

A survey on traditional knowledge of zootherapeutic uses among different ethnic communities of Marybong Valley of Darjeeling hills

Beny Gurung and Dawa Bhutia*

Post Graduate Department of Zoology, Darjeeling Government College, Darjeeling - 734 101, West Bengal, India

*dbhutia16@gmail.com

Received: 19 February 2025

Accepted: 20 May 2025

Abstract

Indigenous healing practices have long included bioresources derived from plants and animals and in contemporary society, this practice continues to be a vital option within the healthcare system. For such indigenous knowledge to be preserved over time, documentation is essential. The present study aims to explore and document the traditional knowledge of ethnozoology among the different ethnic communities residing in the Marybong Valley of Darjeeling Hills. The data was collected through a field survey conducted from February 2024 to September 2024 using a structured questionnaire. A total of 202 respondents were interviewed. Respondents listed about 54 animals (40 wild and 14 domesticated, along with humans) belonging to 10 classes, 27 orders, 38 families and 48 genera used to treat 59 human ailments. Mammals represented the highest number. Our study also shows that numerous ethnic groups living in the Darjeeling Hills have a wealth of traditional knowledge and folklore about using animals for therapeutic purposes; however, the importance of these knowledge systems is rapidly diminishing among the younger generation. Therefore, supporting the documentation of such traditional knowledge is imperative to guarantee its availability and preservation for future generations.

Keywords: Darjeeling hills, Ethnomedicine, Ethnozoology, Zotherapy

1. Introduction

India has a wide variety of flora, fauna and various ethnic communities that primarily rely on conventional medical healthcare treatments. For a very long time, people have been incorporating plants and animals as a part of their traditional healing approach all around the world (Adhikari *et al.*, 2020). Since ancient times, the application of bioresources in traditional medicine has substantially contributed to preserving human health and medical inventories (Vijayakumar *et al.*, 2015; Gomez *et al.*, 2021). According to Patel and Pal (2021), ethnozoology is an interdisciplinary field of study, extending from zoology, anthropology, botany and other disciplines, mainly focusing on the human-animal relationship and the vanishing traditional knowledge system. The practice of using medication derived from animal-based substances to treat ailments in humans is known as zotherapy (Mahawar and Jaroli, 2006).

Zotherapy is an important alternative among the well-known therapies used worldwide (Mola *et al.*, 2020).

Despite advancements in modern science, the age-old tradition of using animals for medicinal purposes to treat various health issues continues to endure (Jugli *et al.*, 2020). A WHO study indicates that around 8.7% of the 252 essential chemicals in various medicinal products are derived from animals and 11% are obtained from plants. Historical sources from ancient society also record extensive use of animal products to treat various ailments (Dhakal *et al.*, 2020). In India, 15-20% of Ayurvedic therapies are derived from animals, whereas over 1,500 animals are used as medicine in China (Vijayakumar *et al.*, 2015; Adhikari *et al.*, 2020; Hassan *et al.*, 2022). Moreover, Kim and Song (2013) have identified 584 species of therapeutic animals in Latin America, while the Unani system lists around 200

treatments with animal origins (Pushpangandhan *et al.*, 2014). Folk animal-based medicine around the world uses at least 284 reptiles, 47 amphibians, 110 primates, 108 mammalian carnivores, 266 marine invertebrates and 100 terrestrial invertebrates (Birto *et al.*, 2019). Nearly 80% of the rural population worldwide relies on traditional medicine and this knowledge system has gained importance in modern healthcare (Borah and Prasad, 2017). Despite the long use of ethnozoological products and medicinal plants in traditional healing, it took around 20 decades to identify the use of animal bio-resources in traditional remedies (Singh *et al.*, 2023).

In India, approximately 54 million tribal people live in nearly 5,000 forest-dominated villages. Due to their ongoing relationship with forests, these groups possess a vast amount of folklore that continues to pass from generation to generation (Bhatia *et al.*, 2014). This kind of knowledge should be noticed and properly documented since it is crucial for comprehending the relationship between humans and animals and the possibilities for future conservation and sustainable development. Nowadays, ethnozoological study aims to preserve and investigate the eroding ethnozoological knowledge of therapeutic animals that are adversely affected by the ongoing social changes induced by modern society (Hassan *et al.*, 2022).

Darjeeling Himalaya has a rich tradition of ethnomedicine because of the large number of indigenous ethnic groups (Rai and Rai, 2020), which

makes it unique to study the different ethnomedicinal perspectives of the indigenous people. The goal of the current study on ethnozoological knowledge is to explore the use, preparation and administration of animals in the traditional healing system while documenting and conserving the traditional understanding of the various ethnic communities in the Darjeeling hills regarding the therapeutic use of animals.

2. Materials and methods

The present work was carried out in a small village, Marybong Tea Estate (also called Marybong Valley; 27°02'39.1" N, 88°11'37.7" E), and its adjoining areas (Fig. 1) located 20 Km away from Darjeeling Town, West Bengal, India. It is situated at an elevation between 3000 and 6000 feet (910 and 1830 meters). Most of the people in this region rely on the forest's resources to supply their daily requirements, such as food, fuel and the materials required for performing their rituals. Different ethnic groups residing in this village include Rai, Gurung, Thapa, Pradhan, Subba, Tamang, Ghimiraj (under various categories like ST, SC, OBC and General) and others that live together harmoniously with great ethnic diversity. Therefore, the data were collected from these different communities residing in and around the village.

The data were collected through a field survey conducted between February and September 2024, utilizing questionnaires and structured interviews with local people to gather information on traditional

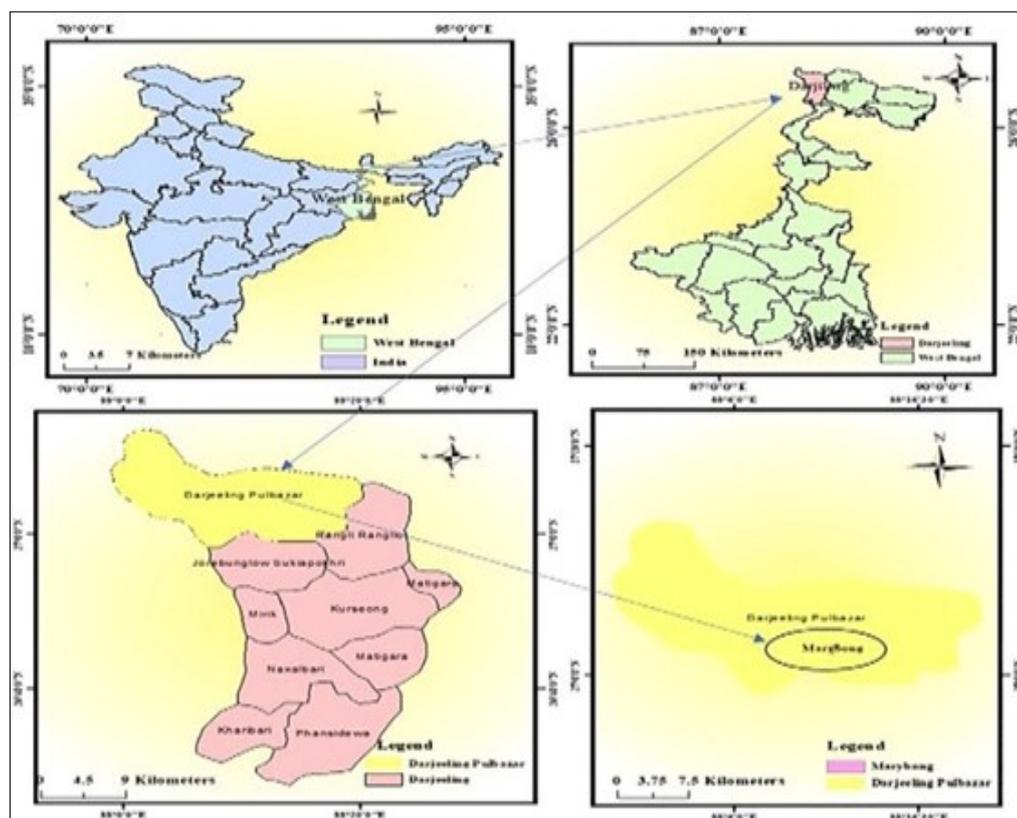


Fig. 1. Location map of the study area

knowledge related to the use of animals and their products. Prior informed consent was obtained from all respondents before administering questionnaires and conducting interviews (Plate 1). The survey included 167 households, with a total of 202 respondents interviewed. Although respondents were randomly selected from various sub-villages, they represented diverse ethnic groups, ages, genders, professions and educational backgrounds. Key informants included experienced village elders, local herbalists and spiritual healers. Participants, aged 20 to 90, were asked about their occupations, animal husbandry practices and ethnozoological knowledge. The questionnaire covered topics such as the use of animals and their parts for

