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## An ethnomedicinal survey on folk medicinal uses of plants in eastern Madhupur region of Pabna District, Bangladesh

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**Abstract**

**Background:** Folk medicine, despite its enormous potential, is possibly the most overlooked medicinal system in the world. Folk medicinal practitioners (FMPs) are considered outdated, unscientific, and even looked down upon as mere charlatans. Yet not only conventional/allopathic medicine but also more systematic forms of traditional medicines (like Ayurveda, Unani Siddha, and homeopathy) owe a lot towards adopting folk medicinal use of plants and formulations. The objective of the present study was to collect data on plants used by FMPs in a section of Pabna district, Bangladesh and to determine whether the uses of a given plant(s) by the FMPs can be scientifically rationalized based on available scientific reports.

**Methods and findings:** Information was collected from a father-son duo FMPs practicing in the eastern Madhupur region of Pabna district in Bangladesh. Both FMPs were informed in details as to the objectives of our repeated visits. Importance was given to obtaining permission to converse with them, take pictures, and to publish any collected information both internationally and nationally. Plants as shown by the FMPs were photographed and plant specimens collected, dried and identified by a trained botanist. Information on only fourteen plants were obtained strongly suggesting that FMPs are possibly a disappearing breed along with their generation-wise orally transmitted medicinal plant knowledge.

**Conclusions:** Comparison of the medicinal uses of the plants by the FMPs and comparing such uses with published pharmacological activity reports on the plants indicate that the FMPs used the plants in a rational manner. The major difference between the FMPs use of a medicinal plant and conventional medicines is that FMPs usually use a plant or plant part wholly versus the conventional method of isolating and identifying the bio-active plant constituent and using it as a drug.

**Keywords:** Pabna, Madhupur, Bangladesh, folk medicine, medicinal plants

**Introduction**

In the modern age, it can be said that three types of medicinal systems co-exist in various countries of the world. The first is conventional medicine, otherwise known as allopathic medicine with defined rules and institutions offering degrees after years of studies before a practitioner known as doctor is allowed to practice <sup>[1]</sup>. The second is traditional medicine, which is defined by the World Health Organization (WHO) as “Traditional medicine refers to health practices, approaches, knowledge and beliefs incorporating plant, animal and mineral based medicines, spiritual therapies, manual techniques and exercises, applied singularly or in combination to treat, diagnose and prevent illnesses or maintain well-being” <sup>[2]</sup>. Traditional medicine in turn can be divided into two major groups – codified traditional medicinal systems like Ayurveda, Unani, Siddha, homeopathy, Traditional Chinese Medicine (TCM) and Kampo, to name only a few with their respective institutions for conferring degrees and recognized textbooks and principles of practice, and non-codified medicinal practices like folk and tribal medicines.

The Merriam-Webster dictionary defines folk medicine as “traditional medicine as practiced nonprofessionally especially by people isolated from modern medical services and usually involving the use of plant-derived remedies on an empirical basis” [definition accessed on February 3, 2023 at <https://www.merriam-webster.com/dictionary/folk%20medicine>]. This is an apt definition. The only missing thing in the definition is that folk medicine is possibly the earliest form of medicine since the advent of humans, along with quite possibly their diseases.

The same applies to tribal medicine, which is just folk medicine of the tribal people (folk medicine refers to the medicine of the mainstream population or the largest community). The earliest forms of medicinal treatment(s) were passed orally from generation to generation. Codification could only begin following discovery of paper, clay tablets, and writing formats like the cuneiform script in Sumer [3]. The various traditional medicinal systems other than folk/tribal medicine possibly were initiated in a non-codified form but unlike folk medicine were rapidly codified and improved upon following discovery of writing [4-6].

That folk medicine/tribal medicine was not codified was partially due to absence of writing among many wild tribes but mostly by the diversification of folk medicinal practices. Any item can be used in folk medicine for healing; besides plants, animals, fish, birds, reptiles, and insects, there are also reported uses of incantations, amulets, soil and sundry other items like excreta of animals [7-10]. However, in folk/tribal medicine, it is accepted that the majority of treatment are based on plants. Diverse species of plants exist in different parts of the world; even one country may have more than one region where the vegetation is different. As such, any sort of codification becomes difficult and even currently, folk medicinal practices are generally orally transmitted between previous and successive generations [11]. Since forests and wilderness are disappearing at a fast rate and conventional medicine is rapidly taking over folk medicine, there is every reason to document folk medicinal practices before it disappears totally.

Plants have formed the basis for discovery of many important conventional drugs like quinine, artemisinin, digoxin, reserpine, vincristine, vinblastine, and taxol, to name only a very few [12]. The emergence of new zoonotic viruses and the

