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A Traditional and Pharmacological Approach of Medicinal Plants in Mizoram, India

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Abstract

Traditional medicine is the sole method of treatment in rural India even today. Several communities practice their traditional method of treatment and are not affected by the advances in modern medicine. The tribal communities prefer to use and consult their own traditional practitioners since these are easily available, accessible and cheap. It is also believed that these are free of side effects and very effective. The Mizos of the north-eastern state of India (Mizoram), use several plants to treat various ailments. Their practices are unique and are usually carried out by elderly persons of the community or traditional healers. Several plants used in their traditional medicine have been scientifically validated for their efficacy and toxicity studies. However, a large number still awaits identification and efficacy validations. This manuscript describes both the studied and untouched medicinal plants used in the traditional medicine system of the Mizos of Mizoram. Although, several other remedies are yet to be discovered, this study has described most of them in current use.

Keywords: medicinal plants, Mizoram, traditional medicines, traditional practices

1. Introduction

Medicinal plants serve as the mainstay of various traditional disease management strategies since time immemorial [1]. These practices are passed onto many generations and some have even led to great discoveries providing instant cure and eradication of various diseases. Despite the growth in the pharmaceutical industry, modern health care system and drugs are still impractical and inaccessible for the less privileged communities [2]. According to World Health Organization (WHO), about 90% of the people in developing countries still use traditional medicines as their primary health care system, while in some parts in combination with modern drugs [3]. Due to high reliance on traditional medicines, WHO has laid down strategies for the improvement of health care system in developing countries particularly for the economically deprived communities. The strategies aim to frame policy, enhance safety, efficacy, quality, ensure access and to promote balanced use of traditional medicines. Through these strategies, traditional medicines are projected to be integrated into disease management programs in Primary Health Centers (PHC), thereby increasing recognition and support from the Government [4]. International organizations and policy makers believe that primary health care system PHCs are

still the best to meet the needs of the people in villages and are assumed to be the universal solution for improving human health [5].

The practice of traditional healing in Indian culture has been assumed to be as old as civilization. Traditional healing by various medicinal plants has been trusted and has gained much acceptance among many cultures as the proportion of cure is believed to be high and significant [6]. This may perhaps be related to the rich biodiversity where plants having medicinal values can be obtained from the forest at any disposal. Poor economy background of deprived communities may as well play an important role in the high reliance on forest resources for medicinal purpose and nutraceuticals [7].

Mizoram, one of the 7 sister states of Northeast India is inhabited mainly by the Mizo tribe (**Figure 1**). It shares an international boundary with Bangladesh in the south western part and with Myanmar in the south eastern side. It also shares the national boundary with the state of Assam in the north; Manipur in the north east and Tripura in the west. It is located between 21°56'N to 24°31'N, and 92°16'E

Figure 1.
A traditional Mizo couple.

to 93°26'E. The climate of Mizoram is relatively mild. It is never too hot nor too cold during summer and winter [8]. The state lies in the Indo-Myanmar sub-tropical forest region and is a biodiversity hot-spot with many endemic species. The rich biodiversity provides immense treasure and sustainable supply of medicinal plants and hence leads to frequent use of plants as medicine [9]. The knowledge and practices are passed down the generations which are still in practice while some are kept in secrecy by villagers [10]. Medicinal plants are the immediate rescue for various ailments especially in remote areas where modern medical facilities are far from being attained [11]. The practices are quite similar in most parts of the state but the parts of the plant, type of preparation and consumption vary slightly from place to place. In most cases, decoction of the different parts of the plants is consumed orally without meticulous proper dosage [12]. Consumption of decoction of leaves is the most common form of use other than raw, aqueous

Figure 2.
A traditional healer preparing medicine.

extract, powdered, crushed, drooping or homogenized in water. The parts of the plant mainly used as medicine are leaves, roots, seeds and stem bark, among which leaves constitute the highest percentage. Besides, various ingredients such as sugar, oil, water, honey, and citrus juice are added to enhance the taste, aid consumption and to conceal the smell [13]. These medicines are usually prepared at home (**Figure 2**). The medicinal plant parts are also usually processed at home (**Figure 3**).

Traditional knowledge and practices serve as the basic framework for scientific studies including chemical analysis and biological activity studies. Different varieties of plants have been used as medicine among which some of them are still in use today (**Table 1**). The various plants used for treatment of various common diseases are discussed in this study.

Figure 3.
Turmeric being dried for use as medicine.

