



ORIGINAL ARTICLES

Medicinal Plants Used by Folk Medicinal Practitioners of Six Villages in Thakurgaon District, Bangladesh

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Sanjoy Sarker, Syeda Seraj, Mohammad Mafruhi Sattar, Wahid Mozammel Haq, Majeedul H. Chowdhury, Ishtiaq Ahmad, Rownak Jahan, Farhana Jamal, Mohammed Rahmatullah: Medicinal Plants Used by Folk Medicinal Practitioners of Six Villages in Thakurgaon District, Bangladesh.

ABSTRACT

Folk medicinal practitioners, otherwise known as Kavirajes form an important component of the primary health-care system of Bangladesh. Almost every village of the 86,000 villages of the country has one or more practicing Kavirajes. Kavirajes also practice in the towns and cities; however, their patients mainly consist of the rural population of the country. The major distinction separating the Kavirajes from other forms of traditional medicinal practices of Bangladesh is their almost exclusive reliance on medicinal plants in their formulations, which are simple and mainly consist of plant juice, decoctions or pastes that is administered orally or topically depending upon the ailment. In previous ethnomedicinal surveys, we have observed considerable differences in the selection of medicinal plants for treatment of the same ailment among Kavirajes of even adjoining villages. Thus to get a comprehensive view of the medicinal plants used by the Kavirajes and their mode of use, one has to survey the Kaviraj population of Bangladesh. The objective of the present study was to conduct a survey among the Kavirajes of six villages, namely Akhanagar, Akcha, Goualia, Raipur, Uttar Thakurgaon, and Vungapara, which falls in Thakurgaon district in the northern part of the country. It was observed that a total of 110 plants were used by the Kavirajes, the plants being distributed into 63 families. Virtually all plant parts were used in treatments; however, leaves constituted 44.6% of the total uses. Other major plant parts used were whole plants (8.1%), roots (13.5%), fruits (10.8%), and stems (6.1%). The Kavirajes treated a wide variety of ailments. From the number of plants used (29), gastrointestinal disorders appeared to be the most common ailment treated. Respiratory tract disorders like cold, coughs and asthma were treated with 19 plant species, and fever was treated with 10 plant species. The Kavirajes had 11 plants for treatment of diabetes, 10 plants for pain in various forms, 10 plants for jaundice, 9 plants for treatment of urinary problems like dysuria or polyuria, and 8 plants for treatment of sex-related disorders. Other ailments treated by the Kavirajes included skin disorders, cancer, fungal infections, eye problems, cuts and wounds, burns, helminthiasis, paralysis, heart disorders, hypertension, alopecia, gout, rheumatism, debility, menstrual problems, cholera, hemorrhoids, gall bladder and kidney stones, snake bite, insect bite, rabies, epistaxis, mumps, chicken pox, and bone fractures. Since the Kavirajes' medicinal plant repertoire included plants which were used for treatment of diseases difficult to cure with modern allopathic medicine like cancer, diabetes, hypertension, and rheumatism, these plants merit further scientific studies towards discovery of new drugs, which can prove beneficial in the treatment of some major diseases affecting millions of people throughout the world.

Key words: Medicinal plants, folk medicine, Thakurgaon, Kaviraj, Bangladesh.

Introduction

Traditional medicinal practices exist in a number of countries of the world including the Indian sub-continent comprising the countries of Bangladesh, India and Pakistan. Among the various systems of traditional medicinal practices existing in Bangladesh, the major systems are Ayurvedic, Unani, homeopathy, and the folk medicinal system. Unlike the first three traditional medicinal practices, which have their defined procedures for diagnosis and treatment of diseases, folk medicine is practiced by practitioners, otherwise known as Kavirajes or Vaidyas, who rely almost exclusively on medicinal plants for treatment and to a great extent these selection of

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medicinal plants used for treatment depends upon the individual Kaviraj. Each Kaviraj keeps his knowledge of medicinal plants and formulations to himself and this knowledge is usually passed on from generation to generation within the family. As such, to obtain a comprehensive view of the medicinal plants used by the Kavirajes, one has to interview more or less all Kavirajes of the country. The Kavirajes usually practice in the rural areas and the 86,000 villages of Bangladesh almost all have one or more practicing Kavirajes, depending upon the village population. Kavirajes are also present in the towns and cities, where they are more frequented by slum dwellers and the poorer sections of the people, who cannot afford visits to allopathic doctors and purchase allopathic medicines. Quite a number of the practicing Kavirajes are known to treat diseases for which allopathic medicine has no known cure like cancer, rheumatism and diabetes. As such, many affluent people also visit the Kavirajes as a last resort when their diseases or conditions have been given up as untreatable by allopathic doctors.

Allopathic medicine has generally treated traditional medicinal practices with disdain because such practices lack the rigorous scientific procedures necessary to establish and market any allopathic drug. Traditional medicinal knowledge has always been based on centuries' year old experiences and which has been and still is dependent on the traditional medicinal practitioner's experiences with the plant kingdom. In recent years, recognizing the facts that not all diseases can be cured with allopathic medicine and that a number of allopathic drugs have serious side-effects and that a number of allopathic drugs have developed disease-resistant vectors, modern science is increasingly turning its attention to the plant kingdom as a potential source for future efficacious drugs. It is also recognized that many modern medicines are plant-based and have been discovered through carefully observing the traditional medicinal practices of indigenous people (Cotton, 1996). In fact, considering the more than 250,000 plant species that exist throughout the world, it may be confidently said that quite a number of these plants, which are yet to be scientifically studied, contains secondary metabolites or phytochemicals, which can form the basis of new medicines.

