

Ethnobiological Fauna And Tharu Community of The Uttarakhand: Patterns of Utilization and Dietary Significance

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Abstract—The Tharu people, Indigenous to the Terai region of northern India, have a deep connection with animals, reflecting their traditional agricultural lifestyle and cultural beliefs. To document the traditional knowledge, we interviewed a total of 35 people, out of which 20 were men and 15 were women. Before the interviews, we visited the community multiple times to make sure we included diverse participants. The predominance of men over women was due to cultural constraints. We collected information on animals important for medicine and food from May to June 2024. The present study enlisted (N=19) species, classified into (N=14) different families. The Bovidae family holds the highest dominance over all others, comprising (N=5) species; (*Bos taurus*, *Bos torus*, *Bubalus bubalis*, *Ovis aries*, and *Capra aegagrus hircus*.) followed by Canidae comprising (N=2) species; (*Canis lupus*, *Canis aureus*.) The documented species were found to treat various human ailments (musculoskeletal problems, skin problems, respiratory diseases, wounds, sexual disorders, liver diseases, epilepsy, Diabetes, eye disease, abdominal disorders, brain disorders, and blood diseases). Among the diseases treated, skin problems were the most frequently addressed, involving the highest number of species, including (*Bos taurus*, *Ovis aries*, *Sus domesticus*, *Felis chaus*, *Canis aureus*, *Pteropus giganteus*, *Cornu aspersum*, *Equus ferus caballus*, *Capra aegagrus*, and *Callosciurus erythraeus*). A total of (N=19) animal parts were identified from the documented species

used in ethnomedicinal practices. Bones were found to be the most frequently utilized obtained from (N=7) species (*Equus ferus caballus*, *Canis lupus*, *Oryctolagus cuniculus*, *Canis aureus*, *Felis chaus*, *Sus domesticus*, and *Callosciurus erythraeus*) followed by gall bladder from (N=5) species (*Capra aegagrus onerosus*, *Gallus gallus domesticus*, *Ursus thibetanus*, *Canis aureus*, and *Rattus rattus*). Based on the number of usage of species, a total of three categories were created. Category first (single usage), category second (Double usage), and category third (Multiple usage). The maximum number of species belonged to category third (multiple usage) with 47% species (*Bos torus*, *Capra aegagrus hircus*, *Equus ferus caballus*, *Gallus gallus domesticus*, *Canis lupus*, *Pteropus giganteus*, *Camelus dromedaries*, *Ursus thibetanus*, *Canis aureus*, *Sus domesticus*). The Tharu community in the Himalayas shows a

Index Terms—Ethnobiology, Fauna, Uttarakhand

I. INTRODUCTION

Animal resources have been of significant value in different features of human life from its origins. Various animal species exist in art, music, religion, literature, medicine, food, and other human expressions (Davies, 2012). The phenomenon of zotherapy is noticeably mutually by a broad geographic distribution and profound historical origins. Zotherapy contributes significantly to healing practices, and magic rituals and constitutes an

important alternative in modern civilization (Altaf et al., 2017). Various civilizations have utilized animals and their parts and products as medicine (Barcan, 2020). According to the World Health Organization, most of the world's population relies primarily on animal-based medicine (Imtiaz, 2021). WHO reported that about 8.7 % of 252 essential chemicals used in various medicines come from animal origin (Tesfaye and Erena, 2020).

In India different tribal populations exist, however, the central Himalayan region (Uttarakhand) is inhabited by five major schedule tribes such as Jansaries, the Tharus, Buksa, Raji, and Bhotia (Sati and Sati, 2020). Tharu tribal population characterized the Terai belt of Uttarakhand (Malhotra, 2024). Livestock is an essential part of the Tharu tribal community in this region (Sharma et al., 2021). Tharu tribal population in Uttarakhand is reported to be approximately 60,000 and is also distributed in the states of Bihar and Uttar Pradesh (Malhotra, 2024). They live along Indo-Nepal borders in about 46 villages, use many animals for healthcare practices, and have enormous knowledge about their medical usage.

Upon going through the regional literature, we found that enough work has been carried out across the Tharu community concerning flora, (Thapa, (2020); Singh, (2017); Gharti et al., (2024); Chaudhary and Rajbhandary, (2021) Sharma et al., (2014), however, there is a lack of studies that report the ethno-usage of animal species (traditional medicine and livelihood). To find the gap, we drafted the following objectives to enrich the existing literature.

