

Original Article

Exploring ethnomedicinal plants for treating diverse skin ailments among tribal communities in Mizoram, India: insights from traditional healing practices

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ABSTRACT

Throughout history, plants have been extensively utilized in traditional medicine for primary healthcare purposes. It is recognized that medicinal plants contain a diverse array of bioactive compounds, making them an alternative option to synthetic medications for addressing a variety of illnesses. The primary aim of this review is to compile comprehensive data on folk medicinal plants utilized by diverse tribal communities in Mizoram, India, as traditional remedies for treating various skin diseases. A thorough literature review was conducted utilizing various sources including books and electronic databases to gain insights into the etiology of skin diseases and the corresponding traditional herbal treatments. Results: Ninety-five plant species from fifty different families have been identified for their ethnomedicinal properties in treating various skin conditions. Roots, rhizomes, stems, leaves, barks, bulbs, flowers, and even whole plants are employed as folk remedies to address a range of skin infections, often administered in the form of crushed juice, paste, or decoction. Conclusion: This information serves to guide researchers in identifying previously unexplored medicinal plants, offering avenues for developing novel therapeutic approaches and isolating and identifying new bioactive compounds that are both safe and cost-effective.

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Introduction

The field of ethnomedicine encompasses the exploration of plants utilized by humans for medicinal purposes.

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Dating back to the pre-Vedic era, people have employed plants to address a wide array of diseases and ailments afflicting both humans and animals [1]. This indigenous medicinal system, encompassing Ayurveda, Siddha, and Unani, has long been an integral facet of Indian culture, serving as a conduit between herbal biodiversity and cultural diversity [2,3]. Such traditional medicinal practices are deeply intertwined with the richness of herbal biodiversity, with reports indicating that 70 percent of new medications stem directly or indirectly

from natural sources, as highlighted by a "Mongabay" publication on March 20, 2007. Delving into indigenous knowledge concerning natural resources holds significant importance for disease management and conservation efforts, as it safeguards traditional wisdom that may serve as a wellspring for novel medication development [4]. The World Health Organization (WHO) estimates that approximately 80% of the global population relies on traditional medicine for their primary healthcare needs [5], which has proven to be more cost-effective in treating a diverse range of ailments [6]. Northeast India is particularly rich in plant species with potential medicinal properties, prompting numerous scientific investigations aimed at validating their ethnomedicinal uses. In comparison to the orthodox or allopathic medical approach, traditional therapeutic systems present advantages in terms of cost-effectiveness and reduced side effects. The northeastern region of India is predominantly inhabited by various tribal communities, comprising more than 220 distinct ethnic groups with a combined population of 38,857,769 as per the Census of 2011 [7]. These ethnic groups possess unique cultural identities, deeply rooted customs, and traditional knowledge systems [8]. Situated within both the Indo-Burma and Himalayan biodiversity hotspots on the Indian subcontinent, Northeast India boasts high levels of endemism, contributing to its rich reservoir of medicinal plants [9–11]. The remarkable ethnic diversity, coupled with the region's phytogeographical variations and diverse flora, plays a pivotal role in the utilization of traditional medicine practices by these tribal communities. Their distinctive lifestyle, closely intertwined with natural resources, has fostered unparalleled advancements in the field of ethnobotany [7]. The tropical and sub-tropical climate of Mizoram fosters a diverse range of plants, including herbs, shrubs, and trees, contributing to its rich flora and fauna, which encompasses a variety of medicinal plants [12,13]. Presently, approximately 95 percent of the state's rural populace relies on medicinal plants or herbal remedies as primary sources for treating a multitude of disorders and ailments [12,13]. Tribal communities, deeply intertwined with nature, inhabit regions abundant in plant resources utilized for food, shelter, and medicinal purposes [14]. Given the limited healthcare facilities and transportation infrastructure in rural areas, traditional medicine remains the primary healthcare option for these communities, underscoring its significance in addressing primary health issues [15]. However, Mizoram's healthcare infrastructure is inadequate, characterized by a scarcity of hospitals, nursing homes, and medical personnel relative to the population size,

thereby limiting access to modern medical services, particularly in rural areas with deficient communication systems [15]. Consequently, local traditional healers serve as the primary healthcare providers in these regions [15]. Nonetheless, the transmission of indigenous knowledge pertaining to traditional medicine has suffered due to insufficient documentation, despite its longstanding practice within tribal communities [16]. This review endeavours to consolidate literature documenting the traditional medicinal uses of various ethnomedicinal plants applied by different tribes of the Mizo community, with the aim of fostering the preservation of their traditional culture and knowledge, as well as promoting the conservation and sustainable utilization of plant resources for the development of new pharmaceutical products or novel chemical entities. Special emphasis is placed on documenting the ethnomedicinal applications of diverse plant species in Mizoram and their efficacy in treating various skin diseases and illnesses among the Mizo communities.

Methodology

Google Scholar, PubMed, and Science Direct were used for accessing relevant articles. The state government of Mizoram websites was also accessed. To retrieve appropriate information, 'ethnomedicinal plants of Mizoram' or 'traditional plants of Mizoram' was used alone or in combination with other appropriate keys.

