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Research Article

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Medicinal plants and formulations of a Unani folk medicinal practitioner of Bhola district, Bangladesh

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ABSTRACT

Unani form of traditional medicine is prevalent in Bangladesh, whose practitioners are known as Hakims. The objective of the present study was to document the medicinal plants and formulations of a Unani folk medicinal practitioner in Bhola district of the country. This type of practitioners are not registered and do not have training from established Unani colleges but practice on the basis of their own experience and study of available Unani treatises. The Hakim was observed to use a total of 38 plants distributed into 31 families in his formulations, some of which were simple and some exceedingly complex polyherbal formulations. The Hakim treated a wide variety of diseases including helminthiasis, fever, respiratory tract disorders, bleeding from nose and mouth, gastrointestinal disorders, weakness of nerves, cuts and wounds, skin disorders, loss of memory, leprosy, paralysis, rheumatism, piles, toothache, diabetes, hoarseness of voice, burns, decreased urinary output, swellings of hands or legs, kidney and gall bladder stones, liver and spleen disorders, pain, jaundice, sexual disorders, snake bite, leucorrhea, and hysteria. The use of multiple plants in formulations to treat diverse diseases suggests that the Hakim possessed a good knowledge of the medicinal properties of plants, both singly and in combination.

Key words: Ethnomedicine, Unani, folk medicine, Bhola, Bangladesh

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INTRODUCTION

The Unani system of medicine originated in Greece, and Hippocrates is credited with being the father of this system of medicine. It gained popularity among Arab and Persian physicians in the 9th century and was introduced into India by the Arabs. Unani medicine maintains that there are four 'humors', namely Dam (blood), Balghum (phlegm), Safra (yellow bile) and Sauda (black bile) in the body. Disease is a natural process caused by imbalance of the humors, and the body regains its healthy state through a balance of the humors. Pharmacotherapy or the administration of plants (also sometimes animal parts and minerals) is resorted to as one of the methods to restore the balance of the humors. At present, Unani medicine is practiced in the Indian sub-continent countries of India, Pakistan and Bangladesh, the practitioners being known as Hakims or Hekims. All three countries have Unani colleges and Unani formularies along with Unani medicine manufacturers, who manufacture Unani medicines according to prescribed formularies.

Traditional medicine in Bangladesh is a unique blend of different ethnomedicinal influences [1]. There are established traditional medicinal systems like Ayurveda, Unani and homeopathy with their well-defined formularies

and medical colleges. Side by side exists folk medicine and tribal medicine, where folk medicinal practitioners (Kavirajes) and tribal medicinal practitioners conduct their individual practices based on the practitioners own experiences and/or tribal customs, which experiences or customs are usually passed on from generation to generation, with each generation adding to the medicinal knowledge. Folk medicinal practitioners, in turn, can be influenced by Ayurveda or Unani, not by going through the respective colleges, but reading a few books on their own, and then combining Ayurveda or Unani systems with their own individualized formulations. As such, many Kavirajes and Hakims exist within Bangladesh, who are not registered Ayurveda or Unani college graduates, but claim themselves to be Kavirajes or Hakims based on whether their methods of practice has been influenced by Ayurveda or Unani. Such practitioners can be called variations of folk medicinal practitioners, because they do not dispense formulary-wise and Government approved manufactured Ayurveda or Unani medicines, but base their preparations on their claims of what is Ayurveda or Unani methods.

To realize the full potential of traditional medicinal systems of Bangladesh, it is of interest to conduct surveys among as many folk medicinal practitioners as possible, because the documentation of this highly individualistic style of selecting medicinal plants for treatment of a particular disease gives a better idea of the medicinal applications of a given plant species. Towards that, we had been conducting surveys among folk and tribal medicinal practitioners for a number of years [2-15]. The objective of the present survey was to document the medicinal plants and formulations of a folk medicinal practitioner, who called himself a Hakim and practiced in Bhola district in the southern part of Bangladesh.

