



RESEARCH ARTICLE

Traditionally Used Unexplored Ethnomedicinal Plants by Thadou-Kuki Tribe of Churachandpur District, Manipur, India

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ABSTRACT

Aim/Background: The indigenous Kuki people have always have a good knowledge of medicinal plants available in their surroundings which are used in treating various illnesses. The present study aims to identify, collect and document traditional uses of ethnomedicinal plants by Thadou-Kuki tribe of Churachandpur district, Manipur.

Materials and methods: A total of 80 informants were interviewed through an open-ended and semi-structured questionnaire. The data obtained were analyzed through the Informant Consensus Factor (ICF) and the Fidelity level (FL).

Results: It was reported that 55 medicinal plants belonging to 55 genera and 34 families were documented during the survey. The Asteraceae family was the most dominant among all other families. Herbs constituted the largest proportions indigenous to the community with 38.18%. Leaves were the most frequently used plant parts. Decoction and Oral ingestion was found to be the most common mode of preparation and route of application respectively. The consensus analysis revealed that liver diseases, cardiovascular diseases, and respiratory diseases showed the highest ICF with 0.96, 0.92, and 0.91 respectively. While at least four plant species showed 100% FL value namely *Centella asiatica*, *Clerodendrum glandulosum* Lindl., *Solanum indicum* L. and *Justicia adhatoda* L. used for treating hypertension, and *Centella asiatica* used for treating gastrointestinal problem also reported 100% FL value.

Conclusions: Our data showed that the inhabitants of the studied area still rely on medicinal plants for treating different diseases. Our findings will provide baseline data to exhibit a connection between the traditional knowledge experts and scientific researchers.

KEYWORDS:

ethnomedicinal plants, survey, tribal, traditional knowledge, plant conservation.

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INTRODUCTION

Presently, there is an urgent need to investigate the role of ethnobotanical studies about age-old traditional folk proficiency and also in finding new plant resources for the

development of drugs and food [1]. Ethnic communities have always learned and passed on orally about the traditional knowledge for a very long time from generation to generation. This knowledge was based mainly on their lifelong experience with the use of plants in curing illnesses and has been regarded

as cultural importance in preserving and maintaining the continuity of transmission among the people [2]. All cultures of people have the mastery and use of plants and their products in curing different illnesses. In most of the developing countries, people successfully and relentlessly rely on traditional medicine for prime healthcare. The World Health Organization (WHO), 2011 reported that as many as 80% of the world still depends on traditional medicine for its basic healthcare [3, 4]. In India, the traditional belief system of treatment has a long history that is deeply rooted among the rural and tribal populations of the country [5]. The tribal populations in the country constituted as many as 53 million consisting of 550 different communities [6]. India has rich biodiversity and is home to three biodiversity hotspots- Himalaya, Western Ghats, and Indo-Burma. It has an estimated 47,513 plant species, out of which about 11.4 % of the world's flora and covers 2.4 % of the earth's surface. It is also rich in terms of genetic resources of medicinal and aromatic plants and of which 11% are known to contain medicinal values [7].

The North-Eastern states of India are endowed with several important medicinal plant species of pharmaceutical importance. It is also known to be one of the richest hubs of diverse plants consisting of medicinal and aromatic plants in the world [8, 9]. It has diverse cultures of people and a home to the largest number of tribal communities known as the Scheduled Tribes [10]. Due to its favorable geographical and climatic conditions of the place, the people depend mostly on the photo resources available. The study was conducted in Manipur and it is one of the eight North-Eastern states of the India. It lies between 87° 32'E to 97° 52'E latitude and 21° 34'N to 29° 50'N latitude and is well known to be the biographical gateway of India because of its rich genetic resources [11]. It is a small state situated in the far easternmost corner of India. It is bounded in the East by Myanmar and in the West by Assam, Mizoram in the South, and Nagaland in the North. The state has a geographical area of 22,327 km². It can be topographically divided into two distinct regions - the hills (covers 90 % of the total area) and the plains (covers only 10 % of the total area). The plain lies almost exactly in the middle encircled and flanked by walls of the hill [12]. Manipur have a monsoon climate with hot & wet summer and cold dry winter owing to its geographic structure, location, the intensity of forest cover, water bodies. The hills are dominated by the two major tribes of Manipur - the Kuki and the Naga. And the valley is densely

dominated by the Meetei. The state falls under the Indo-Myanmar hotspot region and ranks 8th among the 34 biodiversity hotspot regions in the world [13]. Being a hilly region, the tribal populations are bound to rely upon traditional herbal practices. Healthcare practices based on traditional knowledge are profoundly followed in Manipur till today [14]. This system of treatment may be the only healthcare facility available in some rural villages of Manipur. So, the future aim

should be finding out the unexplored medicinal plant species in this region keeping in mind the conservation aspects of the known plants and also provide quality knowledge to enhance the skill of planting these valuable medicinal plants in large scale productions which will ultimately benefit the larger populations of the state.

MATERIALS AND METHODS

Study Area

The study was carried out in four villages of Churachandpur district of Manipur namely, Patlen village, Songpi village, Kingkin Village, and Molhoi village respectively. Churachandpur District lies in the South-Western part of Manipur (Fig. 1). It lies between latitudes 23 56'43" N to 24 42'N and longitudes 920 58'E to 930 52'8"E approximately. It is bounded on the North by Tamenglong, Imphal East, Senapati, Bishnupur and Thoubal Districts, south by Mizoram and Myanmar (Burma), east by Chandel district, and west by Assam State. The total area of the district is 4,570 sq. km. It is the largest district in Manipur. The topography of the district is hilly and it is located 60 km south of the capital Imphal.

The district has a small valley portion extended from Manipur (Imphal) valley along the Khuga River basin while the rest of the major portion belongs to the rugged hilly terrain. Churachandpur district is divided into 3 hilly regions, viz., i) Western Hilly Region, ii) Eastern Hilly Region and iii) Southern Hilly Region, based on geology, soils, topography, climate, and natural vegetation [15].

According to the 2011 census report, about 92.9 percent of the total population of the district is Scheduled Tribes, the absolute population being 254,787 persons, of which 126,328 are males and the rest 128,459 are females. Only 0.2 percent of the population belongs to Scheduled Castes whereas the proportion of the general population is 6.9 percent. The major ethnic group speaks Thadou-Kuki.

About the selected tribes

'Kuki' refers to an ethnic group which in Bengali means 'hill people' or 'highlander'. The Kuki groups are mainly found in North-east India, Northwest Burma, and in the Chittagong hill tracts in Bangladesh [16]. In Manipur, the Kuki and its affiliated tribes are dispersed over the hill districts. They largely dominated the districts of Churachandpur, Kangpokpi, and Chandel. The Kuki consisted of sub-groups namely - Thadou, Paite, Hmar, Vaiphei, Simte, Gangte, Sukte, Mizo/ Lushai, Kom, Zou, etc. [17]. Thadous is the sub-group of the Kuki group which constituted the most populous tribe in Manipur with a population of 2,15,913 speakers of the language [18].

