Ayurvedic Influences and Novel Combination of Phytotherapy and Zootherapy by a Folk Medicinal Practitioner of Domar Upazila in Nilphamari District, Bangladesh

Abstract

Background: Bangladesh is possibly unique in that many different traditional medicinal systems are present like Ayurveda, Unani, homeopathy, and folk medicine. The objective of the present study was to document the novel therapeutic practices of a folk medicinal practitioner (FMP) in Nilphamari district, who used a combination of phytotherapy and zootherapy practices, and whose formulations further included his own modifications of standard Ayurvedic formulations.

Methods and findings: Interviews of the FMP regarding his ethnomedicinal practices were carried out with the help of a semi-structured questionnaire and the guided field-walk method from August 2016 till February 2017. The FMP used a total of 44 plants distributed into 29 families in his formulations. The total number of formulations used was 25 for treatment of a diverse group of ailments like respiratory tract disorders, eye disorders, filariasis, diabetes, weakening of immune system, erectile dysfunction, hypertension, tuberculosis, heart disorders, puerperal fever, and jaundice. The FMP also used parts from seven animals (fish, insect, bird – all are classified as animal) alone or in conjunction with plants in his treatment.

Conclusions: The FMP used a number of plants in his treatment, the ethnomedicinal uses of which plants being hitherto not reported from Bangladesh. The combination of phytotherapy and zootherapy is unique as well as modifications of Ayurvedic formulations, and if scientifically validated, may prove useful for treatment of a number of diseases. Overall, the FMP’s treatment methods merit further scientific attention especially towards development of an effective method to treat diabetes, hypertension, and filariasis.

Keywords: Phytotherapy; Zootherapy; Folk medicine; Ayurveda; Nilphamari; Bangladesh

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Introduction

It is very possible that human beings have been afflicted with diseases of some sort or other since their very advent. It has been suggested from genetic evidence that many tropical diseases of human beings may have originated during Paleolithic times or before, that is even as early as 2.5 million years ago when our early human ancestors were still isolated in Africa [1]. Whether human beings knew how to treat themselves after occurrence of diseases during Paleolithic times is not known with certainty; however, the great apes and other animals have been reported to self-medicate following diseases [2], which makes it a possibility...
that human beings also treated themselves during diseases. It has been reported that human beings became aware or were already aware of the medicinal properties of plants somewhat around 5,000 years ago [3]. Since then, plants have been and still are excellent sources for the discovery of many modern allopathic drugs, and many modern drugs have been discovered through close observations of indigenous or traditional medicinal practices [4].

The need for new drugs has become really acute in present times. There has been an emergence of new infectious diseases like AIDS, Ebola, Hanta, Zica, MERS to name only a few, and which details have been reviewed by the World Health Organization (WHO) [5]. In addition, there has been emergence of antibiotic-resistant bacteria and drug-resistant vectors [6,7]. Plants can form the first line of resource in discovering novel and efficacious drugs against these threats of new diseases as well as drug-resistant diseases.

Bangladesh can be regarded as a hot spot for traditional medicinal systems. Some of the oldest and established traditional medicinal practices present in the country with their own training institutions and registered practitioners include Ayurveda, Unani and homeopathy [8]. The various tribes have their tribal medicinal practitioners, who use mostly medicinal plants but may also include rituals, amulets and zootherapy in their practices [9-12]. There are religious healers, whose practice method deals with amulets and incantations [13]. There are folk medicinal practitioners (FMPs), who can possess quite detailed and accurate knowledge on the healing properties of plants [14-17]. The other interesting part about FMPs in Bangladesh is that although Bangladesh is a small country, the FMPs differ remarkably in the selection of plant(s) to treat any given disease even within adjoining villages [18].

As such, documentation of the practices of FMPs of Bangladesh can be a rich source of knowledge on the medicinal properties of plants and their therapeutic uses. Since a relatively fewer number of FMPs combine phytotherapy with zootherapy and/or other inanimate ingredients, their use of various items for treatment of diseases can provide an extra dimension to traditional medicinal knowledge. The objective of the present study was to document the practices of a FMP at Paschim Boragari village in Domar Upazila, Nilphamari district, Bangladesh who was selected because of his novel combinations of phytotherapy and zootherapy in his folk medicinal practice, use of previously unreported medicinal plants, and use of Ayurvedic formulations with his own innovative modifications.

**Materials and Methods**

Nilphamari district is in northern Bangladesh. The area of the district is 1580.85 sq km, and is located in between 25°44' and 26°19' north latitudes and in between 88°44' and 89°12' east longitudes (Figure 1). It is bounded by West Bengal state of India on the north, Rangpur district on the south, Lalmonirhat district on the east, Panchagarh and Dinajpur districts on the west. Domar Upazila has an area of 250.84 sq km and is one of the six Upazilas of the district. There are 47 villages in Domar Upazila with a combined population of 215699.

The FMP (initials RI, male, age 50 years) resided in Paschim Boragari village in Domar Upazila. A number of visits were made to the FMP by the authors (but most frequently SN) between August 2016 and February 2017 to interview the FMP, collect plant specimens and gather accurate information on the animal parts used in his formulations. Prior Informed Consent was obtained from the FMP to disseminate any information obtained. At the same time, the villagers were randomly queried as to whether they have at least once visited the FMP for treatment, and regarding the success of the FMP’s formulations in treatment of diseases.

Actual interviews of the FMP were conducted with the help of a semi-structured questionnaire and the guided field-walk method of Martin [19] and Maundu [20]. The FMP was further queried with the help of the semi-structured questionnaire as to plants, animals, and formulations used, disease(s) treated, source and mode of collection and preservation of plants, season of collecting, preparation of formulations, mode of administration, and any precautions which needed to be followed during medication period together with any other details which the FMP wanted to provide. In the guided field-walk method, the FMP took the interviewers on guided field-walks through areas from where he collected his medicinal plants, pointed out...
the plants, and mentioned their use(s). The semi-structured questionnaire and the guided field-walks were augmented with informal conversations between the authors and the FMP, in which conversations the FMP disclosed freely on any topic of his choice and which informal conversations really increased the extent of rapport between the authors and the FMP and provided more information on the medicinal use of plants and animals.

The plants used by the FMP were found to be available within the village area within a radius of about five miles. However, some plants or plant parts (Table 1) as well as two products, namely Mahalaxmi Vilas and Mrityunjaya Rasa were bought from a shop at Saidpur in Nilphamari district, which sold Ayurvedic and Unani medicines, herbs (dried) and spices. Some of these dried herbs and spices were imported from India. Both Mahalaxmi Vilas and Mrityunjaya Rasa, according to the FMP were manufactured by Ayurvedic companies of Bangladesh; the FMP, however, did not divulge the names of the Companies although he gave the names of the ingredients of both preparations. The FMP mentioned that previously he used to get these two medicines from India. Likewise, with the exception of tiger fat, which was extremely rare and supposed to be smuggled in from outside Bangladesh (possibly India) by travelling vendor(s), the rest of the animal items were common and could be procured locally. The FMP himself was not able to guarantee that the fat really came from a tiger. Most plants could be easily identified through their local names. However, all plants were verified as to their identities by the plant taxonomist at the Medicinal Plant Collection Wing of the University of Development Alternative with help from Bangladesh National Herbarium (where necessary). Plant or plant part specimens were deposited at the Medicinal Plant Collection Wing of the University of Development Alternative [12]. The various animals (including also fish, insects, and shells) were identified on the basis of their local names (Bengali) and validated through discussion with a trained zoologist of the University of Development Alternative.

