

Ethnomedicinal Uses of Medicinal Plants with Citation Frequencies: Used by the Local People of Kapasia Upazila under Gazipur District, Bangladesh

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Abstract: Ethno-medicinal study was conducted to document medicinal plants used by the local people of Kapasia upazila under Gazipur district. The targets of the study were to identify and document plant species used for treatment of various ailments and to find out the level of consensus or agreement between informants regarding the uses of plants for particular diseases categories. The study has been resulted in recording of 100 medicinal plant species with 329 formularies to treat 72 ailments. These Ethnobotanical data were collected by interviewing 108 local informants from 5 different localities of Kapasia upazila under Gazipur. Demographic features of informants, life-form, part-used, methods of preparation, mode of application and ethnomedicinal uses were documented. These species belongings to 96 genera and 51 families. Such data indicates that the study area has plenty of medicinal plants with their diversity of health care uses. Ailment category **Cardiovascular diseases** attained highest FIC (Factor of Informants Consensus) value. Species used for this purpose are *Tamarindus indica* which were cited by many informants. Second highest FIC value was found in case of **Fever**. Medicinal plants used for this purpose are *Ocimum sanctum & Adhatoda vasica*. Those were cited by a good number of informants. Highest FIC values attained plants could be recommended for further phytochemical study to isolate compounds responsible for the remedy of ailment category such as Cardiovascular disease and Fever. *Ocimum sanctum* was the most utilized medicinal plant species with highest CF (Citation Frequency) value that used for Cold, Cold-fever, Cough and Running nose. In the present survey, 9 species have attained 100% FL (Fidelity Level) values. This FL values means that the informants tend to rely on one specific plant species for treating one certain ailment than several ailments. The study asserted that such species need to be protected in the study area to sustain traditional medicinal plants and culture. Finally, number of threats to the medicinal plants have been identified and some measures for conservation have been suggested.

Keywords: Ethnomedicinal plants, Consensus factor, Local people, Gazipur district, Bangladesh.

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Introduction

Human has been depended on plants for various needs since time immemorial as all ancient and modern people have used plants as a source of medicines (Hussain et al. 2006). Documentation of traditional knowledge on ethnomedicinal use of plants has been considered as a high priority to support the discoveries of drugs benefiting mankind. (Pieroni 2000, Pradhan and Badola 2008). Ethnomedicinal studies are of significant value to discover contemporary drugs from indigenous medicinal plant resources. In 2003, the world health organization (WHO) calculated that over 80% of African population used traditional medicinal for primary health care and the treatment with medicinal herbs comprises 30-40% of all used medications in China (O' Sullivan, 2005). Bangladesh is a rich floral diversity most of which possesses medicinal properties (Rana et al.2010). The rural population of Bangladesh has traditionally depended on folk medicinal healers for treatment of their ailments (Hussain et al. 2006). The work on ethnobotany in Bangladesh is very recent, but Hutchinson first worked on CHT (Chittagong Hill Tracts) in 1909. In our country, the identification and documentation of medicinal usages of plants has already been started. Some noticeable studies include Hassan and Khan (1986,1996), Mia and Huq (1988), Alam (1992), Alam et al. (1996), Khan et al. (2002), Yusuf et al. (2002), Uddin and Hassan (2004), Uddin et al. (2004), Uddin et al. (2006), Uddin (2006), Uddin et al. (2008), Yusuf et al. (2006), Uddin and Roy (2007), Uddin et al. (2012), Haque et al. (2014) and Uddin and Hassan(2014). In the recent era, the role of medicinal species in traditional health practice has diverted the attention of researches towards ethnomedicines. These traditional medicines are cost effective, safe and affordable (WHO). This article has provided a vast information about the medicinal plants of Kapasia upazila under Gazipur district. The information of medicinal plants was collected from interviews of local peoples. The present study was designed to document the medicinal uses of plants and to determine consensus of such uses among the villagers of Gazipur. Present investigation gives an opportunity to explore the interrelationship between plants, human being, environment ecology and traditional knowledge.

Materials & Methods

Study area

Gazipur is a district of Bangladesh. It is located in the northern neighborhood of Dhaka. This district lies between 23054'41.4792" N and 90023'20.2632" E. The total area of Gazipur is

about 1741.53 km². The district is bounded by Mymensingh and Kishoreganj districts on the North, Dhaka, Narayanganj and Narshingdi district on the South, Narshingdi on the East, and Dhaka and Tangail districts on the West. The district was established in 1984. It has 1 city corporation, 5 upazilas including Gazipur sadar upazila, Kaliakair upazila, Kapasia upazila, Sreepur upazila, Kaliganj upazila. 40 union parishads, 710 moujas, 3 municipalities, and 1163 villages. Main rivers are old Brahmaputra, Shitalakshhaya, Turag, Bangshi, Balu, Banar. The area enjoys tropical climate with average annual rainfall is 2036 mm. The summers are much rainier than the winter in Gazipur. Bhawal National Park is located in Gazipur. It is truly natural treasure. The ethnic group Garo, who inhabit Mymensingh, Tangail, Jamalpur, Sherpur, Sylhet and Gazipur. However, all homesteads are usually covered by dense and lush green foliage of wide variety of both native and exotic species of trees. Both sides of the high road are covered by exotic trees.

Plant samples and data collection

The study area has been visited 4-5 times in different seasons of the year 2016-2017. The data of medicinal uses have been recorded through semi-structured interviews, key informant discussions and informal conversations with local people and also herbal practitioners (Alexiades1996). Participant observation, plant interview, field interview and group interview were also followed to collect data (Alexiades 1996). A total of 107 informant has been interviewed. They were mostly female with the age range from 18 to 80 years old. Male informants were also interviewed. Education levels of the informants were from illiterate up to B.Sc. degree. Professionally they were mostly housewife, small shopkeepers & high school teacher. During the fieldsurvey, information on uses of plants to treat different ailments, parts used, modes of preparation as well as administration was gathered during the field study. The vernacular names have been collected with the help of local people. Voucher specimens for each medicinal plant have been collected and processed using standard herbarium techniques (Hyland 1972 and Alexiades 1996). The specimens were identified consulting different floras viz., Hooker 1872-1897, Prain 1903, Uddin and Hassan 2004, Siddiqui et al. 2007c and Ahmed et al. 2008a, 2008b, 2009c, 2009d, 2009e. Specimens available at Dhaka University Salar Khan Herbarium (DUSHA) were consulted in identifying the collected plant specimens. The voucher specimens are deposited at DUSHA.