EXPERIMENTAL SECTION

Prior informed consent was obtained from the Hakim, Md. Motassim Billah, age 42 years, practicing in Bhola Sadar of Bhola district, Bangladesh. The Hakim was fully informed of the nature of our visit and consent obtained to disseminate any information provided both nationally and internationally. Interviews were conducted during the first two months of 2014 in Bengali language, which was spoken by both the Hakim as well as the interviewers. Actual interviews were conducted with the help of a semi-structured questionnaire and the guided filed-walk method of Martin [16] and Maundu [17]. In this method, the Hakim took the interviewers on guided field-walks through areas from where he collected his medicinal plants, pointed out the plants, and described their uses. Plant specimens were photographed, collected, pressed and dried and brought to Dhaka, where they were identified at the Bangladesh National Herbarium. Voucher specimens were deposited with the Medicinal Plant Collection Wing of the University of Development Alternative.

RESULTS AND DISCUSSION

The Hakim was observed to use a total of 38 plants distributed into 31 families in his various formulations. The total number of formulations was 36 containing one or more of the 38 plants. These various formulations were used for treatment of a diverse number of diseases or disorders, which included helminthiasis, fever, respiratory tract disorders, bleeding from nose and mouth, gastrointestinal disorders, weakness of nerves, cuts and wounds, skin disorders, loss of memory, leprosy, paralysis, rheumatism, piles, toothache, diabetes, hoarseness of voice, burns, decreased urinary output, swellings of hands or legs, kidney and gall bladder stones, liver and spleen disorders, pain, jaundice, sexual disorders, snake bite, leucorrhea, and hysteria. The results are shown in Table 1.

Both simple and several complex formulations were used by the Hakim. For treatment of asthma, dried leaves of *Justicia adhatoda* were advised by the hakim to be rolled and smoked as cigarettes. On the other hand, for treatment of all sorts of helminthic infestations, 5-7g leaves of *Andrographis paniculata*, 5-7g young leaves of *Lannea coromandelica*, 2-3g leaves and stems of *Leea crispa*, 2-3 fruits of *Piper nigrum*, and half spoon seeds of *Nigella sativa* were combined and powdered in a cast iron mortar and pestle and mixed with 10-12 ml of leaf juice of *Celsia coromandaliana*, 3-5 ml leaf juice of *Neolamarckia kadamba*, and 1-3g of powdered rhizome of *Curcuma longa*. The mixture was advised to be taken orally with water in the form of a sherbet after waking up in the morning. It is to be noted that the Hakim himself prepared all formulations and then gave the formulations to the patients.

The Hakim used the same plant in different manner to treat different diseases, and occasionally in the same manner to treat different diseases. For instance, 1.5-3 ml of fresh whole plant juice of *Centella asiatica* was advised to be orally taken to relieve constipation, to improve digestion, weakness of nerves, dysentery, to increase urine output, to reduce swelling of hands or legs, and to decrease spasms. In this case oral administration served to treat diseases as

diverse as constipation and weakness of nerves. On the other hand, paste of whole plant was advised to be topically applied for leprosy, cuts and wounds, and facial skin fracture. One complex formulation for blood purification, and treatment of scabies, eczema, itches, joint pain, rheumatism, piles included 15 different plant parts with other ingredients like sugar and honey.

In the Unani system of medicine, *Andrographis paniculata* (see Serial No. 1, Table 1 for a polyherbal formulation containing leaves of this plant for treatment of helminthic infections) is considered aperient, emollient, astringent, diuretic, emmenagogue, gastric tonic, and carminative [18]. The Hakim used the plant along with other plants for helminthiasis. It was therefore of interest to compare some of the uses of the various plant species used by the Hakim in this polyherbal formulation with other ethnomedicinal use reports. In traditional Indian medicine, the plant is used for helminth infestations [19]. The Deb barma clan of the Tripura tribe of Moulvibazar district, Bangladesh uses the plant against malaria [20]. The Tharu tribes of Dudhwa National Park, India use the plant against fever and anorexia [21]. The tribals of Mayurbhanj district of Orissa, India, use the plant to cure warts [22]. In Sheopur district of Madhya Pradesh, India, the plant is used to treat stomach disorders and cholera [23]. In Rajouri-Poonch districts of Jammu and Kashmir State, India, the plant is used to treat kidney disorders [24]. The plant is used for treatment of snake bite and scorpion sting by the Malayali tribes of Yercaud Hills, Salem district, Tamil Nadu, India [25]. Ethnic people of Dindori district, Madhya Pradesh, India, use *Andrographis paniculata* against malarial fever, general fever, and intestinal worms [26].

