

Ethnozoological Diversity of Northeast India: Empirical Learning with Traditional Knowledge Holders of Mizoram and Arunachal Pradesh

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Northeast India harbors rich floral and faunal biodiversity. In their co-existence with the surrounding faunal resources, the native communities of the region have accumulated a rich body of ethno-zoological knowledge, which is now threatened due to globalization and other forces. In view of the importance of Ethnozoological resources in food, medicine and health, it has investigated and documented the vanishing Ethnozoological knowledge from different tribal communities of Arunachal and Mizoram. A field survey was made to collect primary source data. Further, secondary data were gathered through available literature and on-line sources. The primary data were documented through personal interviews using open-ended questions and group discussions with the experienced elderly people. A total of 39 aquatic and terrestrial species being used by *Adi* tribal peoples of East Siang district as food, medicine and/or for spiritual and cultural purposes were documented. We recorded Ethnozoological information from communities of Mizoram state on a total of 48 faunal species, of which 35 were reported to be used commonly for ethno-medical purposes, to treat coughs, asthma, tuberculosis, paralysis, earache, weakness, muscular pain, malarial fever, convulsion, diabetes, etc. We found that the Ethnozoological knowledge among young *Mizo* tribal members, as well as younger *Adi* tribal members, was less than that of the older people in these communities. This information is still preliminary, and further scientific validation is required for a more complete understanding of the dynamics of these knowledge systems, their role in supporting human welfare is undeniable. Based on these findings, it is concluded that there is ample scope for collection, compilation and exploration of the bio-efficacy of ethnofaunal diversity in Arunachal Pradesh and Mizoram, and sustainable conservation of species used in ethnomedicines and food systems must be ensured.

Keywords: Ethno-zoological knowledge, Traditional medicine, Traditional foods, Tribal communities, Mizoram, Arunachal Pradesh.

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India, with a mere 2.4% of the world's land area, is gifted with exceptionally high faunal diversity. With a total of 89,451 documented faunal species, the country accounts for 7.31% of the earth's faunal species¹. Wild animals and their products constitute essential ingredients in the preparation of drugs in traditional medicine and cultural foods in many communities^{2,3}. Animal-based medicines have always played a significant role in healing practices, magic rituals and religions of indigenous communities all over the world⁴. Of the 252 essential chemicals selected by the World Health Organization, 11.1%

come from plants and 8.7% from animal sources⁵. Today, there is an increasing desire to apply Ethnobiological studies to revealing the centuries-tested traditional knowledge of plants and animals, as well as in the search for new resources of food, drugs, etc.^{6,7}. The tribal and indigenous communities, who depend almost entirely on local plants and animals as home remedies and for their day-to-day lives are the real custodians of the knowledge of medicinally important plants and animals. Faunal species used as remedies, although representing an important component of traditional medicine (sometimes in association with plant species), have been less studied than medicinal plants in India⁸⁻¹¹. In particular, as far

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as authors know, only one research paper focusing on the use of zoological species for medicinal purposes had been published so far from Northeast states of India¹². Much more research on the use of animal products in folk medicine is needed to evaluate the dynamics and bio-efficacy of these resources, and the potential impacts of their use on the conservation of bioresources¹³. Not only is traditional medicine often viewed as the best treatment for some ailments and conditions, the numbers of traditional medical healers practicing in Arunachal Pradesh and Mizoram are far greater than the number of western medical practitioners.

Arunachal Pradesh and Mizoram are considered very diverse in terms of flora and fauna, and the biocultural knowledge associated with this diversity is being widely applied within the local communities. The native peoples of these two states have interacted with nature for hundreds of years and evolved location specific medicinal and cultural knowledge around the indigenous biodiversity. Remotely located, close with nature and with less access to modern medicinal and food facilities, these communities have been compelled to use locally available bioresources in all the spheres of life. The richness of ethnozoological knowledge among the tribal communities of Arunachal Pradesh and Mizoram has encouraged us firstly to explore and document the diversity of usage of animals in food and medicine systems in these two states, and, secondly to evaluate the need for and approaches to conservation of this knowledge and of the animals themselves.

Research methodology

Arunachal Pradesh lies between 26° 28' to 29° 30' N lat. and 91° 30' to 97° 30' E long. The topography is characteristically rugged due to lofty, haphazardly arranged mountain ranges and deep valleys criss-crossed by a number of rivers and streams spreading along the southern slopes of the eastern Himalayas to the western slope of the Potkoi hills and around the huge valley of river Brahmaputra. Arunachal Pradesh known as a hot-spot of biocultural diversity; its Northeast region is home to 26 different tribes, which are further grouped into 110 sub-tribes, each with distinctive dialects, ethnicity, food habits and habitation. The state is divided in 16 administrative districts and there are five major climatic zones: tropical, subtropical, temperate, sub-temperate and alpine. The environmental variability and the cultural

affinity of local tribes with flora and fauna make this state unique.

