controlled trials. Journal of Education and Health Promotion, 10, 272.

Korani, M., & Jamshidi, M. (2020). The effect of aqueous extract of Trachyspermum ammi seeds and ibuprofen on inflammatory gene expression in the cartilage tissue of rats with collagen-induced arthritis. Journal of Inflammation Research, 13, 133–139.

Kotta, J. C., Lestari, A. B. S., Candrasari, D. S., & Hariono, M. (2020). Medicinal effect, in silico bioactivity prediction, and pharmaceutical formulation of Ageratum conyzoides L.: A review. Scientifica, 2020, 1–12.

Kumar, K. S., Sabu, V., Sindhu, G., Rauf, A. A., & Helen, A. (2018). Isolation, identification and characterization of apigenin from Justicia gendarussa and its anti-inflammatory activity. International Immunopharmacology, 59, 157–167.

Kumar, M., Radha, Devi, H., Prakash, S., Rathore, S., Thakur, M., Puri, S., Pundir, A., Bangar, S. P., Changan, S., Ilakiya, T., Samota, M. K., Damale, R. D., Singh, S., Berwal, M. K., Dhumal, S., Bhoite, A. G., Sharma, A., Senapathy, M., Bhushan, B. (2021). Ethnomedicinal plants used in the health care system: Survey of the mid hills of Solan district, Himachal Pradesh, India. Plants, 10(9), 1842.

Kumar, V., Mahdi, F., Khanna, A. K., Singh, R., Chander, R., Saxena, J. K., Mahdi, A. A., & Singh, R. K. (2012). Antidyslipidemic and antioxidant activities of Hibiscus rosa sinensis root extract in alloxan induced diabetic rats. Indian Journal of Clinical Biochemistry, 28(1), 46–50.

Kumari, R., Rathi, B., Rani, A., & Bhatnagar, S. (2013). Rauvolfia serpentina L. Benth. ex Kurz.: phytochemical, pharmacological and therapeutic aspects. Int J Pharm Sci Rev Res, 23(2), 348–355.

Kurup, V. P., & Barrios, C. S. (2008). Immunomodulatory effects of curcumin in allergy. Molecular Nutrition & Food Research, 52(9), 1031–1039.

Kusnul, Z., Yektiningsij, E., & Rahayu, D. (2023). Consumption of herbal teas decrease health problems (fatigue, cough and throat problems, skin problems, and stomatitis). International Journal of Scholarly Research in Multidisciplinary Studies, 2(2), 058–065.

Leatherdale, B. A., Panesar, R. K., Singh, G., Atkins, T. W., Bailey, C. J., & Bignell, A. H. (1981). Improvement in glucose tolerance due to Momordica charantia (Karela). BMJ, 282(6279), 1823–1824.

Leelaveni, A., Dash, S., Behera, S. K., Das, S., & Mandal, A. K. (2018). Ethno medicinal study in North West Ganjam, Odisha. Int. J. Innov. Sci. Res, 7, 1167–1174.

Lu, N., Yang, Y., Li, X., Li, J., Cheng, J., Lv, Z., & Du, Y. (2021). The protective action of piperlongumine against mycobacterial pulmonary tuberculosis in its mitigation of inflammation and macrophage infiltration in male BALB/c mice. Journal of Veterinary Research, 65(4), 431–440.

Mahajan, T. S., & Pandey, O. P. (2015). Effect of electric and magnetic treatments on germination of bitter gourd (Momordica charantia) seed. International Journal of Agriculture and Biology, 17(2), 351–356.

Maisha, M. H., Jui, Z. S., & Begum, N. (2024). Ethnomedicinal and ethnobotanical uses of aquatic flora by local inhabitants of Gopalganj District, Bangladesh. Journal of Medicinal Plants Studies, 12(1), 157–165.

Mani, K., Aiyalu, R., Thiruvengadarajan, V. S., Arivukkarasu, R., & Suriyapriya, K. (2023). A comprehensive review of Drynaria quercifolia (L.) J. Sm. Pharmacognosy Reviews, 17(34), 332–337.

Mansour, M. E., Sherif, M. E., Ismail, Y. M., Abd Elhameed, A., & Bassouiney, S. A. (2021). Evaluation of the possible effect of methotrexate, fluoxetine, and Moringa oleifera in rat model of rheumatoid arthritis. Benha Medical Journal.