A second plant in the polyherbal formulation against helminthiasis, *Lannea coromandelica*, is used in various villages of Kurigram district, Bangladesh against chronic dysentery [27]. The tribals of Koraput district, Orissa, India, use the plant to treat dysentery caused from indigestion [28]. Gum of the plant is used by ethnic people of Dindori district, Madhya Pradesh, India against diarrhea and dysentery [26]. Leaf juice is used in cuts in several districts of Nepal [29]. The plant is used against swelling caused by snake bite in Vizianagaram district, Andhra Pradesh, India [30]. Leaf paste is used for body pains and inflammation by Malayali tribals in Kolli Hills of Tamil Nadu, India [31]. Ethnic groups in Khammam district, Andhra Pradesh, India use the bark of the plant for wound healing [32]. In Tangail district, Bangladesh, the bark of the plant is used against peptic ulcer [33].

The third plant used by the Hakim in the polyherbal formulation against helminthiasis was *Leea crispa*. Local people of Amarkantak region, Madhya Pradesh, India, uses leaf paste of the plant to treat wounds [34]. The Oraon tribe in West Dinajpur in West Bengal State, India, uses roots to treat body pain and swellings [35]. Root is chewed to treat dental caries in Banke district, Nepal [36]. Pounded leaves of the plant are used externally to treat wounds; crushed tuber is taken as anthelmintic in Meghalaya, India [37].

The fourth plant in the polyherbal formulation against helminthiasis was *Piper nigrum*. Dried seeds of the plant are reportedly taken orally against throat infections by the tribes in Madurai district of Tamil Nadu, India [38]. Fruits are used with other plants by the Kurichyas tribals of Kannur district, Western Ghats, Kerala, India, to treat stomach ulcers, bronchitis, and coughs [39]. The Tai-Khamyangs of Assam, India, use fruits of the plant along with other plants for treatment of internal bleeding as a consequence of bone fracture, fever with cold, gynecological disorders, melina, pneumonia, and retention of urine [40]. Leaf juice of *Solanum surattense* along with seeds of *Piper nigrum* is used in northern part of Nara desert, Pakistan, to treat joint pains [41]. The fruits of the plant are used against gastrointestinal problems by villagers in Gingee Hills in Villupuram district, Tamil Nadu, India [42]. Seeds are taken orally to reduce throat infections, colds, and coughs by tribals in Chitteri Hills, India [43]. Fruits of the plant are used with *Achyranthes aspera* by tribals in Pratapgarh, Rajasthan, India, to treat piles [44].

The fifth plant used by the Kaviraj in the polyherbal formulation was *Nigella sativa*. The local people of Kangra Valley, Himachal Pradesh, India, consider the seeds of the plant as diuretic and diaphoretic [45]. In Bhopal district, India, seeds are used to treat stone diseases [46]. The Kanuris tribals of northeastern Nigeria use the plant to treat diabetes and hypertension [47]. In East Anatolia, Turkey, the seeds are considered anthelmintic [48]. In villages of Chuadanga and Jhenaidah districts of Bangladesh, seeds are used by folk medicinal practitioners to treat infertility in women [12]. Seeds are used to treat rabies, toothache, and blood dysentery by folk medicinal practitioners in Daudkandi sub-district of Comilla district, Bangladesh [49].