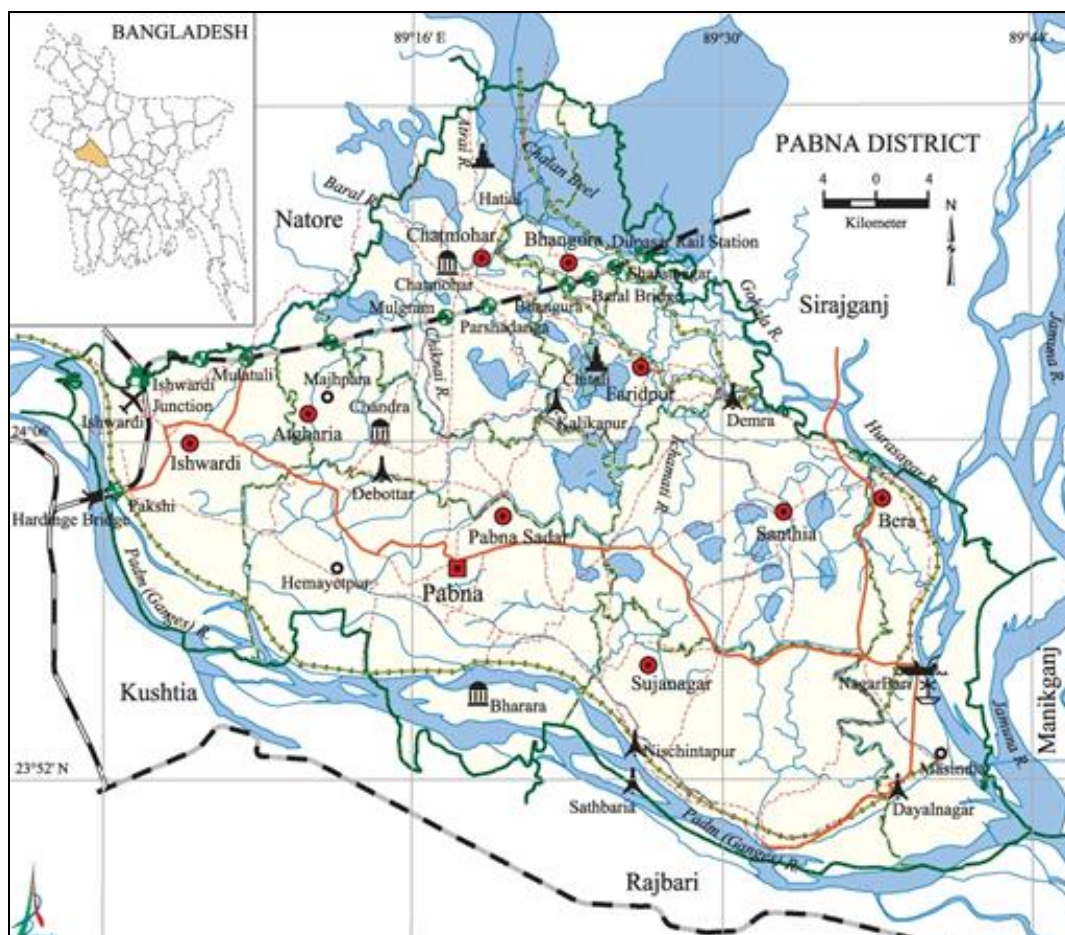
rise of drug-resistant vectors highlight the importance of conserving plant species and folk medicinal practices. Close observation of the medicinal practices of indigenous people (ethnopharmacology) have served as a basis for the discovery of many conventional drugs [13], and this may as well act as pointers for plant-derived novel drug discoveries against emerging viral diseases and antibiotic-resistant microorganisms. For that reason we are trying to build up a medicinal plant database of plants used by folk and tribal medicinal practitioners of the country, for these practitioners and their knowledge is fast disappearing. The goal of our project is to publish as much as possible the information that we gather from our ethnomedicinal surveys [14-45], so that scientists working in this field are aware of the potential of Bangladeshi plants. The objective of the present study was to conduct an ethnomedicinal survey among the folk medicinal practitioners (FMPs) of eastern Madhupur region of Pabna district, Bangladesh.

### Methods

Information was obtained from two FMPs, a father-son duo practicing in eastern Madhupur region of Pabna district, Bangladesh. The father was 85 years old and had been practicing for over 45 years. The son was around 55 years old and practicing for 20 years. Informed consent was obtained from the two FMPs including publishing the information provided nationally and internationally. The ethnobotanical survey methods of Martin [46] and Maundu [47] were followed.

### Results and Discussion

Pabna district has an area of 2371.50 sq km, and located in between 23°48' and 24°21' north latitudes and in between 89°00' and 89°44' east longitudes (Figure 1).



**Fig 1:** Pabna district map. Inset: showing map of Bangladesh with Pabna district shown in yellow

The district has 9 Upazilas (sub-districts). The average literacy rate is 42.4%; males form 45.2% of the total population. Pabna Sadar is the largest Upazila. Eastern Madhupur, the study area, falls within this Upazila. A number of major rivers like the Padma, Jamuna, and Ichamoti flows through Pabna district. The main source of income is agriculture. Around 35 types of vegetables along with paddy are grown in this district.

The plants and formulations used by the two FMPs are shown in Table 1. A total of 14 plant species distributed into 13 families were used by the FMPs. The continuous erosion of folk medicinal knowledge is demonstrated in the number of plants used, for only 14 plants were used in a total of only 9 formulations. In our previous studies as referenced between references 14-45, we could obtain a much higher number of plants from the FMPs. However, the present FMPs showed their versatility in disease treatment by using the same plant to treat diverse diseases. A plant can produce secondary metabolites of different natures, which can give different pharmacological activities, and so can be used for treatment of diverse diseases<sup>[48]</sup>. In a previous article, we have shown that based on its phytochemicals (secondary metabolites), the plant *Artemisia herba-alba* Asso. (Asteraceae) can be potentially used for treatment of COVID-19 as well as comorbidities<sup>[49]</sup>.

Arguably, one of the important plants used by the FMPs was *Mikania cordata* (Figure 2) for treatment of hepatitis B, liver disorders, and jaundice. This is one of the cases where integration is at work. Hepatitis can arise from many causes like viruses, alcohol consumption, and even certain medications. Viral hepatitis, again can be Hepatitis A-E, each caused by a different virus. The partly-literate FMPs had no diagnostic procedures in their hand to diagnose the exact cause for hepatitis. Hepatitis was diagnosed in an allopathic clinic, but then the patients came to the FMPs for treatment mostly because allopathic treatment costs were beyond their reach. Jaundice and liver disorders, however, could be diagnosed by the FMPs based on yellow coloration of skin and eyes. Jaundice in Bengali is known by the name 'kamla', and treatment of jaundice by various systems of traditional medicine has been going on for thousands of years. Treatment of jaundice has also been described in Ayurveda, where the disease is recognized as arising from liver disorders<sup>[50]</sup>.