Mizoram is situated in the lower corner of Northeastern India, bounded on the Northeast by the states of Manipur, Tripura and Assam, in the Southwest by Bangladesh and Myanmar (Burma). It is one of 23 states in India, with an area of 21,087 km². Mizoram is a land of rolling hills, rivers and lakes. As many as 21 major hills ranges or peaks of different heights run through the length and breadth of the state, with plains scattered here and there. The average height of the hills to the west of the state is about 1,000 m. About 80 % of the people of Mizoram are engaged in agricultural pursuits. The main pattern of agriculture followed is Jhum or Shifting cultivation. Of the total 21 lakh ha of land estimated, 6.30 lakh ha of land is available for cultivation of horticulture crops. The existing area under different horticulture crops account for about 4127.6 ha, which is only 6.55 % of the estimated potential area. All their activities of Mizos centre around *jhum* cultivation, and their festivals are linked with such agricultural operations. *Kut* is the Mizo term for festival. Among the various cultural festivals, only three, viz. *Chapchar Kut*, *Mim Kut* and *Thalfavang Kut* are observed today.

Two unique tribal communities inhabit the state: *Chakma* and *Mara* (other than *Lai*, *Paite*, and *Hmar* which have their own dialect). There are eight districts in Mizoram state (Aizawl, Lunglei, Champhai, Lawngtlai, Mamit, Kolasib, Serchhip and Saiha) and three autonomous district councils: Chakma (in Southwestern Mizoram bordering Bangladesh); Lai (in Lawgtlai, Sangau and Chawngte point); and Mara (Saiha district), with a total population 173,885 (2001 census). This ethnozoological study was carried out in five purposively selected districts of Mizoram, mostly with the *Zomi-Paite* community in Champhai district.

Data collection

In order to collect data on medicinal and nutritional values of animal resources from Arunachal Pradesh, East Siang district was selected purposively, based on people's proximity to forests and their dependency on wild resources for food and medicine. Within East Siang district, the Pasighat subdivision, and within this area, we sampled six total villages randomly: Balek, Yagrung, Runne, Mirsam, Yabgo and Sibut. In each village an informal discussion was held with

the Community Chief *Gaon Burha* to identify key knowledge holders for animal resources. For each village, a list of such experts was prepared and they were contacted as potential participants. After they were advised about purpose of the study and had given consent, they were interviewed. From the six villages, a total of 60 persons (approximately 10 per village) were interviewed. Before starting the formal interviews, an informal meeting was held and a focus group discussion was organized to understand the dynamics of Ethnozoological resources and knowledge at the village level. Biodiversity contests were held among the adults of the villages to gain information on various Ethnozoological species used in foods or medicines and for cultural and spiritual purposes. The knowledge holders were interviewed in an informal environment with open-ended questions. Written notes were complemented by use of an audio-recorder during the interviews, and the recordings were later transcribed. At the outset, it was evident that the knowledge relating to use of animal resources in medicines, foods, cultural and spiritual purposes was part of a complex 'community knowledge system.' For this reason, prior informed consent (PIC) was obtained from the village *Gaon Burha* – who is the representative of the *Adi* community. However, in cases where some knowledge on a particular practice relating to animal resources was claimed by an individual, then PIC was also obtained from that individual.

Zootherapy (the treatment of disease and maintenance of health with medicines from animal products) forms an integral part of local cultures in Arunachal Pradesh and Mizoram, and information about animals and their uses is passed down from generation to generation through oral folklore or shared by word of mouth, primarily amongst the older generations. Elders are recognized as natural reservoirs of traditional knowledge in their respective communities. A field survey on Zootherapy practices was carried out in randomly selected villages of Arunachal Pradesh during 2006 to 2008 and in purposively selected villages of Mizoram from January to December 2010.

Information on the use of medicinally important faunal species was obtained primarily through an informal interview schedule with open-ended questions and group discussions. The authors travelled from village to village and door to door to identify key respondents. Questions were asked

about ailments for which the animal-derived remedies were used, and about the preparations and administration of these medicines. People who consider themselves, or are considered by the community as having exceptional knowledge about the use of animals were also identified carefully and then interviewed individually in a formal interview schedule in their respective localities. In all, 32 individuals (21 men and 10 women) were interviewed with varying age groups (Fig. 1).

The interview information was analyzed and cross-checked with available literature for further authentication. For each animal species mentioned, the local name in local dialect, part used, mode of application and medicinal uses were represented, along with correct zoological name and family/order name. The majority of discussions from Mizoram state focused on faunal species used in home remedies, the parts used, and their respective preparation, application, and associated techniques. Secondary data were gathered through available relevant literature. Most of the data from knowledge holders of Mizoram was collected from informal interviews, although, some of the Ethnozoological practices were recorded in through participant observation. Prior informed consent (PIC) was obtained from the village chief. However, in cases where some knowledge on a particular practice relating to animal resources was claimed by an individual, then PIC was also obtained from that individual.

Results and discussion

Results reveal that, *Adi* tribe use about 39 species of aquatic and terrestrial animals in their health system (Table 1). The specific usage and of each species are listed with specific health purpose, while further, over here about some specific species for the details aspects are discussed. Ethnozoological resources are integral parts of the medicine, food, cultural and spiritual systems of *Adi* tribe, for whom use of a total of 39 species of aquatic and terrestrial animals in their health system were recorded (Table 1). The specific usages for each species are listed with their specific associated ailments, and, as well, applications of certain species are described in greater detail. The Ethnozoological resources are collected through hunting and day-to-day food gathering practices. *Adi* male hunters will cut a particular body part from the animal they hunt

