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Author(s)	**Mohammad Shaheed Hossain Chowdhury**, **Masao Koike**, Nur Muhammed, Md. Abdul Halim, Narayan Saha and Hajime Kobayashi
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Use of plants in healthcare: A traditional ethno-medicinal practice in southeastern rural areas of Bangladesh

Mohammad Shaheed Hossain Chowdhury[1,2], Masao Koike[1*], Nur Muhammed[1], Md. Abdul Halim[3], Narayan Saha[3] and Hajime Kobayashi[4]

[1] Forest Policy Laboratory, Department of Forest Science, Faculty of Agriculture, Shinshu University, 8304 Minamiminowa-Mura, 399-4598 Nagano-Ken, Japan.

[2] Assistant Secretary, Administration Cadre of Bangladesh Civil Service, Govt. of the Peoples' Republic of Bangladesh.

[3] Department of Forestry and Environmental Science, School of Agriculture and Mineral Sciences, Shahjalal University of Science and Technology, Sylhet-3114, Bangladesh.

[4] Laboratory of Forest Environment and Ecology, Department of Forest Science, Faculty of Agriculture, Shinshu University, 8304 Minamiminowa-Mura, 399-4598 Nagano-Ken, Japan.

*** Author for all correspondence:**

E-mail: makoike@gipmc.shinshu-u.ac.jp

Abstract

This study considered the traditional ethno-medicinal practices of the rural people of Feni district, Bangladesh focusing on their utilization of medicinal plants and associated indigenous knowledge. Ninety households were interviewed, using a semi-structured questionnaire. Plant resources are used to treat 26 different ailments ranging from simple cuts to complex diabetes. In total, 46 medicinal plants are as used; a third are trees. Homesteads are the primary source; few medicinal plants are cultivated. Above-ground plant parts are most used, particularly leaves. The diverse patterns of use of different medicinal plant parts shows the considerable indigenous knowledge of the rural people, and this is generally widely available.

Key words: Medicinal plants; ailments; indigenous knowledge; using pattern; biodiversity; Bangladesh

Introduction

The earliest mention of the medicinal use of plants is in the *Rig Veda* (4500-1600 BC) which includes information about the use of plant parts as medicine in the South Asian sub-continent (Ghani 2003; Shamshad 2004). Over time, interest in the exploitation of plants for therapeutic purposes increased at a surprising rate (Walter 2001; Rao and Arora 2004). By the late 1970s, according to the World Health Organisation (WHO: Penso 1980; Anon. 2008a), 21,000 medicinal plant species were used globally. It is estimated that 75% of the global population uses plants and plant extracts for their medicinal needs (Abelson 1990). Farnsworth *et al*. (1985) pointed out the reliance of more than 80% of the developing world on conventional medicines, predominantly plants, for primary health care. Over the past decade, there has been a dramatic increase in the demand for medicinal plants for use in Traditional Medicine (TM) and Contemporary and Alternative Medicine (CAM) in both developing and developed countries (Lee *et al*. 2008). In China, TM accounts for about 40% of all health care delivered (WHO 2002) and, in Amazonia, medicinal plants serve as the main form of health care for a majority of the populace (Shanley and Luz 2003).

Developed countries have also started to focus on the trade of medicinal plants. Natural raw materials are used in 37% of the global sales of pharmaceutical products (Pramono 2002). According to Laird and Tenkate (2001), the largest global markets for medicinal and aromatic plants are under the control of China, France, Germany, Italy, Japan, Spain, the UK and the USA; Japan has the highest per capita consumption of botanical medicines in the world. At present, the annual average global market for herbal raw materials is about US$ 6 billion; this is projected to expand to about US$ 5 trillion by 2050 (Anon 2008a). Almost every nation on the earth has started to put emphasis on activities concerning medicinal plants. For instance, Canada has begun to cultivate commercially valuable medicinal plants in British Columbia within the Medicinal Plant Project (Wills 2008); almost every city and town in South Africa has some form of trade in plants for medicinal purposes (Dold and Cocks 2001); some plant-based natural finished products have become prospective export commodities in Indonesia and are frequently sent overseas to Japan, Saudi Arabia, the UK, Malaysia, Singapore and the Netherlands (Pramono 2002); and the Nepal Eco-essential Medicinal Plants Society has established a park-cum-medicinal plant garden in western Nepal with a view to conserving the biodiversity of tropical medicinal and aromatic plants (Shukla 2008).

With productive soils, a tropical climate and seasonal diversity, Bangladesh houses about 5,000 plant species distributed across the country (Kadir 1990; Yusuf *et al.* 1994). About 500 of these species have so far been claimed to possess medicinal or curative properties (Ghani 2004; Hossain 2005; Anon. 2008), and Haque (2004) suggests that the number is more than a thousand. A total of 85% of the country's population live in rural areas (Halim *et al.* 2007) and almost 80% of these people are dependent on medicinal plants for their primary healthcare (Hossain 2005; Anon. 2008), with herbal medication remaining a most popular and accepted way of treatment (Rashid 2008). Mukul *et al.* (2007) stated that so many people habitually use such medication

because herbal treatment is, in some cases, considered to be relatively cheap. However, its popularity also stems from the efficacy of the treatment in most cases (Anon. 2007) and relative safety, with few or no side effects (Mukul *et al.* 2007). In addition, herbal medicines, because of their decentralized nature, are generally easily and quickly available (Elliot *et al.* 1986). Despite such a high demand and the presence of more than 400 companies producing herbal medicines, medicinal plants are not yet commercially farmed in Bangladesh. More than 90% of the plants and products needed to meet domestic demand are imported from other countries, such as India, Nepal and Pakistan (Hossain 2005). Most rural people depend on medicinal plants gathered from the wild, in adjacent village forests (Halim *et al.* 2007) which cover about 13% of the total forested area of the country (Kibria *et al.* 2000). The customary homestead tree production system also serves as a conservatory of indispensable plant products and remedies. About 10 million households in over 85,000 villages have usable land around their homes, and about 80% of this land is covered by plants (Hossain and Chatterjee 1999).