Table 1. Medicinal plants and formulations of the Hakim of Bhola district, Bangladesh

Serial Number	Scientific Name	Family Name	Local Name	Parts used	Disease, Symptoms, Formulations, and Administration
1	*Andrographis paniculata* (Burm. f.) Wall. Nees	Acanthaceae	Kalomegh	Leaf	All sort of helminthic infections. 5-7g leaves of *Andrographis paniculata*, 5-7g young leaves of *Lannea coromandelica*, 2-3g leaves and stems of *Leea crispa*, 2-3 fruits of *Piper nigrum*, and ½ spoon seeds of *Nigella sativa* are combined and powdered in a cast iron mortar and pestle and mixed with 10-12 ml of leaf juice of *Celsia coromandaliana*, 3-5 ml leaf juice of *Neolamarckia kadamba*, and 1-3g of powdered rhizome of *Curcuma longa*. The mixture is taken orally with water in the form of a sherbet after waking up in the morning.
2	*Justicia adhatoda* L.	Acanthaceae	Bashok	Whole plant, leaf, bark	Fever, shivering, respiratory difficulties. 2-3g dried whole plant and powdered leaves are taken orally with decoction of double the amount of leaves and bark. Asthma. Dried leaves are smoked as a cigarette. Bleeding from nose and mouth. Leaf juice is orally taken.
3	*Lannea coromandelica* (Houtt.) Merr.	Anacardiaceae	Kaulfa	Young leaf	See *Andrographis paniculata*.
4	*Centella asiatica* (L.) Urban	Apiaceae	Aadmukni	Whole plant	To relieve constipation, to improve digestion, weakness of nerves, dysentery, to increase urine output, to reduce swelling of hands or legs, to decrease spasms. 1.5–3 ml of fresh whole plant juice is orally taken. Alternately, 0.5-1g dried whole plant is soaked in 1 glass of water and then orally taken. Leprosy, cuts and wounds, facial skin fracture. Paste of whole plant is topically applied.
5	*Acmella oleracea* (L.) R.K. Jansen	Asteraceae	Akor korha	Root	To clear brain, brain disorder due to tobacco, loss of memory, paralysis, toothache, chest pain. 2-3g root is taken orally on a regular basis.
6	*Oroxylum indicum* Vent.	Bignoniaceae	Sona pata	Leaf	Blood purification, scabies, eczema, itches, joint pain, rheumatism, piles. 80g leaves of *Oroxylum indicum*, 60g bark of *Pterocarpus santalinus*, 60g bark of *Santalum album*, 60g root of *Smilax china*, 60g flowers of *Rosa damascena*, 40g bark of *Cinnamomum verum*, 40g fruits of *Piper cubeba*, 40g leaves of *Borago officinalis*, 20g skin of fruits of *Terminalia bellirica*, 40g *Polypodium vulgare* whole plant, 40g resin of *Shorea robusta*, 10g skin of fruits of *Terminalia chebula*, 15g fruits of *Terminalia citrina*, 20g rhizome of *Nardostachys jatamansi*, and 40g stems of *Cuscuta reflexa* are crushed and powdered in a cast iron mortar and pestle followed by straining the mixture. 900g honey and 1 kg sugar (preferably mishri or crystalline sugar) is boiled in water and the strained mixture is added to the water and cooled. 2-3 spoonfuls of the decoction are taken 2-3 times daily.