Table 1—Ethnozoological resources used by *Adi* tribe of Arunachal Pradesh for food, ethnomedicines and sociocultural purposes

| Species | Zoological name | Ethnomedicinal, food and other values |
|---|--|--|
| Aquatic species | | |
| <i>Ari machh</i> | <i>Mystus seenghala</i> | This species is given to the new mothers |
| <i>Frog</i> | | Bones are used for taboo purposes |
| <i>Ghongha-I</i> | <i>Paludomus conica</i> | Given to week person, diabetic patient and used in fertility enhancement |
| <i>Ghongha-II</i> | <i>Parreysia sikkimensis</i> | Given to week person, diabetic patient and used in fertility enhancement |
| <i>Goroi machh</i> | <i>Channa punctatus</i> | This species is given to the new mothers and patient suffering from malaria |
| <i>Kachhua</i> (turtle) | <i>Cyclemys gemeli</i> | Used in food and bones are used to cure skin disease, and in cultural purposes |
| <i>Kaoui</i> | <i>Anabas testidunus</i> | Given to week persons for energy improvement, and used in curing malaria. |
| <i>Mangur machh</i> | <i>Clarius batracus</i> | Given to week persons for energy improvement |
| <i>Ngopi machh</i> | | Given to old age, diabetic person, and used in curing skin disease |
| <i>Prawn</i> | <i>Penaeus indicus</i> | Given to old age and diabetic person |
| <i>Puthi machh</i> | <i>Puntius</i> spp. | Given to old age and diabetic person |
| <i>Singhi machh</i> | <i>Heteropneustes fossilis</i> | Given to week persons for energy improvement |
| <i>Take</i> (crab) | <i>Scylla serrata</i> | Given to old age, diabetic person, and used in curing skin disease |
| <i>Talu machh</i> | <i>Indigenous to Arunachal Pradesh</i> | Given to diabetic patient and new mothers |
| <i>Tengna machh</i> | <i>Mystus cavasius</i> | Given to week persons for energy improvement |
| Birds and other animal species | | |
| <i>Bandar</i> | <i>Maccaca mulata</i> | Meat in food, bones in fertility and skull in showing hunting art |
| <i>Banel</i> (boar) | <i>Sus scrofa</i> | Meat in food, bones in fertility and skull in hunting art |
| <i>Chamgadad-I</i> | <i>Sphaerias blanfordi</i> | Used as meat, wings are used for curing skin diseases, in delivery and bones are used as taboo item for domestic animals |
| <i>Chamgadad-II</i> | <i>Taphozous nudiventris kachhenis</i> | Used as meat, wings are used for curing skin diseases, in delivery and bones are used as taboo item for domestic animals |
| <i>Chittidar owl</i> | <i>Otus spilocephalus</i> | Used as taboo item and to escape evil spirit |
| <i>Chuha</i> | <i>Cannoyms badius badius</i> | Used in meat and cultural purposes |
| <i>Goh saanp</i> | Lizard group | Curing joint pains and skin diseases |
| <i>Harnbil-I</i> | <i>Anorrhinus austeni</i> | Used in meat for energy enhancement and in cultural signal in their cap |
| <i>Harnbil-II</i> | <i>Anthracoceros albirostris</i> | Used in meat for energy enhancement and in cultural signal in their cap |
| <i>Hepa</i> (wild cat) | <i>Felis vhaus</i> | Used in meat food |
| <i>Jhadiwala chua</i> | <i>(Golunda elloti elloti</i> | Used as meat and given to old aged persons |
| <i>Jungle eagle</i> | <i>Bubo nipalensis</i> | Used in meat for and as cultural signal at the entry point of house |
| <i>Kebung II</i> | <i>Hylopetes alboniger</i> | Used in food and cultural purposes as dowry item |
| <i>Kebung-II Malayan giant squirrel (MGS)</i> | <i>Ratufa bicolour</i> | Used in food and cultural purposes as dowry item |
| <i>Kebung-III, Red-bellied squirrel (RBS)</i> | <i>Callosciurus erythraeus</i> | Used in food and cultural purposes as dowry item |

(Contd.)

Table 1—Ethnozoological resources used by *Adi* tribe of Arunachal Pradesh for food, ethnomedicines and sociocultural purposes (*Contd.*)

| Species | Zoological name | Ethnomedicinal, food and other values |
|--|--|---|
| <i>Kebung-IV</i> , Hoary-bellied squirrel (HBS) | <i>C. pygerythrus</i> | Used in food and cultural purposes as dowry item |
| <i>Kebung-V</i> , Himalayan striped squirrel (HSS) | <i>Tamiops macclellandi</i> . | Used in food and cultural purposes as dowry item |
| <i>Kaoua</i> | <i>Corvus</i> spp. | Used in spiritual purposes |
| <i>Lomadi</i> | <i>Vulper bengalensis</i> | Meat in food, bones in fertility and skull in showing hunting art |
| <i>Manta (red ants)</i> | | Eggs and adults are used in curing malaria |
| <i>Mithun</i> | <i>Bos frontalis</i> | Most prestigious semi-wild animal used in meat and cultural purposes as dowry item |
| <i>Nwur moose</i> | <i>Herpestes auropunctatus</i> <i>Auropunctatus</i> | Meat purpose and use in spiritual purposes |
| <i>Pahadi maina</i> | <i>Gracula religiosa</i> | Used in meat for energy enhancement |
| <i>Pedwala chuha</i> | <i>Niviventer fulvescens fulvescens</i> | Used in meat and cultural purposes as dowry item |
| <i>Ruk-kung</i> | <i>Oecophylla smaragdina</i> | Given to old age persons and curing digestive system |
| <i>Salika</i> | <i>Acridotheres tristis</i> | Used as meat, in taboos and spiritual purposes |
| <i>Shahi</i> | <i>Hystrix hodgsonii</i> | Tail is used for testing alcohol power and poison in the traditional beverage called <i>opong</i> |
| <i>Siyar</i> | <i>Canis aureus</i> | Used in meat and bones are used for curing skin diseases |
| <i>Tari</i> | <i>Aspongopus najus</i> | Curing malaria and predicting weather |
| <i>Udnewala kebung</i> | <i>Belomys pearsoni pearsoni</i> | Used in food and cultural purposes as dowry item |

