

An investigation on the ethnozoological therapeutic practices among the indigenous communities of Goalpara district of Assam in India

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Abstract

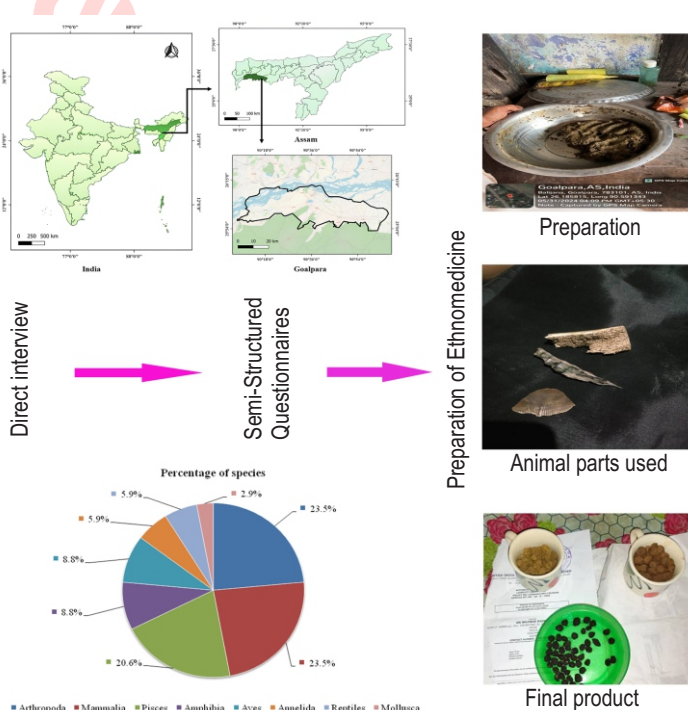
Aim: This study investigated the ethnozoological therapeutic practices among the ethnic communities of Goalpara district, Assam.

Methodology: The ethnozoological data was collected between April 2022 and March 2023 from 265 informants selected for their recognized expertise in traditional healing practices, through direct interviews using semi-structured questionnaires. Respondents, aged between 30 and 70 years (with a small proportion >70 included), comprised farmers, housewives, and local healers from Rabha, Garo, Bengali, Assamese, Hajong and Islamic communities.

Results: Altogether 31 animal species under four major phyla: Mollusca, Annelida, Arthropoda and Chordata were identified with therapeutic properties. Of these, chordates accounted for 67.6% of the documented practices, followed by arthropods (23.5%), annelids (5.9%) and molluscs (2.9%). Among the recorded classes of chordates, mammalian group was used more often, accounting for 34.7% of the documentations, followed by Pisces (30.4%), Amphibia (13.04%), Aves (13.04%) and Reptilia (8.6%).

Interpretation: The findings highlight Goalpara as a unique repository of ethnozoological knowledge with both cultural and pharmacological significance. Integrating this knowledge with modern medicine could provide new avenues for drug discovery, ensure safety and support biodiversity conservation through sustainable practices.

Key words: Documentation, Ethnomedicine, Ethnobiology, Goalpara, Zotherapy



Introduction

Traditional knowledge and practices play a crucial role in promoting species and habitat conservation, fostering the sustainable use of biodiversity and ensuring effective management of natural resources (Haq *et al.*, 2023). Ethno-biological resources have been utilized across various social systems since the evolution of human society in the form of traditional medicines (Alves and Rosa, 2005). While plants are widely recognised for their bioactive compounds used as therapeutics in ethnomedicinal systems, animal resources also contribute significantly to traditional healing systems due to their medicinal properties and benefits to human health (Costa-Neto, 2005). Ethnozoological practices or zootherapy is the treatment of human ailments using preparations obtained from animals and their body parts (Costa-Neto, 2005). Dating back to the early centuries, India has been supporting a rich traditional knowledge in the field of zootherapy with valuable documentation in ancient texts such as Ayurveda and Charaka Samhita enlisting 24 Insects, 16 Reptiles, 21 Fishes, 41 Aves and 41 Mammals within the framework of Ayurvedic medicine (Tripathy, 1995).