Tribal Communities of Mizoram

The demographic composition of Mizoram predominantly comprises tribal populations, encompassing 16 scheduled castes, 14 scheduled tribes, and 37 sub-tribes, alongside 15 distinct ethnic tribal communities [17]. These communities, namely Lusei (Mizo), Paihte, Hualngo, Tlau, Thadou, Ralte, Hmar, Mara, Para, Pawi, Bawm, Pang, Chakma, Riang, Baite, and Mog, respectively, possess a profound connection with their natural surroundings and have a longstanding tradition of utilizing traditional herbal medicine for addressing various health concerns. Among these fifteen tribes, namely Mizo, Mara, Pang, and Lai, there is a gradual erosion of traditional medicinal knowledge. Typically, the older members of these communities hold extensive expertise in traditional medicine, which has been passed down through generations since antiquity. Documenting such invaluable indigenous knowledge is imperative for conservation efforts, aiming to alleviate pressure on natural resources and address the need for preserving this wealth of information.

Geographical Background of Mizoram

Mizoram, situated in northeastern India, is one of the eight states falling within the Indo-Myanmar biodiversity hotspot, nestled at the far reaches of the Himalayan range, encompassing an area of 21,087 square kilometers [18]. Geographically, it lies between 92°16' to 93°26' E longitude and 21°56' to 24°31' N latitude [19,20]. The state shares international borders with Bangladesh to the west and Myanmar to the east and south, while also sharing interstate borders with Assam, Tripura, and Manipur. Mizoram comprises eleven districts, including three newly formed ones, namely Aizawl, Champhai, Kolasib, Lawngtlai, Lunglei, Mamit, Saiha, Serchhip, Hnahthial, Saitual, and Khawzawl. The name "Mizoram," derived from the local language, translates to the "land of Highlanders."

Characterized by its picturesque mountainous terrain, the state boasts elevations exceeding 6,560 feet near the Myanmar border, with an average altitude of approximately 4,000 feet above sea level [21,22] (Figure 1). This hilly and lush green state enjoys a temperate climate, with winter temperatures ranging from 11°C to 21°C and summer temperatures from 20°C to 30°C. Mizoram experiences the direct influence of monsoons, resulting in heavy rainfall from May to September, with an average annual precipitation of 250 centimeters [23]. Despite its elevation, snowfall is absent across the state [24]. As per the 2011 census, Mizoram's population stood at 1.097 million, boasting a commendable literacy rate of 91.33% [25]. A detailed breakdown of the state's population distribution is provided in Table 1.

Table 1: Population distribution as per 2011 census.

| | Male | Female | Total |
|------------|---------|---------|----------|
| Population | 555,339 | 541,867 | 1097,206 |
| Rural | 269,135 | 256,300 | 525,435 |
| Urban | 286,204 | 285,567 | 571,771 |
| Literacy | 438,529 | 409,646 | 848,175 |

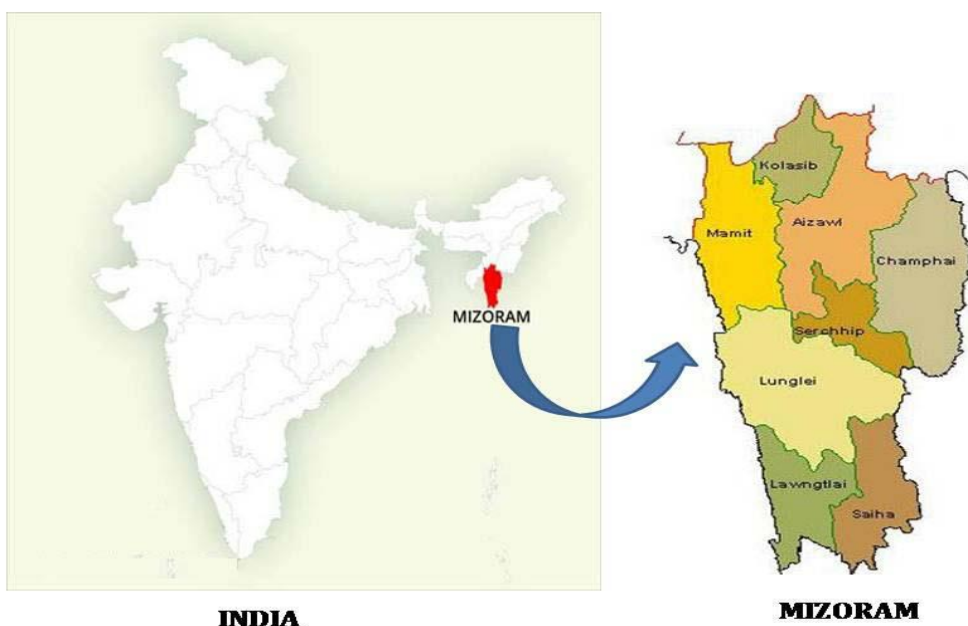


Figure 1: Geographical location of Mizoram.