and preserve it for later use to treat a particular disease. For an example, gall bladders of bear and deer are removed when the animal is killed and, after shade drying, they are preserved to use in treating malaria. Similarly, women have also developed their own knowledge systems in use of animal resources in medicine and healthcare. For example, while gathering foods from forest, *Adi* women collect larvae of an ant, called *run-kung* (*Oecophylla smaragdina*) (Fig. 2) to administer to a person suffering from malaria. Interestingly, the adults of this ant are left on the back of a malaria patient. After coming into the contact of body, these adult ants frequently bite and inject some acids/hormones into a person suffering from malaria. This results in increased body heat and, ultimately, curing the patient. During this treatment, however, precautions are taken in food consumed. Malaria suffering persons should not eat bamboo shoots either in fresh or fermented form, because, it is said, the malaria will be activated and curing of this disease becomes problematic. It has been learned that while fishing, *Adi* women (who are skilled in catching fish in forest streams and rivers) select *singhi* (*Heteropneustes fossilis*) and *mangur* (*Clarius batracus*) for the preparation of a special dish. These two species are given to those people who are weak and need an immediate supply of energy. Similarly,

Adi women collect the *tari* insect (*Aspongopus najus*) (Fig. 3) and give it to a malaria patient after mixing it with some local leafy plants (e.g. *ongin-Clerodendrum colebrookianum*, *bangko-Solanum spirale*, etc.). The *pumger* larvae are exclusively collected by *Adi* women, to be used as a cultural food and as part of economic adaptation during food shortage. This food is preferred by persons with digestive problems and is given to jaundice patients under supervision of a traditional healer.

It was found that elders of remote villages use porcupine tails (Fig. 4) to detect the level of alcohol and poison in the traditionally made beverage called *opong*. The quills have been used among the *Adis* for making tattoos, other than in acupuncture therapy. Lizard species are used extensively in curing joints pain. Further, about four species of *kebung*s (squirrel species found in Arunachal Pradesh Table 2) are widely used in food, as a dowry in marriage and for medicinal purposes. The foods prepared from *kebung*s are given to old aged person, to new mothers for enhancing lactation and to those with high blood pressure. Some species, such as hornbill (Fig. 5), have been used in a number of cultural and spiritual purposes, whereas the skulls of boars, monkey (Fig. 6), deer (Fig. 7) and other animals are used as decorations and hunting victory items in front of

every *Adi* house, as well as in their community hall (*mosup*). Bones of these animals have been used to improve fertility and virility of men.

Despite the transition from traditional agriculture, forest dependency and food gathering to settled agriculture and commercial cultivation of market crops (orange, pineapple and ginger), the *Adi* are still dependent on Ethnozoological resources for the food, health and socio-cultural purposes¹⁴. However, this transition is affecting the level of conservation of the animal species reported in this paper. For an example, *kebung*s are now being hunted for sale into local markets for income, which has never been the case in the past (about 20 yrs back). *Kebung*s have always been part of the marriage and food system, however, people hunted them sustainably, only for meeting their subsistence and ceremonial needs. There is a similar story behind the slaughtering of *mithun*, the wild cattle, for marketing purposes. Despite a considerable level of dependency on Ethnozoological resources by *Adi*, the ever-mounting population growth of state and aggressive deforestation for *jhum* agriculture (swidden agriculture) with a reduced fallow period (average 7-8 yrs) have further compounded to cause a rapid erosion of forest faunal biodiversity. The *Adi* communities – who are exclusively dependent on forest and river resources – have to face the negative consequences of this situation. Ethnomedicines, foods, health of human and animals and biodiversity conservation have all been tightly linked together in the past. Now, attraction of many towards a materialistic culture and overall modernization has changed the balance of these factors. On the one hand, increasing use of modern drugs may decrease pressure on local species harvested for ethnomedicines. On the other, however, the commercial use of such resources as food and as marketed products could still accelerate the erosion of biodiversity and potential extinction of species. Refinement and validation of some of the reported ethnomedicinal and health foods can help to discourage some belief based practices, and may ultimately reduce demand for these species. Some of the species with particularly high food and cultural values, such as *mithun*, *kebung*s, hornbill, and some fish species, need immediate scientific attention in order to help develop animal and fish husbandry practices. This approach could significantly reduce the hunting of these species but for it to work, it will need cooperation and coordination in between agriculture and forest departments, to help rationalize

agricultural and forest habitats to conserving threatened animal species. Differences in ecological ethics between old and young generations was observed to be a critical factor in the conservation of aquatic and terrestrial animal species¹⁵⁻¹⁷. Older *Adi* people still follow traditional practices of hunting (using plant-based poisons, manual traps, traditional fishing nets, etc.) and accessing animals used in food and ethnomedicines from various habitats. Younger people tend to use more destructive modern tools and techniques (such as dynamite, high voltage electric current and bombs in fishing, air-guns and pistols in hunting, etc.), which leads to rapid depletion of animal populations¹⁶. Use levels of particular species in food, ethnomedicines and culture are governed by many factors including social, cultural, economic, technological and political. Ability to balance all these factors is important in sustaining species in any particular ecosystem and habitat.