Sl. No	Ailment	Medicinal plant
1	Parasite infections	<i>Euphoria longan</i> , <i>Morus alba</i> , <i>Punica granatum</i> , <i>Schima wallichii</i> , <i>Eupatorium odoratum</i> , <i>Annona squamosa</i> , <i>Artemisia nilagirika</i> , <i>Lagerstroemia speciosa</i> , <i>Benincasa hispida</i> , <i>Carica papaya</i> , <i>Dioscorea bulbifera</i> , <i>Michelia champaca</i> , <i>Piper longum</i> , <i>Trichosanthes anguina</i> , <i>Chenopodium ambrosioides</i> , <i>Gossypium</i> sp., <i>Dalbergia pinnata</i> , <i>Ziziphus oenoplia</i> , <i>Acacia oxyphylla</i> , <i>Milletia pachycarpa</i> , <i>Millettia taiwaniana</i> , <i>Imperata cylindrica</i> , <i>Ilex khasiana</i> , <i>Acmella oleracea</i> , <i>Callicarpa arborea</i>
2	Diarrhea	<i>Catunaregam spinosa</i> , <i>Chrysophyllum lanceolatum</i> , <i>Aegle marmelos</i> , <i>Ziziphus mauritiana</i> , <i>Tamarindus indica</i> , <i>Spondias pinnata</i> , <i>Rhus semialata</i> , <i>Garcinia morella</i> , <i>Garcinia cowa</i> , <i>Ficus racemose</i> , <i>Embllica officinalis</i> , <i>Dillenia indica</i> , <i>Bruinsmia polysperma</i> , <i>Artocarpus chama</i> , <i>Parkia roxburghii</i> , <i>Mikania micrantha</i> , <i>Melastoma malabathricum</i> , <i>Rourea minor</i> , <i>Rhododendron arboretum</i> , <i>Quercus serrata</i> , <i>Quercus oblongata</i> , <i>Punica granatum</i> , <i>Psidium guajava</i> , <i>Pogostemon cablin</i> , <i>Picrasma javanica</i> , <i>Phyllodium pulchellum</i> , <i>Osbeckia chinensis</i> , <i>Acer oblongum</i> , <i>Actinida chinensis</i> , <i>Careya arborea</i> , <i>Mussaenda macrophylla</i> , <i>Stereospermum tetragonum</i> , <i>Clerodendrum colebrookianum</i> , <i>Blumea lanceolaria</i>
3	Skin	<i>Achyranthes aspera</i> , <i>Albizia chinensis</i> , <i>Artocarpus lakiicha</i> , <i>Jatropha curcus</i> , <i>Arisaema tortuosum</i> , <i>Artemisia indica</i> , <i>Chenopodium ambrosioides</i> , <i>Chenopodium viscosum</i> , <i>Elsholtzia blanda</i> , <i>Buddleja asiatica</i> , <i>Centella asiatica</i> , <i>Lantana camara</i> , <i>Actinida chinensis</i> , <i>Eryngium foetidum</i> , <i>Mimosa pudica</i> , <i>Polygonum plebeium</i> , <i>Prunus cerasoides</i> , <i>Buddleia asiatica</i> , <i>Erythrina stricta</i> , <i>Tinospora cordifolia</i> , <i>Psychotria calocarpa</i> , <i>Mimosa pudica</i> , <i>Oroxylum indicum</i> , <i>Nigella sativa</i>
4	Diabetes	<i>Dillenia pentagyna</i> , <i>Casearia tomentosa</i> , <i>Abrus precatorius</i> , <i>Averrhoa carambola</i> , <i>Lagerstroemia speciosa</i> , <i>Phyllanthus fraternus</i> , <i>Tinospora cordifolia</i> , <i>Aloe barbadensis</i> , <i>Artocarpus heterophyllus</i> , <i>Curcuma longa</i> , <i>Embllica officinalis</i> , <i>Mimosa indica</i> , <i>Mimosa pudica</i> , <i>Albizia procera</i> , <i>Aegle marmelos</i> , <i>Allium cepa</i> , <i>Alstonia scholaris</i> , <i>Allium sativum</i> , <i>Clerodendrum colebrookianum</i> , <i>Plantago major</i> , <i>Physalis angulate</i> , <i>Passiflora quadrangularis</i> , <i>Scurrula parasitica</i> , <i>Mallotus roxburghianus</i>
5	Cancer	<i>Aglaia edulis</i> , <i>Prunus domestica</i> , <i>Ficus hirta</i> , <i>Dillenia pentagyna</i> , <i>Ageratum conyzoides</i> , <i>Blumea lanceolaria</i> , <i>Aloe barbadensis</i> , <i>Artocarpus heterophyllus</i> , <i>Azadirachta indica</i> , <i>Carica papaya</i> , <i>Clerodendrum colebrookianum</i> , <i>Curcuma longa</i> , <i>Embllica officinalis</i> , <i>Mimosa indica</i> , <i>Momordica charantia</i> , <i>Ageratum conyzoides</i> , <i>Gynura conyza</i> , <i>Dillenia indica</i> , <i>Scurrula parasitica</i> , <i>Rhynchochelum ellipticum</i> , <i>Aegle marmelos</i> , <i>Allium hookeri</i> , <i>Eryngium foetidum</i> , <i>Mikania micrantha</i> , <i>Alpinia galanga</i> , <i>Ageratum conyzoides</i> , <i>Solanum khasianum</i> , <i>Lonicera macrantha</i> , <i>Senecio scandens</i> , <i>Croton caudatus</i> , <i>Mussaenda macrophylla</i> , <i>Callicarpa arborea</i> , <i>Byttneria aspera</i> , <i>Rhus javanica</i>
6	Malaria	<i>Acacia concina</i> , <i>Andrographis paniculata</i> , <i>Adhatoda vasica</i> , <i>Alstonia scholaris</i> , <i>Artemisia nilagirika</i> , <i>Clerodendrum serratum</i> , <i>Acacia concinna</i> , <i>Acer oblongum</i> , <i>Alstonia scholaris</i> , <i>Anogeissus acuminata</i> , <i>Artemisia vulgaris</i> , <i>Begonia inflata</i> , <i>Borginia ciliate</i> , <i>Canna indica</i> , <i>Cassia fistula</i> , <i>Chickrassia tabularis</i> , <i>Dichroa febrifuga</i> , <i>Eryngium foetidum</i> , <i>Kyllinga monocephala</i> , <i>Lantana camara</i> , <i>Mikania micrantha</i> , <i>Musa paradisiaca</i> , <i>Sylvestris</i> sp., <i>Passiflora nepalensis</i> , <i>Phyllanthus fraternus</i> , <i>Picrasma javantica</i> , <i>Piper betle</i> , <i>Piper longum</i> , <i>Prunus cerasoides</i> , <i>Rotheca serrate</i> , <i>Spathodea stipulata</i> , <i>Stereospermum personatum</i> , <i>Vitex peduncularis</i> , <i>Garcinia cowa</i> , <i>Plantago major</i> , <i>Pittosporum napaulense</i>
7	Fungal infections	<i>Ficus auriculata</i> , <i>Gelsemium elegans</i> , <i>Chickrassia tabularis</i> , <i>Spathodea stipulate</i> , <i>Asparagus racemosus</i> , <i>Homalomena aromatica</i> , <i>Curcuma longa</i> , <i>Trachyspermum ammi</i> , <i>Callicarpa macrophylla</i> , <i>Bidens pilosa</i>
8	Measles	<i>Securinega virosa</i> , <i>Adhatoda vasica</i> , <i>Azadirachta indica</i> , <i>Amomum subulatum</i> , <i>Cucurma caesia</i> , <i>Anacolosa crassipes</i> , <i>Securinega virosa</i> , <i>Phyllanthus airy-shawii</i> , <i>Homalomena aromatica</i> , <i>Anogeissus acuminata</i> , <i>Lantana camara</i> , <i>Rhus javanica</i>
9	Chickenpox	<i>Securinega virosa</i> , <i>Adhatoda vasica</i> , <i>Rhus semialata</i> , <i>Embelia nagushia</i> , <i>Anogeissus acuminata</i> , <i>Averrhoa carambola</i> , <i>Embelia vestita</i>