medicinal purposes, preparation methods and administration techniques. All interviews were recorded and documented. Species identification was carried out by mentioning vernacular names to locals and showing them, photographs sourced from the internet, relevant literature and regional references (Haseler, 1964; Sreedevi and Tyagi, 2012; Saren and Basu, 2013; De, 2016; Poudel *et al.*, 2018; Dhakal *et al.*, 2020; Chhetri *et al.*, 2020; Naulak and Pradhan, 2020). The "Integrated Taxonomic Information System" (<http://www.itis.gov>) was also consulted for taxonomic verification. Additionally, the conservation status of each species was noted using the IUCN Red List of Threatened Species (<http://www.iucnredlist.org>) and the literature.



Plate 1. a-e. Interviewing the locals in the study area; f. Landscape view of one of the surveyed site

3. Results and discussion

A total of 202 informants (97 males and 105 females, aged between 20 and 90 years) participated in the study. The respondents were from different castes and communities (Fig. 2 & 3). The male and female ratio distribution shows that 48.02% of the respondents were male and 51.98% were female. Out of 202 respondents, 147 responded positively about having knowledge of the medicinal use of animals, with older respondents above 60 years of age having more knowledge of ethnozoology

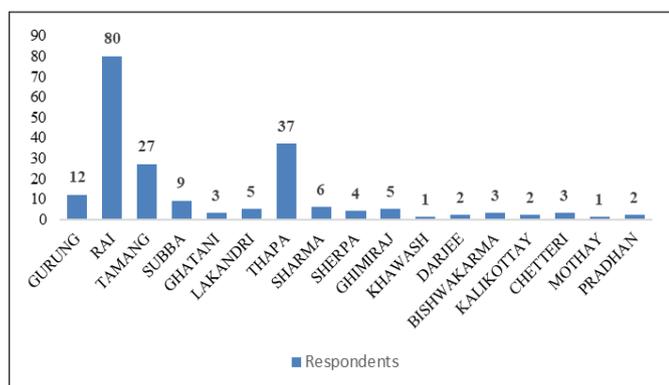


Fig. 2. Number of respondents in each community

than the younger respondents. The study found that labourers and farmers had better knowledge of ethnozoology as compared to other professions. It was also revealed that illiterate individuals had more knowledge of ethnozoology than literate individuals (Table 1).

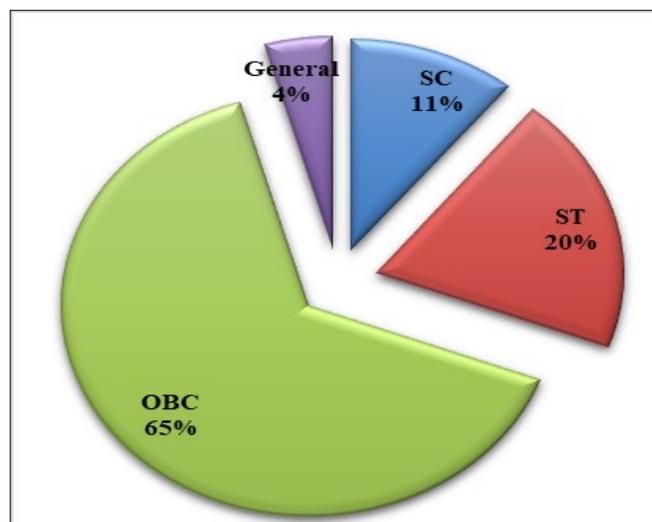


Fig. 3. Percentage of ethnic communities in a study area

Table 1. Socio-Demographic profile of the respondents.

Demographic Features	Total number of Respondents. N=202 (%)	
Gender		
Male	97 (48.02)	
Female	105 (51.98)	
Marital Status		
Married	169 (83.66)	
Unmarried	33 (16.34)	
Age Group		Number of Respondents having Knowledge. n=147 (%)
20-30	26 (12.9)	3 (2.1)
30-40	24 (11.9)	19 (12.9)
40-50	26 (12.9)	15 (10.2)
50-60	32 (15.8)	26 (17.7)
60-70	49 (24.3)	43 (29.3)
70-80	35 (17.3)	32 (21.7)
Above 80	10 (4.9)	9 (6.1)
Educational Qualification		
Illiterate	63 (31.2)	49 (33.3)
Primary	20 (9.9)	17 (11.5)
Middle	38 (18.8)	35 (23.8)
Matriculate	37 (18.3)	27 (18.4)
Secondary	18 (8.9)	12 (8.2)
Graduate and above	26 (12.9)	7 (4.8)
Occupation		
Labor/Farmer	96 (47.5)	78 (53.1)
Government Employee	24 (11.9)	19 (12.9)
Private Employee	19 (9.4)	7 (4.8)
Business	7 (3.5)	4 (2.7)
Unemployed/Unapplicable	27 (13.4)	22 (14.9)
Student	10 (4.9)	-
Other	19 (9.4)	17 (11.6)

* N= Total number of respondents; n= Number of respondents having Knowledge

3.1. Ethnozoological analysis

The present study recorded the use of 54 animal species along with humans belonging to 10 classes, 27 orders, 38 families and 48 genera (Table 2). Out of 54 animal species, 40 were wild and 14 were domesticated. Mammals (n = 22) represented the highest number, followed by insects (n = 10), Aves (n = 9), Amphibians (n = 3), Actinopterygii (n = 3), Clitellate (n = 2), Gastropods (n = 2), Malacostraca (n = 1), Arachnida (n = 1) and Reptiles (n = 1) (Fig. 4).

3.2. Ailments category

More than 50 different types of illnesses, such as fever, tuberculosis (TB), asthma, wounds, etc., were treated using traditional zotherapy out of 54 recorded animal species in the study area. All the reported diseases were classified into 12 ailments, categorized based on information obtained from the respondents in the study area. These are cardiovascular problems, musculoskeletal problems, reproductive problems, eye, nose and throat problems, respiratory problems, neurological problems, dermatological problems, gastrointestinal problems, urinary problems, ophthalmological problems, oncology

problems and general health problems. Various diseases were grouped together under one ailment category; for example, diseases like paralysis, seizures, alcoholism, lethargy, epilepsy and depression were included under one ailment category named "neurological problems" based on the number of animals cited in relation to these diseases. The maximum number of animals has been reported for the treatment of respiratory-related problems (n=27) (Fig. 5).

3.3. Parts and products used

Locals have been reported to use 27 different kinds of animal products and parts for the treatment of various illnesses. Flesh was the most used animal product to treat various diseases. Other forms of animal products used to treat various illnesses were blood, milk, honey, urine, etc. (Fig. 6). The result also shows 18 different modes of preparation for ethnomedicine. Cooking is the most common method of preparation, followed by raw, boiled, juice, roasted, etc. (Fig. 7). The most common method of administration is oral (67%), followed by topical (33%) (Fig. 8).