Various ethnic groups across India possess profound understanding of animal resources and their therapeutic properties for their primary medical requirements (Mahawar and Jaroli, 2008). Over the years, researchers have reported traditional knowledge held by the local communities in several districts of different states in India (Gupta *et al.*, 2003; Patil, 2003; Solavan *et al.*, 2004; Negi and Palyal, 2007; Mahawar and Jaroli 2008). The north eastern region of India, inhabited by diverse ethnic groups largely depend on the traditional healing practices for various ailments. Ethnobiological practices have been reported in Nyishi and Galo tribes of Arunachal Pradesh by Chakravorty *et al.* (2011), Naga tribes of Nagaland by Jamir and Lal (2005), Chakhesang tribe of Nagaland by Kakati and Doulo (2002), Ao tribe of Nagaland by Kakati *et al.* (2006), Monpa tribe of Arunachal Pradesh by Solanki and Chutia (2004). The state of Assam also shows a rich tradition of healing through herbal (Sajem and Gossai, 2006), animal-based medicines as well as composite preparations of plant and animal derivatives (Kalita *et al.*, 2005).

The Goalpara district of Assam, which shares a political boundary with the neighbouring state of Meghalaya, is home to diverse ethnic communities such as the Rabhas, Bodos, Garos and Hajongs. Each of these groups has its own unique cultural practices including ethnozoological practices. Despite rich biodiversity and varied traditions of the ethnic communities in Goalpara, there has been limited documentation of the ethnozoological practices specific to this district. This represents a significant gap in both academic research and cultural preservation. There is a considerable potential to uncover the valuable insights into the ethnozoological practices of these communities. Therefore, the present study was undertaken to document the ethnozoological practices prevalent in the region with the prospection that the information generated from this study will enhance existing knowledge and aid in formulating

strategies for sustainable utilization of natural resources.

Materials and Methods

Study area: The present study was conducted in fourteen selected villages of Goalpara district, covering five blocks namely Kharmuja, Lakhipur, Krishnai, Balijana and Matia to document the ethnozoological practices. The district, spanning 1824 sq. km, is bordered by the River Brahmaputra in the north, the Garo Hills in the south, and the Kamrup and Dhubri districts of Assam in the east and west, respectively. The geographical map of the study area (Fig. 1) was constructed using Quantum Geographic Information System (QGIS-Version 3.30.3's-Hertogenbosch). Goalpara, situated between 25°53' N to 26°30' N latitude and 90°07' E to 91°05' E longitude, has a forest cover of 18.48% of its total geographical area (Wahal, 2011). The district experiences a moderate climate, with an average annual maximum and minimum temperatures of 28.4°C and 17.8°C, respectively. This agrarian district receives an average annual rainfall of 2739 mm and bears an average relative humidity of 81%.

Data collection: The study was conducted from April 2022 to March 2023, involving interactions with 265 informants through semi-structured questionnaires. Respondents were selected based on their expertise in folk medicines and belonged to various communities, including Rabha, Garo, Bengali, Assamese, Hajong and Islamic communities. Selection criteria included peer recognition within the community as knowledge holders. Expertise was validated through repeated cross-verification of responses and triangulation across informants. To accommodate illiterate respondents, researchers conducted interviews directly and filled the questionnaires. The informants were aged between 30 and 70 years, with a small proportion above 70 years. They were recognized for their knowledge within their communities and comprised 63% males and 37% females. The majority of the informants were farmers (57%), followed by housewives (33.6%) and local healers (9.4%).

The questionnaires focussed on the significance and relevance of ethnomedicine in traditional healing practices, as well as the cultural perspectives on faith healing. In addition, the study explored the healing process, examining the animal-derived components utilized, their preparation methods, prescribed usage, and the specific ailments they address. These questions aimed to capture a thorough understanding of traditional healing practices. Detailed records have been meticulously compiled, documenting the intricate details of each medicinal treatment, thus facilitating a comprehensive analysis of these indigenous remedies. The fauna utilized across different therapeutic practices has been quantitatively analyzed and represented as percentage distribution in a pie diagram.

