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A Survey of Medicinal Plants in the Treatment of Cough, Cold, and Fever in Gopalganj District, Bangladesh

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ABSTRACT

Bangladeshi rural and urban populations have used traditional medicine as their primary source of healthcare since ancient times. The local people of Gopalganj district have long used herbal medicines in and around their habitations to cure various ailments. So, our study aimed to determine the mode of use of native medicinal plants to treat cough, cold, and fever in Kashiani and Gopalganj Sadar upazila of Gopalganj District, Bangladesh. Data were collected from the beneficiaries' local people and kavarajes through direct interviews, group discussions, and visits to the gardens of medicinal plants from 40 villages of the Gopalganj district. Findings revealed that 42 medicinal plant species belonging to 33 families have been identified that are frequently used by the local communities to treat cough, cold, and fever. Among the selected species, the highest contribution was recorded for herbs (35.71%), followed by trees (35.71%), shrubs (16.16%), and climbers (11.90%), respectively. Moreover, this study revealed that among the 61 plant species from 32 families, 12 species utilized the entire plant as medicinal parts, ten species used fruits, eight species used leaves, eight species used roots, four species used barks, four species used seeds, one species used flowers, one species used stems, and one species used bulbs as their medicinal parts. This survey signifies the ethno-medicinal benefits of plant species that can treat cough, cold, and fever in the study area.

Keywords: Gopalganj, Medicinal plant, Distribution pattern, Common diseases, and Ethnobotanical.

INTRODUCTION:

Plant materials have been used for medicinal purposes since ancient times, keeping natural sources as the primary source of all drugs until about a century ago (Joo, 2014; Pan *et al.*, 2014). Environment and nature have offered many remedies to treat human ailments. Almost half a million plant species are currently used as medicinal plants worldwide (Mukhuddin *et al.*, 2024). As of the latest available data from the World Health Organization, 70-80% of people in South Asian

countries use various plants as their primary source of medicine to cure different diseases, including cough, cold, and fever. Traditional medicine is practiced mainly in India, China, Japan, Pakistan, Sri Lanka, and Thailand (Musa *et al.*, 2023). Bangladesh has been profusely prosperous in medicinal plants due to favorable weather and fertile land (Mukul *et al.*, 2007; Prodhan *et al.*, 2017). Bangladeshi forests, jungles, hills, and flatlands possess at least five thousand herbs, shrubs, trees, and aromatic and aquatic plants (M. Rahman &

Fakir, 2015). Not surprisingly, a district in the southern part of Bangladesh named Gopalganj is also considered an extra habitat for numerous medicinal plants (Siddique *et al.*, 2021). The socio-economic conditions in Gopalganj significantly impact the health of its population. Despite a steady increase in healthcare facilities, the overall situation remains challenging. Only 30% of the population has access to primary healthcare services. Approximately 20% of the population can avail themselves of Western medicines, while the majority, about 75-80% of rural residents, still rely on traditional ethnomedicine practitioners for healthcare worldwide (Shah *et al.*, 2013).

These practitioners are crucial in providing primary healthcare services to rural communities. Besides, they have been used as therapeutic agents and raw materials for modern medicine. Traditional medical practitioners, not only in Gopalganj but also in the Indian subcontinent, have long utilized medicinal plants like *Vitex negundo*, *Moringa oleifera*, *Madhuca longifolia*, *Achyranthes aspera*, and *Aloe indica* for treating various diseases. Many of the world's population still heavily relies on herbal medicines to keep themselves healthy and disease-free (Alamgir *et al.*, 2018; Gurib-Fakim, 2006; Mohd *et al.*, 2012; Parveen *et al.*, 2020). Medicinal plants are rich in antioxidants and secondary metabolites that protect against diseases linked to free radicals (Lawal *et al.*, 2017; Savithramma *et al.*, 2011). For instance, *Ocimum sanctum* L. has been finely recorded for its therapeutic potential and described as an antiasthmatic and antiseptic drug (Dubey & Pandey, 2018). Recent observations by different health authorities have demonstrated that plant medicines have been used progressively by less developed areas as they are the only means of keeping healthy there, and also have been used by developed countries as they produce fewer side effects with a greater probability of getting well from various diseases (Salmerón-Manzano & Manzano-Agugliaro, 2020).

