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RESEARCH ARTICLE

Ethnozoological Insights on the Traditional Practices and Knowledge Among the Chang Tribe of Nagaland

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Abstract: The Chang tribe inhabiting the Tuensang district of Nagaland has a rich tradition of ethnozoology. The present study was conducted to record therapeutic efficacy of traditional knowledge and zootherapeutic practices. Documentation is based on semi-structured questionnaire and group discussion. The data collected were analysed using use value (UV), fidelity level (FL) and informant consensus factor (ICF). The present study recorded 43 animal species with 9 belonging to the invertebrate group and 34 to the vertebrate group. Among the vertebrate group, mammals are more extensively used (64.71%) followed by birds (20.59%), reptiles (8.82%), and both amphibians and Pisces have the lowest usage (2.94% each). While in invertebrates category, the Arthropoda phylum shows the highest utilization at 77.8%, followed by the Annelida and Mollusca phyla, each comprising 11.1%. The present study sheds light on the rich ethnomedicinal knowledge of the Chang Nagas, emphasizing the critical role of both vertebrates and invertebrates in their traditional medicine, henceforth, providing evidence of inter play between biological diversity and cultural practices also contributes to the broader understanding of biocultural diversity and its importance.

Keywords: Zootherapeutic, Use value, Fidelity level, Informant consensus factor

Introduction

The diversely extensive heritage and knowledge of folk medicines used by various ethnic communities worldwide to heal, cure, and manage various human ailments are products of their culture, traditions, native values, arts, ideas and rituals (Young, 1983; Janes, 1999). Numerous scientific reports in many parts of the world have documented the therapeutic use of ethnozoological animal products. World Health Organisation (WHO, 1993) report stated that around 70-80% of the world's population depends on traditional medicines for treatment, and humans have used natural chemicals since our early ancestors began harnessing natural resources for their benefit (Agosta, 1996). Despite significant advancements in medical science, the practice of treating patients with animal-based products has a long stand tradition (Jugli *et al*., 2020). In the traditional Indian system of medicine, Ayurvedic remedies, substances from animals like cow urine and buffalo milk are used for therapeutic purposes. Animal-based medicines have been elaborated from parts of the animal body, from products of its metabolism or from non-animal

materials (Costa-Neto, 2005). Nearly 15-20% of the Ayurvedic medicine is based on animal-derived substances (Unnikrishnan, 1998).

Liu *et al*. (2024) documented the use of 55 animal-derived medicines by the Gelao community in Northern Guizhou, China, of which 34 are sourced from wild animals. Similarly, Radha *et al*. (2022) recorded the zootherapeutic practices in Tiruppur district, Tamil Nadu, identifying 28 animal species used in treating 13 categories of ailments. In Sikkim, Dhakal *et al*. (2020) documented the use of 59 animal species in various ethnozoological practices. Kakati et al. (2006) reported that the Ao community utilizes 25 vertebrate species for medicinal purposes, employing different body parts to treat ailments. Among the Angami tribes of Nagaland, Doulo et al. (2019) recorded the use of 45 animal species-15 invertebrates and 30 vertebrates-in treating 38 different ailments through traditional medicine. A broader survey of existing literature on zootherapeutic applications across Northeast India reveals a predominant use of mammals and mammalian products in states such as Meghalaya, Mizoram, Nagaland, Sikkim and Tripura, with similar trends observed in Arunachal Pradesh and Assam. In contrast, fish-based medicines are more commonly used in Manipur, while in Arunachal Pradesh, insects are the most frequently utilized in traditional medicinal practices (Tynsong, 2021).

Materials and Methods

The present study was carried out in Tuensang District, a rural and tribal settlement under the state of Nagaland, India, situated in the eastern region of Nagaland, with an altitude of 1371m (26°14'60.00"N, 94°44'59.99"E) with an area of 915 sq. km. Documentation is based on semi-structured questionnaire and group discussion. Three quantitative tools (use value, fidelity level and informant consensus factor) were used for data analysis.

The Use Value (UV) was calculated to determine how important and common each animal species was, based on how often it was reported in the study area. It was computed as $UV = \Sigma Ui / n$, where Ui is the number of use-reports for a species and n is the total number of informants surveyed (Phillips et al., 1994). To assess how effective and important a species was for a specific disease, the Fidelity Level (FL) was used, given by $FL (\%) = Np/N \times 100$, where Np is the number of informants who reported using the species for that disease, and N is the number who reported using it for any medicinal purpose (Friedman et al., 1986). In order to use this tool, illness was classified into broad disease categories such as problems deemed (1) gastro-intestinal & parasitic, (2) dermatological, (3) respiratory, (4) gynaecological and reproductive health, (5) bites and bleeding, (6) musculo-skeletal, (7) neurological/physiological, (8) oral and pharyngeal, (9) genitourinary, (10) not classified, and (11) blood/blood forming.

Results and Discussion

The present study recorded 43 animal species with 9 belonging to the invertebrate group and 34 to the vertebrate group (Table 1). Some important animals used in ethnozoological practices by the Chang tribe have been shown in Fig. 1. The study shows more frequent use of vertebrates in traditional zootherapeutic practices within the Chang community, with mammals representing the most frequently utilized group, while arthropods constitute the majority of invertebrate-based remedies (Fig. 2, 3). The animal-derived products were used to treat a wide spectrum of ailments, from respiratory disorders, musculoskeletal injuries and gastrointestinal conditions to skin ailments and general health issues. Honey was found to be one of the most versatile remedies, being used for both internal and external treatments, whereas animals such as frogs, birds, porcupines, flying squirrels and pythons were associated with specific therapeutic applications. Overall, the results highlight the predominant role of vertebrate species in traditional medicine while also emphasizing the continued importance of selected invertebrates in indigenous healthcare practices.