Results and Discussion

Medicinal plants and diseases treated by the FMP

The FMP was found to use a total of 44 plants distributed into 29 families in his formulations, which were 25 in number. These formulations were used to treat respiratory tract disorders, eye disorders, filariosis, diabetes, weakness of immune system, erectile dysfunction, hypertension, tuberculosis, heart disorder, puerperal fever and jaundice. The results are shown in Table 1. The formulations included both monoherbal and polyherbal formulations. Different formulations were used to treat the same disease; an example is the treatment of filariosis with three different formulations and the treatment of tuberculosis with two different formulations. Multiple formulations for treatment of the same disease usually implied that either the disease was quite common and possibly serious, or all the ingredients of a particular formulation were not easy to obtain at any given time. This was an important issue, for although the formulations may contain dried plant(s) or plant part(s) (dried months or even 1-2 years ago), every formulation was made fresh before dispensing it to a patient. It may be mentioned in this context that lymphatic filariosis is endemic in Nilphamari district [21]. Tuberculosis and what is more important, multidrug-resistant tuberculosis is also present in Bangladesh [22].

Animal parts and diseases treated by the FMP

The FMP used parts from 7 animals in his formulations to treat various diseases, which are shown in Table 2. Three animal parts were used by themselves while four animal parts were combined with plant parts for treatment. Body fat obtained from the graylag goose (domesticated) was rubbed on chest to prevent mucus accumulation and pneumonia; various fish species belonging to the Puntius genera were advised to be fried in clarified butter and taken orally; and body fat of the Bengal tiger was advised to be rubbed all over the body to prevent cold. Animal parts which were used with plants included milk of Black Bengal goat (for eye disorders and tuberculosis), tail of common house gecko (for puerperal fever), secreted resin of Indian lac insect (for tuberculosis), and shell of conch (for night blindness).

FMP’s treatment with animals and ayurvedic influences

Although the FMP used conch with other plants to treat eye disorders, the shell of the conch by itself (grounded to a fine powder or its ash) or in combination with plants is used as a collyrium in Ayurvedic medicines for treatment of eye disorders [23]. Paste prepared from roots of Glycyrrhiza glabra and bark of Santalum album in goat milk was used by the FMP to treat tuberculosis. In classical Ayurvedic texts in Sanskrit, which dates back to at least more than 3,000 years ago, tuberculosis has been described as ‘Rajayakshma’ and treatment has been prescribed with ‘Chhagaseva’, ‘Chhaga’ being Sanskrit for goat; in fact, patients were advised to stay with goats and consume as many products they can obtain from goats including milk and clarified butter obtained from the milk [24]. The patients were also advised to make use of goat feces and goat urine by remaining in close proximity to them, and to acquire a ‘goat’ odor.

FMP’s treatment with plants and minerals and ayurvedic influences

One possible example of Ayurvedic influence was the use of Mahalaxmi Vilas by the FMP to treat erectile dysfunction and hypertension (see Acorus calamus and Ipomoea mauritiana, Table 1). However, it should be pointed out that Ayurvedic texts mention Mahalaxmi Vilas Ras and not Mahalaxmi Vilas. Mahalaxmi Vilas Ras is a herbo-metallic preparation and contains: Abhara Bhasma – Bhasma (calx) of Mica – 48 g; Shuddha Gandhaka – Purified and processed Sulfur – 24 g; Vanga Bhasma – Bhasma (calx) of Tin – 12 g; Shuddha Parada – Purified and processed Mercury – 6 g; Shuddha Haratala – Purified Oripment (Arsenic trisulfide) – 6 g; Tamra Bhasma – Bhasma (calx) of Copper – 3 g; Karpoora – Camphor – 6 g; Jatipha – Nutmeg (fruit) – 12 g; Vridhaharu – Argyrea speciosa – 12 g; Swarna Bhasma – Bhasma (calx) of Gold – 12 g. The fine powder of above ingredients is ground with the juice
Table 1: Medicinal plants and formulations of the FMP from Nilphamari district, Bangladesh.