Traditionally, both rural and indigenous/ethnic communities worldwide are knowledgeable about the local plants and other natural resources on which they are so immediately and intimately dependent (Khisa 1998). Indigenous knowledge (IK) plays a central role in disease diagnosis and health care practices in traditional medication systems (Zuberi 2004). The IK system presupposes the perception and understanding of local people about their strategies of development (Chowdhury 2002). It develops through sharing experience, and normally passes orally between generations (Amin 2000). Consequently, the traditional systems and IK associated with them in developing countries, such as Bangladesh, have been affected by rapid westernization and introduction of modern medicines (Zuberi 2004). Given that many districts have virtually no designated forests, social forestry has been undertaken as an alternative sustainable forestry practice in Bangladesh, with marginal fallow lands - such as roadsides, sides of railway lines, institutional premises and degraded public forest areas – being brought under tree cover with the active participation of local people and effective benefit sharing mechanism (Muhammed *et al.* 2005). These marginal land plantations to some extent substitute for the decreasing village forests, and are adding a new dimension to fallow land utilization (SDNPBD 2006).

With regard to the use of plants for medicinal purposes, Alam (1992) reported the use of 76 species by the *Marma* tribe in the Chittagong Hill Tracts (CHTs), Rahman (1997) recorded 52 species used by the tribal people of Sylhet and CHTs, Halim *et al.* (2007) found that 47 species were used by the religio-cultural *Shaiji* community of southwestern Bangladesh, and Mukul *et al.* (2007) explored 40 species used by people near a conservation area of northern hilly region of Bangladesh. However, no study has yet focused on the utilization of plants for healthcare by the widespread rural people in the plain regions of the country. Thus, the present study was undertaken in Feni, a district devoid of natural forests which is a transitional section between the southeastern vast hilly region of the CHTs and other plains regions of southern and middle part

of the country. Its aim was to assess plant-based ethno-medicinal practice and document the IK associated with it.

Study area

The study was carried out in the rural areas of Feni (Figure 1), a district in southeastern Bangladesh with an area of 928 km². It consists of six upazillas (sub-districts): Chhagalnaiya, Daganbhuiyan, Feni Sadar, Parshuram, Phulgazi and Sonagazi. The district was chosen because it is a transitional section between the southeastern vast hilly region (i.e., CHTs) and other plains regions in the southern and middle part of the country. The annual average maximum and minimum temperatures are 34.3°C and 14.4°C, with an annual average rainfall of 3302 mm. The district supports a population of 1,196,219, with a literacy rate of 40.7%. Most of the people (36.7%) have agriculture as their major occupation. In the district are 74,824 hectares of cultivable land and 772 hectares of fallow land (Sultan 2004). The main rivers are the Feni, the Choto Feni and the Muhuri; the landscape comprises the Tripura valley (as the district is bordered with Tripura hills of India to the east), Feni River estuary, and green agricultural fields (BTTG 2008). Feni is one of the 28 districts where marginal lands have become forested with both indigenous and exotic tree species, with herbs and shrubs as undergrowth.

From the six upazillas of Feni, Sonagazi was selected for detailed study because it is the southernmost region facing the Bay of Bengal and bordered by two rivers - the Feni and the Choto Feni - to the east and west. The upazilla is more or less flooded with water during the rainy season, resulting in the deposition of sediments increasing the productiveness of land, ultimately contributing to its floral diversity.

Methods

The study was conducted from early March to late July 2007, using a multi-stage random sampling method. From the upazilla, three villages were selected at random: one from the northeastern part, one from the southwestern part, and the other from the middle of the upazilla, so that the findings reflect the whole upazilla. From each of the three villages, 30 households (irrespective of socio-economic condition) were selected randomly for the comprehensive study. Thus a total of 90 households were selected. Before household survey, casual field visits were arranged within the villages along with local old people, religious leaders and other key informants to review and document the availability of medicinal plants in the locality.

A semi-structured questionnaire was used to collect the information in interviews with the household heads who took help from other members of the family when necessary. The respondents were asked about the medicinal plants they use; parts they use; ailments to be treated; patterns of use; and maintenance of medicinal plants. The plants used for medicinal purposes were first recorded using local names. In some cases, an immediate visit to the habitat of certain plants was organized with the respondent, to identify the species by its conventional Bangla name. Although local names of plants vary from region to region within the country,

established Bangla names have been well documented by Dey (2006) along with different local names. Once local names had been obtained, corresponding Bangla names were found out by reference to Dey (2006) and, in some cases, by showing photographs to the respondent. Finally, scientific names and family of the species were obtained consulting published literature (e.g., BARC 1972-1992; Chopra *et al.* 1992; Chevallier 1996; Das and Alam 2001; Dey 2006).