Ethnomedicinal Approaches for the Treatment of Skin Diseases

The skin, being a crucial organ of the body, serves multiple essential functions including protection against trauma, ultraviolet radiation, temperature variations, toxins, and microbial pathogens. Additionally, it regulates sensory perception, temperature homeostasis, synthesis of vitamin D, and elimination of waste products [26]. According to estimates from the Global Burden of Disease (GBD) study spanning from 1990 to 2010, there are 15 prevalent categories of skin diseases across 187 countries, notably including eczema, psoriasis, acne vulgaris, pruritus, alopecia areata, decubitus ulcer, urticaria, scabies, fungal skin infections, impetigo, abscesses, and various bacterial, viral, and non-melanoma skin cancers [27]. Skin disorders exhibit a significant global morbidity rate, affecting approximately 20-30% of the population at least once during their lifetime, ranking as the fourth leading cause of non-fatal disease burden worldwide [28]. Developing countries experience a higher incidence of skin diseases due to factors such as overcrowding, unhygienic living conditions, and inadequate healthcare resources. However, despite their prevalence, skin diseases often receive less attention compared to other health issues, posing potential risks for the development of more severe medical conditions. Children are particularly vulnerable to skin ailments compared to adults [30], with tribal populations facing additional challenges due to factors like poor sanitation, adverse environmental conditions, strenuous labor, and

lack of awareness regarding hygienic practices. Skin pathogens such as certain fungi (e.g., *Candida* spp.) and bacteria significantly contribute to the occurrence of skin diseases [31]. Proper identification, documentation, scientific validation, biochemical analysis, and investigation of bioactive constituents are crucial steps that can aid researchers in developing novel therapeutic agents, potentially impacting society positively. It's noteworthy that many synthetic drugs used for treating skin conditions are associated with adverse side effects, underscoring the importance of exploring alternative treatment options.

All the information regarding ethnomedicinal plants used in the treatment of various skin diseases are arranged alphabetically by their scientific name (Family name in parentheses) followed by the local name in Mizo (M), English (E) language wherever available along with part(s) of the plant used medicinally and method of application listed in Table 2.

Plant Part Used

All parts of different plant species were utilized against various skin diseases or ailments. Besides this leaves 33 (34.73%) are most frequently used by the tribal communities (Figure 2) followed by bark 16 (16.84%), stem 9 (9.47%), root 8 (8.42%), fruit 7 (7.36%), whole plant 6 (6.31%), rhizome 3 (3.15%), latex 3 (3.15%), seed 3 (3.15%), shoot 2 (2.10%), resin 1 (1.05%), bulb 1 (1.05%), aerial part 1 (1.05%), flower 1 (1.05%) and pods 1(1.05%) respectively.

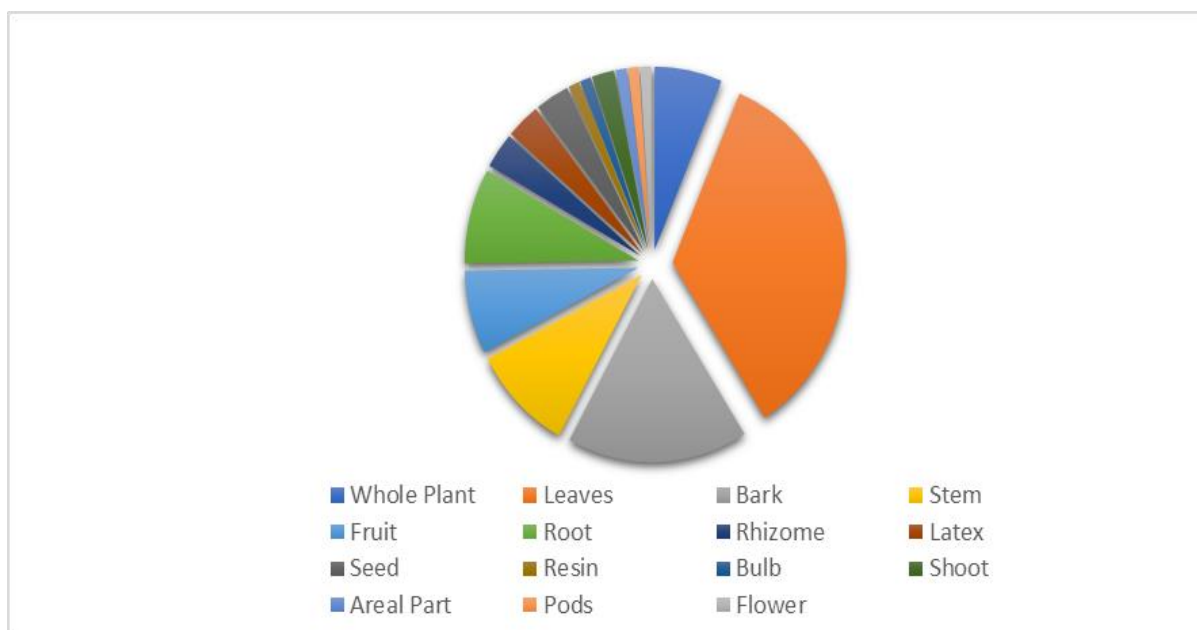


Figure 2: Percentage of Plant parts used by Tribal communities of Mizoram.

