Indian Journal of Traditional Knowledge
Vol 23(7), July 2024, pp 675-686
DOI: 10.56042/ijtk.v23i7.12417

Traditional healthcare practices of Manipur, North-East India – Its genesis and sciences

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Received 18 June 2021; revised 23 May 2024; accepted 28 June 2024

In the present cross-cultural ethnopharmacological survey, altogether thirty traditional practitioners in sixteen districts of the Manipur state belonging to nine different ethnic communities were interviewed. A predesigned questionnaire was used for documentation of traditional healthcare knowledge of folklore healers. Their patient care and preparations of traditional medicines were recorded in written and audio-visual formats. The survey data was re-compiled in MySQL 5.1.41(4) as an NEIEM database. The ethnopharmacological information on 274 different formulations used for 57 different human and animal diseases were documented during this survey. The 181 different plants, 30 animals, and 11 different organic/minerals matters were found to be used as components of 274 formulations. In course of this survey, several manuscripts and an ancient therapeutic protocol *"Sida Hidak Taret"* (Seven Life Saving Medicines) were documented. The present study preserves the indigenous traditional healthcare knowledge of Manipur for future generations.

Keywords: Frequency of citation (FOC), *Hidak Yachal*, Informant consensus factor (ICF), *Maiba* and *Maibi*

IPC Code: Int Cl.[24]: A61K 36/00

Traditional knowledge (TK) refers to the ancient practices of an ethnic group connected with its survival. There are several ethnic groups across the globe and every ethnic group has their own skill and traditional practices in several occupations like handicrafts, foods, medicines, textiles, dances, sports, agriculture, costumes etc. In fact, it is tightly linked with their cultural practices[1].

The TK of the inhabitants of a particular community has developed through experience, observation and adaptation to their daily livelihood in the surrounding environment. Since ancient times, it has been passed from generation to generation orally and through stories, legends, folklore, rituals, songs etc. In ancient civilizations, like Chinese, Indian Greek, Roman and others several archaic records were found as stone inscriptions, copper plates, and Agar bark or manuscripts etc[2].

The traditional health care system of Manipur known as '*Maiba-Maibi Layeng'* (*Maiba-Maibi* System of Treatment) has several manuscripts

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Abbreviations

TK - Traditional knowledge; AMMMP - *Apunba Manipur Maiba-Maibi Phurup;* IBSD – Institute of Bioresources and Sustainable Development; FoC - Frequency of Citation; FIV - Family Importance Value; ICF - Informant Consent Factor; NEIFM - North Eastern Institute of Folk Medicine; FRLHT - Foundation for Revitalization of Local Health Traditions; MBB - Manipur Biodiversity Board; PHSC - Primary Healthcare Service Centre; NEIEMdb – North East India Ethnic Medicine database; PBR - People's Biodiversity Register; AYUSH - Ayurvedic, Yoga and Naturopathy, Unani, Siddha and Homeopathy

such as '*Hidak Yachal*' (Traditional Medicine Formulary), '*Pombirol*' (Human Physiology and Anatomy), '*Hidaklon*' (Formulary and Medicinal Plants), '*Poireiton Khunthok*' (Travelogue of the prince Poireiton) etc. and many more printed documents[1-4].

Luckily, Manipur has its own archaic records written in their own script. Through these old records, one can see how Manipur culture has been flourishing from time immemorial. Manipur has age-old stone inscriptions, copper plates, manuscripts etc[5].

In modern civilization, *Apunba Manipur Maiba-Maibi Phurup* (AMMMP) an apex body of the folklore healers of the Manipur state has existed since the early 1970s for protection and sustainable utilization of age-old Manipur traditional healthcare practices through scientific tools. Presently, digitalisation and Internet networks are fast exchanging traditional knowledge. The world has become a universal village with the advent of data sciences. However, presently around 2000 traditional healers are working in Manipur, however youngsters are choosing different employment sectors including defence, education, and industries in the state as well as outside of the state; they are not interested in the traditional healthcare practices after death of the elderly traditional practitioners as we experienced in our earlier studies[6]. Therefore, an immediate ethnopharmacological survey was required for documentation and perseveration of valuable traditional healthcare knowledge of traditional healers for future generations.

With this information and our previous experiences[6], in the present survey works, we have tried to explore the genesis of Manipur's traditional healthcare practices along with documentation of traditional healthcare knowledge with an aim to understand the sciences behind the indigenous healthcare tradition of Manipur.