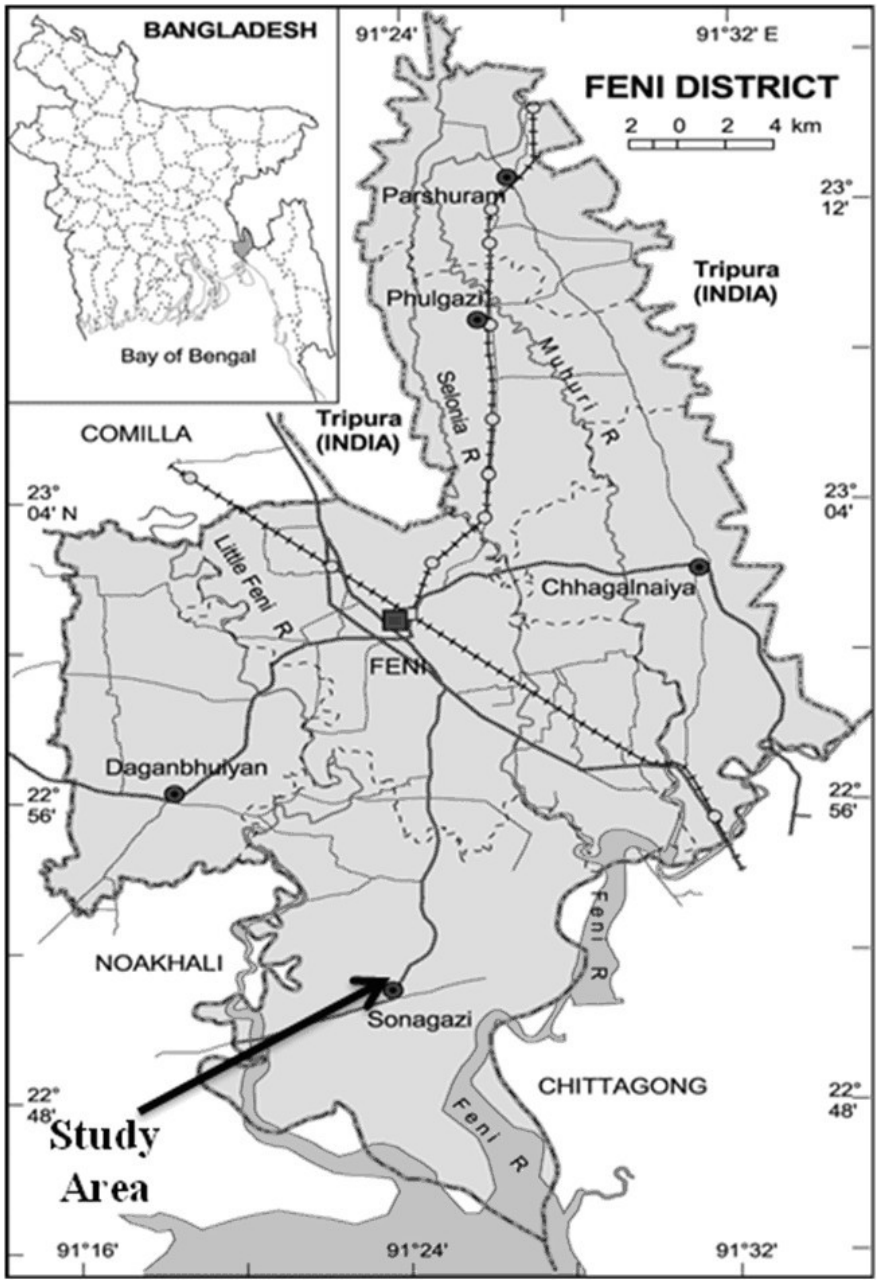

Figure 1. Map of Feni district showing study area.

Results and discussion

Plants used for medicinal purposes

Like the hill people of Bangladesh, the rural inhabitants of the study area in the plains use plant parts for curing different ailments. A total of 46 plant species belonging to 31 families and more than 40 genera were reported to be used as medicine (Table 1). Among the medicinal plants, trees were most frequent growth form (34.8%) followed by herbs and shrubs (26.1% each), creepers (8.7%) and palms (4.3%) (Figure 2). Similar trends with regard to the use of medicinal plants were reported by Miah and Chowdhury (2003) and Mukul *et al.* (2007) in studies conducted among communities in hilly regions. In contrast, in a plains ecosystem, Halim *et al*. (2007) found that trees were used least.

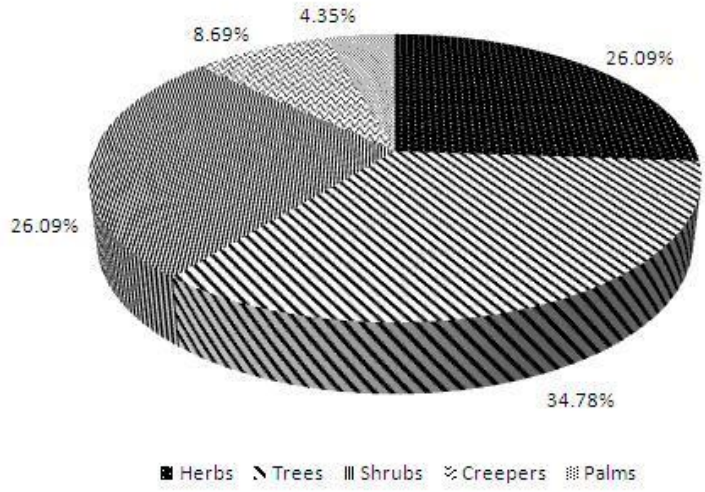

Figure 2. Medicinal plants according to growth form in the study area.

Of the 31 floral families with species with medicinal properties, five families - Compositae, Compretaceae, Leguminosae, Liliaceae and Rutaceae – each had three species; four families - Arecaceae, Cucurbitaceae, Verbenaceae and Zingiberaceae – had two species each, and the other families had 1 species only. Schippmann *et al*. (2002) reported the wide therapeutic use of two families - Apocynaceae and Asclepiadaceae - throughout the world; both are also used in the study area. The availability and utilization of these two families were also mentioned by Sajem and Gosai (2006), Halim *et al*. (2007) and Mukul *et al*. (2007).

Sources of medicinal plants

Among the medicinal plant species of the study area, the most frequent source (32.6%) (Fig. 3) was the respondents' homesteads (homegardens): an age-old forestry practice around the dwelling house where a number of crops including trees are grown with livestock, poultry and fish mainly to satisfy the farmer's basic needs (Akhtar 1997). Homesteads are primarily used to grow plants for household consumption, so that food and fruit species predominate. They supply

Table 1. Medicinal plants used by the rural people in the study area.