Data analysis:**Factor of informant consensus (Fic):**

$$Fic = \frac{Nur - N_{taxa}}{Nur - 1}$$

Where, Nur is the number of use reports in each category and N_{taxa} is the number of species in each category (Heinrich et al. 1998).

Citation frequency of medicinal plants (Cf %): Cf values are useful to determine most common medicinal plants in the study area. Citation frequency values of medicinal plants were estimated using the formula:

$$Citation\ frequency = \frac{n}{N} \times 100$$

Where, n refers to number of people interviewed citing species, N refers to total number of people interviewed (Friedman et al. 1986).

$$Fidelity\ level\ (Fl\ \%) = \frac{I_p}{I_u} \times 100$$

Where, I_p denotes to number of informants who indicate use of a species for the same major ailment, I_u refers to total number of informants who mentioned the same plant for any other use (Friedman et al. 1986).

Result & Discussion

A total of 100 plant species belong to 96 genera and 51 families with 329 formularies have been recorded from Kapasia. Such plants were used to treat 72 ailments. For each species scientific name, local name, parts used, ailments treated, mode of treatment and percentage of respondents (citation) who have knowledge, have been provided (Table 1). It is evident that the study area still has huge diversity of knowledge about the uses of medicinal plants. Such knowledge has been inherited orally from generation to generation. One of the causes for huge diversity of medicinal plants is that the study area located near to the Gojari forest.

Among these plants used parts are Bark (48%), Leaf (24%), Stem (16%), Fruit (12%). Barks are the majority of parts used followed by leaves, stem, fruits (Fig 1). Among the medicinal plants, about 23 has been represented by herbs, 25 by trees, 27 by shrubs and 25 by climbers (Fig 2). This is an indication of sustainable use of natural resources. Out of 329 formularies, 66 was of internal applications and rest 34 were external applications (Fig 3). According to informants, maximum medicinal plants (62) they used to have been collected from wild resources (Fig 4)

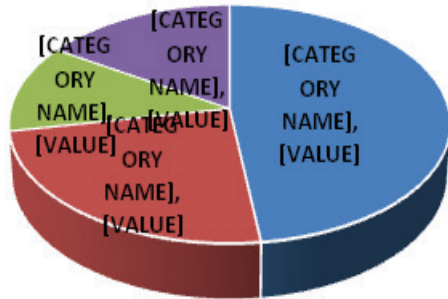


Fig 1: Plant's parts

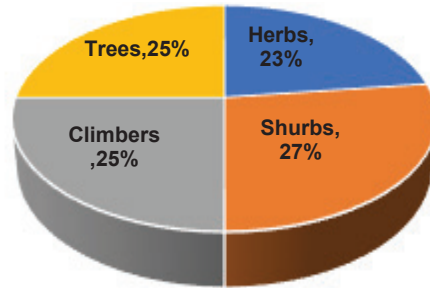


Fig 2: Plant's classification

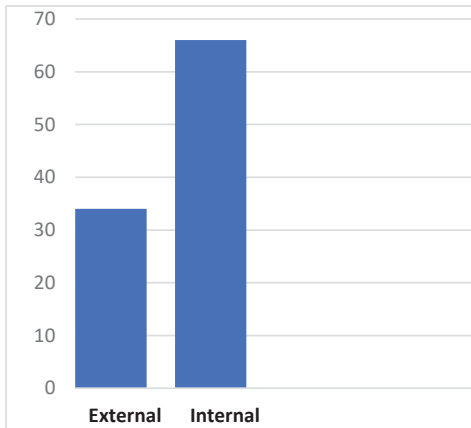


Fig 3: Application type

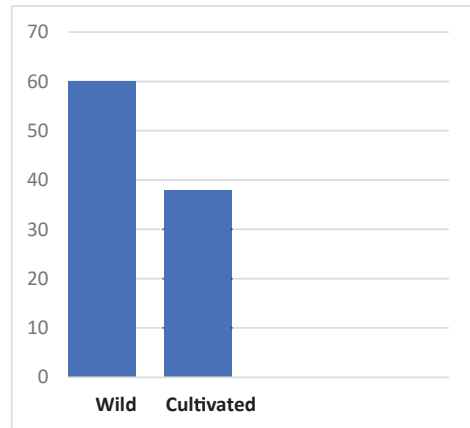


Fig 4: Plants type

Modes of preparation and administration:

The modes of preparation of herbal medicines were in the forms of paste, powder, tablet, juice, raw and fumes. In terms of administration, oral administration was found as the principal mode of intake of medicine followed by administration of dermal, nasal and others. We found that FMPs in the investigated area often mix water as a solvent for preparation of juice after mashing, and sometimes milk / coconut water / lemon sap is added as a solvent to increase the viscosity of the preparation.