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Table 2: List of traditional medicinal plants used by tribal communities of Mizoram against various skin diseases.

| Sl. No | Botanical name | Family | Local name | English name | Parts Use | Uses | References |
|--------|--|---------------|------------------|------------------------|-------------|--|------------|
| 1. | <i>Acalypha indica</i> Linn. | Euphorbiaceae | Chhawntan | Indian Acalypha | Leaves | Juice of leaves applied externally in scabies, itches, rash, syphilis and snake bite | [32] |
| 2. | <i>Achyranthes aspera</i> Linn. | Amaranthaceae | Buchhawl | Prickly Chaff flower | Leaves | Juice of crushed leaves used directly on cuts and wounds | [4] |
| 3. | <i>Adhatoda vasica</i> Nees. | Acanthaceae | Kawldai | Malabar Nut | Leaves | Decoction of leaves is used for the treatment of measles and chicken pox | [33] |
| 4. | <i>Adhatoda zeylanica</i> Medik. | Acanthaceae | Kawl-dai | Malabar Nut | Leaves | The leaves are applied to wounds and cuts | [34] |
| 5. | <i>Albizia chinensis</i> Osbek Merr. | Minosaceae | Vang | Sau tree | Bark | The bark infusion is used as lotion in scabies and other skin disease | [24] |
| 6. | <i>Allium sativum</i> Linn. | Liliaceae | Purunvar | Garlic | Bulb | The bulb is cut, and the juice is applied to all kinds of skin diseases, including ringworms, scabies, itches, acne, leukoderma etc. | [4] |
| 7. | <i>Alocasia fornicate</i> (Roxb.) Schott. | Araceae | Baibing | Giant taro; Sala-kochu | Whole plant | The juice of the plant is applied on snake bite | [35] |
| 8. | <i>Alstonia scholaris</i> (L.) R. Br. | Apocynaceae | Thum-riat | Devil Tree | Latex | Latex from the plant is used against skin diseases like leprosy, ringworm etc. | [36] |
| 9. | <i>Amomum dealbatum</i> Roxb. | Zingiberaceae | Aitebawp | Java cardamom | Fruits | Juice of fruit is applied on skin to cure inflammation and bee bite | [37] |
| 10. | <i>Anacardium occidentale</i> Linn. | Anacardiaceae | Sazupumpu i-thei | Cashew | Barks | Juice of crushed bark is applied externally on ringworms and leprosy | [35] |
| 11. | <i>Anacolosia crassipes</i> Kurz. | Olaceae | Lushainaut ur | | Leaves | The leaves are boiled, and the water is used for bathing children suffering from measles and skin eruption | [37] |
| 12. | <i>Anogeissus acuminata</i> (Roxb. ex-DC.) Wall. ex Guillem. & Perr. | Combretaceae | Zairum | Button tree | Bark | Decoction of bark is used externally in sprain and to cure burns without leaving any scar mark | [24] |
| 13. | <i>Anthocephalus chinensis</i> (Lam.) Rich. Ex Wall | Rubiaceae | Banphar | Kadam | Fruits | Ripe fruits are used to protect mouth ulcer | [38] |

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|-----|--|-----------------|-------------------|---------------------|-----------------------|---|---------|
| 14. | <i>Aporosa octandra</i> (Buch.-Ham. ex D. Don) Vickery | Euphorbiaceae | Chhawn - tual | | Bark | Decoction of bark is taken thrice daily in case of stomach ulcer | [19,39] |
| 15. | <i>Artocarpus heterophyllus</i> Lam. | Moraceae | Lamkhuang | Jackfruit | Leaves | Paste of leaves is locally used on skin diseases like ring worm and itching | [40] |
| 16. | <i>Artocarpus lakoocha</i> Roxb. | Moraceae | Theitat | Monkey jack | Stem & Bark | The powder of stem, bark is applied on wounds. Infusion of bark is used externally to treat pimples and cracked skin | [24] |
| 17. | <i>Azadirachta indica</i> A. Juss. | Meliaceae | Nimthing | Margosa tree | Stems, barks & leaves | Stem, bark is used as an astringent for skin disease. Leaves are used as antiseptic, antibiotic in boils, ulcer and eczema | [35] |
| 18. | <i>Bauhinia variegata</i> Linn. | Leguminosae | Vau-Vau be | Mountain ebony | Bark | Decoction of bark is used in sores itches and various skin diseases | [4] |
| 19. | <i>Blumea lanceolaria</i> Roxb. | Compositae | Buar-ze | Lance-leaved blumea | Leaves | Juice of crushed leaves applied on various skin diseases | [4] |
| 20. | <i>Butea frondosa</i> Koen. ex. Roxb. | Papilionaceae | Tuahpui | The forest flame | Seed | The powdered seed mixed with lime water is used externally in ring worm and other skin disease | [24] |
| 21. | <i>Callicarpa arborea</i> Roxb. | Verbenaceae | Hnah-kiah | Beauty berry | Bark | Bark of this plant is powdered and mixed to form a paste to treat wounds | [34] |
| 22. | <i>Calotropis gigantea</i> Linn. | Asclepiadaceae | Rawl-damdawi | The crown flower | Latex | The latex is applied externally on various skin diseases | [4] |
| 23. | <i>Canarium strictum</i> Roxb. | Burseraceae | Beraw | Black drammar tree | Bark | Decoction of bark is used in rashes | [19] |
| 24. | <i>Carica papaya</i> Linn | Caricaceae | Tingfanghana | Papaya | Fruits & leaves | Paste of leaves are used in ring worm | [40] |
| 25. | <i>Cassia alata</i> Linn. | Caesalpiniaceae | Tuihlo/Kel-be-pui | Ringworm Shrub | Leaves | Juice of crushed leaves is applied externally as a remedy for various skin disease like ring worm, gonorrhoea, scabies, eczema and snake bite | [4] |
| 26. | <i>Cassia fistula</i> Linn. | Caesalpiniaceae | Makpazangkang | Indian Laburnum | Leaves | Leaf juice along with lime water is used externally to treat skin disease | [24] |
| 27. | <i>Cassia tora</i> Linn. | Caesalpiniaceae | Kel-be | Sickle Senna | Fruits & leaves | Crushed leaves and fruits are applied on skin for the treatment of ring worm, itching, swelling, scabies etc. | [4] |
| 28. | <i>Centella asiatica</i> Linn. | Umbelliferae | Hnahbial | Indian pennywort | Whole plant | The juice of the plant is applied on various skin diseases such as itches, ulcers, sores etc. | [4] |