- To identify and catalogue animal species used in traditional medicine.
- Determine the range of human ailments treated by the documented animal species.

II. METHODOLOGY

STUDY AREA

Dehradun (Figure 1), located in Uttarakhand, is famous for its beautiful valleys and natural landscapes (Sati, 2020). It sits between the Shivalik ranges to the south and the Himalayan foothills to the north, with around 714,000 people living there. The Tons River flows through, providing fertile plains for farming. The area's diverse geography supports animal species

like rats, rabbits, wild goats, water buffalo, and cattle (Mussarat et al., 2021). Dehradun has a subtropical climate with mild weather throughout the year and clear seasonal changes (Mishra and Garg, 2023). Most people in Dehradun practice Hinduism (82.53%), followed by Muslims. (11.7%), Sikhs (3.50%), Christians (1.06%), Jains (0.63%), and Buddhists (0.29%). Ethnic groups like Jaunsari, Tharu, Gujjar, and Buxa also live there. The warmest months are from May to June and the coldest months are from June to January (Vautard et al., 2020). The area gets its heaviest rainfall from July to September.

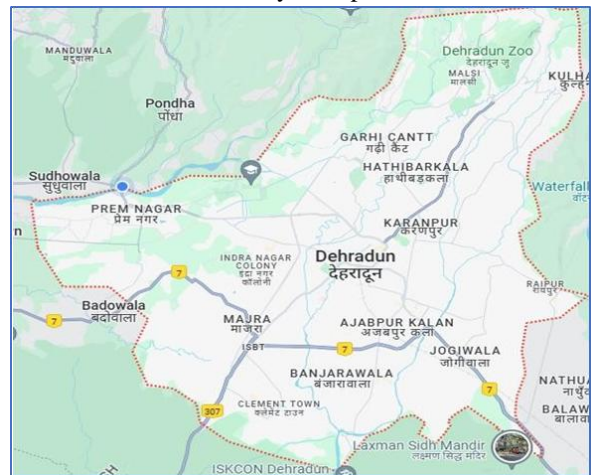


FIGURE. 1: MAP OF THE STUDY AREA

DEMOGRAPHY OF INFORMANTS

We interviewed a total of 35 people—20 men and 15 women. Before the interviews, we visited the community -multiple times to make sure we included diverse participants. The predominance of men over women was due to cultural constraints. We collected information on animals important for medicine and food from May to June 2024. The interviews were conducted in Hindi and included people of different ages, genders, and occupations (Table 1). We used a flexible approach with our questions to gather traditional knowledge comprehensively. The most knowledgeable people were elderly within the community, provided guidance preserving traditional knowledge, and most respondents (42.85%) were illiterate (see the table below). We observe that most of the respondents are engaged in agriculture (32.28%) as their primary occupation and very few are employed in government positions (14.28%) many women are engaged in household duties and caretaking, contributing to domestic activities with their families.

The nomenclature of animal species was verified by integrated taxonomy and information system (ITIS) (<https://www.itis.gov>). For the qualitative data analysis of the result, we employed chord diagrams, bar diagrams, and pie charts.

TABLE 1 DEMOGRAPHIC STATUS OF THE RESPONDENTS FROM THE STUDY AREA

Demographic Features	Number	Percentage
Ethnic Group	Tharu	
Language	Nepali, Hindi	
EDUCATION		
Illiterate	15	42.85%
Primary education	10	28.57%
Secondary education	8	22.85%
Higher education	2	5.71%
AGE RANGE		
Young (18-26)	9	25.71%
Middle (27- 55)	11	31.42%
Old (56-75)	15	42.85%
PROFESSION		
Farmers	6	17.14%
Agricultural workers	12	32.28%
Government employees	5	14.28%
Housewives	7	20%
Shopkeepers	5	14.28%
GENDER		
Male	20	57.14%
Female	15	42.85%
RELIGION		
	Hinduism	
	Islam	

III. RESULTS AND DISCUSSION

TAXONOMIC ACCOUNT

The present study enlisted a total of (N=19) species (Table 2). The species were classified into (N=14) different families (Figure. 2). The Bovidea family holds the highest dominance over all others, comprising (N=5) species; (*Bos taurus*, *Bos torus*, *Bubalus bubalis*, *Ovis aries*, and *Capra aegagrus hircus*), followed by Canidae comprising (N=2) (*Canis lupus*, *Canis aureus*) Twelve families (e.g., Equidae, Phasianidae, Helicidae, Leporidae, Apidae,

Pteropodidae, Camelidae, Ursidae, Felidae, Suidae, Sciuridae, Muridae) were found to be monotypic Hassan et al., (2022) reported the maximum usage of the Bovidea family in the ethnomedicinal Western Himalayas; Likewise, Haq et al., (2021) reported the usage of many different families of plant species for ethnobiological usage.