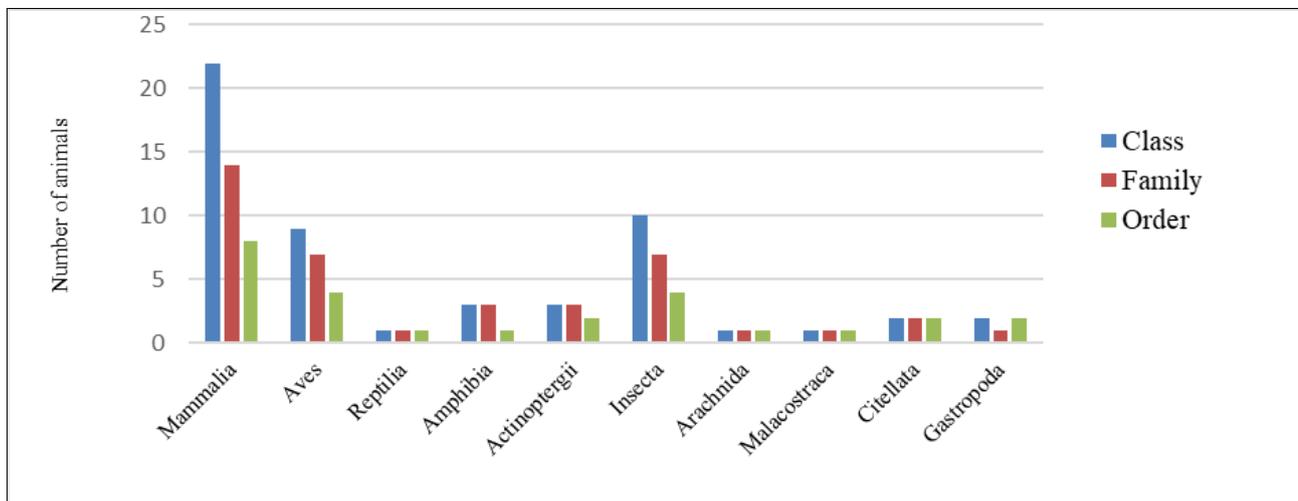


Fig. 4. Taxonomic groups of ethno-medicinal animals used by the different ethnic groups in a study area