Methodology

Ethno-pharmacological survey, documentation of traditional knowledge and collection

A cross-culture survey was carried out on "Traditional Healthcare Practices of Manipur' (THPM) in continuation of our earlier documentation work by following the established protocol reported[6]. The survey was conducted as per the approval of the Office of the Manipur Biodiversity Board, Government of Manipur, Imphal, Manipur, (letter No.: 4/3/2013-14/MBB/88-89 dated 7th July 2014) and a 'Memorandum of Agreement' (MoA) was signed between the Director, Institute of Bioresources and Sustainable Development (IBSD), Manipur, India and the President, '*Apunba Manipur Maiba Maibi Phurup*'(AMMMP) (Manipur State Traditional healer's Association), Manipur, India on May 5, 2011. The team comprised a pharmacologist, a botanist, a researcher in the related field from IBSD, Imphal and a state coordinator (Experienced traditional healer of the state) as well as a district state coordinator (Experienced traditional healer of respective districts) from 'Manipur State Traditional Healers' Association'. The survey team was formed for the documentation of traditional healthcare knowledge in consultation with *Maiba* (Male traditional healers of Manipur state) and *Maibi* (Female traditional healers of Manipur state). Manipur State Traditional healer's Association selected traditional healers based on their experience and the popularity of practices in the region. In brief, the district coordinators randomly selected preferably experienced traditional healers among AMMMP members who were practicing in their respective districts in consultation with the state coordinator. The survey team obtained their consent for sharing traditional knowledge; thereafter-traditional healers were interviewed in person for their knowledge regarding the disease treatment, medicinal formulations, and methods of preparation, mode of administration, doses, and food restriction during treatment etc. and recorded the same by the survey team. The symptoms of the diseases treated by the traditional healers were documented in the local language, translated into English, and authenticated by the western medicine doctors. The details of ethno-pharmacological information are documented as written documents in a pre-designed questionnaire. During the survey, we captured photographs; video and audio by voice recorder. The voice recording, still photography and videography were also done. During the survey, interactions with the patients treated by respective healers were done; and subsequent feedbacks from patients were also received as and when required. Apart from TK documentation, different ancient manuscripts, books (translated into currently used script), copper plates, and stone inscriptions available with the traditional healers were explored, and photographs of the same were captured during this survey. A status assessment of the

'Manipur State Traditional Healers' Association', working for the protection of old age traditional healthcare practices was done and old photographs of different activities of the organization were also collected as evidence. Further, quantitative indices like frequency of citation (FoC), Family Importance Value (FIV) and Informant Consent Factor (ICF) were implemented to understand the species of importance.

***Descriptive Statistics* (*DS*)**

Prance 1987 reported Quantitative ethnobotany for the first time. Later, research community used it to estimate the popular species used by folklore healers[7]. The DS may provide further valuable understanding for probable new species of interest[8-9].

***Frequency of Citation* (*FoC*)**

FoC indicates commonly used species. FoC values gives statistics for frequency of citation of plants used by folklore healers for a particular disease.

$$\text{FoC} = \frac{\text{Number of citation of that paricular species}}{\text{Total number of all citation for all species}} \text{ X } 100$$

In present study, FoC was calculated separately for the data collected during survey for a particular plant species and the data collected from literature survey for same plant species. The result indicates significant difference among the survey and reference dataset of a specific species.

***Informant Consensus Factor* (*ICF*)**

The ICF value calculated to know the plant species commonly used for treatment of each disease recorded during survey. ICF value is in the range of 0 to 1 and value 1 indicates highest used taxa for a particular ailment[10].

$$\text{ICF} = \frac{\text{Nr} - \text{Nt}}{\text{Nr} - 1}$$

Where, Nr = Number of citation for a particular diseases; Nt = Number of plant used for particular diseases by all the healers. However, if healer has not used any plant, in such case ICF value will be zero.

***Family Importance Value* (*FIV*)**

FIV revealed importance of family of the plant species[11].

$$\text{FIV} = \frac{\text{FC(Family)}}{\text{N}} \text{ x } 100$$

Where, FC = Total number of healer citing particular family of plant species; N = Total number of healers joined in ethnopharmacological survey.

Design and development of Manipur Traditional Medicine Database (MTMdb) - under construction

Design and development of unique global traditional medicine database is difficult task due to heterogeneous nature of data, and socio-cultural differences. The major challenges for development of databases are (i) data integration (unavailability of unique protocol), (ii) need for Globally Unique Identifier (specific taxonomies, linking primary and secondary data), (iii) Data accuracy (variety of method for characterisation of species used by taxonomist across the globe), (iv) update and maintenance of database (regular update with new information), (v) Biogeography (biodiversity rich and scant zones), (vi) data heterogeneity (dialect of ethnic healers and community) and (vii) biopiracy[12-14]. The various formulations made by the local healers in treatment of ailments were obtained from the nature. Thus, biodiversity informatics now provides more attention towards the development of species specific and region-specific database[13,14].

A database on traditional medicines in details is very much resourceful for modern research. Database could bring new insight and discoveries concerning ethno-medicine. The database developed during the study will be the first knowledge base information that would make available systematic details about the healers, their specialty, plant (local, common and scientific name), part used, taxonomical details of plant, dosage form of traditional formulation, dosage, biogeography, uses (general and specific), phytochemicals (main and other chemicals), formulation (plant, animal, aquatic and others) and socio-economic prospects of the treatment used in the system.