Species		Habit	Family	Species		Habit	Family
Local Name	**Scientific Name**			**Local Name**	**Scientific Name**		
Aam	*Mangifera indica* L.	Tree	Anacardiaceae	Kochu	*Colocasia esculenta* (L.) Schott.	Herb	Araceae
Ada	*Zingiber officinale* Rosc.	Herb	Zingiberaceae	Komla	*Citrus aurantium* L.	Tree	Rutaceae
Adoni	*Centella asiatica* (L.) Urban.	Herb	Umbelliferae	Kela	*Musa* spp Var.	Shrub	Musaceae
Aphon	*Calotropis gigantean* L.	Shrub	Asclepiadaceae	Korola	*Momordica charantea* L.	Climber	Cucurbitaceae
Anarosh	*Annas comosus* (L.) Merr.	Shrub	Bromeliaceae	Lemu	*Citrus aurantifolia* (Chris. & Pan.) Sw.	Shrub	Rutaceae
Arjun	*Terminalia arjuna* Bedd.	Tree	Compretaceae	Maya lota	*Mikamia scandens* (L.) Willd.	Climber	Compositae
Basak	*Adhatoda vasica* Nees.	Shrub	Acanthaceae	Mendi	*Lawsonia inermis* L.	Shrub	Lythraceae
Bel	*Aegle marmelos* (L.) Correa.	Tree	Rutaceae	Menda	*Litsea polyantha* Juss.	Tree	Lauraceae
Bhait	*Clerodendrum viscosum* Vent.	Shrub	Verbenaceae	Methi	*Trigonella foenum-graceum* L.	Shrub	Leguminosae
Chatim	*Alstonia scholaris* Br.	Tree	Apocynaceae	Narkel	*Cocos nucifera* L.	Palm	Arecaceae
Chirota	*Swertia chirata* Ham.	Herb	Sapindaceae	Neem	*Azadirachta indica* Juss.	Tree	Meliaceae
Daad	*Cassia alata* L.	Shrub	Leguminosae	Ninda	*Vitex negundo* L.	Shrub	Vebenaceae
Dalim	*Punica granatum* L.	Tree	Puniaceae	Paan	*Piper betel* L.	Climber	Piperaceae
Dombor	*Ficus hispida* L.	Tree	Moraceae	Pathor kuchi	*Kalanchoe pinnata* (Lamk.) Pers.	Herb	Crassulaceae
Dupa	*Cynodon dactylon* Pers.	Herb	Graminae	Piaj	*Allium ceipa* L.	Herb	Liliaceae
Genda	*Tagetes erecta* L.	Herb	Compositae	Roshun	*Allium sativum* L.	Herb	Liliaceae
Grito-kumari	*Aloe indica* Tow.	Herb	Liliaceae	Tela-kucha	*Coccinea cordifolia* L.	Climber	Cucurbitaceae
Holud	*Curcuma longa* L.	Herb	Zingiberaceae	Tetoi	*Tamarindus indica* (L.) Cogn.	Tree	Leguminosae
Isopgul	*Plantago ovate* Forst.	Herb	Compositae	T Amlr oki i Hort F oki	*Emblica officinale* L.	Tree	Euphorbiaceae
Jam	*Syzygium cumini* (L.)	Tree	Myrtaceae		*Terminalia chebula* Retz.	Tree	Compretaceae

	Skeels.			o			
Joba	*Hibiscus rosa-sinensis* L.	Shrub	Malvacea	l a	Boh era	*Terminalia belerica* Roxb.	Tree	Compretaceae
Jolpai	*Eleocarpus robustus* Roxb.	Tree	Elaeocarpaceae	Tulshi		*Ocimum sanctum* L.	Shrub	Lamiaceae
Kanthal	*Artocarpus heterophyllus* Lamk.	Tree	Moraceae	Shuari		*Areca catechu* L.	Palm	Arecaceae

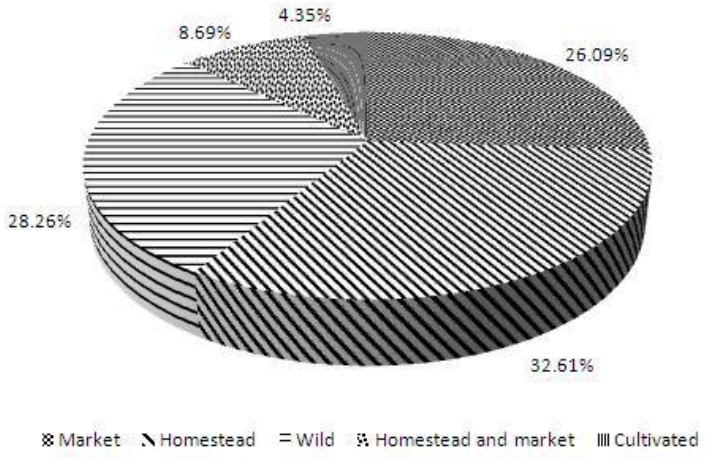

Figure 3. Sources of medicinal plants in the study area.

also timber, fuel wood, fodder and medicine in Bangladesh, with the farmers carefully maintaining the horizontal and vertical structure to ensure maximum utilization of water, nutrients, light and space (Millat-e-Mustafa *et al*. 1996). Anthropogenic environments ranked the second highest (28.3%) as a source of medicinal plants followed by markets (26.1%), homestead-and-market (8.7%) and cultivated habitat (4.3%).

According to the respondents, anthropogenic environments comprise diversified habitats such as graveyards, jungles, fallow lands, hinterlands, roadsides, pond and canal banks and the traditional village groves from where they mainly collect herbaceous plants. The graveyards of rural Bangladesh are generally full of vegetation, due to the belief that the departed souls buried there remain in peace with the soothing effects of plants. The villagers prefer that they are mainly covered by herbs and shrubs, to reduce the difficulty arising from large trees in digging graves. Hinterlands are behind homesteads, which are usually kept fallow and unproductive; in some cases, they are used for household waste disposal and roaming place for domestic poultry. However, some herbaceous plants are grown there deliberately. Voek (2004) showed that older fallows in humid tropics become sources of medicine, thatch, timber and fruits. Village forests complement the plant resources in homesteads; they consist of a small portion of privately-

owned land serving as a reserve for trees and bamboos which are planted and managed for both personal and commercial use. Together, village forests and homesteads constitute a tenth (0.27 million ha) of the national forest area (2.53 million ha) (Muhammed *et al*. 2005). Vergara (1997) reported that village forests supply about 70% of the fuel wood and timber and 90% of bamboo used in construction and cottage industries in Bangladesh.