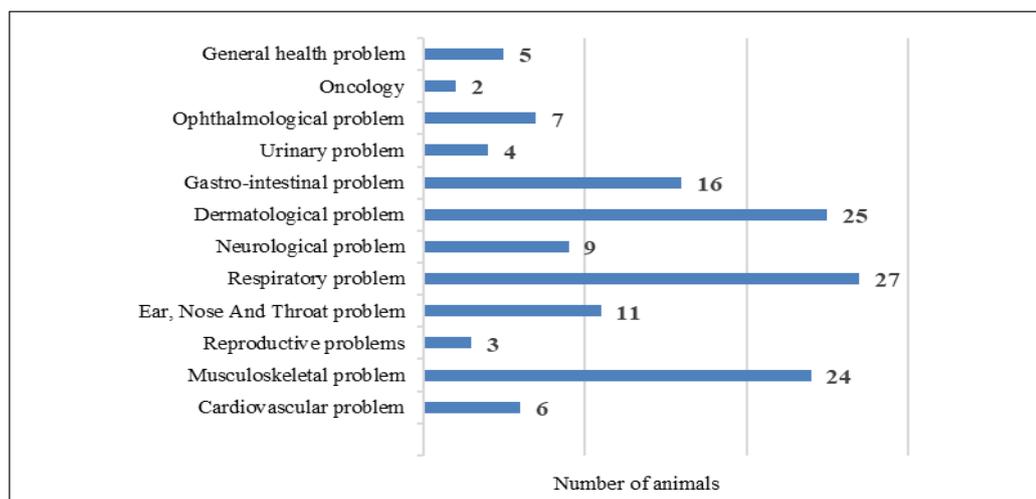


Fig. 5. Number of animals used for the treatment of various diseases

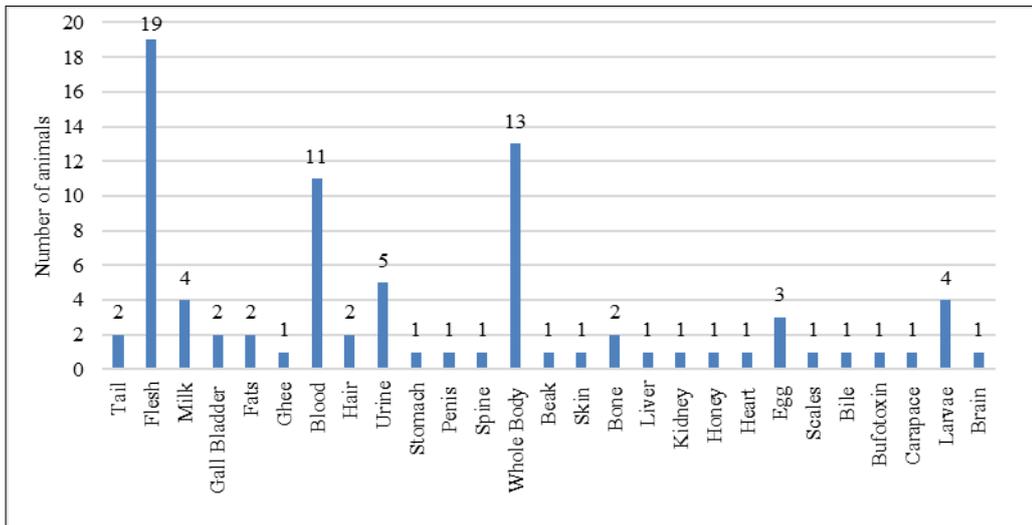


Fig. 6. Parts and products used as ethno-medicine

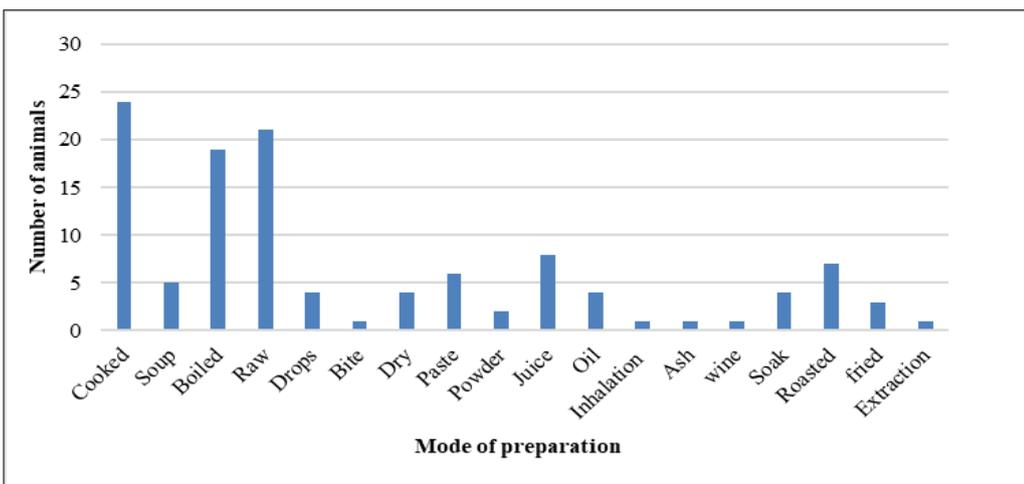


Fig. 7. Modes of preparation of medicine

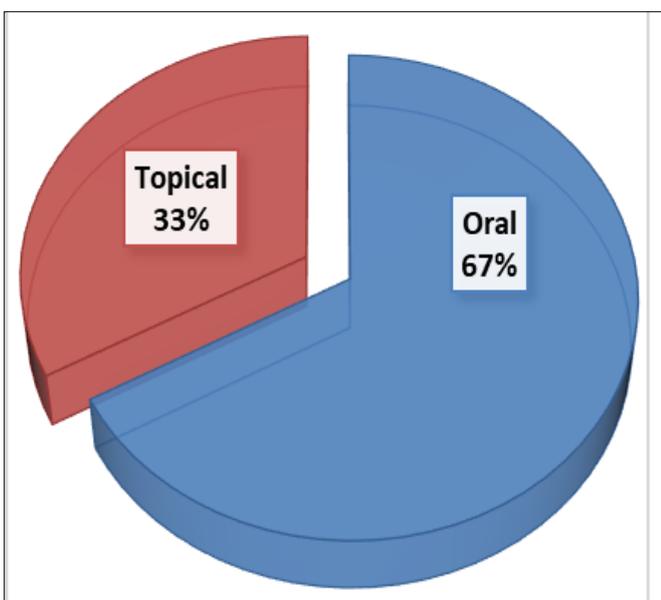


Fig. 8. Modes of administration of ethno-medicine based on animals

About 202 respondents were interviewed during the survey, out of which 147 could provide proper information on traditional medicine regarding the use of animals. Female respondents were more numerous (51.98%) compared to male respondents. A similar trend was also observed in the Manobo Umayamnonn tribe of the Philippines (Gomez *et al.*, 2021). The result shows that a large number of respondents were between the ages of 60 and 70 (n = 49). This shows that people of high age had more knowledge of ethnomedicine than the younger generation. The reason behind less knowledge among the younger generation might be due to the growing education system, dependency on allopathic medicine and globalization (Bhatia *et al.*, 2014; Kumera *et al.*, 2022). However, the survey discovered that individuals in the 70–90 age range demonstrated a decline in their ethnozoological knowledge. This may be attributed to their advanced age, potentially leading them to forget essential knowledge about the use of animals in ethnomedicine. The current study also discovered that labourers and farmers had better knowledge of ethnozoology compared to other professions, while

Table 2. List of animals and their parts used as a traditional medicine with modes of preparation and application in the studied area

Sl. No.	English name/ order/family*	Scientific names	Vernacular name	Part(s) used	Disease(s) treated	Mode of preparation/application
Class: Mammalia						
1	Ox and Cow (D) Order- Artiodactyla Family- Bovidae	<i>Bos spp.</i>	<i>Goru and Gai</i>	Flesh and tail	Tuberculosis	Cooked meat and tail soup are given to Tuberculosis patients for quick recovery.
				Milk	Nutraceutical	Milk helps increase stamina and energy.
2	Himalayan Black Bear (W) Order- Carnivora Family- Ursidae	<i>Ursus thibetanus</i>	<i>Bhalu</i>	Flesh	Gout	Cooked meat is given orally to patients suffering from gout.
					Asthma	Burnt flesh is considered good for asthma.
				Gall bladder/ bile	Gout	Massaging with a few drops of bile juice around a swollen area can help relieve swelling.
					Edema	Cooked meat soup is taken orally to treat edema.
					Typhoid, vulnerary for wounds	In people suffering from typhoid cases, a small amount of bile mixed with milk is taken orally; bile is also used as an antiseptic, applied directly to the cuts and wounds.
					Tuberculosis	A few drops of bile mixed with warm water are taken on an empty stomach in the morning to cure Tuberculosis.
				Cancer	The gallbladder is dried and cut into small pieces, which are prescribed to be eaten two times a day after a meal for the treatment of cancer.	
Fats	Gout	Fat is smeared and massaged in cases of gout.				
3	Sheep (D) Order- Artiodactyla Family- Bovidae	<i>Ovis aries</i>	<i>Bheda</i>	Ghee	Wounds and scars	The ghee is applied to wounds and scars for quick healing and to fade the scars.
4	Indian Hare (W) Order- Lagomorpha Family- Leporidae	<i>Lepus nigricollis</i>	<i>Kharayo</i>	Flesh	Nutraceutical	Cooked meat soup is given to the mother after delivery for strength and speedy recovery.
					Jaundice, seizures	Cooked meat is believed to cure jaundice and frequent seizures.
					Hypertension	Cooked meat is also believed to cure high blood pressure.
				Milk	Wound	Milk is applied directly to the wounds to promote healing.
				Blood	Asthma	Fresh blood is taken orally when available to treat asthma.
Hair	Wounds	The ash of the hair is directly applied to heal cuts and wounds.				
5	Barking Deer (W) Order- Artiodactyla Family- Cervidae	<i>Muntiacus vaginalis</i>	<i>Mirga</i>	Flesh	Asthma, fever	Cooked meat and soup are given orally to cure asthma and fever.
				Urine	Ear infection	A drop of urine is applied over the infected ear until recovery.
				Blood	Piles, asthma Dysmenorrhoea	Fresh blood is taken orally to cure piles and asthma; fresh blood is also prescribed to drink to get relief from menstrual cramps.

6	Porcupine (W) Order- Rodentia Family- Hystricidae	<i>Hystrix brachyura</i>	<i>Dumsi</i>	Stomach	Malaria, diabetes, Asthma, fever	The dried stomach and inner contents are boiled, and the soup is given orally to people suffering from malaria, diabetes, fever and asthma.
					Infertility	Cooked meat is believed to treat infertility in females.
				Tail	Asthma	The tail of a porcupine is burned and then cooked to make a soup, which is then given orally to the patient suffering from asthma.
					Hypertension	The dried stomach is crushed into powder and mixed with water, which is then given orally to cure a high BP.
				Penis	Ear infection	The dry penis of a porcupine is rubbed on a stone and by adding a few drops of water, a paste is made, which is used as an ear drop to cure ear infection until it recovers.
				Bile	Kidney stone	Bile mixed with water is taken for a week to treat kidney stones.
				Spine	Shingles (herpes zoster)	Burnt spines are gently massaged around the herpes (blisters) as a remedy for healing.
7	Indian Flying Fox (W) Order- Chiroptera Family- Pteropodidae	<i>Pteropus giganteus</i>	<i>Chamera</i>	Flesh	Piles	Burnt flesh is consumed to cure piles.
					Asthma, nose bleeding, arthritis, tuberculosis	After peeling off the skin, cooked meat is given orally to cure asthma and frequent nose bleeding, ease arthritis pain and improve poor vision. It is also given to the Tuberculosis patient for quick recovery.
				Blood	Ear infection	A few drops of fresh blood are applied inside the infected ear to heal the infection.
Cut wounds	A few drops of blood are directly applied to the wounds until they heal.					
8	House mouse (W) Order- Rodentia Family- Muridae	<i>Mus musculus</i>	<i>Musa</i>	Blood	Warts	Dab a little amount of blood over a wart and leave it overnight to treat the virus. Repeat nightly for a week.
9	Bengal Fox (W) Order-Carnivora Family- Canidae	<i>Vulpes bengalensis</i>	<i>Syal</i>	Flesh	Gout Asthma	Meat and grain are mixed, and the combination is left to ferment with yeast to produce a local alcohol known as "Syal Ko Rakshi". It is occasionally used to treat gout and is thought to keep blood pressure stable. The addition of <i>Terminalia chebula</i> Retz., and <i>T. bellirica</i> (Gaertn.) Roxb., fruits during the fermentation process is said to enhance the effectiveness of this locally produced alcohol to treat asthma.
					Piles, urinary tract infection (UTI), tuberculosis	Cooked meat is given orally to cure piles, UTI and asthma and it is also given to Tuberculosis patients for quick recovery.
				Bone	Jaundice	The bone is rubbed, making paste. One tablespoon of the paste is given orally for 4 to 5 days, two times a day, to treat jaundice.
10	Rhesus Monkey (W) Order- Primates Family- Cercopithecidae	<i>Macaca mulatta</i>	<i>Badhar</i>	Blood Liver Kidney	Tuberculosis, scabies, heart disease	A cup of fresh blood and boiled (liver and kidney) meat are given orally to the patient suffering from tuberculosis; cooked meat is also prescribed to be eaten by the patient suffering from heart disease and scabies. Fresh blood is also suggested for people suffering from heart disease.
					Leukemia, arthritis, epilepsy, asthma, leprosy, tumor	Occasionally given to patients suffering from leukemia, arthritis, epilepsy, asthma and leprosy, it is also believed to be good for treating tumors.