Results

Ethnopharmacological survey on Manipur Traditional Healthcare Practices

The IBSD-AMMMP joint team surveyed traditional healthcare practices of Manipur in all sixteen districts. Altogether thirty traditional healers from different nine ethnic groups in sixteen districts interacted. A total of 274 traditional medicinal formulations were recorded which were used for 57 diseases. A total of 181 different plant products, 30 animal products, and 11 different matters (salt,

sugar etc.) were used as constituents of 274 traditional medicines. Survey data recorded in print and audio-visual format. Selected photographs captured during interaction with traditional healers are given in Figure 1, details of traditional healers are cited in (Supplementary Table S1) and the commonly used plants are listed in (Supplementary Table S2). The majority of *Maiba* and *Maibi* used five plants of five different families in the maximum formulations (Supplementary Table S3). The traditional medicines commonly used by *Maiba* and *Maibi* are selecting for pharmacological screening to justify for their traditional claim. A comparative study using statistical tools was carried out with primary data (the traditional uses of plants recorded during the survey) and secondary data (Published literature available on traditional uses of respective plants) to understand the uniqueness of our findings in the present ethnopharmacological survey. However, a comparative table is provided in supplementary materials (Supplementary Table S2 and Table S4), where traditional uses of particular plants are compared with traditional uses for respective plants reported in other published ethnopharmacological surveys conducted across the globe. It also included

Fig. 1 — The traditional health care practitioners sharing their traditional knowledge with ethnopharmacological survey team of IBSD & AMMMP, Imphal; (a) Smt. Setur Promila of Hnatham Village, Chandel district (16.12.2014), (b) Mr. Selsi Shem Lamkang of Lamkang Thamlapokpi, PO Pallel, Chandel district (16.12.2014), (c) Mr. Khulpuwa Agnam of Kambangkhunou, Chandel district (16.12.2014), (d) Mr. Yangmi Kasar of Khaibatang, Hungpung, Ukhrul district (5.1.2015), (e) Mr. Khaidem Angouchou Singh of Lamlaimakhaleikai, Imphal East district (26.9.2014), (f) Mrs. Kangabam Thaba Devi of Langollairembileikai, PO- lamphel, PS Lamphel, Imphal West district (29.09.14), (g) Mr. Pr. Paokhokam Singsan of Bethal Village, Churchandpur district, (21.10.2014), (h). Mrs. Wangjam Shanti Chanu of Thongjao Awang Maning Leikai, Thoubal district (29.10.2014)

phytoconstituents and commercial perspectives of individual plants that may be very much essential for researchers working in related fields, industrialists, and policymakers across the globe (Table S5). It was also observed that a few the young generation is taking a keen interest in carrying forward the traditional knowledge of their ancestor. Therefore, during the present survey, the team came across several young traditional practitioners who shared their TK acquired from their ancestors (grandfather, father, maternal uncle, and mother). We hope that the results of scientific validation will be proven soon. So far, the IBSD has developed an anti-arthritic formulation, out of this traditional medicine documented, which is presently under phytochemical and pre-clinical investigations.

Collection of ancient documents and assessment

"Sida Hidak Taret" (Life saving Medicine Seven)

According to the ancient mythological manuscript, "*LainingthouPuthiba*" puya, the "Sun God" while travelling on horseback met two beautiful girls working in a paddy field. The "Sun God" who disguised a smart handsome young man dismounted from the horse and approached the girls for short interaction. During the talk, the two girls threw a challenge to solve riddles (like quiz competition) and the defaulter should be the slave. He also accepted the challenge, but the "Sun God" was defeated by the girls. While knowing the background of success for the two girls as their father "Puthiba", the "Sun God" chased Puthiba who disguised a crab by riding his horse to kill him. Just after jumping down into a river, the horse trampled on the crab. Puthiba (Crab) received serious injuries. Daughters of Puthiba asked the "Sun God" to treat Puthiba otherwise he should be their slave. The "Sun God" treated injured "Puthiba" by producing "*Sida Hidak Taret* (Seven Life Saving Medicines). From this incident onward, the history of *Maiba-Maibi* treatment of Manipur has been started. The therapeutic protocol popularly known as *"Sida Hidak Taret"* (Seven Life Saving Medicines) in Meitei Community of Manipur, in which seven different medicinal plants were suggested for all seven days in a week, is homophones word in Meitei Manipuri language[1]. The scientific reports and traditional uses of all seven plants were surveyed. The scientific and traditional uses of *Sida Hidak Taret* established their usefulness for treatment of accidental injury (trauma). The *Sida Hidak Taret* treatment includes pain killer/analgesic, antipyretic, anti-inflammatory, anti-septic/antibiotic, anxiolytic, antidepressant, antacid, anti-hypertensive, sedative/ hypnotic, antioxidant agents those are generally prescribed as per standard protocol for week long treatment of accidental injury in modern health care systems (Table 1 and Fig. 2).

***Poireiton Khunthok* (*Travelogue of the King Poireiton*)**

Another manuscript "Poireiton Khunthok" edited and published by Pandit Achouba late Moirangthem Chandra Singh revealed the rich local health tradition of Manipur during the first century A.D. The book mentioned about several medicinal plants locally available in Manipur like *Tairel* (*Toona siliata*), Pungphai (*D. agyptium*), *Yembum* (*Knoxia roxburghii*), *Yendung* (*Cycas pectinata*), *Taimayen* (*Chukrasia tabulari*) etc. These are the ethno medicinal plants of Meitei community of Manipur relating to their traditional knowledge[2]. This manuscript was translated in Meitei Manipuri language using Bengali script on the year 1995.