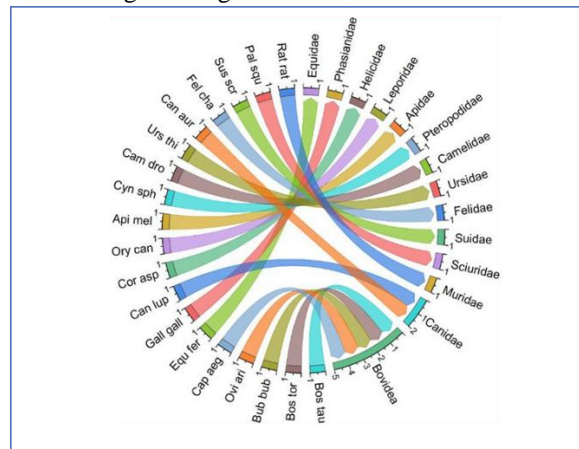


FIGURE 2. CHORD DIAGRAM REVEALING THE DISTRIBUTION OF SPECIES ACROSS THE FAMILIES. THE COMPLETE NAMES OF THE SPECIES ARE PROVIDED IN TABLE 2

ETHNOMEDICINAL PROFILE

The present study has documented (N=19) animal species used widely to treat various human ailments (Figure 3). The various documented diseases include musculoskeletal problems, skin problems, respiratory diseases, wounds, sexual disorders, liver diseases, epilepsy, Diabetes, eye disease, abdominal disorders, brain disorders, and blood diseases.

Among the diseases treated, skin problems” were the most frequently addressed, involving the highest number of species, including (*Bos taurus*, *Ovis aries*, *Sus domesticus*, *Felis chaus*, *Canis aureus*, *Pteropus giganteus*, *Cornu aspersum*, *Equus ferus caballus*, *Capra aegagrus*, and *Callosciurus erythraeus*). Wounds were the next most common condition, with (N=8) species (*Bos taurus*, *Capra aegagrus hircus*, *Canis lupus*, *Oryzopsis caniculus*, *Apis mellifera*, *Felis chaus*, *Sus domesticus*, and *Callosciurus erythraeus*). (N= 7) species treated musculoskeletal problems (*Canis aureus*, *Sus domesticus*, *Bubalus bubalis*, (N=6) species managed abdominal disorders (*Bos taurus*, *Capra aegagrus hircus*, *Gallus gallus domesticus*, *Canis lupus*, *Oryzopsis caniculus*, and *Ursus thibetanus*). Liver diseases and stomach

problems each were treated by (N=5) species (*Capra aegagrus hircus*, *Gallus gallus domesticus*, *Camelus*, *Ursus thibetanus*, and *Sus domesticus*) were used to treat liver diseases; and (*Bos taurus*, *Capra aegagrus hircus*, *Equus ferus caballus*, *Gallus gallus domesticus*, and *Canis lupus*) were used to treat stomach problems. Eye-related disorders were treated by (*Pteropus giganteus*, *Ursus thibetanus*, and *Rattus rattus*). Respiratory diseases and epilepsy were managed by (N =2) species each (*Camelus dromedarius* and *Canis aureus*). Finally, brain disorders were treated by (*Cornu aspersum*), blood disorders by (*Sus domesticus*), diabetes by (*Camelus dromedarius*), and sexual disorders by (*Canis lupus*), each with a single species involved. Altaf et al., (2017) also reported the usage of animal species against various ailments vicinity of river Chenab, Punjab-Pakistan, likewise, Confessor et al., (2009) reported the ethnomedicinal use of animal species from a semiarid region, in Northeastern Brazil.

