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Combination of Ayurveda and folk medicine: Plants and formulations of a traditional medicinal practitioner in Noakhali district, Bangladesh

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Abstract
Folk medicine is perhaps the most common form of traditional medicinal practices in Bangladesh for anybody can practice it without requiring formal training or registration. As such, practices of folk medicinal practitioners (FMPs) can be varied and can range from use of plants, animals and minerals to wearing amulets and uttering incantations for disease treatment. However, plants are most commonly used by FMPs and selection of plants for treatment of a particular disease can vary widely among FMPs. Thus documentation of the plants used by as many FMPs as possible is important for this documentation can help in scientific researches on any given plant leading to new drug discoveries. The objective of this study was to document the medicinal plants and formulations used by a FMP in Noakhali district, Bangladesh, who had a degree in Ayurveda (the traditional medicinal practice of the Indian subcontinent) but described himself as a FMP. The FMP used a total of 25 plants distributed into 17 families in his formulations. There were two interesting features in the FMPs formulations. First, the same plant or plant parts from the same plant was used to treat multiple diseases suggesting that the FMP was knowledgeable about different medicinal properties of different plant parts from the same plant. Second, the FMP was aware and described the toxicities due to over-dosage of some of his preparations and further advised when to avoid the formulations. Taken together, the formulations of this particular FMP represent a combination of two traditional medicinal systems, namely Ayurveda and folk medicine and so can be of interest to scientists searching for new medications.

Keywords: Ethnomedicine, Ayurveda, folk medicine, Noakhali, Bangladesh

Introduction
Ayurveda is a traditional form of medicine practiced in the Indian subcontinent and which dates back to possibly 5,000 years ago [1]. Ayurveda has a well-defined philosophy of causes and treatment of diseases as well as to maintain human body and health. Besides India, this system of medicine is also practiced in Bangladesh with Government registered colleges and Ayurvedic practitioners. Folk medicine on the other hand can be practiced by anybody in Bangladesh, who claims to know treatment methods for one or more diseases. This form of practice can take many forms, from using plants, animals and minerals in treatment to wearing amulets and uttering incantations. As such, the treatment methods of folk medicinal practitioners (FMPs) are diverse and there is no unified theory for the causation and treatment of diseases. FMPs are the most numerous group of traditional medicinal practitioners in Bangladesh and can be found in practically every village and town of the country. FMPs are in common with tribal medicinal practitioners (TMPs), the only difference between them being that FMPs practice among the mainstream population while TMPs practice among tribes.
A common feature between Ayurvedic practitioners, FMPs and TMPs is that plants form the mainstay of treatment by all three groups. The practices also occasionally overlap with folk medicine borrowing from Ayurveda or tribal medicine, as well as tribal medicine borrowing from folk medicine or Ayurveda [2, 3]. The result is a bewildering variety of treatment modes, which on the other hand presents the scientist with a vast opportunity to conduct further research with the plants and other components used by any given traditional practitioner of medicine to discover new drugs.
Documentation of traditional uses of medicinal plants is one of the quickest ways to isolation of phytochemicals from plants and finding out their therapeutic values.

As such, we had been conducting ethnomedicinal surveys among the folk and tribal medicinal practitioners of the country for several years [4-21]. The objective of the present survey was to document the therapeutic practices of a folk medicinal practitioner (FMP) in Noakhali district, who mixed elements of both folk and Ayurvedic medicinal practices in his formulations.

Materials and Methods

The survey was conducted in 2016 at Ramnagar village, which falls under Begumganj Police Station in Noakhali district of Bangladesh. The village had a folk medicinal practitioner (FMP), named Bijoy Govinda Chakraborty, male, age 62 years and practicing for 40 years. The FMP claimed to have learnt folk medicinal practices from his uncle, Nagendra Kumar Chakraborty. Interestingly, the FMP also was a graduate in Ayurveda degree from a Bangladesh Government approved Ayurveda College.

Prior Informed Consent was first obtained from the FMP. He was thoroughly apprised as to the nature of our visit and consent obtained to disseminate any information both nationally and internationally. Actual interviews were conducted in the Bengali language, which was spoken fluently by the FMP as well as the interviewers. The interviews were conducted with the help of a semi-structured questionnaire and the guided field-walk method of Martin [22] and Maundu [23]. In this method the FMP took the interviewers on guided field-walks through areas from where he collected his medicinal plants, pointed out the plants, and described their uses. All plant specimens were photographed and collected on the spot, pressed, dried and brought back to Bangladesh National Herbarium at Dhaka for identification, deposition, and obtaining accession numbers. However, accession numbers of three plants were not obtained because of their easy availability and being common plants. Voucher specimens were also deposited with the Medicinal Plant Collection Wing of the University of Development Alternative.