According to the respondents, as growth forms other than herbs are abundantly available in homesteads, they do not collect their medicinal parts from the wild. Most of these anthropogenic environments are disturbed areas, but human interference does not hamper the availability of medicinal plants. Similarly, Gazzaneo *et al*. (2005) noticed the preference of local specialists for using medicinal plants from anthropogenic zones in the Atlantic Forest of northeastern Brazil. The highland *Maya* people of Chiapas, Mexico, rely almost exclusively on disturbed areas for medicinal plants, even in communities that are adjacent to stands of primary forest (Stepp 2000 cited in Stepp and Moerman 2001). Voek (2004) reported that, compared to the bewildering biological diversity encountered in old-growth forests, disturbed areas are floristically simpler and thus easier to comprehend. In the present study, it was observed that the respondents only buy medicinal plant parts – fresh (fruits) or dried forms (plant parts other than fruits) – from markets when the species are not endemic to their microclimatic zone.

Plants with multiple uses, either as vegetables or as spices and condiments, were cultivated in the study area. *Momordica charantia* L. and *Zingiber officinale* Rosc. are two such species which are frequently used as vegetables and spice, respectively, all over the country. The respondents shared parts from plants such as *Adhatoda vasica* Nees., *Azadirachta indica* Juss., *Lawsonia inermis* L., *Punica granatum* L. and *Terminalia arjuna* Bedd. with each other; even when only one or two medicinal plants grow in a homestead, the demands of the next-door residents as well as people living further away can easily be met in a particular region. However, the preferred source of medicinal plants varies from region to region, even from country to country, depending on the availability of plants. Unlike the respondents in the study area, the *Shaiji* saints of Bangladesh (Halim *et al*. 2007), traditional healers of Ethiopia (Yineger and Yewhalaw 2007) and local people in China (Lee *et al*. 2008) generally prefer wild harvested medicinal plants for herbal medication. Halim *et al.* (2007) presented a scientific argument citing Palevitch (1991) and Uniyal *et al.* (2000) with regard to the preferences of communities for collecting medicinal plant parts from wild sources in different regions: the medicinal properties of plants are due mainly to the presence of secondary metabolites that plants need in their natural environments under particular conditions of stress and competition, which perhaps would not be expressed under monoculture conditions, as levels of active ingredients can be much lower in such fast-growing cultivated stocks. In wild populations, plants can be older due to slow growth rates, and can have higher levels of active ingredients. While it can be presumed that cultivated plants are likely to be somewhat different in their properties from those gathered in natural habitats, it is

also clear that certain values in plants can be deliberately enhanced under controlled conditions of cultivation.

Curative plant parts

Both above- and below-ground plant parts are used in herbal medication in the study area. Above-ground plant parts are used more often (80.4%) than below-ground plant parts (15.2%), and whole plants are rarely used (4.4%). In some cases, different parts of an individual plant are used for treating different ailments; in other cases, different parts of more than one plant are mixed together and applied against a single ailment. With regard to above-ground plant parts, only leaves were used from most species (37.0%); for 6.5% of species, leaves and other parts are used (Fig. 4). Fruits are also used from 21.7% of species; species providing flowers for healing purposes accounted for only 2.2%. The predominant use of leaves has also been reported by

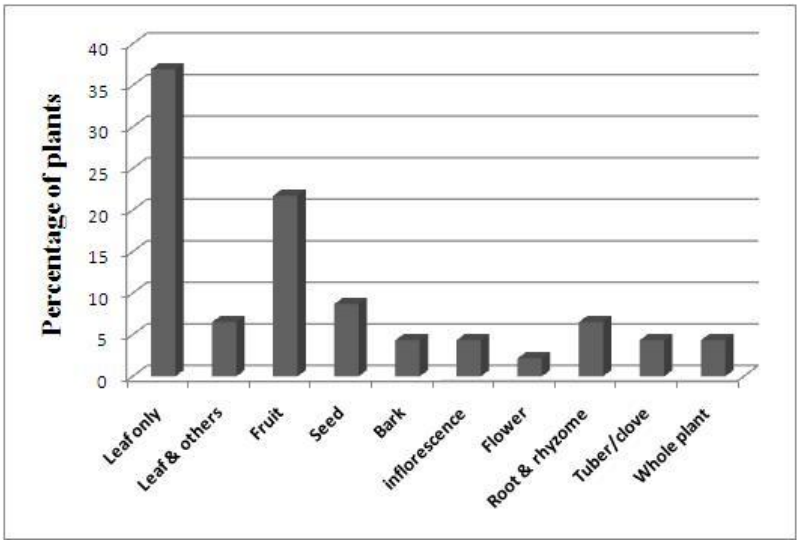

Figure 4. Different plant parts used against ailments in the study area.

researchers in different countries (e.g., Gazzaneo *et al*. 2005; Sajem and Gosai 2006; Bussmann and Sharon 2006; Halim *et al*. 2007; Mukul *et al*. 2007). However, Lulekal *et al*. (2008), in southeastern Ethiopia, found that local people most frequently use roots of medicinal plants for healing purposes. Halim *et al*. (2007) opined that plentiful use of leaves ensures sustainable harvesting of medicinal plants; and Schippmann *et al*. (2002) suggest that this also provides an incentive to protect and maintain wild populations and their habitats and the genetic diversity of medicinal plants.