11	Himalayan Orange bellied squirrel (W) Order-Rodentia Family- Sciuridae	<i>Dremomys lokriah</i>	Lothorkay	Flesh	Gouts, piles, heart disease,	Meat cooked in charcoal is suggested for treating gout and piles and is believed to be good for heart disease.
					Leprosy	Cooked meat is given orally to the patient suffering from leprosy.
					Kidney stone, arthritis, tuberculosis	Cooked meat soup is given to cure kidney stones and arthritis. It is also given to the tuberculosis patient for quick recovery.
12	Chinese Pangolin (W) Order- Pholidota Family- Manidae	<i>Manis pentadactyla</i>	Salak	Scales	Measles	The scale is rubbed and the paste is applied all over the body to treat measles.
					Fever, pneumonia, Tonsillitis	Alternatively, a teaspoon of the paste is given orally to children suffering from fever, measles, pneumonia and tonsillitis. Adults are advised to chew the piece of scale to treat measles, pneumonia and tonsillitis.
				Meat	Paralysis	Cooked meat is given occasionally to cure paralysis.
13	Goat (D) Order- Artiodactyla Family- Bovidae	<i>Capra spp.</i>	Bakhra	Blood	Taeniasis	The fresh blood of the black goat is taken orally to cure tapeworm infection.
				Milk Urine	Tuberculosis	A cup of milk is given orally daily to help tuberculosis patients recover quickly. Tuberculosis patients were put to sleep in a goat house because the smell acted as a disinfectant against the bacteria and helped them recover quickly.
				Bile	Cut wounds	A few drops of bile are directly applied to the wound until recovery.
14	Himalayan Serow (W) Order- Artiodactyla Family- Bovidae	<i>Capricornis thar</i>	Thar	Flesh	Typhoid	Cooked meat and soup are taken orally to cure Typhoid.
15	Wild Boar (W) Order- Artiodactyla Family- Suidae	<i>Sus scrofa</i>	Badel	Flesh	Immunity booster	Consumption of burnt meat is suggested to increase immunity.
16	Yak (D) Order- Artiodactyla Family- Bovidae	<i>Bos grunniens</i>	Chauri Gai	Blood Flesh	Immunity booster	Fresh blood and cooked meat are taken orally to boost immunity against various diseases.
17	Human Order- Primates Family- Homonoidea	<i>Homo sapiens</i>	Manchay	Bone	Epilepsy	Bone is grounded with water and then paste is given orally to treat epilepsy.
				Urine	Wounds	Urine is applied to the wounds as an antiseptic.
				Milk	Eye infection	2 or 3 drops of milk are applied to the infected eye until recovery.
18	Dog (D) Order- Carnivora Family- Canidae	<i>Canis familiaris</i>	Kukur	Brain	Terminal illness or life-limiting illness	The brain is taken out immediately after killing the dog and a tiny amount is minced and combined with milk. 3 or 7 spoonfuls of the mixture are given at a time to increase life expectancy.
19	Himalayan Goral (W) Order- Artiodactyla Family- Bovidae	<i>Nemorhaedus goral goral</i>	Ghoral	Flesh	Nutraceutical	Often taken as a source of calcium and to promote strength.

20	Horse (D) Order- Perissodactyla Family- Equidae	<i>Equus spp.</i>	<i>Ghoda</i>	Urine	Alcoholism	A few drops of urine mixed with alcohol are given orally to get rid of alcoholism.
					Viral flu	Urine is applied all over the body to reduce the risk of catching the viral flu.
21	Donkey (D) Order- Perissodactyla Family- Equidae	<i>Equus asinus</i>	<i>Gadha</i>	Urine	Viral flu	Urine is applied all over the body to reduce the risk of catching viral flu.
22	Pig (D) Order- Aritiodactyla Family- Suidae	<i>Sus spp.</i>	<i>Shoongur</i>	Nose	Nose bleeding	Burnt meat is crushed to powder and applied over the nose to stop continuous nose bleeding.
					Herpes labialis (cold sores)	Burnt meat powder is also applied over the herpes blisters for healing.
Class: Aves						
23	Blue whistling Thrust (W) Order- Passeriformes Family- Muscicapidae	<i>Myophonus caeruleus</i>	<i>Kalchura</i>	Whole body	Piles	The whole body is burned thoroughly and then eaten to cure piles, or the whole body is mashed and put in a thin cloth to remove the fluid, which is then taken orally to cure piles, or cooked meat soup is also suggested to be taken orally for treating piles.
24	2. Large-billed crow (W) House crow (W) Order- Passeriformes Family- Corvidae	<i>Corvus macrorhynchos</i> <i>Corvus splendens</i>	<i>Kaag</i>	Blood	Emollient	Raw blood is applied to treat the cracked soles of the feet.
				Flesh	Scabies	Dried flesh is rubbed all over the skin to treat scabies.
					Tuberculosis	Cooked meat is given orally to cure Tuberculosis.
25	3. House Sparrow (W) Order- Passeriformes Family- Passeridae	<i>Passer domesticus</i>	<i>Bhangera</i>	Blood	Ear infection	A few drops of blood mixed with water are put inside each affected ear for 2-3 days, depending on the infection.
				Flesh	Lethargy	Burnt meat is taken orally to overcome lethargic feelings and apathy.
26	4. Pigeon (D) Order- Columbiformes Family- Columbidae	<i>Columba livia</i>	<i>Parewa</i>	Blood	Paralysis	Fresh blood is used as a massage therapy for paralysis.
				Whole body (pigeon squabs)	Piles Provides immunity	Cooked meat is taken orally to cure piles and increase immunity, and it also maintains blood pressure.
					Heart	Infertility
27	5. Kalij Peasant (W) Order- Galliformes Family- Phasianidae	<i>Lophura leucomelanos</i>	<i>Kaliz</i>	Flesh	Cold and cough	Cooked meat soup is taken orally to cure colds and coughs.
				Heart	Tuberculosis	Boiled hearts are given to Tuberculosis patients for quick recovery.
28	6. Quail (D) Order- Galliformes Family- Phasianidae	<i>Coturnix spp.</i>	<i>Battai</i>	Egg	Asthma	Eggs are consumed to treat asthma.

29	7. Domestic Duck (D) Order- Anseriformes Family- Anatidae	<i>Anas platyrhynchos domesticus</i>	Hash	Flesh	Asthma	Cooked meat is taken orally to treat asthma.
					Nutraceutical	Often taken as a source of protein.
				Egg	Surgical wounds	A boiled egg is given orally to help heal the surgical wounds faster.
30	8. Common Myna (W) Order- Passeriformes Family- Sturnidae	<i>Acridotheres tristis</i>	Ruppi	Flesh	Piles	Cooked meat is taken orally, or the whole body is mashed and put on a cloth to remove the fluid, which is then taken orally to cure piles.
					Speech delay or alalia	Cooked meat or boiled eggs are given orally to produce speech in children.
31	9. Domestic fowl (D) Order- Galliformes Family- Phasianidae	<i>Gallus domesticus</i>	Kukhra	Flesh	Nutraceutical	Cooked meat soup is given to the mother after delivery to promote strength.
				Egg	Fractured bones	A few dried leaves of <i>Viscum articulatum Burm.f.</i> , with a pinch of wild turmeric powder and a <i>simrik</i> obtained from seeds of <i>Bixa orellana</i> L., are boiled with milk and after that, a raw egg is beaten in a glass of prepared milk, which is given orally to cure fractured bones until recovery. It is also believed to be good for backbone pain, and the mixture is consumed for 3 days.
				Fat	Burns	Fat is applied to burns for quick healing.
Class: Reptilia						
32	Indian Tent Turtle (W) Order- Testudines Family- Geoemydidae	<i>Pangshura tentoria</i>	Kachuwa	Bone (Carapace)	Chickenpox, Tonsillitis, Pneumonia	The bone is rubbed to make a thick paste. 1 tablespoon of the paste is given orally to cure chickenpox, tonsillitis and pneumonia.
					Wounds and burns	The paste is also applied generously to burns and wounds for quick healing.
Class: Amphibia						
33	Liebig's Frog (W) Order-Anura Family- Dicroglossidae	<i>Nanorana liebigii</i>	Man Pah	Whole body	Measles, Dysentery	The whole body is boiled to make a soup, which is then administered orally to treat measles and dysentery.
					Piles	Cooked meat soup is suggested to be eaten for piles.
				Skin	Wound healing	The skin is dipped in hot water and then placed over the wounds for quick healing.
34	Frog (W) Order- Anura Family- Ranidae	<i>Amolops himalayanus</i>	Piray Pah	Whole body	Dysentery/ diarrhoea	The whole body is boiled to make a soup, which is then administered orally to treat dysentery.
35	Toad (W) Order-Anura Family- Bufonidae	<i>Duttaphrynus spp.</i>	Khasray vaguta	Bufotoxin (milky white secretion)	Ecchymosis (bruises)	Bufotoxin secreted over the skin of the toad is expelled quickly and then applied to the bruises for quick recovery.