7	*Borago officinalis* L.	Boraginaceae	Gao joban	Leaf	See *Oroxylum indicum.*
8	*Terminalia bellirica* (Gaertn.) Roxb.	Combretaceae	Bohera	Fruit skin	Hoarseness of voice. Skin of fruits of *Terminalia bellirica* are taken orally with fruits of *Piper nigrum*, butter, and salt prepared from sea water. To increase memory and eye sight. Powdered skin of fruits is mixed with water and taken orally. Loss of appetite, to increase digestion. 5-7g skin of fruit is orally taken. See *Oroxylum indicum.*
9	*Terminalia chebula* Retz.	Combretaceae	Horitoki	Fruit	Piles, constipation, indigestion, weakness of liver, to increase memory and eye sight, loose stool. 5-7g of dried and powdered fruit is taken orally with water or any other liquid. See *Oroxylum indicum.*
10	*Terminalia citrina* Roxb. ex Fleming	Combretaceae	Jongli horitoki	Fruit	See *Oroxylum indicum.*
11	*Kalanchoe pinnata* (Lam.) Pers.	Crassulaceae	Pathorkuchi	Leaf	Kidney and gall bladder stones. 4-5 crushed leaves of *Kalanchoe pinnata* are taken orally with 5-6 fruits of *Piper nigrum* and mishri (crystalline sugar).
12	*Coccinia grandis* (L.) Voigt	Cucurbitaceae	Kola kochu	Whole plant, leaf, root, seed	Gastric troubles, to improve brain function, spleen disorders, to reduce burning sensations in body, to reduce sugar in urine (diabetes). 25-50 ml of whole plant juice is orally taken. Alternately, dried leaves and bark of roots are orally taken with 3-10g water or honey. Alternately, 1-2g seeds are taken directly or with water or with honey orally. Skin infections, abscess, burns. Paste of whole plant is applied topically with ghee (clarified butter).
13	*Cuscuta reflexa* Roxb.	Cuscutaceae	Swarna lota	Whole plant	Pain, sprain, injury. Paste of whole plant is topically applied. Jaundice. 3-5g whole plant juice is taken orally 2-3 times daily. To maintain healthy kidneys. Whole plant juice is orally taken. See *Oroxylum indicum.*
14	*Shorea robusta* Gaertn.	Dipterocarpaceae	Osh, Maghrebi	Resin	See *Oroxylum indicum.*
15	*Phyllanthus emblica* L.	Euphorbiaceae	Amloki, Amla	Fruit	To increase memory, to strengthen heart, to improve digestion, to improve loss of appetite. Fresh fruits (1 kg) are soaked in water within a vessel for 2-3 days. The water is changed daily. After 2-3 days, the fruits are boiled in water containing 1 kg sugar (sugar syrup). The following day, the fruits are again boiled in sugar syrup over a low fire. 2-3 fruits are taken daily orally. To increase urination, gastric troubles, vomiting, excessive thirst. 3-12g of unripe fruit is orally taken with sugar.
16	*Astragalus gummifer* Labill.	Fabaceae	Katira	Gum	See *Ficus benghalensis*.