In this survey, we aimed to demonstrate the relationship between the availability of valuable medicinal plant in the local area of Gopalganj and their usage method. We also demonstrated how an underdeveloped area of Bangladesh has survived cough, cold, and fever for thousands of years, almost only through traditional medicines. As

different plant medicines are ubiquitous in the Gopalganj district, so biotechnologists have an excellent opportunity to develop a multipurpose variety of plants through various genetic manipulations. However, there remains a limited understanding of their mechanisms of action, and integrating these traditional practices with modern medicine has been a challenge (Rahman *et al.*, 2013; Matos *et al.*, 2021; Rony *et al.*, 2019).

MATERIALS AND METHODS:

Study area

Gopalganj is a district in the Dhaka Division of Bangladesh, with 1,172,415 inhabitants and a surface area of 1,490 km². It is located on the bank of the Madhumati River. The maximum and minimum average temperature in Gopalganj district varies from 8.6°C to 23.3°C. The study covers forty villages (Parulia, Kumaria, Sonadanga, Krisnopur, Laxmipur, Digharkul, Shibpur, Sajail, Kusumdia, Haridashpur, Majra Bathoydupa, Ratkandi, Haturia, Vadulia, Bairpara, Chotokharkandi, Mahanag, Teguria, Bethuri, Rahimdia, Narail, Dhirail, Puisur, Hatisur, Dlnia, Bagajuru, Gopinathpur, Vabanipur, Gonapara, Haridaspur, Paranpur, Fakirkandi, Manikharpur, Tetigati, Vojargati, Vatiapara, Nijamkandi and Kati) under the Madhumati floodplain in Gopalganj Sadar and Kashiani upazila under the Gopalganj district.

Methodology

In this survey-based study, traditional medicinal plant data were collected from local people and kavrages across the Gpalganj sadar upazila and Kashiani upazila of Gopalganj district through interviews and questionnaire fill-out between during 24th May to 7th July 2022. The questionnaire included:

- Questions addressing the place of the interview.
- Interviewee's characteristics.
- Plants' local name.
- The indications of local use.
- The used parts.
- The methods of use.
- The season of occurrence.
- The types of plants.

Secondary data and information were collected by searching from PubMed, Science Direct, Research Gate, Google Scholar, Google, CD-ROM, and

previous research and survey reports. MS-Excel is used to process all collected information by microcomputer. Responses to the completed questionnaires were numerically coded and analyzed using a Microsoft Excel sheet. Moreover, descriptive statistics such as frequency and percentage distribution were used to analyze data, and graphs and tables were used to interpret the findings.

RESULTS:

This study area has a vast diversity of medicinal plants and traditional medicinal knowledge (Kumari & Kumari; Mondol *et al.*, 2019). In this investigation, the indigenous knowledge of 28 plant species belonging to 22 families was collected with scientific names, family names, local names, and modes of use used for treating cough ailments by Kavirajes and local peoples. These species are *Acacia nilotica*, *Achyranthes aspera*, *Acorus calamus L.*, *Adhato vassica*, *Allium cepa*, *Asparagus racemosus*, *Adhatoda zeylanica*, *Acalypha indica*, *Boerhaavia diffusa L.*, *Cajanus cajan L.*, *Calotropis procera*, *Citrullus lanatus*, *Datura metel L.*, *Dillenia indica L.*, *Ficus hispida*, *Hibiscus rosa-sinensis L.*, *Kalanchoe pinnata* *Ocimum sanctum L.*, *Phyllanthus emblica L.*, *Piper longum L.*, *Piper nigrum L.*, *Plumbago indica L.*, *Terminalia chebula*, *Tinospora cordifolia*, *Tylophora indica*, *Vitex negundo L.*, *Withania somnifera* and *Zingiber officinale*. Among the selected species of medicinal plants, the maximum contribution was recorded for