The indigenous Kuki people have always depended on forests

for food, fuel woods, timber, bamboo, medicinal plants, and various socio-cultural needs. They also have a good knowledge of medicinal plants available in their surroundings which are used in treating various illnesses. Their dependency on the medicinal plants varied from a minimum of 10% to a maximum of 40% from the forest [19]. So, for the protection of indigenous knowledge of medicinal plants, proper substantiation has been proposed for many reasons. Firstly, it secures that indigenous cultural inheritance is preserved from being lost for the younger generations. This practiced of validating traditional knowledge of native plant species has contributed to many vital drugs and will also serve as important aspects of the conservation approach [20]. Due to the changes in our traditional culture and also the introduction of modern technologies, the indigenous traditional knowledge of traditional plants and therapies of various tribes is becoming dead. Therefore, this study has been particularly carried out to established systematic and comprehensive documentation, presentation, and validation of folk medicine as well as the traditions and culture of the indigenous tribe of the region.

METHODS OF STUDY

Informants

The informants were villagers from the four villages mentioned. The informants consisted mainly of females and very few numbers of male informants. The prevalence of female informants is subsequently because the male in the study area was unwilling to talk with the interviewers. Female informants constituted 90% of the respondents and however, 10% of the respondents constituted of male informants. Aged people were more preferred over the younger generation as they tend to have more knowledge of traditional plant treatment.

Field Survey and Data collection

Ethnomedicinal surveys were conducted during April 2017-March 2018 in the Thadou-Kuki inhabited areas of Churachandpur district, Manipur to interact and gather information on ethnomedicinal plants for the treatment of diseases. The targeted group speaks the Thadou dialect so there was no language barrier faced during the survey and information was made fully understandable to the interviewer during the survey. Prior consent of the informants was obtained before collecting the information. 20 interviews were collected from each of the four villages randomly. But this was mainly carried out based on the individual experiences on the knowledge of plants as informed by the villagers.

Queries were asked based on ready-made semi-structured questionnaires and group conversation and information was gathered using a semi-structured questionnaire. Information regarding the demographic background, local plant names,

part(s) used, methods of preparation, and the application was conducted. The standard methods of [21] were followed during the plant collection and also while preparing the specimens for referencing and depositing. During the field survey, medicinal plants reported by informants were verified, collected and identified in the field with the help of their vernacular/local names by the local inhabitants. Some of the plants were not available in the nearby fields so it was collected from the wild. All the plants were not in the flowering and fruiting stage during the visit so the same site was revisited for the sample collection during the flowering and fruiting season. The herbarium was prepared and the voucher specimens were submitted and identified by a plant taxonomist at Botanical Survey of India (BSI), Eastern Regional Centre, Shillong, and Ethnomedicinal Research Centre, Manipur. Scientific names were crosschecked using "The Plant List" (www.theplantlist.org) databases [22]. The ethical code/guidelines given by "The Biological Diversity of India" (<http://ethnobiology.net/code-of-ethics/>), [23] and "International Society of Ethnobiology" (http://nbaindia.org/uploaded/act/BDACT_ENG.pdf) were followed [24].

Quantitative data analysis

The data collected from the respondents during the survey was analyzed using three quantitative indices namely Informant Consensus Factor (ICF) and Fidelity Level (FL) which are described as follows:

Informants' Consensus Factor (ICF) is the determination of the level of uniformity in the information provided by the respondents [25]. It measures the constancy of the knowledge of respondents as well as the knowledge of using the plants for treating a particular disease. The ICF is calculated by applying the following formula (Eq. 1):

$$ICF = \frac{(N_{ur} - N_s)}{(N_{ur} - 1)} \quad (\text{Eq. 1})$$

where, Nur = number of use reports from respondents for a particular plant-use category;

Ns = number of species that are used for that plant use category for all informants.

Fidelity Level determines the percentage of respondents claiming the use of certain plant for the same major purpose to treat a particular disease [26]. FL value was used in knowing the most well-received species in treating a particular disease. The FL was calculated using the following formula (Eq. 2):

$$FL (\%) = \frac{N_i}{N_t \times 100} \quad (\text{Eq. 2})$$

Where Ni = number of respondents who independently claimed the use of a particular species for the same major disease and

Nt = total number of respondents who claimed the plant species for any major disease.

RESULTS AND DISCUSSIONS

Demographic profile of the respondents

A total of 80 informants including 70 females and 10 males were interviewed. The informants were further categorized into different groups based on the demographic profiles (name, gender, age and qualification) as shown in Table 1. Most of the informants were farmers by the occupation because agriculture was the only source for them. Some of the informants were labourers in other agricultural fields and only a few numbers of them owned and work in their agricultural fields for their livelihood. Farming was the main occupation among the respondents.

The respondents were categorized into different age groups to examine which age groups have a maximum knowledge concerning the use of plants as medicines for various types of disease and also during emergency cases like allergy, cuts, and wounds, etc. The age groups which consisted of 40 years and above consisted of maximum numbers of respondents with 39 numbers which were further followed by age groups between 31-40 years with several 25 respondents. The least respondents were in the age group between 20-30 years with 16 respondents.

A fair percentage of the respondents (51.25%) had attended a primary school and further could not continue their studies due to poor economic background. While a very least percentage of 3.75% had finished their graduation. Different parameters were used regarding where the source of knowledge was gained. From the study, it was reported that, with reference to the knowledge of plant and its usage the respondents gained mostly from their parents which constituted about 57.5% and the least percentage were acquired from traditional health practitioners with 5%.

Characteristics of the ethnomedicinal plants

A total of 55 ethnomedicinal plants belonging to 55 genera and 34 families were documented during the survey based on the information and knowledge of the native people. The number of taxa under each family are - Acanthaceae (3) Amyridaceae (1) Anarcadiaceae (1) Apiaceae (2) Asteraceae (12) Balsaminaceae (1) Begoniaceae (2) Campulunaceae (1) Cannabaceae (1) Caricaceae (1) Caryophyllaceae (1) Convolvulaceae (1) Costataceae (1) Crassulaceae (1) Cucurbitaceae (2) Eleocarpaceae (1) Fabaceae (1) Lamiaceae (3) Leguminosae (1) Lythraceae (1) Melastamaceae (1) Mimosaceae (1) Myrtaceae (1) Oxidaceae (1) Passifloraceae (1) Plantaginaceae (2) Poaceae (1) Polygonaceae (1) Rutaceae (1) Saururaceae (1) Solanaceae (3) Urticaceae (1)

Xanthorrhaceae (1) Zingiberaceae (1). Out of the total 34 families recorded, Asteraceae was the most dominant family with 12 species followed by Acanthaceae and Solanaceae with 3 species each. Families in conjunction with their species used for herbal preparations are mentioned in the Table 2. Similar findings were made by a study on medicinal plants in Manipur [27, 28] where the Asteraceae family were reported to the highest among any other plant family (Fig. 2). This may be attributed to the fact that Asteraceae being the most predominantly found plant family present in the state of Manipur. Of all the flowering plants distributions in the world, Asteraceae is one of the largest family [29]. The prevalence of the Asteraceae family for use in medicinal purposes is not a new finding, similar cases of studies have been reported from all over the world [30]. These findings were also in agreement with most of the ethnomedicinal plant studies carried out in the north-eastern part of India [31, 32].