Results and Discussion

The present study identified 31 distinct animal species belonging to four major phyla viz. mollusca, annelida, arthropoda

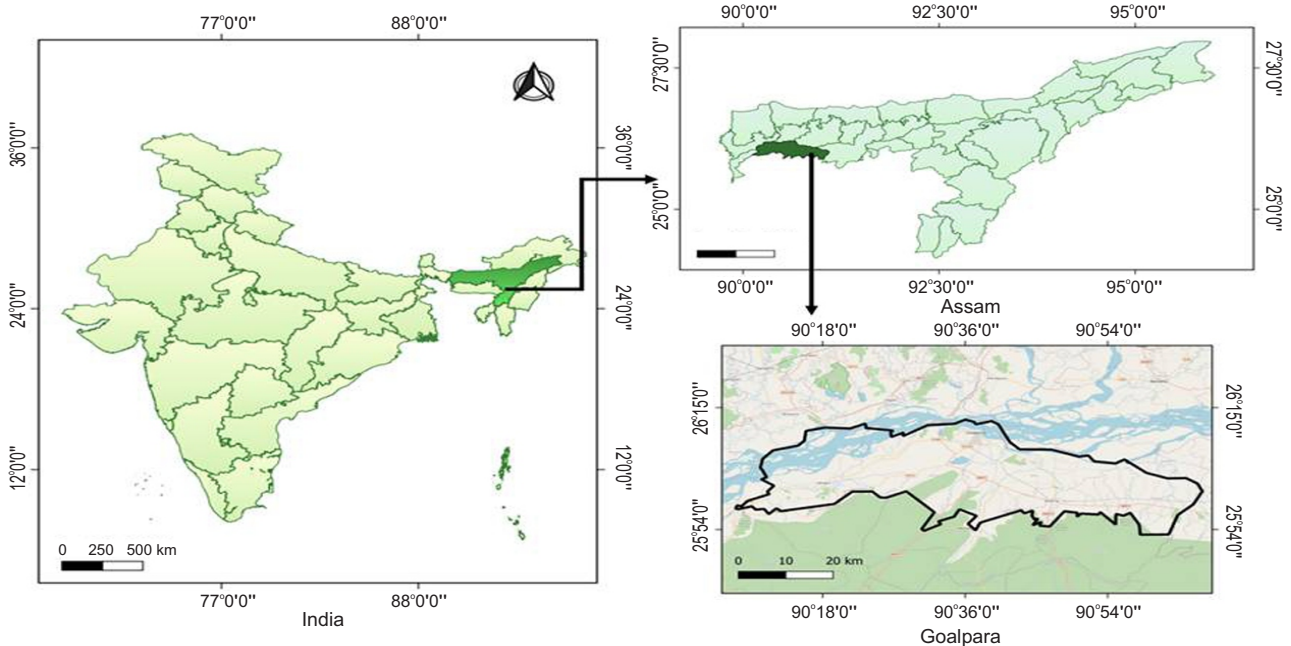


Fig. 1: Map of the study area.