Table 1. List of animal species used as therapeutics among the Chang tribe

Sl. No.	Scientific Name	Common Name	Local Name	Parts Used	Diseases treated
Non-Vertebrates					
1.	*Eisinia fetida*	Redworm	Khen-Khen	Whole body, Body fluid	Pneumonia, Ulcer, Intestinal problems
2.	*Lepidotrigona arcifera*	Stingless Bee	Muotshou	Honey	Fractures and dislocation, Cough
3.	*Apis cerena*	Honey bee	Nyangkhit	Honey	Cough and sore throat
4.	*Tipulia* sp.	Crane fly larvae	Die Yaang	Whole body/ body fluid	Mouth ulcers (among children), measles
5.	*Epicauta hirticornis*	Blister beetle	Phot Yaang	Body fluids	Warts
6.	*Myrmeleon immaculatus*	Antlion	Phaisuk/ Heebhü	Whole body parts	Splinter, warts
7.	*Papeipema nebris*	Stalk borer	Wanam Yaang	Whole body fluids	Intestinal problems, mouth and throat ulcers
8.	*Cancer* sp.	Crab	Hin	Whole body fluid	Cough
9.	*Pila globosa*	Snail	Khabthung	Whole	Cough
Vertebrates					
Sl. No.	Scientific Name	Common Name	Local Name	Parts Used	Disease
1.	*Rana* sp.	Frog	Yuk	Whole body	Wound healing, intestinal problems
2.	*Upupa epops*	Hoopoe	Mühghaü Aunak	Whole body	Tuberculosis, general issues
3.	*Ketupa nipalensis*	Spot Bellied Eagle Owl	Aulu	Down feather flesh	Cuts, body easing
4.	*Gallus gallus*	Chicken	Aunak	Fats, flesh	Burns, skin graft, injury complication
5.	*Passer domesticus*	House sparrow	Auningshou	Feces, Flesh	Boil, Ascariasis, evil eye illness

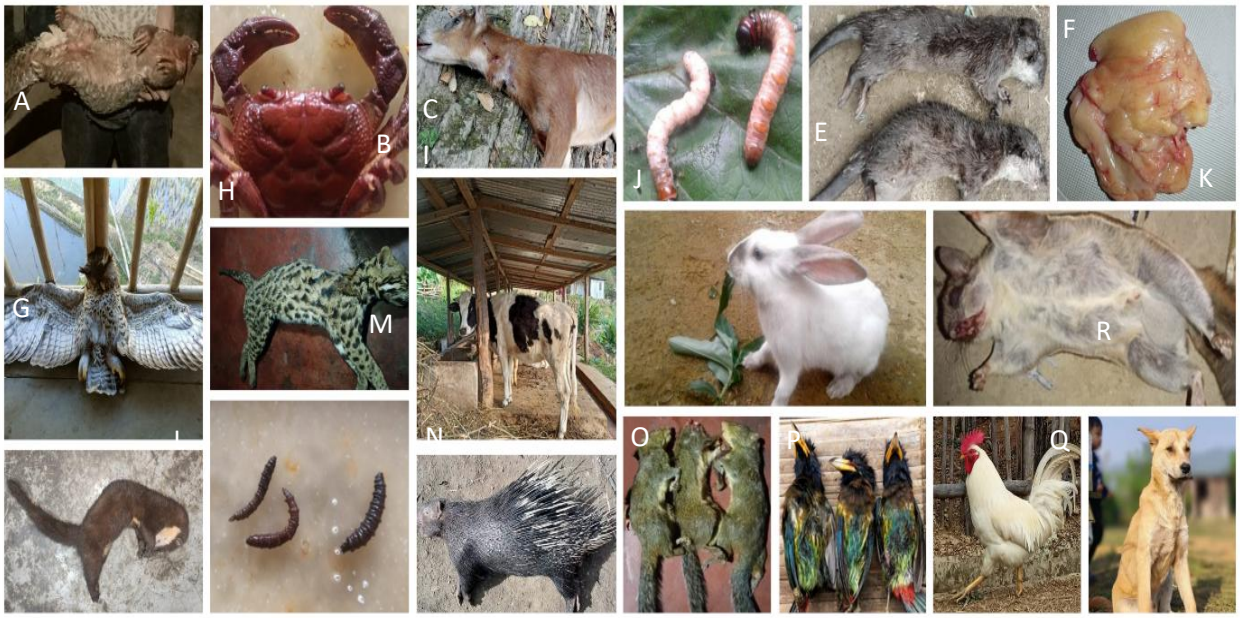
6.	*Psilopogon virens*	Great Barbet	Angu	Blood feathers	Fractures and dislocations, Tuberculosis, burns and bee sting.
7.	*Corvus calminatus*	Crow	Aukumak	Flesh	Malaria
8.	*Enicurus maculatus*	Spotted forktail	Aujeeng	Feathers	Splinter in body
9.	*Canis familiaris*	Dog	Kei	Blood, flesh, fur	Tuberculosis, Cough, dog bite, general issue, malaria, child delivery
10.	*Aonyx cinerens*	Asian small clawed otter	Laam	Claws	Remove bone stuck in throat
11.	*Funambulus* sp.	Squirrel	Kongnge	Whole blood	Cough, stomach ache, malaria, general issues
12.	*Naemorhedus* sp.	Goral	Yaüh	Bone marrow	Fracture and dislocation cracked heels
13.	*Capra hircus*	Goat	Lon	Blood, flesh	Tuberculosis, injury complications.
14.	*Moschus* sp	Deer	Meishi	Fetus, gall blader and small intestine	Child delivery, stomach ache, back ache, nutrient supplement.
15.	*Sus domesticus*	Pig	Ok	Piglet	Nutrient supplement, injury complications
16.	*Rhinolophus* sp.	Bat	Bak	Whole	Migraine, bed wetting, Pneumonia
17.	*Felis catus*	Cat	Danila	Whole	Evil eye illness
18.	*Semnopithecus entellus*	Northern plains Gray Langur	Ouh	Blood, flesh	Tuberculosis, General issues.
19.	*Suncus murinus*	Asian house shrew	Somshou	Whole	Cough, general issues, evil eye illness, irregular menstruation and cramps, stomach ache, malaria.
20.	*Bos taurus*	Cow	Masu	Gall bladder, Hoof, Fur	Stomach ache, dysentery.
21.	*Rattus norvegicus*	Albino Rat	Yebok	Whole	Pneumonia, Ascariasis
22.	*Pteromys* sp.	Flying Squirrel	Nyang	Whole	Cough, post stroke and injury complications.
23.	*Manis*	Pangolin	Kaomaitho	Scales, Flesh	Stomach ache, general issues,