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|-----|--|------------------|-------------------|-------------------------|-------------------------|---|------|
| 29. | <i>Chukrasia tabularis</i> A. Juss. | Meliaceae | Zawngtei | Indian Redwood | Bark | Juice extracted from bark is applied on skin for cuts and wounds | [4] |
| 30. | <i>Cirsium sinense</i> C.B.Clarke | Asteraceae | Len-hling | | Roots | Roots are crushed and applied on wounds | [34] |
| 31. | <i>Clerodendrum infortunatum</i> Linn. | Verbenaceae | Phuihnamchhia | Hill glory bower | Leaves | Leave juice are taken to treat skin disorder | [37] |
| 32. | <i>Clerodendrum viscosum</i> Vent. | Verbenaceae | Phuihnamchhia | Glory Tree | Rhizome, leaves & roots | The rhizome is boiled, and the water is dabbed on the infected scabies skin. Juice of the leaves are also used for the cell | [4] |
| 33. | <i>Combretum flagrocarpum</i> C. B. Clarke | Combretaceae | Leihruai-sen | White Combretum | Leaves | The leaf juice is applied to wounds and cuts to stop bleeding | [34] |
| 34. | <i>Commelina nudiflora</i> Linn. | Commelinaceae | Dawng | Creeping Dayflower | Leaves & stems | Extract of leaves and stems are used in treatment of different skin disease | [4] |
| 35. | <i>Curculigo capitulate</i> Kuntz. | Amaryllidaceae | Phaiphek | Palm grass | shoots | Paste of tender shoots applied on cuts and wounds as haemostatic and antiseptic | [41] |
| 36. | <i>Curcuma longa</i> Linn. | Zingiberaceae | Aieng | Turmeric | Rhizome | One cup crushed juice is taken orally in empty stomach for the treatment of gastric ulcer | [15] |
| 37. | <i>Cuscuta reflexa</i> Roxb. | Convolvulaceae | Japanhloral | Amar Bel | Whole plant | Juice of crushed plant is used against various skin disease | [4] |
| 38. | <i>Cynodon dactylon</i> (L.) Pers. | Poaceae | Phaitualhlo | Bahama grass | Leaves | Leaves are crushed and the juice is extracted from the leaves and used to stop bleeding | [34] |
| 39. | <i>Dichrocephala integrifolia</i> Kuntz. | Asteraceae | Vawk-ek-atum-tual | Bicolor Buttonweed | Shoots | The tender shoots are used as poultice for insect bites and stings | [41] |
| 40. | <i>Dicranopteris linearis</i> (Burm. f.) Underw. | Gleicheniaceae | Ar-thla-dawn | Old World forked fern | Whole plant | The plant is used to expel intestinal worms, treat boils, ulcers and wounds | [41] |
| 41. | <i>Dillenia indica</i> Linn. | Dilleniaceae | Kawrthindang | Elephant apple | Leaves & bark | Powder of bark is applied externally on various skin diseases | [4] |
| 42. | <i>Dipterocarpus turbinatus</i> C.F.Gaertn | Dipterocarpaceae | Lawnghthing | Common gurjun tree | Resin | Oleo-resins used against ringworm | [4] |
| 43. | <i>Elsholtzia blanda</i> Benth | Lamiaceae | Nauhri | Ban tulsi; Jangli tulsi | Aerial parts | Infusion of aerial part of the plant is used in skin diseases and inflammation | [42] |
| 44. | <i>Emblica officinalis</i> Gaertn. | Euphorbiaceae | Sun-hlu | Indian Gooseberry | Bark | The crushed bark is applied to wounds and cuts | [34] |