<table>
<thead>
<tr>
<th>S.No</th>
<th>Scientific Name (Accession Number)</th>
<th>Family Name</th>
<th>Local Name (Bengali)</th>
<th>Parts used (Origin)</th>
<th>Ailments and mode of medicinal use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><em>Adhatoda vasica</em> Nees (MPCW-UODA 547/2017)</td>
<td>Acanthaceae</td>
<td>Bashok</td>
<td>Leaf (Found in the wild; also cultivated in homesteads.)</td>
<td>Accumulation of mucus in chest. Leaves are boiled in water with table salt and the water is taken orally in small sips after it has become lukewarm. Coughs. Decoction of leaves of <em>Adhatoda vasica</em> and <em>Solanum surattense</em> is orally taken. See <em>Picrorhiza kurroa</em>.</td>
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<td>2</td>
<td><em>Acorus calamus</em> L. (MPCW-UODA 548/2017)</td>
<td>Acoraceae</td>
<td>Boj</td>
<td>Rhizome (Herbal/spice shop; also available in the wild. Dried or fresh rhizomes were used depending on availability.)</td>
<td>Loss of eyesight, night blindness, eyes assuming a totally white color. Paste is prepared in goat milk of rhizomes of <em>Acorus calamus</em>, roots of <em>Saussurea lappa</em>, fruits of <em>Terminalia bellirica</em>, <em>Piper peepuloides</em>, <em>Piper nigrum</em>, bark of <em>Xeromphis spinosa</em> and ‘shankha navi’ (Zoological name: <em>Turbinella pyrum</em>, English – conch or sea shell, dried section of a conch containing shell and meat, which has been dried to hard stone like substance; used in Ayurvedic medicine and also used as gemstone). A little amount of water is added to the paste and the mixture stirred with a pigeon feather and applied inside the eyes with the soft part of the feather. Hypertension. Mahalaxmi Vilas (a decoction of aerial parts and fruits of <em>Tribulus terrestris</em>, whole plants of <em>Withania somnifera</em>, fruits of <em>Piper nigrum</em>, fruits of <em>Piper peepuloides</em>, leaves of <em>Laurus nobilis</em>, dried rhizome of <em>Zingiber officinale</em>, fruits and seeds of <em>Amomum subulatum</em>, aril of <em>Myristica fragrans</em>, and tuber of <em>Acorus calamus</em>) is taken orally. See <em>Ipomoea mauritiana</em>.</td>
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<td>3</td>
<td><em>Calotropis procera</em> (Aiton) W.T. Aiton (MPCW-UODA 550/2017)</td>
<td>Apocynaceae</td>
<td>Shet Akondo</td>
<td>Root (Found in the wild.)</td>
<td>Filariasis. Paste of roots (where root paste is made in a ‘kanji’ – iron mortar and pestle) is topically applied to swollen areas. Kanji is the local name for a mortar and pestle made from stone.</td>
</tr>
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<td>4</td>
<td><em>Alocasia indica</em> (Roxb.) Schott. (MPCW-UODA 553/2017)</td>
<td>Araceae</td>
<td>Mankochu</td>
<td>Tuber (Cultivated for consumption of stems and tubers as vegetable.)</td>
<td>Night blindness. Dried tubers are cooked and taken orally.</td>
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<td>5</td>
<td><em>Saussurea lappa</em> (Decne.) (MPCW-UODA 554/2017)</td>
<td>Asteraceae</td>
<td>Kur</td>
<td>Root (Found in the wild.)</td>
<td>See <em>Acorus calamus</em>.</td>
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<td>6</td>
<td><em>Brassica juncea</em> (L.) Czern. (MPCW-UODA 558/2017)</td>
<td>Brassicaceae</td>
<td>Shorisha</td>
<td>Seed oil, seed (Cultivated for its seed oil, which is used in cooking.)</td>
<td>Accumulation of mucus in chest accompanied with labored breathing. Seed oil is massaged on the chest. When massaged on a regular basis, the oil has both preventive and therapeutic effects. See <em>Schima wallichii</em>.</td>
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<td>7</td>
<td><em>Carica papaya</em> L. (MPCW-UODA 559/2017)</td>
<td>Caricaceae</td>
<td>Pepe</td>
<td>Fruit (Cultivated for its edible fruits.)</td>
<td>See <em>Picrorhiza kurroa</em>.</td>
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<td>8</td>
<td><em>Terminalia bellirica</em> (Gaertn.) Roxb. (MPCW-UODA 560/2017)</td>
<td>Combretaceae</td>
<td>Bohera</td>
<td>Fruit (Cultivated for its fruits, which are considered medicinal.)</td>
<td>See <em>Picrorhiza kurroa</em>. See <em>Acorus calamus</em>.</td>
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<td>9</td>
<td><em>Terminalia chebula</em> Retz. (MPCW-UODA 561/2017)</td>
<td>Combretaceae</td>
<td>Haritoki</td>
<td>Fruit (Cultivated for its fruits, which are considered medicinal.)</td>
<td>See <em>Picrorhiza kurroa</em>. See <em>Acorus calamus</em>.</td>
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<td>No.</td>
<td>Plant Name</td>
<td>Family</td>
<td>Common Name</td>
<td>Part Used</td>
<td>Uses</td>
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<td>10</td>
<td>Ipomoea mauritiana Jacq. (MPCW-UODA 562/2017)</td>
<td>Convolvulaceae</td>
<td>Bhui kumra</td>
<td>Tuber (Found in the wild.)</td>
<td>Diabetes. Dried and powdered tubers are taken orally every morning. To boost immunity, to keep body warm during cold weather. Tubers from at least 12 years old plants of Ipomoea mauritiana are mixed with flowers of Gardenia jasminoides, made into a paste and taken orally. Erectile dysfunction. Tuber of Ipomoea mauritiana is mixed with “Mahalaxmi Vilas’ (a claimed Ayurvedic decoction of aerial parts and fruits of Tribulus terrestris, whole plants of Withania somnifera, fruits of Piper nigrum, fruits of Piper peepuloides, leaves of Laurus nobilis, dried rhizome of Zingiber officinale, fruits and seeds of Amomum subulatum, aril of Myristica fragrans, and tuber of Acer calamus), seed husks of Plantago ovata, and ghee (clarified butter) and taken orally. [Mahalaxmi Vilas was obtained from a herbal/spice shop in Saidpur, Nilphamari district, which shop also sold other Ayurvedic and Unani preparations]</td>
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<td>11</td>
<td>Cassia fistula L. (MPCW-UODA 562/2017)</td>
<td>Fabaceae</td>
<td>Shona pata</td>
<td>Leaf (Found in the wild.)</td>
<td>See Swertia chirayita.</td>
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<td>12</td>
<td>Glycyrrhiza glabra L. (MPCW-UODA 563/2017)</td>
<td>Fabaceae</td>
<td>Josthi modhu</td>
<td>Root (Herbal/spice shop; roots are imported from India and bought in the dried form.)</td>
<td>Tuberculosis (where blood comes out with vomit). Roots are orally chewed. Alternately, paste prepared from roots of Glycyrrhiza glabra and wood of Pterocarpus santalinus in goat milk is orally taken. Accumulation of mucus in chest. Roots are chewed and taken orally. See Rubia tinctorum.</td>
</tr>
<tr>
<td>13</td>
<td>Pterocarpus santalinus L.f. (MPCW-UODA 564/2017)</td>
<td>Fabaceae</td>
<td>Rokto chandan</td>
<td>Wood (Herbal/spice shop; dried wood or bark is imported from India.)</td>
<td>Respiratory difficulties, asthma, coughs, pneumonia. Oil obtained from wood is rubbed on the chest till cure. See Glycyrrhiza glabra.</td>
</tr>
<tr>
<td>14</td>
<td>Swertia chirayita (Roxb. ex Fleming) H. Karst. (MPCW-UODA 566/2017)</td>
<td>Gentianaceae</td>
<td>Chirata</td>
<td>Aerial part (Cultivated for its aerial parts, which are common home remedies.)</td>
<td>Diabetes. 2 parts of leaves of Cassia fistula, 2 parts of aerial parts of Swertia chirayita, 1 part of Azadirachta indica leaf, and 1 part of Clerodendrum viscosum leaf are mixed and taken orally daily. Chest pain (heart problem). Decoction of Piper chaba leaf, Azadirachta indica leaf and Swertia chirayita aerial part is orally taken. See Picrorhiza kurroa.</td>
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<td>15</td>
<td>Laurus nobilis L. (MPCW-UODA 567/2017)</td>
<td>Lauraceae</td>
<td>Tejpata</td>
<td>Leaf (Herbal/spice shop; leaves are imported from India and obtained in the dried form.)</td>
<td>See Ipomoea mauritiana.</td>
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<td>16</td>
<td>Azadirachta indica A. Juss. (MPCW-UODA 568/2017)</td>
<td>Meliaceae</td>
<td>Neem</td>
<td>Bark, leaf (Cultivated as a useful medicinal tree; also grows in the wild.)</td>
<td>See Picrorhiza kurroa. See Swertia chirayita.</td>
</tr>
<tr>
<td>17</td>
<td>Tinospora cordifolia (Wild.) Miers. (MPCW-UODA 570/2017)</td>
<td>Menispermaceae</td>
<td>Guloncho</td>
<td>Leaf, stem (Collected from the wild.)</td>
<td>Puerperal fever. Leaves and stems of Tinospora cordifolia are orally taken with boiled rhizomes of Zingiber officinale and honey. See Picrorhiza kurroa.</td>
</tr>
<tr>
<td>18</td>
<td>Ficus carica L. (MPCW-UODA 572/2017)</td>
<td>Moraceae</td>
<td>Dumur</td>
<td>Bark, fruit (Cultivated for its edible fruits.)</td>
<td>Diabetes (symptoms: acidic feeling in mouth, whiteness in eyes, whiteness in soles of feet, feeling of dizziness after eating sweets). Bark juice and fruits are taken orally once or twice daily.</td>
</tr>
<tr>
<td>20</td>
<td>Musa sapientum L. (MPCW-UODA 574/2017)</td>
<td>Musaceae</td>
<td>Kola</td>
<td>Fruit (Cultivated for its edible fruits.)</td>
<td>Puerperal fever. A small piece from the tip of a tail of the common house gecko (Hemidactylus frenatus) is taken orally after inserting the piece within a ripe fruit.</td>
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<td>No.</td>
<td>Species</td>
<td>Family</td>
<td>Common Name</td>
<td>Description</td>
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<td>21</td>
<td><em>Myristica fragrans</em> (Houtt.) (MPCW-UODA 575/2017)</td>