Bangladesh has over 5,000 floral species and many of them are in use by the Kavirajes in folk medicine. In our previous ethnomedicinal studies conducted among folk and tribal medicinal practitioners of the country, we have noticed considerable variation between the medicinal plants selected by different Kavirajes for treatment of a given ailment. This variation exists even between Kavirajes practicing in adjoining villages with identical flora. A number of these studies have been documented (Nawaz *et al.*, 2009; Rahmatullah *et al.*, 2009a-c; Hasan *et al.*, 2010; Hossan *et al.*, 2010; Mollik *et al.*, 2010a,b; Rahmatullah *et al.*, 2010a-g; Jahan *et al.*, 2011). The inescapable conclusion is that if one has to obtain a comprehensive picture of the medicinal plants used by the folk medicinal practitioners, then as many Kavirajes as possible need to be interviewed to learn about the diseases treated, medicinal plants used, and the formulations of their administration. The objective of the present study was to conduct an ethnomedicinal survey among the Kavirajes of six villages of Thakurgaon district, which lies in the northern region of Bangladesh.

Materials and Methods

The present survey was conducted among the Kavirajes of six villages of Thakurgaon district in the northern part of Bangladesh, namely Akhanagar, Akcha, Goualia, Raipur, Uttar Thakurgaon, and Vungapara. Each village (other than Raipur) had one practicing Kaviraj. Raipur had two practicing Kavirajes. The Kavirajes were Sree Jitendra Nath Barman (Akhanagar), Noidar Chan (Akcha), Mohammad Kafil Uddin (Goualia), Nepali Rani Barman (Raipur), Sree Harilal Barman (Raipur), Jagadish Chandra Barman (Uttar Thakurgaon), and Kalicharan Barman (Vungapara). Of the seven Kavirajes, six belonged to the Hindu religion, while one, Mohammad Kafil Uddin was Muslim. It may be mentioned in this regard that Kavirajes in Bangladesh, till recent times, belonged mostly to the Hindu religion.

Informed consent was obtained at first from the Kavirajes. All Kavirajes were informed thoroughly about the nature and purpose of our visit and consent obtained to disseminate their provided information both nationally and internationally. Interviews were conducted of the Kavirajes with the help of a semi-structured questionnaire and the guided field-walk method of Martin (1995) and Maundu (1995). In this method, the Kavirajes took the interviewers on guided field-walks through areas from where they collected their medicinal plants, pointed out the plants and described their uses. Interviews were conducted in the Bengali language, which was spoken by both interviewers and interviewees alike. All provided information was double-checked with the Kavirajes in later evening sessions. Plant specimens were collected and dried on the spot and brought

back to Dhaka to be identified at the Bangladesh National Herbarium. The ex-Curator and Principal Scientific Officer of the Bangladesh National Herbarium, Mr. Manjur-Ul-Kadir Mia also helped in the identification of plant samples.

Results and Discussion

The seven Kavirajes of the six villages surveyed in Thakurgaon district used 110 plant species distributed into 63 families for treatment of various diseases. The results are shown in Table 1. Major families contributing plant species towards treatment of various diseases included the Apocynaceae, Combretaceae, Euphorbiaceae, Fabaceae, Moraceae, Piperaceae, and Poaceae families (Table 2). Some plant families like the Berberidaceae, Loranthaceae, and the Urticaceae family plants were not usually observed to be used by other Kavirajes in other regions of Bangladesh (see our earlier reports, References above). The large number of plant species used for treatment of diseases testified to the Kavirajes' knowledge of the medicinal properties of plants growing within the surveyed area. As mentioned earlier, the practice of the Kavirajes is generational; as a result, knowledge is accumulated over successive generations resulting in the formation of a large data base within the Kaviraj as to the medicinal properties of various plants growing within an extended area of the Kavirajes' habitat.

It was observed that virtually all parts of plants were used for treatment. Leaves constituted the plant part most frequently used, forming 44.6% of total uses. Leaves were followed by roots at 13.5% and fruits at 10.8%. Whole plants were used 8.1% of the time, while barks formed 9.5% of total uses. Other plant parts used included stems, flowers, seeds, plant sap, rhizome and gum. The results are shown in Table 3.

The mode of treatment of the Kavirajes was quite simple. In most cases juice would be extracted from the whole plant or plant part through macerating, crushing or boiling in water followed by administration of the juice either topically or orally, depending on the disease. Skin infections, cuts, wounds, burns or eye diseases usually had topical applications of plant parts; for other diseases, the mode of administration was mostly oral. With two exceptions, the Kaviraj used a single plant for treatment of a single disease. However, various parts from the same plant were observed to be used to treat different diseases. A single plant part also would be used for treatment of multiple diseases. To cite one instance of each, the bark of *Lannea coromandelica* was used for treatment of diabetes. The barks of *Mangifera indica* were used for treatment of diarrhea, while young leaves of the same plant were used for treatment of headache. The leaves of *Aloe barbadensis* were used for treatment of two highly different ailments like dysuria and constipation. The two instances where parts from multiple plants were used for treatment were a combination of fruits of *Piper longum*, seeds of *Piper nigrum* and rhizomes of *Zingiber officinale* for treatment of jaundice, and a combination of leaves of *Centella asiatica*, rhizomes of *Zingiber officinale* and fruits of *Piper nigrum* for treatment of cold.

Table 1: Medicinal plants used for treatment of various ailments by the seven Kavirajes of six villages surveyed in Thakurgaon district, Bangladesh.