**Fig 2:** *Mikania cordata*

Interestingly, ethanolic extract of whole plants of *Mikania cordata* demonstrated better anti-inflammatory activity than aspirin in heat-induced and hypotonic solution-induced hemolysis tests<sup>[51]</sup>. Systemic inflammation in obstructive jaundice has been reported<sup>[52]</sup>. Acute viral hepatitis also cause inflammation of liver, against which the plant is used by the FMPs<sup>[53]</sup>. This suggests that the plant can be useful against inflammatory diseases of the liver. In Bangladesh, use of *Clerodendrum infortunatum* L. against jaundice and other hepatic disorders has also been observed<sup>[54]</sup>.

The mode of use of *Calotropis gigantea* (Figure 3) for alleviation of pain by the present FMPs has been reported previously for Bangladesh by the Bede people of Dhaka district<sup>[55]</sup>. The plant is used for piles, wounds, swellings, digestive disorders, and pain by inhabitants of Cholistan desert, Punjab, Pakistan<sup>[56]</sup>. Analgesic activity of ethanolic extract of aerial parts of the plant have been reported from Saudi Arabia; notably the plant is used in that country for joint pain and constipation<sup>[57]</sup>. Mustard oil was applied to leaves of the plant prior to application of warmed oil-brushed leaves to painful areas (Table 1). The oil can act as skin permeation booster and aid transdermal delivery of phytochemical constituents in the leaf<sup>[58]</sup>. It is always a matter of scientific curiosity as to how the FMPs could know not only that leaves of the plant can act as analgesic, but further know the use of oil to enhance the analgesic effect. Vomiting, indigestion, and stomach ache can indicate digestive problems. The use of black pepper powder along with roots of the plant *Calotropis gigantea* is also interesting. Black pepper and its major alkaloid piperine reportedly stimulates pancreatic digestive enzymes, digestive capacity, and reduces significantly the gastrointestinal food transit time, and as such can alleviate digestive problems<sup>[59]</sup>. Methanolic extract of roots of the plant show nootropic activity and is considered good for piles<sup>[60]</sup>.



**Fig 3:** *Calotropis gigantea*

**Table 1:** Medicinal plants of the folk medicinal practitioners of Pabna district

Scientific name	Family	Local name	Part(s) used	Ailments and formulations
<i>Trachyspermum ammi</i> (L.) Sprague ex Turrill	Apiaceae	Ajwain, Jwain	Seed	See <i>Carica papaya</i> .
<i>Calotropis gigantea</i> (Aiton) Dryand.	Apocynaceae	Akondo	Leaf, fruit, root	Body ache, wound and sores, vomiting, indigestion, stomach ache, piles. Mustard oil is applied to the leaves and then leaves are warmed over a fire. The warm leaves are then applied to the painful part(s). 1 kg powdered roots are mixed with 50g black pepper powder. Tablets weighing about 2.5g each are then prepared from the mixture. For wound and sores, vomiting, indigestion, and stomach ache, 3 tablets are taken orally in the morning on an empty stomach. For piles, 1 tablet is taken at night after meals for 45 days.
<i>Colocasia esculenta</i> (L.) Schott	Araceae	Kata kochu	Leaf	Body pain. Ointment is prepared by cooking leaves in 2 liters of water. The ointment is massaged onto painful areas for 7 days.
<i>Mikania cordata</i> (Burm. f.) B. L. Robinson	Asteraceae	Jarmani lota	Leaf	Hepatitis B, liver disorders, jaundice. Leaves are crushed, dried in the sun, and made into pills of about 5g each. One tablet is taken orally in the morning with ripe banana ( <i>Musa acuminata</i> ) juice on an empty stomach for 4 months.
<i>Carica papaya</i> L.	Caricaceae	Pepe	Fruit	Liver disease, constipation, spleen disorders. Unripe fruits are boiled in 20 liters of water till the volume reaches 12 liters. Seeds of <i>Trachyspermum ammi</i> , Triphala (dried powdered fruits of <i>Terminalia bellirica</i> , <i>Terminalia chebula</i> , and <i>Phyllanthus emblica</i> in equal proportions by weight), dried slices of ripe fruit of <i>Aegle marmelos</i> , and blacksalt (kiln-fired rock salt having the pungent smell of sulfur) are then added to the water and boiled till the volume is around 8 liters. 2 kg of sugar is next added to the mixture to make a syrup. Four teaspoons of the syrup is taken orally before meals in the morning and night for 2 months.
<i>Terminalia bellirica</i> (Gaertn.) Roxb.	Combretaceae	Bohera	Fruit	Sores and wounds, fever, asthma, spleen disorders, sexual diseases. Fruits are dried in the sun, powdered and mixed with honey. The decoction is taken orally before breakfast in the morning and after meals at night, 3 months for asthma and 7 days for the other ailments.
<i>Terminalia chebula</i> Retz.	Combretaceae	Horitoki	Fruit	See <i>Carica papaya</i> .
<i>Ocimum tenuiflorum</i> L.	Lamiaceae	Tulsi	Leaf	Cough. Several fresh leaves are boiled with black pepper ( <i>Piper nigrum</i> ) in one liter of water to make a syrup. One teaspoon of the syrup is taken orally after meals for one week.
<i>Musa acuminata</i> L.	Musaceae	Kola	Fruit	See <i>Mikania cordata</i> .
<i>Phyllanthus emblica</i> L.	Phyllanthaceae	Amloki	Fruit	See <i>Carica papaya</i> . Burning sensations in body, leucorrhoea. Fruits are powdered after drying in the sun. The powder is taken orally 2 times a day with cold water for 30 days.
<i>Piper nigrum</i> L.	Piperaceae	Gol morich	Fruit	See <i>Persicaria hydropiper</i> .
<i>Persicaria hydropiper</i> (L.) Delarbre	Polygonaceae	Bish katali	Leaf	Menstruation problem. One kg of raw leaves is mixed with 100g black pepper ( <i>Piper nigrum</i> ), crushed, and tablets prepared from the mixture weighing about 2.5g each. One tablet is taken orally in the morning and night on an empty stomach for 2 months. See <i>Ocimum tenuiflorum</i> .
<i>Aegle marmelos</i> (L.) Correa	Rutaceae	Bael	Fruit	See <i>Carica papaya</i> .
<i>Elettaria cardamomum</i> L.	Zingiberaceae	Elachi	Fruit	Blood pressure, cough, sexual disease. One fruit is taken orally with a glass of water at night after meal for 40 days.