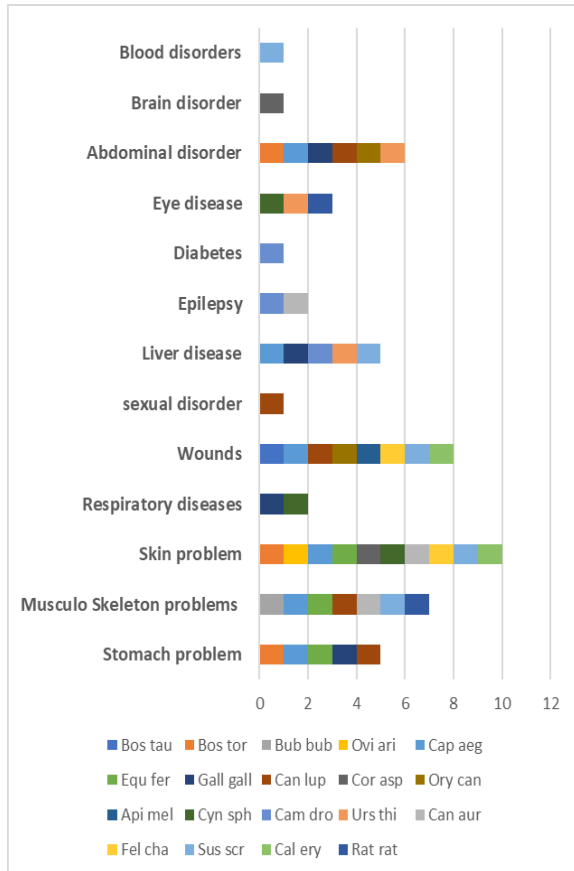


FIGURE 3: BAR DIAGRAM REVEALING THE DISEASES THE DOCUMENTED ANIMAL SPECIES TREATED. THE COMPLETE NAME OF THE SPECIES IS PROVIDED IN TABLE 2

PART USAGE

Different communities worldwide have utilized various animal parts for various purposes (Hussain et al., 2021). In the present study, we identified a total of (N= 19) animal parts from the documented species used in ethnomedicinal practices (Figure. 4). Bones were found to be the most frequently utilized obtained from (N= 7) species (*Equus ferus caballus*, *Canis lupus*, *Oryctolagus cuniculus*, *Canis aureus*, *Felis chaus*, *Sus domesticus*, and *Callosciurus erythraeus*) followed by gall bladder from (N=5) species (*Capra aegagrus onerosus*, *Gallus gallus domesticus*, *Ursus thibetanus*, *Canis aureus*, and *Rattus rattus*), fat from (N=4) species (*Canis lupus*, *Camelus dromedaries*, *Capra aegagrus hircus*, *Ovis aries*), dung from (N=4) species (*Bos torus*, *Bos tauru*, *Bubalis bubalis*, *Capra aegagrus*, *Capra aegagrus hircus*), fur from (N=3) species (*Callosciurus erythraeus*, *Felis chaus*, *Oryctolagus cuniculus*). The other products/parts of the documented species were also enlisted. For instance, milk from (*Bos torus*, *Camelus dromedaries*) venom from (*Cornu aspersum*, *Apis mellifera*) meat from (*Bubalus bubalis*, *Gallus gallus domesticus*) blood from (*Equus ferus caballus*, *Pteropus giganteus*) hooves from (*Equus ferus caballus*, *Canis lupus*) urine from (*Bos torus*, *Camelus dromedaries*). The parts like the heart, kidney, liver, Propolis, faces, skin & horns of different species were also used in the minor. Confessor et al., (2009) also reported the part usage of the different animal’s part upon investigating the ethnomedicinal usage of the semiarid region, in northeastern Brazil.

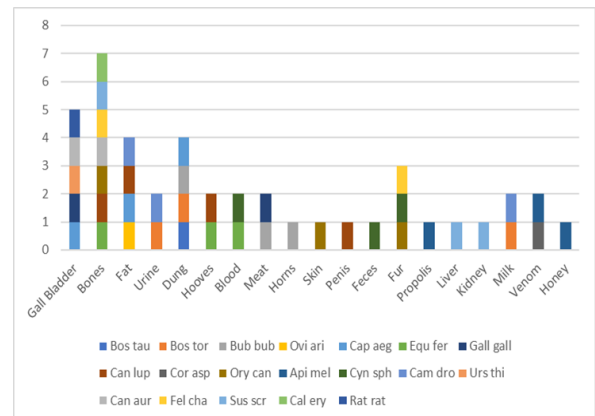


FIGURE 4: BAR CHART REVEALING THE GASTRONOMIC USAGE OF THE SPECIES BY THE THARU COMMUNITY. THE COMPLETE NAMES OF THE SPECIES ARE PROVIDED IN TABLE 2