Serial Number	Scientific Name	Family Name	Local Name	Utilize Part	Ailment
1	<i>Andrographis paniculata</i> (Burm. F.) Wall. ex Nees	Acanthaceae	Niltong, Kalomegh	Whole plant	Fever. Juice obtained from macerated whole plant is taken thrice daily up to 7 days.
2	<i>Justicia adhatoda</i> L.	Acanthaceae	Har baksha, Bashok	Leaf	Cold, fever, jaundice. 100g juice obtained from macerated leaves is taken orally with honey thrice daily for 7 days.
3	<i>Aloe barbadensis</i> Mill.	Aloaceae	Ghee kumari	Leaf	Dysuria (burning sensations during urination), constipation. Leaves are boiled in water. Two teaspoonful of the decoction is taken with sugar for 14 days.
4	<i>Achyranthes aspera</i> L.	Amaranthaceae	Dhanshari, Coscoria	Leaf	Abdominal pain. 3 ml juice obtained from crushed leaves is taken once daily for 7 days.
5	<i>Amaranthus spinosus</i> L.	Amaranthaceae	Kanta khorja	Root	Urinary problems (burning sensation during urination). Crushed roots are taken twice daily for 7 days.
6	<i>Lannea coromandelica</i> (Houtt.) Merr.	Anacardiaceae	Jiga	Bark	Diabetes. Bark is cut into small pieces and soaked overnight in water. The water is then taken 1-3 times daily.
7	<i>Mangifera indica</i> L.	Anacardiaceae	Aam	Young leaf, bark	Diarrhea, headache. Juice obtained from crushed bark is orally administered for diarrhea. Young leaves are mixed with salt and massaged on the forehead or eaten as remedy for headache.
8	<i>Polyalthia longifolia</i> (Sonn.) Thwaites (PL)	Annonaceae	Debdaru	Bark	Dysentery, itch, scabies. Decoction made from powdered bark is taken with honey for dysentery. Powdered bark is mixed with mustard oil and applied to affected

					areas as treatment for itch and scabies.
9	<i>Alstonia scholaris</i> (L.) R.Br.	Apocynaceae	Chatim gach	Stem, bark	Charu gha (scurvy) - local term indicating ulceration and sometimes accompanied by swellings of mouth, mouth ulcer. Sap obtained from stem is applied to affected area. Crushed bark is taken for mouth ulcer.
10	<i>Carissa carandas</i> L.	Apocynaceae	Koromcha	Leaf, fruit	Cold. Leaves are boiled in water to make a syrup, which is then taken twice daily for 7 days. Fruits are eaten when in season.
11	<i>Catharanthus roseus</i> (L.) G. Don	Apocynaceae	Noyon tara	Leaf, flower	Cancer, diabetes, fungal infection. Crushed leaves and flowers are boiled and the decoction taken twice daily for 9 days. Taking 2-3 leaves orally with water daily can control blood sugar.
12	<i>Holarrhena antidysenterica</i> (L.) Wall. ex A. DC.	Apocynaceae	Kutishwer	Bark, seed	Diarrhea. Juice obtained from macerated bark and seeds is taken twice daily with honey until cure.
13	<i>Nerium indicum</i> Mill.	Apocynaceae	Korobi	Leaf	Skin disorders. Crushed leaves are applied topically once daily for 10 days.
14	<i>Alocasia macrorrhizos</i> (L.) G. Don.	Araceae	Mana, Mankochu	Whole plant, leaf	Iron deficiency, vision problem, jaundice, constipation. For iron deficiency, vision problem and jaundice, leaves are cooked and eaten as vegetable. For constipation, whole plants are cooked and eaten as vegetable.
15	<i>Typhonium trilobatum</i> (L.) Schott	Araceae	Taka lai	Whole plant	Gastric problems (symptoms: formation of gas inside stomach). Whole plants are cooked and taken as vegetable.
16	<i>Areca catechu</i> L.	Arecaceae	Supari gach	Root	Toothache. Crushed root is mixed with salt and used for brushing teeth.
17	<i>Aristolochia indica</i> L.	Aristolochiaceae	Ishwar mul	Leaf, root	Allergy, skin disorders. Juice obtained from boiled leaves and roots is taken twice daily for 7 days.
18	<i>Calotropis procera</i> (Ait.) Ait.f.	Asclepiadaceae	Akondo	Leaf	Jaundice. Juice obtained from crushed leaves is taken twice daily till cure.
19	<i>Tagetes erecta</i> L.	Asteraceae	Gada phool	Leaf	Wounds. Paste made from crushed leaves is applied to wounds.
20	<i>Berberis asiatica</i> Roxb. ex DC.	Berberidaceae	Dar holdi	Root	Severe ulceration. Juice obtained from crushed roots is taken 1-2 times per week until cure.
21	<i>Bombax ceiba</i> L.	Bombacaceae	Shimul	Leaf, root	Sexual weakness. Leaves and roots are soaked in water overnight followed by drinking the water early in the morning. This is continued for 7 days.
22	<i>Heliotropium indicum</i> L.	Boraginaceae	Hatishur	Leaf	Conjunctivitis. A few drops of juice obtained from macerated leaves is topically applied to the eyes.
23	<i>Ananas comosus</i> (L.) Merr.	Bromeliaceae	Anarosh	Young leaf	Helminthiasis. Young leaves are chewed and the juice taken orally twice a week.
24	<i>Opuntia dillenii</i> (Ker-Gawl.) Haw.	Cactaceae	Monsha debi	Whole plant	Paralysis. Juice obtained from macerated whole plant is massaged onto the paralyzed area twice daily for 4 weeks.
25	<i>Carica papaya</i> L.	Caricaceae	Papay	Fruit	Fever, blood dysentery. 200 ml fruit juice is taken twice daily for 5 days.
26	<i>Mesua nagassarium</i> (Burm. F.) Kosterm.	Clusiaceae	Nageshwar	Flower	Fever. Flowers are soaked in water for 3 days and then the water taken.
27	<i>Terminalia arjuna</i> (Roxb. ex DC.) Wight & Arn.	Combretaceae	Arjun	Leaf, bark	Low sperm count, dysentery, heart disease. Barks are soaked in water and the water taken once daily on an empty stomach for 4 days for dysentery and 41 days for low sperm count. 50g powder obtained from dried leaves is taken with 20g sugar twice daily for heart disease.
28	<i>Terminalia belerica</i> (Gaertn.) Roxb.	Combretaceae	Bohera	Leaf, fruit	Coughs, indigestion. Leaves and fruits are boiled and the decoction taken thrice daily for 7 days.
29	<i>Terminalia catappa</i> L.	Combretaceae	Kath badam	Leaf	Skin disorder. Juice obtained from crushed leaves is applied topically.
30	<i>Terminalia chebula</i> Retz.	Combretaceae	Horitoki	Leaf	Fungal infection. Crushed leaf is boiled and the juice taken thrice daily for 8 days.
31	<i>Tradescantia</i>	Commelinaceae	Chakkhu ratan	Leaf	Blood purifier. Juice obtained from