<td>Myristicaceae</td>
<td>Jayatri</td>
<td>Aril (Herbal/spice shop; imported from India and available in the dried form.)</td>
<td>See <em>Ipomoea mauritiana</em>.</td>
</tr>
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<td>22</td>
<td><em>Boerhavia repens</em> L. (MPCW-UODA 577/2017)</td>
<td>Nyctaginaceae</td>
<td>Punornava</td>
<td>Root (Collected from the wild.)</td>
<td>See <em>Rubia tinctorum</em>. See <em>Schima wallichii</em>.</td>
</tr>
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<td>23</td>
<td><em>Phyllanthus emblica</em> L. (MPCW-UODA 578/2017)</td>
<td>Phyllanthaceae</td>
<td>Amloki</td>
<td>Fruit (Cultivated for its edible fruits, which are also considered medicinal.)</td>
<td>See <em>Picrorhiza kurroa</em>.</td>
</tr>
<tr>
<td>24</td>
<td><em>Piper betle</em> L. (MPCW-UODA 579/2017)</td>
<td>Piperaceae</td>
<td>Pan</td>
<td>Leaf (Cultivated for its leaves, which are chewed with lime.)</td>
<td>Night blindness. 21 drops of leaf juice are applied to the eyes for 3-4 days.</td>
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<tr>
<td>25</td>
<td><em>Piper chaba</em> Blume (MPCW-UODA 580/2017)</td>
<td>Piperaceae</td>
<td>Choi</td>
<td>Leaf (Cultivated; stems are used as spice in cuisines of southern districts of Bangladesh.)</td>
<td>See <em>Swertia chirayita</em>.</td>
</tr>
<tr>
<td>26</td>
<td><em>Piper longum</em> L. (MPCW-UODA 581/2017)</td>
<td>Piperaceae</td>
<td>Pipla</td>
<td>Fruit (Cultivated for its fruits, which are used as spice.)</td>
<td>See <em>Piper nigrum</em>.</td>
</tr>
<tr>
<td>27</td>
<td><em>Piper nigrum</em> L. (MPCW-UODA 582/2017)</td>
<td>Piperaceae</td>
<td>Gol morich</td>
<td>Fruit (Cultivated for its fruits, which are used as spice.)</td>
<td>Hypertension. Mrityunjaya Rasa is taken orally. The medicine was made from 10 g fine powder of each of: Shuddha Vatsanabha – purified Aconitum ferox, Maricha – Black pepper – <em>Piper nigrum</em> fruits, Pippali – Long pepper fruit – <em>Piper longum</em>, Shuddha Gandhaka – Herbal purified Sulfur, Tankana Bhasma – Borax, Shuddha Hingula – Purified and processed Cinnabar (Mercury compound) – 20g or Shuddha Parada – Herbal purified Mercury – 20g. Fine powder of ingredients are triturated with juice extract and made into paste form, pills are prepared and taken orally. [Mrityunjaya Rasa was obtained from a herbal/spice shop in Saidpur, Nilphamari district, which shop also sold other Ayurvedic and Unani preparations] See <em>Acorus calamus</em>. See <em>Ipomoea mauritiana</em>.</td>
</tr>
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<td>28</td>
<td><em>Piper peepuloides</em> Roxb. (MPCW-UODA 583/2017)</td>
<td>Piperaceae</td>
<td>Pipul</td>
<td>Fruit (Cultivated for its fruits, which are used as spice.)</td>
<td>See <em>Acorus calamus</em>. See <em>Ipomoea mauritiana</em>.</td>
</tr>
<tr>
<td>29</td>
<td><em>Picrorhiza kurroa</em> Royle ex. Benth (MPCW-UODA 586/2017)</td>
<td>Plantaginaceae</td>
<td>Kotki</td>
<td>Bark (Collected from the wild.)</td>
<td>Jaundice. Fermented combination of bark of <em>Picrorhiza kurroa</em> and <em>Azadirachta indica</em>, along with fruits of <em>Terminalia bellirica</em>, <em>Terminalia chebula</em>, <em>Phyllanthus emblica</em>, dried aerial parts of <em>Swertia chirayita</em>, and leaves of <em>Adhatoda vasica</em> and <em>Tinospora cordifolia</em> is orally taken with honey. Ripe fruits of <em>Carica papaya</em> are also taken orally as well as cooked unripe fruits of the same plant during the medication period.</td>
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<tr>
<td>No.</td>
<td>Scientific Name</td>
<td>Family</td>
<td>Common Name</td>
<td>Description</td>
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</tr>
<tr>
<td>30</td>
<td><em>Plantago ovata</em> Forsk. (MPCW-UODA 587/2017)</td>
<td>Plantaginaceae</td>
<td>Isapulg</td>
<td>Seed husk (Herbal/spice shop; seeds soaked in water are generally taken as home remedy for relief of constipation.)</td>
<td>See <em>Ipomoea mauritiana</em>.</td>
</tr>
<tr>
<td>31</td>
<td><em>Gardenia jasminoides</em> Ellis. (MPCW-UODA 590/2017)</td>
<td>Rubiaceae</td>
<td>Gonduraj</td>
<td>Flower (Grown in homesteads for its fragrant flowers.)</td>
<td>All diseases except gastrointestinal disorders, to boost immunity. Flowers are orally taken. See <em>Ipomoea mauritiana</em>.</td>
</tr>
<tr>
<td>32</td>
<td><em>Rubia tinctorum</em> L. (MPCW-UODA 592/2017)</td>
<td>Rubiaceae</td>
<td>Monjistha</td>
<td>Leaf (Collected from the wild.)</td>
<td>Filarisis. Paste prepared in a ‘kanji’ (iron mortar and pestle) of roots of <em>Rubia tinctorum</em>, <em>Glycyrrhiza glabra</em>, <em>Solanum nigrum</em>, and <em>Boerhavia repens</em> is applied as a poultice on swollen areas.</td>
</tr>
<tr>
<td>33</td>
<td><em>Xeromphis spinosa</em> (Thunb.) Keay. (MPCW-UODA 594/2017)</td>
<td>Rubiaceae</td>
<td>Mon</td>
<td>Bark (Collected from the wild.)</td>
<td>See <em>Acorus calamus</em>.</td>
</tr>
<tr>
<td>34</td>
<td><em>Schleichera oleosa</em> (Lour.) Oken (MPCW-UODA 596/2017)</td>
<td>Sapindaceae</td>
<td>Lakha</td>
<td>Bark (Herbal/spice shop; imported from India in the dried form.)</td>
<td>Tuberculosis (where blood comes out with vomit). Bark and ‘al’ta’ (Bengali term for lac, which is the scarlet resinous secretion of a number of species of lac insects, of which the most commonly cultivated species is Kerria lacca) soaked water is orally administered.</td>
</tr>
<tr>
<td>35</td>
<td><em>Datura metel</em> L. (MPCW-UODA 597/2017)</td>
<td>Solanaceae</td>
<td>Dhutra</td>
<td>Root (Collected from the wild.)</td>
<td>See <em>Schima wallichii</em>.</td>
</tr>
<tr>
<td>36</td>
<td><em>Solanum nigrum</em> L. (MPCW-UODA 600/2017)</td>
<td>Solanaceae</td>
<td>Gur kamai</td>
<td>Root (Collected from the wild.)</td>
<td>See <em>Rubia tinctorum</em>.</td>
</tr>
<tr>
<td>37</td>
<td><em>Solanum surattense</em> Burm.f. (MPCW-UODA 602/2017)</td>
<td>Solanaceae</td>
<td>Kantakari</td>
<td>Leaf (Collected from the wild.)</td>
<td>See <em>Adhatoda vasica</em>.</td>
</tr>
<tr>
<td>38</td>
<td><em>Withania somnifera</em> (L.) Dunal (MPCW-UODA 604/2017)</td>
<td>Solanaceae</td>
<td>Ashwagandha</td>
<td>Whole plant (Collected from the wild.)</td>
<td>See <em>Ipomoea vasica</em>.</td>
</tr>
<tr>
<td>39</td>
<td><em>Schima wallichii</em> Choisy (MPCW-UODA 607/2017)</td>
<td>Theaceae</td>
<td>Kanak</td>
<td>Root (Collected from the wild.)</td>
<td>Filarisis. Roots of <em>Schima wallichii</em>, <em>Datura metel</em>, <em>Vitex negundo</em>, <em>Boerhavia repens</em>, and bark of roots of <em>Moringa oleifera</em> are made into a paste with <em>Brassica juncea</em> seeds and applied as poultice on swollen areas.</td>
</tr>
<tr>
<td>40</td>
<td><em>Clerodendrum viscosum</em> Vent. (MPCW-UODA 608/2017)</td>
<td>Verbenaceae</td>
<td>Vati</td>
<td>Leaf (Collected from the wild.)</td>
<td>See <em>Swerita chirayita</em>.</td>
</tr>
<tr>
<td>41</td>
<td><em>Vitex negundo</em> L. (MPCW-UODA 609/2017)</td>
<td>Verbenaceae</td>
<td>Nishinda</td>
<td>Root (Collected from the wild.)</td>
<td>See <em>Schima wallichii</em>.</td>
</tr>
<tr>
<td>42</td>
<td><em>Amomum subulatum</em> Roxb. (MPCW-UODA 610/2017)</td>
<td>Zingiberaceae</td>
<td>Boro elach</td>
<td>Fruits and seeds (Herbal/spice shop; dried fruits containing seeds are imported from India and used as spice.)</td>
<td>See <em>Ipomoea mauritiana</em>.</td>
</tr>
<tr>
<td>43</td>
<td><em>Zingiber officinale</em> Roscoe (MPCW-UODA 611/2017)</td>
<td>Zingiberaceae</td>
<td>Ada</td>
<td>Rhizome (Cultivated locally as a spice.)</td>
<td>See <em>Tinospora cordifolia</em>. See <em>Ipomoea mauritiana</em>.</td>
</tr>
<tr>
<td>44</td>
<td><em>Tribulus terrestris</em> L. (MPCW-UODA 612/2017)</td>
<td>Zygophyllaceae</td>
<td>Gokkhur</td>
<td>Aerial parts, fruits (Herbal/spice shop; imported from India.)</td>
<td>See <em>Ipomoea mauritiana</em>.</td>
</tr>
</tbody>
</table>
extract, made into paste and pills are prepared [25]. However, the FMP used Mahalaxmi Vilas and not Mahalaxmi Vilas Ras, the latter being used for a multitude of diseases by Ayurvedic practitioners but not erectile dysfunction or hypertension. Since the product was claimed by the FMP to be bought from a shop, which (according to the FMP) sold it as an Ayurvedic preparation, it is possible that the product was given a slightly modified Ayurvedic classical name (Mahalaxmi Vilas instead of the actual Mahalaxmi Vilas Ras) and passed along as the original Ayurvedic product. It is also possible that since Mahalaxmi Vilas contained different ingredients from Mahalaxmi Vilas Ras, it was given a different name. It is further to be noted that the FMP himself further modified the obtained product, Mahalaxmi Vilas from Mahalaxmi Vilas Ras with his own addition of tubers of Ipomoea mauritiana, seed husks of Plantago ovata, and clarified butter, and the product used by the FMP did not include any metallic elements present in Mahalaxmi Vilas Ras. The FMP further used his product to treat different diseases (erectile dysfunction and hypertension) other than specified by Ayurveda for Mahalaxmi Vilas Ras (skin diseases, diabetes, elephantiasis), assuming that Mahalaxmi Vilas and Mahalaxmi Vilas Ras signified the same product. Interestingly, we were not able to obtain Mahalaxmi Vilas at the Saidpur herbal shop; the owner mentioned that a new batch will come on an unspecified date.