Habitat

The plant species collected grow in a multifarious range of habitats ranging from valley plains, mountainous forests, and hilly regions. The medicinal plants recorded in the study grow as herbs, shrubs, subshrubs, undershrubs, trees, and climbers. Herbs constituted the largest proportions indigenous to the community with 38.18 %, this may be due to the easy availability and higher curative potency in comparison to other growth forms [33]. The present findings are also in agreement with the findings of other reports [34, 35] who claim that herbs proved to be the most widely used plants worldwide by traditional healers for ethnomedicinal plant preparations. Other growth forms of the ethnomedicinal plants include undershrub (16.30%), Subshrub (3.63%), Shrubs (20%), trees (12.72%), and climbers (9.09%) respectively.

Parts used

In the present investigation, the most used part of the plant is leaves with 56.36% and it has greatly surpassed other parts of the plants (Fig. 2). This is followed by whole plants (21.81%) and fruits (12.72%)

Leaves are highly accessible to the people and are preferred because of the production of secondary metabolites and are active sites for photosynthesis [36]. Other than using the other parts of the plants like the bark and roots, leaves are considerably used mostly to avoid overexploitation which will eventually threaten the species. Uprooting the whole plant or singly using the roots will ultimately lead to a decline in the population of medicinal plants [37].

Cultivated and wild medicinal plants

In the present study, most of the collected plants are non-

cultivated either available in forests, hilly tracks, and paddy fields. While others are cultivated or found in and around the nearby places of the inhabitants. Aloe vera (L.) Burm.f, Cannabis sativa, and Kaempferia parviflora Wall Ex. Baker is extensively cultivated to be sold in the market at a fair price. Because of their high medicinal values with an effective curative property, it is observed that cultivated plants are considered of better quality than found in the forests. However, according to the study reported by Uniyal et al., [38], no scientific study supports these beliefs because medicinal properties present in plants are mainly due to the presence of secondary metabolites. The growing demand for these cultivated plant products in the market also attributed more strongly to the value and prices respectively. To name a few wild plants in the present study, Lobelia nummularia Lam., Cheilocostus speciosus (J. Konig) C. Spect and Blumea lanceolaria (Roxb) Druce.

A fair number of medicinal plants can be grouped under medicinal food plants which are included in the daily diet of the indigenous people. Medicinal plants have long been integrated as a habitual dietary pattern by the people [39]. Medicinal foods are the oldest form of therapies known to people and the traditional way of treatment among the various populations documented [40]. Medicinal food derived from plants has a long history of use by the Chinese traditional medicine also known as Food Therapy [41] which is strongly in agreement with the present people beliefs. The plants are either steamed, boiled, and cooked as dishes and taken with rice to cure a particular disease. Out of the total plants collected, 19 plants can be used as food therapy and are given as follows: *Luffa acutangula* (L.) Roxb, *Solanum torvum* Sw., *Houttuynia cordata* Thunb., *Acmella paniculata* (Wall. Ex DC.) R.K. Jansen, *Plantago major* L., *Centella asiatica* (L.) Urb., *Passiflora edulis* Sims, *Clerodendrum glandulosum* Lindl., *Benincasa hispida* (Thunb.) Cogn., *Mikania micrantha* Kunth, *Solanum indicum* L., *Eryngium foetidum* L., *Persicaria chinensis* ((L.) H. Gross, 14. *Phlogocanthus thyriformis* (Roxb.ex.Hardw.) Mabb., *Justicia adhatoda* L., *Elsholtzia communis* Benth., *Zanthoxylum acanthopodium* DC., *Allium hookeri* Thwaites and *Mentha spicata* L.

Mode of preparations

The mode of preparations of the plants can be broadly categorized into 8 groups namely- Aqueous extract, decoction, juice, paste, powder, raw, soup, and steam. The extracts are the fresh exudates from the plants which are directly applied to the affected part of the body. A decoction is prepared by boiling the plant parts with water till the volume of the water is reduced to the required amount. The leaves are steep in the hot water for 30 min or longer so that most of the nutrients are drawn. The juice is taken orally as such or with honey. The paste is prepared by grinding either the fresh/dried leaves with

water or oil. It is thoroughly ground to make a smooth paste for it to apply to the skin. The fresh leaves are either sun-dried or shade-dried to make a powder and are smoked by rolling a paper or by using tobacco leaves. Raw forms of preparation are done by chewing the fresh shoots or parts of the plants. Soup is prepared by cooking part of the plants like leaves, seeds, flowers, stems, and shoots as a dish by adding salt to enhance the taste.

Steaming was done by boiling the plants with water and the steam is being inhaled in a closed room or is done by covering the face with a thick towel to prevent the steam to escape from open spaces. Among the different mode of preparations of the medicinal plants, the majority of the preparations were done in the form of decoction (46.6%) from the freshly collected plant parts which constituted mostly the leaves (Fig. 3a). Other studies also reported decoction as the most common mode of preparations in herbal medicines [42, 31]. A decoction is also the most common method of administration in Chinese herbal medicine. It is taken orally and many people believed that it is quickly absorbed and has the strongest action of all the other forms of traditional preparations [43]. Other forms of preparations constituted boiled/cooked (10.9%), paste (9.6%), Aqueous extract (6.8%), steam (6.8%), juice (5.5%) and powder (2.7%) respectively. The boiled/cooked method of preparations involves cooking edible plants having medicinal properties and are included in the diet. This method is also very common among a tribal group of populations. The paste is prepared by mostly pounding the plants (leaves, roots, barks, etc.) and is applied topically on the affected part of the skin. This form is also common due to its easy preparations for wound healing [44]. Raw method of preparations also does not need many steps and involves the direct applications of the raw plants and therefore it is also among the common method of preparation. Steam inhalation is the technique by which the steam is liberated from boiling water containing the herbal plants and is inhaled by the person at ordinary room temperatures. This form of treatment is common many other ethnomedicinal studies [45, 46].

Route of administrations

Analysis of the present study revealed that the plant remedies are broadly classified into six (6) categories namely- Oral, topical, inhalation, bathing, and smoking. Oral administration constituted a major 62.3% of the administration (Fig. 3b). Similar findings were reported by many other ethnomedicinal plant studies revealing the oral route as the most approved mode of administrations [47, 48, 49]. Ailments such as cardiovascular, gastrointestinal, gynecological, liver, and urological problems are usually given through oral administration. Topical application contributes to 14.5% of the overall administrations. In most of the ethnobotanical study of medicinal plants, oral administration was always followed by

topical applications [50, 51]. Topical applications were mainly used in skin treatments. Other routes of applications included the local route of applications which constituted 8.7% and are mainly used in the treatment of eye infections, ear infections, and headaches. Inhalation was used for respiratory infection treatment. Bathing (5.8%) was mainly used in the treatment of fever and skin infection. Bathing for curing a particular illness like fever is an uncommon practice among ethnomedicinal plant treatment. Other studies also reported similar use of plants in bathing for curing fever and skin infections. Whereas the least used route was smoking with 2.9% [52, 53].