Table 1: Ethnomedicinal uses of medicinal plants with citation frequencies (CF):

Scientific name & Local name	Family & Plant type	Part used	Ailments	Treatment method	CF%
<i>Adhatoda vasica</i> Nees PS1 (Bashok/ Bahok)	Acanthaceae, Shrub	Leaf	Cough	Warm Juice is used.	31.50
<i>Aegle marmelos</i> (L.) Corr. PS2 (Bel)	Rutaceae, Tree	Young fruit	Dysentery, Anthelmintic, keep stomach cool, Piles, Keep body cold, Freshness, Cow's diarrhea;	Juice is taken.	8.33
<i>Allium sativum</i> L. (Roshun/Roun)	Liliaceae, Herb	Tuber, Bulb	Pain, Cold-fever, Liver disease, Headache;	Flake is used, juice is taken.	5.50
<i>Alstonia scholaris</i> (L.)R.Br.PS58 (Chatim/ Chaitta)	Apocynaceae Tree	White juice, Stem, Bark	Child's cough, Diarrhea, Keep body cool, Dysentery;	White latex of leaf is used, juice is taken.	6.48
<i>Amorphophallus bulbifer</i> (Rox b.)PS3 (Mankachu)	Araceae, Shrub	Rhizome, Root, Stem, Leaf	Pain	Rhizome is eaten.	1.85
<i>Amorphophallus paenifolius</i> (Dennst.) Nicolson Var. Campanulatus (Decne.) (OI/Olkochu)	Araceae, Annual bulb bush	Stem	Pain, Piles, Blood purifier.	Rhizome is eaten. Whole plant is eaten also.	4.63
<i>Ananas sativus</i> (Lindl.) Schult. F. PS4 (Anarosh)	Bromeliaceae, Herb	Leaf, Young part of stem	Hair grow/ tonic, Anthelmintic	Juice is taken.	8.33

Table 1 contd)

<i>Andrographis paniculata</i> (Brum.f.) Wall.ex Nees PS5 (Kalmegh/Kalmeghi/Chirta)	Acanthaceae, Herb	Leaf, Stem	Anthelmintic/Helminthosporium, Liver disease, Fever	Juice is eaten, Leaf is used too.	12.90
<i>Artocarpus heterophyllus</i> Lamk. PS6 (Kathal/Kadol)	Moraceae, Tree	Bark, Tumer	Headache;	Tumor type part is eaten.	0.92
<i>Borassus flabellifer</i> L. PS7 (Tal/Ashari)	Palmae, Tree	Young root,	Cold, Cough;	Young root is used.	
<i>Brassica campestris</i> DC. Non L PS69 (Sarisha/Eura)	Cruciferae, Annual plant	Seed	Cold, Cough;	Seed are used.	0.93
<i>Bryophyllum pinnatum</i> (Lamk.) Oken PS8 (Pathorkuchi)	Crassulaceae, Herb	Leaf, Rhizome	Burning sensation, Debility, Stomachache, Jaundice, Kidney problems,	Juice & leaf extract is used.	9.23
<i>Cajanus cajan</i> (L.) Millsp. PS9 (Orohor/Aroshpata)	Fabaceae, Shrub	Leaf	Jaundice, Debility, Burning sensation in different parts of body.	Leaf is used.	12.04
<i>Calotropis procera</i> (Ait.) R. Br. PS10 (Akanda/Ahon pata)	Asclepiadaceae, Shrub	Leaf	Wrenched, Fractured bone;	Leaf is used.	1.85

Table 1 Contd.)

<i>Carica papaya</i> L. PS11 (Pepe)	Caricaceae, Tree	Fruit	Increase digestion ability, Piles, Indigestion, Gastric, Ulcer, Ring	Raw & ripe fruit is eaten.	7.40
<i>Cassia alata</i> (L.) PS12 (Dadmordon)	Fabaceae, Tree	Leaf	Ring worm, Scab	Leaf is used.	1.85
<i>Cassia fistula</i> L. PS13 (Shonalu/ Bandorlathi/ Bandorlori)	Fabaceae, Tree	Fruit	Cough, Anthelmintic, Cow's diarrhea, Diarrhea, Piles, Fever, Child's cold.	Black part inside the fruit is used.	9.26
<i>Centella</i> <i>asiatica</i> (L.) Urban PS14 (Thankuni/ Khuidamanik/ Khudemanik)	Umbelliferae, Herb	Whole plant, Leaf	Debility, White flow, Child's sleeping, Jaundice, Blood purifier, Stomachache, Dysentery, Brain tonic, Anemia, Burning sensation, Heart disease,	Whole plant is used.	21.30
<i>Chromolaena</i> <i>odorata</i> (L.) King & Robinson PS15 (Bagajori/ Dumki/ Ashamlota)	Asteraceae, Climber	Leaf	Stop bleeding from wound.	Leaf extract is used.	10.2
<i>Cicca acida</i> (L.) PS16 (Orboroi/ Toluibori)	Euphorbiaceae, Herb	Bark	Tooth pain.	Bark is used.	0.92

Table 1 Contd.)

<i>Citrus aurantifolia</i> (Christm. & panzer) Swingle PS17 (Kagoji lebu/ Nemu)	Rutaceae, Shrub	Fruit	Appetizer, Vomit;	Sap is eaten from fruit.	1.85
<i>Citrus grandis</i> (L.) Osbeck PS18 (Jambura)	Rutaceae, Shrub	Fruit	Cold	Fruit is eaten.	0.92
<i>Clerodendrum viscosum</i> Vent. PS19 (Vaat/Vait/Vat pata)	Verbenaceae, Shrub	Leaf	Stomachache, Abscess, Scab, Child's Piles, Tooth pain, Child's cold;	Leaf is eaten.	9.26
<i>Coccinea grandis</i> (L.) Voigt PS20 (Telakucha)	Cucurbitaceae, Climbing & cirrus herb	Leaf	Diabetes, Dropsy, Period problem, Burning sensation in different parts of body;	Plant is eaten, leaf juice is eaten too.	7.40
<i>Cocos nucifera</i> L. PS21 (Narkel/ Dab)	Palmae, Tree	Water	Diarrhea, Jaundice	Fruits water is drunk.	1.85
<i>Coix lachrymal-jobi</i> L. (Kaijgota)	Poaceae	Leaf	Jaundice	Leaf juice is eaten.	0.92
<i>Colocasia esculenta</i> (L.) Schott PS22 (Kachu)	Araceae, Shrub	Leaf, Stem	Blood purifier	Leaf & stem is eaten.	0.92
<i>Costus speciosus</i> (Koenig ex Retz. Smith) PS23 Khustha/ Kura/ Kew	Castaceae, Shrub	Rhizome	Anthelmintic/ Helminthosporium;	Sap of rhizome is taken.	0.925

Table 1 Contd.)