Sl. No	Ailment	Medicinal plant
10	Jaundice	<i>Chonemorpha fragrans</i> , <i>Emblica officinalis</i> , <i>Oroxylum indicum</i> , <i>Terminalia chebula</i> , <i>Dillenia pentagyna</i> , <i>Clerodendrum colebrookianum</i> , <i>Catharanthus roseus</i> , <i>Cassia fistula</i> , <i>Carica papaya</i> , <i>Capsicum frutescens</i> , <i>Aeschynanthus sikkimensis</i> , <i>Adhatoda zeylanica</i> , <i>Adhatoda vasica</i> , <i>Homalomena aromatica</i> , <i>Passiflora</i> sp., <i>Acacia concina</i> , <i>Amomum subulatum</i> , <i>Gynura conyzia</i> , <i>Lagerstroemia speciosa</i> , <i>Laportea crenulate</i> , <i>Momordica charantia</i> , <i>Musa superba</i> , <i>Alocasia indica</i> , <i>Cucurma caesia</i> , <i>Passiflora edulis</i> , <i>Andrographis paniculate</i> , <i>Ardisia paniculate</i> , <i>Averrhoa</i> sp., <i>Dendrocnide sinuate</i> , <i>Dillenia indica</i> , <i>Hibiscus rosa-sinensis</i> , <i>Lagerstroemia speciosa</i> , <i>Mallotus roxburghianus</i> , <i>Phyllanthus fraternus</i> , <i>Ficus semicordata</i> , <i>Hedyotes scandens</i> , <i>Mimosa pudica</i> , <i>Bridelia monoica</i> , <i>Benicasia hisipida</i> <i>Curcuma longa</i> , <i>Dendrocnida sinuate</i> , <i>Euphorbia royleana</i> , <i>Saccharum officinarum</i> , <i>Garcinia cowa</i> , <i>Vitex peduncularis</i> , <i>Rubus rosifolius</i> , <i>Punica granatum</i>
11	Stomach issues	<i>Aloe barbadensis</i> , <i>Aporosa octandra</i> , <i>Erythrina stricta</i> , <i>Lagerstroemia speciosa</i> , <i>Artemisia indica</i> , <i>Baccaurea ramniflora</i> , <i>Berberis nepalensis</i> , <i>Dillenia pentagyna</i> , <i>Elaegnus caudate</i> , <i>Erythrina alba</i> , <i>Callicarpa arborea</i> , <i>Blumea lanceolaria</i> , <i>Carica papaya</i> , <i>Citrus aurantifolia</i> , <i>Curcuma longa</i> , <i>Curcumorpha longiflora</i> , <i>Helicia robusta</i> , <i>Mallotus philippensis</i> , <i>Lobelia angulate</i> , <i>Mentha arvensis</i> , <i>Musa</i> sp., <i>Osbeckia sikkimensis</i> , <i>Tinospora cordifolia</i> , <i>Zanonia indica</i> , <i>Smilax glabra</i> , <i>Senecio scandens</i> , <i>Scoparia dulcis</i> , <i>Saprosma ternatum</i> , <i>Prismatomeris tetrandra</i> , <i>Picria felterrae</i> , <i>Picrasma quassiooides</i> , <i>Picrasma javanica</i> , <i>Acer oblongum</i> , <i>Aganope thyrsiflora</i>
12	Food poisoning	<i>Zingiber officinale</i> , <i>Parkia roxburghii</i> , <i>Carica papaya</i> , <i>Trachyspermum roxburghianum</i> , <i>Phyllanthus emblica</i> , <i>Parkia timoriana</i> , <i>Acer oblongum</i>
13	Respiratory ailments	<i>Occimum tenuiflorum</i> , <i>Zingiber officinale</i> , <i>Drymaria cordata</i> , <i>Terminalia crenulate</i> , <i>Sonchus arvensis</i> , <i>Solanum tuberosum</i> , <i>Senna occidentalis</i> , <i>Pueraria tuberosa</i> , <i>Achyranthes aspera</i> , <i>Uncaria sessilifructus</i> , <i>Tithonia diversifolia</i> , <i>Syzygium cumini</i> , <i>Sonerila maculate</i> , <i>Sapindus mukorossi</i> , <i>Zingiber officinale</i> , <i>Occimum tenuiflorum</i> , <i>Terminalia chebula</i>
14	Typhoid	<i>Vitex peduncularis</i> , <i>Occimum tenuiflorum</i> , <i>Adina cordifolia</i>
15	Tonsilitis	<i>Uncaria sessilifructus</i> , <i>Aeschynanthus sikkimensis</i> , <i>Costus speciosus</i> , <i>Sterculia villosa</i> , <i>Smilax glabra</i> , <i>Sarcococca pruniformis</i> , <i>Sapindus mukorossi</i> , <i>Abelmoschus manihot</i>
16	Blood pressure	<i>Amomum dealbatum</i> , <i>Aporosa octandra</i> , <i>Semecarpus anacardium</i> , <i>Catharanthus roseus</i> , <i>Trachycarpus martianus</i> , <i>Terminalia arjuna</i> , <i>Solanum incanum</i> , <i>Senna occidentalis</i> , <i>Senecio scandens</i> , <i>Rauwolfia serpentine</i> , <i>Picrasma quassiooides</i> , <i>Picrasma javanica</i> , <i>Passiflora quadrangularis</i>
17	Vomiting	<i>Annona squamosa</i> , <i>Pratia begonifolia</i> , <i>Trichosanthes anguina</i> , <i>Trachyspermum roxburghianum</i> , <i>Pogostemon cablin</i> , <i>Alangium chinense</i>
18	Snake bite	<i>Antidesma bunius</i> , <i>Phyllanthus acidus</i> , <i>Benicasia hisipida</i> , <i>Wrightia arborea</i> , <i>Pogostemon cablin</i> , <i>Tagetes erecta</i> , <i>Solanum anguivi</i> , <i>Rauwolfia serpentine</i> , <i>Acacia pennata</i> , <i>Pothos scandens</i>
19	Toothache	<i>Paedaria foetida</i> , <i>Centella asiatica</i> , <i>Solanum incanum</i> , <i>Lepidagathis rigida</i> , <i>Millettia pachycarpa</i> , <i>Cynodon dactylon</i> , <i>Acmella paniculate</i> , <i>Tabernaemontana divaricate</i> , <i>Solanum viarum</i> , <i>Psidium guajava</i> , <i>Physalis angulate</i> , <i>Osbeckia stellate</i> , <i>Osbeckia crinite</i>
20	Kidney ailments	<i>Solanum nigrum</i> , <i>Scoparia dulcis</i> , <i>Saraca asoca</i> , <i>Citrus sinensis</i> , <i>Saccharum arundinaceum</i> , <i>Osbeckia sikkimensis</i> , <i>Achyranthes bidentata</i> , <i>Smilax ovalifolia</i> , <i>Costus speciosus</i> , <i>Jasminum nervosum</i> , <i>Hedychium spicatum</i> , <i>Rotula aquatic</i> , <i>Begonia inflata</i> , <i>Desmos chinensis</i> , <i>Ardisia macrocarpa</i> , <i>Myrica esculenta</i> , <i>Ageratina adenophora</i> , <i>Stevia rebaudiana</i> , <i>Actephila excelsa</i> , <i>Oryza sativa</i> , <i>Vitex peduncularis</i> , <i>Solanum nigrum</i> , <i>Centella asiatica</i> , <i>Occimum tenuiflorum</i> , <i>Phyllanthus fraternus</i> , <i>Ricinus communis</i> , <i>Sida acuta</i> , <i>Hedyotes scandens</i> , <i>Helicia robusta</i> , <i>Mimosa pudica</i> , <i>Plantago asiatica</i> , <i>Xanthium strumarium</i> , <i>Tagetes erecta</i> , <i>Syzygium cumini</i> , <i>Stevia rebaudiana</i> , <i>Siegesbeckia orientalis</i> , <i>Sida acuta</i> , <i>Pseudognaphalium luteoalbum</i> , <i>Actephila excelsa</i>

Table 1.
Commonly used medicinal plant by the Mizos of Mizoram.

2. Medicinal plants used in the traditional medicine system

2.1 Parasitic infections

Different varieties of plants have been used traditionally for the treatment and elimination of parasites in human and livestock. In Mizoram, the fruits of *Euphoria longan* (Lour.) Steud (theifeihmung), bark of *Morus alba* L. (thingtheihmu), and the juice of the fruit and bark of *Punica granatum* L. (theibuhfai) have been reported to have antiparasitic activities [14]. The bark extract of *Schima wallichii* (khiang), crushed leaves of *Eupatorium odoratum* Linn. (tlangsam) [15], juice of *Annona squamosa* L. leaves (theiarbawm), decoction of the leaves of *Artemisia nilagirika* Clarke (sai), root mixed with powdered fruits of *Lagerstroemia speciosa* ZL. (chawnpui), seeds of *Benincasa hispida* (maipawl), seeds of *Carica papaya* L. (thingfanghma), decoction of the tubers of *Dioscorea bulbifera* L. (ram-bahra), leaf juice of *Michelia champaca* L. (ngiau) mixed with honey, decoction of *Piper longum* L. (voko-hrui), and the fruits of *Trichosanthes anguina* L. (berul) have also been reported to be used frequently for the elimination of parasites [13]. Also, *Chenopodium ambrosioides* L., *Gossypium* (la) species and *Dalbergia pinnata* (Lour.) (Hruitengtere) have been reported to possess anthelmintic efficacy [16, 17]. In addition, the roots of *Ziziphus oenoplia* (L.) Mill. (muvanlai hling) are also consumed as an anthelminthic [18].

Acacia oxyphylla, locally known as Khang-ngo has been reported for its use as a deworming agent. Its alcohol extract has exhibited significant nematocidal activity at 5, 10 & 20 mg/ml concentrations against the fowl nematode *Ascaridia galli* [19] and anticestodal activity against the fowl cestode *Raillietina echinobothrida* [20]. The root peels of *Millettia pachycarpa*, locally known as Ru-lei showed a concentration dependent activity against *R. echinobothrida* and *A. galli* [21, 22]. Also, the extract of *Acacia caesia* stem bark (20 mg/ml) has been found to possess distinct anthelmintic activity against the tapeworm *Raillietina tetragona* [23]. The methanol extract of *Millettia taiwaniana* roots are also known to possess significant anthelmintic activity at 20 mg/ml against intestinal tapeworms *Taenia tetragona* and *Raillietina galli* [24, 25]. Likewise, the chloroform extract of *Imperata cylindrica* roots have exhibited anthelmintic activity against *R. tetragona* and *A. galli* [26]. *Ilex khasiana*, locally known as KZ thing also showed activities in which the methanol extract of leaves exhibited a concentration dependent increase in anthelmintic activity against *R. tetragona* [27]. The hexane, chloroform and methanol extracts of *Acmella oleracea*, locally known as ansapui or ankasa in Mizo, showed distinct anthelmintic activity against *R. echinobothrida* and *A. galli* [28, 29]. Likewise, the alcohol extract of *Callicarpa arborea*, locally known as hnahkiah is known to possess anticestodal activity against *R. echinobothrida* [30].