Results and Discussion

The FMP used a total of 25 plants distributed into 17 families in his formulations. The results are shown in Table 1. The plants were used to treat a variety of disorders like gastrointestinal ailments, hepatic disorders, respiratory disorders, rheumatoid arthritis, skin disorders, anemia, fever, diabetes, beriberi, piles, helminthiasis, pain, wounds, insect bites, eye disorder, bone fracture, allergy, hypertension, and hypercholesterolemia. The FMP used both monoherbal and polyherbal formulations in his treatment. He also used different parts of the same plant to treat different diseases showing that he possessed knowledge of the medicinal properties of different parts of the same plant.

Diabetes is a disorder, which has no cure. At best, antidiabetic medicines can reduce blood glucose levels. However, diabetic patients develop other more serious complications with time like cardiovascular disorders, kidney disorders, and vision problems. The FMP used a number of plants like *Aloe barbadensis*, *Eclipta alba*, *Cassia fistula*, *Mimosa pudica*, *Saraca asoca*, *Cinnamomum zeylanicum*, and *Emblica officinalis* to treat diabetes.

Table 1: Medicinal plants and formulations of the FMP from Noakhali district.

Serial Number	Scientific Name (Accession Number)	Family Name	Local Name	Parts used	Ailments and mode of medicinal use
1	*Adhatoda vasica* Nees (43396)	Acanthaceae	Bashok	Leaf, root	Diarrhea. Fifteen drops of leaf juice is taken orally twice a day. Jaundice. Fifteen drops of leaf juice is taken orally twice daily with one teaspoon of honey. Asthma. Roots are washed and dried and then burnt and the ash collected. Equal amounts of ash and honey are mixed and bottled. Half teaspoon of the mixture is licked and taken orally at bed time for 3-4 consecutive nights. This gives remarkable results without any adverse effects.
2	*Andrographis paniculata* (Burm.f.) Wall. Nees. (43402)	Acanthaceae	Kalomegh	Leaf, root, whole plant	Jaundice. Decoction of leaf and root is taken orally twice daily. No adverse effects. Liver disorders. !0 ml of decoction of whole plant is taken orally once daily. No adverse effects. Rheumatoid arthritis. Whole plant is dried and powdered. One teaspoon powder is added to a cup of warm water and taken orally twice daily. No adverse effects.
3	*Centella asiatica* (L.) Urb. (43409)	Apiaceae	Thankuni	Whole plant, leaf	Anemia. One teaspoon of whole plant extract is taken twice daily. To be avoided during pregnancy and breast feeding. Skin ulcer. Paste of whole plant and a small amount of water is topically applied to affected areas once daily. Excess use may cause nausea and headache. Coughs. Leaves are taken orally with ½ teaspoon honey once daily. Long-term use can cause liver problem.
4	*Asparagus racemosus* Willd. (43414)	Asparagaceae	Shotomul	Leaf, root tuber, root	Beriberi. One cup of raw leaves are consumed daily. Jaundice. 50 ml of root tuber juice is taken orally with 5 ml honey twice daily. Diarrhea. Small tuber root pieces are boiled in milk and 5 ml of the decoction is taken orally once daily. Dysentery. 2-3g of powdered roots are added to 120-130 ml goat's milk, stirred, and taken orally 2-3 times daily. A strict diet of rice and milk is recommended during this period. Consumption of leaves, root tubers, or roots may cause skin rashes or eczema but this will disappear in a few days. If these rashes cause irritation or pain, turmeric paste or *Aloe vera* leaf gel is to be rubbed on the affected areas of the skin.