<i>Chrinum asiaticum</i> Roxb. PS24 (Bonrashun/ Bonrown/ Gor rown/ Bon kanur)	Amaryllidaceae, Shrub	Bulb, Stem	Cow's disease, Liver disease	Stem is used.	1.85
<i>Crotalaria saltiana</i> Andr. (Jhunjhuna/ Jhonjhoni)	Fabaceae, Shrub	Leaf	Eczema	Leaf paste is used.	0.92
<i>Curcuna longa</i> L. PS25 (Holud/Holdi/ Oldi)	Zingiberaceae, Herb	Rhizom, Flower, Stem	Disease protector, Weakness, Excess bleeding in period, Abscess, Child's abscess, wrenched, skin beauty, Blood purifier.	Turmeric pest & juice is used.	6.48
<i>Curcuma zedoaria</i> (Christm.) Rosc. (Shoti/ Hodi/ Fodi)	Zingiberaceae, Shrub	Rhizome , Stem	Cow's diarrhea, Stomachache, Cow's disease, Hen's fulfulia disease.	Juice of stem & rhizome is used.	5.55
<i>Cuscuta reflexa</i> Roxb. PS26 (Shornolata/ Shoinnolata/ Shunnolata)	Convolvulaceae, Sycophant	Stem, Leaf	Wrenched, Jaundice, Diabetes, Fracture, Anthelmintic	Extract of stem, leaf & rhizome is used. Stem is used separately.	5.55
<i>Cynodon dactylon</i> (L.) Pers. PS27 (Durba ghash)	Poaceae, Herb	Whole plant, Leaf	Stop bleeding, Jaundice, Debility, Anthelmintic, Helminthospori- -um, Wound, Gastric;	Plant is chewed, juice from plant is eaten.	17.60

Table 1 Contd.)

<i>Datura metel</i> (L.) PS28 (Dhutura/ Dhatura/ Dhutra)	Solanaceae, Shrub	Leaf, Flower	Scab, Abscess, Ear pain, Dog's bite, Dropsy	Leaf pest & extract is used.	10.18
<i>Diplazium esculentum</i> (Retz.) Sw. PS29	Pteridophyta	Root	Fever	Plant is tied with child's hand.	0.92
<i>Drynaria quercifolia</i> (L.) J.Sm. PS30 (Jungra/ Pankhiraz)	Polypodiaceae	Rhizome Root	Headache, Gastric	Root is used, sap from rhizome & stem is eaten.	5.55
<i>Diospyros philippensis</i> (DCS.) PS31 (Gab/ Bilati Gab)	Ebenaceae, Medium Tree	Bark	Cholera, Dysentery	Bark is used.	0.92
<i>Eclipta prostrata</i> (L.) Mant. PS32 ()Kalakehorta/ Kalkeshi/ Keshraj	Asteraceae, Herb	Whole plant, Leaf	To induce child's sleep, Child's digestion & Anthelmintic, Child's stomachache, Jaundice, Debility, Scab, Diarrhea, Burning sensation at different parts of body	Whole plant is used, leaf extract is eaten.	13.80
<i>Elaeocarpus robustus</i> Roxb. PS33 (Jolpai/ Jolphoi)	Elaeocarpaceae, Small Tree	Fruit	Appetizer	Fruit is eaten.	0.92
<i>Erioglossum edulis</i> Blume (Chagol ledi/ Chagol ladi/ Chagol jhuri)	Sapindaceae, Small Tree	Fruit	Appetizer	Fruit juice is taken.	0,92

Table 1 Contd.)

<i>Erythrina orientalis</i> (L.) PS34 (Muchimandar/ Mandar/ Mandail)	Fabaceae, Medium tree	Flower, Bark	Child's vomiting, Cow's diarrhea, Dysentery	Bark is tied with child's hand. Juice from bark is used.	2.77
<i>Euphorbia thymifolia</i> (L.) Burm. PS35 (Dudhiya/ Dudhgudani/ Dudhmanik)	Euphorbiaceae, Shrub	Leaf, Stem, Leaf juice, Tree's juice.	Scab, Cow's disease, Cold, Child's diarrhea, Leg's abscess, to induce child's sleep, Weakness.	Leaf juice is used.	12.90
<i>Evolvulus nummularius</i> (L.) PS36	Convolvulaceae, Herb	Whole plant	Cut, Stop bleeding	Juice of plant is taken.	0.92
<i>Ficus racemosa</i> L. PS37 (Domrapata/ Dumur)	Moraceae, Shrub	Leaf, Fruit	Cow's cough, Dysentery	Leaf juice is taken, fruit is used.	2.77
<i>Glycyrrhiza glabra</i> Linn. (Josthimodhu)	Fabaceae, Climbing plant	Leaf	Piles	Leaf is eaten.	0.92
<i>Glycosmis pentaphylla</i> (Retz.) A.DC. PS38 (Motkila/ Datmajon/ Ashsheora)	Rutaceae, Shrub	Branch, Leaf	Dysentery, Tooth paste, Diarrhea, Jaundice, Ear wound, Child's stomachache.	Leaf juice is taken.	7.40
<i>Grewia tiliaefolia</i> Roth. PS39 (Dattoipata/ Aghor/ Ashar)	Tiliaceae, Medium tree	Leaf	Dysentery	Leaf juice is taken, young leaf is rubbed & eaten.	1.85

Table 1 Contd.)