2.2 Diarrhea

Certain plants from Mizoram have been reported for their capacity to ameliorate diarrhea. The juice of the fruits of *Catunaregam spinosa* (Thunb.) (Sazukthei), bark of *Chrysophyllum lanceolatum* Casar. (Theipabuan), *Aegle marmelos* (Correa) Linn. (Belthei), *Ziziphus mauritiana* Lam. (Borai/Kawrsunhlu), *Tamarindus indica* L. (Tengtere), decoction of the bark of *Spondias pinnata* (L.f.) Kurz. (Tawitaw), fruits of *Rhus semialata* Murray (Khawmhma), fruits of *Garcinia morella* (Gaertn.) Desr. (Kawrvawmba), boiled leaves of *Garcinia cowa* Roxb. ex Choisy. (Chengkek), fruits of *Ficus racemosa* L. (Thei-chek/Chho), crushed bark juice of *Embllica officinalis* Gaertn. (Sunhlu), decoction of the bark of *Dillenia indica* L. (Kawrthindeng), fruits of *Bruinsmia polysperma* (C. B. Clarke) Steenis. (Theipaling/Kawh/Theirelchhin/

Theichhinkhup), and the inner coat of the bark of *Artocarpus chama* Buch. Ham. (Tatkawng) were described to be effective against diarrhea [14]. The fruits or young shoots of *Parkia roxburghii* G. Don (zawngtah), boiled leaves of *Mikania micrantha* (Japan hlo), and *Melastoma malabathricum* Linn. (Builukham) are often used for the treatment of diarrhea [15]. Also, the infusion of the leaves of *Rourea minor* (Gaertn.) Alston (chingpirinu thei/pho arh) and the flowers of *Rhododendron arboretum* Sm. (chhawkhleiparsen) are used for treating diarrhea and dysentery. Galls produced from the tree of *Quercus serrata* (sasua/sasaw thing), fruits of *Quercus oblongata* D. Don (then), young fruits of *P. granatum* Linn. (theibuhfai/Darjeeling/manding), bark and young leaves of *Psidium guajava* Linn. (kawlthei/kawiam/charthei), *Pogostemon cablin* (Blanco) Benth. (Patchouli), and the infusion of the bitter bark of *Picrasma javanica* Blume (thing damdawi/khawsik damdawi thing) are also known to be used to treat dysentery. In addition, the decoction of the bark, leaves and roots of *Phyllodium pulchellum* (L.) Desv., decoction of the roots of *Osbeckia chinensis* Linn. (builukham), and a decoction of bark and leaves of *Acer oblongum* Wall. Ex DC. (thing phingphihlip) are also used for treating diarrhea [18].

The activities of certain traditionally acclaimed antidiarrheal plants on different microorganisms have been evaluated. The methanol extracts of 12 plants namely, *Albizia lebbbeck*, *Bombax ceiba*, *Abroma augusta*, *Actinida chinensis*, *Careya arborea*, *Chonemorpha fragrans*, *Clerodendrum colebrookianum*, *Costus speciosus*, *D. indica*, *Gynura conyzia*, *Hibiscus sabdariffa*, and *Momordica charantia* showed distinct inhibition zones against gram positive bacteria (*Staphylococcus aureus*), gram negative bacteria (*Escherichia coli*, *Pseudomonas aeruginosa*), and yeast (*Candida albicans*) with Minimum Inhibitory Concentration (MIC) ranging from 1.635 to 7.972 mg/ml [31]. Likewise, *A. chinensis*, *C. arborea*, *Mussaenda macrophylla* and *Stereospermum tetragonum* extracts were also reported to have inhibition activity against 4 microorganisms namely *Fusarium graminearum*, *S. aureus*, *Escherichia coli* and *Fusarium oxysporum* f. sp. *ciceri* [32]. The alcohol extracts of *C. colebrookianum* Walp., exhibited antimicrobial activity against bacteria such as *E. coli* (MTCC DH5 α), *Serratia marcescens* (MTCC 7103) and *S. aureus* (MTCC 4301) [33]. The alcohol extracts of *Blumea lanceolaria* root, stem and leaf showed antibacterial activity against three bacteria namely *E. coli*, *S. aureus* and *Pseudomonas aeruginosa* [34].

2.3 Skin diseases

For the treatment of various skin diseases, the crushed leaves of *Achyranthes aspera* L. (buchhaw1) and *Albizia chinensis* (Osb.) Merr. (vang), juice of the crushed bark of *Artocarpus lakiicha* Roxb. (theitat) and *Jatropha curcus* L. (thingthau), pounded poultice of *Arisaema tortuosum* (Wall.) Schott. (mithi vaimim), crushed leaf juice of *Artemisia indica* Willd. (sai), *Chenopodium ambrosioides* (buarchhim-tir), *C. viscosum* Vent. (phuihnamchhia) and *Elsholtzia blanda* Benth. (nauhri), powdered flower pastes of *Buddleja asiatica* Lour. (serial), infusion of *Centella asiatica* (L.) Urban (lambak), and *Lantana camara* var. *aculeate* (L.) Mold. (hling pangpar) have been reported to be effective against various skin diseases [35]. The bark infusion of *A. chinensis* Merr. (vang) was also found to be effective against skin disorders [13]. Plants such as *Eryngium foetidum* L. (bahkhawr/bachikhawm), *Mimosa pudica* L. (hlo nuar/hlo zak), *Polygonum plebeium*, and *Prunus cerasoides* D. Don are often used for the treatment of various diseases of the skin [36]. *Buddleia asiatica* Lour (Se rial/Sial rial), paste of bark of *Erythrina stricta* Roxb. (Fartuahpui), and the root paste of *Tinospora cordifolia* (DC.) Miers. ex. Hook. (Theisawntlung) have also been reported for their healing properties of skin diseases [17, 37]. The juice of the stem, bark and leaves of *Psychotria calocarpa* Kurz (kawr pelh), and an

infusion of the bark of *A. chinensis* (Osborne) Merr. (Vang) is commonly used as a lotion for scabies and various skin diseases [18].

The ethanolic extract of *M. pudica* (hlo nuar) was found to heal wound in a concentration dependent manner [38]. The ethanolic extract gel of *Oroxylum indicum* (archangkawm) (10%) was found to enhance wound contraction which led to reduction of mean healing time in mice [39]. The dried seed extract of *Nigella sativa* has been known to accelerate collagen synthesis thereby reducing wound healing time [40].

2.4 Diabetes

Antidiabetic properties of certain plants have been reported from different parts of Mizoram. Decoction of the bark of *Dillenia pentagyna* Roxb. (Kaihzawl), decoction of the roots of *Casearia tomentosa* Roxb. (Vakithei) [14], juice of *Abrus precatorius* L. (sentet) leaves mixed with milk [13], fruits of *Averrhoa carambola* L. (theiherawt), bark of *Lagerstroemia speciosa* (L.) Pers. (thla do/chawnpui), decoction of the aerial parts of *Phyllanthus fraternus* Webster. (Mithi sunhlu) and decoction of the stem of *Tinospora cordifolia* (DC.) Miers. ex. (hrui vankai/hrui vankai hnah mam) are commonly used to treat diabetes [37]. Antidiabetic activity of plants such as *Aloe barbadensis* (L.) Burm.f. (awle lei), *Artocarpus heterophyllus* (Lam.) (lamkhuang/la ui), *Curcuma longa* (L.) (aieng), *E. officinalis* (L.) (sunhlu), *M. indica* (L.) (theihai), and *M. pudica* (L.) (hlo nuar) have also been reported [31]. *Albizia procera* Roxb. (kang tek), *A. marmelos* (L.) Corr (bel thei), *Allium cepa* Linn. (purun sen), *Alstonia scholaris* (thuamriat), *Allium sativum* Linn. (Linn.) R. Br (purun var), and *C. colebrookianum* Walp. (phuihnam) are frequently used for the treatment of diabetes [41, 42]. A decoction of the whole plant of *Plantago major* Linn. (kel ba an), fruits, stem and leaves of *Physalis angulata* L. Var. *angulata* L. (Kelasawirawphit/chalpang puak), tea made from leaves of *Passiflora quadrangularis* L. (sapthei lian chi) and fruits of *A. marmelos* (L.) Correa (bel thei) have been reported for their use as an antidiabetic remedy [18].

The ethanolic extract of *Scurrula parasitica* (thlilhli ek bawm) at concentrations of 100 and 200 mg/kg has been known to possess significant hypolipidemic and antihyperglycemic activity in albino rats [43]. The methanolic extract of *Mallotus roxburghianus* (zawngte nawhlung) leaves have shown to possess antidiabetic properties on streptozocin induced diabetic models of experimental animals. However, the activity may not be dose dependent, as the two different doses of extract (200 mg/kg and 400 mg/kg) did not show any significant variation in the results [44].