GASTRONOMIC USAGE

Tharu community in the Himalayas shows a profound reliance on livestock production within their gastronomic tradition. Livestock such as Cows, buffaloes, goats, and poultry are integral to their dietary practices, as they offer products like, milk, ghee, butter, and lassi enriching their cuisine with flavor and nutritional value (Figure 5). Buffaloes are especially valued for their milk, and sometimes even meat. Their milk is used to make ghee and other dairy items. Cows are highly esteemed for their milk, which is essential for producing ghee. Overall, the Tharu people's culinary traditions are deeply connected to their cultural heritage and their natural environment. Suunto et al., (2011) also reported the gastronomic usage of the different animals of the Cariri paraibano, Brazil. Harmayani et al., (2019) reported the gastronomic usage of the different animals of Nepal.

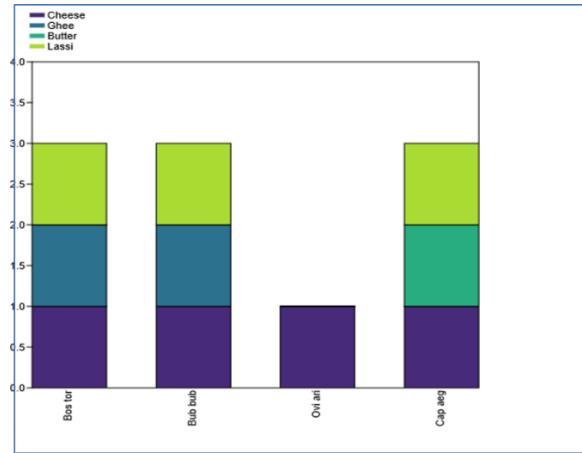


FIGURE 5: BAR CHART REVEALING THE GASTRONOMIC USAGE OF THE SPECIES BY THE THARU COMMUNITY. THE COMPLETE NAMES OF THE SPECIES ARE PROVIDED IN TABLE 2

TABLE 2: INVENTORY OF DOCUMENTED SPECIES WITH ETHNOBIOLOGICAL USAGE

Scientific name [Family]	Abbreviation	English name	Ethnic group	Part used	Preparation form	Ethno-pharmacological usage	Gastronomic usage	
<i>Bos taurus</i> Linnaeus [Bovidea]	<i>Bos tau</i>	Ox	Tharu	Gall, Horn, Bones and fat	Bile extract from the gall bladder. Horns and bones are ground into powder. Fat is extracted from the tail or back and is used to make medicinal oils and balms.	Bile from ox gall is used to treat digestive disorders, liver ailments, and jaundice. Horns are used in wound healing. Bones from oxen are used to treat fractures and musculoskeletal injuries. Oils and balms, are applied externally to treat muscle pain, joint stiffness, and rheumatic conditions.	Yes	
<i>Bos torus</i> Linnaeus [Bovidea]	<i>Bos tor</i>	Cow	Tharu	Urine and Dung		Cow urine is used in treating digestive issues, and urine even as disinfectants.	Yes	
<i>Bubalus bubalis</i> Linnaeus [Bovidea]	<i>Bub bub</i>	Buffalo	Tharu	Bones and Horns, fat	Bones and horns are ground into powder. Fat, particularly from the tail and back applied externally.	The powdered form of bones and horns is used to treat fractures and musculoskeletal injuries. Fat is applied externally to treat skin problems.	Yes	NE
<i>Ovis aries</i> Linnaeus [Bovidea]	<i>Ovi ari</i>	Sheep	Tharu	Fat	Fat from tail and back, made into medicinal balms and ointments	Balms and ointments are used to protect skin diseases.	Yes	NE