					Asparagus racemosus should not be taken by persons with kidney diseases.
5	*Aloe barbadensis* Mill. (43413)	Asphodelaceae	Ghritokumari	Leaf	Arthritis. Two teaspoons of leaf gel is taken orally twice daily for 15 days. May damage the kidneys and cause blood in urine. Swellings. To one cup of hot water is added one teaspoon leaf gel. The mixture is topically applied to swellings. No adverse effects. Diabetes. One teaspoon of leaf gel is orally taken with water at every meal. To be avoided during pregnancy for it may cause uterine contractions resulting in miscarriage. Piles. Leaf gel is combined with sulfur and made into a paste, which is applied externally. No adverse effects.
6	*Eclipta alba* (L.) Hassk (43410)	Asteraceae	Kalokeshi	Leaf, whole plant	Diabetes. One cup of leaf decoction is taken orally with one teaspoon honey twice daily. Excessive taking of the decoction may cause genital itching and dryness. Piles. Steamed leaves are topically applied to piles during excessive pain. Ascaris infection. Whole plant juice is mixed with castor oil in a 2:1 ratio (v/v). 5 ml of the mixture is taken orally every morning on an empty stomach. Taking the mixture on a full stomach can result in vomiting.
7	*Oroxylum indicum* (L.) Vent.	Bignoniaceae	Sona pata	Leaf	See *Terminalia bellirica*.
8	*Terminalia bellirica* (Gaertn.) Roxb. (43391)	Combretaceae	Bohera	Fruit	Constipation, helminthiasis, appetite stimulant. Fruits of *Terminalia bellirica*, *Terminalia chebula* and *Emblica officinalis* and leaves of *Oroxylum indicum* are soaked in water overnight. One glass of the water is taken orally with a little amount of rock salt the following day in the morning and evening. No adverse effects.
9	*Terminalia chebula* Retz. (43397)	Combretaceae	Hortoki	Fruit	Anemia. Dried fruit powder and ghee (clarified butter) are heated together and mixed with honey. Two teaspoons are taken orally once daily. Not to be taken during pregnancy. Constipation. One fruit is taken orally daily. Note that fruits are not to be taken in excess if suffering from debility, depression, indigestion, and early stages of fever. Asthma. 2g of dried fruit is chewed and taken orally once daily at night. Piles. Two teaspoons of dried fruit powder is added to half a bucket of water and the buttocks are immersed in the water for 10 minutes before taking a bath. See *Terminalia bellirica*.
10	*Acalypha indica* L. (43386)	Euphorbiaceae	Muktajhuri	Whole plant, leaf	Arthritis. Paste of whole plant is made with salt and applied topically over affected areas once daily. Piles. Equal quantities of whole plant juice and castor oil are mixed and boiled till it becomes thick. The mixture is cooled and stored in a container. Two teaspoons of the mixture are taken orally with hot milk at bedtime for 5 consecutive days. It may cause intestinal irritation. Headache. Leaf juice is applied topically to scalp twice daily.
11	*Cassia fistula* L. (43404)	Fabaceae	Sonalu	Leaf, fruit, flower	Constipation. Leaves are grinded thoroughly in water and taken orally (one teaspoon) once daily with cooked rice. It may cause nausea and dizziness if taken in excess. Diabetes. Fruit pulp is mixed with a jug of water for 2 hours followed by drinking the water twice daily. Jaundice. One teaspoon of flower paste is taken orally once daily with one teaspoon honey. Joint pain. Fruit pulp is grinded with water and boiled on a low flame. This is then left for 2 hours followed by topical application on painful joints.
12	*Clitoria ternatea* L. (43405)	Fabaceae	Aparajita	Root	Recurrent fever. 1-2 teaspoon of root decoction is taken orally twice daily for a few days. No adverse effects. Chronic cough. Roots of *Clitoria ternatea* are mixed with 2-3 fruits of *Piper nigrum* and 7 leaves of *Ocimum sanctum* and boiled in a glass of water till the volume is reduced to half the original volume. The decoction is filtered and taken orally once daily for a few days. No adverse effects.
13	*Mimosa pudica* L. (43390)	Fabaceae	Lojjaboti	Leaf, whole plant	Diabetes. 30 ml of leaf juice is taken orally twice daily. May be toxic in overdose. Itching. Whole plant juice is mixed with sesame oil in a 4:1 ratio (v/v) and is applied topically over skin. Asthma. 15 ml of whole plant juice is taken orally daily for 15 days.
14	*Saraca asoca* (Roxb.) Willd. (43387)	Fabaceae	Ashok	Flower, bark	Dysentery. Flowers are added to a small amount of water and grinded to extract juice. 15 drops of the juice is taken orally once daily. No adverse effects.