A total 48 faunal species having Ethnozoological values among the knowledge holders of Mizoram State were documented. Table 2 provides an inventory of these species, including their zoological names, common and local names, zootherapies, and modes of preparation and administration. These animal resources used as medicines by the tribal people of Mizoram consist of: mammals (21), birds (6), reptiles (7), arthropod (1), amphibian (1), annelids (2), insects (6), fish species (2), arachnida (spider) (1) and diplopods (1) (Fig. 8). These animal resources are used in the treatment of over 50 kinds of diseases or ailments for humans and/or as veterinary medicines: including asthma, arthritis, leprosy, malaria (Pv & Pf), wounds, burns, diarrhea, women's medicines, convulsions, earache, respiratory ailments, kidney problems, cholera, tuberculosis, diabetes and hypertension, jaundice and liver problems, rheumatism, stomachache, and dysentery. Asthma, malarial fever and stomachache are the most frequently cited ailments.

Based on effectiveness in curing diseases and ailments the most important species identified were: *Tachypodoiulus niger*, *Upupa epops*, *Python molurus*, *Pheritima* spp., *Hysterix indica*, *Ovis aries*, *Cimex lactularis*, *Calotes calotes*, *Nycticebus coucang*, *Myrmelon formicarius*, *Bufo melanostictus* and *Apis mellifera* (honeybee). The medicinal parts of the animals used included fat, feathers, hair, bile, blood, meat, bone, skin, milk, and liver. These parts were used raw or in cooked/boiled/roasted form. Zootherapeutic products are consumed or applied in

Table 2—Ethno-Zootheurapeutical inventory of practices from Mizoram states followed by local tribes

| S. No. | Zoological name, common name and local name | Parts use | Treated disease | Method of preparation and mode of application |
|--------|---|--------------------------------------|--|---|
| 1 | <i>Apis mellifera</i> Linn. Honey-bee (Khawi-vah) | Honey | Throat pain Irregular - menstruation Burns and cuts: | Mixed with ginger and taken orally. Mixed with alcohol (traditional beverage) and in same proportion and drink at bed time. Topically applied on affected portion. Mixed with turmeric powder or solely taken orally. |
| 2 | <i>Arctonyx collaris</i> Collaris Cuvier Hog badger (Phi-vawk) | Fatty-oil | Cancer | Fatty oil is taken internally with water @ ½ cup once a day. |
| 3 | <i>Bos gaurus</i> Smith. Indian Bison (Bawng) (Pure black color is prefer) | Urine (collected at morning) Bile | Scurvy (at thigh and leg) Asthma | First urine is collected in morning and taken it orally @25ml or more. Mixed with rice, eaten twice a day and continued for 7 days ¹⁸ . |
| 4 | <i>Bagarius bagarius</i> Hamilto – Buchanan . Gangetic goonch (Thaichawni-nu) | Fatty-oil | Gout, rheumatism & joints | Equal part of fatty-oil with those of <i>Rhyticeros undulatus</i> , <i>Hylobates hoolock</i> and <i>Panthera tigris</i> are mixed and massaged on the body ¹² . |
| 5 | <i>Bufo melanostictus</i> Schneider Toad (Utawk/Tawkphar) | Bile | Diabetes | Fresh bile taken as such orally. |
| 6 | <i>Calotes sp.</i> (Laiking) | Roasted meat | Pneumonia, asthma, cough. | Fried-dried meat is cooked and taken. Compulsive bite. |
| 7 | <i>Calotes versicolor</i> Daudin Common garn lizard (laiking-awr-sen) | Dried meat, roasted meat | Asthma, cough & cold. | Dried meat is roasted or grinded up and eaten. Remove skin and put on fire and taken internally. ¹² |
| 8 | <i>Callosciurus pygerythrus</i> Geoffroy Hoary bellied squirrel (Hlei-pui Mei-par) | Meat and soup | Antispasmodic, swellings & sprain. | Meat is cooked and broth obtained is taken internally ¹² . |
| 9 | <i>Canis familiaris</i> Dog (Ui) | Fresh blood Skull | Asthma, fever, as haemostatic Burn (fire) | Fresh and warm blood is drunk. Burn and make into powder form and applied on affected area thrice daily. |
| 10 | <i>Canis aureus</i> Linn. Jackal (Sihal) | Head | Wounds & ulcers | Powdered ex-skeleton applied externally |
| 11 | <i>Capra hircus</i> Linn., <i>Capra capra</i> Goat (Kel) | Fresh milk, Liver | Snake bite. Night blindness | Drink 100 gm of <i>Acalyfa</i> leaf +250 gm of liver roasted for 15-20 mins without oil. This mixture is administered to the patient to take 2 hrs before meals. The patient should avoid taking salty substance in advance ²¹ . |
| 12 | <i>Capricornis sumatraensis</i> Bechstein Serow (Sa-za) | Dried tongue Horn | Chronic ulcer Revitalization | Ground to powder and applied externally. Scrapped tender horn mixed with milk ¹² . Young horn is eaten after roasting. |
| 13 | <i>Carausius morosus</i> Stick insect (Ar-a-mawnghawlh) | Whole part | Wounds, prickling spines | Whole part of body grounded into paste and is applied on the body ¹² . |
| 14 | <i>Centropus sinensis sinensis</i> Stephens. Crow pheasant (Lal-ruanga se-hnawt) | Meat | Asthma | Meat is boiled with rice and is eaten ¹² . |
| 15 | <i>Cervus unicolor</i> Kerr Sambar (Sa zuk) | Tender horn (male) Blood | General weakness Dysentery | Deposited substance inside the horn is taken as such and mixed with honey. Dry blood + sugar administered for three days ¹ . |
| 16 | <i>Chiroptera sp.</i> Bat (Bak) | Meat Bone | Involuntary urination in nights (children) Toothache | Roasted meat given to children above 2-10 yrs old ¹² . Stretch feather and put water upon it, keep for sometimes and drink, repeated if required. Powder form placed at affected area. |