	<i>zebrina</i> Heynh. ex Bosse				crushed leaves is taken early in the morning regularly for 7 days.
32	<i>Ipomoea fistulosa</i> Mart. ex Choisy	Convolvulaceae	Dhol kolmi	Leaf, flower	Peptic ulcer. Tablet made from 50g dried leaf powder and 20g dried flower powder is taken once daily for 14 days.
33	<i>Ipomoea mauritiana</i> Jacq.	Convolvulaceae	Vui kumra	Leaf, root	Sexual disorders. Juice from boiled leaves and roots is taken twice daily for 21 days.
34	<i>Ipomoea quamoclit</i> L.	Convolvulaceae	Berati phool	Whole plant	Wounds, burns. Paste made from whole plant is applied topically.
35	<i>Kalanchoe pinnata</i> (Lam.) Pers.	Crassulaceae	Heam kancha	Leaf	Cold, polyuria (excessive urination), abdominal pain. Juice obtained from crushed leaves is taken during common cold. For polyuria, 3-4 leaves are chewed in the morning and afternoon. For abdominal pain, leaf is chewed with salt.
36	<i>Coccinia grandis</i> (L.) J. Voigt	Cucurbitaceae	Telakuch pata	Leaf	Hypertension, diabetes. Juice obtained from crushed leaves is taken thrice daily for 7 days for hypertension. Leaves are chewed every morning to keep blood sugar under control during diabetes.
37	<i>Momordica charantia</i> L.	Cucurbitaceae	Usta	Leaf, fruit	Diabetes, cancer, headache, skin disorder. One teaspoonful of juice obtained from crushed leaves and fruits is taken daily for diabetes and cancer. For headache and skin disorder, boiled leaves are applied topically to head or skin.
38	<i>Cuscuta reflexa</i> Roxb.	Cuscutaceae	Alok lota	Stem	Jaundice. 2 ml juice obtained from macerated stems is taken twice daily for 4 days.
39	<i>Dillenia indica</i> L.	Dilleniaceae	Chalta	Leaf	Sex stimulant. 25 ml juice obtained from crushed leaves is taken once daily for 15 days.
40	<i>Croton bonplandianum</i> Baill.	Euphorbiaceae	Bishollo koroli	Leaf	Burns. Paste prepared from leaves is applied topically.
41	<i>Euphorbia tirucalli</i> L.	Euphorbiaceae	Dudh zaron	Leaf	Cancer, coughs. Juice obtained from macerated leaves is taken once daily for cancer and twice daily for coughs.
42	<i>Phyllanthus emblica</i> L.	Euphorbiaceae	Amloki	Leaf, bark, fruit	Alopecia, indigestion. Decoction of crushed leaves, roots and bark is taken thrice daily for 14 days.
43	<i>Ricinus communis</i> L.	Euphorbiaceae	Venna gach	Leaf, fruit	Pain, inflammation. Juice obtained from macerated leaves and fruits is slightly warmed and applied to affected areas.
44	<i>Tragia involucrata</i> L.	Euphorbiaceae	Bischatu	Leaf, root	Diabetes. Small pieces of leaves and roots are soaked in water overnight and the water taken the following morning. This is continued for a long time.
45	<i>Abrus precatorius</i> L.	Fabaceae	Josthi modhu	Leaf	Cold, coughs. One ounce juice obtained from crushed leaves is taken daily till cure.
46	<i>Clitoria ternatea</i> L.	Fabaceae	Aparajita	Leaf, root	Burns, pimples. Juice obtained from crushed leaves and roots is applied topically.
47	<i>Mimosa pudica</i> L.	Fabaceae	Lojjaboti	Root	Jaundice. 50g crushed root is taken twice daily for 30 days.
48	<i>Mucuna pruriens</i> (L.) DC.	Fabaceae	Shoashing, Alkushi	Seed	Sexual problems, gout. Crushed seed powder is taken (3-4 teaspoonful) for 10 days.
49	<i>Senna alata</i> (L.) Roxb.	Fabaceae	Borno chondal	Root	Liver diseases. Juice obtained from crushed roots is taken with honey 1-2 times daily till cure.
50	<i>Leucas indica</i> L.	Lamiaceae	Dulfi	Leaf	Gout. Leaves are cooked and taken as vegetable for 2 days.
51	<i>Mentha arvensis</i> L.	Lamiaceae	Pudina	Leaf	Dysentery, indigestion. Juice obtained from crushed leaves is taken thrice daily for 7 days.
52	<i>Ocimum gratissimum</i> L.	Lamiaceae	Tulshi	Leaf, root	Coughs, antibiotic. Juice obtained from a combination of macerated leaves and roots is considered antibiotic. Juice obtained from crushed roots is taken with honey for coughs.
53	<i>Cinnamomum verum</i>	Lauraceae	Kabak chini	Leaf, stem	Arthritis (joint pain). Juice obtained from