Martin, G. J. (1995). Ethnobotany: A Methods Manual. Chapman & Hall: London; New York.

Matin, A., Khan, M. A., Ashraf, M., & Quresh, R. A. (2001). Traditional use of herbs, shrubs and trees of Shogran Valley, Mansehra, Pakistan. Pakistan Journal of Biological Sciences, 4(9), 1101–1107.

Mawla, F., Khatoon, S., Rehana, F., Jahan, S., Shelley, M. M. R., Hossain, S., & Rahmatullah, M. (2012). Ethnomedicinal plants of folk medicinal practitioners in four villages of Natore and Rajshahi Districts, Bangladesh. American-Eurasian Journal of Sustainable Agriculture, 6, 406–416.

Mazumder, T. Z., Sharma, M. K., & Lal, M. (2022). Phytochemical properties of some important medicinal plants of north-east India: a brief review. J Pharm Innov, 11, 167–175.

Mehta, R. J. R. (2014). Ethno-medicinal plants used for treatment of gynecological disorders by tribal of Shivpuri district of Madhya Pradesh.

Memarzia, A., Saadat, S., Behrouz, S., & Boskabady, M. H. (2021). Curcuma longa and curcumin affect respiratory and allergic disorders, experimental and clinical evidence: A comprehensive and updated review. BioFactors.

Meryem Şeyda Erbay & Aynur Sarı. (2018). Plants used in traditional treatment against hemorrhoids in Turkey. MARMARA PHARMACEUTICAL JOURNAL, 22(2), 110–132.

Mia, M. M. U. K., Kadir, M. F., Hossan, M. S., & Rahmatullah, M. (2009). Medicinal plants of the Garo tribe inhabiting the Madhupur forest region of Bangladesh. American Eurasian Journal of Sustainable Agriculture, 3(2), 165–171.

Mikulska, P., Malinowska, M., Ignacyk, M., Szustowski, P., Nowak, J., Pesta, K., & Cielecka-Piontek, J. (2023). Ashwagandha (Withania somnifera)—Current research on the health-promoting activities: A narrative review. Pharmaceutics, 15(4), 1057.

Mishra, D. K., Singh, S., & Singh, P. (2024). Therapeutic benefits and processing of marigold (Tagetes species): A review. Indian Journal of Health Care, Medical & Pharmacy Practice, 5(1), 148–166.

Mishra, S., Aeri, V., Gaur, P. K., & Jachak, S. M. (2014). Phytochemical, therapeutic, and ethnopharmacological overview for a traditionally important herb: Boerhavia diffusa Linn. BioMed Research International, 2014, 1–19.

Mishra, S., Beladiya, J., & Mehta, A. (2023). Evaluation of the antioxidant, antihyperglycemic and hypolipidemic potential of Alstonia scholaris leaves extracts in streptozotocin-induced diabetic rats. Journal of Natural Remedies, 499–511.

Mohyuddin, A., Kurniawan, T. A., Khan, Z. U. D., Nadeem, S., Javed, M., Dera, A. A., Saeed, S. (2022). Comparative insights into the antimicrobial, antioxidant, and nutritional potential of the Solanum nigrum complex. Processes, 10(8), 1455.

Mozaffarpur, S. A., Naseri, M., Esmaeilidooki, M. R., Kamalinejad, M., & Bijani, A. (2012). The effect of Cassia fistula emulsion on pediatric functional constipation in comparison with mineral oil: A randomized, clinical trial. DARU Journal of Pharmaceutical Sciences, 20(1).

Muhammad, N., Ullah, S., Rauf, A., Muhammad Atif, Patel, S., Muhammad Israr, Akbar, S., Shehzad, O., Saeed, M., Saud Bawazeer, Md. Sahab Uddin, Derkho, M., Mohammad Ali Shariati, & Mubarak, M. S. (2021). Evaluation of the anti-diarrheal effects of the whole plant extracts of Cuscuta reflexa Roxb in pigeons. Toxicology Reports, 8, 395–404.

Muhammed Haneefa Shoja, Reddy, N. D., Nayak, P. G., Srinivasan, K. N., & Rao, R. (2015). Glycosmis pentaphylla (Retz.) DC arrests cell cycle and induces apoptosis via caspase-3/7 activation in breast cancer cells. Journal of Ethnopharmacology, 168, 50–60.