	crassicaudata		k		Tuberculosis, evil eye illness.
24.	*Herpestes* sp.	Mongoose	Hawatshou	Whole, gall bladder	Ascariasis, diarrhea, malaria, cough, pneumonia, Tuberculosis, internal issues
25.	*Selenarctos sp.*	Bear	Saab	Gall Bladder	Stomach ache, general issues
26.	*Oryctolagus* sp.	Rabbit	Lang yuk	Whole	Cough, Ascariasis
27.	*Nannospalax sp*	Blind mole rat	Yuklou	Whole, Blood	Cough, chest pain, stomach ache and Diarrhea
28.	*Hystrix* sp.	Porcupine	Saan	Small intestine & stomach, whole	Cough, stomach ache, diarrhea, intestinal problem and malaria
29.	*Pteropus medius*	Flying fox	Lok	Urine, Whole, fur	Deaf, urinary problem, malaria, general issues
30.	*Prionailurus bengalensis*	Leopard Cat	Laat	Whole	Mental disorder, Cough
31.	*Monopterus albus*	Eel	Kongshi	Blood	Anemia
32.	*Rhabdophis plumbicolor*	Green Keelback	Sendek	Flesh	Ascariasis. Urinary problem, back ache
33.	*Indotyphlops braminus*	Blind Snake	Yungleang	Whole	Back ache
34.	*Python sp.*	Python	Pinyu Saomai	Fats	Rheumatism, dislocations, cracked heels

Use value:

A high use value signifies frequent and significant use of a species by the local community, while low use value Indicates infrequent utilization and minor importance, implying the species is less essential for immediate needs or less accessible (Phillips *et al*., 1994). The use value, however, does not differentiate whether a species is utilized for single or multiple purposes (Musa *et al*., 2011).

In terms of use value, the data analysis infers that species like *Lepidotrigona arcifera* (UV = 1.07) and *Tipulia* sp. (UV = 0.92) have high use values, reflecting their broad applicability and high utilization within the community. Species such as *Apis cerena* (UV = 0.67) and *Rana* sp. (UV = 0.82) have moderate use values, indicating a balanced level of use. Species like *Papeipema nebris* (UV = 0.1) and *Felis catus* (UV = 0.15) have low use values, suggesting limited use or highly specific medicinal applications (Fig. 4).



(A) Manis crassicauda, (B) Cancer sp.*, (C) Moschus* sp., (D) *Papeipema nebris, (E) Aonyx cinerens*, (F) Fats of *Gallus gallus*, (G) *Ketupa nipalensis, (H) Prionailurus bengalensis*, (I) *Bos taurus*, (J) *Orytolagus* sp., (K) *Pteromys* sp., (L) *Herpestes* sp., (M) *Tipulia* sp., (N) *Hystrix* sp., (O) *Funambulus* sp., (P) *Psilopogon virens,* (Q) *Gallus gallus,* (R) *Canis familiaris*

Fig 1 (A – R):- Some important animals used in ethnozoological practices by the Chang tribe.