Incensus Conformus Factor (ICF)

The Incensus Conformus Factor (ICF) may be regarded as one of the effective methods for the identification of potentially effective medicinal plants [25]. The factor ranges from 0 to 1, where high-value ICF indicates a high rate of Informant Consensus. The different illnesses are grouped into several general categories and this method is upheld by other ethnobotanical researchers [54, 55]. In the current study, the ICF value ranges from 0 to 0.96. The present study reported 52 different ailments which are further grouped into 13 broad categories set up on the information gathered from the respondents (Table 3). Categories of ailments such as liver diseases, cardiovascular diseases, and respiratory diseases showed the highest ICF. This entails that the diseases of these categories have the highest level of agreement for being treated with herbal preparations. Liver diseases with the highest ICF score of 0.96 and under this category are the plant species namely *Luffa acutangula* (L.) Roxb, *Oroxylum indicum* (L.) Kurtz, *Cuscuta reflexa* Roxb, *Benincasa hispida* (Thunb) Cogn. and *Saccharum officinarum* L.

Cardiovascular diseases were listed to have the second-highest ICF value (0.92) and under this category are *Plantago major* L., *Centella asiatica* (L.) Urb., *Passiflora edulis* Sims, *Clerodendrum glandulosum* Lindl, *Solanum indicum* L., *Phlogocanthus thyriformis* (Roxb. Ex. Hardw.) Mabb., and *Justicia adhatoda* L. High ICF value for liver and cardiovascular diseases could be attributed to the high occurrence of such diseases, comprehensive knowledge, and also the effortless availability and abundance of plants species in the study area. The other reason may be the high efficacy in treating certain diseases. In Manipur, liver disorders are primarily and effectively treated with the help of ethnomedicinal plants by local healers [56]. The lowest ICF value was observed in gynecological, musculoskeletal, and neoplasm with ICF values of 0 respectively.

Fidelity Level

Fidelity level (FL) demonstrates the percentage of the respondents claiming the use of a certain plant for the same

major purposes. From the (Table 4), the fidelity level of each of the species was calculated with each category.

A high Fidelity level value represents the most popular plants used to treat any particular diseases [57]. The fidelity level of plant species for specific diseases in the present study area varies between 19.23 and 100 %. The findings of the present study revealed that at least four plant species showed 100% FL value. *Centella asiatica* (L.) Urb., *Clerodendrum glandulosum* Lindl., and *Solanum indicum* L. were used to treat hypertension while *Centella asiatica* (L.) Urb. was also used to treat the gastrointestinal problem [57]. While *Centella asiatica* (L.) Urb. was effectively used for treating hypertension, it provided the lowest fidelity level of 19.23 % in treating Asthma. The reason may be the low prevalence of the illness in the study area. Another reason may be people resorting to allopathic medicines due to the trend in treating more serious illnesses with non-herbal medicines. As reported by Sabaragamuwa et. al., *Centella asiatica* (L.) Urb. is a herbal plant that is highly valued for its medicinal properties and for treating oxidative stress, inflammation, neuron damage, neurotoxicity, anxiety, depression, ACE inhibition problem, and accumulation of amyloid plaques [58]. The pharmacological activities of the plant is mainly derived from four major bioactive triterpene glycosides namely asiaticoside, madecassoside, Asiatic acid, and madecassic acid which are cumulatively called Centellosides [59]. Pharmacological studies of the *Clerodendrum* genus have shown that the compounds and their extracts have major activities in anti-inflammatory, anti-nociceptive, anti-oxidant, anti-hypertensive, anticancer, antimicrobial, anti-diarrhoeal, hepatoprotective, hypoglycemic, hypolipidemic, memory enhancing and neuroprotective and other activities. Other studies also directly supported the effective use of *Centella* and *Clerodendrum* genus which is in agreement with the present traditional beliefs [60].

CONCLUSION

The need to conduct an ethnomedicinal plant study is felt more than ever. The regions in which the study was carried out were found to be the ideal spot for ethnomedicinal plant studies. Although the advancement in science has led to people using allopathic drugs for treating illnesses, a fair percentage of people still rely on medicinal plants for treating any diseases. WHO reported the use of herbal medicines in large populations and it holds for people in these regions. Folks still rely on herbal plants mainly due to their less or no toxic effects, easy accessibility of the plants, and also the absence of healthcare facilities in the region due to their isolated montane location. During the survey, it was found that the knowledge of plants and their preparations in the use of treating most of the diseases were still prevalent among the people. The knowledge on how to use the plants was also widely distributed among the people. The Thadou-Kuki tribe of Manipur has a rich culture and

traditions, their knowledge of ethnomedicinal plants is also richly endowed. However, despite the extensive experiences and the knowledge of plants in treating a disease, a scientific study of the reported plants needs to be carried out for its proper documentation, identification, standardization, and validation which will eventually guide us in the development of new drugs and also for the production of naturally based products in the future. It was also noted that some of the plants which have medicinal properties were also used as food by the local community. People gathered or used ethnomedicinal plants directly or indirectly for food or vegetables. This cycle shares an inseparable connection between the people and the medicinal plants. The data collected will be of significant value for the conservationist, researchers, etc. Authorities should ensure the wise use of these plants in terms of sustainability and conservation which are under threat to overexploitation. The uprooting of the whole plants for their medicinal use should be banned especially for threatened plant species for plant conservation. Furthermore, our findings will serve as a baseline data to settle a connection between traditional knowledge experts and scientific researchers.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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Author's contributions

NH: Conceptualisation, survey, sample collection and manuscript writing.

RKD: Conceptualisation, supervision of the project, manuscript editing.

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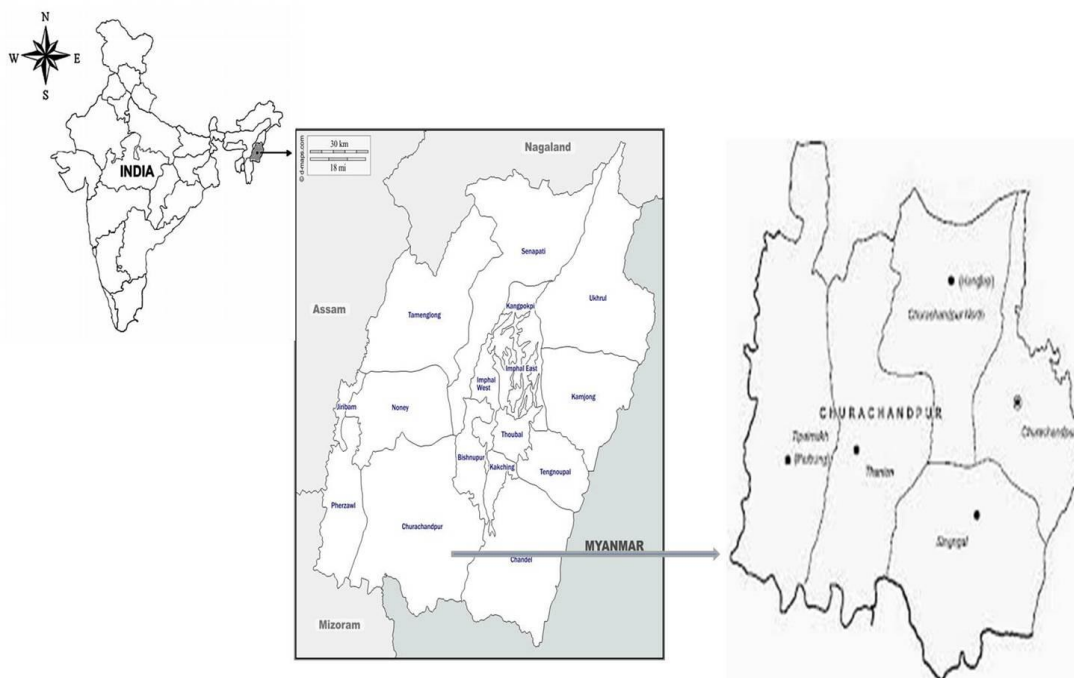