Patterns of use for specific ailments

The study showed that local people use different plant parts to treat 26 different ailments (Table 2). Ten species are used against diabetes: five trees, two herbs, and three creepers. Both colds/coughs and cuts/wounds are treated with six species, and indigestion and dysentery with five species each. Three species - *Allium sativum* L., *Azadirachta indica* Juss. and *Aegle marmelos* (L.) Correa. - are each used as a therapeutic agent against up to five ailments. Mukul *et*

al. (2007) reported the use of *A. indica* Juss. alone against six diseases by the people residing in and around a conservation area of northern Bangladesh. This plant has been used in treating so many ailments that it has been called "the village pharmacy" in India (Anon. 2008b).

Table 2. Number of plants used against different ailments in the study area.

Name of ailments	Number of plants used					
	Herb	Shrub	Tree	Creeper	Palm	Total
Apathy to food intake	-	-	2	-	-	2
Cold & cough	4	2	-	-	-	6
Constipation	2	-	1	-	-	3
Cuts & wounds	4	-	-	2	-	6
Dandruff	-	1	-	-	-	1
Diabetes	-	2	5	3	-	10
Diarrhea	-	-	1	-	1	2
Dysentery	-	2	1	1	1	5
Ear ache	1	1	-	-	-	2
Faintness	1	-	-	-	-	1
Fever	1	1	-	-	-	2
Flatulence	1	-	1	1	1	4
Heat stroke	1	-	1	-	1	3
Hypertension & heart disease	1	-	1	-	-	2
Indigestion	-	-	4	1	-	5
Joint ache & rheumatism	-	1	-	1	-	2
Liver disease	1	-	-	-	-	1
Oral disease	-	2	2	-	-	4
Scabies & skin disease	-	1	1	-	-	2
Sexual disease	1	-	-	-	-	1
Skin dullness	2	1	-	-	-	3
Tonsil pain	-	1	-	-	-	1
Ulcer & gastric pain	3	-	4	-	-	7
Urinating problem	1	-	-	-	1	2
Vomiting	-	-	-	-	1	1
Worm in intestine	1	-	1	-	-	2

The diverse patterns of use of different parts of medicinal plants (Table 3) shows that rural people have a high level of indigenous knowledge, as discussed further below. Most of the plant parts are consumed orally after processing, such as macerating or squeezing into extracts, grinding into powder, blending together, soaking in water, boiling in water or milk or mustard oil, rubbing, or burning. Some are taken raw, and some after cooking as vegetables. Some plant parts are applied externally to different body parts for curing cuts, wounds, scabies, muscle congestion and joint ache, and skin problems. There are also some unusual uses of plant parts. One is the use of fresh mango leaf, which is wrapped and used as a toothbrush, without any toothpaste, to

keep teeth healthy. Another is the sun-dried seed of *Jam* (*Syzygium cumini* (L.) Skeels.) which, after grinding into powder, is licked with some salt as a regular treatment against diabetes. This corresponds with the findings of Pandey and Khan (2002) who suggested the 40% water-soluble gummy fiber present in *Jam* seeds lowers blood glucose levels in diabetic rats. Another important medicinal plant used frequently is *Momordica charantia* L.. Both the leaf and fruit of this creeper are used against diabetes; comparably, Umesh *et al.* (2005) explored the efficacy of this plant against diabetes in rats, and Dean (1997, cited in Miah and Chowdhury 2003) found that *M. charantia* L. proteins (the momorcharins) selectively inactivate the ribosomes of tumor and HIV-infected cells, without damaging the healthy cells.

Maintenance, myth and traditional beliefs

Since most of the plant parts used for curing ailments are gathered from homesteads, the respondents use several maintenance regimes (Alam and Mohiuddin 1992). However, some rural people are keen to raise certain species with medicinal properties, particularly *Azadirachta indica* Juss., *Punica granatum* L., *Lawsonia inermis* L., *Ocimum sanctum* L. and *Areca catechu* L.. *A. indica* is usually planted on the southern side of the homestead in the belief that air from the south is purified by its foliage. They take special care of this plant in terms of watering, supporting with sticks, and removing dried leaves and branches in the early stages of growth. *L. inermis* L. and *O. sanctum* L. are viewed as sacred plants by the people of the Muslim and the Hindu religious communities, respectively, and are the most cared-for species in the study area. The leaf of *L. inermis* L. is often used in dyeing the palms of the hands of females and children on religious occasions, and of the couple at bridal ceremony, and more generally in the Muslim community, and younger family members sometimes put their own blood at the base of the plant at the time of planting, with a superstitious belief of hoping for long life. In the Hindu community, the leaf of *O. sanctum* L. is used commonly in worship; the earth around the base of this species is kept neat and clean, even buffed up regularly with mud paste by older Hindu women with a religious belief. Miah and Rahman (2004) have also reported the availability of these two plants and their religious folk-ways having positive effects on the flora of the Muslim and Hindu homesteads in Bangladesh. Some species – such as *Aloe indica* Tow., *Kalanchoe pinnata* (Lamk.) Pers. and *Tagetes erecta* L. - are grown in earthen pots and kept in front of houses, serving both for beautification and medicinal purposes.

Indigenous knowledge

In traditional systems, indigenous knowledge (IK) plays a central role in disease diagnosis and health care practices (Zuberi 2004). In the present study, the rural people were found to depend heavily on plant parts for curing a variety of ailments. Not only older people, but also younger people, possess some knowledge on medicinal use of plants. However, while older people have a vast knowledge regarding the treatment of different disorders ranging from simple cuts to even incurable diabetes, younger people are knowledgeable only about the plants used to treat

Table 3. Using pattern of medicinal plants in the study area with parts used and ailments.