<i>Capra aegagrus hircus</i> Erxleben [Bovidea]	<i>Cap aeg</i>	Goat	Tharu	Fat and gallbladder	Fat, particularly from the kidneys or back, is used to make bombs and oil. Bile is extracted from the gallbladder.	Balms and ointments are used to protect skin diseases, also employed for soothing muscle pain, joint stiffness, and wound healing. Bile from the gallbladder is used to treat jaundice, digestive disorders, and wound healing.	Yes	VU
<i>Equus ferus caballus</i> Linnaeus [Equidae]	<i>Equ fer</i>	Horse	Tharu	Bones, hooves, and blood	Bones are grounded into powder or decoction. Hooves are often boiled to extract gelation substances. Blood is mixed with milk or other liquid.	Powdered or decoction of bones is used to treat skin disorders. Gelatinous substance used to treat joint pain. The horse's blood is mixed with milk or other liquid used to treat ingestion.	Yes	NE
<i>Gallus gallus domesticus</i> Linnaeus [Phasianidae]	<i>Gall gall</i>	Chicken	Tharu	Meat and gallbladder	Meat is used to make soups. Bile extract from gallbladder.	Meat soups are used to treat colds, flu, and respiratory ailments. Bile from the gallbladder is used to treat digestion and liver health.	Yes	NE
<i>Canis lupus</i> Linnaeus [Canidae]	<i>Can lup</i>	Dog	Tharu	Bones and penis	Bones are used to make broth or in fine powdered form. Penis is prepared in various forms such as powdered, tinctures, or extract.	Bones broth or powdered form is used to treat joint pain, digestive issues, and wound healing. Powders, tinctures, or extracts from the penis are used to treat sexual health issues and boost vitality.	Yes	LC
<i>Cornu aspersum</i> <i>O.F.Muller</i> [Helicidae]	<i>Cor asp</i>	Garden snail	Tharu	Slime and venom	Slime is produced from the foot of the snail. Venom secretion from the salivary gland.	Slime has healing properties for the skin used to reduce wrinkles, scars, and acne. Venom is used as a painkiller and in the treatment of neurological disorders.	Yes	NE
<i>Oryctolagus caniculus</i> Linnaeus	<i>Ory can</i>	Rabbit	Tharu	Bones, Fur, skin	Bones are used to make broth or ground into powdered.	Powdered from or broth of bones is used to treat	Yes	LC
[Leporidae]					Fur and skin are used directly.	conditions like osteoporosis. Fur can be utilized to cover wounds and injuries, providing protection and aiding in healing. Similarly, skin can be used as wound dressings, protecting		

						and promoting healing.		
<i>Apis mellifera</i> Linnaeus [Apidae]	<i>Api mel</i>	honeybee	Tharu	Honey, propolis	Honey is extracted from the bee yard. Propolis is a resin-like material.	Honey is applied directly to treat wounds, inflammation, and infections. Propolis is used to treat infections and cold sores.	Yes	NE
<i>Pteropus giganteus</i> <i>Brunnich</i> [Pteropodidae]	<i>Cyn sph</i>	Bat	Tharu	Blood, droppings.	Blood extract from the bat is consumed directly or mixed with other medicinal ingredients. Dropping and faeces are used directly.	Blood is used to treat respiratory disorders and asthma. Dropping is used to treat skin diseases.	Yes	LC
<i>Camelus dromedaries</i> Linnaeus [Camelidae]	<i>Cam dro</i>	Camel	Tharu	Milk, urine, and hump fat.	Milk from the camel is consumed directly. Urine is consumed by mixing with milk. Oils are extracted from the hump fat.	Milk is used to treat autoimmune disorders, diabetes, and allergies. Urine is used to treat jaundice and epilepsy. Oil is applied directly or ingested in small quantities to treat skin conditions and joint pain	Yes	NE
<i>Ursus thibetanus</i> G.Cuvier [Ursidae]	<i>Urs the</i>	Bear	Tharu	Gallbladder	Dried and ground into powder, then taken in. small doses or mixed with other medicinal ingredients.	The powdered form of the gall bladder is used to treat fever, liver disease, eye problems, and hemorrhoids.	Yes	VU
<i>Canis aureus</i> Linnaeus [Canidae]	<i>Can aur</i>	Golden jackal	Tharu	Gallbladder and bones	Bile is extracted from the gallbladder. Bones are ground into powder.	Bile is used to treat rheumatism and epilepsy. The powdered form of bones is used to treat skin disease.	NO	LC
<i>Felis chaus</i> Schreber [Felidae]	<i>Fel cha</i>	Jungle cat	Tharu	Bones, fat, and fur.	Bones are ground into powder. Fat is rendered into oil. Fur is used directly	Bones extract can help strengthen bones, treat fractures. Oil of the animal is used to treat various skin-related diseases. Fur is used as ointments.	NO	LC
<i>Sus scrofa</i> <i>Domesticus</i> Linnaeus [Suidae]	<i>Sus scr</i>	Pig	Tharu	Liver, heart, fat, and bone	The liver and heart are cooked. Fat is rendered into lard. Bones are boiled to make soups and broth.	Cooked liver is consumed to treat anemia. Cooked liver is consumed to strengthen the heart and improve cardiovascular health. Fat lard is applied	Yes	NE