Fig. 1: Study site

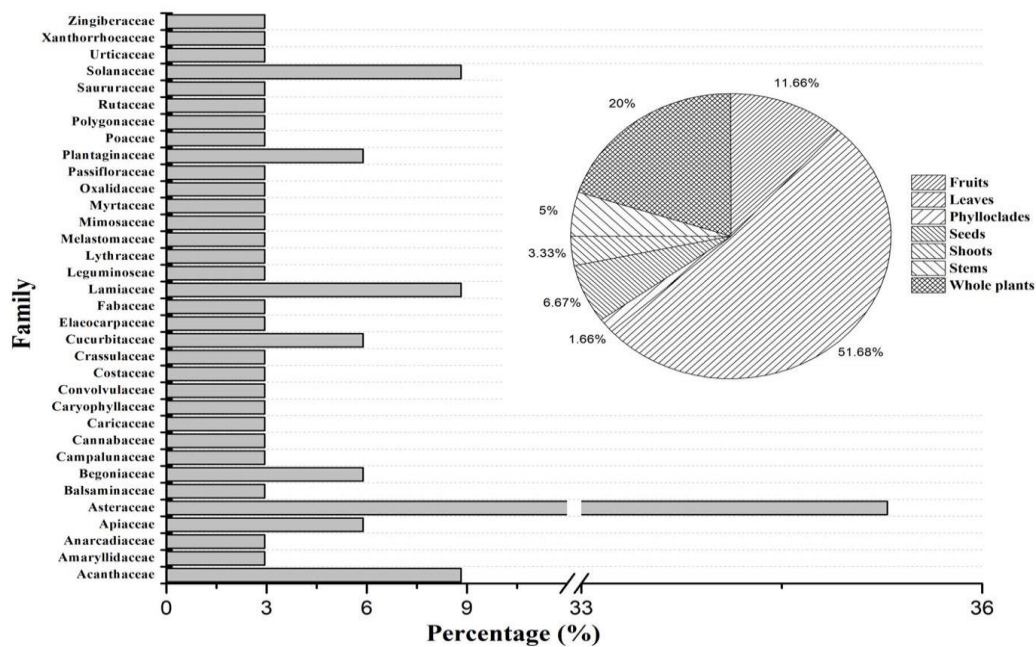


Fig. 2: Number of species present in the families and distributions of plant parts.

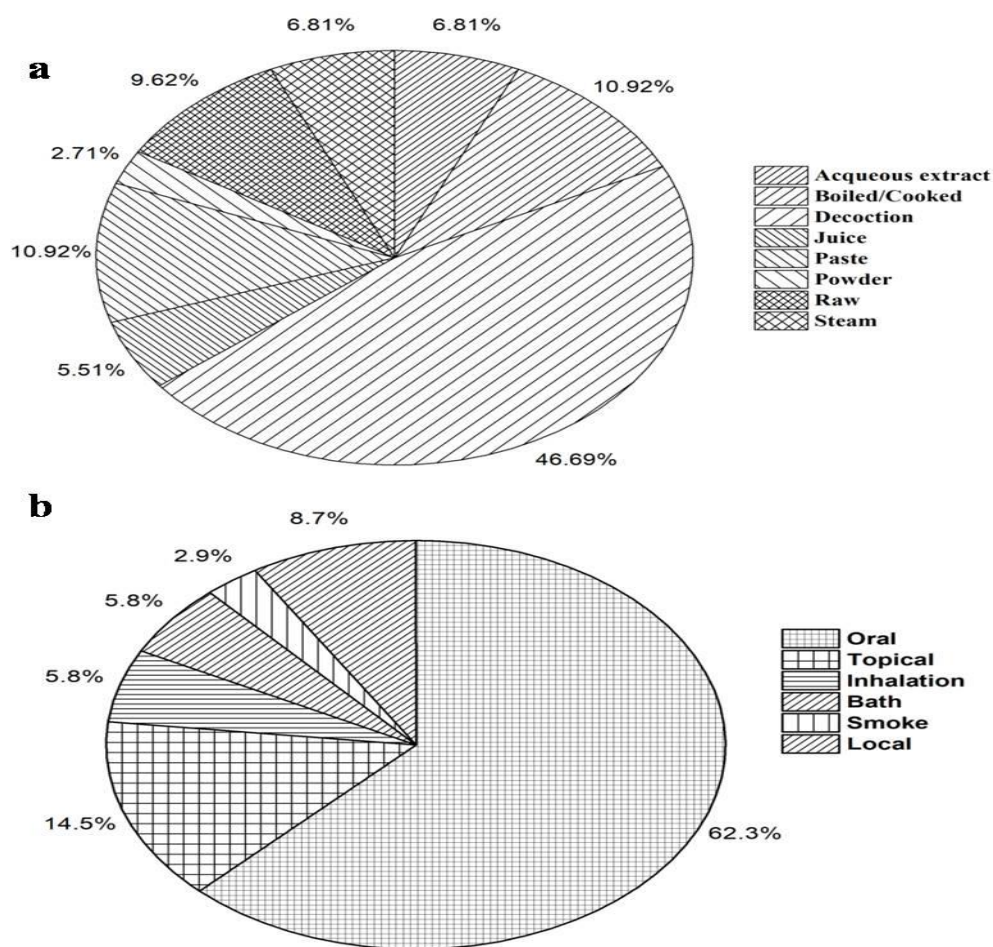


Fig. 3. Mode of preparations (a) and route of application (b).

Table 1: Demographic profile of the informants.

Parameter	Specification	Frequency	Percentage (%) (n=80)
Gender	Female	70	87.50
	Male	10	12.50
Age groups	20-30 years	16	20.00
	31-40 years	25	31.25
	41 years & above	39	48.75
Occupation	Farmers	45	56.25
	Government employee	9	11.25
	Others	26	32.50
Education level	Primary	41	51.25
	Intermediate	8	10.00
	Graduate	3	3.75
	Never attended school	8	10.00
Source of knowledge	Parental	46	57.50
	Friends	24	30.00
	Traditional health practitioners	4	5.00
	Others	6	7.50

Table 2: Ethnomedicinal plants used by the indigenous people with their vernacular name, specimen number, scientific names, family, habitat, parts used, used against diseases/purposes, mode of preparation and application and use value.