Munasinghe, M. A. A. K., Abeysena, C., Yaddehige, I. S., Vidanapathirana, T., & Piyumal, K. P. B. (2011). Blood sugar lowering effect of Coccinia grandis (L.) J. Voigt: Path for a new drug for diabetes mellitus. Experimental Diabetes Research, 2011, 1–4.

Mutiarawati, D. T. (2020). In vitro anthelmintic activity of Acalypha indica leaves extracts. Health Notions, 4(3), 94–99.

Nagi, K., Roy, B., & Yadav, A. K. (2022). In vitro cestocidal activity of Persicaria hydropiper (L.) Delarbre, a traditionally used anthelmintic plant in India. Journal of Parasitic Diseases.

Naik, S. R., Bhagat, S., Shah, P. D., Tare, A. A., Ingawale, D., & Wadekar, R. R. (2013). Evaluation of anti-allergic and anti-anaphylactic activity of ethanolic extract of Zizyphus jujuba fruits in rodents. Revista Brasileira de Farmacognosia, 23(5), 811–818.

Nammi, S., Boini, M. K., Lodagala, S. D., & Behara, R. B. S. (2003). The juice of fresh leaves of Catharanthus roseus Linn. reduces blood glucose in normal and alloxan diabetic rabbits. BMC Complementary and Alternative Medicine, 3(1).

Nayak, P., & Thirunavoukkarasu, M. (2016). A review of the plant Boerhaavia diffusa: Its chemistry, pharmacology and therapeutical potential. The Journal of Phytopharmacology, 5(2), 83–92.

Newing, H., Eagle, C., Puri, R. K., & Watson, C. W. (2011). Conducting research in conservation (Vol. 775). Oxfordshire: Routledge.

Ngbolua, K. T. N., Mbadiko, C. M., Matondo, A., Bongo, G. N., Inkoto, C. L., Gbolo, B. Z., & Mpiana, P. T. (2020). Review on ethnobotany, virucidal activity, phytochemistry, and toxicology of Solanum genus: Potential bio-resources for the therapeutic management of COVID-19. European Journal of Nutrition & Food Safety, 12(7), 35–48.

None Nuratu Adejumoke Okwara, Uzoma, C., Perpetua, N., Favour, N., Ekenedirichukwu, J. (2024). Antimicrobial effect of aqueous extracts of Garcinia kola, Cymbopogan citratus, and Bryophyllium pinnatum against sputum bacterial isolates from human subjects. GSC Biological and Pharmaceutical Sciences, 28(1), 083-100.

Oguntibeju, O., Aboua, Y., & Goboza, M. (2019). Vindoline—a natural product from Catharanthus roseus reduces hyperlipidemia and renal pathophysiology in experimental type 2 diabetes. Biomedicines, 7(3), 59.

Ozoluaa, R. I., Eboka, C. J., Durua, C. N., & Uwayaa, D. O. (2010). Effects of aqueous leaf extract of Bryophyllum pinnatum on guinea pig tracheal ring contractility. Nigerian Journal of Physiological Sciences, 25(2), 149-157.

Panchawat, S. (2012). Ficus religiosa Linn. (Peepal): A phyto-pharmacological review. International Journal of Pharmaceutical and Chemical Sciences, 1(1), 435-446.

Patel, J. R., Tripathi, P., Sharma, V., Chauhan, N. S., & Dixit, V. K. (2011). Phyllanthus amarus: Ethnomedicinal uses, phytochemistry and pharmacology: A review. Journal of Ethnopharmacology, 138(2), 286–313.

Patel, K., Singh, R. B., & Patel, D. K. (2013). Medicinal significance, pharmacological activities, and analytical aspects of solasodine: A concise report of current scientific literature. Journal of Acute Disease, 2(2), 92–98.

Patil, R. H., Patil, M. P., & Maheshwari, V. L. (2023). Biological and pharmacological properties of Apocynaceae members. In Apocynaceae Plants: Ethnobotany, Phytochemistry, Bioactivity and Biotechnological Advances (pp. 105–117). Springer Nature Singapore: Singapore.

Patrício, K. P., Minato, A. C. D. S., Brolio, A. F., Lopes, M. A., Barros, G. R. D., Moraes, V., & Barbosa, G. C. (2022). Medicinal plant use in primary health care: An integrative review. Ciência & Saúde Coletiva, 27, 677-686.