Kabui Salang Maiba

The story of "Kabui Salang Maiba" further revealed the rich traditional health care system prevailing in the Kabui (Rongmei) community of Manipur. Use of *"Nongnang Kori"*(*Syzygium jambos*) plant as one of the components of traditional medicines of Manipur as mentioned in it.

***'Hidak Yaichal'* (Manipur Traditional Medicine Formulary)**

This manuscript described different formulations for Manipur Traditional Medicine in Original Meitei Script[4]. Later this manuscript was translated into Meitei language using Bengali script in the year 1984 (Fig. S1 a and b).

***'Pombilang'* (Human Physiology and Anatomy)**

This manuscript described about human physiology and anatomy used by ancient traditional practitioners of Manipur.

***'Hidaklon'* (Formulary and Medicinal Plants)**

This manuscript is a monograph of Ritual Hymns and Chanting of Manipur as sources of information on medicinal plants[3]. This manuscript translated and published in two parts (Part-1 and part-2) by Mr. M. Gourachandrain the year 2005 into Meitei language, using Bengali script.

Stone inscription and Copper plate

Different stone inscription and copper plate also noticed during survey[5]. Late N. Khelchandra Singh, Fellow of Sahitya Akademiand *Sangeet Natak Akademy Ratna* awardees from Manipur describe about ancient

Table 1 — Composition of *Sida Hidak Taret* (Lifesaving Medicine Seven) and their scientific evidences

Sl No	Days	Name of plants	Traditional Use	Scientific Reports
1.	**Sunday** means ***Nongmaijing*** **in** Meitei Manipuri language	*Phlogacanthus thyrsiformis* (Roxb. ex. Hardw.) Mabb. (Fam.: Acanthaceae) ***Nongmangkha*** in Meitei Manipuri language Vasaka in hindi; Ram basak, Lal basak in Bengali	To cure fever, jaundice, skin infection, pox, High blood pressure, boils, diarrhea, dysentery, cold, cough, body ache, constipation etc.	Analgesic activity, antibacterial activity, antidiarrhoeal activity, anti asthamatic activity[19]. analgesic, anti-inflammatory, and anti-oxidant activities, anti-cancer[20].
2.	**Monday** ***Ningthouka*** in Meitei Manipuri language	*Tinospora cordifolia* (Willd.) Hook. f. & Thom. (Fam.: Menispermaceae) ***Ningthoukhongli*** in Meitei Manipuri language Geloy, Guduchi in Hindi and Bengali; Heart-leaved Moonseed in English	To cure diabetes, Piles, Asthma, Fever, Jaundice, Migraine, Muscular sprain, diarrhea etc	Anti-Cancer activity, Immunomodulator activity, Post -menopausal syndrome, Hepatic disorders, Mental disorders, Digestive activity [21].
3.	**Tuesday** ***Leipakpokpa*** in Meitei Manipuri language	*Kaempferia rotunda* L. (Fam.: Zingiberaceae) ***Leipaklei*** in Meitei Manipuri language Bhumi champa in Hindi & Bengali; Indian crocus in English	To cure Sinusitis, abortificient, mumps, tumour, high blood pressure, wound, swelling etc.	Anthelmintic activity[22]. Wound healing activity[23], Antioxidant activity[24,25] antimutagenic activity[26], Anti-allergic activity[27], antibacterial and anti-tumor activity[28].
4.	**Wednesday** ***Yumsakiesha*** in Meitei Manipuri language	*Stellaria media* (L.) Vill. (Fam.: Caryophyllaceae) ***Yerum Keirum*** in Meitei Manipuri language Buch-bucha in hindi; Chickweed in English	To cure skin infection, skin itching, allergy, burn wounds and Bones fracture	Anti-obesity effect[29], anti-inflammatory and analgesic[30].
5.	**Thursday** ***Sagolsen*** in Meitei Manipuri language	*Datura metel* L. (Fam.: Solanaceae) ***Shagol hidak*** in Meitei Manipuri language Dhatura in Hindi & Bengali; Moonflowers in English	To cure Piles, dizziness, muscular sprain, dysentery, asthma, joint pain etc.	Anti-cholinergic activity[31], analgesic, anti- asthmatic treatment[32,33], anti-asthmatic agent[34,35], treatment of gastric pains and indigestion[36].
6.	**Friday** ***Irai*** in Meitei Manipuri language	*Cassia siamea* Lam. (Fam.: Caesalpiniaceae) **Laihidak** in Meitei Manipuri language Seemia/Kassod in Hindi; Kassod Tree in English, Minjiri in Bengali	To cure Malaria, stomach pains, hypertension, diabetes, insomnia, anxiety, swellings etc.	Antibacterial[37], antidiabetic activity[38], Sedative, antidepressant, antipyretic, analgesic, anti-inflammatory, diuretic, antioxidant, anticancer, anxiolytic[39].
7.	**Saturday** ***Thangja*** in Meitei Manipuri language	*Litsea monopetala* (*Roxb*.) *Pers.* (Fam.: Lauraceae) **Thang hidak** in Meitei Manipuri language Maida Lakdee in hindi; Meda pata in Bengali; Indian laurel or Soft Bollygum in English	Used as nerves and bone tonic, stomachache, stimulant, analgesic, antiseptic etc.	Anti-microbial, Anti-hyperglycemic, antimicrobial, antidiarrheal, cytotoxic, and anti-inflammatory activities[40].

stone inscription and copper plate in his book entitled: "Manipuri Language Status and Importance" published in the year 1975.