Sl. No.	Vernacular name	Voucher No.	Scientific names	Family	Habitat	Parts Used	Used against diseases/Purposes	Mode of preparation and application
1.	Japanese na	07/08/2017-1	Eupatorium adenopharum Hort.Berol.ex Kunth	Asteraceae	Small gregarious undershrub	Leaf	Diabetes	Leaves is boiled to make a decoction and taken orally
2.	Belbukong/Leisan	07/08/2017-2	Melastoma malabathricum L.	Melastomaceae	Hispid undershrub	Whole plant	Diabetes Tongue ulcers	Whole parts of the plants is boiled to make a decoction and taken orally Ripened fruits are chewed
3.	Lhangmui	07/08/2017-3	Luffa acutangula (L.) Roxb.	Cucurbitaceae	Large tendril climber	Leaf, Fruits	Liver diseases	The leaves are boiled to make a decoction and taken orally The fruits are boiled and included in the diet
4.	Bahlong	07/08/2017-4	Oroxylum indicum (L.) Kurz.	Begoniaceae	Small tree	Fruits (Unripe)	Diabetes Liver diseases Gastrointestinal problem Kidney diseases (oedema)	The fruits are first roasted and the blackish layer of it is removed. After cleaning it is then boiled to make a decoction and taken orally
5.	Belheng na	07/08/2017-5	Cajanus cajan (L.) Millsp.	Leguminosae	Hispid profuse shrub	Leaf	Kidney diseases (oedema)	The leaves are boiled to make a decoction and taken orally
6.	Vailou	07/08/2017-6	Ageratum conyzoides (L.) L.	Asteraceae	Profuse hispid herb	Leaf	Antiseptic/ Antibiotic	Fresh leaves extract is applied topically
7.	Sumkawn pah		Datura metel L.	Solanaceae	Large, erect and stout herb	Leaf	Dysentery Piles	Decoction of the leaves is mixed with mishri and 1 teaspoon is taken orally *High doses not recommended as it can be poisonous
8.	Khongbai anche	07/08/2017-8	Scoparia dulcis L.	Plantaginaceae	Erect herb	Leaf, Stem	Fever Diabetes Gastrointestinal problem	Decoction of the leaves is taken orally
9.	Sai anjang	07/08/2017-9	Solanum torvum Sw.	Solanaceae	Profuse spiny undershrub	Fruits, Seeds	Gastrointestinal problem Headache	The whole fruits with seeds is steamed or boiled and consumed as such The fruits with seeds is pounded to make a paste and applied directly on the forehead
10.	Meikah lou	07/08/2017-10	Bryophyllum pinnatum (Lam.) Oken	Crassulaceae	Succulent herb	Phylloclades	Cuts and burns	The paste is applied topically

11.	Loubuong	07/08/2017-11	Crassocephalum crepidioides (Benth.) S. Moore	Asteraceae	Erect herb	Leaf	Gastrointestinal	Decoction of the leaves is taken orally
12.	Aithanglou	29/08/2019-26	Houttuynia cordata Thunb.	Saururaceae	Profusely spreading aromatic herb	Leaf, Roots	Kidney stones Tonsillitis	Decoction of the leaves is taken orally The leaves can be included in the diet and eaten raw The leaves and roots are pounded and the paste is taken orally
13.	Sihmichang mai	29/08/2019-22	Oxalis corniculata L.	Oxalidaceae	Profused stragglings herb	Whole plant	Sinusitis	The whole plant is boiled and the steam is inhaled through the nostril
14.	Ansache	29/08/2019-11	Acmella paniculata (Wall. Ex DC.) R.K. Jansen	Asteraceae	Trailing herb	Leaf, Flowers	Hookworm infestations Piles	Decoction of the leaves and flowers is taken orally The leaves are boiled and the pile patient is made to sit
15.	Vohbilche	29/08/2019-12	Plantago major L.	Plantaginaceae	Gregarious delicate herb	Leaf, Flowers	Boil sepsis Hypertension Intestinal wall thickness Kidney stones	The leaves paste is applied directly to the affected part The leaves are boiled and included in the diet Decoction of the leaves is taken orally
16.	Sinus lou	29/08/2019-15	Drymaria cordata (L.) Willd. Ex Schult.	Caryophyllaceae	Profuse straggling creeping herb	Whole plant	Sinusitis	The whole plant is boiled and the steam is inhaled through the nostril
17.	Changkongche	29/08/2019-16	Centella asiatica (L.) Urb.	Apiaceae	Profuse straggling herb	Whole plant	Asthma Gastrointestinal problem Hypertension	Decoction of the leaves are taken orally or the whole plants is boiled and included in the diet
18.	Gulkhi	29/08/2019-20	Lobelia nummularia Lam.	Campunulaceae	Trailing herb	Whole plant	Kidney stones	Decoction of the whole plants is taken orally
19.	Huihing	29/08/2019-21	Cuscuta reflexa Roxb.	Convolvulaceae	Leafless parasitic climber	Whole plant	Liver diseases	Decoction of the whole plants is taken orally
20.	Kolthei na	29/08/2019-23	Psidium guajava L.	Myrtaceae	Small tree	Shoots	Diarrhoea Dysentery	The shoots are eaten raw

21.	Ponkap	29/08/2019-17	<i>Bidens pilosa</i> L.	Asteraceae	Erect herb	Whole plant	Anti-inflammatory Digestive problem	Decoction of the whole plants is taken orally
22.	Lingsi na	29/08/2019-03	<i>Debregeasia longifolia</i> (Burm.f.) Wedd.	Urticaceae	Large dioecious shrub	Leaf	Diabetes	Decoction of the leaves is taken orally
23.	Sapthei na	20/11/2019-1	<i>Passiflora edulis</i> Sims	Passifloraceae	Climber	Leaf	Hypertension	Decoction of the leaves is taken orally The boiled leaves can be included in the diet
24.	Ngencha	20/11/2019-2	<i>Cheilocostus speciosus</i> (J.Konig) C.Specht	Costaceae	Rhizomatous slender herb	Stem	Ear infection	The stem extracts is applied directly to the ear or it is applied dabbing the extracts in a cotton and applied poultice
25.	Anphui	20/11/2019-4	<i>Clerodendrum glandulosum</i> Lindl.	Lamiaceae	Large glabrous shrub	Leaf	Hypertension	Decoction of the leaves is taken orally The boiled leaves can be included in the diet
26.	Khongma	20/11/2019-5	<i>Rhus chinensis</i> var. <i>Chinensis</i>	Anacardiaceae	Small deciduous tree	Leaf, Fruits	Chicken pox Kidney stones	Decoction of the leaves is taken orally The fruits are coarsely pounded and is soaked in water for few days and it taken orally
27.	Maipong	20/11/2019-6	<i>Benincasa hispida</i> (Thunb.) Cogn.	Cucurbitaceae	Robust climber	Fruits	Liver diseases Blood purifier	Juice is extracted from the fruits and taken orally in empty stomach
28.	Veinamgui	20/11/2019-9	<i>Mikania micrantha</i> Kunth	Asteraceae	Aggressive climber	Leaf	Sprain Piles	The leaves paste/poultice is applied over the sprain The leaves are boiled and a person is made to sit in the hot decoction in case of piles
29.	Manchep	20/11/2019-10	<i>Xanthium strumarium</i> L.	Asteraceae	A medium-sized subshrub	Leaf, Seeds	Kidney stones	The leaves and seeds decoction is taken orally
30.	Saikang	20/11/2019-17	<i>Artemisia nilagirica</i> (C.B.Clarke) Pamp.	Asteraceae	Hispid undershrub	Whole plant	Body odour Skin rashes	The whole plants is boiled and it is used for bathing
31.	Anjangkha neote	20/11/2019-18	<i>Solanum indicum</i> L.	Asteraceae	Perennial prickly undershrub	Fruits	Hypertension Mouth ulcers Stomache	The whole fruits with seeds is steamed or boiled and consumed as such The crushed fruits along with the seeds is mixed with honey and applied to the tongue The fruits are chewed and eaten
32.	Hampajahcha	20/11/2019-19	<i>Mimosa pudica</i> L.	Mimosaceae	Stragglng spiny undershrub	Leaf, Roots	Fomentation after childbirth for faster healing Urethritis	The leaves and roots are boiled water and used for bathing. Decoction of the leaves and roots are taken