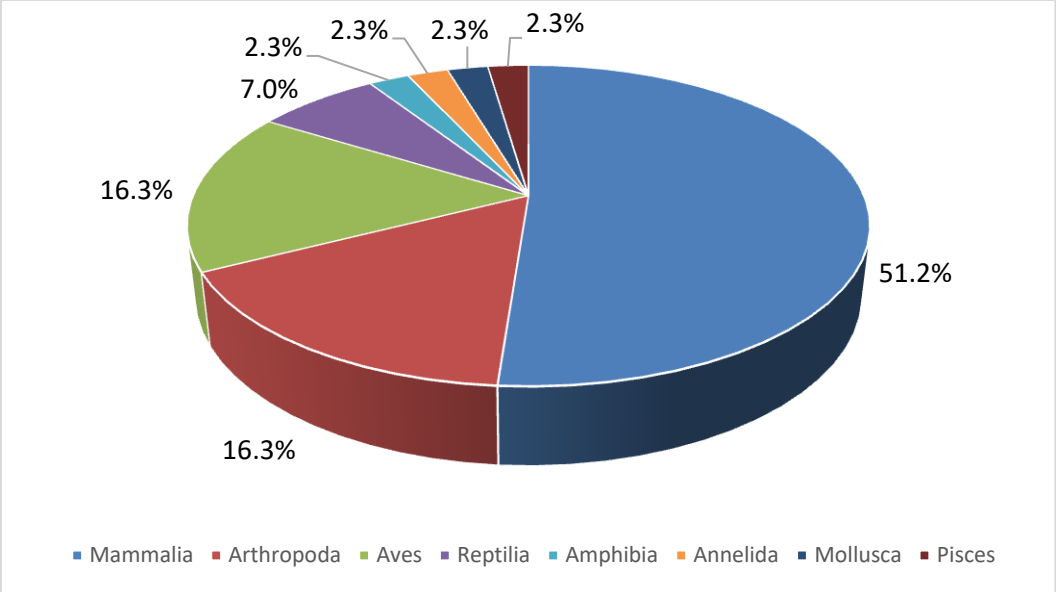


Fig. 2: The percentage distribution of different animal groups recorded with therapeutic use among the Chang Nagas

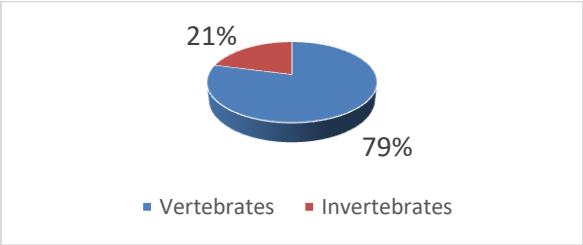


Fig 3:The percentage distribution of vertebrates and invertebrates therapeutic use among the Chang tribe

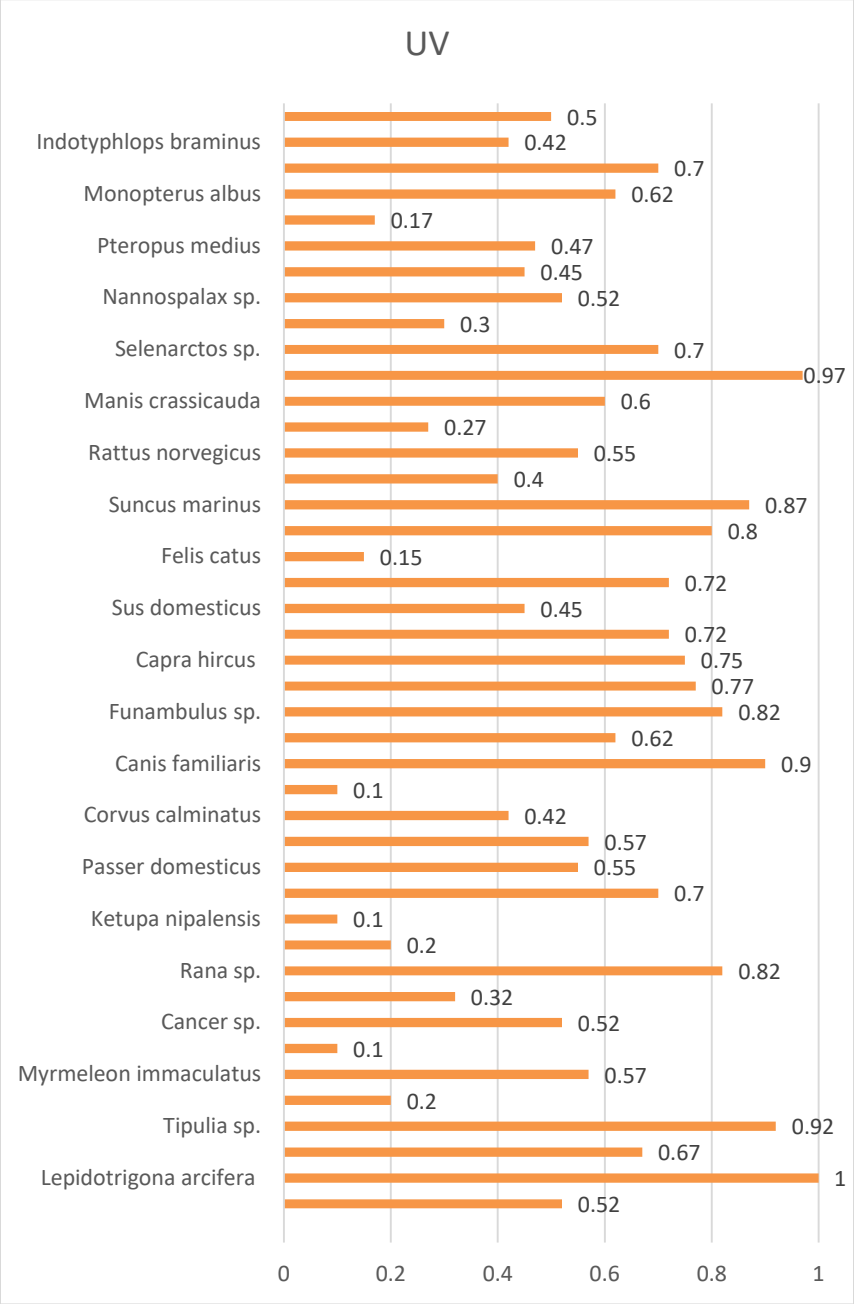


Fig 4. Graphical representation showing different Use Value of vertebrates and invertebrates.