Assessment of societal response towards Manipur traditional health care practices

The modern system of medicines like Allopathy came into the state only after the British captured administration in 1891. They brought modern doctors to treat their indisposed officials and army personnel in the early part of the 20th century. Traditional healthcare practices by *Maiba-Maibi* were the only available healthcare support before that period. It is still important with the support of indigenous people. In Manipur, especially in the Meitei community, a *Maiba* (Male traditional healer of Manipur) calls after the death of a person to confirm the death of the person by physical investigation. Because, the death certificate of a government or private hospital issued

Fig. 2 — Photographs of medicinal plants suggested for week long treatment of accidental injury as per Manipuri ancient therapeutic protocol "*Sida Hidak Taret*" (Life Saving Medicine Seven), a particular plant suggested for a particular day of the week

by qualified doctors does not have traditional, cultural, or religious acceptance. In religious post-death rituals, known as "*Lanna Thouram*" or "*Sorat*" and "*Phiroi*," where a labelled seat kept for '*Maiba'* that not allowed occupy by anybody else. It is an example of the support extended by Manipuri society to the traditional healers.

Assessment of status, history and responsibility of Apunba Manipur Maiba Maibi Phurup (AMMMP) (Manipur State Traditional Healers' Association)

The AMMMP was registered in 1984 under the Societies Registration Act (Regd. No. 5492 of 1984) of the Constitution of India. In 1985, AMMMP organized a state-level conference at G.M. Hall, Imphal, Manipur State, India in which about 1000 *Maibas* (Male traditional healers) and *Maibis* (Female traditional healers) attended and shared the traditional knowledge of healthcare practices of the state (Supplementary Fig. S2). Since the registration of AMMMP number of *Maibas* and *Maibis* obtained their membership from the *Manipur State Traditional Healers' Association.* In October 2008, AMMMP started its activities in association with the North Eastern Institute of Folk Medicine (NEIFM), Pasighat, Arunachal Pradesh, Government of India. Since 2008, it has taken up training and other activities in collaboration with the Foundation for Revitalization of Local Health Tradition (FRLHT), Bangalore, India. In May 2011, AMMMP and the Institute of Bioresources and Sustainable Development (IBSD), Department of Biotechnology, Ministry of Science and Technology, Government of India, Takyelpat, Imphal signed an agreement to take up a joint venture for the Ethno-pharmacological Research and Drug Discovery. Currently, the ongoing Ethno-pharmacological research has been taken up jointly by AMMMP and IBSD, which could cover all districts of Manipur state. The work has been taken up with a vision of Scientific Management of Bioresources in the Indian region of Indo-Burma Biodiversity hotspots and the mission is bioresources development and their sustainable utilization through biotechnological intervention for socio-economic growth of the North Eastern Region of India. Apart from collaborative scientific works with similar Government agencies, Manipur traditional practitioners approached the modern health care system of the state. The project director, of National Health Mission, Manipur Dr. Okram Ibomcha Singh, on the spot recruited a *Maibi* (female traditional healer/health worker) Mrs. K.R. Anei (40 years) of the same village in Charoi Khullen Primary Health Service Centre (PHSC) during his visit in the interior part of Churachandpur district of Manipur on 26th August, 2014. The *Maibi* is an expert in child delivery and helping for safe natural child delivery in the PHSC. The health care system of *Maiba-Maibi* in Manipur is very popular in rural areas. Till today it is the only health care system in the villages where there is no modern doctor or contemporary advanced health care facility available.

Data annotation

Maximum healers believe natural bioresources as medicine cure different diseases with negligible adverse effects and therefore safe for use. In the present study, we considered 81 identified plants from different 50 families.

Frequency of Citation (FoC)

FoC offers valuable clues for the commonly used plant species by the healers and ranges from 3.33-40.00% with an average value of 0.04%. Out of which *Plumeria acuminate* (*40%*)*, Clerodendrum siphonanthus* (*36.67%*)*, Meyna laxiflora* (*30.00*) *followed by Cannabis sativs, Paederia foetida and Melothria perpusilla* (FoC= 26.67% respectivelly) all the FoC values showed significant range[15-17]. The plant species with higher FoC may offer valuable insight for new phytochemicals. Although in case of secondary data on plant species, the frequency of citation ranges from 0.27-4.27% with an average value is 0.03%, of which *Saccharum officinarum* (*4.27%*)*, Adhatoda vasica, Ageratum conyzoides* (*3.47% respectively*)*,* followed by *Areca catechu* and *Schizophyllum commune* 2.93% respectively. The bar plot for FoC for survey and reference data depicts the difference in the use of species (Fig. 3). The graph further discovered fewer differences in FoC of *Sacchrum offinarum, Ageratum conyzoides, Adhatoda vasica, Psidium guajava and Nerium indicum* of survey and reference data (Table S3).