<i>Heliotropium indicum</i> L. PS40 (Hatishur/ Attihura)	Boraginaceae, Herb	Leaf	Eye problem	Leaf juice is taken.	0.92
<i>Hibiscus rosasinensis</i> L. PS41 (Joba/ Rokto joba)	Malvaceae, Shrub	Leaf, Flower	Menstruation problem, Debility, Old dysentery	Flower is mashed to make tablet, juice of flower is taken.	4.63
<i>Holarrhena antidysenterica</i> (L.) Wall.ex. Decne. PS42 (Kurchi/ Kudishor)	Apocynaceae, Tree	Leaf, Seed, Leaf's sap.	Stop bleeding, Vomiting	Leaf juice is taken, seed is used.	3.70
<i>Hyptis suaveolens</i> (L.) Poit. (Tokma/Tomha /Tonha)	Labiatae, Shrub	Seed	Piles	Seed is used.	0.92
<i>Ipomoea fistulosa</i> Mart. ex. choisy PS43 (Bokful/ Dholkolmi)	Convolvulaceae, Heart	Leaf juice	Stop bleeding	Juice of leaf is given to the wound place.	0.92
<i>Jatropha curcas</i> L./ <i>Jatropha gossypifolia</i> L. PS44 (Berom/ Verenda/ Jatiberom)	Euphorbiaceae, Shrub	Juice from stem, bark & leaf	Foot abscess, Burning sensation, pain, Foot wound, Child's vomiting, Hand's wound.	Juice of stem is used; stem & bark are used too.	0.92
<i>Lablab purpureus</i> (L.) PS45 (Ushi/ Sim)	Fabaceae, Climbing plant	Leaf	Ring worm, Scab	Juice of leaf is used.	17.60

Table 1 Contd.)

<i>Lawsonia inermis</i> L. PS46 (Mehedi/ Mehedi)	Lythraceae, Shrub	Leaf	Cool brained, Hair tonic, increase beauty of hair, Weakness, Remove hair fall.	Leaf is mashed & used in different ways.	12.90
<i>Lannea coromandelica</i> (Hovtt.) Merr.	Anacardiaceae	Seed	Dysentery	Seed is smashed, juice is taken & used.	0.92
<i>Leucas aspera</i> (Willd.) Link PS47 (Dorkolosh/ Dondokolosh/ Shetdron)	Labiatae, Herb	Leaf, Root	Cold, Cough, Scab, Jaundice, Tumor	Leaf & flower juice is taken.	10.18
<i>Litsea glutinosa</i> (Lour.) Robinson PS48 (Karjolipata/ Kukurchita/Ch afaittapata/ Menda)	Lauraceae, Shrub	Leaf	Dysentery, burning sensation in different parts of body, Debility, Keep body cold, Piles, Piles.	Leaf sap Is taken & mixed with sugarcane & eaten.	14.80
<i>Loranthus falcatus</i> L.f. (Amkuruj/ Kudala)		Branch	Piles, Dysentery, Debility, Keep body cold.	Stem is cut & tied with hand.	0.92
<i>Mellotus philippensis</i> (Lamk.) (Shitarongi)	Fabaceae	Leaf	Gastric scab, Skin problem.	Leaf juice is eaten.	0.92
<i>Mangifera indica</i> L. PS49 (Aam)	Anacardiaceae, Tree	Leaf & Bark's juice, Leaf	Foot scab, Foot crack, Acne	Black cocoon grow on leaf is burned & given to the acne to cure it.	1.85

Table 1 Contd.)

<i>Melia azadirachta</i> L. PS50 (Nim)	Meliaceae, Tree	Leaf, Branch	Scab, Anthelmintic, Tooth pain & paste, Weevil (louse problem), Pimple, Skin disease.	Leaf is used in different ways.	25.92
<i>Mikania cordata</i> (Burm.f.) Robinson (Rifujilota/ Taralota)	Asteraceae, Shrub	Leaf	Stop bleeding	Leaf sap is taken.	0.92
<i>Mimosa pudica</i> L. PS51 (Lojjaboti)	Fabaceae, Shrub	Root	Fever at night, Headache, Period problem, Stop child's crying, Child's pimple, Madness, Appetizer, Snake bite, Fractured bone	Root is used in different ways.	11.10
<i>Momordica charantia</i> L. PS52 (Uchche/ Titakola/ Korola/ Uichcha)	Cucurbitaceae, Climbing plant	Fruit	Pain, Stomachache, Anthelmintic	VegeTable Is eaten, leaf juice is eaten too.	2.77
<i>Moringa oleifera</i> Lamk. PS53 (Shajna/ Shojina)	Moringaceae, Small tree	Bark, Leaf	Cold, Eye power decrease	Bark & leaf is eaten separately.	7.40
<i>Mucuna puriens</i> (L.) DC. (Bilaichimthi/ Alkushi/ Kanch)	Fabaceae, Climbing plant	Seed	Insect's bite	Seed is made powder, given to the wounded place.	0.92

Table 1 Contd.)

<i>Musa paradisiaca</i> (L.) PS54 (Kola/ Modnakola)	Musaceae, Shrub like herb	Root	Dropsy	Root is tied with hand or body.	1.85
<i>Neolamarckia cadamba</i> (Roxb.) Bosser PS55	Rubiaceae, Deciduous plant	Leaf	Pain	Wormed & fomented leaf is used.	0.92
<i>Nigella sativa</i> L. (Kalizira/ Kalazira/ Kalozira)	Umbelliferae, Herb	Seed	Stomachache, Cold, Diarrhea	Seed is eaten.	7.40
<i>Nymphaea nouchali</i> auct. non. Burm. f. PS56 (Hapla/ Shapla)	Nymphaeaceae, Aquatic herb	Whole plant	Period problem, Excess bleeding	Whole plant is used to make tablet with Rokto-chondon plants parts.	0.92
<i>Ocimum sanctum</i> L. PS57 (Tulshi)	Labiatae, Herb	Leaf	Cold- cough, Running nose, Cold- fever;	Leaf juice is used in different ways.	36.11
<i>Phyllanthus embelica</i> L. PS58 (Amloki)	Euphorbiaceae, Medium tree	Fruit	Appetizer, Piles, Hair tonic, remove hair falling, Wound, Cut, Blood purifier, Weakness.	Raw fruit is eaten, fruit juice is eaten too.	11.11

Table 1 Contd.)