2.5 Cancer

Increase in cancer cases in recent years has led to the exploration of certain anticancer plants for immediate remedy. The juice of *Aglaia edulis* (Roxb.) Wallich (raithei) fruits, crushed fruits of *Prunus domestica* L. (Japan theite), fruits of *Ficus hirta* Vahl. (sazutheipui) and the decoction of the bark of *D. pentagyna* Roxb. (kaihzawl) are known to be effective against certain types of cancer [14]. The anticancer activity of the roots of *Ageratum conyzoides* (Linn.,) (vaihlenhlo), leaves of *B. lanceolaria* Linn. (buar ze), stem and bark of *D. pentagyna* Roxb. (kaihzawl), *Aloe barbadensis* (L.) (awle lei), *Artocarpus heterophyllus* (Lam.) (lamkhuang), *Azadirachta indica* (A. Juss) (nim thing), *C. papaya* (L.) (thing fanghma), *C. colebrookianum* (Walp.) (phuihnam), *C. longa* (L.) (aieng), *E. officinalis* (L.) (sunhlu), *Mimosa indica* (L.) (hlo nuar) and *M. charantia* (L.) (changkha/changkha rek) have also been reported [31]. Roots of *Ageratum conyzoides* Linn. (vaihlenhlo), leaves of *B. lanceolaria* Linn. (buar ze) and *G. conyza* sp., stem bark of *D. pentagyna* Roxb

(kaihzawl), and *D. indica* Linn. (kawrthindeng) were also found to possess anticancer property [45]. The decoction of the whole plant of *Scurrula parasitica* L. (thlik-thliekbawm) and the decoction of the leaves of *Rhynchosyris elliptica* (Wall. Ex D. Dietr.) A. DC. (tiarrep) are recommended for the treatment of cancer [18].

A study also suggested that *D. pentagyna* (kaihzawl) used in the traditional medicine of the Mizos, has antitumor activity against murine ascites Dalton's lymphoma [46]. In another study, the ethanolic extract of *A. marmelos* (L.) Correa (bel thei) showed protection against cardiotoxicity [47]. *Allium hookeri* (mizo purun), *Eryngium foetidum* (bahkhawr/bachikhawm), *Mikania micrantha* (japan hlo), and *Alpinia galanga* (ai chal) were found to exhibit cytotoxicity against HeLa cells in a dose dependent manner. The IC₅₀ were found to be 138.5, 199.7, 49.02, and 209.4 µg/mL, respectively [48]. The root extract of *A. conyzoides* (vaihlenhlo), stem bark of *D. pentagyna* (kaihzawl), fruit of *Solanum khasianum* and leaves of *Lonicera macrantha* (leihruisen), *Senecio scandens* (saiek hlo), *Croton caudatus* (ran lung damdawi/kam sa hulh/vawkze), *Mussaenda macrophylla* (vakep) and *B. lanceolaria* (buarze) were found to have anticancer activity against cancer cells such as MCF-7, HeLa, and Dalton's lymphoma cells. Out of these, extracts of *D. pentagyna* and *S. khasianum* were found to be a potent source of anticancer compound [49]. The methanolic extracts of the leaves of *Callicarpa arborea* Roxb. (hnahkiah) and *Byttneria aspera* Colebr. (zawng luang hrui/zawng hnuang hrui) were found to have anticancer activity against human cancer cell lines such as colon cancer cell lines (HT-29), breast cancer cell line (MCF-7), cervical cancer cell line (HeLa), leukemia cell line (MOLT-4) and ovarian cancer cell line (OVCAR-3) [50]. The aqueous extract of *C. caudatus* Geisel (ran lung damdawi/kam sa hulh/vawkze) was found to have in vivo anticancer activity against Dalton's lymphoma (% increase in life span 92.5%) and an in vitro anticancer activity with IC₅₀ of 28.36 µg/ml [49]. The chloroform extract of *C. arborea* (hnahkiah) showed promising anti-proliferative and cytotoxic activity against A549, Type II human adenocarcinoma cell line [51]. The leaf, bark and fruit extract of *Rhus javanica* L., were also found to possess anticancer activity against HeLa cell line [52].

2.6 Malaria

Different varieties of plants are used for treating malaria based on traditional practices. The leaf infusion of *Acacia concina* DC (khangthur), *Andrographis paniculata* Nees. (hnahkhapui), decoction of the leaves and roots of *Adhatoda vasica* Nees. (kawldawi), decoction of the bark of *Alstonia scholaris* R.Br. (thuamriat), and decoction of the leaves of *Artemisia nilagirika* Clarke (sai) have been reported for their use as an antimalarial agent [13]. Also, *Clerodendrum serratum* (L.) Moon (Ram phuihnam) [17], *Acacia concinna* (Willd.) DC. (Khang-thur), *Acer oblongum* Wall. ex DC. (Thing-phing-phi-hlip), crushed juice or decoction of the stem bark of *Alstonia scholaris* L. R. Br. (thuamriat), decoction of the aerial parts of *A. paniculata* (Burm. f.) Wall. ex Nees (hnah-kha-pui), decoction of the bark of *Anogeissus acuminata* Roxb. ex DC. Guill. (zai-rum), decoction of the roots or leaves of *Artemisia vulgaris* L. (sai), decoction of the rhizome of *Begonia inflata* C.B. Clarke (se-khupthur), decoction of the leaves of *Boraginaria ciliate* (Haw.) Sternb. (kham-dam-dawi), infusion of the leaves or powdered roots of *Canna indica* L. (kung-pui-mu-thi), decoction of the roots of *Cassia fistula* L. (ngai-ngaw/phung-ril), decoction of the leaves and bark of *Chickrassia tabularis* Andr. Juss. (zawngtei), decoction of leaves or roots of *Dichroa febrifuga* Lour. (khaw-sik-dam-dawi or ui-te-pangang-hlo), leaf juice of *Eryngium foetidum* L. (bahkhawr), decoction of the roots of *Kyllinga monocephala* Rottb. (artelubawk), decoction of the leaves of *Lantana camara* L. (Shilong tlang-sam or til-duh-par), juice of the leaves of *Mikania micrantha*

H.B.K. (Japan-hlo), decoction of the leaves of *Musa paradisiaca* L. var., *Sylvestris* sp. (changel), decoction of the roots of *Passiflora nepalensis* Wall. (nau-awi-mu-hrui), decoction of the whole plant of *Phyllanthus fraternus* Web. (mitthi-sun-hlu), decoction of the bark of *Picrasma javantica* Bl. (thing-dam-dawi or khaw-sik-dam-dawi-thing), leaf juice of *Piper betle* L. (panruang), decoction of the fruits of *Piper longum* L. (vako-hrui), decoction of the leaves, seed and roots of *P. major* L. (kelba-an), decoction of the bark of *Prunus cerasoides* D. Don. (tlaizawng), decoction of the roots, stem and leaves of *Rotheca serrate* L. Steane & Mabb. (lei-dam-suak), decoction of the flower, leaves and bark of *Spathodea stipulata* Wall. (zih-haw), *Stereosrermum personatum* (Hassk.) De. Chatt. (zihngthal), and a decoction of the young stem, bark and leaves of *Vitex peduncularis* Wall. (thing-khawi-lu-pa) [53] are used to treat malaria. In addition, the roots of *Garcinia cowa* (dang kha) [54], the decoction of the whole plant of *P. major* Linn. (kel ba an), bark of *Pittosporum napaulense* (DC.) Rehder & Wilson (thing pho arh) and the decoction of the roots of *Passiflora nepalensis* Wallich (Nauawimu hrui) are commonly used for the treatment of malaria [18].

2.7 Fungal infections

The juice of the fruits of *Ficus auriculata* Lour. (theibal), root of *Gelsemium elegans* Benth. (hnamtur), and *Alocasia indica* (saidawl/vandaw) have been reported for their use in the traditional medicine of the Mizos as an antifungal agent [14, 46, 55]. The leaf extract of *Chickrassia tabularis* Andr. Juss. (zawngtei), *P. betle* L. (panruang) and the paste of the leaves and bark of *Spathodea stipulata* Wall. (zih-haw) are well known antifungal agents [53]. The decoction of the roots of *Asparagus racemosus* Willd. (arkebaw) is often consumed for treating fungal infection [16].