The Mahalaxmi Vilas used by the FMP for treatment of hypertension and erectile dysfunction contained among other plants, Withania somnifera. This plant, according to Ayurveda, can lower stress [26], and so can be useful in cases of hypertension. Another plant, present in this polyherbal formulation was Tribulus terrestris, described in Charaka Samhita (a classical Ayurvedic text) as diuretic (which can help hypertensive patients through increased urine output), and other Ayurvedic texts as an aphrodisiac [27]. Zingiber officinale, another component of Mahalaxmi Vilas is also considered an Ayurvedic anti-hypertensive plant [28].

Another formulation of Ayurvedic influence (in the form of ingredients but not therapeutic use) is the use of Mrityunjaya Rasas by the FMP for treatment of hypertension (see Piper nigrum, Table 1). This is a classical Ayurvedic herbo-metallic preparation, whose ingredients include 10 g fine powder of each of Shuddha Vatsanabha – Purified Aconitum ferox, Maricha – Black pepper – Piper nigrum, Pippali – Long pepper fruit – Piper longum, Shuddha Gandhaka – Herbal purified Sulfur, Tankana Bhasma – Borax, Shuddha Hingula – Purified and processed Cinnabar (Mercury sulfide) – 20 g or Shuddha Parad – Herbal purified Mercury – 20 g. Fine powder of ingredients are triturated with juice extract and made into paste form, from which pills are prepared [29]. This shows that the FMP used Mrityunjaya Rasas, which had the same ingredients as described in classical Ayurvedic texts and did not contain any innovations or changes introduced by the FMP as he did for Mahalaxmi Vilas. It is to be mentioned that as per Ayurveda, Mrityunjaya Rasas is to be used for treatment of all types of fever; the FMP used the same product to treat hypertension. The FMP mentioned that this treatment is an innovation over the classical treatment, which he learned from his grandfather.

The use of poisonous plants like Aconitum ferox, which contains large quantities of the toxic alkaloid pseudaconitine, along with other metallic toxic elements (as in Mritunjaya Rasas) raise concerns about this Ayurvedic formulation used by the FMP. However, herbo-metallic preparations and ‘bhasmas’ (ashes or calcined elements) were considered safe in Ayurveda and are still claimed to be safe [30]. The word ‘Shuddha’ used before some ingredients in Mritunjaya Rasas (above) means purified and safe from toxicity (in general it means use of the elements as bhasmas). Bhasmas are prepared by either the Putapaka method (purification, wet grinding, and incineration) or the Kupipakwa method (purification, mixing metals with mercury and sulfur, wet grinding, and incineration); it has been claimed that these processes lead to formation of non-toxic nano-particles and so increasing the efficacies of the medicine containing bhasmas [31]. Mercury, when converted to the sulfide form, apparently becomes safe to use in medicine, as claimed through toxicity studies on a mercury-based Ayurvedic formulation, Sidh Makardhwaj [32]. Rural patients are quick to raise a furor in Bangladesh over alleged mistakes particularly by FMPs; that there have been no allegations of immediate poisoning or other mishaps following use of Mritunjaya Rasas by this FMP (or others to the best of our knowledge) suggests that any toxicity if present in the product possibly manifests itself only after long-term use or after a long time following use, in which case Mritunjaya Rasas will have been forgotten or considered as the cause.