Fidelity Level:

Within the accounted data, several species exhibited a 100% FL (15 animal species), indicating unanimous preference among informants for treating particular ailments (Fig. 5). These include *Lepidotrigona arcifera* for fractures and dislocation, *Apis cerena* for cough, *Epicauta hirticornis* for warts, *Pila globosa* for cough, and *Rana* sp. for wound healing. *Aonyx cinerens* also displayed a 100% FL for removing bones

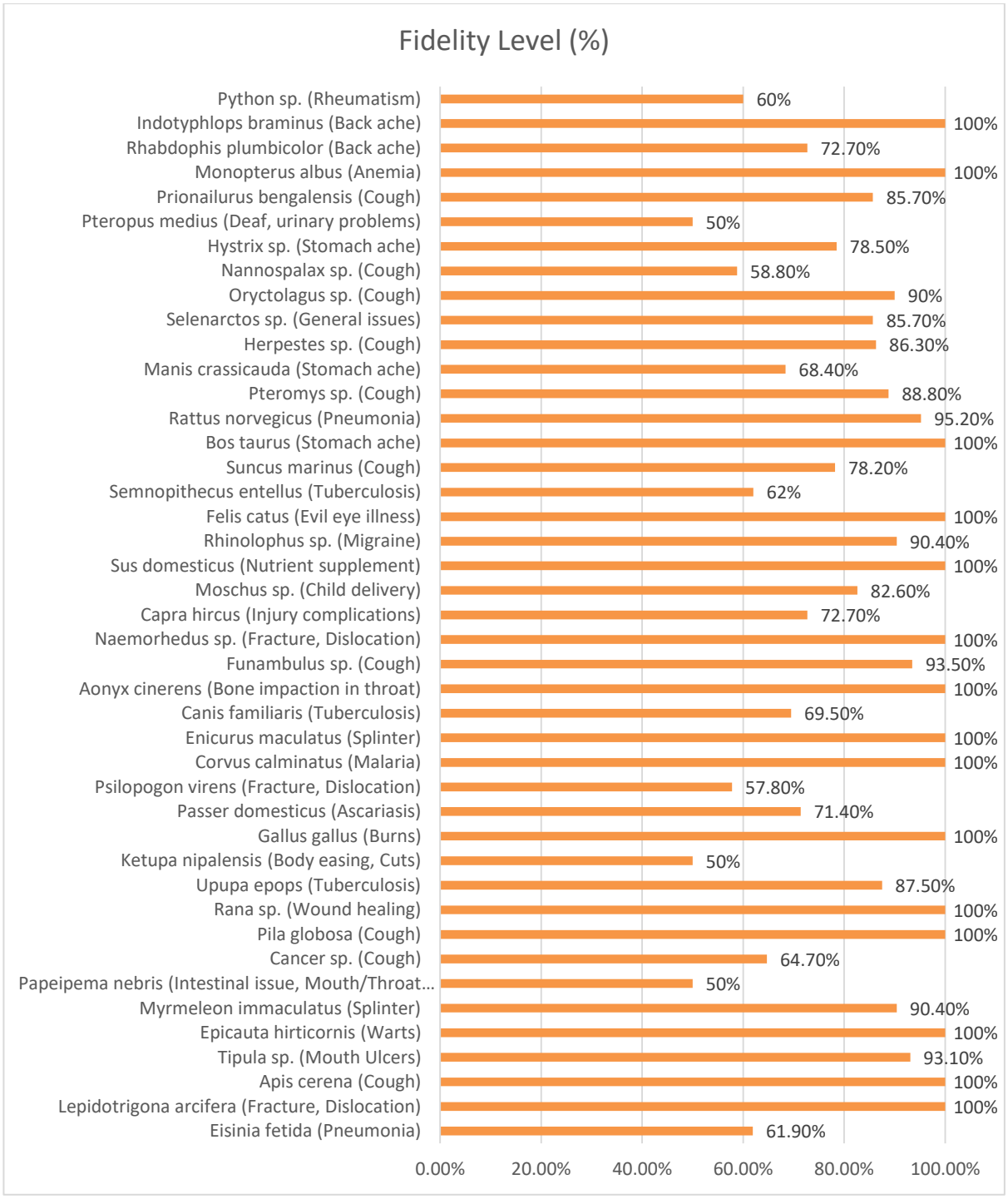


Fig 5. Graphical representation of species and ailments having highest Fidelity Level.

stuck in the throat, highlighting its unique and specialized medicinal use. Species such as *Cancer* sp. (64.7% for cough), *Passer domesticus* (71.4% for ascariasis), and *Capra hircus* (72.7% for injury complications) demonstrated moderate FL values, showing significant but lesser accord use for certain ailments. Lower FL percentages included *Herpestes* sp. (27% for ascariasis) and *Hytrix* sp. (7% for intestinal problems), indicating less common use or multiple medicinal uses that diluted the FL percentage

Informant Consensus Factor:

The study on the Informant Consensus Factor (ICF) reveals significant insights into traditional animal-based remedies, underscoring the extend of agreement among informants regarding the use of different animal species for treating particular ailment. The results exhibit high ICF values across multiple disease categories, indicating strong consensus among informants. Categories such as blood-related diseases (ICF = 1.0), musculoskeletal issues (ICF = 0.94) and oral and pharyngeal problems (ICF = 0.94) show particularly high levels of homogeneity (Table 2). The disease category with the lowest ICF scores for bites and bleeding (0.8). The data analysis indicates that, out of the total 43 animal species reported for therapeutic uses, the highest number of animal species (21) are utilized for respiratory system-related problems, with 273 use reports.