(Contd.)

Table 2—Ethno-Zootheurapeutical inventory of practices from Mizoram states followed by local tribes (*Contd.*)

| S. No | Zoological name, common name and local name | Parts use | Treated disease | Method of preparation and mode of application |
|-------|--|--|--|---|
| 17 | <i>Cimex lactularis</i> Bed bug (Khum-fa) | Whole part | Inflammatory glands, boils & ulcers. Malarial fever (Pv) | Bugs (3 Nos) are crushed and applied on the affected part of body. 3-5 bugs inserted into empty capsule and taken orally. Two to five times is sufficient to get rid of chronic fever. |
| 18 | <i>Cyprinus carpio</i> Linn. Common carp (Sa-ngha) | Bile fat | Fever, headache | Biles are swallowed and fat is taken/eaten |
| 19 | <i>Gallus gallus</i> Linn. Red jungle fowl (Ar) | Feather Fat & meat | To remove pin-worms. Nasal obstruction | Burnt feather applied on anus. Pour 2-5ml of warm fatty oil into nose. |
| 20 | <i>Geochelone elongata</i> Blyth Star tortoise (Sa-tel) | Fluid coming out from the neck. | Piles | Applied externally ¹² . |
| 21 | <i>Gryllus pensylvanicus</i> Field cricket (Perhpawng) | Whole part | Chest problem | Roasted and taken orally. |
| 22 | <i>Herpestes edwardsi</i> Geoffroy Common mongoose (Sari-vaithun) | Meat | Inflammatory diseases, measles, pork allergy. | Fresh meat is taken after a proper boiling ¹² . |
| 23 | <i>Heteropoda venatoria</i> . House spider (Mai-mawm) | Dead and dry spider | Ottorhoea | Dead and dry spider is grounded to powder and put into the orifice, wrapped it up with a soft cloth ¹² . |
| 24 | <i>Hylobates hoolock</i> Harlan Hoolock gibbon (Hauhuk) | Meat Fresh & warm blood Bored tusk/ bone | Facilitate easy labor. Bee-sting, Colic, hepatitis, hemicranias, Tuberculosis & fever. Bone fracture Headache & toothache. Prevent the attack of diseases. | Cooked meat is given to pregnant woman; soup taken internally. Blood mixed with local liquor and taken internally. Drink 10 ml at a time ¹² . Blood mixed with turpentine and is applied externally. Tied with thread on waist or wrist ¹² . |
| 25 | <i>Hystrix indica</i> Kerr. Indian porcupine (Sa-kuh) (Figure: 8) | Meat Intestine & Rectum | Pregnant women Prevention and remedy against common bird-flu. Stomachache, colic, dysentery, fever, malarial fever. Colic | Making labor easy at the time of delivery. Mixed with water and given to the poultry birds (reported to be effective) Stomach/intestine taken with or without water internally twice daily. Boil in water and administered twice a day for 7 days ¹ . |
| 26 | <i>Lutra perspicillata</i> Geoffroy Otter (Sahram) | Male organ | Aphrodisiac. Sexual debility | Boiled or roasted male organ taken as such to improve sexual debility in couple. It is also given to women who do not conceive ¹² . Special remark: A person who had touched the alimentary canal of this animal (live one) has able to eject substance like coins, stuck at the esophagus by touching the patient's neck. |
| 27 | <i>Limnaea</i> sp. Water snail (Chengkawl) | Flesh | Measles, liver ailment & jaundice. Swellings & sprains | Male and female limnaea are boiled in water and the flesh inside the crush is picked out and eaten. Limnaea boiled with <i>Pteridium aquilinum</i> (L) Kuhn. (<i>Cha-kawk</i>) and taken internally ¹² . Remark: It is also given to rearing birds for regular laying eggs (the meat is rich in calcium) |

(Contd.)