herbs species (36%), followed by shrubs (25%), trees (21%), and climbers (18%) (Fig. 1). Moreover, among the selected species, usable plant parts used was maximum for the whole plant with nine species (28.12%), followed by fruit with six species (18.75%), leaf with five species (15.62), root with three species (9.37%), seeds with two species (6.25%), seeds with two species (6.25%), rhizome with two species (6.25%), bark with one species (3.12%), bulb with one species (3.12%), stem with one species (3.12%) and flower with one species (3.12%) (Fig. 2).

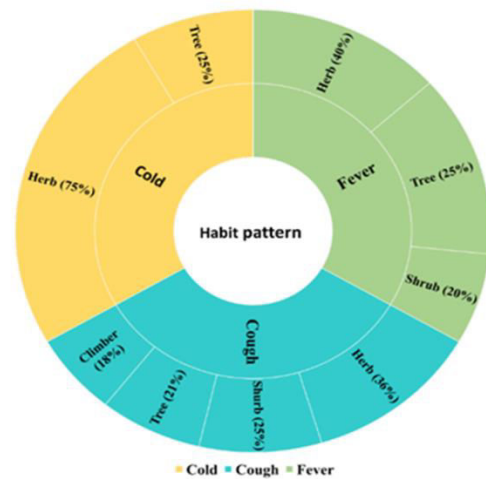


Fig. 1: Habit pattern of medicinal plants used in cough, cold and fever.

Herbs are used a maximum of 75 % in the treatment of cold and a minimum of 36 % in case of cough

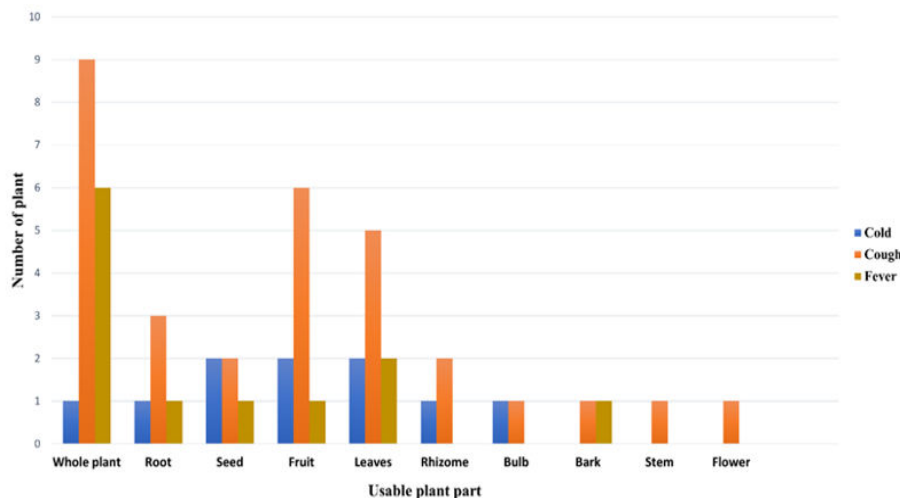


Fig. 2: Usable plant part of medicinal plants used in cough, cold and fever.

The highest number of whole plants was used in case of cough and the lowest number was used in

cold treatment. We also collected eight medicinal plants from the study area with their scientific name,

family names, local names, and modes of use that are used against the cold. These plants are *Acacia nilotica*, *Allium cepa*, *Brassica nigra*, *Nigella sativa* L., *Ocimum sanctum* L., *Piper longum* L., *Tagetes erecta* L. and *Zingiber officinale*. Among the selected species of medicinal plants, the maximum contribution was recorded for herb species (75%) followed by trees (25%) (Fig. 1). Besides, among the selected species, usable plant parts used for the treatment were the leaf with two species (20%), fruit with two species (20%), seeds with two species (20%), whole plant with one species (10%), root with one species (10%), rhizome with one species (10%) and bulb with one species(10%) (Fig. 2).