Table 2. Informant Consensus Factor (ICF) values for different disease categories

Disease Category	**Animal Species Included in Each Category**	**ICF (Nur)**
Bites and bleeding (dog bite, bee sting)	*Psilopogon virens, Canis familiaris,*	0.8 (6)
Anemia	*Monopterus albus*	1 (25)
Dermatological (warts, splinter, wound healing, cuts, burns, skin graft, boil, cracked heel)	*Epicauta hirticornis, Myrmeleon immaculatus, Rana* sp.*, Ketupa nipalensis, Gallus gallus, Passer domesticus, Psilopogon virens, Enicurus maculatus, Naemorhedus* sp.*, Python* sp.	0.91 (111)
Gastrointestinal & parasitic (Ascariasis, diarrhea, dysentery, stomach ache, malaria, intestinal problem)	*Eisinia fetida, Papeipema nebris, Rana* sp. *Passer domesticus,Corvus calminatus, Canis familiaris, Funambulus* sp.*, Moschus* sp.*, Suncus marinus, Bos taurus, Rattus norvegicus, Manis crassicauda, Herpestes* sp.*, Selenarctos* sp.*, Oryctolagus* sp.*, Nannospalax* sp.*, Hystrix* sp.*, Pteropus medius, Rhabdophis plumbicolor.*	0.86 (134)
Genitourinary (urinary problems, bed wetting)	*Rhinolophus* sp.*, Pteropus medius, Rhabdophis plumbicolor*	0.83 (13)
Gynecological & reproductive health (child delivery, irregular menstruation & cramps)	*Canis familiaris, Moschus* sp.*, Sancus marinus*	0.92 (26)
Musculo-skeletal (fracture and dislocation, back ache, chest pain, rheumatism)	*Lepidotrigona arcifera, Psilopogon virens, Naemorhedus* sp.*, Moschus* sp.*, Nannospalax* sp.*, Rhabdophis plumbicolor, Indotyphlops braminus, Python* sp.	0.94 (128)
Neurological/psychological (mental disorder, post	*Rhinolophus* sp.*, Pteromys* sp.*, Prionailurus bengalensis*	0.9 (21)

stroke, migraine)		
Not classified (deaf, general issues, body easing, injury complications, evil eye illness, nutrient supplement)	*Upupa epops, Ketupa nipalensis, Gallus gallus, Passer domesticus, Canis familiaris, Funambulus* sp*., Capra hircus, Moschus* sp*., Sus domesticus, Felis catus, Semnopithecus entellus, Suncus marinus, Pteromys* sp*., Manis crassicauda, Herpestes* sp*., Selenarctos* sp*., Pteropus medius,*	0.86 (117)
Oral and pharyngeal (mouth & throat ulcers, bone impaction in throat)	*Eisinia fetida, Tipulia* sp*., Papeipema nebris, Cancer* sp*., Aonyx cinerens,*	0.94 (70)
Respiratory (cough, sore throat, measles, pneumonia, tuberculosis)	*Eisinia fetida, Lepidotrigona arcifera, Apis cerena, Cancer* sp*., Pila globosa, Upupa epops, Psilopogon virens, Canis familiaris, Funambulus* sp*., Capra hircus, Rhinolophus* sp*., Semnopithecus entellus, Suncus marinus, Rattus norvegicus, Pteromys* sp*., Manis crassicauda, Herpestes* sp*., Oryctolagus* sp*., Nannospalax* sp*., Hystrix* sp*., Prionailurus bengalensis,*	0.92 (276)

The collected data reveals a significant reliance on vertebrate species, particularly mammals, which constitute the majority of the medicinal resources. Across different parts of the world, the use of animals to treat various diseases has been documented in many traditional medical practices (Alves *et al*, 2012; Alonso-Castro, 2014; Lev, 2003; Efa, 2023; Solís and Casas, 2019). Similar observations were also reported in North-East India (Kakati and Doulo, 2002; Solanki and Chutia, 2004; Jamir and Lal, 2005; Chakravorty *et al*., 2011). This highlights the intricate relationship between traditional knowledge systems and biodiversity. Invertebrates, though less commonly used, it also plays a significant role in traditional practices. In the present study, vertebrates comprise 79% of the total species used, with mammals being the most frequently utilized group (64.71%). This observation is consistent with previous studies from Nagaland, which highlighted the widespread use of mammals and their body parts for treating various ailments (Kakati *et al*., 2006; Doulo *et al.,* 2019). Similar findings have been reported in other regions of India, where the use of mammals in traditional medicine is significantly higher compared to other animal groups (Mahawar and Jaroli, 2008). In contrast, invertebrates account for 21%, with the phylum Arthropoda being the most prominent, accounting for 77.78% of the invertebrate group. These results underscore the dominant role of vertebrates, particularly mammals, in zootherapeutic practices, while also highlighting the significant contribution of arthropods among invertebrate-based remedies. Honey from both stingless bees (*Lepidotrigona arcifera*) and honey bees (*Apis cerena*) is widely utilized for fractures, dislocations, coughs, and sore throats, illustrating the dual role of honey in both internal and external treatments. Similar uses of honey have been documented in earlier (Mahawar and *Jaroli,* 2006; Mary and *Yamakanamardi,* 2019; Wilsanand *et al.*, 2007; Das, 2015; Budjaj *et al*., 2021). Snail (*Pila globosa*) was revealed to treat cough in the present study which was also reported to be used among the indigenous tribal communities in Wayanad district of Kerela (Mary and *Yamakanamardi,* 2019). The *Cancer* sp. is revealed to be used for treating cough, measles and mouth ulcer among the community, similar was reported from previous studies (Mahawar *and Jaroli,* 2007). The use of frog (*Rana* sp.) to aid wound healing and intestinal issues, signifying its perceived efficacy in postoperative care. Similar research on the use of frog for wound healing was reported (Chakravorty *et al*., 2011; Das, 2015).