The analgesic activity of hydroalcoholic extract of *Colocasia esculenta* leaves has been confirmed in scientific studies in rats in hot plate and tail flick models [61]. The FMPs used leaves of the plant to treat body pain. The leaves and roots of the plant are rich in flavones like apigenin and luteolin [62]. Luteolin has been shown in several studies to be effective in alleviating pain under chronic conditions [63]. Overall, the scientific evidence suggests the validity of the FMP's use of *Colocasia esculenta* in the treatment of pain.

A complex polyherbal formulation was used by the FMPs to treat liver disease, constipation, and spleen disorders. The formulation contained *Trachyspermum ammi*, Triphala (dried powdered fruits of *Terminalia bellirica*, *Terminalia chebula*, and *Phyllanthus emblica* in equal proportions by weight), and dried slices of ripe fruit of *Aegle marmelos*. Ripe fruits of

*Aegle marmelos* are considered as one of the best laxatives [64]; the efficacy of the fruits are increased when used in sun-dried form. Triphala is considered a major hepatoprotective agent in Ayurveda [65]. A recent review has pointed out the hepatoprotective effect of fruit pulp of *Aegle marmelos* against carbon tetrachloride-induced hepatotoxicity [66]. *Trachyspermum ammi* is reportedly used for flatulence, diarrhea, dyspepsia, abdominal pain, and piles, as reviewed by Bairwa and others [67].

Ethanollic and alcoholic extracts of *Terminalia bellirica* (Figure 4) reportedly demonstrated anti-pyretic and analgesic activity in acetic acid-induced writhing, Eddy's hot plate method and brewer's yeast-induced fever models in mice and rats [68]. The FMPs used the fruits for treatment of sores and wounds, fever, asthma, spleen disorders, and sexual diseases.

The analgesic property of the fruits can prove useful in alleviating pain arising from sores, wounds, and other disorders, while the anti-pyretic property can prove useful in

fevers. Incidentally, the Ayurvedic uses of *Terminalia bellirica* include redness of eyes, asthma, constipation and weak eyesight [69].

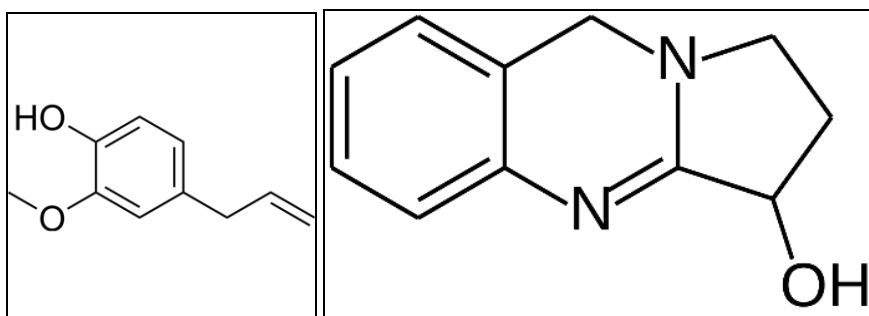


**Fig 4:** *Terminalia bellirica* tree.

Interestingly, the Unani system of medicine also utilizes the fruits of *Terminalia bellirica* in nearly the same way as Ayurveda. A review summarized the Unani uses as “obesity, diarrhea, weakness of digestive system, ageing, greying of hairs, weakness of memory and eyesight, strengthening of immunity, and general weakness” [70]. Fruits have been otherwise reported to be used in Bangladesh (Domar Upazila in Nilphamari district) for loss of eyesight, eyes becoming totally white, and night blindness. However, the fruits are not used alone, they are used along with rhizomes of *Acorus calamus* L., roots of *Saussurea lappa* C.B. Clarke, fruits of

*Terminalia bellirica*, *Terminalia chebula*, *Piper peepuloides* L., *Piper nigrum*, and bark of *Xeromphis spinosa* (Thunb.) Keay [71].

The leaves of *Ocimum tenuiflorum* were used by the FMPs for coughs. The leaves form a common remedy for treatment of coughs and respiratory disorders from home remedies to Ayurveda [72]. The plant contains 7% eugenol [73]; vasicine and vasicinone (quinazoline alkaloids) are also present in the plant, which being bronchodilators are effective for coughs and asthma [74].



**Fig 5:** Eugenol (left), vasicine (right)

A recent review mentions the use of *Phyllanthus emblica* fruits in Ayurveda for treatment of leucorrhoea. The fruits also have antiinflammatory properties [75], justifying the FMPs use of the fruits to treat leucorrhoea. Ayurveda and Unani systems of medicine also considers the fruits as ‘cooling’, that is produces a soothing/cooling effect in the body, which is useful during fever or high outside temperatures [76]. Tibetan medicine also describes the fruits to have a cooling effect on the body when consumed [77].