In this study, the Indigenous knowledge of 10 plant species used for the treatment of fever ailments by Kavirajas and local peoples belonging to 10 families

that were collected which are *Andrographis paniculate*, *Azadirachta indica*, *Brassica nigra*, *Bombax ceiba* L , *Bixa orellana* L., *Calotropis procera*, *Datura metel* L., *Heliotropium indicum* L., *Ocimum sanctum* L. and *Dillenia indica* L. Among the selected species of medicinal plants, the maximum contribution was recorded for herbs species (40%), followed by trees (40%) and shrubs (20%) (Fig. 1). This study also indicated that usable plant parts used were maximum for a whole plant with six species (54.55%) followed by the leaf with two species (18.18%), fruit with one species (9.09%), seeds with one species (9.09%), root with one species (9.09%) and bark with one species (9.09%) (Fig. 2). Medicinal plants used for treating the study area's cough, cold, and fever ailments are depicted in Table 1.

Table 1: Medicinal plants, Local name, and their parts used for treating cough, cold, and fever ailments.

Disease	Scientific name	Family name	Local name	Plant parts	Mode of use
Cough	<i>Acacia nilotica</i>	Mimosaceae	Babla, Kikor.	Fruit	Fruit juice
	<i>Achyranthes aspera</i>	Amaranthaceae	Apang,Uputhlangra	whole plant	Decoction
	<i>Acorus calamus</i> L	Acoraceae	Bach	Rhizome	Rhizome is cut into small pieces, and pasted with honey
	<i>Adhato vassica</i>	Acanthaceae	Basak	whole plant	Decoction
	<i>Allium cepa</i>	Liliaceae	Piaj	Bulb	Bulb
	<i>Asparagus racemosus</i>	Liliaceae	Satamuli	Root	Root paste
	<i>Adhatoda zeylanica</i>	Acanthaceae	Basak	whole plant	Decoction
	<i>Acalypha indica</i>	Euphorbiaceae	Muktajhuri	whole plant	Decoction
	<i>Boerhaavia diffusa</i> L	Nyctaginaceae	Punarnava	whole plant	Decoction
	<i>Cajanus cajan</i> L.	Fabaceae	Arhar	Leaves	Leaves juice
	<i>Calotropis procera</i>	Asclepiadaceae	Akand	Whole part	Decoction
	<i>Citrullus lanatus</i>	Cucurbitaceae	Tarmuj	Fruit	Fruit juice
	<i>Datura metel</i> L	Solanaceae	Dhuttra, Dhutura	Whole part	Decoction
	<i>Dillenia indica</i> L.	Dilleniaceae	Chalta, Chalita.	Fruit	Fruit juice
	<i>Ficus hispida</i>	Moraceae	Dumur	whole plant	Decoction
	<i>Hibiscus rosa-sinensis</i> L.	Malvaceae	Jaba	flower	Twig juices
	<i>Kalanchoe pinnata</i>	Crassulaceae	Patharkuchi;	Leaves	Leaves juice
	<i>Ocimum sanctum</i> L.	Lamiaceae	Tulsi.	Whole plant	Decoction
	<i>Phyllanthus emblica</i> L	Euphorbiaceae	Amloki, Amla.	Fruits	Fruits juice
	<i>Piper longum</i> L.	Piperaceae	Pipul, Pipla	Fruits	Fruits juice
	<i>Piper nigrum</i> L	Piperaceae	Golmarich, Kalimarich	Fruits	Fruits juice
	<i>Plumbago indica</i> L.	Plumbaginaceae	Raktachita,	Root	Root paste
<i>Terminalia chebula</i>	Combretaceae	Haritaki, Hartaki	seeds	The seeds and the oil from the seeds	
<i>Tinospora cordifolia</i>	Menispermaceae	Gulancha, Gurach, Gadancha	Stem	Stem paste	
<i>Tylophora indica</i>	Asclepiadaceae	Antamul	Root and Leaves	A paste from the root, Leaves juice	
<i>Vitex negundo</i> L.	Verbenaceae	Nishinda, Bara	bark	The bark	