From the present study, birds like the hoopoe (*Upupa epops*) and the spot-bellied eagle (*Ketupa nipalensis*) were found to be used to treat tuberculosis and general health issues, suggesting a broad-spectrum use of avian species in traditional remedies. Budjaj *et al*. (2021) reported that blood of hoopoe is drunk for general healing among the Berbers in the Rif, Northeastern Africa. The Great Barbet (*Psilopogon virens*) is traditionally used by the community in the treatment of fractures, dislocations, burns, and several other conditions though there is no documented report of the same. Interestingly, Tynsong (2021) have reported the use of the Great Barbets in the treatments of malaria, dysentery, wounds and rheumatism. The dried stomach and small intestine of Porcupine (*Hystrix* sp.) were known to locals to treat stomach ache, cough, diarrhoea, malaria and intestinal problems. Similar findings were reported by Jugli *et al*. (2020). The soup of flying squirrel (*Pteromys* sp.) is revealed to relieve cough in the present study. Similar reports from the Chakhesang tribe of Nagaland uses the flesh of flying squirrel in treating cough (Kakati and Doulo, 2002). The use of fats of *Python* sp. in the treatment of rheumatism, dislocations and cracked heels within the tribal of the study area. Several studies have reported similar use of python for relieving rheumatism (Soewu, 2008; Chakravorty *et al*., 2011; Faiz *et al*., 2022).

This trend aligns with findings from other tribes in Nagaland and across India, emphasizing the perceived effectiveness and accessibility of animal-based remedies. The study highlights the rich biodiversity and traditional knowledge of the Chang Naga community, with cough, stomach ache, tuberculosis, and pneumonia being the most commonly treated ailments. Respiratory issues involved the highest number of species. Quantitative analysis revealed that many species had a 100% Fidelity Level (FL) and high Informant Consensus Factor (ICF), indicating consistent use of specific animals for particular conditions. Overall, gastrointestinal, dermatological, and respiratory diseases were the most frequently treated, with mammals and birds playing a major role in zootherapeutic practices in Tuensang district.

Conclusion

The present study sheds light on the rich ethnomedicinal knowledge of the Chang Nagas, emphasizing the critical role of both vertebrates and invertebrates in their traditional medicine, henceforth, providing evidence of interplay between biological diversity and cultural practices. In addition, by documenting and analyzing the medicinal use of animals, the research contributes to the broader understanding of biocultural diversity and its importance.

Declarations

Ethics approval and consent to participate: Prior informed consent was obtained from all participants before conducting the interviews.

Consent for publication: Not applicable.

Competing interests: The authors declare no conflict of interest.

Funding: Not applicable.

Authors' contributions: All authors contributed equally to the study, manuscript preparation and final approval.

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References

Agosta, W. C. (1996). Bombardier beetles and fever trees: a close-up look at chemical warfare and signals in animals and plants.

Alonso-Castro, Á. J. (2014). Use of medicinal fauna in Mexican traditional medicine. *Journal of ethnopharmacology*, *152(1), 53-70.*

Alves, R. R. N., Neta, R. O. D. S., Trovão, D. M. D. B., Barbosa, J. E. D. L., Barros, A. T., & Dias, T. L. P. (2012). Traditional uses of medicinal animals in the semi-arid region of northeastern Brazil. *Journal of Ethnobiology and Ethnomedicine, 8(1), 41.*

Budjaj, A., Benítez, G., & Pleguezuelos, J. M. (2021). Ethnozoology among the Berbers: pre-Islamic practices survive in the Rif (northwestern Africa). *Journal of ethnobiology and ethnomedicine, 17(1), 43.*

Chakravorty, J., Meyer-Rochow, V. B., & Ghosh, S. (2011). Vertebrates used for medicinal purposes by members of the Nyishi and Galo tribes in Arunachal Pradesh (North-East India). *Journal of ethnobiology and ethnomedicine*, *7(1), 13.*

Costa-Neto, E. M. (2005). Animal-based medicines: biological prospection and the sustainable use of zootherapeutic resources. *Anais da Academia Brasileira de ciências, 77(1), 33-43*.