Peter, E. L., Kasali, F. M., Deyno, S., Mtewa, A., Nagendrappa, P. B., Tolo, C. U., Ogwang, P. E., & Sesaazi, D. (2019). Momordica charantia L. lowers elevated glycaemia in type 2 diabetes mellitus patients: Systematic review and meta-analysis. Journal of Ethnopharmacology, 231, 311–324.

Peters, D. E., Jumbo, S. N., & Ogunka-Nnoka, C. U. (2021). Evaluation of possible laxative potential of aqueous extract and saponin fraction of Centella asiatica leaves in loperamide-induced constipated Wistar rats. Journal of Biochemistry International, 8(1), 104-110.

Porwal, A., Gandhi, P., Mokashi-Bhalerao, N., Borkar, N., Khobragade, K., Porwal, D. A., Gandhi, P., Mokashi-Bhalerao, N., Sr, N. E. B., & Khobragade, K. (2024). Efficacy and safety of oral Euphorbia prostrata tablet and topical cream in the management of hemorrhoids during pregnancy: Results from a prospective multicenter study. Cureus, 16(2).

Prajapati, A. (2024). A study on different pharmacological activity of Bhumyamlaki (Phyllanthus amarus Schum and Phyllanthus niruri L.): An important medicinal plant of India.

Prasanna, G., & Anuradha, R. (2016). A comprehensive review on phytopharmacological activities of Drynaria quercifolia L. Int J Pharmacogn Phytochem Res, 8(8), 1304-1313.

Prasanna, G., Devi, R., & Ishwarya, G. (2019). In vitro evaluation of antidiabetic and cytotoxicity potentials of the rhizome extract of Drynaria quercifolia (L.) J. Smith. Asian Journal of Pharmaceutical and Clinical Research, 72–76.

Priya, F. J., Rose, A. L., Vidhya, S., Arputharaj, A., Akshana, S., & Fathima, U. F. R. (2021). A new frontier drug development in nanomedicine and its anti-urolithiatic activity of Kalanchoe pinnata. Oriental Journal of Chemistry, 37(2), 444–449.

Qamar, N., P, J., & Bhatti, A. (2020). Toxicological and anti-rheumatic potential of Trachyspermum ammi derived biogenic selenium nanoparticles in arthritic Balb/c mice. International Journal of Nanomedicine, 15, 3497-3509.

Quinlan, M. B. (2011). Ethnomedicine. A Companion to Medical Anthropology, 379-403.

raditional medicine: growing needs and potential. World Health Organization. www.who.int.

Raghuvanshi, D., Dhalaria, R., Sharma, A., Kumar, D., Kumar, H., Valis, M., Kuča, K., Verma, R., & Puri, S. (2021). Ethnomedicinal plants traditionally used for the treatment of jaundice (icterus) in Himachal Pradesh in Western Himalaya—a review. Plants, 10(2), 232.

Rahman, A. H. M. M. (2015). Ethnomedicinal survey of angiosperm plants used by Santal tribe of Joypurhat District, Bangladesh. International Journal of Advanced Research, 3(5), 990-1001.

Rahman, M. A. (1970). Indigenous knowledge of herbal medicines in Bangladesh. 3. Treatment of skin diseases by tribal communities of the Hill Tracts Districts. Bangladesh Journal of Botany, 39(2), 169–177.

Rahmatullah, M., Mollik, M. A. H., Azam, A. T. M. A., Islam, M. R., Chowdhury, M. A. M., Jahan, R., ... & Rahman, T. (2009). Ethnobotanical survey of the Santal tribe residing in Thakurgaon District, Bangladesh. American Eurasian Journal of Sustainable Agriculture, 3(4), 889-898.

Rahmatullah, M., Rahman, A., Uddin, F., Hasan, M., Khatun, A., Bashar, A. A., & Jahan, R. (2011). An ethnomedicinal survey conducted amongst folk medicinal practitioners in the two southern districts of Noakhali and Feni, Bangladesh. Advances in Natural and Applied Sciences, 5(1), 115–132.

Rajan Logesh, Das, N., Gobi Sellappan, Piesik, D., & Mondal, A. (2023). Unripe fruits of Litchi chinensis (Gaertn.) Sonn.: An overview of its toxicity. Annales Pharmaceutiques Françaises, 81(6), 925–934.