			Nishinda, Nigunda,		
	<i>Withania somnifera</i>	Solanaceae	Aswagandh, Chota Dhuppa	Leaves	Leaves juice
	<i>Zingiber officinale</i>	Zingiberaceae	Ada	Rhizome	Rhizome is cut into small pieces, and paste with honey
Cold	<i>Acacia nilotica</i>	Mimosaceae	Babla, Kikor.	Fruit	Fruit juice
	<i>Allium cepa</i>	Liliaceae	Piaj	Bulb	Bulb
	<i>Brassica nigra</i>	Brassicaceae	Kalo Sarisha, Rai Sarisha.	Leaves and Seed	Leaves juice and Seed extracts
	<i>Nigella sativa L.</i>	Ranunculaceae	Kalojira, Kalijira, Mugrela	Seed	Seed extracts
	<i>Ocimum sanctum L.</i>	Lamiaceae	Tulsi.	whole plant	Decoction
	<i>Piper longum L.</i>	Piperaceae	Pipul, Pipla	Fruit	Fruit juice
	<i>Tagetes erecta L.</i>	Asteraceae	Genda	Leaves	Leaves juice
	<i>Zingiber officinale</i>	Zingiberaceae	Ada	Rhizome	Rhizome cut into small pieces, roasted, and made into paste.
Fever	<i>Andrographis paniculata</i>	Acanthaceae	Kalomegh, Kalamegh.	Whole plant	Decoction
	<i>Azadirachta indica</i>	Meliaceae	Neem.	bark	Decoction
	<i>Brassica nigra</i>	Brassicaceae	Kalo Sarisha, Rai Sarisha, Krishnarai	Leaves and Seed	Leaves juice and Seed extracts
	<i>Bombax ceiba L.</i>	Bombacaceae	Shimul, Shimul-tula, Lalshimul	Whole plant	Decoction
	<i>Bixa orellana L.</i>	Bixaceae	Latkan, Belatihaldi, Utkana	Whole plant	Decoction
	<i>Calotropis procera</i>	Asclepiadaceae	Shet Akand, Chhoto Akand, Akanda.	Whole plant	Decoction
	<i>Datura metel L.</i>	Solanaceae	Dhuttra, Dhutura.	Whole plant	Decoction
	<i>Heliotropium indicum L.</i>	Boraginaceae	Hatishur.	Root	Root paste
	<i>Ocimum sanctum L.</i>	Lamiaceae	Tulsi.	whole plant	The paste of whole plant
	<i>Dillenia indica L.</i>	Dilleniaceae	Chalta, Chalita.	Fruit	Fruit juice



Fig. 3: Photographs of some important medicinal plants used for the treatment of cough, cold, and fever that are available in our study area.

All of these plant parts are used in different forms by the local people of this study. Various modes of use include decoction of the whole plant, fruit juice, root paste, leaves juice, whole part, fluid extract of the flower, and stem paste. The rhizome is used differently: people cut it into small pieces, roast it into a paste, and take the paste with honey orally to cure cough. Some important medicinal plant photographs (Fig. 3) that are used in this study, are (*Achyranthes aspera* L., *Acalypha indica* L., *Acorus calamus* L., *Holarrhena pubescence*, *Madhuca longifolia*, *Nigella sativa*, *Ocimum tenuiflorum*, *Plumbago indica* L., *Piper betle*, *Piper longum*L., *Terminalia bellirica*, *Tinospora cordifolia*, *Vitex negundo*, *Zingiber officinale* and *Heliotropium indicum*) are more available in the study area.