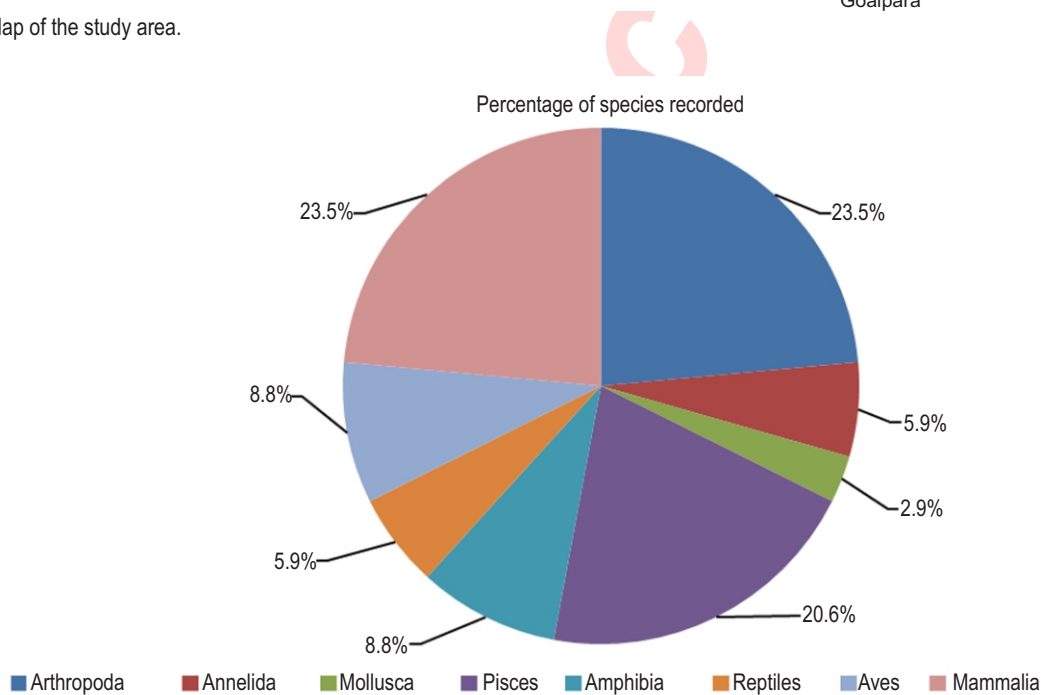


Fig. 2: Percentage of taxa in therapeutic practice.

and chordata utilized for various therapeutic purposes (Table 1). The findings highlighted the diverse categories of animals used for treating various ailments and disorders. Variations in the documentation of animals across different taxa can be attributed to species availability, as their habitats are largely influenced by climatic conditions, geographical factors and agricultural and industrial activities (Meyer-Rochow, 2009). A study conducted in Dima Hasao district of Assam found that the Baite tribe used 34 animal species to treat 34 distinct health issues (Betlu, 2013).

Likewise, within the Karbi community of Assam, 48 distinct animal species have been documented for their therapeutic properties, including treatment of piles, cancer, tuberculosis and eczema (Verma *et al.*, 2014). Results also documented the specific body parts processed for therapeutic purposes and the recommended methods and dosages for particular health conditions. Different animal taxa utilized in traditional healing practices are presented in Fig. 2. The study revealed a significant prevalence of chordates, accounting 67.6% of the documented therapeutic

practices followed by Arthropods as the second most commonly prescribed taxa, comprising 23.5% of the reported instances, while Annelids and Molluscs accounted 5.9% and 2.9% respectively. Among the chordates, mammals were the most frequently used class comprising 34.7% of documentations, followed by fishes (30.4%), amphibians (13.04%), birds and reptiles (8.6%) (Fig.2). The study revealed a greater utilization of animal flesh in zootherapeutic practices among the local inhabitants. The flesh of *Periplaneta americana*, *Sartoriana sp.*, *Abcondita chinensis*, *Vespa sp.* and *Leptocorisca sp.* has been traditionally used to treat ailments such as asthma, jaundice, piles, cancer and fever, respectively. In the North-eastern Brazil also, roasted cockroach (*Periplaneta americana*) is brewed into tea to treat asthma (Costa-Neto and Oliveira, 2000). Similarly, in Mizoram, sun-dried cockroaches are boiled and the solution is consumed to treat asthma, stomach-ache and excessive salivation in children (Lalramnghinglova, 1999). This corresponds with the present findings, which also documented a similar form of treatment using cockroaches. In Nagaland, the Naga tribes use edible crab (*Cancer pararus*) to treat jaundice and liver diseases, by crushing the crab into a paste and then boil it to prepare a medicinal drink (Jamir and Lal, 2005). This practice corroborates with the present findings. Ethnozoological use of firefly, *Luciola discicollis* to treat human disease is rare. The firefly *Luciola discicollis*, which possess a bioluminescent abdomen, was used for treating myopia by the indigenous people of the Plateau of Benin (Loko et al., 2019). In the present study, the whole body of firefly *Abcondita chinensis* was found to be used in combination with black pepper (*Piper nigrum*) and honey which was administered orally three times a day for the treatment of piles.

Similarly, the whole body of *Vespa sp.* was mixed with water and consumed for the treatment of cancer, a practice which was also reported by Borah and Prasad (2017). Beyond medical uses, hornet such as *Vespa magnifica* is regarded as a highly delicious and valued food among many tribes of Arunachal Pradesh (Narba et al., 2021). Despite their painful stings and potential allergic effects, *Vespa sp.* is traditionally used for treating cold and gastritis by some Indian tribes (Dehghani et al., 2019). According to Moreno et al. (2014), venom extracted from *V. orientalis* showed anticancer properties. Senthilkumar et al. (2008) reported that this insect species has been used traditionally for the treatment of arthritis. Further, the rice bug, *Leptocorisca varicornis* is traditionally used by the local communities near Gibbon Wildlife Sanctuary, Assam for treating fever, corroborating with the present findings.