	J.Presl.				macerated leaves and stems is applied to affected areas twice daily for 7 days.
54	<i>Litsea glutinosa</i> (Lour.) C.D.Robins.	Lauraceae	Pipulti, Khara jora gach	Leaf, fruit	Burning sensations during urination. Juice obtained from a combination of crushed leaves and fruits is taken twice daily for 1 week. To increase physical strength, constipation. Leaves are boiled in water followed by straining the water. The water is taken every morning for 21 days.
55	<i>Leea macrophylla</i> Roxb. ex Hornem	Leeaceae	Hati kana	Leaf, root	Rheumatism. Paste prepared from crushed leaves and roots are applied to affected areas.
56	<i>Asparagus racemosus</i> Willd.	Liliaceae	Shotomul	Leaf, root	Debility (in case of males). Leaves and roots are boiled together and the decoction taken twice daily for 14 days.
57	<i>Urginea indica</i> Kunth.	Liliaceae	Bon piyaz	Leaf, fruit	Rheumatism, acidity, dysentery. Juice obtained from macerated leaves is slightly warmed and applied to affected areas twice daily for 4 days for rheumatism. Juice obtained from macerated leaves and fruit is taken on an empty stomach thrice daily for 14 days for acidity and dysentery.
58	<i>Dendrophthoe falcata</i> (L.f) Etting.	Loranthaceae	Manda	Leaf, bark	Skin diseases, asthma, menstrual problems. Leaf paste is used for skin diseases. Juice obtained from squeezed bark is taken for asthma and menstrual problems.
59	<i>Lygodium flexuosum</i> (L.) Sw.	Lygodiaceae	Shangi var	Whole plant	Lower back pain. Juice obtained from macerated whole plant is applied topically.
60	<i>Punica granatum</i> L.	Lythraceae	Dalim	Bark	Dysentery. About 100g bark is grinded, mixed with salt and water and taken twice daily for 7 days.
61	<i>Sida acuta</i> Burm. f.	Malvaceae	Boirally	Leaf	Dysuria (burning sensations during urination). Juice obtained from crushed leaves is taken with honey twice daily for 3 days.
62	<i>Azadirachta indica</i> A. Juss.	Meliaceae	Neem	Stem	Toothache. Young stems are crushed and applied to tooth.
63	<i>Stephania japonica</i> (Thunb.) Miers	Menispermaceae	Cherakee	Leaf	Sexual problems. 100g juice obtained from crushed leaves is taken orally with honey till cure.
64	<i>Tinospora crispa</i> (L.) Hook.f. & Thoms.	Menispermaceae	Gorincha	Leaf	Fever, diabetes, cholera. Leaves are boiled in 3 glasses of water for 20 minutes. ½ glass of the decoction is taken thrice daily before meals.
65	<i>Artocarpus heterophyllus</i> Lam.	Moraceae	Kathal	Gum	Dry cracked heels, hemorrhoids. Gum is applied to affected areas.
66	<i>Ficus benghalensis</i> L.	Moraceae	Bot	Sap	Kidney pain. Sap is taken with one teaspoonful of honey for a week.
67	<i>Ficus hispida</i> L.f.	Moraceae	Joggo dumur gach	Leaf, fruit	To keep healthy, diabetes. Crushed leaves and fruits are taken to keep healthy. Fruits are taken for diabetes.
68	<i>Ficus racemosa</i> L.	Moraceae	Dumra	Fruit	Jaundice, diabetes. Fruits are cooked with mustard oil and taken as vegetable.
69	<i>Ficus rumphii</i> Blume	Moraceae	Ashok, Pakur	Bark	Hematuria (passing of blood with urine). Juice obtained from crushed bark is taken with honey.
70	<i>Streblus asper</i> Lour.	Moraceae	Shaora gach	Leaf	Fever. ½ cup of juice obtained from squeezed leaves is taken twice daily for 5 days.
71	<i>Moringa oleifera</i> Lam.	Moringaceae	Sajna gach	Leaf	Diabetes, acidity, hypertension. Juice obtained from macerated leaves is taken until cure.
72	<i>Musa sapientum</i> L.	Musaceae	Aita kola	Young leaf	Diarrhea, diabetes, blood purifier, coughs, dysentery, insect bite. Juice obtained from macerated young leaves is taken for diarrhea, dysentery, diabetes, coughs, and as a blood purifier. Crushed young leaves are applied topically to insect bites.
73	<i>Psidium guajava</i> L.	Myrtaceae	Piyara gach	Leaf	Menstrual problems. Juice obtained from