The essential oil of *Homalomena aromatica* (anchiri) was found to be effective against three pathogenic fungi namely, *Epidermophyton floccosum*, *Microsporum gypseum*, and *Trichophyton rubrum* with Minimum Cidal Concentration (MCC) between 1.2 to 1.8 µl/ml [56]. The essential oil of *C. longa* (aieng) was found to exhibit antifungal activity against pathogenic fungi *Trichophyton rubrum* and *T. mentagrophytes* with Minimum Inhibitory Concentration (MIC) of 2.1 mg/ml and 1.9 mg/ml respectively [57]. The essential oil extracted from the mature seeds of *Trachyspermum ammi* L. showed inhibition against *Candida albicans* and *Aspergillus flavus* with MIC of 0.086 mg/ml and 0.202 mg/ml respectively [58]. The ethanol and aqueous extracts of *Callicarpa macrophylla* Vahl. stem was found to have antifungal activity against six pathogenic fungi namely, *Rhizopus oligosporus*, *Gibberella fujikoroii*, *C. albicans*, *Myrothecium verrucaria*, *Cryptococcus neoformans*, *A. niger*, and *Neurospora crassa* [59]. Also, the methanol extract of the leaves of *Bidens pilosa* was also found to have inhibition activity against *C. albicans* at concentration of 10 mg/ml with 9.1 mm zone of growth inhibition [60].

2.8 Measles

The boiled leaves of *Securinega virosa* Roxb. (saisiak), *Adhatoda vasica* Nees. (kawldai) and the decoction of the leaves of *Azadirachta indica* used in the Mizo traditional medicine are reported to be effective against measles [61]. The decoction of the rhizome of *Amomum subulatum* Roxb. (ailaidum) [13] and *Cucurma caesia* (ailaidum) are often used for the treatment of measles [55]. The boiled leaves of *Anacolosa crassipes* Kurz (lushai nautur) and *S. virosa* (Roxb. ex Willd.) Baill. are used while bathing while the leaf juice of *Phyllanthus airy-shawii* Brunel & J.P.Roux. (mawsai) are applied on the infected skin [16]. Also, the fresh juice of *Homalomena aromatica* (anchiri) roots [35], paste of the leaves of *Anogeissus acuminata* Roxb. ex

DC. Guill. (zairum), leaves of *Lantana camara* L. (shillong tlangsam) [53] and the decoction of the leaves of *Rhus javanica* L. (khawmhma) have been reported for their efficacy against measles [52].

2.9 Chicken pox

The boiled leaves of *Securinega virosa* Roxb. (saisiak) is often used while bathing to cure chicken pox, while the boiled leaves of *Adhatoda vasica* Nees. (kawldawi) and the raw fruits of *Rhus semialata* (khawmhma) are consumed for the treatment of chicken pox [61]. A decoction of the leaves of *Embelia nagushia* D. Don (thing) [13], paste of the leaves of *Anogeissus acuminata* Roxb. ex DC. Guill. (zairum), paste of the leaves of *A. carambola* L. (theiherawt) [53] and a decoction of the leaves of *Embelia vestita* Roxb. (tling) are also often used [14].

2.10 Jaundice

The fruit, leaves and roots of *Chonemorpha fragrans* (Moon.) (phungtheikelki) are taken raw or boiled to treat jaundice [61]. Also, the fruit juice of *E. officinalis* Gaertn. (sunhlu) [15], *Jatropha curcas* L. (kang damdawi/thing thau), *M. charantia* L. (changkha/vhangkha rek), *O. indicum* vent. (archangkawm), *Terminalia chebula* (re raw), *Zingiber officinale* Roscoe (sawhthing), *D. pentagyna* Roxb. (kaihzawl), *C. colebrookianum* Walp. (phuihnam), *Catharanthus roseus* L. (kumtluang), *Cassia fistula* L. (ngaingaw/phungril), *Carica papaya* L. (thingfanghma), *Capsicum frutescens* L. (hmarcha pui), *Aeschynanthus sikkimensis* Stapf, *Adhatoda zeylanica* Nees and *Adhatoda vasica* Nees (kawldawi) are used commonly for the treatment of jaundice [62]. The roots of *Homalomena aromatica* (anchiri) [56], the inner portion of the fruit of *Passiflora spp* (sapthei), infusion of the leaves of *Acacia concina* DC. (khangthur), decoction of the leaves of *Amomum subulatum* Roxb. (ailaidum), decoction of the leaves of *G. conyza* Cass. (buarze), root decoction of *Lagerstroemia speciosa* ŽL. Pers. (chawn-pui or thlado), root decoction of *Laportea crenulata* Gaud. (thakpui), juice of the leaves of *M. charantia* L. (changkha), and the stem juice of *Musa superba* Roxb. (tumbu or changel) have been reported to be effective against jaundice [13]. Also, *Alocasia indica* (Saidawl/Vandawl), *C. papaya* (thingfanghma), *Cucurma caesia* (ailaidum) and *Passiflora edulis* (sapthei) are frequently used for the treatment of jaundice [55]. The use of the whole plant of *Andrographis paniculata* (Burm.f.) Wall. ex. Nees (hnahkhapui), boiled juice of *Ardisia paniculata* Roxb. (naunuar), fruits of *Averrhoa sp.* (theiherawt), boiled roots of *Dendrocnide sinuata* (Blume) Chew (thakpui), boiled fruit juice of *D. indica* L. (kawrthindeng), fruit of *Hibiscus rosa-sinensis* L. (midum pangpar/bangla par), crushed leaves of *Inula cappa* (Buch.-Ham. ex D. Don) DC. (buarthau), and the aerial parts and roots of *Lagerstroemia speciosa* (L.) Pers. (chawnpui/thlado) have also been reported to possess efficacy against jaundice [16]. In addition, the twigs of *Mallotus roxburghianus* Muell. (zawngtenawhlung), juice of the whole plant of *Phyllanthus fraternus* Webster. (mithisunhlu) [63], decoction of the leaves of *Ficus semicordata* var. conglomerate (Roxb.) Kurz. (theipui), *Hedyotes scandens* D. Don, (kelhnamtur/laikingtuibur), and a decoction of the whole plant of *Phyllanthus fraternus* Webs (mithisunhlu) have been described to be effective against jaundice [35]. The leaves of *M. pudica* (hlonuar) [38], boiled roots of *Bridelia monoica* (Lour.) Merr. (phaktel), decoction of the leaves of *Ficus semicordata* Buch. Ham. ex Sm. (theipui) [14], crushed leaves of *Benicasia hisipida* (Thumb.) Cogn. (maipawl), decoction of the root stock of *C. longa* L. (aieng), decoction of the roots of *Dendrocnida sinuate* (Blume) (thanpui), decoction of the leaves of *Euphorbia royleana* Boiss. (chawng), juice of the tender shoot of *Musa sp.*

(changel) and juice of the stem of *Saccharum officinarum* L. (fu) are also used for the treatment of jaundice [37]. Also, the leaves of *Garcinia cowa* (dang kha), decoction of the whole plant of *M. pudica* L. (hlonuar), infusion of the bark and leaves of *V. peduncularis* wall. Ex Schauer are used to treat jaundice [54, 64]. The decoction of the stem, leaves and roots of *Rubus rosifolius* Sm. Ex Baker (hmubel-bing/chultheihmu) and the young fruits of *P. granatum* Linn. (theibuhfai/Darjeeling/manding) are also commonly used to cure jaundice [18].