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|-----|--|----------------|-----------------|-------------------------|-----------------|--|------|
| 45. | <i>Erythrina stricta</i> Roxb. | Fabaceae | Fartuah | Indian coral tree | Bark & leaves | Fresh bark and leaves are applied on sores | [4] |
| 46. | <i>Eucalyptus citriodora</i> Hook. | Myrtaceae | Nawhalh thing | Lemon Scented Gum | Seeds | Oil obtain from seed is applied externally for all kinds of skin diseases | [4] |
| 47. | <i>Eupatorium odoratum</i> Linn. | Asteraceae | Tlangsam | Siam weeds; Bitter bush | Leaves | The leaves are crushed and applied to wounds and cuts. It is also effective for clotting of bloods | [34] |
| 48. | <i>Ficus benghalensis</i> Linn. | Moraceae | Hmawng | Indian Banyan | Bark | Decoction of bark is given orally for the treatment of various skin disease | [4] |
| 49. | <i>Ficus religiosa</i> Linn. | Moraceae | Hmawngahn ahzum | Peepal tree | Leaves & shoots | Leaf and young shoots are used in skin diseases | [42] |
| 50. | <i>Ficus semicordata</i> Roxb. | Moraceae | Theipui | Drooping fig | Stem & bark | Juice of stem and bark is used for treating boil | [33] |
| 51. | <i>Galinsoga parviflora</i> Cav. | Asteraceae | Sazu chaw | Chickweed; Quick weed | Whole plant | Juice of the plant is used in cuts and injuries | [41] |
| 52. | <i>Garcinia cowa</i> Roxb. | Clusiaceae | Chengkek | Brindal berry | Bark & leaves | Bark and leaves are used in ulcer | [42] |
| 53. | <i>Garcinia sopsopia</i> (Buch.-Ham.) Mabb. | Clusiaceae | Thensaker | Mangosteen | Stems | Stem juice is applied on Snake bite area | [42] |
| 54. | <i>Gardenia coronaria</i> Buch.-Ham. | Rubiaceae | Rul-hluah | Crown Gardenia | Root & leaves | The infusion of roots and leaves are taken orally against snake bite (Dose 50ml twice daily) | [42] |
| 55. | <i>Gelsemium elegans</i> (Gardner & Chapm.) Benth. | Loganiaceae | Hanamutur | Heartbreak grass | Root | Root juice is applied topically in ring worm and in case of tiger bites. Root is given orally in case of peptic ulcer. Leaf juice is applied as antiseptic on cuts and wounds. | [24] |
| 56. | <i>Gmelina arborea</i> Linn. | Verbenaceae | Thalmaung | Beech wood | Leaves & Fruits | Leaf juice are given orally to treat ulcers and used topically in scorpion stings and snake bites. The roasted fruit is crushed, and juice is applied externally on itching skin | [24] |
| 57. | <i>Gynocardia odorata</i> Roxb. | Flacourtiaceae | Saithei | Chalmogra | Seeds | Seeds are extracted and used as a lotion in leprosy and other skin diseases | [42] |
| 58. | <i>Gynura conyza</i> Cass. | Compositae | Buarzo | | Leaves | Juice of leaves is used externally in various skin diseases | [4] |

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|-----|---|------------------|---------------|---------------------|----------------------|--|------|
| 59. | <i>Hedychium spicatum</i> Sm. | Gingiberaceae | Kelhnamtur | Spiked ginger lily | Rhizome | The rhizome is used against inflammation pain and snake bite | [42] |
| 60. | <i>Homalomena aromatica</i> (Spreng.) Schott. | Araceae | Anchirui | Gandh-kochu | Leaves & rhizomes | Juice of leaves and rhizomes are used as a lotion for treatment of skin disease | [4] |
| 61. | <i>Houttuynia cordata</i> Thumb. | Saururaceae | Vaithinthan g | Fish mint | Leaves | Leaves are used in various skin disease | [4] |
| 62. | <i>Jatropha curcas</i> Linn. | Euphorbiaceae | Kangdamd awi | Jatropha | Leaves, stems & nuts | Leaves, stems and nuts are used in scabies, eczema and ring worm | [42] |
| 63. | <i>Lepidagathis hyalina</i> Nees. | Acanthaceae | Vangvat-hlo | Curved lepidagathis | Leaves | Juice of leaves is applied leech bite | [41] |
| 64. | <i>Lindernia ruellioides</i> (Colsm.) Pennell | Scrophulariaceae | Thasuih | Dry False Pimpernel | Whole plant | The plant is externally used for sciatica, skin worms and wounds | [19] |
| 65. | <i>Linostoma decandrum</i> (Roxb.) Wall. ex Meisn | Thymeleaceae | Ngaihhih | | Root | The roots are boiled in water and the water is used for dressing scabies and other skin disorders | [4] |
| 66. | <i>Lobelia pyramidalis</i> Wall. | Campanulaceae | Chul-be-raw | Wild tobacco | Latex | The latex is applied over warts, boils and various skin disorders | [4] |
| 67. | <i>Lygodium flexuosum</i> Swartz. | Lygodiaceae | Dawnzempui | Maidenhair creeper | Roots | The boiled fresh root is used for curing rheumatism, sprains, scabies, ulcers, eczema and cut wounds | [41] |
| 68. | <i>Mallotus philippensis</i> (Lam.) Müll. Arg. | Euphorbiaceae | Bari khei | Kamala tree | Fruits | Fruits are used in scabies and ring worm | [42] |
| 69. | <i>Melastoma malabathricum</i> Linn. | Melastomataceae | Builukham-pa | Malabar melastome | Bark & roots | Bark and roots are used for curing wounds and other skin disease | [34] |
| 70. | <i>Melocanna baccifera</i> Roxb. | Poaceae | Mautak | | Stem | The outer skin is scraped off and applied on cuts as hemostatic | [42] |
| 71. | <i>Merremia umbellata</i> Linn. | Convolvulaceae | Vawktesentil | Yellow Merremia | Leaves | Leaves are applied on burns and sores | [42] |
| 72. | <i>Mesua ferrea</i> Linn. | Clusiaceae | Herhse | Ironwood | Flowers & leaves | Flowers and leaves are used against snake bite and scorpion sting | [42] |
| 73. | <i>Mikania micrantha</i> Kunth | Asteraceae | Japan-hlo | Bitter vine | Leaves | The leaf juice is applied to cuts and wounds and clotting the blood as a first aid | [34] |