Leaves of *Persicaria hydropiper* were used by the FMPs to treat menstrual problems. Common menstrual problems can be dysmenorrhoea or painful cramps during menstruation, and menorrhagia or excessive bleeding during menstruation, which time period may be prolonged. Such problems may result in pain. Methanol extract of leaves reportedly showed antinociceptive effects in mice when using heat-induced (hot-plate and tail-immersion test) and chemical-induced (acetic acid, formalin, glutamic acid, cinnamaldehyde) nociception

models [78], and so can play a role in alleviating menstrual pain. A survey carried out with 800 unmarried girls between 12-19 years of age in two areas of Bangladesh found about 50% of the girls suffered from menstrual problems including abdominal and back pain. Less than half of the females suffering from menstrual problems sought the advice of allopathic physicians [79]. As such, FMPs can play an effective role in lessening this burden of menstrual disorders. However, it is important to work out effective dosages and take into account any possible toxicities. The FMPs used *Piper nigrum* fruits in their formulation, which are known to give analgesic and antiinflammatory effects [80].

*Elettaria cardamomum* fruits were used by the FMPs for treatment of blood pressure, cough, and sexual diseases. The fruits were considered around the eleventh century in Europe to have aphrodisiac properties. Fruits reportedly demonstrated blood pressure lowering, fibrinolysis enhancing, and antioxidant activities [81]. In Ayurveda, it is known as 'kasahara', that is it can relieve coughs [82].

The knowledge of the FMPs may not be precise and extensive as modern scientists, but they can certainly be a pointer for modern scientists to perform their research in specific directions. As such, modern science and scientists can learn a lot from the FMPs. The FMP's knowledge needs to be documented before they and the plants they use disappear forever.

## References

1. Van Rooyen D, Pretorius B, Tembani NN, ten Ham-Balowi W. Allopathic and traditional health practitioner's collaboration. *Curationis*. 2015;38(2):1-10. DOI: 10.4102/curationis.v38i2.1495
2. Fokunang CN, Ndikum V, Tabi OY, Jiofack RB, Ngameni B, Guedje NM, *et al.* Traditional medicine: Past, present and future research and development prospects and integration in the National Health System of Cameroon. *Afr J Tradit Complement Altern Med*. 2011;8(3):284-295. DOI: 10.4314/ajtcam.v8i3.65276
3. Emberling G. Visible language: Inventions of writing in the ancient Middle East and beyond. *News & Notes, the Oriental Institute of the University of Chicago*. 2010;207:3-9.
4. Narayanaswamy V. Origin and development of Ayurveda (a brief history). *Anc Sci Life*. 1981;1(1):1-7.
5. Islam A. Origin and development of *Unani* medicine: An analytical study. *Intellectual Discourse*. 2018;26(1):23-49.
6. Catić T, Oborovic I, Redzic E, Sukalo A, Skrbo A, Masic I. Traditional Chinese Medicine – an overview. *Int J Biomed Healthc*. 2018;6(1):35-50.
7. Disha IT, Khatun Z, Rahmatullah M. Incantations, medicinal plants and formulations of the Rai Kshatriya tribe of Pabna district, Bangladesh. *Am - Eur J Sustain Agric*. 2012;6(4):304-314.
8. Bhuiyan P, Khatun Z, Jahan S, Morshed MT, Rahman S, Afsana NA, *et al.* Use of Quranic verses, amulets, numerology, and medicinal plants for treatment of diseases: a case study of a healer in Narsinghdi district, Bangladesh. *Am - Eur J Sustain Agric*. 2013;7(5):415-425.
9. Daria S, Islam MR. The use of cow dung and urine to cure COVID-19 in India: A public health concern. *Int J Health Plann Manage*. 2021;36(5):1950-1952. DOI: 10.1002/hpm.3257
10. Khatun Z, Bhuiyan P, Roney MSI, Rahmatullah M. Traditional knowledge on zootherapeutic practices among some folk medicinal practitioners of Bangladesh. *Am.-Eur J Sustain Agric*. 2013;7(3):155-161.
11. Singh NN. Folk medicine and its significance in the modern world (The case of the Meetei people of Manipur). *Int J Interdisciplinary and Multidisciplinary Studies*. 2015;2(6):49-55.
12. Rates SMK. Plants as source of drugs. *Toxicon*. 2001;39(5):603-613. DOI: 10.1016/S0041-0101(00)00154-9
13. Patwardhan BK. Drug Discovery and Development: Traditional Medicine and Ethno pharmacology. New India Publishing Agency, New Delhi; c2007. ISBN: 81-89422-29-4
14. Seraj S, Rahmatullah M, Monjur-E-Khudha M, Aporna SA, Khan MSH, Jahan R. Amulets and other uncommon treatments prescribed by traditional medicinal practitioners of the Bede community residing in Porabari village of Dhaka district, Bangladesh. *J Altern Complement Med*. 2011;17(11):987-993. DOI: 10.1089/acm.2011.0340
15. Khatun A, Jannat K, Peash TA, Jahan R, Rahmatullah M. Some esoteric home remedies practiced in Narayanganj district, Bangladesh. *J Med Plants Stud*. 2018;6(4):166-168.
16. Shandhi MM, Khatun T, Mondol N, Patwary SA, Jannat K, Rahmatullah M. Tying or hanging of plants to body to cure diseases: an esoteric method of treatment. *J Med Plants Stud*. 2019;7(2):131-133.
17. Rahmatullah M, Ferdausi D, Mollik MAH, Jahan R, Chowdhury MH, Haque WM. A Survey of Medicinal Plants used by Kavirajes of Chalna area, Khulna District, Bangladesh. *Afr J Tradit Complement Alternat Med*. 2010;7(2):91-97.
18. Rahmatullah M, Khatun MA, Morshed N, Neogi PK, Khan SUA, Hossain MS, *et al.* A randomized survey of medicinal plants used by folk medicinal healers of Sylhet Division, Bangladesh. *Adv Nat Appl Sci*. 2010;4(1):52-62.
19. Rahmatullah M, Kabir AABT, Rahman MM, Hossain MS, Khatun Z, Khatun MA, *et al.* Ethnomedicinal practices among a minority group of Christians residing in Mirzapur village of Dinajpur District, Bangladesh. *Adv Nat Appl Sci*. 2010;4(1):45-51.
20. Rahmatullah M, Momen MA, Rahman MM, Nasrin D, Hossain MS, Khatun Z, *et al.* A randomized survey of medicinal plants used by folk medicinal practitioners in Daudkandi sub-district of Comilla district, Bangladesh. *Adv Nat Appl Sci*. 2010;4(2):99-104.
21. Rahmatullah M, Mollik MAH, Ahmed MN, Bhuiyan MZA, Hossain MM, Azam MNK, *et al.* A survey of medicinal plants used by folk medicinal practitioners in two villages of Tangail district, Bangladesh. *Am-Eur J Sustain Agric*. 2010;4(3):357-362.
22. Rahmatullah M, Mollik MAH, Islam MK, Islam MR, Jahan FI, Khatun Z, *et al.* A survey of medicinal and functional food plants used by the folk medicinal practitioners of three villages in Sreepur Upazilla, Magura district, Bangladesh. *Am-Eur J Sustain Agric*. 2010;4(3):363-373.
23. Rahmatullah M, Jahan R, Khatun MA, Jahan FI, Azad AK, Bashar ABMA, *et al.* A pharmacological evaluation of medicinal plants used by folk medicinal practitioners of Station Purbo Para Village of Jamalpur Sadar Upazila in Jamalpur district, Bangladesh. *Am-Eur J Sustain*