17	*Pterocarpus santalinus* L. f.	Fabaceae	Rokto chandan	Bark	See *Oroxylum indicum.*
18	*Cinnamomum verum* J. Presl.	Lauraceae	Dar chini	Bark	See *Oroxylum indicum.*
19	*Leea crispa* L.	Leeaceae	Mochka lota	Leaf, stem	See *Andrographis paniculata*.
20	*Aloe barbadensis* Miller	Liliaceae	Ghritokumari	Leaf pulp	To increase appetite and digestion, burning sensations in spleen. 7-12g leaf pulp is taken orally on a regular basis.
21	*Ficus benghalensis* L.	Moraceae	Bot	Sap	Swelling of armpits, abscess, cracking of feet. A cotton swab is soaked in sap and then applied topically. Low semen density, premature ejaculation, nocturnal emissions. Several drops of sap of *Ficus benghalensis* along with 3-5g young stems of the same plant and 5-10g of aerial roots of the same plant are mixed with honey, sugar, and 'katira gum' (gum obtained from *Astragallus gummifer*) and taken orally.
22	*Moringa oleifera* Lam.	Moringaceae	Sojna	Root, fruit	Kidney or gall bladder stones. 5-10g root juice is taken with cow milk orally. To increase appetite, gastric trouble, stomach disorders. Fruits pickled in vinegar are orally taken.
23	*Piper cubeba* L.	Piperaceae	Kabab chini	Fruit	See *Oroxylum indicum.*
24	*Piper nigrum* L.	Piperaceae	Gol morich	Fruit	See *Cynodon dactylon*. See *Terminalia bellirica*. See *Kalanchoe pinnata*. See *Andrographis paniculata*.
25	*Cynodon dactylon* (L.) Pers.	Poaceae	Durba	Whole plant	To increase urination, coughs and coming of blood with coughs. 7-12g whole plants of *Cynodon dactylon* are combined with several fruits of *Piper nigrum*, honey and mishri (crystalline sugar) and made into a paste, which is taken orally. To reduce swellings, to stop bleeding from external cuts and wounds, pain. Crushed whole plant is topically applied.
26	*Saccharum officinarum* L.	Poaceae	Aakh	Stem juice	See *Citrus aurantifolia*.
27	*Polypodium vulgare* L.	Polypodiaceae	Bos fayez	Whole plant	See *Oroxylum indicum.*
28	*Nigella sativa* L.	Ranunculaceae	Kali jeera	Seed	See *Andrographis paniculata*.
29	*Rosa damascena* Mill.	Rosaceae	Gulab	Flower	See *Citrus aurantifolia*. See *Oroxylum indicum.*
30	*Neolamarckia kadamba* (Roxb.) F. Bosser	Rubiaceae	Kodom	Leaf	Acidity, helminthic infections. 3-5g of leaf juice is orally taken with water. See *Andrographis paniculata*.
31	*Citrus aurantifolia* (Christm.) Swingle	Rutaceae	Kagji lebu	Fruit	Liver and biliary disorders, vomiting or vomiting tendency, excessive thirst, excessive bile secretion. 450 ml vinegar obtained from juice of sugarcane (*Saccharum officinarum*) is mixed with 450 ml 'arak gulab' (water in which petals of *Rosa damascena* has been soaked), 450 ml fruit juice of *Citrus aurantifolia*, 150 ml water, and 3 kg sugar and the mixture boiled to obtain a syrup. 2-4 spoonfuls of the syrup are taken twice daily following mixing with water. See *Curcuma longa*.
32	*Citrus maxima* (Burm. f.) Merr.	Rutaceae	Jambura	Fruit	See *Curcuma longa*.
33	*Santalum album* L.	Santalaceae	Shet chandan	Bark	See *Oroxylum indicum.*
34	*Mimusops elengi* L.	Sapotaceae	Bokul	Flower, fruit, leaf, bark	To maintain healthy heart conditions. Flowers are regularly smelled. To strengthen teeth. Unripe fruits are chewed. Snake bite. Leaf paste is applied topically. Leucorrhea, low semen density. Powdered bark is mixed with water and taken in the form of sherbet.
35	*Celsia coromandeliana* Vahl.	Scrophulariaceae	Kukur muta	Leaf	See *Andrographis paniculata*.
36	*Smilax china* L.	Smilacaceae	Tope chini	Root	See *Oroxylum indicum.*
37	*Nardostachys jatamansi* DC.	Valerianaceae	Jata mangsi	Rhizome	See *Oroxylum indicum.*
38	*Curcuma longa* L.	Zingiberaceae	Holudi	Rhizome	Blocked nose, hysteria. Rhizomes dried over a fire are powdered and inhaled through the nose. Skin marks. Paste is topically applied. Pain. Paste is topically applied to painful areas with lime. Helminthic infections. 3g rhizome powder of *Curcuma longa* is taken orally with fruits of *Citrus aurantifolia* or fruits of *Citrus maxima* (the latter is better). See *Andrographis paniculata*.