Das, D. (2015). Ethnozoological practices among tribal inhabitants in Khowai district of Tripura, North-East India. *J Global Biosci*, *4(9), 3364-3372.*

Dhakal, P., Chettri, B., Lepcha, S., & Acharya, B. K. (2020). Rich yet undocumented ethnozoological practices of socio-culturally diverse indigenous communities of Sikkim Himalaya, India. *Journal of ethnopharmacology*, *249*, *112386.*

Doulo, V., Angami, D., & Shüya, K. (2019). Traditional knowledge of Zootherapeutic use among the Angami Tribes of Nagaland, India. RUSIE: *A Journal of Contemporary Scientific, Academic and Social issue, Vol. 6.*

Efa, D. A. (2023). Animal and their products used for treatment and prevention of disease practiced by traditional healers in Jimma Arjo district, East Wollega Zone, Western Ethiopia. *Veterinary medicine and science*, *9(6), 2660-2675.*

Faiz, M., Altaf, M., Umair, M., Almarry, K. S., Elbadawi, Y. B., & Abbasi, A. M. (2022). Traditional uses of animals in the Himalayan region of Azad Jammu and Kashmir. *Frontiers in Pharmacology, 13, 807831.*

Friedman, J., Yaniv, Z., Dafni, A., & Palewitch, D. (1986). A preliminary classification of the healing potential of medicinal plants, based on a rational analysis of an ethnopharmacological field survey among Bedouins in the Negev Desert, Israel. *Journal of ethnopharmacology, 16(2-3), 275-287.*

IUCN. (1993). *Guidelines for the Conservation of Medicinal Plants. IUCN.*

Jamir, N. S., & Lal, P. (2005). Ethnozoological practices among Naga tribes. *Indian Journal of Traditional Knowledge 4, 1, 100-104.*

Janes, C.R. (1999) The health transition, global modernity and the crisis of traditional medicine: the Tibetan case. *Social Science & Medicine. Jun 1;48(12):1803-20.*

Jugli, S., Chakravorty, J., & Meyer-Rochow, V. B. (2020). Zootherapeutic uses of animals and their parts: an important element of the traditional knowledge of the Tangsa and Wancho of eastern Arunachal Pradesh, North-East India: *Environment, development and sustainability*, *22(5), 4699-4734.*

Kakati, L.N., & Doulo, V. (2002). Indigenous knowledge system of zootherapeutic use by Chakhesang tribe of Nagaland, India. *Journal of Human Ecology. 13(6):419-23.*

Kakati, L.N., Ao, B., & Doulo, V. (2006). Indigenous knowledge of zootherapeutic use of vertebrate origin by the Ao tribe of Nagaland. *Journal of Human Ecology. 19(3):163-7.*

Lev, E. (2003). Traditional healing with animals (zootherapy): medieval to present-day Levantine practice. *Journal of ethnopharmacology*, *85(1), 107-118.*

Liu, X., Li, S., Feng, Y., Chen, X., Ma, Y., Xiao, H., ... & Xie, J. (2024). Traditional knowledge of animal-derived medicines used by Gelao community in Northern Guizhou, China*. Journal of Ethnobiology and Ethnomedicine, 20(1), 31.*

Mahawar, M. M., & Jaroli, D. P. (2006). Animals and their products utilized as medicines by the inhabitants surrounding the Ranthambhore National Park, India. *Journal of Ethnobiology and Ethnomedicine, 2(1), 46.*

Mahawar, M. M., & Jaroli, D. P. (2007). Traditional knowledge on zootherapeutic uses by the Saharia tribe of Rajasthan, India*. Journal of Ethnobiology and Ethnomedicine, 3(1), 25.*

Mahawar, M. M., & Jaroli, D. P. (2008). Traditional zootherapeutic studies in India: a review. *Journal of Ethnobiology and Ethnomedicine*, *4(*1*), 17.*

Mary, V., & Yamakanamardi, M. (2019). Traditional knowledge of therapeutic uses of animal resource among indigenous tribal communities in Wayanad District, Kerala State, India*. Int J Adv Res (Indore), 7, 310-25.*

Musa, Musa S., Fathelrhman E. Abdelrasool, Elsheikh A. Elsheikh, L. A. M. N. Ahmed, Abdel Latif E. Mahmoud, and Sakina M. Yagi. "Ethnobotanical study of medicinal plants in the Blue Nile State, South-eastern Sudan." *Journal of Medicinal Plants Research 5, no. 17 (2011): 4287-4297.*

Phillips, O., Gentry, A. H., Reynel, C., Wilkin, P., & Galvez-Durand B, C. (1994). Quantitative ethnobotany and Amazonian conservation. *Conservation biology, 8(1), 225-248.*

Radha, P., Udhayavani, C., Nagaraj, R., & Sivaranjani, K. (2022). Zootherapeutic documentation from Tiruppur district, Tamil Nadu, India. *Journal of Research in Siddha Medicine*, *5(1), 3-11.*

Soewu, D. A. (2008). Wild animals in ethnozoological practices among the Yorubas of southwestern Nigeria and the implications for biodiversity conservation. *African Journal of Agricultural Research*, *3(6), 421-427.*

Solanki, G. S., & Chutia, P. (2004). *Ethno zoological and socio-cultural aspects of Monpas of Arunachal Pradesh. Journal of Human Ecology, 15(4), 251-254.*

Solís, L., & Casas, A. (2019). Cuicatec ethnozoology: traditional knowledge, use, and management of fauna by people of San Lorenzo Pápalo, Oaxaca, Mexico. *Journal of Ethnobiology and Ethnomedicine*, *15*(1), 58.

Tynsong, H. (2021). Ethno-zoological study of animals-based medicine used by traditional healers of North-east India. *Asian Journal of Ethnobiology*.

Unnikrishnan, P.M. (1998). Animals in ayurveda*. Amruth.1(3):1-23.*

World Health Organization. (1993). Guidelines on the conservation of medicinal plants*. Gland: International Union for Conservation of Nature and Natural Resources.*

Wilsanand, V., Preema Varghese, P. V., & Rajitha, P. (2007). Therapeutics of insects and insect products in South Indian traditional medicine.

Young, A. (1983). The relevance of traditional medical cultures to modern primary health care. *Social science and medicine.17(16):1205-11.*