The present study reports animal-derived products such as honey, fish oil, ghee and milk that have been traditionally used to treat various ailments including obesity, cough, cold, flu, skin disease, dysuria, nightfall etc. The findings of this study are consistent with existing ethnozoological literature. Honey, for instance, is well documented in folk medicine for treating cough and sore throat (Saranraj et al., 2016). Stingless bee honey is also used to treat respiratory illness, such as bronchitis when mixed with ingredients like lemon, agave mezcals and pulp of *Crescentia*

alata (Zulkhairi Amin et al., 2018). Recent experimental studies suggest that honey may also play a role in obesity management by reducing body weight, body fat composition, adipocyte hypertrophy and adipocyte hyperplasia (Ugusman et al., 2022). Raw honey enhances adipolysis and improves glucose homeostasis and insulin sensitivity in adipocyte cells, leading to lower levels of glucose, triglycerides, cholesterol and low-density lipoprotein (LDL) in the blood (Zulkifli et al., 2022). These scientific insights support its reported use in the present study for obesity management. The present study reported the use of earthworm (*Lumbricus terrestris*) to treat impotency in males. In this practice, the sun dried earthworms are ground into a powder and mixed with cloves (*Syzygium aromaticum*) and almond oil (*Prunus dulcis*). Similar usage has been documented among the Sukuma tribe of North-western Tanzania, where a paste prepared from dried earthworms (*Pheretima posthuma*) mixed with hot water is used to treat impotency (Vats and Thomas, 2015). Additionally, Verma and Pathak (2016) reported earthworms as potent aphrodisiac capable of enhancing libido and sexual behaviour.

In the present study, the extracts of leech (*Hirudinaria sp.*) were reported to be used for treating joint pain and body aches Hohmann et al. (2018) reported that a single session of leech therapy significantly reduced pain intensity in individuals with chronic low back pain. Leeches secrete more than 20 bioactive compounds and carboxypeptidase inhibitors, which exhibit analgesic, anti-inflammatory, platelet-inhibitory, anticoagulant, thrombin-regulatory and antimicrobial properties (Sig et al., 2017). Historically, Greek physicians used leeches for bloodletting and for treating rheumatic pain, gout, fever and hearing loss (Abdualkader et al., 2013). Leech therapy has shown to be an effective symptomatic treatment for osteoarthritis of the knee (Zaidi et al., 2009). The fresh water apple snail *Pila globosa* has a wide range of ethnozoological applications. Traditionally, it has been employed to treat diseases like high blood pressure, heart disease, asthma, rickets, rheumatoid arthritis, osteoporosis, calcium metabolism, bleeding piles, constipation, diarrhoea, smallpox, syphilis, dizziness, anxiety, nervousness, urticaria, night blindness and conjunctivitis (Patel and Kurhe, 2023). Present study also reported the use of *Pila sp.* for better eye sight, for which shell is removed and soft body parts are cooked and consumed.

Several fish species were recorded in the present study that are used for treating different ailments. *Chitala chitala*, *Clarias batrachus*, *Heteropneustes fossilis* and *Labeo rohita* were used to treat skin disease, body ache, wound healing and cough, respectively. The dried scales of *Chitala chitala* are ground, mixed with coconut oil and were traditionally applied to remove dandruff in infants, particularly among the Bodo community of Kokrajhar, Assam (Basumatary et al., 2023). Similar use of Asian catfish species, *Clarias batrachus* and *Heteropneustes fossilis* have been reported in the previous studies (Borah and Prasad, 2017; Nasreen and Borah, 2023; Sharma et al., 2023). Moreover, *Ophichthys cuchia* has been widely used to treat anaemia and loss of appetite. In Kokrajhar district, the meat and blood of *O. cuchia* are traditionally consumed to increase the haemoglobin

Table 1: Animal taxa and their body parts used in traditional therapeutic activities and mode of use