Rajeev, S. R. P. (2020). Effect of "Sittamatti (Sida cordifolia Linn.) Kudineer (decoction)" in respiratory complaint - cough. International Journal of Research - GRANTHAALAYAH, 8(8), 24–36.

Rao, P. K., Hasan, S. S., Bhellum, B. L., & Manhas, R. K. (2015). Ethnomedicinal plants of Kathua District, J&K, India. Journal of Ethnopharmacology, 171, 12–27.

Rashied, R. M. H., Abdelfattah, M. A. O., El-Beshbishy, H. A., ElShazly, A. M., Mahmoud, M. F., & Sobeh, M. (2022). Syzygium samarangense leaf extract exhibits distinct antidiabetic activities: Evidences from in silico and in vivo studies. Arabian Journal of Chemistry, 15(6), 103822.

Raskin, I., & Ripoll, C. (2004). Can an apple a day keep the doctor away? Current Pharmaceutical Design, 10(27), 3419–3429.

Rawat, H., Verma, Y., Ayesha, N. S., Negi, N., Pant, H. C., Mishra, A., ... & Gaurav, N. (2021). Nyctanthes arbor-tristis: A traditional herbal plant with miraculous potential in medicine. International Journal of Botany Studies, 6, 427-440.

Razzak, A. (2020). Pharmacological and phytochemical profile of Trachyspermum ammi: Evidence from the traditional medicine and recent research. International Journal of Unani and Integrative Medicine, 4(3), 19–23.

Resurreccion-Magno, M. H. C., Villaseñor, I. M., Harada, N., & Monde, K. (2005). Antihyperglycaemic flavonoids from Syzygium samarangense (Blume) Merr. and Perry. Phytotherapy Research, 19(3), 246–251.

Rodríguez-González, S., Gutiérrez-Ruíz, I. M., Pérez-Ramírez, I. F., Mora, O., Ramos-Gomez, M., & Reynoso-Camacho, R. (2017). Mechanisms related to the anti-diabetic properties of mango (Mangifera indica L.) juice by-product. Journal of Functional Foods, 37, 190–199.

Rohani, S., Afrooz, T., Sarder, M. S., Tuti, M. K., Jannat, K., & Rahmatullah, M. (2018). Rhynchostylis retusa (L.) Blume: A potential plant to cure paralysis. J Med Plants Stud, 6(4), 20-21.

Roshan, N., Rupkala Thapa, None, & Kumar, M. (2023). Evaluation of anti-diabetic activity of Justicia adhatoda (Linn.) leaves in diabetic Wistar rats. Journal of Universal College of Medical Sciences, 11(01), 50–54.

Ruth, O. N., Unathi, K., Nomali, N., & Chinsamy, M. (2021). Underutilization versus nutritional-nutraceutical potential of the Amaranthus food plant: A mini-review. Applied Sciences, 11(15), 6879.

Sachdewa, A., & Khemani, L. D. (2003). Effect of Hibiscus rosa sinensis Linn. ethanol flower extract on blood glucose and lipid profile in streptozotocin induced diabetes in rats. Journal of Ethnopharmacology, 89(1), 61–66.

Sadasivan, S., Latha, P. G., Sasikumar, J. M., Rajashekaran, S., Shyamal, S., & Shine, V. J. (2006). Hepatoprotective studies on Hedyotis corymbosa (L.) Lam. Journal of Ethnopharmacology, 106(2), 245–249.

Saha, M. R., Ul Bari, F. M. S. N., Rahman, M. A., & Islam, M. A. (2012). In vitro cytotoxic and anthelmintic activities of Leonurus sibiricus L.. Journal of Scientific Research, 4(3), 721–727.

Sahu, S. K., Das, D., Tripathy, N. K., Dinda, S. C., & Kumar, S. (2012). Evaluation of hypoglycemic activity of Mollugo pentaphylla and Glinus oppositifolius (L).

Salami, E. O., Ozolua, R. I., Okpo, S. O., Eze, G. I., & Uwaya, D. O. (2013). Studies on the anti-asthmatic and antitussive properties of aqueous leaf extract of Bryophyllum pinnatum in rodent species. Asian Pacific Journal of Tropical Medicine, 6(6), 421–425.

Samantha, R., Weerasinghe Shanika, Tarannum Fatema, & Walters Keisha, B. (2023). Inhibition and dissolution of calcium oxalate crystals and kidney stones by the extract of Kalanchoe pinnata. Journal of Medicinal Plant Research, 17(6), 201–217.