Class: Actinopterygii						
36	Stone Loach (W) Order- Cypriniformes Family- Nemacheilidae	<i>Indoreonectes spp.</i>	<i>Garela</i>	Whole body	Cyclic vomiting	Fish cooked over fire is administered orally to children suffering from recurrent vomiting.
37	Asla (W) Order- Cypriniformes Family- Cyprinidae	<i>Schizothorax spp</i>	<i>Asala</i>	Whole body	Nutraceutical	Cooked meat is given to the mother after the delivery to promote strength.
38	Mud Eel (W) Order- Synbranchiformes Family- Synbranchidae	<i>Monopterus albus</i>	<i>Bam Machha</i>	Blood	Anemia	Fresh blood is consumed orally to treat anemia.
Class: Insecta						
39	Red ant (W) Order- Hymenoptera Family- Formicidae	<i>Solenopsis sp.</i>	<i>Chattay Kamila</i>	Whole body	Poor vision	Consuming a random house ant is believed to enhance eyesight.
40	Honey bee (D) Order- Hymenoptera Family- Apidae	<i>Apis indica</i>	<i>Mauri</i>	Honey	Cough and cold	Honey mixed with grated ginger and Tulsi is given orally for curing coughs and colds.
41	White Grub (W) Order- Coleoptera Family- Scarabaeidae	<i>Holotrichia spp</i>	<i>khumlaykira</i>	Larvae	Ascariasis	Larvae are consumed directly to treat ascariasis.
42	Winged Termite (W) Order- Blattodea Family- Termitidae	<i>Odontotermes spp</i>	<i>Chichimira</i>	Whole Body	Depression	A handful of winged termites are roasted in an iron pot by adding a pinch of salt and dried red chilli along with a tablespoon of mustard oil. This is then consumed with cold water to cure depression.
					Constipation	Fried termites are suggested to eat for constipation problems.
43	Yellow-legged Hornet (W) Order- Hymenoptera Family- Vespidae	<i>Vespa velutina</i>	<i>Aringal</i>	Larvae and Cocoon	Nutraceutical, Body ache, Allergy	Larvae and cocoons are eaten raw or boiled as a dietary supplement or fried and consumed as a remedy for allergies and body pain.
44	Asian Giant Hornet (W) Order- Hymenoptera Family- Vespidae	<i>Vespa mandarinia</i>	<i>Bacchiew</i>	Larvae and Cocoon	Nutraceutical, Body ache	Larvae and cocoons are eaten raw or boiled as a dietary supplement or fried and consumed as a remedy for body pain.
45	Common Nocturnal Hornet (W) Order- Hymenoptera Family- Vespidae	<i>Provespa barthilemii</i>	<i>Pahaelay</i>	Larvae and Cocoon	Tuberculosis	Fried larvae and cocoons are consumed to cure Tuberculosis.

46	Wasp (W) Order- Hymenoptera Family- Vespidae	<i>Vespula spp.</i>	<i>Barula</i>	Cocoon	Asthma	The wasp nest is burned, and the cocoons are given orally to treat asthma.
					Joint pain	It is also taken as a protein supplement, and it is a great medicine for joint pain.
47	Cockroach (W) Order- Blattodea Family- Blaberidae	<i>Periplaneta americana</i>	<i>Sanghli Kira</i>	Whole body	Asthma	Some cockroaches are soaked in water, typically overnight; then, in the morning, merely sip the water to treat asthma.
					Alopecia (baldness)	The whole body is crushed to make a paste, which is then applied straight to the scalp.
48	Eupatorium gall fly (W) Order- Diptera Family- Tephritidae	<i>Procecidochares utilis</i>	<i>Pattay</i>	Larvae and pupae	Diabetes	Larvae and pupae are taken out of the stem gall of the host plant (<i>Ageratina Adenophora</i> (Spreng.) R.M.King & H.Rob.) and directly consumed for treating diabetes.
Class: Arachnida						
49	Black Spider (W) Order- Arenea Family- Theridiidae	<i>Parasteatoda spp.</i>	<i>Kali Makura</i>	Whole body	Vulnerary for insect bites and stings	The whole body is dipped in 100 grams of pure mustard oil and stored in an airtight bottle. When needed, the oil is gently applied over the affected skin with the help of a cock feather in case of insect bites and stings.
Class: Malacostraca						
50	Fresh water crab (W) Order- Decapoda Family- Potamidae	<i>Himalayapotamon spp.</i>	<i>Gangata</i>	Whole body	Nutraceutical	Often consumed as a rich source of calcium.
					Gout, arthritis, Dysentery, jaundice	The whole body is mashed and strained in a thin cloth to remove the fluid. One tablespoon is given orally to the patient suffering from gout, arthritis, dysentery and jaundice.
					Hypotension	It also helps maintain blood pressure.
					Enuresis	Boiling crab soup is also suggested and believed to cure accidental urination in children and adults.
Class: Citellata						
51	Earthworm (W) Order- Opisthopora Family- Megascolecidae	<i>Perionyx spp.</i>	<i>Gadewla / Gavara</i>	Whole body	Pneumonia, cough, Measles	The worms are mashed and put together in a piece of thin cloth and squeezed to extract the juice. 1 tablespoon is given orally to children suffering from pneumonia, cough and measles.
52	Jawed Land Leech (W) Order- Arhynchobdellida Family- Haemadipsidae	<i>Haemadipsa spp</i>	<i>Juga</i>	Whole body	Wounds	Living leeches are attached to wounds for quick healing.
Class: Gastropoda						
53	Apple snail (W) Order- Architaenioglossa Family- Ampullariidae	<i>Pila globosa</i>	<i>Siganay kira</i>	Whole body	Gout, arthritis	The whole body is dipped in water overnight and in the morning, the water is consumed by people suffering from gout and arthritis.
54	Land Snail/ Slug (without shell) (W) Order- Stylommatophora Family- Helicinae	<i>Cornu spp.</i>	<i>Chiplay kira</i>	Flesh	Low vision	Flesh cooked in milk is given orally to improve vision.
					Tuberculosis	Boiled meat is given orally to cure tuberculosis.

* D= domestic; W= wild

illiterate people knew more about medicinal animals than literate. This could be explained by the fact that illiterate people typically rely more on natural resources and traditional knowledge systems, which eventually leads them to study more about the environment and preserve those practices related to resource utilization and its importance. On the other hand, literate people lean more towards the modern education system and have neglected the traditional knowledge system. During the study, a group of students was also interviewed, and they clearly indicated their lack of knowledge of ethnozoological practices. This might be the influence of modern education and a lack of interest, leading to gaps in their understanding. The present study revealed the use of 54 species of animals, including both wild and domestic, to treat 59 human ailments. Mammals represented the highest use, followed by Insects, Aves, Amphibians, Actinopterygii, Clitellates, Gastropods, Malacostraca, Arachnids and Reptiles. A similar trend was also observed in other parts of India, Ethiopia, Nepal and Pakistan (Negi and Kandari, 2017; Raja *et al.*, 2018; Dhakal *et al.*, 2020; Ullah *et al.*, 2020; Adhikari *et al.*, 2020; Kumera *et al.*, 2022.). According to Adhikari *et al.* (2020), mammals are primarily utilized due to their rich content of essential vitamins and proteins. Various animal body parts and products have historically been employed in treating a range of ailments, including tuberculosis, asthma, skin conditions and other health-related problems. Among these, meat stands out as a preferred choice, likely owing to its high nutritional value and claimed therapeutic advantage.