					crushed leaves is taken twice daily.
74	<i>Syzygium aromaticum</i> (L.) Merr. & L. M. Perry	Myrtaceae	Lobongo	Leaf, flower	Coughs, to increase mental strength. Crushed leaves and flowers are taken with honey for 7 days.
75	<i>Syzygium cumini</i> (L.) Skeels	Myrtaceae	Jaam	Leaf, bark, seed	Tooth caries, dysentery, diabetes, stone in kidney or penis. Leaves are mixed with salt and used to brush teeth during tooth caries. Crushed bark is eaten with honey for dysentery. Seeds are soaked in water overnight and the water taken the following morning for diabetes or stones in kidney or penis.
76	<i>Geodorum densiflorum</i> (Lam.) Schltr.	Orchidaceae	Shonkho muni	Whole plant	Meho (urinary problems arising from endocrinological disorders or diabetes). Juice obtained from crushed whole plant is mixed with honey and taken 2-3 times daily for a month.
77	<i>Averrhoa carambola</i> L.	Oxalidaceae	Kamranga	Fruit	Cold, cough, dandruff. For colds and coughs, 1-2 mature fruits are taken daily till cure. For dandruff, juice obtained from fruits is rubbed on head.
78	<i>Piper betle</i> L.	Piperaceae	Paan pata	Leaf	Sexual problems. Juice obtained from crushed leaves is taken with honey twice daily for 1 week.
79	<i>Piper chaba</i> W. Hunter	Piperaceae	Aishta pata	Leaf	Stone accumulation or formation in gall bladder, dysuria. Juice from crushed leaves is taken regularly till cure.
80	<i>Piper longum</i> L.	Piperaceae	Pipul	Fruit	Jaundice. A mixture of powdered <i>Piper longum</i> fruit, <i>Piper nigrum</i> seeds, and <i>Zingiber officinale</i> rhizome is taken orally.
81	<i>Piper nigrum</i> L.	Piperaceae	Gol morich	Fruit, whole plant	Cold. For common cold, the leaves of <i>Centella asiatica</i> are taken with rhizomes of <i>Zingiber officinale</i> and fruits of <i>Piper nigrum</i> . Jaundice. A mixture of powdered <i>Piper longum</i> fruit, <i>Piper nigrum</i> seeds, and <i>Zingiber officinale</i> rhizome is taken orally. Rabies, gastric problems, ulcer, dysentery. Whole plant is administered orally.
82	<i>Bambusa oldhamii</i> Munro	Poaceae	Bansh	Young stem	Cold. Young stems are cooked and eaten as vegetable.
83	<i>Cynodon dactylon</i> (L.) Pers.	Poaceae	Durba ghash	Leaf	To keep body healthy, to stop bleeding from external cuts and wounds. Juice from crushed leaves is taken to keep body healthy. Crushed leaves are applied to cuts and wounds to stop bleeding.
84	<i>Milium effusum</i> L.	Poaceae	Nol twin	Whole plant	Wounds. Juice from crushed whole plant is applied to wounds.
85	<i>Saccharum officinarum</i> L.	Poaceae	Kushul, Aakh	Stem juice	Indigestion. Preserved stem juice (2-3 years old) is taken orally.
86	<i>Vetiveria zizanioides</i> (L.) Nash	Poaceae	Binnar mura	Root	Epistaxis (nose bleed). Juice obtained from crushed roots is taken through nose.
87	<i>Drynaria quercifolia</i> (L.) J. Smith	Polypodiaceae	Ponkhi raj	Rhizome	Diarrhea, coughs. Juice obtained from crushed rhizomes is taken 2-3 times daily till cure.
88	<i>Eichhornia crassipes</i> (Mart.) Solms	Pontederiaceae	Kochuripana	Leaf, root	Fever. Juice obtained from macerated leaves and roots is taken twice daily for 7 days.
89	<i>Zizyphus mauritiana</i> Lam.	Rhamnaceae	Boroi	Leaf	Toothache. 100g leaf is boiled in water containing common salt and taken twice daily for 21 days.
90	<i>Anthocephalus chinensis</i> (Lam.) A. Rich. ex Walp.	Rubiaceae	Kodom	Leaf, bark	Fever. Juice obtained from macerated leaves and bark is mixed with honey and taken twice daily for 7 days.
91	<i>Ixora coccinea</i> L.	Rubiaceae	Langon	Root	Dysentery. Crushed roots are taken twice daily till cure.
92	<i>Paederia foetida</i> L.	Rubiaceae	Gondho vadal, Paad pata	Leaf	Indigestion. Leaves are cooked with salt like vegetable and taken once daily for 1 week.
93	<i>Aegle marmelos</i> (L.) Corr.	Rutaceae	Bel	Fruit	Dysentery, constipation, excessive bleeding during menstruation. Mature