Table 2—Ethno-Zootheurapeutical inventory of practices from Mizoram states followed by local tribes (*Contd.*)

| S. No | Zoological name, common name and local name | Parts use | Treated disease | Method of preparation and mode of application |
|-------|---|-----------------------------------|---|---|
| 28 | <i>Maccaca assamensis</i> Mc Clelland. The Assamese Macaque (Zawng) | Meat Brain Fresh warm blood | Easy labor General weakness Malarial fever | Cooked meat is given to pregnant women ¹² . Cooked brain given to the children to impart body activeness. Fresh blood is taken orally. |
| 29 | <i>Manis crassicaudata</i> Gray Indian Pangolin (Saphu) | Bile Meat Scale/feathers | Splenomegaly Muscle stiffness Appetizer Piles | Cooked bile taken internally. Meat is boiled or fried and taken. Inhaling the burning smoke of scale/feathers. The ring is made up from the feather and tied on finger or neck or leg ¹ . |
| 30 | <i>Melursus ursinus</i> Shaw Sloth bear (Savawm) | Bile Hair, fat | Stomachache, dysentery, diarrhea, indigestion, etc. Fever, rheumatism | A pinch of solid bile is given to patient. Sometime mixed with clay soil when it in liquid forms ¹² . Hair burnt + honey is given to patient for 3 days ¹ . |
| 31 | <i>Muntiacus muntjak</i> Zimmerman Barking deer (Sa-khi) | Horn Fresh urine | Revitalization of body or stamina. Otorrhoea | Young horn is scrapped and taken with water. Urine is dropped into the ear. |
| 32 | <i>Myrmelon formicarius</i> Ant-lion (Thiam-thai-nu) | Whole part | Warts or verrucose | It is crushed and applied on wart which was pricked to bleeding ¹² . |
| 33 | <i>Nycticebus coucang</i> Boddaert Slow loris (Sahuai nido) | Dry bones, ribs Hairs | Self defense against the magic power of witchcraft, the power of which remain inactive. Haemostatic | Dry bones or ribs kept in the pocket/body Applied on cuts to stop bleeding. |
| 34 | <i>Ovis aries</i> Sheep (Beram) | Meat Fat | Skin disease (white patches cover whole body) Rheumatism, arthritis | Eaten after dressing (boiled/fried). One time taking also very effective. Fat used as massage oil on the affected area. |
| 35 | <i>Panthera tigris tigris</i> Linn. Tiger (Sakei/keipui) | Fatty-oil Liver | Scabies , itches and Leprosy Tonic and courage | Fatty-oil is applied externally ^{12,21} . The gall stone mixed with honey and taken as tonic. The liver is eaten to impart courage ¹ . |
| 36 | <i>Paratelphusa</i> sp. Fresh water crab (Chak-ai) | Boiled crab Whole body | Inflammatory glands/diseases. Warts. Jaundice & liver | Crabs are boiled and the water is drunk. Living crabs are crushed and applied externally on the body. Grind with boiled wild banana male flower (pendant) and taken orally. |
| 37 | <i>Periplaneta americana</i> Linn. Cockroach (Chuk-chu) | Body | Asthma, stomachache Saliva exuding out of mouth in children | Cockroaches are killed, sundried and boiled and the water is drunk, or taken as tea ¹² . Fried or roasted and taken orally. |
| 38 | <i>Pheritima</i> spp. (Changel-changpat) | Whole body | Chronic fever, malaria (Pv)and convulsion | Taken as such orally or grind and mixed with honey and drink. |
| 39 | <i>Python molurus</i> Linn. Python (Sa-phai) | Bile & meat Fatty substance | Colic, stomachache, dysentery, cholera, hotness inside stomach & localized headache, fever. Burn, Cut and wound (as fly repellent) Easy labor at the time of delivery. | A small piece of dried bile is eaten. Smeared on affected portion. The fatty oil after warming smeared on the cut or wound /injured portion, no fly will attack which enhance healing (better than Himax for animals). Warm oil is smeared over abdomen when the pain initiated. |

(Contd.)

Table 2—Ethno-Zootheurapeutical inventory of practices from Mizoram states followed by local tribes (*Contd.*)

| S. No | Zoological name, common name and local name | Parts use | Treated disease | Method of preparation and mode of application |
|-------|--|---|---|--|
| 40 | <i>Picus canus hassei</i> Stolpe Blacknapped green wood pecker (Thloh) | Meat | Asthma | Cooked meat is taken internally ¹² . |
| 41 | <i>Rhinoceros unicornis</i> Linn. Genda (Sa-mak) | Horn | Anti-venom | Horn dipped in pure milk for 30 minutes and placed at biting point. |
| 42 | <i>Rhyticeros undulatus ticehursti</i> Deignan Wheathead Hornbill (Kawl-hawk) | Fatty -oil | Easy labor | Warm fatty-oil applied on the waist of pregnant women ¹² . |
| 43 | <i>Sus scrofa cristatus</i> Wagner Wildpig (Sa-nghal) | Meat | Pile disorder | Cooked meat is taken as meal ¹² . |
| 44 | <i>Tachypodoiulus niger</i> Black millipede (Ketami-nu) | Whole part | Tuberculosis | Decoction is prepared and taken orally. |
| 45 | <i>Tehanochelys trijuga</i> Turtle (Sum-si) | Meat Bile | Cooked meat taken. The bile dipped into water for sometime is drunk. | Malarial fever. Effective in curing diabetes |
| 46 | <i>Varanus bengalensis</i> Daudin Monitor (Tangkawg) | Tongue Skin (dried) Meat Bile Meat and skeleton | To stop stammering in children. Expellant of bedbug. Asthma. Malarial fever Arthritis | Cooked tongue is given to children. Dried skin is burn and the smoke is fumigated near the bed at night time. Cooked meat is eaten. Cooked bile is swallowed. One kg of meat + skeleton of the monitor mixed together with 3 L of coconut milk and boiled till the meat is completely dissolved. ²¹ |
| 47 | <i>Upupa epops</i> Common hoopoe (Chhuangtuar) | Body | Kidney problem | Boiled of roasted meat taken as curry. |
| 48 | <i>Viper ruselli</i> (Shaw) (Rul-ngan) | Fatty -oil Bile | Warming Fatty oil Malarial fever | Applied on warts or verrucose ¹² . Whole or as convenient size orally taken. |