Lohani (2011) noted the prevalent use of meat in ethnomedicine, particularly within the Magar community of Central Nepal. Similarly, Adhikari *et al.* (2020), Hassan *et al.* (2022), and Dhakal *et al.* (2020) also observed significant utilization of meat in ethnomedicinal practices in different regions, like the Chitwan-Annapurna Landscape in Central Nepal, the Jammu and Kashmir Himalayas and the Sikkim Himalayas, respectively. The recent study also indicates that cooking was the most common method with oral administration (67%) being the most prevalent, followed by topical (33%). Oral administration of medicine is also reported to be the most common in other studies (Kim and Song, 2013; Vijayakumar *et al.*, 2015; Borah and Prasad, 2016; Mola *et al.*, 2020; Adhikari *et al.*, 2020; Kumera *et al.*, 2022).

Animal parts and products have been utilized as medical therapies for a very long time by many people worldwide and this practice has a long history with widespread geographic distribution. The animals used for healing purposes in the present study are also being used by various ethnic communities across different parts of India and the world. Upon comparing the literature, we also discovered that some animals that are used by various ethnic communities in India have similar uses in the study area, while others exhibit

differences in their usage. In the study area, *Perionyx spp.*, a thin, small and reddish worm found inside the trunk of banana plants, is traditionally used to treat pneumonia, chicken pox and measles. This practice remains prevalent and locals still use this method to treat small children. Bora and Prasad (2017) have reported a similar use of this species for curing pneumonia by the traditional healers of Gibbon Wildlife Sanctuary, Assam.

In the study area, the live leech is attached to the wound for blood sucking and quick healing. Similar use of leech has also been reported by the people of the Yavatmal district of Maharashtra (Misar *et al.*, 2016). According to a survey, leech therapy is used in over 70% of French hospitals, demonstrating the usefulness of leeches in modern medicine. Leech therapy is mainly common among the ethnic people of Jammu and Kashmir for the treatment of inflammation, bruises and pain (Hassan *et al.*, 2022). The larvae of the Eupatorium gall fly, which are found inside the gall stem of the host plant, *Ageratina adenophora* (Spreng.) R.M.King & H.Rob., consumed by the inhabitants of the study area to treat diabetes, may not have been reported so far in India.

It is interesting to note that the Indian Tent Turtle is utilized by the people in the study area to treat chickenpox, pneumonia, tonsillitis, wounds and burns. Since turtles are not endemic to the Darjeeling Hills, the species of turtles used in traditional medicine are mainly bought by locals and vendors from the low-lying areas where turtles are frequently found. In India, there are records of using certain species of turtles, including the Indian tent turtle, Indian roofed turtle, Indian flap shelled turtle and hard-shell turtle, for traditional medicine and cultural uses (Mahawar and Jaroli, 2008; Barhadiya and Singh, 2020).

According to the informants, it is possible to use certain animals for the same ailments. For example, fox, Himalayan black bear, hare, porcupine, bat, monkey, quail, cockroach and barking deer can be used to treat asthma. It was also noted that the same animals can be used to treat more than one disease. An example was *Hystrix brachyura* and its parts used for the treatment of asthma, diabetes, ear infection, herpes zoster, infertility, malaria, kidney stones and hypertension. Our research outcomes are similar to the previous findings of Chhetri *et al.* (2020) in the Darjeeling Hill region. However, more information was added to the present study on the use of animals in ethnomedicine. The result of the study thus provides proof that the inhabitants of Darjeeling Hills have been employing ethnomedicine to cure health problems and improve their overall well-being since prehistoric times. Similarly, our research is consistent with the findings of Dhakal *et al.* (2020), who documented the prevalence of using mammals, amphibians, reptiles and other animal species native to the Sikkim Himalayas for medicinal purposes. The people of Darjeeling and Sikkim have historically

interacted and exchanged cultures due to their near geographical proximity, which may account for some of the similarities.

We also found that the locals of the study area utilized a combination of medicines obtained from plant-based products along with animal products. For example, arachnids are crushed and dipped in pure mustard oil to heal wounds and insect bites. Furthermore, it is believed that fermenting fox meat with local grains and fruits of *Terminalia chebula* Retz., and *T. bellirica* (Gaertn.) Roxb., to produce an alcoholic beverage enhances its efficiency in treating gout, blood pressure and asthma. This alcoholic beverage is locally known as “Syal Ko Rakshi,” which was also described by Chhetri *et al.* (2020). For the treatment of fractured bones and back pain, a combination of *Viscum articulatum* Burm.f., turmeric powder, cow milk and eggs from domestic fowl is utilized. Chettri and Chowdhury (2018) have also reported similar uses of these combinations to treat bone fractures among tea garden workers in Darjeeling Hills. Such combinations, where both plants and animals are utilized to prepare certain medicines, have also been documented in different regions of India (Jaroli *et al.*, 2010; Mishra *et al.*, 2011; Bora and Prasad, 2017).

The ethnic group in the study area has particular religious practices and beliefs that are comparable to those found in other regions of India. They worshipped the nature deity *Sansari Mata* using *Columba livia* and *Capra spp.* *Gallus domesticus* is used in the Rai community’s *Kul puja* ceremony. Spines of *Hystrix spp.* are kept in some homes for good fortune and traditional healers Jhaakri wear these spines as crowns during rituals. Scales of the Chinese pangolin are believed to be utilized by traditional healers to treat patients thought to be impacted by black magic and they are also worn as necklaces or rings to ward off the evil eye.

Furthermore, of the 54 animal species that have been identified, 29 falls into the IUCN Red List category; of these, 2 are vulnerable (Himalayan black bear and Himalayan serow), 1 is critically endangered (Chinese pangolin), 1 is near threatened (Himalayan goral), and the rest 25 are classified as least concern. It is important to note that the information in the study area was based on the respondents’ prior knowledge. These days, the majority of people rely more on plant-based medicine and rarely utilize animal-based medicine. People are also aware of the Wildlife Protection Act. Very few people go birding and hive hunting for food and medicinal purposes. The locals in the study area also claim that they obtained their knowledge of flock medicine mainly through parental heritage, society and personal experience, which was passed down orally from generation to generation. Cultural shifts, urbanization, reliance on allopathic treatments and a lack of interest among young people all contribute to the rapid decline of this traditional knowledge system, making it increasingly challenging to study in the future.

4. Conclusion

The present study attempts to gather and document folk knowledge on the use of animal-based therapies by the ethnic groups of the Darjeeling Hills. According to our research, there is a wealth of folklore and traditional knowledge about the therapeutic usage of animals among various ethnic communities in Darjeeling Hills and understanding the connections between many ethnic communities and how they engage with nature is greatly enhanced by this research. The amount of documentation in this discipline is remarkably low despite the significant amount of knowledge about folk medicines. Consequently, the entire Darjeeling Hill region offers a noticeably greater area for studying ethnozoological diversity. Since the younger generation has lost interest in learning about their customs and traditional knowledge, it is crucial to promote and encourage this generation's usage of traditional medicine. Furthermore, accurate documentation of this knowledge is necessary to preserve traditions and cultural identity in case they disappear. Moreover, this data can be helpful in the scientific search for novel drugs and utilized as a strategy for sustainable practices and conservation techniques.

Acknowledgements

The authors are highly indebted to all the villagers for actively participating in the questionnaire survey, without whom this research would not have been a success. P. G. Department of Zoology, Darjeeling Government College, is also highly appreciated.