						topically to treat skin conditions, burns, and wounds. Bones broth and soups are consumed to treat wounds, joint pain, and skin ailments.		
<i>Callosciurus erythraeus</i> Pallaus [Sciuridae]	<i>Pal squ</i>	Squirrel	Tharu	Bones, fur, and fat	Bones are sometimes ground into powder or used to make broth. Fur is used directly. Fat is rendered and applied directly.	Powder form of bones or broth is consumed to strengthen bones, treat fractures, or alleviate joint. Fur of the animal used to treat various skin-related diseases. Fat is used to treat joint pains, arthritis, and skin conditions	Yes	LC
<i>Rattus rattus</i> Linnaeus [Muridae]	<i>Rat rat</i>	Rat	Tharu	Tail and gallbladder	Tail is dried and grinding into powder or mixed with other herbs. Gallbladder is dried and ground into powder or prepared decoction by boiling in water.	Powdered tail is ingested orally or applied topically to treat joint pain muscle stiffness and arthritis. Powder form or decoction of the gallbladder is consumed orally by mixing with other ingredients used to treat jaundice, gallstone, and hepatitis.	Yes	LC

IV. CONCLUSION

The current study attempted to acquire information about the ethnic community (Tharu) for the use of animals to treat health disorders and to identify species consumed as primary food. The utilization of animal resources across various dimensions of human life, particularly within ethnic communities, reflects a profound historical and cultural symbiosis with the natural environment. In the central Himalayan region of Uttarakhand, India, the Tharu community exemplifies this relationship through their extensive use of animal products in both medicinal and dietary practices. The Tharus incorporate a range of animal-derived substances, including meat and bile etc into their traditional therapeutic regimens. This practice underscores a deeply ingrained body of knowledge transmitted across generations, highlighting the significant role of zotherapy in their indigenous healthcare system. The dietary patterns of the Tharu community further illustrate the integral role of fauna. Animal-based food products constitute essential

components of their diet. The gastronomic practices of the Tharu community in the Himalayas demonstrate a profound reliance on livestock, including cows, buffaloes, goats, and poultry. These animals contribute significantly to their cuisine by providing essential dairy products such as milk, ghee, butter, and lassi, which not only enrich the flavor and nutritional value of their dishes but also reflect their cultural and environmental context. Buffaloes, in particular, are valued for both their milk and meat, while cows are essential for ghee production. This reliance on livestock underscores a deep connection between the Tharu people’s culinary traditions and their cultural heritage. These studies collectively highlight the universal significance of livestock in shaping local food practices and preserving cultural identities across different communities. However, the pressures of urbanization and socio-cultural changes threaten the preservation of these traditional practices. Documenting and safeguarding this traditional knowledge are imperative to prevent its potential erosion. The continued reliance on animal-based

medicines and the intricate practices surrounding their use within the Tharu community highlight the necessity of preserving these traditions as part of the broader cultural and ecological heritage. This study thus emphasizes the critical need for concerted efforts to document and protect traditional knowledge to ensure its continuity in the face of modernizing influences.

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AUTHOR CONTRIBUTIONS

Conceptualization: All authors read and approved the final manuscript.

FUNDING

No external funding resources were available for this particular study.

DATA AVAILABILITY STATEMENT

All the required data is provided in the article.

ETHICS DECLARATIONS

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The present research work is purely based on field surveys instead of human or animal trials. Therefore, ethical approval and consent to participate are not applicable. However, the formal consent regarding data collection and publication was taken verbally from informants. In addition, ethical guidelines of the International Society of Ethnobiology (<https://www.ethnobiology.net/what-we-do/core-programs/ise-ethics-program/code-of-ethics/>) were strictly followed.

CONSENT FOR PUBLICATION

The present paper does not contain any individual data; therefore, this section does not apply to our study.

COMPETING INTERESTS

The authors declare that they have no competing interests.

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