Sepehr, F., Shirafkan, H., Behzad, C., Memariani, Z., & Mozaffarpur, S. A. (2022). The effect of Cassia fistula L. syrup in geriatrics constipation in comparison with lactulose: A randomized clinical trial. Journal of Ethnopharmacology, 297, 115466.

Shankara, B. E. R., YL, R., Rajan, S. S., SA, R., & BL, D. (2014). Evaluating the anthelmintic potential of leaf gall extracts of Terminalia chebula (Gaertn.) Retz. (Combretaceae). Journal of Young Pharmacists, 6(3), 20–23.

Sharma, P., Rani, S., Ojha, S. N., Sood, S. K., & Rana, J. C. (2014). Indian herbal medicine as hepatoprotective and hepatocurative: A review of scientific evidence. Life Sciences Leaflets, 50, 61–70.

Sharma, S., Singh, O., Kumar, S., BK, A., & Jayswal, A. (2022). Topically to minimize the Ficus religiosa powder as a treatment of gonorrhea.

Shen, S.-C., & Chang, W.-C. (2013). Hypotriglyceridemic and hypoglycemic effects of vescalagin from pink wax apple [Syzygium samarangense (Blume) Merrill and Perry cv. Pink] in high-fructose diet-induced diabetic rats. Food Chemistry, 136(2), 858–863.

Siddiqui, S. A., Rahman, A., Rahman, M. M., Fazle, M., Rouf, S., Ali, M., Al-Hemaid, F. M. A., & Farah, M. A. (2018). Evaluation of anti-nociceptive, anti-inflammatory and antipyretic potential of Mikania cordata (Burm. F.) Robinson in experimental animal model. Saudi Journal of Biological Sciences, 25(6), 1049–1055.

Singer, M., & Erickson, P. I., Eds. (2011). A Companion to Medical Anthropology. Wiley-Blackwell: Oxford, UK.

Singh, D., Singh, B., & Goel, R. K. (2011). Traditional uses, phytochemistry and pharmacology of Ficus religiosa: A review. Journal of Ethnopharmacology, 134(3), 565–583.

Singh, S., Kumar, S., Singh, S., Mishra, C., Tripathi, D., & Verma, V. S. K. (2021). Estrogenic effect of Asparagus racemosus, Cissus quadrangularis, Punica granatum, and Pueraria tuberosa in post-menopausal syndrome. Pharmacognosy Research, 13(4), 238–245.

Sirama, V., Kokwaro, J., Owuor, B., & Yusuf, A. (2014). In-vitro anthelmintic bioactivity study of Eclipta prostrata L. (whole plant) using adult Haemonchus contortus worms: A case study of Migori County, Kenya. IOSR Journal of Pharmacy and Biological Sciences, 9(6), 45–53.

Sobia, H. N., Khan, S., & Nadeem, F. (2018). Use of malabar nut (Justicia adhatoda L.) from traditional medicine to current pharmacopeia–A review study. Int J Chem Biochem Sci, 13, 46-51.

Srivastava, V., Mubeen, S., Semwal, B. C., & Misra, V. (2012). Biological activities of Alocasia macrorrhiza: A review. Sciences, 2(01).

Su, C., Qi, B., Wang, J., Ding, N., Wu, Y., Shi, X.-P., Zhu, Z.-X., Liu, X., Wang, X.-H., Zheng, J., Tu, P.-F., Shi, S.-P. (2018). Megastigmane glycosides from Urena lobata. Fitoterapia, 127, 123–128.

Sumantri, I. B., Ismayadi, & Mustanti, L. F. (2021). The potency of wound healing of nanogel-containing Mikania micrantha leaves extract in hyperglycemic rats. Pharmaceutical Nanotechnology, 9(5), 339–346.

Suprianto, S., Febriady, A., & Syafitri, M. V. (2023). Effectiveness testing of the combination of ethanol extract of red ginger (Zingiber officinale var. rubrum) and turmeric (Curcuma domestica Val.) as antibacterial on bacterial growth Escherichia coli.

Sutradhar, R.K., Rahman, A.K.M.M., Ahmad, M., Chandra Bachar, S., Saha, A., & Guha, S.K. (2006). Bioactive alkaloid from Sida cordifolia Linn. with analgesic and anti-inflammatory activities. Iranian Journal of Pharmacology and Therapeutics, 5(2), 175-178.