Although not actually prescribed in Ayurvedic classical texts like Charaka, the use of Calotropis procera in the treatment of lymphatic filariasis (similar to the FMP) has been reported for the southern Indian district of Gulbarga [33]. However, the Vedas (which contains description of a number of Ayurvedic plants) mention C. procera as a plant active against parasites, which include leishmanial parasites [34]. The FMP used Adhatoda vasica to treat coughs and mucus. Similar uses have been reported in Ayurveda, where the Sanskrit name of the plant has been mentioned as ‘amalaka’ or ‘bashika’ [35].

The FMP used rhizomes of Acorus calamus along with parts from other plants (polyherbal formulation) to treat eye disorders. Interestingly, the word acorus is derived from the Greek word ‘acoron’, which in turn is derived from the Greek word ‘coreon’ meaning pupil of the eye, and has been used since ancient times for eye disorders [36]; an Ayurvedic medicine named Chandrodlay Varti containing rhizomes of A. calamus is used for eye disorders like early stages of cataract, pterygium (surfer’s eye), and growth over the eyes (pinguecula) [37]. Sausuraa lappa, another plant used in the polyherbal formulation for eye disorder by the FMP, has also been described in Ayurveda as useful for ‘netraroga’ (diseases of the eye; the Ayurvedic name for the plant is ‘kustha’) [38]. Any traditional medicinal uses of Xeromphis spinosa, to our knowledge, has not been reported from Bangladesh, so the FMP was unique in using this plant along with other Ayurvedic plants of known uses against eye disorders. An Ayurvedic medicine – Triphala Ghrita Netratarpan containing fruits of Terminalia bellirica, Terminalia chebula and Phyllanthus emblica (to be noted is that the fruits of the first two plants were used by the FMP...
in his formulation for eye disorders) is used to treat Computer Vision Syndrome (CVS), an eye disorder [39].

Alocasia indica, used by the FMP for night blindness, has been reported to be used by other FMPs in Jhalokati district, Bangladesh for treatment of rhinitis [40]. Brassica juncea seed oil (used by the FMP for accumulation of mucus in chest accompanied with labored breathing) is a very well-known Ayurvedic plant, known in Sanskrit as rajika, and described in classical Ayurvedic texts like Charaka Samhita, Sushruta Samhita, Bhela Samhita, and Kasypa Samhita for treatment of a variety of diseases including massaging on body to ward off cold-related disorders [41]. Ipomoea mauritiana, used by the FMP to treat diabetes, is reportedly used in Rangpur district, Bangladesh to treat rheumatic pain [42].

The use of Mahalaxmi Vilas (MV) by the FMP for treatment of erectile dysfunction (ED) cannot be evaluated as to whether it is an Ayurvedic formulation, for as explained earlier, Ayurveda does not have any formulation with this name. However, the use of several plants by the FMP in his Mahalaxmi Vilas (Table 1), namely Tribulus terrestris, Withania somnifera, and Myristica fragrans have been mentioned as plants used as herbal aphrodisiacs in traditional medicines to treat ED [43]. Plants present in MV like Zingiber officinale, T. terrestris, W. somnifera, and M. fragrans are also mentioned in Ayurvedic texts to improve sexual performance and virility (Vajikaran) [44]. Fruits of Piper nigrum (another ingredient of MV) are used by traditional medicinal practitioners of Khulna city, Bangladesh to treat spermatorrhoea [45]. The Pankho tribe of Rangamati district, Bangladesh use leaves of Acorus calamus (tuber of the plant is used in MV) to treat asthma [46]. Leaves of A. calamus are taken for typhoid, and roots for snake bites by the Soren clan of the Santal tribe in Rajshahi district, Bangladesh [47]. The Ayurvedic use of Amomum subulatum (another ingredient of MV) is for stomach disorders [48]. Taken together, it appears that the FMP used a combination of already known Ayurvedic plants along with some local plants of his own selections to treat erectile dysfunction. Whether such a combination is helpful needs scientific evaluation but it does show the versatility of a FMP’s practice in Bangladesh.

A paste of roots of Glycyrrhiza glabra and wood of Pterocarpus santalinus in goat milk was used by the FMP to treat tuberculosis. Incidentally, this is the same preparation used in Ayurveda to treat tuberculosis, except that in this formulation in Ayurveda (Ayurveda has several formulations for treating tuberculosis) milk from other animals can be used [49]. The FMP used a combination of leaves or aerial parts of Swertia chirayita, Cassia fistula, Azadirachta indica, and Clerodendrum viscosum to treat diabetes. C. fistula (aragbadh in Ayurveda), A. indica (nimba), and S. chirata (ardhatikta) are considered Ayurvedic anti diabetic plants [50,51]. Leaves of C. viscosum are used by the Marakh sect of the Garo tribe living in Mymensingh district, Bangladesh to treat diabetes [52]. It thus appears that the FMP is in this case also using a combination of Ayurvedic and locally used (meaning used in Bangladesh) anti diabetic plants.

Azadirachta indica is considered in Ayurveda to be good for treatment of cardiovascular disorders [53]; S. chirayita has uses as an Ayurvedic plant to treat hypertension [54]; Piper chaba is used by folk medicinal practitioners of Chalna area, Khulna district, Bangladesh as a tonic [55]; thus these three plants used by the FMP to treat chest pain (heart problem) is again a combination of local and Ayurvedic influences. It is interesting to note that the Central Council for Research in Ayurveda and Siddha, New Delhi, India recommends Tinospora cordifolia and Zingiber officinale to treat chikungunya, a disease causing fever and pain [56]; the FMP used a combination of the two plants to treat puerperal fever, which also causes fever and pain. Ficus carica (used by the FMP for diabetes treatment) is recommended in all three of the established traditional medicinal systems of India, namely Ayurveda, Unani and Siddha to treat diabetes [57]. East Javanese people use several banana (Musap sa pimpment) cultivars to treat typhoid and yellow fever [58]; the FMP used bananas along with the tip of the tail of common house gecko to treat puerperal fever.