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|-----|---|----------------|------------------|---------------------------------|----------------|---|------|
| 74. | <i>Millettia pachycarpa</i> Benth. | Fabaceae | Rulei | Fish poison climber | Roots | The infusion of root is used as a lotion for wounds and decoction of root is used for washing scabies and itches | [19] |
| 75. | <i>Musa superba</i> Roxb. | Musaceae | Changel or Tumbu | Cliff banana; Rock banana | Stem | The stem juice is applied at the site of snake bites, bee stings and burnt skin | [24] |
| 76. | <i>Nerium indicum</i> Mill. | Apocynaceae | Sarawn | Indian Oleander | Roots & leaves | Crushed root mixed with water is used against ring worm. Decoction of leaves is used for the treatment of skin diseases like ringworm, leprosy, itches etc. | [4] |
| 77. | <i>Nicotiana tabacum</i> Linn. | Solanaceae | Vaihlo | Tobacco | Leaves | Leaf is crushed and the juice is applied to wounds and cuts. It can also cure pig's skin disease | [34] |
| 78. | <i>Ocimum americanum</i> Linn. | Lamiaceae | Runhmui | Hoary basil | Leaves & seeds | Juice of crushed leaves is mainly used in external application of various skin diseases like itch, tick, bites etc. | [4] |
| 79. | <i>Oroxylum indicum</i> Linn. | Bignoniaceae | Archangkawn | Indian Trumpet Flower | Stems | Stems are used as antidote for scorpion sting | [42] |
| 80. | <i>Parkia roxburghii</i> G. Don. | Mimosaceae | Zawng | Tree bean | Fruits | The green portion of fruits are mixed with little amount of water and applied to wounds and scabies | [34] |
| 81. | <i>Parkia timoriana</i> Merr. | Mimosaceae | Zawngtah | Tree Bean | Pods | Green skin of pods is applied on cuts and wounds | [42] |
| 82. | <i>Phyllostachys bambusoides</i> Sieb. & Zucc. | Poaceae | Montho | Japanese Timber Bamboo | Fruits | Fruit juice is used on the affected area of skin diseases such as eczema and ring worm | [40] |
| 83. | <i>Plantago major</i> Linn. | Plantaginaceae | Kelbe-an | Great Plantain | Leaves | The leaf decoction is used externally in sores and ulcers to hasten the formation of new skin | [24] |
| 84. | <i>Schima wallichii</i> DC. | Theaceae | Khiang | Needle wood | Stems | The juice of stems is used to stop bleeding from cuts and used as antiseptic. The fruit is boiled, and the water is applied against the bite if spider, scorpion etc. | [34] |
| 85. | <i>Securinega virosa</i> (Roxb. ex Willd.) Baill. | Euphorbiaceae | Saisiak | Snowberry tree; Common bushweed | Leaves | Decoction of leaves is used for various skin diseases like measles, chicken pox, itches etc. | [4] |

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|-----|--|----------------|---------------|---------------------------------------|-----------------------|--|------|
| 86. | <i>Senecio scandens</i> Buch. Ham. | Asteraceae | Sai-ek-hlo | Wild daisy | Leaves & Aerial parts | Leaves and aerial parts are boiled and used in the treatment of ulcerated cancer | [42] |
| 87. | <i>Stereospermum neuranthum</i> Kurz. | Bignoniaceae | Zihaw | | Bark | Decoction of bark is used in chronic ulcer | [19] |
| 88. | <i>Stereospermum colais</i> Mabb. | Bignoniaceae | Zihngal | Yellow snake tree | Leaves | Leaf juice is applied on itching skin | [33] |
| 89. | <i>Syzygium cumini</i> Linn. | Myrtaceae | Lenhmui | Black plum tree | Bark | Decoction of bark is used for treating skin diseases | [4] |
| 90. | <i>Tarenna odorata</i> Roxb. | Rubiaceae | Khalagor song | | Roots | Paste of roots is applied on snake bite | [19] |
| 91. | <i>Tectona grandis</i> Linn. | Verbenaceae | Tlawr thing | Indian oak | Bark | Decoction of bark is mixed with oil and used against various skin diseases | [4] |
| 92. | <i>Terminalia catappa</i> Linn. | Combretaceae | Vai-umkhal | Indian almond | Leaves | Juice of young leaves are used to prepare ointment for leprosy, scabies and other skin disease | [4] |
| 93. | <i>Thunbergia grandiflora</i> Roxb. | Acanthaceae | Zawngafian | Skyflower | Leaves | Leaves are used as an antiseptic in cuts and wounds | [42] |
| 94. | <i>Tinospora cordifolia</i> (Willd.) Miers | Menispermaceae | Theisawntlung | Gulancha | Stem | Stems are used in inflammation and skin diseases | [42] |
| 95. | <i>Viscum articulatum</i> Burm.f. | Loranthaceae | Lengpat | Leafless Mistletoe; Jointed Mistletoe | Leaves | Decoction of leaf is used externally in sores, wounds and ulcerated skin | [24] |