							White discharge in women	orally
33.	Seikhupdon	20/11/2019-20	Begonia palmata D.Don	Begoniaceae	Small herb	Leaf, Roots	Chicken pox Measles Kidney stones	Decoction of the leaves and roots is taken orally
34.	Nangkang	20/11/2019-8	Chromolaena odorata (L.) R.M.King and H.Rob.	Asteraceae	Schrumblingshrub	Leaf	Diabetes	Decoction of the leaves is taken orally
35.	Thingchangmai	20/11/2019-24	Carica papaya L.	Caricaceae	Small tree	Fruits, Leaf	Malaria	Decoction of the leaves is taken orally Juice of immature fruits is taken orally
36.	Aloevera	20/11/2019-25	Aloe vera (L.) Burm.f.	Xanthorrhoeaceae	Short-stemmed shrubby aloe	Leaf	Cuts and burns Heart burn	The gel extracts is applied to the affected area The gel is cut into pieces and consumed with honey
37.	Kolbuthei	20/11/2019-26	Punica granatum L.	Lythraceae	Small tree	Leaf	Diabetes	Decoction of the leaves is taken orally
38.	Jonmot	20/11/2019-22	Elaeocarpus floribundus Blume	Elaeocarpaceae	Medium sized evergreen tree	Leaf	Gastrointestinal problem	Decoction of the leaves is taken orally
39.	Puhlou	27/03/2020-40	Blumea flava DC	Asteraceae	Tall aromatic herb	Leaf	Headache	The leaves are pounded and the paste applied directly on the forehead The leaves are boiled and eaten
40.	Changkuong Patikhom	27/03/2020-41	Eryngium foetidum L.	Apiaceae	Spiny aromatic herb	Whole plant	Burns	The leaves are pounded and applied directly to the affected part of the body
41.	Ahmutan	27/03/2020-42	Persicaria chinensis ((L.) H. Gross	Polygonaceae	Scandent subshrubs	Leaf	Kidney stones	Decoction of the leaves is taken orally The boiled leaves can be included in the diet
42.	Kolhou Aeng	27/03/2020-43	Phlogocanthus thyriformis (Roxb.ex.Hardw.) Mabb.	Acanthaceae	Bushy shrub	Leaf	Cough and cold Fever Hypertension Skin itching	The leaves are boiled and the steam is inhaled in a close environment Decoction of the leaves is taken orally The leaves are boiled and it is used for bathing
43.	Kolhou Akang	27/03/2020-44	Justicia adhatoda L.	Acanthaceae	Gregarious shrub	Leaf	Cough and cold Fever Hypertension Skin itching	The leaves are boiled and the steam is inhaled in a close environment Decoction of the leaves is taken orally The leaves are boiled and it is used for bathing
44.	Kolhou Asan	27/03/2020-45	Phlogocanthus pubinervius	Acanthaceae	Large branched	Leaf	Cough and cold	Decoction of the leaves is taken orally

			T.Anderson		shrub		Fever	
45.	Lengmasel	27/03/2020-46	Elsholtzia communis Benth.	Lamiaceae	Aromatic undershrub	Flowers, Leaf	Pharyngitis	The dried leaf powder are burnt and the smoke is inhaled
46.	Ganja	27/03/2020-47	Cannabis sativa L.	Cannabaceae	Aromatic bushy shrub	Leaf	Appetiser Dysentery	The dried leaf powder is smoked before meal to increase the appetite The dried leaf powder mixed with water is taken orally
47.	Buolje	27/03/2020-48	Blumea lanceolaria (Roxb.) Druce	Asteraceae	Tall erect shrub	Leaf	Cancer	Decoction of the leaves is taken orally
48.	Lingnamse	27/03/2020-49	Zanthoxylum acanthopodium DC.	Rutaceae	Spiny bushy shrub	Seeds	Cough Indigestion Toothache	The dried seeds are taken orally for cough and indigestion The fresh seeds are pounded and the extracts is taken in a cotton and applied to the affected part
49.	Louthul Peh	27/03/2020-50	Allium hookeri Thwaites	Amaryllidaceae	Aromatic delicate herb	Whole plant	Micturition	Decoction of the whole plants is taken orally
50.	Noisan	27/03/2020-51	Impatiens balsimina L.	Balsaminaceae	Tall succulent herb	Whole plant	Antibiotic	The leaves and young stems of the plant is lightly pounded to extract the juice and is applied on to the affected part
51.	Ailaivom	27/03/2020-52	Kaempferia parviflora Wall. Ex Baker	Zingiberaceae	Rhizomatous herb	Rhizome	Epigestic pain Dysentery Lungs diseases Piles	The roots are pounded and the extract is taken orally
52.	Hanaling	27/03/2020-53	Solanum myriacanthum Dunal	Solanaceae	Stout bushy undershrubs	Seeds	Dental caries	The seeds are crushed and the extract is applied to the affected area
53.	Kolchu Kang	27/03/2020-54	Saccharum officinarum L.	Poaceae	Tall erect succulent undershrub	Stem	Liver diseases	The juice is taken orally early in the morning before meal
54.	Hampa Namse	27/03/2020-55	Mentha spicata L.	Lamiaceae	Profuse aromatic herb	Whole plant	Carminative Cough and cold	The whole plants can be eaten with food or consumed as such
55.	Songko Kang	27/03/2020-56	Erythrina variegata L.	Fabaceae	Thorny deciduous tree	Bark	Skin Allergy	The bark of the tree is scrapped and applied directly to the skin

Table 3: Informant consensus factor (ICF).