Picrorhiza kurroa and Azadirachta indica bark, along with fruits of Terminalia bellirica, Terminalia chebula, Phyllanthus emblica, dried aerial parts of Swertia chirayita, and leaves of Adhatoda vasica and Tinospora cordifolia were used by the FMP with honey and fruits of Carica papaya to treat jaundice. P. kurroa (known in Ayurveda as kutki) is one of the major components of Arogavardhini Ras, an Ayurvedic preparation for treatment of liver illnesses [59]. Besides P. kurroa, Arogavardhini Ras also contains fruits of Terminalia bellirica, Terminalia chebula, and Phyllanthus emblica and juice extract of A. indica and is taken with honey. The ingredients of Arogavardhini Ras includes - Shuddha Parada – Herbal purified Mercury – 10 g; Shuddha Gandhaka – Herbal purified Sulphur – 10 g; Loha Bhasma – Bhasma prepared from Iron – 10 g; Abhraka Bhasma – Purified and processed Mica – 10 g; Tamra Bhasma – Bhasma prepared from Copper – 10 g; Haritaki – Chebulic Myrobalan fruit rind – Terminalia chebula – 20 g; Vibhitaki – Belliric Myrobalan fruit rind – Terminalia bellirica – 20 g; Amalaki – Indian gooseberry fruit – Emblica officinalis – 20 g; Shilajatu – Asphaltum – 30 g; Pura – Guggulu – Indian bedelium (gum resin) – Commiphora mukul – 40 g; Chitra – Eranda – Castor – Ricinus communis – 40 g; Tikta – Katuki – Picrorhiza kurroa – 220 g. Juice extract of Nimba – Neem – Azadirachta indica – Quantity Sufficient. Fine powders of the above ingredients are ground with the neem juice extract, made into paste and pills are prepared. Pills are taken with honey, fresh ginger juice, water or milk [60]. The differences in the FMP’s and original Ayurveda formulation again shows that the FMP made his own modifications to classical Ayurveda formulations, as has been shown before with other formulations like Mahalaxmi Vilas. It also appears that the FMP is trying to limit the use of metals in his modified formulations. Adhatoda vasica and Carica papaya have been reported to be used by some FMPs of Bangladesh to treat jaundice [61]. In Ayurvedic treatments like Charaka Samhita and Ashtanga Hridaya, Tinospora cordifolia (guduchi) has been mentioned as a useful plant against ‘kamala’ (jaundice) [62].

The FMP used a paste prepared from roots of Rubia tinctorum, Glycyrrhiza glabra, Solanum nigrum, and Boerhavia repens to reduce swellings induced by filariasis (Table 1). G. glabra is considered in Ayurveda to have anti-edema properties [49],
and so may be used to reduce filarial swellings; filariosis is known in Ayurveda as ‘shlipada’, and paste of *Boerhavia repens* is administered orally along with Triphala (Ayurvedic name for equal weight by weight combinations of dry powdered fruits of *Terminalia bellirica*, *Terminalia chebula* and *Emblica officinalis*) to treat filariosis [63]. Another formulation used by the FMP to treat filariosis or rather filarial swellings included roots of *Schima wallichii*, *Datura metel*, *Vitex negundo*, *Boerhavia repens*, and bark of roots of *Moringa oleifera*, which are made into a paste with *Brassica juncea* seeds and applied as poultice on swollen areas. Ethnomedicinal uses of *S. wallichii* are rare and to our knowledge, previously not reported from Bangladesh; fruit decoction is used for snake bite and insect bite in western Mizoram, India [64]. In Ayurveda, *V. negundo* (nirgundi) is used to reduce swellings; so is *D. metel* [65]. *M. oleifera* and *B. juncea* are also used in Ayurveda to reduce swellings and edema [41,66].

The use of *Schleicheria oleosa* bark along with lac for treatment of tuberculosis has previously not been reported. Ethnomedicinal uses of *S. oleosa* include using bark for skin infections and seed oil for skin disorders and rheumatism by various tribes of Satna Forest Division in India [67]. This is possibly the first report of ethnomedicinal use of this plant for tuberculosis. Why lac was used along with remains a question. The FMP specifically mentioned that the combination of lac soaked water (scarlet in color) along with the bark of the plant was used for tuberculosis when accompanied by coming out of blood with vomit. FMPs of Jhalokati district, Bangladesh reportedly use flowers of *H. rosa sinensis* for hematemesis (coming of blood with vomit) [40]. In Kerala, India, flowers of *H. rosa sinensis* are used for treating menorrhagia [68]; in Bangladesh, flowers are used for menstrual irregularities like excessive bleeding during menstruation [69]. It is interesting that red flowers of the plant are used; apparently, these possibly are cases of ‘like replacing like’ or redness of flower or lac replacing redness of blood lost due to menstruation or coming out with vomit.

**Relevant pharmacological activity reports on the plants and animals used by the FMP (scientific validation of uses)**

Any ethnomedicinal study needs to answer the question as to whether the plants and animals or minerals used by any traditional medicinal practitioner(s) can be scientifically validated in their use on the basis of existing pharmacological activity and phytochemical studies, for such scientific validation can help researchers work in the proper direction and strengthens the possibility of discovering new drugs from the plant or any other substances used. This type of scientific validation (including toxicological data) can also ensure safety of monoherbals and polyherbal formulations, and help eradicate the various questions on herbal medicine that may exist among scientists and allopathic medicine practitioners. Although herbal medicines (in the form of medicine or nutritional supplements) are regaining their lost importance, it is still the belief of many allopathic doctors and other general people (particularly the affluent people of Bangladesh) that herbal medicine is nothing short of quackery and should be banned by the health authorities. To determine how much of the present FMP’s phyotherapeutic knowledge can be scientifically validated, searches were conducted in the scientific literature for relevant reports, which can attest to the validity of the FMP’s therapeutic use of the plants and animals shown in **Tables 1 and 2**. The results are shown in **Table 3** (to be noted is that not all relevant references have been quoted but only representative samples).

Interestingly, while none of the animal species can be scientifically validated as to their use(s) by the FMP, out of 44 plant species used by the FMP, 39 species of plant could be validated in their uses on the basis of available pharmacological studies or phytochemical constituent(s) and their bio-activities. This demonstrates the depth of knowledge of the FMP regarding the medicinal properties of plants [70-100]. It is to be noted that polyherbal formulations were used by the FMP, in which various plant species were used in combination to give synergistic effects. Just to give one example, leaves of *Cassia fistula*, *Swertia chirayita* (aerial parts containing leaves), *Azadirachta indica*, and *Clerodendrum viscosum* were mixed and advised to be taken orally by the FMP for treatment of diabetes. It can be seen from **Table 3** that leaves of all four plant species has been scientifically shown to have hypoglycemic properties [101-120]. It is therefore very much possible that the synergistic hypoglycemic effect produced by the combination can lead to better control of elevated blood glucose levels arising during diabetes. Moreover, though yet to be studied in details, the plants may be giving anti-diabetic effect, each through different mechanisms, like less absorption of glucose from intestine, greater utilization of glucose, or stimulating pancreatic insulin secretion or overcoming insulin resistance, to name only a few, the net result being to synergize the desired effect. It is also possible that any adverse effect given by any of the four plant species used may be negated by the presence of other plant(s). For instance, leaves of *A. indica* have hepatotoxic properties, which can be mitigated by the hepatoprotective phytoconstituents of *S. chirayita* [120-123].

The scientific community needs to address the versatile modes of treatment by the FMPs of Bangladesh (like mode of experimentation of a new plant or formulation, if any, standardization of an herbal product containing possibly hundreds of phytochemicals) in the quest for new and better drugs. The versatility of this particular FMP demonstrated itself in several aspects, namely use of polyherbal formulations containing novel mixtures of plant parts (see Serial 14, **Table 1**); use of plants previously unreported in Bangladesh as ethnomedicinal plants, like *Xeromphis spinosa*, *Schleicheria oleosa* or *Schima wallichii*; use of known medicinal plants for novel therapeutic uses (like *Plantago ovata* for erectile dysfunction); mixing of phyotherapy with zootherapy (**Tables 1 and 2**); borrowing or being influenced by established forms of traditional medicinal systems in the Indian sub-continent countries (India, Bangladesh, Pakistan) like Ayurveda, Unani or Siddha (like *Mrityunjaya Rasa*); and finally, the modifications made by the FMP in established formulations of Ayurveda, which appears on the surface to be for the better, like avoidance of heavy metals and addition of other plant parts as in Arogayavardhini Ras (see above). These are the versatility, which needs to be addressed by the scientific community to come to a
been recorded to be of some medicinal use [188]. This usage of animal parts in traditional medicines with more than several thousand years of history of usage strongly justifies scientific validations of their usage.