- Agric. 2010;4(2):170-195.
24. Rahmatullah M, Ishika T, Rahman M, Swarna A, Khan T, Monalisa MN, *et al.* Plants prescribed for both preventive and therapeutic purposes by the traditional healers of the Bede community residing by the Turag River, Dhaka district. *Am-Eur J Sustain Agric.* 2011;5(3):325-331.
  25. Rahmatullah M, Azam MNK, Rahman MM, Seraj S, Mahal MJ, Mou SM, *et al.* A survey of medicinal plants used by Garo and non-Garo traditional medicinal practitioners in two villages of Tangail district, Bangladesh. *Am-Eur J Sustain Agric.* 2011;5(3):350-357.
  26. Rahmatullah M, Biswas KR. Traditional medicinal practices of a Sardar healer of the Sardar (Dhangor) community of Bangladesh. *J Altern Complement Med.* 2012;18(1):10-19. DOI: 10.1089/acm.2011.0395
  27. Rahmatullah M, Hasan A, Parvin W, Moniruzzaman M, Khatun Z, Jahan FI, *et al.* Medicinal plants and formulations used by the Soren clan of the Santal tribe in Rajshahi district, Bangladesh for treatment of various ailments. *Afr J Tradit Complement Alternat Med.* 2012;9(3):350-359. DOI: 10.4314/ajtcam.v9i3.8
  28. Rahmatullah M, Khatun Z, Hasan A, Parvin W, Moniruzzaman M, Khatun A, *et al.* Survey and scientific evaluation of medicinal plants used by the Pahan and Teli tribal communities of Natore district, Bangladesh. *Afr J Tradit Complement Alternat Med.* 2012;9(3):366-373. DOI: 10.4314/ajtcam.v9i3.10
  29. Rahmatullah M, Azam MNK, Khatun Z, Seraj S, Islam F, Rahman MA, *et al.* Medicinal plants used for treatment of diabetes by the Marakh sect of the Garo tribe living in Mymensingh district, Bangladesh. *Afr J Tradit Complement Alternat Med.* 2012;9(3):380-385. DOI: 10.4314/ajtcam.v9i3.12
  30. Rahmatullah M, Khatun Z, Barua D, Alam MU, Jahan S, Jahan R. Medicinal plants used by traditional practitioners of the Kole and Rai tribes of Bangladesh. *J Altern Complement Med.* 2013;19(6):483-491. DOI: 10.1089/acm.2012.0227
  31. Rahmatullah M, Pk SR, Al-Imran M, Jahan R. The Khasia tribe of Sylhet district, Bangladesh, and their fast-disappearing knowledge of medicinal plants. *J Altern Complement Med.* 2013;19(7):599-606. DOI: 10.1089/acm.2012.0254
  32. Akter S, Nipu AH, Chyti HN, Das PR, Islam MT, Rahmatullah M. Ethnomedicinal plants of the Shing tribe of Moulvibazar district, Bangladesh. *World J Pharm Pharm Sci.* 2014;3(10):1529-1537.
  33. Azad AK, Mahmud MR, Parvin A, Chakraborty A, Akter F, Moury SI, *et al.* Medicinal plants of a Santal tribal healer in Dinajpur district, Bangladesh. *World J Pharm Pharm Sci.* 2014;3(10):1597-1606.
  34. Azad AK, Mahmud MR, Parvin A, Chakraborty A, Akter F, Moury SI, *et al.* Ethnomedicinal surveys in two Mouzas of Kurigram district, Bangladesh. *World J Pharm Pharm Sci.* 2014;3(10):1607-1620.
  35. Kamal Z, Bairage JJ, Moniruzzaman, Das PR, Islam MT, Faruque MO, *et al.* Ethnomedicinal practices of a folk medicinal practitioner in Pabna district, Bangladesh. *World J Pharm Pharm Sci.* 2014;3(12):73-85.
  36. Anzumi H, Rahman S, Islam MA, Rahmatullah M. Uncommon medicinal plant formulations used by a folk medicinal practitioner in Naogaon district, Bangladesh. *World J Pharm Pharm Sci.* 2014;3(12):176-188.