Swaroop, A., Bagchi, M., Moriyama, H., & Bagchi, D. (2018). Health benefits of mango (Mangifera indica L.) and mangiferin. Japan Journal of Medicine, 1(2), 149-154.

Tardío, J., & Pardo-de-Santayana, M. (2008). Cultural importance indices: A comparative analysis based on the useful wild plants of Southern Cantabria (Northern Spain). Economic Botany, 62(1), 24–39.

Tekuri, S.K., Pasupuleti, S.K., Konidala, K.K., Amuru, S.R., Bassaiahgari, P., & Pabbaraju, N. (2019). Phytochemical and pharmacological activities of Solanum surattense Burm. F.–A review. Journal of Applied Pharmaceutical Science, 9(3), 126–136.

Thomas, E., Vandebroek, I., Sanca, S., & Van Damme, P. (2009). Cultural significance of medicinal plant families and species among Quechua farmers in Apillapampa, Bolivia. Journal of Ethnopharmacology, 122(1), 60–67.

Timalsina, D., & Devkota, H. P. (2021). Eclipta prostrata (L.) L. (Asteraceae): Ethnomedicinal uses, chemical constituents, and biological activities. Biomolecules, 11(11), 1738.

Trotter, R. J., & Logan, M. L. (2019). Informant Consensus: A New Approach for Identifying Potentially Effective Medicinal Plants. In Routledge eBooks, 91–112.

Umair, M., Altaf, M., Bussmann, R. W., & Abbasi, A. M. (2019). Ethnomedicinal uses of the local flora in Chenab Riverine Area, Punjab Province, Pakistan. Journal of Ethnobiology and Ethnomedicine, 15(1).

Vasudeva, N., & Sharma, S. K. (2006). Post-coital antifertility activity of Achyranthes aspera Linn. root. Journal of Ethnopharmacology, 107(2), 179–181.

Waisundara, V. Y., Watawana, M. I., & Jayawardena, N. (2015). Costus speciosus and Coccinia grandis: Traditional medicinal remedies for diabetes. South African Journal of Botany, 98, 1–5.

Wannasarit, S., Mahattanadul, S., Issarachot, O., Puttarak, P., & Wiwattanapatapee, R. (2020). Raft-forming gastro-retentive formulations based on Centella asiatica extract-solid dispersions for gastric ulcer treatment. European Journal of Pharmaceutical Sciences, 143, 105204.

Warrier, R. R., Priya, S. M., & Kalaiselvi, R. (2021). Gmelina arborea– an indigenous timber species of India with high medicinal value: A review on its pharmacology, pharmacognosy, and phytochemistry. Journal of Ethnopharmacology, 267, 113593.

WHO. (2023). Traditional medicine has a long history of contributing to conventional medicine and continues to hold promise. World Health Organization. https://www.who.int/news-room/feature-stories/detail/traditional-medicine-has-a-long-history-of-contributing-to-conventional-medicine-and-continues-to-hold-promise.

Xiang, J.-Y., Chi, Y.-Y., Han, J.-X., Kong, P., Liang, Z., Wang, D., Xiang, H., & Xie, Q. (2022). Litchi chinensis seed prevents obesity and modulates the gut microbiota and mycobiota compositions in high-fat diet-induced obese zebrafish. Food & Function, 13(5), 2832–2845.

Yadav, N. K., & Yadav, R. (2023). Medicinal effects, phytochemistry, pharmacology of Euphorbia prostrata and promising molecular mechanisms. Chinese Journal of Integrative Medicine.

Yadav, V., Krishnan, A., & Vohora, D. (2020). A systematic review on Piper longum L.: Bridging traditional knowledge and pharmacological evidence for future translational research. Journal of Ethnopharmacology, 247, 112255.

Zakaria, Z. A., Abdul Ghani, Z. D. F., Raden Mohd. Nor, R. N. S., Gopalan, H. K., Sulaiman, Mohd. R., Mat Jais, A. M., Somchit, M. N., Kader, A. A., & Ripin, J. (2008). Antinociceptive, anti-inflammatory, and antipyretic properties of an aqueous extract of Dicranopteris linearis leaves in experimental animal models. Journal of Natural Medicines, 62(2), 179–187.

Zia Uddin, A. (2009). Encyclopedia of Flora and Fauna of Bangladesh. }