several ways, mostly through ingestion or direct application to the affected area and usually not in association with other animal derived ingredients. In some cases, however, an association with medicinal plants or other resources was observed. For example, to treat jaundice, people use banana pendant in association with crab. Besides these, constituent animal parts such as leather, spines, tusk and bone, skin, hair and horn are usually naturally dried, and then ground up. The resulting powder is used in tea preparations, or mixed with milk or food and ingested, or directly applied externally. Honey, fats and oils are usually massaged in the affected areas or ingested. There is no specific dosage for treatments; it depends on factors such as availability of the resources and age group of patients. Notably, younger *Mizo* were less

knowledgeable than their elders in ethnomedicinal knowledge regarding animals (Fig. 9).

There are many medicinal reports about the effectiveness of the honey in treating fresh wound, gastric ulcers or gastro-intestinal disorders in humans^{15,18,19}. Similarly bile of python, viper, bear, and other animals was reported to be very effective a curative agent. Some species were used specifically for women and some were specific to children. It was found that cough, asthma and other respiratory diseases were the most frequently cited type of ailment. The pioneer work from the state pointed out that at minimum 10 animal species were used in *Mizo* traditional medicine for treating asthma and respiratory diseases¹². A number of faunal species were found to have been used by the tribe since



Figs 1-9—(1) *Ruk-kung* (*Oecophylla smaragdina*); (2) *Tari* insect (stink bug/ shield bug) used as chutney; (3) Tail of porcupine tied with thread: This is used for testing poisonous and alcoholic power in traditional beverage called *opong*; (4) Skull of monkey hanged in an *Adi* house; (5) Head of hornbill to be used in *Adi*'s cap; (6) Skull of deer hanged in an *Adi* house; (7) Head of monkey with brain for sale; (8) Horn and head of Serow kept for sale and (9) Dead body of monitor collected for meat and other purpose

ancient times. The common dilemma facing all faunal species is the soaring demand for their body parts for use in medicinal products³.

The majority of wild animals in trade for use in traditional medicinal preparations are collected from

the wild, and the continued depletion of medicinal wildlife resources not only poses a challenge for conservation, but also represents a serious threat to the health status of human populations^{20,21}. For instance, the skin of *Luthra perspicillata* was

marketed @ Rs 1500/ during the 1990s. Similarly, scale of *Manis crassicaudata* was sold @ Rs 1000 in 1996. More recently 1 kg can bring @ Rs 12000-13000 to the middle man in different parts of Mizoram. These wild resources are already reported to be declining in population and spread, in most cases very severely³. Certain animals are already becoming rare due to indiscriminate killing for traditional medicinal preparations¹⁶. Also, reports of scarcity of species used for traditional medicine are being received with increasing frequency.

Conclusion and policy implications

It has been concluded that Ethnozoological practices are an important component of traditional healthcare for the people of Arunachal Pradesh and Mizoram. This study identifies and characterizes the very rich Ethnozoological knowledge of these people in relation to traditional food, medicine and culture. Even today, large populations of both the studied regions of northeast India are using ethnomedicines for treating various diseases and ailments. However, various socio-political and economic changes in the way these zoological medicines are harvested are causing depletion of biocultural resources among studied tribes. This problem of unsustainable use is greater among members of the younger generation and in villages near urban areas since they are exposed to globalization and modern media through which a consumerist philosophy is diffusing rapidly in social systems. There is now need to refine and validate some of the ethnomedicinal practices with an ultimate view of minimizing the pressure on animal populations and sustaining the bioresources from diverse ecosystems. This could also help in other ways to support tribal communities in facing the challenges posed by economic globalization as well as climate change. Younger generations need appropriate education and consultation with the elders of their respective communities in order to learn about biocultural knowledge relating to various species and habitats. This educational process can help to provide better understanding of the status of species and their respective ecosystems, and therefore to promote their conservation through integrated approaches and practices. Poaching and smuggling of animals body parts from communities and other reserve forests of these regions should be condemned at all levels. This work can be pursued effectively by the Indigenous Institutions of each community of the two states

with integrated efforts and assistance of the state Departments. NGOs can take a lead in this regard to develop appropriate plans to enhance biodiversity conservation.

It is hoped that results of this study will be useful in developing further research in the fields of Ethnozoology, Ethnopharmacology, environmental conservation and Ethnocoological restoration. Education on domestication, conservation and preservation of biological diversity in a more effective, systematic and sustainable way should be the most important consideration in devising measures to ensure permanent and reliable sources of ethnomedicines based on number of species found in India that could be used by Indian citizens^{22,23}. Traditional healthcare, including sustainable use of Ethnozoological medicines, should be integrated by the government into the existing healthcare system in a manner that ensures effective conservation of the species used in ethnomedicines, foods and cultural purposes.

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