Local Name	Scientific Name	Parts Used	Ailments	Using Patterns	Source
Aam	*Mangifera indica* L.	Leaf	Teeth disease	Fresh leaves are wrapped and used as tooth brush without tooth paste.	Homestead
Ada	*Zingiber officinale* Rosc.	Rhyzome	Cold/cough	Cut into small pieces and boiled with tea, the decanted extract is then drunk mixing with lemon juice and slight salt.	Cultivated
Adoni	*Centella asiatica* (L.) Urban.	Whole plant	Cold/cough	Cut into pieces, macerated and mixed well with onion, green chili and mustard oil. Then eaten with hot rice.	Anthropogenic env.
Aphon	*Calotropis gigantean* L.	Leaf	Joint ache, rheumatism	Mature leaves are heated over lamp, then placed and pressed over the joints.	Anthropogenic env.
Anarosh	*Annas comosus* (L.) Merr.	Ripe fruit	Fever, intestinal worm	The inner flesh is eaten raw.	Market
Arjun	*Terminalia arjuna* Bedd.	Bark	Hypertension & heart dis.	Soaked in water, decanted water is drunk on a regular basis.	Homestead
Basak	*Adhatoda vasica* Nees.	Leaf	Cough, phlegm congestion during cold	Leaves are macerated and extract is drunk orally.	Anthropogenic env.
Bel	*Aegle marmelos* (L.) Correa.	Fruit	Heat stroke	Inner flesh of ripe fruits is blended with salt and sugar; then taken orally.	Homestead and market
			Ulcer, gastric pain, indigestion, constipation	Dried inner flesh is soaked in water. The decanted water is drunk and soft fruity parts are chewed.	
Bhait	*Clerodendrum viscosum* Vent.	Root	Ear ache	The roots of mature plants are squeezed; the extract thus obtained is heated and then applied inside ears with cotton bud after cooling.	Anthropogenic env.
Chatim	*Alstonia scholaris* Br.	Bark	Diabetes	Bark is soaked in water and decanted extract is drunk.	Anthropogenic env.
Chirota	*Swertia chirata* Ham.	Whole plant	Gastric pain, diabetes, liver dis., fever	Dried plants are soaked in water over night and decanted extract is drunk in the morning with empty stomach.	Market
Daad	*Cassia alata* L.	Leaf	Scabies, skin diseases	Fresh mature leaves are ground to paste and applied over the infected areas.	Anthropogenic env.
Dalim	*Punica granatum* L.	Leaf	Worm in intestine	Leaves are macerated and extract is taken orally in the morning with an empty stomach.	Homestead
Dombor	*Ficus hispida* L.	Inflorescence	Diabetes	Cooked as vegetables and eaten with meals.	Anthropogenic env.
Dupa	*Cynodon dactylon* Pers.	Tender leaf	Cuts and wounds	Ground to make paste and placed over wounds.	Anthropogenic env.
Genda	*Tagetes erecta* L.	Leaf	Cut	Ground to make paste and placed over the cut to stop bleeding.	Homestead
Grito-kumari	*Aloe indica* Tow.	Leaf	Ulcer, constipation, skin dullness	The inner gels of the fleshy leaves are mixed with water and swallowed directly.	Homestead
Holud	*Curcuma longa* L.	Rhyzome	Skin dullness	Green rhizome is ground to make paste and the paste is massaged over face and hands of women.	Market
			Wounds in	Dried mature rhizome is ground with water to	

			livestock	make paste, heated and applied over wounds in livestock getting injured by the attack of predator animals.	
Isopgul	*Plantago ovate* Forst.	Seed coat	Heat stroke, gastric pain, constipation	Soaked in water and the mixture is taken orally early in the morning with empty stomach.	Market
		Seeds	Sexual weakness in males	A table-spoon of seed is cooked with 250 ml milk and sugar and then eaten as sweet-meats.	
Jam	*Syzygium cumini* (L.) Skeels.	Seed	Diabetes	Sun-dried seeds are ground to powder. The powder is eaten by licking with some salt.	Homestead
Joba	*Hibiscus rosa-sinensis* L.	Flower	Dysentery	Petals are rubbed well with water. The decanted juice is taken orally.	Homestead
	.		Skin problem in hand palm	Petals are macerated in between the palms.	
Jolpai	*Eleocarpus robustus* Roxb	Fruit	Apathy to food	Green fruits are sunk into hot liquid extract found after cooking rice and eaten with salt when it becomes soft.	Homestead
Kanthal	*Artocarpus heterophyllus* Lamk.	Inflorescence	Apathy to food	Cut into small pieces, mixed with ripe tamarind, hot chili and salt; then eaten.	Homestead
Kochu	*Colocasia esculenta* (L.) Schott.	Leaf	Cuts and wounds	Petiole's extract is applied over the cuts and wounds.	Anthropogenic env.
Komla	*Citrus aurantium* L.	Fruit skin	Stomach pain	Dried skin along with betel leaf is chewed and extract is swallowed.	Market
Kela	*Musa* spp Var.	Green fruit	Dysentery	Green fruits are burnt, then macerated and mixed with onion and salt; then eaten with hot rice.	Homestead and market
Korola	*Momordica charantea* L.	Leaf, fruit	Diabetes	Ground to find extract which is drunk on a regular basis. Fruit is also cooked as vegetables and eaten with meals.	Cultivated
Lemu	*Citrus aurantifolia* (Chris. & Pan.) Sw.	Leaf	Bad smell in mouth	Fresh mature leaf is chewed.	Homestead and market
		Fruit skin	Pyorrhea	Green fruit skin is eaten with meal.	
Maya lota	*Mikamia scandens* (L.) Willd.	Leaf	Cuts and wounds	Macerated leaves are placed over wounds to stop bleeding.	Anthropogenic env.
			Dysentery, diabetes	Extract obtained after grinding leaves is taken orally.	
Mendi	*Lawsonia inermis* L.	Leaf	Dandruff and grey hair	Leaves are ground to make paste which is applied to hair overlapping the head. After 1-2 hours, rinsed and washed.	Homestead
			Leg burning due to diabetes	Dried leaves are soaked in water over night. Decanted water with leaf extract is drunk in the morning with an empty stomach.	
Menda	*Litsea polyantha* Juss.	Leaf	Diarrhea and dysentery	Juice obtained from grinding leaves is taken orally.	Anthropogenic env.
Methi	*Trigonella foenum-graceum* L.	Seed	Diabetes	Chewed with betel leaf and extract thus produced is swallowed.	Market
Narkel	*Cocos nucifera* L.	Fresh juice	Burning in urinating, heat stroke	Natural water of green fruit is drunk directly.	Homestead
		Tender seed coat	Diarrhea, dysentery	After scrapping tender coat is eaten raw.	