					fruit pulp is mixed with water and sugar or honey and taken for 1 week.
94	<i>Santalum album</i> L.	Santalaceae	Shet chondon	Leaf, stem	Dysentery. Juice obtained from crushed leaves and stems is taken with honey once daily for 15 days.
95	<i>Mimusops elengi</i> L.	Sapotaceae	Bokul	Bark	Coughs, toothache. Juice obtained from macerated bark is orally administered for coughs. Bark is chewed for toothache.
96	<i>Scoparia dulcis</i> L.	Scrophulariaceae	Chini mitha	Leaf	Gastric problems, ulcer. Juice obtained from macerated leaves is taken orally for a considerable period of time.
97	<i>Smilax zeylanica</i> L.	Smilacaceae	Kumra khata	Whole plant	Sexual problems. Juice obtained from macerated whole plant is taken with honey 1-2 times per week.
98	<i>Capsicum frutescens</i> L.	Solanaceae	Ghiya morich	Fruit	Gastric problems, ulcer. Fruits are cooked and taken as vegetable for 15 days.
99	<i>Datura metel</i> L.	Solanaceae	Dhutra	Leaf, root	Coughs, mumps, chicken pox. 100g of leaf paste is mixed with 50g of mustard oil and massages on the chest thrice daily for 3 days for coughs. 30g dried and powdered root is mixed with 50g water and taken daily for 5 days for mumps. In case of chicken pox, 20g root paste is applied to pustules.
100	<i>Solanum torvum</i> Swartz	Solanaceae	Kontikari	Leaf, stem	To prevent chicken pox. One handful of leaves and stems is soaked in a glass of water and the water taken the following morning on an empty stomach.
101	<i>Solanum violaceum</i> Orteg.	Solanaceae	Tit baegun	Root, fruit	Snake bite, itches. For snake bite, juice obtained from macerated root is mixed with water and mustard oil and applied topically to bitten area. Crushed fruits are boiled with water and massaged onto affected areas for itches.
102	<i>Abroma augusta</i> L.f.	Sterculiaceae	Ulot kombol	Bark	Menstrual problems, meho (local term used by the Kavirajes denoting urinary problem arising from endocrinological disorder or diabetes). If too little blood comes out or there is pain during menstruation, juice obtained from macerated bark is mixed with black peppers and orally administered. The same application is followed for meho.
103	<i>Triumfetta rhomboidea</i> Jacq.	Tiliaceae	Golmorich chorchoria	Root	Irregular menstruation. Juice obtained from macerated roots is taken 2-3 times daily for 5 days.
104	<i>Centella asiatica</i> (L.) Urb.	Umbelliferae	Thankuni	Whole plant, leaf	Cold, rabies, gastric problems, ulcer, dysentery. For common cold, the leaves of <i>Centella asiatica</i> are taken with rhizomes of <i>Zingiber officinale</i> and fruits of <i>Piper nigrum</i> . For the rest, the whole plant is administered orally.
105	<i>Fleurya interrupta</i> Gaud.	Urticaceae	Bichuti	Root	Cold. Crushed roots are orally taken with honey twice daily for 5 days.
106	<i>Clerodendrum viscosum</i> Vent.	Verbenaceae	Vauti	Soft leaf	Jaundice, fever. 5-7 crushed leaves are mixed with honey and taken twice daily for 7 days.
107	<i>Vitex negundo</i> L.	Verbenaceae	Nishinda gach	Leaf	Debility, mosquito repellent. Juice obtained from crushed leaves is taken for debility. Leaves are burnt to repel mosquitoes.
108	<i>Cissus quadrangularis</i> L.	Vitaceae	Harjora	Whole plant	Bone fracture. 100g paste of whole plant is applied to the fractured area twice daily for 7 days.
109	<i>Diplazium esculentum</i> (Retz.) Sw.	Woodsiaceae	Dheki shak	Leaf, stem	Fever. Leaves and stems are cooked and eaten as vegetable.
110	<i>Zingiber officinale</i> Roscoe	Zingiberaceae	Ada	Rhizome	Cold. For common cold, the leaves of <i>Centella asiatica</i> are taken with rhizomes of <i>Zingiber officinale</i> and fruits of <i>Piper nigrum</i> . Jaundice. A mixture of powdered <i>Piper longum</i> fruit, <i>Piper nigrum</i> seeds, and

					<i>Zingiber officinale</i> rhizome is taken orally. Rabies, gastric problems, ulcer, dysentery. Whole plant is administered orally.
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Table 2: Plant families and number of plants per family.

Family	Number of plants	Family	Number of plants	Family	Number of plants
Acanthaceae	2	Crassulaceae	1	Oxalidaceae	1
Aloaceae	1	Cucurbitaceae	2	Piperaceae	4
Amaranthaceae	2	Cuscutaceae	1	Poaceae	5
Anacardiaceae	2	Dilleniaceae	1	Polypodiaceae	1
Annonaceae	1	Euphorbiaceae	5	Pontederiaceae	1
Apocynaceae	5	Fabaceae	5	Rhamnaceae	1
Araceae	2	Lamiaceae	3	Rubiaceae	3
Arecaceae	1	Lauraceae	2	Rutaceae	1
Aristolochiaceae	1	Leeaceae	1	Santalaceae	1
Asclepiadaceae	1	Liliaceae	2	Sapotaceae	1
Asteraceae	1	Loranthaceae	1	Scrophulariaceae	1
Berberidaceae	1	Lygodiaceae	1	Smilacaceae	1
Bombacaceae	1	Lythraceae	1	Solanaceae	4
Boraginaceae	1	Malvaceae	1	Sterculiaceae	1
Bromeliaceae	1	Meliaceae	1	Tiliaceae	1
Cactaceae	1	Menispermaceae	2	Umbelliferae	1
Caricaceae	1	Moraceae	6	Urticaceae	1
Clusiaceae	1	Moringaceae	1	Verbenaceae	2
Combretaceae	4	Musaceae	1	Vitaceae	1
Commelinaceae	1	Myrtaceae	3	Woodsiaceae	1
Convolvulaceae	3	Orchidaceae	1	Zingiberaceae	1

Table 3: Plants parts and their percentage uses in the various formulations of the Kavirajes.

Plant part	Percentage of use
Whole plant	8.1
Leaf	44.6
Stem	6.1
Root	13.5
Bark	9.5
Flower	2.7
Fruit	10.8
Seed	2.0
Sap	0.7
Rhizome	1.4
Gum	0.7

Occasionally plant juice or plant part would be mixed with sugar, salt or honey prior to oral administration, usually to make the juice more palatable, but also sometimes for additional therapeutic purposes. A decoction of leaves of *Aloe barbadensis* was advised to be taken with sugar. Powder prepared from dried leaves of *Terminalia arjuna* were also advised to be taken with sugar as treatment for heart disease. For treatment of abdominal pain, leaves of *Kalanchoe pinnata* were advised to be chewed with salt. Notably, abdominal pain can result from gas formation, which can be relieved by taking a little bit of salt (this is a common home remedy in Bangladesh). In this instance, the salt, besides making the leaves palatable can also serve a therapeutic purpose. Juice obtained from macerated leaves of *Justicia adhatoda* was prescribed to be taken with honey as treatment for cold, fever, and jaundice. Honey is usually considered a medicine by the Kavirajes, and is commonly advised to be taken for cold. The use of honey in this instance can serve a synergistic purpose on top of the effects of the leaf juice in relieving cold. In the case of fever and jaundice (when the body is weak), honey can also serve as a good source for energy.