<i>Physalis minima</i> Linn. PS59 (Fotka/ Potka/ Futki)	Solanaceae, Herb	Leaf	Scab, Asthma	Leaf juice is eaten.	1.85
<i>Piper betle</i> L. PS60 (Pan)	Piperaceae, Creeping herb	Leaf, Root	Blood control, Blood purifier	Root & leaf is eaten.	1.85
<i>Polygonum hydropiper</i> L. PS61 (Panmorich)	Polygonaceae, Herb	Leaf	Goat's louse	Leaf paste is used.	0.92
<i>Psidium guajava</i> L. PS62 (Horfi/ Peyara)	Myrtaceae, Small tree	Leaf	Tooth pain	Leaf is used in different ways.	5.55
<i>Pterocarpus santalinus</i> L.f. (Lal chandan)	Fabaceae, Tree	Fruit	Hemorrhage	Fruit is used.	0.92
<i>Punica granatum</i> Linn. PS63 (Dalim/ Dalem)	Punicaceae, Shrub	Leaf, Fruit	Hand & foot's abscess, Nail abscess in foot, Pox, Wound, Blood purifier, to induce sleep, Dysentery.	Leaf & fruit juice is used.	7.40
<i>Shorea robusta</i> Roxb.ex Gaertn.f. (Gajari/ Shal)	Dipterocarpaceae, Tree	Bark	Dysentery	Bark is soaked & eaten.	0.92
<i>Swietenia mahagoni</i> Jacq. PS64 (Mehguni/ Mehgoni)	Meliaceae, Big tree	Fruit, Seed	Diabetes	Seed is eaten, white part of fruit is used.	1.85

Table 1 Contd.)

<i>Syzygium cumini</i> (L.) Skeels PS65 (Jum)	Myrtaceae, Big tree	Seed	Dysentery	Smashed seed is eaten.	0.92
<i>Tagetes patula</i> L. PS66 (Gada/Genda)	Asteraceae, Herb	Leaf	Stop bleeding, Cut, Wound	Leaf juice is used.	7.40
<i>Tamarindus indica</i> L. PS67 (Tetul/Tetoi)	Fabaceae, Tree	Ripe fruit, Raw fruit	High blood pressure, Cold, Diabetes	Ripe & raw fruit is eaten.	9.26
<i>Terminalia arjuna</i> (Roxb. ex Dc.) Wight & Arn. PS68 (Arjun)	Combretaceae, Tree	Bark	Heart disease, Weakness, Burning sensation, Old dysentery	Bark is soaked & eaten that water. Leaf juice is taken.	12.90
<i>Terminalia bellirica</i> (Gaertn.) Roxb. PS69 (Bohera/ Boyra gota)	Combretaceae, Tree	Fruit	Blood purifier, Appetizer	Fruit is soaked & eaten that water.	2.77
<i>Terminalia chebula</i> Retz. PS70 (Hortoki/ Orti/ Ortoki)	Combretaceae, Big tree	Fruit, Bark	Dropsy, Burning sensation, Heart disease, Appetizer	Fruit is soaked & eaten that water. Fruit juice is drunk.	3.70
<i>Tinospora crispa</i> (L.) Hook.f. Thoms PS71 (Ghamchilota/ Ghamachilota/ Gulancha)	Menispermaceae, Creeping shrub	Stem	Anthelmintic/ Helminthosporium, Dysentery, Phthisis, Liver disease, Scab, Appetizer, Piles, Stomachache, Pain, Weakness, Pox.	Stem is used in different ways.	10.18

Table 1 Contd.)

<i>Trapa bispinosa</i> Roxb. (Hingra pata)	Trapaceae	Leaf	Pox	Leaf is used.	1.85
<i>Tragia involuerata</i> Linn. PS72 (Chotra pata)	Euphorbiaceae	Root	To stop child's crying	Root is tied with hand.	1.85
<i>Trigonella foenum-graceum</i> (L.) (Methi)	Fabaceae, Herb	Fruit	Remove hair fall	Fruit is pasted & given to the head.	0.92
<i>Vitis quadrangularis</i> Wall.ex Wight & Arn PS73 (Harvangalota /Harjora)	Vitaceae, Climbing plant	Stem	Fractured bone (Hand, leg or others bone)	Stem is twisted & tied with fractured bone.	5.55
<i>Zingiber officinale</i> Rosc. PS74 (Ada)	Zingiberaceae, Herb	Rhizome, Stem	Cold, Cough, Cow's disease	Rhizome is eaten. juice is eaten.	5.55
<i>Zingiber zerumbet</i> (L.) (Bauda/Bauada /Boj)	Zingiberaceae, Herb	Rhizome, Stem	Cow's disease, Pregnancy pain at belly	Juice is taken from trunk & given to cow. Juice is eaten.	1.85
Dolkochra		Leaf	Debility	Leaf is used with other plants parts to make tablet.	0.92

Table 1 Contd.)

PS75 (Kakjhing)			Gastric, Child's Diarrhea, Pain, Diabetes, Ulcer	Stem is tied with child's body; cooked leaf is eaten.	
Kata taar		Root	Debility	Root of kata taar mixed with other plants parts to make tablet.	0.92
Madamolla		Leaf, Root	Period problem, Excess bleeding, Stomachache.	Leaf juice & root juice is eaten.	0.92
<i>Ziziphus mauritiana</i> Lamk. PS76 (Boroi)	Rhamnaceae	Leaf juice	Rheumatism	Fruit is chewed & eaten the juice.	0.92

Factor informant consensus (FIC):

The factor informant consensus (FIC) was used to determine the ethnopharmacological important plant species (Heinrich et al. 1998).