Discussion

Plant species play a crucial role in both urban and rural settings as important sources of medicinal compounds for addressing health issues. Various plant parts, such as leaves, bark, and roots, have historically served as remedies for a wide range of diseases and ailments, including skin infections, owing to their rich content of bioactive phytoconstituents [43]. These bioactive compounds have demonstrated inhibitory effects against numerous microbes and fungi, including *E. coli*, *S. aureus*, *Salmonella* spp., *B. cereus*, *B. subtilis*, and *Candida albicans* [44,45]. Given the lack of modern medical facilities, transportation constraints, and poverty prevalent in many remote areas, traditional medicinal plants serve as valuable therapeutic remedies among tribal communities. In this study, documentation of 95 plant species across 50 families highlights their therapeutic efficacy in treating skin infections and diseases. Many of the reported species are indigenous to the wild habitats of Mizoram. Among the most frequently cited families are Euphorbiaceae, Verbenaceae, Moraceae, Asteraceae, Caesalpiniaceae, Acanthaceae, Rubiaceae, and Zingiberaceae. Notable species frequently utilized include *Securinega virosa*, *Parkia roxburghii*, *Oroxylum indicum* Linn., *Mikania micrantha*, *Gynocardia odorata*, *Gelsemium elegans*, *Cuscuta reflexa* Roxb., and *Callicarpa arborea* Roxb. Various plant parts, including roots, rhizomes, stems, leaves, barks, bulbs, flowers, fruits, and even the entire plant, are employed as folk remedies to treat a myriad of skin infections and diseases, often in the form of crushed juices, pastes, decoctions, and infusions.

Future Aspect

While traditional medicine is globally practiced for addressing common ailments, it often proves to be more cost-effective and affordable than modern pharmaceuticals. However, several challenges exist with herbal remedies, including limited clinical data on safety and efficacy, particularly when administered by traditional healers. Consequently, the preparation processes, standardization methods, and dosage forms remain largely unknown in many cases [46,47]. Tribal communities primarily utilize traditional medicinal plants as raw food or vegetables in their daily lives and as curative measures for various diseases or disorders. They may also combine folk herbal formulations with conventional medicines, potentially leading to synergistic interactions between phytochemicals. However, drug-herbal interactions pose a global concern, exacerbated by the lack of awareness among local traditional healers regarding the potential toxicity

and interaction potential of their herbal formulations [48]. Currently, the standardization of folk herbal formulations and their practices is progressing slowly, highlighting the urgent need to raise awareness among the general population regarding the proper use of herbal formulations alongside conventional medications. This requires a shift in the perception towards folk herbal formulations, supported by clinical trials conducted by researchers, manufacturers, and regulatory agencies to ensure their quality, consistency, and safety [49]. Regulatory authorities play a crucial role in ensuring the purity, potency, safety, and efficacy of herbal drug formulations. Quality control measures for crude plant drugs and folk herbal formulations are essential for their integration into modern healthcare systems. However, the traditional plant-based drug development industry faces a significant challenge due to the lack of stringent quality control parameters for herbal materials and formulations [50]. Additionally, the specific constituents responsible for the efficacy of herbal formulations are often unknown, and the concentration of active ingredients in plant species varies significantly depending on geographical location. Nonetheless, these limitations can be addressed through further research efforts [51]. Continuity of traditional practices remains a challenge, particularly in remote areas with limited education, leading to the destruction of plant species for medicinal and fuel purposes. Furthermore, the lack of valid documentation for herbal formulations and dosage regimes, coupled with the oral transmission of information from generation to generation, jeopardizes the preservation of traditional medicinal knowledge. There is a pressing need for a global initiative to conserve medicinal plants and revive native healthcare traditions within local communities. Otherwise, valuable remedies risk being lost with the passing of traditional healers, as younger generations show declining interest in traditional medicinal plants compared to their predecessors.

Conclusion

Folk herbal remedies play a significant role in global healthcare systems, particularly in developing nations such as India and Africa, where they are utilized both in disease management and as supplements for maintaining overall well-being. Governments should take proactive measures to support the integration of herbal formulations into primary healthcare systems by providing institutional and financial assistance. This involves prioritizing the identification and documentation of medicinal plants, establishment of local botanical gardens for preserving key species, setting up quality control laboratories for assessing

efficacy, and developing appropriate dosage forms for administration. Researchers must scientifically validate claims made by tribal healers regarding Indian herbs to ensure the safety and efficacy of ethnomedicinal preparations. Once these traditional remedies are scientifically evaluated and endorsed within communities, they can enhance the effectiveness of treatment regimens offered by tribal healers. Concurrently, scientists are dedicated to discovering new lead molecules with improved therapeutic efficacy and fewer side effects, which can lead to the identification of unexplored medicinal plants and bioactive compounds. These scientific investigations may ultimately contribute to the development of herbal medications for various diseases, thus enhancing overall health outcomes.

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Conflict of Interest

None declared.

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