References

- Adhikari J N, Bhattarai B P, Rokaya M B and Thapa T B 2020. Ethno-medicinal uses of vertebrates in the Chitwan-Annapurna Landscape, central Nepal. *PloS One*. 15(10): e0240555.
- Barhadiya G and Singh S 2020. Cultural Use of Turtle Shells, an Underrated Threat in Turtle Conservation: A Case Study in Assam, India. *Reptiles & Amphibians*. 27(2): 213-215.
- Bhatia H, Sharma Y P, Manhas R K and Kumar K 2014. Ethnomedicinal plants used by the villagers of district Udhampur, J&K, India. *J. Ethnopharmacol.* 151(2): 1005-1018.
- Borah M P and Prasad S B 2016. Ethnozoological remedial uses by the indigenous inhabitants in adjoining areas of Pobitora wildlife sanctuary, Assam, India. *Int. J. Pharm. Sci.* 8(4): 90-96.
- Borah M P and Prasad S B 2017. Ethnozoological study of animals based medicine used by traditional healers and indigenous inhabitants in the adjoining areas of Gibbon Wildlife Sanctuary, Assam, India. *J. Ethnobiol. Ethnomed.* 13: 1-13.
- Brito I D S P, Borges A K M, de Faria Lopes S, Dias T L P and Alves R R N 2019. Environmental influence on the choice of medicinal animals: a case study from northeastern Brazil. *J. Ethnobiol. Ethnomed.* 15:55.
- Chettri D and Chowdhury M 2018. Ethnomedicinal approach against bone fracture among the tea garden workers of Darjeeling Hills. *IJTK*. 17(3):512-517.
- Chhetri S, Bhutia D, Yonle R and Gurung Y 2020. Ethnozoological practices among the inhabitants of Darjeeling hills of West Bengal, India. *UPJOZ*. 41(14): 9-18.
- De K 2016. Checklist of Amphibian Fauna of Darjeeling District, West Bengal. *J. Ento. Zool. Stud.* 4(3): 387-390.

- Dhakal P, Chettri B, Lepcha S and Acharya B K 2020. Rich yet undocumented ethnozoological practices of socio-culturally diverse indigenous communities of Sikkim Himalaya, India. *J. Ethnopharmacol.* 249: 112386.
- Gomez E, Gamalinda E, Along A, Ombat L and Almadin F J 2021. Ethnozoological study of traditional medicinal animals and their products used by the Manobo Umayamnon tribe in the Southern Philippines. *J. Ecosys. Sci. Eco-Govern.* 3(1): 25-36.
- Haseler W H 1965. Life history and behavior of the Crofton weed gall fly *Procecidochares utilis* stone (Diptera: Trypetidae). *Aust. J. Entomol.* 4(1): 27-32.
- Hassan M, Haq S M, Ahmad R, Majeed M, Sahito H A, Shirani M and Yessoufou K. 2022. Traditional Use of Wild and Domestic Fauna among Different Ethnic Groups in the Western Himalayas-A Cross-Cultural Analysis. *Animals.* 12(17):2276.
- Jaroli D A, Mahawar M M and Vyas N 2010. An ethnozoological study in the adjoining areas of Mount Abu wildlife sanctuary, India. *J. Ethnobiol. Ethnomed.* 6: 1-8.
- Jugli S, Chakravorty J and 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. *Environ. Dev. Sustain.* 22: 4699-4734.
- Kim H and Song M J 2013. Ethnozoological study of medicinal animals on Jeju Island, Korea. *J. Ethnopharmacol.* 146(1): 75-82.
- Kumera G, Tamire G, Degefe G, Ibrahim H and Yazezew D 2022. Ethnozoological Study of Traditional Medicinal Animal Parts and Products Used among Indigenous People of Assosa District, Benishangul-Gumuz, Western Ethiopia. *Int. J. Ecol.* 2022(1): 8430489.
- Lohani U 2011. Eroding ethnozoological knowledge among Magars in Cental Nepal. *Indian J. Tradit. Knowl.* 10(3): 466-473.
- Mahawar M M and Jaroli D P 2006. Animals and their products utilized as medicines by the inhabitants surrounding the Ranthambhore National Park, India. *J. Ethnobiol. Ethnomed.* 2: 1-5.
- Mahawar M M and Jaroli D P 2008. Traditional zootherapeutic studies in India: a review. *J. Ethnobiol. Ethnomed.* 4:1-12.
- Misar S D, Subhas M, Khinchi P J and Mohitkar S P 2016. Ethnozoological studies among adjoining areas of pandharkawda taluka of yavatmal district, Maharashtra, India. *Int. J. Res. Biosci. Agric. Technol.* 4: 97-100.
- Mishra N, Rout S D and Panda T 2011. Ethno-zoological studies and medicinal values of Similipal Biosphere Reserve, Orissa, India. *Afr. J. Pharm. Pharmacol.* 5(1): 6-11.
- Mola M G, Hailie Y Y, Terefe H B and Kessete R Y 2020. Ethnozoological study of traditional medicinal animals and their products used by the people of South Achefer district, Northern Ethiopia. *Research Square.* doi.org/10.21203/rs.3.rs-70890/v1
- Negi T and Kandari L S 2017. Traditional knowledge and zootherapeutic use of different animals by Bhotiya tribe: A case study from Uttarakhand, India. *Indian J. Tradit. Knowl.* 16(4):638-647.
- Naulak T and Pradhan S 2020. A checklist of mammals with historical records from Darjeeling-Sikkim Himalaya landscape, India. *J. Threat. Taxa.* 12(11): 16434-16459.
- Patel R and Pal M C 2021. Exploring Ethnozoological Observations Among The Tribal Inhabitants In 'Bajag' Forest Range Of Dindori District Of Central India. *Int. J. Aquat. Sci.* 12(2): 4513-4538.
- Poudel A S, Jha P K, Shrestha B B and Muniappan R 2019. Biology and management of the invasive weed *Ageratina adenophora* (Asteraceae): current state of knowledge and future research needs. *Weed Res.* 59(2): 79-92.
- Pushpangadan P, George V, Sreedevi P, Ijini T P and Ninawe A 2014. Ethnozoological knowledge of Indian scheduled tribe, scheduled caste and rural communities. *Indian J. Tradit. Knowl.* 13 (4):735-741.
- Rai U and Rai B 2020. Plant based raw drugs sold in the markets of the Darjeeling Himalaya, India: A case study. *Pln.* 14(2): 293-299.
- Raja L, Matheswaran P, Anbalagan M, Sureshkumar V, Ganesan D and Gani S B 2018. Ethnozoological study of animal-based products practices among the tribal inhabitants in Kolli Hills Namakkal District, Tamil Nadu, India. *World J. Pharm. Sci.* 7 (12):785-797.
- Saren P C and Basu D 2013. A Note on Himalyan Goral *Nemorhaedus goral* (Hardwicke 1825) at Darjeeling District, West Bengal, India. *Rec. Zool. Surv. India.* 113(2): 197-198.
- Singh O I, Devi K S, Singh K B and Singh, K B 2023. Rare And Unexplored Ethnozoological Practices of Tangkhul Naga Community of Manipur: A North Eastern State of India. *J. Adv. Zool.* 44(3): 451-464.
- Sreedevi K and Tyagi S 2016. Notes on male genitalia and endophallus of five predominant species of Holotrichia (Coleoptera: Scarabaeidae: Melolonthinae). *Current Biotica.* 9(4): 328-339.
- Ullah I, Shoukat A, Khan M F, Shah G M, Tabassam S, Sajid M and Badshah K D 2020. Indigenous knowledge of zootherapeutic use among the people of Hazara division Khyber-Pakhtunkhwa, Pakistan. *Indian J. Tradit. Knowl.* 19(3):568-579.
- Vijayakumar S, Yabesh J M, Prabhu S, Ayyanar M and Damodaran R 2015. Ethnozoological study of animals used by traditional healers in Silent Valley of Kerala, India. *J. Ethnopharmacol.* 162: 296-305.