A remarkable thing about the Kavirajes was their claim to have effective treatments for cancer, diabetes, and rheumatism. These are diseases for which allopathic medicine has no easy cure or no cure at all. The Kavirajes had no proper diagnostic procedures for cancer or diabetes. Any unusual or unexplainable swelling of any body part together with gradual wasting away of body was determined to be cancer. Diabetes was usually determined through report of frequent urination and sweet taste of urine. Cancer was treated with three plants, namely, *Catharanthus roseus*, *Momordica charantia*, and *Euphorbia tirucalli*. Diabetes was treated with eleven plants, namely *Lannea coromandelica*, *Catharanthus roseus*, *Coccinia grandis*, *Momordica charantia*, *Tragia involucrata*, *Tinospora crispa*, *Ficus hispida*, *Ficus racemosa*, *Moringa oleifera*, *Musa sapientum*, and *Syzygium cumini*. Irrespective of the lack of modern diagnostic procedures among the Kavirajes, it is interesting that out of the three plants used by the Kavirajes to treat cancer, scientific research has already shown the

anticancer activity present in two of the plants - *Catharanthus roseus* and *Momordica charantia* (Roepke *et al.*, 2010; Ray *et al.*, 2010). The antidiabetic activities of whole plants or plant parts of *Catharanthus roseus*, *Coccinia cordifolia*, *Momordica charantia*, *Tinospora crispa*, *Ficus racemosa*, *Moringa oleifera*, *Musa sapientum*, and *Syzygium cumini* have been also reported (Rasineni *et al.*, 2010; Islam *et al.*, 2009; Hafizur *et al.*, 2011; Sangsuwan *et al.*, 2004; Ahmed and Urooj, 2010; Jaiswal *et al.*, 2009; Adewoye *et al.*, 2009; Pandey and Khan, 2002). The scientific validation of medicinal plant usage by the Kavirajes indicate that folk medicinal knowledge is not only not to be ignored but modern science can benefit a lot through extensive investigation of the plants used by folk medicinal practitioners and their mode of usage. One further comment in this regard is that scientific studies are usually carried out with plant extracts; it is possibly time for scientific studies to be carried out with formulations as exactly used by the folk medicinal practitioners to get relevant results.

The Kavirajes were observed to use a number of plants for treatment of the same disease or symptoms. As pointed out earlier, eleven plants were used for treatment of diabetes. This was because all plants were not available throughout the year, or plant parts like fruits were highly seasonal. The versatility of the Kavirajes was also shown in the observation that they not only used wild plants in their treatment, but also many plants which were cultivated or which could be easily found to be grown as ornamental plants in various village homesteads. Examples of cultivated plants included *Mangifera indica*, *Carissa carandas*, *Alocasia macrorrhizos*, *Typhonium trilobatum*, *Areca catechu*, *Bombax ceiba*, *Ananas comosus*, *Carica papaya*, *Terminalia belerica*, *Terminalia chebula*, *Momordica charantia*, *Phyllanthus emblica*, *Mentha arvensis*, *Cinnamomum verum*, *Punica granatum*, *Azadirachta indica*, *Artocarpus heterophyllus*, *Moringa oleifera*, *Musa sapientum*, *Psidium guajava*, *Syzygium aromaticum*, *Syzygium cumini*, *Averrhoa carambola*, *Piper betle*, *Piper nigrum*, *Saccharum officinarum*, *Zizyphus mauritiana*, *Aegle marmelos*, *Capsicum frutescens*, *Centella asiatica*, and *Zingiber officinale*. Most of these plants were cultivated or grown in homesteads for their edible fruits; however, some were used as spices or vegetables. *Saccharum officinarum* was cultivated to obtain sugar and molasses, while a number of the people of Bangladesh have the habit of chewing *Piper betle* leaves with nuts from *Areca catechu*, especially after meals both as mouth freshener as well as a digestive aid.

Another interesting aspect of the Kavirajes of the surveyed villages in the present study was that they advised several plants or plant parts to be cooked and eaten as vegetable as remedy for several ailments. The leaves of *Alocasia macrorrhizos* were advised to be cooked and eaten as remedy for iron deficiency, vision problem, and jaundice. Notably, the plant is rich in iron as well as in vitamin A; the latter can prove beneficial as remedy for night blindness, a common problem in Bangladesh. Other plants or plant parts advised to be taken in the cooked form were *Typhonium trilobatum*, *Leucas indica*, *Ficus racemosa*, *Capsicum frutescens*, and *Diplazium esculentum*. *Leucas indica* was used as remedy for gout; the plant is extremely bitter and is eaten as a home remedy in the cooked form for alleviation of pain. In this case, the plant could be serving a similar purpose in alleviating pain arising from gout. One plant, namely, *Solanum torvum*, was observed to be used by the Kavirajes not for therapeutic purposes, but to serve as a preventive purpose to prevent chicken pox.

Scientific validation of medicinal plants used by the Kavirajes to treat cancer and diabetes suggest that other plants may be scientifically validated in their traditional uses, when examined for relevant bioactivities. In fact, *Justicia adhatoda*, a plant used by the Kavirajes to treat cold and fever has been shown to contain alkaloids, which exert a beneficial effect on inflammatory diseases (Chakraborty and Brantner, 2001); a bronchodilator alkaloid, vasicinone has also been reported to be present in the plant (Amin and Mehta, 1959). The scientific results suggest that the other medicinal plants used by the Kavirajes merit scientific attention for further studies leading to possible discovery of lead compounds and efficacious drugs. At the same time, considerable attention must be paid such that wild plants do not become endangered or extinct through inappropriate harvesting. Plants whose roots are used in folk medicine gets destroyed totally when the whole plant is uprooted to collect roots; as such if proper conservation efforts are absent these plants can quickly be lost. Thus a two-pronged approach is necessary - to conduct scientific studies on medicinal plants, and to spur conservation efforts of the same plants.

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