DISCUSSION:

Plants have been the most dependable sources of traditional medicine since ancient times (Jamshidi-Kia, Lorigooini, & Amini-Khoei, 2017). Folk physicians rely on plants for their medicinal properties, as they contain metabolites with pharmacological benefits (Wangkheirakpam, 2018). Different parts of plants serve as valuable sources of these pharmaceutical metabolites, possessing antibiotic and antimicrobial properties (Abdel-Razek *et al.*, 2020; Youssef *et al.*, 2019). In this investigation, we found that root and bark of *Plumbago indica* L. has antimicrobial solid properties (Bashir & Kumar, 2021; Dissanayake *et al.*, 2022). Moreover, *Azadirachta indica*, *Brassica napus*, *Plumbago indica* L., *Piper betle*, *Piper longum*L., *Terminalia bellirica* and *Tinospora cordifolia* contain various types of secondary metabolites (alkaloids, benzoyllineolone, glycerol, bezoylisolineolone etc.) which show different pharmacological properties to treat cough, cold and fever.

They also provide ready-made food that sustains us and offers medicinal properties to combat various diseases (Gębczyński *et al.*, 2022). Traditional medicines are the collective knowledge and practices used for diagnosing and preventing physical, social, and mental imbalances (Organization, 1978). These rely solely on practical experience and observations passed down through generations, either verbally or in writing. The constant and excessive use of medicinal plants in drugs has led to their decline (Jamshidi-Kia *et al.*,

2017). Therefore, this study suggested that preserving medicinal plants based on ethnobotanical knowledge acquired from local communities is essential.

Cough, cold, and fever are prevalent and significant public health issues, particularly among populations with poor hygiene standards, especially in developing countries (Zanuzdana *et al.*, 2013). These ailments continue to be the leading cause of morbidity and mortality across all age groups, with an estimated four million cases occurring annually. Their research findings concluded that herbal treatments still play a vital role as home remedies for these conditions (Ciprandi & Tosca; 2022). This study focused on using traditional medicines to combat the prevalent cough, cold, and fever in the Gopalganj district of Bangladesh. Numerous Kavirajies (folk physicians) utilize their traditional plant knowledge to treat these ailments. Forty-two plants, spanning 33 families, were employed in these treatments. The most commonly used parts of these plants in traditional medicine were the leaves and roots (Rahman *et al.*, 2013). In this survey-based study, we have demonstrated how different parts of plants, i.e., fruit, rhizome, bulbs, leaves, flower, root, bark and even whole plants, possess medicinal value to combat various diseases, especially cough, cold and fever (Ballabh & Chaurasia, 2007; Muthu *et al.*, 2006). Notably, the whole plant was most frequently used for treating cough, cold and fever more than other parts of the medicinal plants (Gazi *et al.*, 2013). These plant parts serve as valuable sources of pharmaceutical metabolites, possessing antibiotic and antimicrobial properties.

Modern medicine is gradually replacing traditional practices (Angmo *et al.*, 2012; Hong, 2004; Patwardhan & Partwardhan, 2005). However, this project highlights traditional medicine's scientific basis and usage methods. The survey provides valuable data for further research on natural remedies and could lead to developing new drugs for treating cough, cold, and fever. Despite the numerous data on plants for the treatment of various diseases available, there were some limitations in our understanding of the scientific basis and the usage method of plant parts for the treatment of cough, cold, and fever (Ludwig & El-Hani, 2020; Taylor *et al.*, 2001; Upton *et al.*, 2020).

CONCLUSION:

In this survey, we have tried to make a bridge between the availability of valuable medicinal plant in the local area of Gopalganj and their usage method. Therefore, this survey might be a data storehouse for botanists, biotechnologists, and pharmacists for novel gene extraction from plants that can withstand different diseases. Finally, this project highlights the convergence between modern and traditional medicine according to conventional medicine's scientific basis and usage methods. The survey provides valuable data for further research on natural remedies and could lead to the development of new drugs for treating cough, cold, and fever.

AUTHOR'S CONTRIBUTION:

The investigation, writing-original draft, was prepared by I.H.S, modifying draft preparation, editing, data creation, and figures were prepared by T.A.E. and A.K.B, Writing review, Editing, Visualization, and References were prepared by S.K.B. All authors have read and agreed to the published version of the manuscript.

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CONFLICTS OF INTEREST:

The authors declare no conflicts of interest.

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