Table 2: Consensus of agreement on the uses of medicinal plants among informants:

Ailments	Highly cited plants with CF value	No. of use report	No. of Taxa	FIC value
Cardiovascular disease	<i>Tamarindus indica</i> L. (9.26%)	16	3	0.867
Fever	<i>Ocimum sanctum</i> L. (36.11%) <i>Adhatoda vasica</i> Nees (31.5%)	135	29	0.791
Diabetes	<i>Coccinea grandis</i> L. (7.40%)	10	3	0.778
Orthopaedic	<i>Vitis quadrangularis</i> wall. ex Wight & Arn (5.55%)	12	5	0.636

Infections	<i>Cynodon dactylon</i> (L.) Pers (17.6%) <i>Chromolaena odorata</i> (L.) King & Robinson (10.2%) <i>Tagetes patula</i> L. (7.40%)	40	16	0.615
Dermatological	<i>Melia azadirachta</i> L. (25.92%) <i>Lablab purpureus</i> (L.) (17.6%)	95	41	0.574
Jaundice	<i>Cajanus cajan</i> (L.) (12.04%)	20	10	0.526
Respiratory	<i>Drynaria quercifolia</i> (L.) J.Sm. (5.55%) <i>Tinospora crispa</i> (L.) Hook.f. Thoms (10.18%)	3	2	0.5
Veterinary	<i>Curcuma zedoaria</i> (Christm) Rosc. (5.55%)	17	9	0.5
General health	<i>Centella asiatica</i> (L.) Urban (21.3%) <i>Cynodon dactylon</i> (L.) Pers (17.6%) <i>Lawsonia inermis</i> L. (12.9%) <i>Terminalia arjuna</i> (Roxb. ex Dc.) Wight & Arn. (12.9%)	101	52	0.49
Gastrointestinal	<i>Drynaria quercifolia</i> (L.) J.Sm. (5.55%)	116	66	0.435
Pain	<i>Psidium guajava</i> L. (5.55%) <i>Allium sativum</i> L. (5.5%)	25	17	0.333
Menstrual disease, Birth control	<i>Coccinea grandis</i> L. Voigt (7.40%)	13	9	0.333
Eye disease	<i>Moringa oleifera</i> Lamk. (7.40%)	4	4	0
Kidney disease	<i>Bryophyllum pinnatum</i> (Lamk.) Oken (9.23%)	6	6	0

Table 2 shows that the FIC values varied from 0 to 0.867. 15 categories disease are cited from 24 plants. The highest value (0.867) was found in case of ailments category Cardiovascular disease treated by *Tamarindus indica*. The second highest value (0.791) was found in case of Fever by *Ocimum sanctum* & *Adhatoda vasica*. Third highest value (0.778) was found for Diabetes treated by *Coccinea grandis*. Fourth highest value (0.636) was found for Orthopaedic treated by *Vitis quadrangularis*. Fifth highest value (0.615) was found for Infections by *Cynodon dactylon*, *Chromolaena odorata*, *Tagetes patula*. Sixth highest value (0.574) was found for Dermatological disease treated by *Melia azadirachta* & *Lablab purpureus*. Seventh highest value (0.526) was found for Jaundice treated by *Cajanus cajan*. Same value (0.5) was found for Respiratory disease treated by *Drynaria quercifolia* and Veterinary treated by *Curcuma zedoaria*. 0.49 value was found for General health category treated by 4 species. These are *Centella asiatica*, *Cynodon dactylon*, *Lawsonia inermis*, *Terminalia arjuna*. 0.435 value was found for Gastrointestinal category treated by *Drynaria quercifolia*. Same value 0.333 was found for Pain, Menstrual disease, Birth control. Pain treated by *Psidium guajava* & *Allium sativum*. Menstrual disease & Birth control treated by

Coccinea grandis. 0 value was found for Eye disease treated by *Moringa oleifera* and Kidney disease by *Bryophyllum pinnatum*.

Fidelity level (FI):

The Fidelity level value is useful for identifying the local people's most preferred species in the use for treating certain ailments (Firedman et al. 1986).

Table 3: Fidelity level (FL) values of frequently cited plant species and their major uses:

Ailments	Species	No. of informants	Total no. of informants	Fidelity level%
Cold & cough	<i>Adhatoda vasica</i> Nees	33	33	100
Cold & cough	<i>Ocimum sanctum</i> L.	38	38	100
Fractured bone, Wrenched	<i>Vitis quadrangularis</i> Wall. Ex Wight & Arm	5	5	100
Fractured bone, Wrenched	<i>Calotropis procera</i> (Ait.) R. Br.	2	2	100
Headache, Pain	<i>Psidium guajava</i> L.	5	5	100
Jaundice	<i>Cajanus cajan</i> (L.)	13	13	100
Stop bleeding & wound	<i>Chromolaena odorata</i> (L.)	10	10	100
Stop bleeding & wound	<i>Tagetes patula</i> L.	7	7	100
Jaundice	<i>Cuscuta reflexa</i> Roxb.	2	2	100
Helminthiasis	<i>Andrographis paniculate</i> (Brum.f.) Wall. Ex Nees	9	11	81.8
Cardiovascular disease	<i>Tamarindus indica</i> L.	9	11	81.8
Stop bleeding & wound	<i>Cynodon dactylon</i> (L.) Pers.	13	16	81.2
Helminthiasis	<i>Ananas sativus</i> (Lindl.) Schult. F.	7	9	77.7
Diabetes	<i>Coccinea grandis</i> (L.) Voigt	7	9	77.7
Cold & Cough	<i>Nigella sativa</i> L.	7	9	77.7
Appetizer	<i>Terminalia bellirica</i> (Gaern.) Roxb.	3	4	75
Fever & Running nose	<i>Allium sativum</i> L.	4	6	66.6
Gastric & Alsar	<i>Drynaria quercifolia</i> (L.) J. Sm.	4	6	66.6
Debility	<i>Bryophyllum pinnatum</i> (Lamk.) Oken	7	11	63.6
Helminthiasis	<i>Melia azadirachta</i> L.	7	11	63.6

Table 3 contd.)