Major diseases and their ailments	Number of taxa (Nt)	Number of used reports (Nur)	Informant Consensus factor (ICF)
Cardiovascular	8	80	0.91
Dermatological	14	64	0.83
Endocrinal	7	44	0.89
Fever/Malaria	5	31	0.86
Gastrointestinal	23	61	0.71
General state of health	9	58	0.88
Gynaecological	2	65	0.98
Liver diseases	5	64	0.96
Musculo-skeletal	1	35	0.00
Neoplasm	1	37	0.00
Oropharyngeal/Ear infection	9	40	0.86
Resiratory	2	23	0.95
Urological	11	48	0.81

Table 4: Percentage of Fidelity level.

Species with specific ailments	Fidelity Level (%)
Cardiovascular	
Plantago major L. (Hypertension)	89.65
Centella asiatica (L.) Urb. (Hypertension)	100.00
Passiflora edulis Sims (Hypertension)	93.58
Clerodendrum glandulosum Lindl. (Hypertension)	100.00
Solanum indicum L. (Hypertension)	100.00
Phlogocanthus thyriformis (Roxb.ex.Hardw.) Mabb. (Hypertension)	83.33
Justicia adhatoda L. (Hypertension)	81.48
Dermatological	
Ageratum conyzoides (L.) L. (Antibiotic/Antiseptic)	82.85
Bryophyllum pinnatum (Lam.) Oken (Cuts and burns)	45.71
Plantago major L. (Boil sepsis)	37.93
Rhus chinensis var. chinensis (Chicken pox)	53.33
Artemisia nilagirica (C.B.Clarke) Pamp. (Body odour, Skin rashes)	50.00
Begonia palmata D. Don (Chicken pox, Measles)	35.71
Aloevera (L.) Burm.f. (Cuts and burns)	91.66
Eryngium foetidum L. (Burns)	90.00
Phlogocanthus thyriformis (Roxb.ex.Hardw.) Mabb. (Skin itching)	26.66
Justicia adhatoda L. (Skin itching)	62.96
Impatiens balsamina L. (Antibiotic)	77.77
Erythrina variegata L. (Skin Allergy)	64.00
Endocrinal	
Eupatorium adenopharum Hort.Berol.ex Kunth (Diabetes)	69.3
Oroxylum indicum (L.) Kurz. (Diabetes)	68.57
Melastoma malabathricum L. (Diabetes)	76.66
Scoparia dulcis L. (Diabetes)	50.00

Debregeasia longifolia (Burm.f.) Wedd. (Diabetes)	60.00
Chromolaena odorata (L.) R.M.King and H.Rob. (Diabetes)	76.19
Punica granatum L. (Diabetes)	29.03
Fever/Malaria	
Scoparia dulcis L. (Fever)	75.00
Carica papaya L. (Malaria)	89.28
Phlogocanthus thyriformis (Roxb.ex.Hardw.) Mabb. (Fever)	96.66
Justicia adhatoda L. (Fever)	74.07
Phlogocanthus pubinervius T.Anderson (Fever)	86.66
Gastrointestinal	
Melastoma malabathricum L. (Gastrointestinal problem)	26.66
Oroxylum indicum (L.) Kurz. (Dysentery, Piles)	80.00
Datura metel L. (Gastrointestinal problem)	83.33
Scoparia dulcis L. (Gastrointestinal problem)	75.00
Solanum torvum Sw. (Gastrointestinal problem)	50.74
Crassocephalum crepidioides (Benth.) S. Moore (Gastrointestinal problem)	21.62
Acmella paniculata (Wall. Ex DC.) R.K. Jansen (Hookworm infestations, Piles)	66.66
Plantago major L. (Intestinal wall thickness)	43.10
Centella asiatica (L.) Urb. (Gastrointestinal problem)	100.00
Psidium guajava L. (Diarrhoea / Dysentery)	80.00
Bidens pilosa L. (Digestive problem)	60.00
Mikania micrantha Kunth (Piles)	68.75
Solanum indicum L. (Mouth ulcers, stomache)	76.66
Aloevera (L.) Burm.f. (Heart burn)	76.66
Elaeocarpus floribundus Blume (Gastrointestinal problem)	50.00
Cannabis sativa L. (Dysentery)	26.31
Zanthoxylum acanthopodium DC. (Indigestion)	66.66
Kaempferia parviflora Wall. Ex Baker (Epigestic pain, Dysentery, Piles)	78.08
Mentha spicata L. (Carminative)	65.51
General state of health	
Solanum torvum Sw. (Headache)	26.86
Bidens pilosa L. (Anti-inflammatory)	33.33
Benincasa hispida (Thunb.) Cogn. (Blood purifier)	87.17
Blumea flava DC (Headache)	35.13
Phlogocanthus thyriformis (Roxb.ex.Hardw.) Mabb. (Cough and cold)	40.00
Justicia adhatoda L. (Cough and cold)	44.44
Phlogocanthus pubinervius T.Anderson (Cough and cold)	20.00
Cannabis sativa L. (Appetiser)	21.05
Zanthoxylum acanthopodium DC. (Cough)	33.33
Mentha spicata L. (Cough and cold)	58.62
Gynaecological	
Mimosa pudica L. (Fomentation after childbirth for faster healing, White discharge in women)	95.23
Liver diseases	

Luffa acutangula (L.) Roxb. (Liver diseases)	77.77
Oroxylum indicum (L.) Kurz. (Liver diseases)	85.71
Cuscuta reflexa Roxb. (Liver diseases)	44.73
Benincasa hispida (Thunb.) Cogn. (Liver diseases)	97.43
Saccharum officinarum L. (Liver diseases)	74.28
Musculo-skeletal	
Mikania micrantha Kunth (Sprain)	62.50
Neoplasm	
Blumea lanceolaria (Roxb.) Druce (Cancer)	81.08
Oropharyngeal/Ear infection	
Melastoma malabathricum L. (Tongue ulcers)	40.00
Houttuynia cordata Thunb. (Tonsilitis)	50.00
Oxalis corniculata L. (Sinusitis)	70.83
Drymaria cordata (L.) Willd. Ex Schult. (Sinusitis)	53.33
Cheilocostus speciosus (J.Konig) C.Specht (Ear infection)	50.00
Solanum indicum L. (Mouth ulcers)	93.75
Elsholtzia communis Benth. (Pharyngitis)	50.00
Zanthoxylum acanthopodium DC. (Toothache)	83.33
Solanum myriacanthum Dunal (Dental caries)	80.00
Respiratory	
Centella asiatica (L.) Urb. (Asthma)	19.23
Kaempferia parviflora Wall. Ex Baker (Lungs diseases)	38.35
Urological	
Oroxylum indicum (L.) Kurz. (Kidney diseases (oedema))	91.42
Cajanus cajan (L.) Millsp. (Kidney diseases (oedema))	50.00
Houttuynia cordata Thunb. (Kidney stones)	75.00
Plantago major L. (Kidney stones)	55.17
Lobelia mummularia Lam. (Kidney stones)	83.33
Rhus chinensis var. chinensis (Kidney stones)	53.33
Xanthium strumarium L. (Kidney stones)	90.00
Mimosa pudica L. (Urethritis)	84.12
Begonia palmata D.Don (Kidney stones)	50.00
Persicaria chinensis ((L.) H. Gross (Kidney stones)	71.42
Allium hookeri Thwaites (Micturition)	45.71