2.11 Gastritis/stomach problem/ulcer

Certain medicinal plants are recommended and used for the treatment and alleviation of gastric problems. Aerial raw parts of *Aloe barbadensis* var. *chinensis* Haw. (*Aloe vera*), decoction of the bark of *Aporosa octandra* (Buch. Ham. ex D. Don) (chhawntual), *Erythrina stricta* Roxb. (fartuahpui), *Lagerstroemia speciosa* (L.) Pers. (thlado/chawnpui), decoction of the leaves of *Artemisia indica* Willd. (sai), and the bark of *Baccaurea ramniflora* Lour. (pangkai) are consumed half an hour before food to treat gastritis. The decoction of the bark of *Berberis nepalensis* (DC.) Spreng. (pualleng), *D. pentagyna* Roxb. (kaihzawl), *Elaeagnus caudate* Schlecht. ex Momiyama (kel), *Erythrina alba* Cogn. & Marchal (fartuah par var) and *Callicarpa arborea* Roxb. (hnahkiah), raw leaves of *B. lanceolaria* Roxb. (buarze), juice of the pounded leaves of *C. papaya* L. (thingfanghma), and the juice of *Citrus aurantifolia* Christm. (nimbu) fruits are consumed in the morning, whereas, a decoction of the root stock of *C. longa* L. (aieng), root stocks of slices of *Curcumorpha longiflora* Wall. (ailaidum), decoction of the bark and leaves of *Helicia robusta* (Roxb.) R. Br. Ex Blume (pasaltakaza), *Mallotus philippensis* (Lam.) Muell. Arg. (thingkhei), crushed leaves of *Lobelia angulate* Forst. (choakthi), aerial parts of *Mentha arvensis* L. (pudina), juice of tender shoots of *Musa sp.* (changel), decoction of the roots of *Osbeckia sikkimensis* Craib. (builukham pa), decoction of the stem of *Tinospora cordifolia* (DC.) Miers. ex. Hook. (theisawntlung), and water poured into the fruit cavity of *Zanonia indica* L. (lalruanga dawi bur) are commonly used for treating gastric problems and ulcer [37]. The pounded tuberous roots of *Smilax glabra* Roxb. (tluangngil) is used for stomachache and the decoction of the leaves of *Senecio scandens* Buch.-Ham ex D. Don (saiekhlo), juice of the pounded leaves, roots and stem of *Scoparia dulcis* L. (perhpawng chaw/thlum dem dem) and the leaves of *Saprosma ternatum* (Wall.) Hook.f. (pelhvawm/thinglawhleng) are used for pain relief. The juice of the leaves of *Prismatomeris tetrandra* (Roxb.) K. Schum. (telenga mai suak), decoction of the whole plant of *Picria felterrae* Lour. (khatual), and a decoction of the bark and leaves of *Picrasma quassioides* (thing damdawi/khawsik damdawi thing/thingpil kha) are consumed for treating stomach ulcer. Powdered adry fruits of *Picrasma javanica* Blume (thing damdawi/khawsik damdawi thing) is commonly used to treat stomach ache and the decoction of the bark and leaves of *Acer oblongum* Wall. Ex DC. (thing phingphihlip) and a decoction of the fruits of *Aganope thyrsiflora* (Benth.) (hulhu) are commonly used for various stomach problems [18].

2.12 Food poisoning/allergy

For food poisoning and allergies, different parts of plants such as roasted root stock of *Zingiber officinale* Rosc. (sawhthing) and the bark of *Parkia roxburghii* Roxb. (zawngtah) are chewed while the juice of the leaves of *C. papaya* L. (thingfanghma) is used to treat meat allergy [37]. Also, the leaves of *Trachyspermum roxburghianum* (DC) H Wolff (pardia) are consumed as a remedy for food allergy and the pounded fruits of *Phyllanthus emblica* L. (sunhlu), young leaves and seeds

of *Parkia timoriana* (DC.) Merr. (zawngtah), and a decoction of the bark and leaves of *Acer oblongum* Wall. Ex DC. (thing phingphihlip) are used to treat food poisoning and allergies [18].

2.13 Cough

A decoction of the bark of *Occimum tenuiflorum* Linn. (keifang) and roasted root stock of *Zingiber officinale* Rosc. (sawhthing) are consumed to treat cough [37]. The whole plant of *Drymaria cordata* (L.) Willd. (changkalrit) is boiled and the steam is inhaled to treat sinusitis and cough [16]. Likewise, the bark of *Terminalia crenulate* Roth (tuairam), the roots of *Sonchus arvensis* L. (khuanglawi), and the leaves of *Solanum tuberosum* Linn. (alu) are used to treat chronic cough. Similarly, *Senna occidentalis* (L.) Link (rengan), tubers of *Pueraria tuberosa* (Willd.) DC. (zawng tur/thingba/bul ei) and juice of the pounded leaves of *Achyranthes aspera* Linn. (bu chhaw/ ui hlo) are used to treat cough [18].

2.14 Sore throat

A decoction of the young leaves or root bark of *Uncaria sessilifructus* Roxb. (ralsamkuai), whole plant of *Tithonia diversifolia* (Hemsl.) A. Gray (bawngpupar), seed of *Syzygium cumini* (L.) Skeels (hmuipui/lenhmui), juice of *Sonerila maculata* Roxb. (thaksenhlo), and an infusion of the fruit pulp of *Sapindus mukorossi* Gaertn. (hlingsi) are consumed to treat sore throat [18]. Also, the roasted root stock of *Zingiber officinale* Rosc. (sawhthing), decoction of the bark of *O. tenuiflorum* Linn. (keifang) [37] and the fruit of *Terminalia chebula* Retz. (reraw) are consumed to get relief from cough [63].

2.15 Typhoid

The decoction of the leaves of *V. peduncularis* Wall. ex. Schauer. (thingkhawilu), *O. tenuiflorum* Linn. (tulsi) and *Adina cordifolia* Roxb. (lungkhup) are used as medication for typhoid [37].

2.16 Tonsilitis

The tender leaves of *Uncaria sessilifructus* Roxb. (ralsamkuai) are chewed in case of infection of the tonsils [37]. Also, an infusion of the flowers of *Aeschynanthus sikkimensis* (C.B. Clarke) Stapf. (bawltehlantai) and water from the boiled leaves of *Costus speciosus* (Koeing) Smith. (sumbul) is consumed for relief from tonsilitis [63]. In addition, a decoction of the bark of *Sterculia villosa* Roxb. (khaupui) and decoction of the leaves of *Smilax glabra* Roxb. (tluangngil) are also used. The decoction of the leaves of *Sarcococca pruniformis* Lindl. (pawhrual), infusion of the fruit pulp of *Sapindus mukorossi* Gaertn. (hlingsi) and the seeds of *Abelmoschus manihot* (L.) Medik. Var. *pungens* (uichhu me/uichhu hlo) are commonly eaten as a remedy [18].

2.17 Blood pressure

The fruits of *Amomum dealbatum* Roxb. (aidu), *Aporosa octandra* (Buch. Ham. ex D. Don) (Chhawntual) and juice of the leaf stalk of *Semecarpus anacardium* Linn. F. (vawmbal-pui) are consumed to control and lower blood pressure [14]. Also, the raw leaves of *Catharanthus roseus* Linn. (kumtluang) are often used as a remedy for high blood pressure (63). The flower bud of *Trachycarpus martianus*

(Wall. Ex. Mart.) H. Wendl. (buarpui), bark and leaves of *Terminalia arjuna* (Roxb. Ex. DC) (changkurmam), the fruits of *Solanum incanum* Linn. (samtaw), *Senna occidentalis* (L.) Link (rengan), leaves of *Senecio scandens* Buch.-Ham ex D. Don (saiekhlo), roots of *Rauvolfia serpentina* (L.) Benth. Ex Kurz (thisensang damdawi/thingzungkha), decoction of the bark and leaves of *Picrasma quassioides* (thing damdawi/khawsik damdawi thing/thingpil kha), infusion of the bitter bark of *P. javanica* Blume (thing damdawi/khawsik damdawi thing) and tea made from leaves of *Passiflora quadrangularis* L. (sapthei lian chi) are also commonly consumed to lower high blood pressure [18].