  37. Esha RT, Chowdhury MR, Adhikary S, Haque KMA, Acharjee M, Nurunnabi M, *et al.* Medicinal plants used by tribal medicinal practitioners of three clans of the Chakma tribe residing in Rangamati district, Bangladesh. *Am.-Eur J Sustain Agric.* 2012;6(2):74-84.
  38. Malek I, Miah MR, Khan MF, Awal RBF, Nahar N, Khan I, *et al.* Medicinal plants of two practitioners in two Marma tribal communities of Khagrachhari district, Bangladesh. *Am.-Eur J Sustain Agric.* 2014;8(5):78-85.
  39. Shakera J, Mandal R, Akter T, Nahar N, Rahmatullah M. Folk medicine in Bangladesh: Healing with plants by a practitioner in Kushtia district. *Arch Pharm Pharmacol Res.* 2019;1(5):APPR.MS.ID.000525. DOI: 10.33552/APPR.2019.01.000525.
  40. Rahmatullah M, Jannat K, Nahar N, Al-Mahamud R, Jahan R, Hamid A. Tribal medicinal plants: documentation of medicinal plants used by a Mogh tribal healer in Bandarban district, Bangladesh. *Arch Pharm Pharmacol Res.* 2019;1(5):APPR.MS.ID.000523. DOI: 10.33552/APPR.2019.01.000523.
  41. Shova NA, Islam M, Rahmatullah M. Phytotherapeutic practices of a female folk medicinal practitioner in Cumilla district, Bangladesh. *J Med Plants Stud.* 2019;7(4 Part A):1-5.
  42. Jannat K, Al-Mahamud R, Jahan R, Hamid A, Rahmatullah M. Phyto and zootherapeutic practices of a Marma tribal healer in Bandarban district, Bangladesh. *Int J Appl Res Med Plants.* 2019;2(1):9. DOI: 10.29011/IJARMP-109.100009.
  43. Mondol N, Patwary SA, Shandhi MM, Khatun T, Jannat K, Rahmatullah M. A study of folk medicinal practices in Debashur village, Gopalganj district, Bangladesh. *World J Pharm Res.* 2019;8(5):589-598.
  44. Jannat K, Shova NA, Islam MMM, Jahan R, Rahmatullah M. Herbal formulations for jaundice treatment in Jamalpur district, Bangladesh. *J Med Plants Stud.* 2019;7(2):99-102.
  45. Hosen MS, Rahmatullah M. Simple phytotherapeutic practices of a Tripura tribal medicinal practitioner in Bandarban district, Bangladesh. *J Med Plants Stud.* 2019;7(1):93-95.
  46. Martin GJ. In: *Ethnobotany: A 'People and Plants' Conservation Manual*, Chapman and Hall, London; c195, p. 268.
  47. Maundu P. Methodology for collecting and sharing indigenous knowledge: A case study. *Indigenous Knowledge and Development Monitor.* 1995;3(2):3-5.
  48. Badyal S, Singh H, Yadav AK, Sharma S, Bhushan I. Plant secondary metabolites and their uses. *Plant Archives.* 2020;20(2):3336-3340.
  49. Hasan A, Biswas P, Bondhon TA, Jannat K, Paul TK, Paul AK, *et al.* Can *Artemisia herba-alba* be useful for managing COVID-19 and comorbidities? *Molecules.* 2022;27(2):492. DOI: <https://doi.org/10.3390/molecules27020492>
  50. Deshmukh S, Nikode K, Thakre T. Management of jaundice (Kamala Vyadhi) through Ayurveda – A case study. *J In Sys Med.* 2017;5(4):268-271.
  51. Khatun R, Roy S, Rahman MAA. *In vitro* comparative evaluation of anti-inflammatory and thrombolytic activity of three *Mikania* species available in Bangladesh. *J Pharmacogn Phytochem.* 2017;6(5):1007-1011.
  52. Yang R, Zhu S, Pischke SE, Haugaa H, Zou X, Tonnessen TI. Bile and circulating HMGB1 contributes to systemic inflammation in obstructive jaundice. *J Surg Res.* 2018;228:14-19. DOI: 10.1016/j.jss.2018.02.049