					Irregular menstruation. Bark decoction is taken orally thrice daily. No adverse effects. Piles. 90g of bark is mixed with 360 ml of water, and 30 ml of milk. The mixture is boiled till volume is reduced to ¾ cup. It is taken orally once daily. No adverse effects. Diabetes. Juice is extracted from dried flowers after mixing them with a small amount of water. 15 drops of the juice is taken orally twice daily. No adverse effects.
15	*Hyptis suaveolens* (L.) Poit. (43394)	Lamiaceae	Tokma	Seed	Abscess. Seeds are soaked in water and then applied as poultice over the abscess once daily. No adverse effects.
16	*Ocimum sanctum* L. (43389)	Lamiaceae	Tulsi	Leaf	Itching, rashes. Leaf paste is topically applied to affected areas of skin once daily. Excess use may result in burning sensation. Sinusitis, headache. For sinusitis, two drops of leaf juice is put internally into both nostrils while on an empty stomach. During pregnancy, this is to be done only under medical supervision. For headache, leaf juice is taken orally once daily. See *Clitoria ternatea.*
17	*Cinnamomum zeylanicum* Nees. (43385)	Lauraceae	Daruchini	Bark, bark oil	Wounds, insect bites. 2-5 drops of bark oil is applied topically once. May cause burning sensations. To strengthen teeth. A small piece of bark is kept within the mouth, chewed for 5-10 minutes and the juice swallowed. This is done once daily. May cause gastritis and a tendency for sun burn. Diabetes, to reduce cholesterol. Bark is orally taken daily. Should not be used by persons with nasal bleeding and during menstruation.
18	*Emblica officinalis* Gaertn. (43399)	Phyllanthaceae	Amloki	Fruit	Diabetes. Three tablespoons of fruit juice is mixed with one glass of water and taken orally four times daily. Acne. Two tablespoons of fruit juice are added to quarter glass of water and taken orally once daily in the morning on an empty stomach. Eye diseases. Dried and coarsely grounded fruit is boiled in 2 glasses of water till volume reaches ¼ glasses. The decoction is cooled and strained and several drops are put into eyes twice daily. Liver diseases. One cup of fruit juice is taken orally daily in the morning on an empty stomach. Over dosage of fruit juice consumption may lead to burning sensations during urination. Fruit juice consumption is also to be avoided during diarrhea or dysentery. See *Terminalia bellirica*.
19	*Piper nigrum* L.	Piperaceae	Gol morich	Fruit	See *Clerodendrum viscosum.* See *Clitoria ternatea*.
20	*Piper peepuloides* Roxb. (43408)	Piperaceae	Pipul gach	Bark	Bone fracture. Paste is prepared from stems and leaves of *Cissus quadrangularis*, bark of *Piper peepuloides* and egg white. The paste is topically applied to the fractured area once daily followed by bandaging the area. The process is repeated if fracture does not heal within 24 hours. No adverse effects.
21	*Solanum nigrum* L. (43407)	Solanaceae	Kakmari	Whole plant (fruit, leaf, bark)	Fever, dysentery. Whole plant is soaked in water overnight followed by straining and drinking the water the following morning (every 2 hours). Excessive drinking can lead to headache, diarrhea, and dizziness.
22	*Clerodendrum viscosum* Vent. (43392)	Verbenaceae	Vati gach	Leaf	Dysentery. Pills are prepared from a paste of leaves of *Clerodendrum viscosum*, fruits of *Piper nigrum* and Jawakhar/Yavakshar (Ayurvedic name for potassium carbonate). One pill is taken orally twice daily in the morning and evening. Taking more than two pills within 24 hours may lead to constipation.
23	*Cissus quadrangularis* L. (43384)	Vitaceae	Harjora gach	Stem, leaf	Bone fracture. Leaves and stems of the plant are made into a paste with egg white and topically applied once daily to the fractured area followed by bandaging. If facture does not heal within 24 hours, the process is repeated. No adverse effects. See *Piper peepuloides.*
24	*Curcuma longa* L. (43400)	Zingiberaceae	Holud	Rhizome	Allergy, hypertension. Alum (potassium aluminum sulfate, known in Bengali as fitkari) is powdered and warmed in water followed by mixing the powder with powdered rhizomes. Pills prepared from the mixture are taken orally twice daily in the morning and evening. No adverse effects.
25	*Zingiber officinale* Roscoe	Zingiberaceae	Ada	Rhizome	See *Nigella sativa*.

Diabetes is known as madhumeha in diabetes. Among the plants used by the FMP for treatment of diabetes, *Cassia*

fistula and *Mimosa pudica* have been described as Ayurvedic antidiabetic plants [24]. *C. fistula* is known in Sanskrit (the language of Ayurveda) as aragvadha, while *M. pudica* is known in Sanskrit as lajjalu. The fruits of *C. fistula*, which were used by the FMP to treat diabetes, have reported antihyperglycemic activity [25]. The antidiabetic activity of *M. pudica* leaves have also been reported [26]; notably, the FMP used leaves of the plant to treat diabetes. Thus these two plants used by the FMP for treating diabetes may not only reflect Ayurvedic influences but their antidiabetic uses have been validated by modern scientific studies.

Similar Ayurvedic uses are in existence for other plants used for treatment by the FMP. For instance, the use of *J. adhatoda* by the FMP for treatment of asthma is similar to the plant's Ayurvedic use [27]. In Charaka Samhita (an Ayurvedic text), *A. paniculata* has been described as a useful plant for treating diabetes [28]; the FMP also used the plant to treat jaundice.

It is evident from the above discussion on a few plants used by the FMP that the phytotherapeutic practices of the FMP not only shows Ayurvedic influences but also has been validated in scientific studies. As such, the plants and the formulations used by the FMP, merit further scientific studies. The FMP treated some diseases like diabetes, arthritis, and liver disorders. New and more effective treatments for these diseases are necessary and the plants used by the FMP can prove to be sources of effective medicines.

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