2.18 Antiemetic

The fruits of *Annona squamosa* L. (Theiarbawm) [14] and the crushed leaf juice of *Pratia begonifolia* Lindl. (choak thi) are used as a remedy for vomiting [63]. The fruit and leaves of *Trichosanthes anguina* L. (berul), seeds of *Trachyspermum roxburghianum* (DC) H Wolff (pard), *Pogostemon cablin* (Blanco) Benth. (Patchouli) and the roots and stem of *Alangium chinense* (Lour.) Harms (arsa rim nam) are often consumed as medication to prevent vomiting [18].

2.19 Antivenin

For venomous snake bites, mature leaves of *Antidesma bunius* (L.) Spreng. (tuaitit) and the crushed roots of *Phyllanthus acidus* (L.) Skeels. (kawlsunhlu) are frequently used [14]. *T. indica* L. (tengtere) seeds are attached to the biting area, while crushed juice of the leaves of *Benicasia hisipida* (Thumb.) Cogn. (maipawl) and juice of the tender shoots of *Musa sp.* (changel) are applied on the bitten area [37]. Also, the bark of stem and roots of *Wrightia arborea* (Dennst) Mabb. (hling) and the stem of *Pogostemon cablin* (Blanco) Benth. (Patchouli) are given as an antidote to snake bite. In addition, a decoction of the root, stem and leaves of *Tinospora crispa* (L.) Hook. F. & Thomson (hruivankai), flowers of *Tagetes erecta* L. (derhken), fruits of *Solanum incanum* Linn. (samtaw), crushed fruits of *Solanum anguivi* Lam. (samtawkte), juice of the leaves of *S. dulcis* L. (perhpawng chaw/thlum dem dem), roots of *Rauvolfia serpentina* (L.) Benth. Ex Kurz (thisensang damdawi/thingzungkha), stems of *Pothos scandens* Linn. (laiking tai rua), decoction of the tender leaves of *Acacia pennata* (L.) Willd. (khanghu) and leaves of *A. pruinescens* Kurz (khangpawl) have also been reported to be effective upon external application [18].

2.20 Toothache

For instant relief from toothache, certain plant parts and their fumes are used. *Solanum sp.* (bawnggek hling) fruits are smoked, whereas, the stem of *Paedaria foetida* L. (vawihuihrrui), aerial parts of *Centella asiatica* (L.) Urb. (lambak) and the flower of *Dendrobium sp.* (nauban) are chewed to treat toothache [37]. Also, the whole plant of *Solanum incanum* Linn. (samtaw/bawkbawnkha) [18], leaves of *Lepidagathis rigida* Dalz. (vangvat tur) and infusion of the roots of *Millettia pachycarpa* Benth. (rulei) are used to treat tooth decay while the whole plant of *Cynodon dactylon* (Linn.) Pers. (phaitual) is inhaled [63]. Likewise, the leaves and flowers of *Acmella paniculata* (ankasate) are eaten raw to cure toothache [64]. The root bark of *Tabernaemontana divaricate* (L) R. Br. Ex Roem. & Schult. (pararsi/kelte bengbeh), seeds of *Solanum viarum* Dunal (at hlo hling/rulpuk), fruit of *Solanum incanum* Linn. (samtaw), juice of pounded leaves, roots and stem of *S. dulcis* L. (perhpawng chaw/thlum dem dem), paste of the bark of *Psidium guajava* Linn.

(kawlthei/kawiam/charthei) are applied on the area of toothache. Also, warm water of the cooked leaves of *P. major* Linn. (kel ba an/tuikuk antam) is retained in the mouth to cure toothache. The fruit, stem and leaves of *Physalis angulata* L. var. *angulata* L. (kelasawirawphit/chalpang puak), decoction of the leaves of *Osbeckia stellate* Buch.-Ham.ex Ker Gawl. (builukham pa), decoction of the roots of *Osbeckia crinite* Benth. Ex C.B. Clarke (builukham) and the whole plant or flower head of *A. oleracea* (ansapui/ankasa kir) are chewed to cure toothache [18].

2.21 Kidney problems

A decoction of the aerial parts of *Solanum nigrum* L. (anhling), *S. dulcis* L. (perhpawngchaw), decoction of the bark of *Saraca asoca* Roxb. (mualhawih), leaves of *Citrus sinensis* (L.) Osbeck (serthlum), roots of *Saccharum arundinaceum* Retz. (rairu-ang) and *Achyranthes bidentata* Blume (vangvat tur/vangvat hlo) are used as a diuretic and to ease urination. A decoction of the roots of *O. sikkimensis* Craib. (builukham pa), aerial parts of *Hedychium spicatum* Koenig (kelhnamtur), *Jasminum nervosum* Lour. (maufimhlo), roots of *Oryza sativa* L. (buh) and roots of *Smilax ovalifolia* Roxb. Ex. D. Don (kaihapui) are used to treat urinary complaints and urinary tract infections. For the removal of kidney stones, a decoction of the aerial parts of *Costus speciosus* (Koenig) J.E. Sm (sumbul), infusion of the bark and leaves of *V. peduncularis* wall. Ex Schauer (thingkhawilu pa), water from boiled leaves of *Solanum nigrum* Linn. (anhling), and the juice of the pounded leaves, roots and stem of *S. dulcis* L. (perhpawng chaw/thlum dem dem) are commonly used. The root of *Rotula aquatic* Lour. (tuipuisuthlah/tuipuisuthlah) is also used for the removal of bladder stones [37, 18]. An infusion of the whole plant of *Begonia inflata* Cl. (sekhupthur hmul), decoction of the root and leaf of *Desmos chinensis* (Lour.) (zunin damdawi) and decoction of the root of *O. crinite* Benth. Ex C.B. Clarke (builukham) are used to treat painful urination [63].

Similarly, *Ardisia macrocarpa* Wall. (vahrit thei), bark of *Myrica esculenta* Buch. Ham. ex D. Don. (keifang), decoction of the leaves of *Embelia vestita* Roxb. (tling), fruits of *Ardisia macrocarpa* Wall. (vahrit thei) [14], raw aerial parts of *C. asiatica* (L.) Urb. (lambak), decoction of the bark of *O. tenuiflorum* Linn. (keifang) [37], steamed root extract of *O. sikkimensis* Craib. (builukham pa), infusion of the whole plant of *Phyllanthus fraternus* Webster. (mithi sunhlu), crushed leaves of *Ricinus communis* Linn. (mutih), crushed root of *Sida acuta* Burm. F. (khingkhah), decoction of the roots, stem and leaves of *Cissus discolor* Blume (sangharhmai), boiled whole plant of *Hedyotes scandens* Roxb. (laiking tuibur) [63], decoction of the whole plant of *M. pudica* L. (hlonuar), decoction of the bark of *H. robusta* (Roxb.) R. Br. Ex Blume. (pasaltakaza), decoction of the whole plant of *Plantago asiatica* L. (kelbaan) [63], decoction of the roots of *Xanthium strumarium* L (chabet), leaves of *Tagetes erecta* L. (derhken), seeds of *Syzygium cumini* (L.) Skeels (hmuipui/lenhmu), leaves of *Stevia rebaudiana* (Bertoni) Hemsl. (hnahtlum), *Siegesbeckia orientalis* Linn. (ansapui suak), roots of *S. acuta* Burm.f. (khingkhah/valatha), leaves of *Pseudognaphalium luteoalbum* (L.) (kawhte mei bu), fruits of *Actephila excelsa* (Dolz) Mull.-Arg. (Telenga mai/pem hlek damdawi), and the leaves of *Ageratina adenophora* (Spreng.) R. M. King & H. Rob. (Bihar hlo/Nepal tlangsam/tlangsam suak/aieng rim nam) are consumed to cure various kidney and urinary troubles such as urinary insufficiency, and diseases of the urethra [18].

3. Conclusions

Traditional medicine practices continue to thrive in rural India, particularly in the tribal dominant states. Studies that have evaluated their efficacy have revealed

positive results, indicating that the traditionally used medicinal plants are capable of healing several ailments. Documenting these traditional practices is the first step towards scientifically evaluating both their efficacy and toxicity. Several medicinal plants that continue to be used in traditional medicine still await their scientific validation. Hence, similar studies to document these practices needs to be executed which will not only prevent an age-old tradition from becoming extinct but could also lead to the discovery of new drugs.

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Conflict of interest

The authors declare no conflict of interest.

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