53. Kayesh MEH, Kohara M, Tsukiyama-Kohara K. Epidemiology and risk factors for acute viral hepatitis in Bangladesh: An overview. *Microorganisms*. 2022;10(11):2266.  
DOI: 10.3390/microorganisms10112266
54. Rahmatullah M, Ahammed SMd, Paul S, Jahan R, Farzana B. *Clerodendrum Infortunatum* L. – a plant used for treatment of hepatitis B and hepatic disorders in Jamalpur District, Bangladesh. *Jpn J Gastroenterol Hepatol* 2(3): 1-3.
55. Seraj S, Jahan FI, Chowdhury AR, Monjur-EKhuda M, Khan MSH, Aporna SA, *et al.* Tribal formulations for treatment of pain: A study of the Bede community traditional medicinal practitioners of Porabari village in Dhaka district, Bangladesh. *Afr J Tradit Complement Altern Med*. 2013;10(1):26-34.  
DOI: 10.4314/ajtcam.v10i1.5
56. Azhar MF, Siddiqui MT, Ishaque M, Tanveer A. Study of ethnobotany and indigenous use of *Calotropis procera* (Ait.) in Cholistan desert, Punjab, Pakistan. *J Agric Res*. 2014;52(1):117-126.
57. Mossa JS, Tariq M, Mohsin A, Ageel AM, Al-Yahya MA, Al-Said MS, *et al.* Pharmacological studies on aerial parts of *Calotropis Procera*. *Am J Chinese Med*. 1991;XIX(3-4):223-231.
58. Çalışkan UK, Karakuş MM. Essential oils as skin permeation boosters and their predicted effect mechanisms. *J Dermatol & Skin Sci*. 2020;2(3): 24-30.
59. Srinivasan K. Black pepper and its pungent principle-piperine: A review of diverse physiological effects. *Crit Rev Food Sci Nutr*. 2007;47(8):735-748.  
DOI: 10.1080/10408390601062054
60. Verma S, Srivastava M, Shahjahan, Varma RK, Yadav P. *Calotropis gigantea* (L) root: Pharmacognostic evaluation. *IJPPR*. 2017;9(1): 37-48.
61. Kushwah C, Singh N, Goswami R, Jain NK. Analgesic activity of hydroalcoholic extract of leaves of *Colocasia esculenta*. *Int J Pharm Life Sci (IJPLS)*. 2020;11(12):7112-7116.
62. Pachiappan S, Thenmozhi V, Sundaresan S, Dhanalakshmi M. *Colocasia esculenta* (L.) Schott: Pharmacognostic and pharmacological review. *J Pharmacogn Phytochem*. 2020;9(4):1382-1386.  
DOI: 10.22271/phyto.2020.v9.i4.s.11937
63. Ntalouka F, Tsirivakou A. Luteolin: A promising natural agent in management of pain in chronic conditions. *Front Pain Res*. 2023;4:1114428.  
DOI: 10.3389/fpain.2023.1114428
64. Kaur A, Kalia M. Physico chemical analysis of bael (*Aegle Marmelos*) fruit pulp, seed and pericarp. *Chem Sci Rev Lett*. 2017;6(22):1213-1218.
65. Gupta R, Gupta A, Singh RL. Hepatoprotective activity of Triphala and its constituents. *IJPRR*. 2015;4(1):34-55.
66. Ugwu CE, Suru SM. Medicinal plants with hepatoprotective potentials against carbon tetrachloride-induced toxicity: a review. *Egyptian Liver J*. 2021;11:88.  
DOI: <https://doi.org/10.1186/s43066-021-00161-0>
67. Bairwa R, Sodha RS, Rajawat BS. *Trachyspermum ammi*. *Pharmacogn Rev*. 2012;6(11):56-60.  
DOI: 10.4103/0973-7847.95871
68. Sharma US, Sharma UK, Singh A, Sutar N, Singh PJ. Screening of *Terminalia bellirica* fruit extracts for its analgesic and antipyretic activities. *Jordan J Biol Sci*. 2010;3(3):121-124.
69. Kumari S, Krishna JM, Joshi AB, Gurav S, Bhandarkar AV, Agarwal A, *et al.* A pharmacognostic, phytochemical and pharmacological review of *Terminalia bellerica*. *J Pharmacogn Phytochem*. 2017;6(5):368-376.
70. Alam S, Ansari S. A brief review of *Terminalia bellerica* (Balela) with special reference of Unani medicine. *TANG (Humanitas Medicine)*. 2019;9(3):e5.
71. Nahar S, Farzana B, Jahan R, Rahman T, Hossan MS, Wiart C, *et al.* Ayurvedic influences and novel combination of phytotherapy and zootherapy by a folk medicinal practitioner of Domar Upazila in Nilphamari District, Bangladesh. *Am J Ethnomed*. 2017;4(2):17.
72. Kaur S, Sabharwal S, Anand N, Singh S, Baghel DS, Mittal A. An overview of Tulsi (Holy basil). *Eur J Mol Clin Med*. 2020;7(7):2833-2839.
73. Aggarwal A, Mali RR. *Ocimum tenuiflorum* – A medicinal plant with its versatile uses. *Int J Rec Adv Sci Tech*. 2015;2(2):1-10.
74. Deore SL, Jaju PS, Baviskar BA. Simultaneous estimation of four antitussive components from herbal cough syrup by HPTLC. *Int Sch Res Notices*; c2014. 976264. DOI: 10.1155/2014/976264
75. Saini R, Sharma N, Oladeji OS, Sourirajan A, Dev K, Zengin G, *et al.* Traditional uses, bioactive composition, pharmacology, and toxicology of *Phyllanthus emblica* fruits: A comprehensive review. *J Ethnopharmacol*. 2022;282:114570. DOI: 10.1016/j.jep.2021.114570
76. Gaire BP, Subedi L. Phytochemistry, pharmacology and medicinal properties of *Phyllanthus emblica* Linn. *Chin J Integr Med*; c2014. DOI: 10.1007/s11655-014-1984-2
77. Singh E, Sharma S, Pareek A, Dwivedi J, Yadav S, Sharma S. Phytochemistry, traditional uses and cancer chemopreventive activity of Amla (*Phyllanthus emblica*): The sustainer. *J Appl Pharm Sci*. 2011;2(1):176-183.
78. Khatun A, Imam MZ, Rana MS. Antinociceptive effect of methanol extract of leaves of *Persicaria hydropiper* in mice. *BMC Complement Altern Med*. 2015;15:63.  
DOI: <https://doi.org/10.1186/s12906-015-0558-y>
79. Kabir H, Saha NC, Wirtz AL, Gazi R. Treatment-seeking for selected reproductive health problems: behaviours of unmarried female adolescents in two low-performing areas of Bangladesh. *Reprod Health*. 2014;11:54.  
DOI: 10.1186/1742-4755-11-54
80. Tasleem F, Azhar I, Ali SN, Perveen S, Mahmood ZA. Analgesic and anti-inflammatory activities of Piper nigrum L. *Asian Pac J Trop Med*. 2014;7S1:S461-S468.  
DOI: 10.1016/S1995-7645(14)60275-3
81. Verma SK, Jain V, Katewa SS. Blood pressure lowering, fibrinolysis enhancing and antioxidant activities of Cardamom (*Elettaria cardamomum*). *Ind J Biochem Biophys*. 2009;46:503-506.
82. Grover M. Ayurvedic and therapeutic significance of queen of spices, *Elettaria cardamomum* Maton (choti elaiichi). *World J Pharm Med Res*. 2021;7(8):290-300.