Hair related problem	<i>Lawsonia inermis</i> L.	5	8	62.5
Dysentery, Diarrhea, Cholera	<i>Aegle marmelos</i> (L.) Corn.	5	8	62.5
Burn	<i>Litsea glutinosa</i> (Lour.) Robinson	6	10	60
Burn	<i>Terminalia arjuna</i> (Roxb. ex Dc.) Wight & Arn.	6	10	60
Menstrual disease	<i>Hibiscus rosa-sinensis</i> L.	3	5	60
Debility	<i>Terminalia arjuna</i> (Roxb. ex Dc.) Wight & Arn.	4	7	57.1
Appetizer	<i>Phyllanthus embelica</i> L.	7	13	53.8
Dysentery, Diarrhea, Cholera	<i>Litsea glutinosa</i> (Lour.) Robinson	4	8	50
Cardiovascular disease	<i>Terminalia arjuna</i> (Roxb. ex Dc.) Wight & Arn.	4	8	50
Debility	<i>Centella asiatica</i> (L.) Urban	10	20	50
Helminthiasis	<i>Tinospora crispa</i> (L.) Hook.f.Thoms	8	18	44.4
Liver disease	<i>Andrographis paniculata</i> (Brum.f.) Wall. Ex Nees	2	5	40
Headache, Pain	<i>Allium sativum</i> L.	2	5	40
Dysentery, Diarrhea, Cholera	<i>Centella asiatica</i> (L.) Urban	5	15	33.3
Dropsy	<i>Coccinea grandis</i> (L.) Voigt	1	3	33.3
Piles	<i>Litsea glutinosa</i> (Lour.) Robinson	2	6	33.3
Pox	<i>Punica granatum</i> Linn.	3	9	33.3
Hair related problem	<i>Phyllanthus embelica</i> L.	2	7	28.5
Dropsy	<i>Datura metel</i> (L.)	1	8	12.5
Brain related problem	<i>Mimosa pudica</i> L.	1	9	11.1
Brain related problem	<i>Centella asiatica</i> (L.) Urban	1	11	9.09
Anaemia	<i>Centella asiatica</i> (L.) Urban	1	11	9.09

Table 3 shows that the Fidelity level is useful for identifying the local people's most preferred species in the use for treating certain ailments (Friedman et al. 1986). The analyzed results indicated that FL values varied from 9.09 up to 100%. (Table 3). Medicinal plants recorded in the study area,

27 species have been identified those have FL values more than 50%. Among them, 100% FL values attained by 9 species. These species are: *Adhatoda vasica*, *Ocimum sanctum*, *Vitis quadrangularis*, *Calotropis procera*, *Psidium guajava*, *Cajanus cajan*, *Chromolaena odorata*, *Tagetes patula*, *Cuscuta reflexa*. Such high FL values means that the informants tend to rely on one specific plant species for treating one certain ailment than several ailments.

Citation frequency (Cf) :

Citation frequency values varied from species to species as indicated in the Table 4. Four species attained the Cf values of more than 10% including *Adhatoda vasica*, *Ocimum sanctum*, *Cajanus cajan*, *Cynodon dactylon*. High Cf data of medicinal plants is the indication of popular and common species in the study area which can be used for further analysis to find new drugs.

Table 4. Citation frequency of some selected medicinal plants:

Medicinal plants	Ailments	Use report	Cf (%)
<i>Adhatoda vasica</i> Nees	Cold & Cough	33	30.56%
<i>Ocimum sanctum</i> L.	Cold & Cough	38	35.19%
<i>Cajanus cajan</i> (L.)	Jaundice	13	12.04%
<i>Cynodon dactylon</i> (L.) Pers.	Stop bleeding & wound	13	12.04%
<i>Chromolaena odorata</i> (L.)	Stop bleeding & wound	10	9.26%
<i>Centella asiatica</i> (L.) Urban	Debility	10	9.26%
<i>Andrographis paniculata</i> (Brum.f.) Wall. Ex Nees	Helminthiasis	9	8.33%
<i>Tamarindus indica</i> L.	Cardiovascular disease	9	8.33%
<i>Tinospora crispa</i> (L.) Hook.f.Thoms	Helminthiasis	8	7.40%
<i>Tagetes patula</i> L.	Stop bleeding & wound	7	6.48%
<i>Coccinea grandis</i> (L.) Voigt	Diabetes	7	6.48%
<i>Melia azadirachta</i> L.	Helminthiasis	7	6.48%
<i>Litsea glutinosa</i> (Lour.) Robinson	Burn	6	5.56%
<i>Centella asiatica</i> (L.) Urban	Dysentery, Diarrhea, Cholera	5	4.63%
<i>Lawsonia inermis</i> L.	Hair related problem	5	4.63%
<i>Allium sativum</i> L.	Fever & Running nose	4	3.70%
<i>Hibiscus rosa-sinensis</i> L.	Menstrual disease	3	2.78%
<i>Allium sativum</i> L.	Headache, Pain	2	1.85%
<i>Phyllanthus embelica</i> L.	Hair related problem	2	1.85%
<i>Coccinea grandis</i> (L.) Voigt	Dropsy	1	0.93%
<i>Centella asiatica</i> (L.) Urban	Anaemia	1	0.93%
<i>Mimosa pudica</i> L.	Brain related problem	1	0.93%

From observations in the field and discussions with local people, a good number of threats to medicinal plants have been identified. The most serious threat is availability of the modern medicines which promotes the negligence of use of herbal medicines among the local people in the study area. People are gradually depending on modern medicines and forgetting the use of herbal medicines. Moreover, senior people with herbal knowledge do not like to share their knowledge with junior. Due to sudden death of such people, herbal knowledge of the area is lost forever. According to local people such event is great threat to medicinal plants and traditional knowledge.

The data indicated that the study area has plenty of medicinal plants (100 species) and diversity health care uses (72 ailments with 329 formularies) of such plants. Using modern mathematical tools FIC values on the uses of medicinal plants have been determined. Ailment category Cardiovascular disease attained highest FIC value. Species used for this purpose are *Tamarindus indica* which cited by many informants. Second highest FIC value has attained by Fever. Medicinal plants used for this purpose are *Ocimum sanctum* & *Adhatoda vasica*. Since the FIC values attained highest, such plants could be recommended for further phytochemical study. Culturally important medicinal plants have been determined based on FI values. In our survey 9 species have been attained 100% FL values. These are *Adhatoda vasica*, *Ocimum sanctum*, *Vitis quadrangularis*, *Calotropis procera*, *Psidium guajava*, *Cajanus cajan*, *Chromolaena odorata*, *Tagetes patula*, *Cuscuta reflexa*. Such species needs to be protected in the study area to sustain traditional medicinal plants and culture.

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