Family Importance Value (FIV)

FIV Value defines the plant species of a specific family and their use in the treatment of specific diseases[15]. From Table - S6 it has been found that the species from families Asteraceae and Lamiaceae (20.00), respectively followed by Rubiaceae (16.67) have shown the highest use by the native people. The abundance and availability of particular plant species are affecting the use of particular species by the importance[10,11].

Informant Consensus Factor (ICF)

ICF value revealed several plant species used in various disease conditions. A total of eleven categories of diseases were listed and infectious disorder with 37 use-reports, followed by dermatological disorder with 31 use-reports. This finding shows infectious disorders and dermatological disorders are prevalent in the study area. ICF values range from 0.0 (nervous/metabolic disorder) – 0.44 (jaundice/liver disorder). The average ICF for all diseases was 0.17 and followed a significant range. Total number of ailments treated by the healers and plant species used were shown in Figure 4 and Table S7. The interesting difference found from different indices highlights species that need further attention for conservation and protecting the knowledge of the traditional healthcare system.

Database architecture and content (System level)

The North East India Ethnic Medicine database (NEIEMdb) will be based on mining impeccably assimilating data from an extensive dataset normalised in MS Excel, MS Word, JPEG and MP3 datasets obtained during the ethnopharmacological survey on Manipur traditional healthcare practices (questionnaire-based interaction with ethnic healers, the formulation, method of preparation and raw materials used for treatment). This data will be re-compiled in MySQL 5.1.41 (4) relational database along with cross-references of taxonomy, morphology, phytochemistry, ethnomedicinal uses, snaps, references, summary, and gallery. Figure - 5 represents the architecture and outline of NEIEMdb. The MySQL database will be normalized and indexed to ensure effectual and precise data retrieval through the enquiry choice available in the NEIEMdb web interface. At present search by common name, scientific name, chemical (common name), medicinal use, healer name, disease name and advanced option are provided for users. A regular updating to the NEIEMdb database ensure that its' contents are up to date with the periodic updates in an experimental pharmacological, and phytochemical study. The NEIEMdb web interface will be developed in Apache 2.0 Handler CGI 1.1[18] runs on the Windows 2003 web server and utilizes the MySQL (XAMPP-win32-1.7.7) module to query and retrieve data from the back-end MySQL database (MySQL database management system, 2016). The main page of the database is outlined in Figure 6. The NEIEMdb have preserved valuable traditional knowledge, ancient documents, and historic manuscripts of Manipur folklore healthcare practices for future generations that may lost with the demise of the respective ethnic healers.

Discussion

Present study offer valuable traditional healthcare knowledge on Manipur Traditional Healthcare practices by *Maiba-Maibi* since long. These plants are treasures for useful medicinal agent(s) and sources for discovery of many bioactive principles due to limitations of synthetic drugs particularly adverse drug reactions, side effects and drug resistance. Ancient literature reveals that since time immemorial there have been scientific healthcare practices in Manipur. The scientific validation of the bioresources used in traditional medicine by the application of biotechnological tools and value addition, initially can