Potential lead compounds and drugs from the plants and animals used by the FMP

A number of relevant bioactive phytochemicals or compounds present in plants and animals used by the FMP and which can serve as potential lead compounds or future drugs have been given in Table 3 and their structures shown in Figure 2 (for instance vasicine, vasicinol, and vasicinone from A. vasica).

Table 2: Animal parts and formulations used by the FMP in Nilphamari district, Bangladesh.

<table>
<thead>
<tr>
<th>Serial Number</th>
<th>Scientific Name (English name)</th>
<th>Family Name</th>
<th>Local Name (Bengali)</th>
<th>Parts used</th>
<th>Ailments and mode of medicinal use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Anser anser (Graylag goose)</td>
<td>Anatidae</td>
<td>Raj hansh</td>
<td>Body fat</td>
<td>Accumulation of mucus in chest, pneumonia. The fat of the Indian domesticated goose (graylag goose, zoological name – Anser anser) is rubbed on both sides of the chest. This can bring cough relief and prevent occurrence of pneumonia.</td>
</tr>
<tr>
<td>2</td>
<td>Capra aegagrus hircus (Black Bengal goat)</td>
<td>Bovidae</td>
<td>Chagol</td>
<td>Milk</td>
<td>See Acorus calamus, Glycyrrhiza glabra in the plant list (above).</td>
</tr>
<tr>
<td>3</td>
<td>Puntius conchonius (Rosy barb), Puntius phutunio (Spotted sail barb), Puntius sarana (Olive barb), Puntius sophore (Pool barb), Puntius ticto (Ticto barb)</td>
<td>Cyprinidae</td>
<td>Kanchan punti, Phutani punti, Sarpunti, Jat punti, Tit punti (respectively)</td>
<td>Whole fish after taking off scales and clearing the insides</td>
<td>Night blindness (nyctalopia). Whole fish is fried in ‘ghee’ (clarified butter) and taken orally. The fish can be any Puntius species found in Bangladesh.</td>
</tr>
<tr>
<td>4</td>
<td>Panthera tigris tigris (Bengal tiger)</td>
<td>Felidae</td>
<td>Bagh</td>
<td>Body fat</td>
<td>Cold. Body fat is rubbed all over the body to prevent catching cold.</td>
</tr>
<tr>
<td>5</td>
<td>Hemidactylus frenatus (Common house gecko)</td>
<td>Geckkonidae</td>
<td>Tiktti</td>
<td>Tail</td>
<td>See Musa sapientum in the plant list (above).</td>
</tr>
<tr>
<td>6</td>
<td>Kerria lacca (Indian lac insect)</td>
<td>Kerriadae</td>
<td>Laksha</td>
<td>Secreted resin</td>
<td>See Schleicheria oleosa in the plant list (above).</td>
</tr>
<tr>
<td>7</td>
<td>Turbinella pyrum (Conch)</td>
<td>Turbinellidae</td>
<td>Shankha</td>
<td>Shell</td>
<td>See Acorus calamus in the plant list (above).</td>
</tr>
</tbody>
</table>

Table 3: Scientific validation of plants and animals used by the FMP.

<table>
<thead>
<tr>
<th>Serial Number</th>
<th>Scientific Name (English name)</th>
<th>Family Name</th>
<th>Local Name (Bengali)</th>
<th>Parts used</th>
<th>Ailments and mode of medicinal use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Anser anser (Graylag goose)</td>
<td>Anatidae</td>
<td>Raj hansh</td>
<td>Body fat</td>
<td>Accumulation of mucus in chest, pneumonia. The fat of the Indian domesticated goose (graylag goose, zoological name – Anser anser) is rubbed on both sides of the chest. This can bring cough relief and prevent occurrence of pneumonia.</td>
</tr>
<tr>
<td>2</td>
<td>Capra aegagrus hircus (Black Bengal goat)</td>
<td>Bovidae</td>
<td>Chagol</td>
<td>Milk</td>
<td>See Acorus calamus, Glycyrrhiza glabra in the plant list (above).</td>
</tr>
<tr>
<td>3</td>
<td>Puntius conchonius (Rosy barb), Puntius phutunio (Spotted sail barb), Puntius sarana (Olive barb), Puntius sophore (Pool barb), Puntius ticto (Ticto barb)</td>
<td>Cyprinidae</td>
<td>Kanchan punti, Phutani punti, Sarpunti, Jat punti, Tit punti (respectively)</td>
<td>Whole fish after taking off scales and clearing the insides</td>
<td>Night blindness (nyctalopia). Whole fish is fried in ‘ghee’ (clarified butter) and taken orally. The fish can be any Puntius species found in Bangladesh.</td>
</tr>
<tr>
<td>4</td>
<td>Panthera tigris tigris (Bengal tiger)</td>
<td>Felidae</td>
<td>Bagh</td>
<td>Body fat</td>
<td>Cold. Body fat is rubbed all over the body to prevent catching cold.</td>
</tr>
<tr>
<td>5</td>
<td>Hemidactylus frenatus (Common house gecko)</td>
<td>Geckkonidae</td>
<td>Tiktti</td>
<td>Tail</td>
<td>See Musa sapientum in the plant list (above).</td>
</tr>
<tr>
<td>6</td>
<td>Kerria lacca (Indian lac insect)</td>
<td>Kerriadae</td>
<td>Laksha</td>
<td>Secreted resin</td>
<td>See Schleicheria oleosa in the plant list (above).</td>
</tr>
<tr>
<td>7</td>
<td>Turbinella pyrum (Conch)</td>
<td>Turbinellidae</td>
<td>Shankha</td>
<td>Shell</td>
<td>See Acorus calamus in the plant list (above).</td>
</tr>
</tbody>
</table>
Conclusions

Folk medicinal practice and folk medicinal practitioners in Bangladesh form a versatile group of practitioners with no single philosophy of practicing methods. Since such practice, although mainly dependent on phytotherapy, can also include diverse elements such as zootherapy, use of minerals or metals, as well be influenced by more established forms of traditional medicine like Ayurveda or Unani (along with innovations carried out on formulations in these two traditional medicinal systems), documentation of such practices can lead to scientific research and potential discovery of new and more efficacious medicines. As such, the phytherapeutic and zootherapeutic practices of the FMP documented in the present study can prove useful in discovery of novel medicines against diseases like filariasis, diabetes, hypertension, heart problems, and bacterial infections. This is more so, because a review of the scientific literature demonstrated that most of the plants used by the FMP for therapeutic purposes are scientifically validated in their use(s) based on reported pharmacological activity studies or presence of relevant bioactive phytoconstituents. These types of polyherbal or poly-product based therapeutic formulations can also help in a paradigm switch from the current one molecule therapeutic mode of treatment.

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