Neem	*Azadirachta indica* Juss.	Leaf	Scabies, eczema, skin diseases	Mature leaves are ground to make paste; the paste is placed over the infected areas.	Homestead
			Diabetes	Fresh tender leaves are cooked with shrimps and oil; then eaten with rice. Dried leaves are soaked in water over night and decanted extract is taken orally.	
		Narrow branch	Tooth ache	Cut into pieces of 6 inches and used as tooth brush without any tooth paste.	
Ninda	*Vitex negundo* L.	Leaf	Tonsil pain	Leaves are boiled in hot water with some salt and then gargled for several times.	Anthropogenic env.
		Branch	Tooth ache	Cut into pieces of 6 inches and used as tooth brush without any tooth paste.	
Paan	*Piper betel* L.	Leaf	Flatulence, indigestion	Along with betel nut, ginger and CaO leaf is chewed and extract is swallowed.	Market
			Congestion in muscles	Leaf is heated over lamp and placed over muscles	
			Cuts and wounds	Leaf is macerated and applied over wounds to stop bleeding.	
Pathor-kuchi	*Kalanchoe pinnata* (Lamk.) Pers.	Leaf	Cough in baby	Fleshy leaves are rubbed well to extract the juice which is fed to babies with sugar.	Homestead
Piaj	*Allium ceipa* L.	Tuber	Phlegm congestion in cold	Cut into pieces, added in hot water in a cylindrical container and stirred well. Then the vapor emitting from the mixture is slowly breathed in each nostril.	Market
Roshun	*Allium sativum* L.	Cloves	Heart dis., flatulence, troubles in urinating	Eaten raw with regular meals.	Market
			Faintness	Heated with mustard oil, then massaged on palms and feet of faint patient.	
			Ear ache	Heated with mustard oil and then applied with cotton bud inside the ear in case of severe ear ache.	
Tela-kucha	*Coccinea cordifolia* L.	Leaf	Diabetes	Leaves are cooked as vegetables and eaten with rice.	Anthropogenic env.
Tetoi	*Tamarindus indica* (L.) Cogn.	Fruit	Diabetes	Inner part of ripe fruit is rubbed with water. The mixture is taken orally with some salt.	Homestead
Trifola (Amloki, Horitoki & Bohera)	*Emblica officinale* L. *Terminalia chebula* Retz. *Terminalia belerica* Roxb.	Dried fruits	Ulcer, gastric pain, indigestion	Soaked in water over night and decanted extract is drunk in the morning with an empty stomach.	Market
Tulshi	*Ocimum sanctum* L.	Leaf	Cough	Leaf extract is taken orally after mixing with few drops of honey.	Homestead
Shuari	*Areca catechu* L.	Seed	Flatulence, vomiting	Dried seeds are cut into pieces, chewed for some time and extract is swallowed finally.	Homestead and market

common ailments such as cuts, wounds, scabies, aching joints, stomach pain, cold, coughs, diarrhea, and dysentery. Our fieldwork suggested that older people generally suffer from more complex ailments such as hypertension, diabetes, and sexual weakness, which makes them more interested in looking for the curative agents available in the region, while younger people usually

do not care much about these issues. As the simple ailments mentioned above are more commonly seen in younger people, they get acquainted with respective curative plants by being informed repeatedly by older people. Whenever children get sick, their parents or other older members of the family take care of them with medicinal plants. However, this is all at the preliminary stage; if anybody suffers severely from any disease, they go to the Upazilla Health Complex, eight Family Planning Centers, five Satellite Clinics and village physicians for modern medical treatments (Mahin 2004).

In the study area, all members of the respondents' families appeared to have equal access to available IK, as older people actively wish to disperse knowledge deliberately to the younger generations. However, some people prepare and prescribe certain herbal medicines secretly, using single or multiple plant parts, and do not wish to transmit the recipe or formula to others, claiming that they obtained the method in a nightmare, and that it will lose its efficacy if unlocked to all. They are reported to pass on that knowledge to only one selected member of the family who does not disseminate the knowledge. In such cases, ethno-botanists may face an obstacle in documenting IK for corroboration with existing scientific knowledge or assessing possibilities for further research on the efficacy of the respective plants against diseases.

Conclusion

Rural people have a strong reliance on plant resources for everyday healthcare. Because of their high dependence on plants for medicinal uses, they have an intimate understanding of the ecology and, in some cases, the silviculture of different plant species. Such knowledge could easily provide the basis for the commercial farming of some selected plants, which could decrease the need to import herbal medicinal raw materials, thus benefiting the national economy. The state Forest Department could foster medicinal plant cultivation involving local people in terms of training, technology, raw materials, supervision and marketing. IK-based folk medicine is specific to ecosystems and ethnic communities, with different characteristics in different localities (Zuberi 2004). Prakash (1999) suggested that such knowledge increases the efficiency of screening plants for medicinal properties by more than 400 percent. The IK practiced by rural people in using medicinal plants can also be used in the conservation of forest resources, as proposed in the Convention on Biological Diversity. When leaves are the main plant part used for medicine, and they are not overharvested – as often happens commercially – but used for everyday treatment, rural people ensure sustainability in natural resource utilization, and this may be the key factor in the conservation of floral diversity. Full understanding of the medicinal values of the plants used by rural people requires chemical analysis of the respective plant parts, which may provide suggestions for research on the properties of those plants for treating diseases. Such research, linked to experimental trial testing of the effect of folk medicines would increase the confidence of traditional users and healers in the possible effects of such herbal preparations. Both government agencies and non-governmental organizations have roles to play in this regard.

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