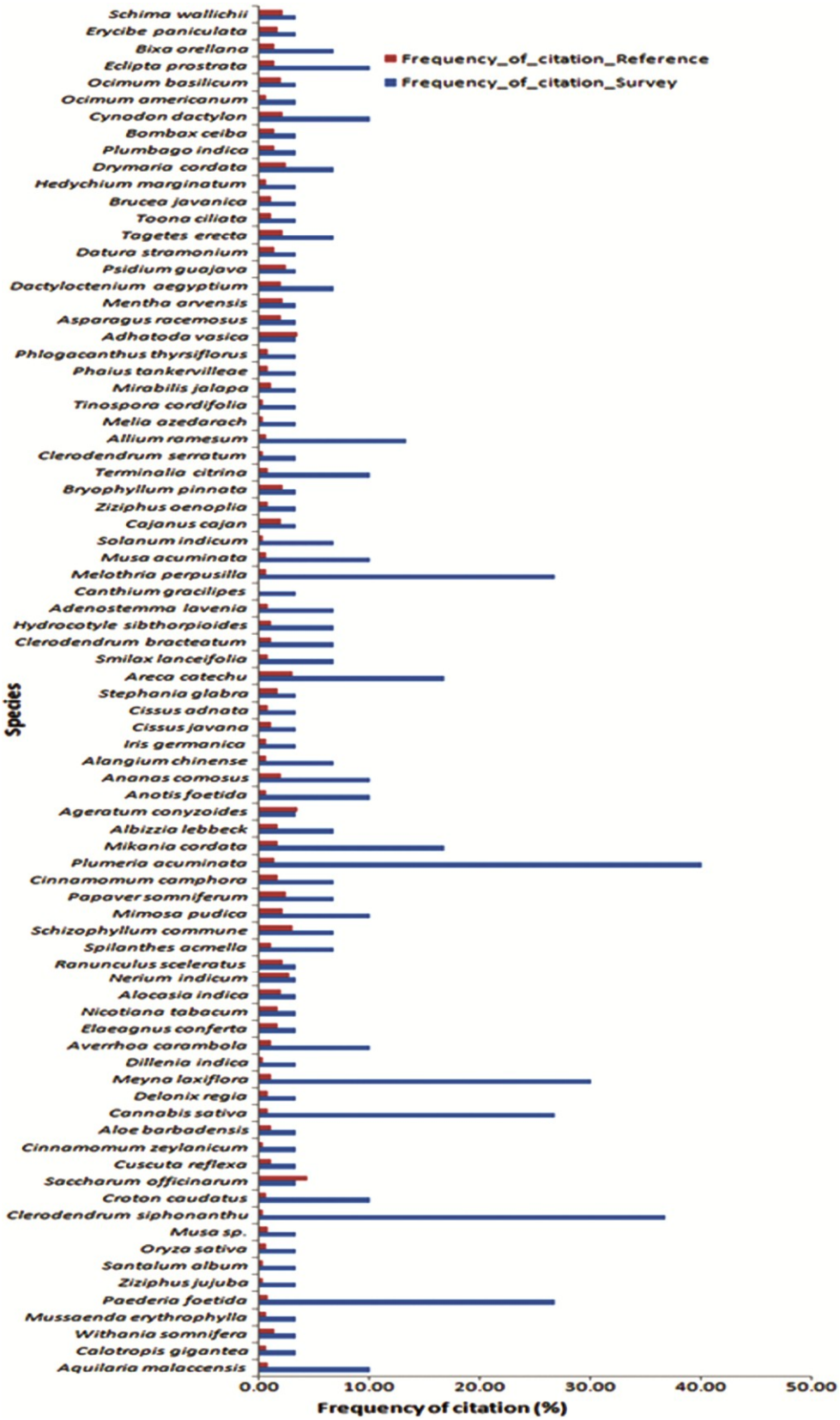

Fig. 3 — The bar plot for frequency of citation for survey and reference data clearly depict the variation in use of species

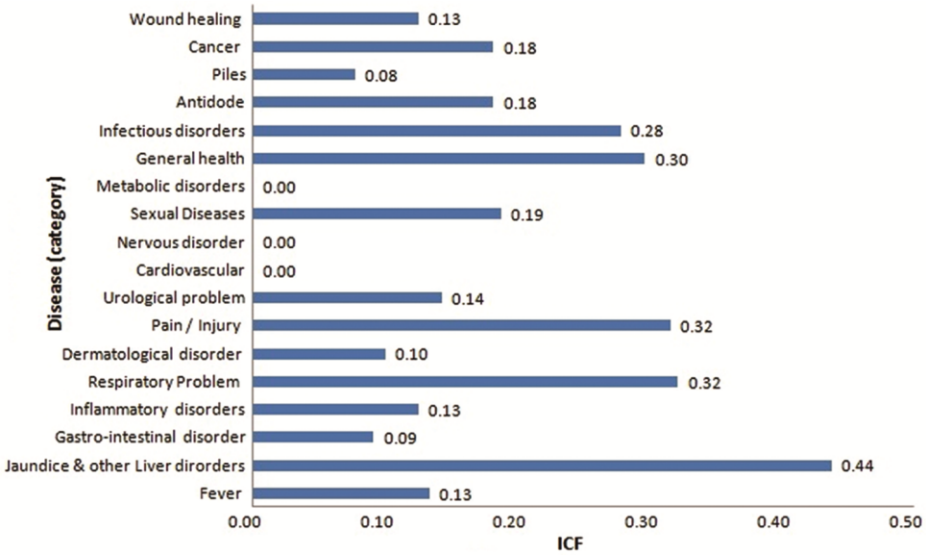

Fig. 4 — Informant Consensus Factor indicating the category wise use of plant species by informants for various diseases

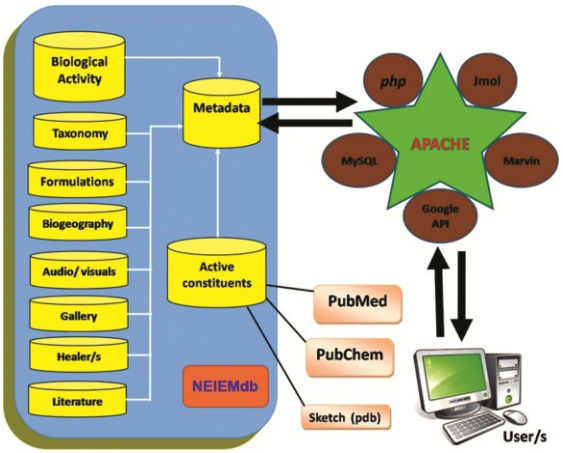

Fig. 5 — Architecture and outline of MTMdb database. The figure desiged by the research team member Er. Bharat Gopalrao Somkuwar. For icone of different database extracted fron the following site: Apache, 2016 [http://www.apache.org/] date of last browsing June 20, 2016 included in reference list Sl No. 18, MySQL database management system [http://www.mysql.com/], PHP [http://www.php.net/], Jmol: an open-source Java viewer for chemical structures in 3D[http://www.jmol.org/], Marvin: Marvin was used for drawing, and displaying chemical structures, Marvin 14.9. *Chem Axon* 2014 [http://www.chemaxon.com] and https://scholar.google.co.in