The sixth plant used by the Hakim was *Celsia coromandeliana*. Roots of the plant have ethnomedicinal uses for treatment of goiter in Bangladesh [50]. The seventh plant used by the Hakim in his anthelmintic polyherbal formulation was *Neolamarckia kadamba* (also known as *Anthocephalus chinensis*). The Marakh sect of the Garo tribe in Mymensingh district, Bangladesh, uses stem bark of the plant against diabetes [51]. The Santal tribe residing in Thakurgaon district, Bangladesh, uses leaves of the plant against tumors [52]. The folk medicinal practitioners in

Vasu Bihar village, Bogra district, Bangladesh, use leaves against mouth wounds [53]. The tribals of Similipal Biosphere Reserve, Orissa, India, uses stem bark against eye inflammation and leaf juice against stomach pain [54].

The eighth and the last plant used by the Hakim in his anthelmintic polyherbal formulation was *Curcuma longa*. The plant is used to get relief from pain, flu and nasal congestions in northwest Pakistan [55]. Rhizomes are used on sprains in valley districts of Manipur, India [56]. Rhizomes are used against dysmennorhea in Kerala, India [57]. The plant is used against beetle bites by Malayali tribes of Yercaud Hills, Southern Eastern Ghats, salem district, Tamil Nadu, India [25]. The rhizomes are used for tonsils, inflamed joints and pain in northern part of Nara Desert, Pakistan [41]. In Uttara Kannada district of Karnataka, India, the plant is used for treatment of different types of wounds [58]. Rhizomes are used to counteract dyspepsia by the Jaintia tribes of Cachar Hills district of Assam, India [59]. Rhizomes are used to treat yellow fever, malaria, and typhoid fever in Ethiope Council Area of Delta State, Nigeria [60]. Rhizomes are used against jaundice by the Gond and Baiga tribals of Mandla district, Madhya Pradesh, India [61].

The ethnomedicinal analyses of various reports show that some of the plants used by the Hakim in his polyherbal anthelmintic preparation have reported ethnomedicinal uses against helminthiasis. These plants include *Andrographis paniculata* [19, 26], *Leea crispa* [37], and *Nigella sativa* [48]. Among the other plants used in the polyherbal preparation are plants which have ethnomedicinal uses against gastrointestinal disorders and which plants include *Andrographis paniculata* [23], *Lannea coromandelica* [26, 28, 33], *Piper nigrum* [39, 42], *Nigella sativa* [49], *Neolamarckia kadamba* [54], and *Curcuma longa* [59].

Gastrointestinal disorders can arise from helminthiasis or from oral partaking of *Andrographis paniculata*. Interestingly, among the plants mentioned in the Bangladesh National Formulary of Unani Medicine [62], *Andrographis paniculata* is mentioned as a drug against helminthic infections. The medication is available in capsule or tablet form containing either 500 or 250 mg dried leaves of the plant containing at least 1% andrographolide. Adverse effects of the medication mentioned in the Formulary include allergy, stomach disorders, and vomiting tendency. Thus the Hakim may have included the other plants not only to offer a synergistic action against helminthic infestations, but also to counteract the gastrointestinal disorders that may be caused by *Andrographis paniculata*.

It is interesting that the Hakim did not follow the Unani Formulary with complete accuracy but improvised on the formulary. Although only one formulation has been analyzed in the Discussion, this holds true for the other formulations also. In fact, some of the plants used by the Hakim are not even mentioned in the Unani formulary, like *Lannea coromandelica*. This goes on to show that at least this Hakim made his own improvisation on the Unani formulary, and if the net effect desired by the Hakim was to reduce stomach disorders occurring from helminthiasis or other causes, he has other similar ethnomedicinal uses in his support. Overall, the formulations of the Hakim demonstrate a good knowledge of the medicinal properties of plants, which can be utilized by scientists to prepare both monoherbal and polyherbal preparations with more efficacy. In fact, it has been reported that dried leaves of *Justicia adhatoda* should be smoked to get relief from asthma [63], which was precisely the formulation of the Hakim. The Hakim's use of *Centella asiatica* to heal cuts and wounds has been scientifically validated in incision and burn wound models in animals [64]. The Hakim's use of *Kalanchoe pinnata* to treat kidney and gall bladder stones has also been scientifically validated [65]. Overall, it can be said that it is very much possible that scientists will be able to discover newer and better drugs following the leads of traditional medicinal practitioners.

CONCLUSION

Folk medicinal practitioners in Bangladesh often practice as Ayurvedic Kavirajes or Unani Hakims without obtaining proper accreditation from Ayurveda and Unani colleges. In their practice, they occasionally improvise on established Ayurvedic and Unani formulations. Scientific validation of these improvisations can be beneficial to patients and pave the way for discovering new drugs.

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