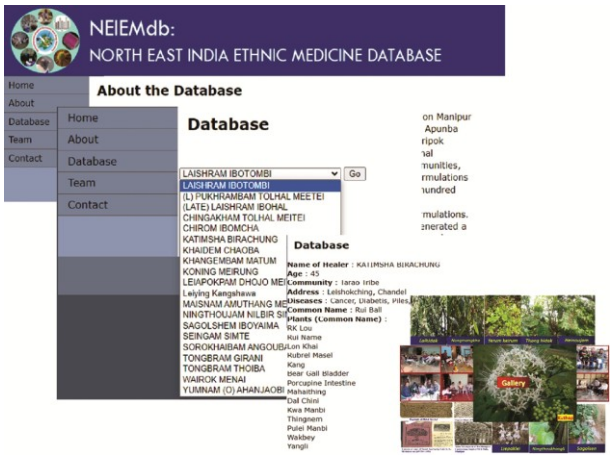

Fig. 6 — Outline of the main page of database

help traditional healers of Manipur (*Maiba-Maibi*) for their traditional healthcare practices and can spread across the globe through pharmaceutical industries in future[6]. NEIEMdb, audio-visual and written documents compiling out of the ethno-pharma-cological survey data has play a major role in preservation of indigenous traditional knowledge of Manipur traditional Healthcare Practices for future epochs. The information content of the database will provide baseline data exploring phytochemical, pharmacological evaluation of novel ligands[14]. The knowledge base also provides useful information to the policymakers for bioresources that are on the verge of extinction and in formulating the suitable strategy for sustainable management towards biodiversity conservation. FoC expounds shared information on species[9]. ICF indicates consistency of data[10]. FIV depicts particular family of species use by the informants. Manipur State Traditional Healers' Association is an organised apex body for protection of age-old traditional healthcare practices[11]. Such organization need to be formed every state of the country for systematic conservation of age-old indigenous traditional knowledge and sustainable utilization of Traditional medicine. The scientific and

traditional uses of *Sida Hidak Taret* established their usefulness for treatment of accidental injury (trauma). The *Sida Hidak Taret* treatment includes pain killer/analgesic, antipyretic, anti-inflammatory, anti-septic/antibiotic, anxiolytic, antidepressant, antacid, anti-hypertensive, sedative/hypnotic, antioxidant agents those are generally prescribed as per standard protocol for weeklong treatment of accidental injury in modern health care systems[19-40].

However, several necessary action need to be taken up for protection of valuable traditional healthcare knowledge and conservation of medicinal plants used by *Maima-Maibi,* namely documentation of traditional healthcare knowledge of all healers, establishing medicinal plant gardens in schools, colleges of each districts of the state according to their natural habitat and micro climatic condition and training of traditional healers for scientific collection of plant or animal samples, preparation of herbarium/ specimen, storage and scientific identification of bioresources. The traditional ethno-veterinary practices also need to include for documentation.

Conclusion

The present study keeps the indigenous traditional healthcare knowledge of Manipur alive for future generations. This document will offer an opportunity to take up a program on cultivation, conservation, and sustainable utilization of local natural resources used by *Maiba-Maibi* for the treatment of different diseases. In addition, it helps to make a systematic research strategy on traditional medicine for the economic development of the rural society of Manipur, North-East India.

Supplementary Data

Supplementary data associated with this article is available in the electronic form at https://nopr.niscpr.res.in/jinfo/ijtk/IJTK_23(07)(2024)675-686_SupplData.pdf

Acknowledgements

Authors are grateful to Dr. Dipak Kumar Hore, (Ex. Principal Scientist, ICAR, Govt. of India), for editing and correction, Dr. Sudripta Das, Scientist-F (Plant Biotechnology), Dr. Biseswhori Thongam, Scientist- E (Plant Taxonomy) and Dr. Brajakishore Singh, Scientist-D (Natural Product Chemistry) for their constant support and constructive comments. Authors are also thankful to Mr. Gourshyam Thingnam, Mr. Mangi, Mr. Surjit Singh, the other technical, non-technical, account and administrative staffs of IBSD, Imphal for providing their constant support for successful compilation of this survey work under Pharmacological core research project.

Conflict of Interest

The authors declare that they have no competing interests.

Author Contributions

BGS: data analysis, interpretation and writing original draft and editing; NTR: data analysis and coordination for survey with IBSD team and interpretation; KN: Documentation, interpretation, data analysis; NSS: documentation and interpretation; DB: documentation, data analysis and drafting manuscript and LKD: Designed the study, Survey, supervision, manuscript writing, draft review and editing. TPR, AP, KR, KA, YHM, MNS, KTD, SP, SSL, KA, HY, YKAW, YLL, YSM, SJS, KAS, DNK, SLH, PPS, MIS, NBS, HKU, AS, TK, TD, HH, LLH, WSC, LJM, WMS, are Traditional healers and share their traditional healthcare knowledge with survey team of IBSD.

Prior Informed Consent

Prior Informed consent obtained from all the traditional healers (*Maiba and Maibi*) in the form of IBSD-AMMMP 'Memorandum of Agreement' signed on reveal, publish, and share the data including photograph as and when required with prior information to the knowledge holder.

Data Availability

Data will be made available on request.

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