Animal Group	Scientific Name	Common Name	Local Name	Parts used	Medicinal uses/ Ailment cured	Preparation/ composition	Prescription
Arthropoda	<i>Apis mellifera</i>	Honey bee	Mou makhi	Honey	Cough, Cold, Flu	Raw honey or honey mixed with Tulsi	One tablespoon full three times daily
Arthropoda	<i>Periplaneta americana</i>	Cockroach	Poitachura	Flesh	Asthma	Cooked and consume (Wings and antennae are removed)	—
Arthropoda	<i>Sartoriana</i> sp.	Crab	Kekura	Flesh	Jaundice	Cook the flesh and consume	—
Arthropoda	<i>Apis</i> sp.	Honey bee	Mou makhi	Honey	Obesity/ Belly fat	Honey mixed with lemon juice and ginger juice.	one glass of the mixture is to be taken twice daily
Arthropoda	<i>Apis</i> sp.	Honey bee	Mou makhi	Honey	Eye disease	Fresh honey	one drop in each eye twice daily
Arthropoda	<i>Abseondita chinensis</i>	Firefly	Junaki porua	Whole body	Piles	Firefly (<i>Abseondita chinensis</i>) is mixed with black pepper (<i>Piper nigrum</i>) to make powder and then mixed with honey.	One tea spoon full of prepared medicine is taken orally three times a day
Arthropoda	<i>Vespa</i> sp.	Hornet	Kodu borol	Whole body	Cancer	Whole body is grinded and mixed with water	The mixture is prescribed to drink
Arthropoda	<i>Leptocorisa</i> sp.	Rice bug	Gandhi puk	Whole body	Fever	Whole body is boiled and consumed	—
Annelida	<i>Lumbricus terrestris</i>	Earthworm	Kesu	Whole body	Impotency in male	Sun dried earthworm is grounded into powder form and then mixed with cloves (<i>Syzygium aromaticum</i>) and almond oil (<i>Prunus dulcis</i>).	Massage on penis about 10-15 minutes before going to sleep
Annelida	<i>Hirudinaria</i> sp.	Leech	Juk	Whole body	Joint pain/ body ache	Put 10 leeches in a coconut and bury in soil for 1 month. After 1 month take out the leeches and boil it.	Massage the affected area with the extract 3 times daily.
Mollusca	<i>Pila</i> sp.	Snail	Shamuk	Whole body	Eye sight	Shell is removed and soft body parts are cooked and consumed	—
Pisces	<i>Ophichthys cuchia</i>	Eel	Kuchia	Raw blood & Flesh	Anaemia	Drink the raw blood or cooked and consume.	—
Pisces	<i>Chitala chitala</i>	Indian Fetherback	Chital	Fish oil	Skin disease	Mix Chital fish oil, Neem (<i>Azadirachta indica</i>) leaf extract and coconut oil and apply on the affected area.	—
Pisces	<i>Clarias batrachus</i>	Catfishes	Magur	Flesh	Body ache	Cooked and consumed	—
Pisces	<i>Pangasius pangasius</i>	Pangas	Pangas	Fats	Cough, Common cold, headache & fever	Fat/oil of pangas catfish is extracted and mixed with garlic (<i>Allium sativum</i>), cloves (<i>Syzygium aromaticum</i>), Nutmeg (<i>Myristica fragrans</i>), Mace (<i>Myristica fragrans</i>) and small amount of peppermint (<i>Mentha</i>	1) For Cough: Massage five times daily on the neck area 2) For Common the cold: Apply in nostrils 3) For headache: Apply on the

Table continued

						<i>piperita</i>). The mixture is then used for the treatment of Cough, Common cold, headache & fever	forehead and massage five times daily. 4) For fever: Apply on the whole body and massage five times daily. The mixture is to be taken 4 times daily with water
Pisces	<i>Ophichthys cuchia</i>	Eel	Kuchia	Blood	Loss of appetite	Blood of kuchia is mixed with ajwain powder (150 gm), peppermint, sugar, Honey, Lemon juice and ginger juice.	
Pisces	<i>Heteropneustes fossilis</i>	Cat fish	Singhi	Flesh	Wound healing	Singhi fish (<i>Heteropneustes fossilis</i>) boiled with mustard oil (<i>Brassica juncea</i>).	Apply in the affected area
Pisces	<i>Labeo rohita</i>	Rohu fish	Rou Mach	skeleton	Cough and chest pain	The skeleton is cooked and ground to make powder. And a small amount of power is mixed with one spoonful of honey	Prepared medicine is taken orally once daily
Amphibia	<i>Hoplobatrachus</i> sps.	Bull Frog	Bamun bhekuli	Flesh	Asthma	The flesh is cooked and consumed	—
Amphibia	<i>Polypedates</i> sp.	Common tree frog	Pat beng	Flesh	Asthma	The flesh is cooked and consumed	—
Amphibia	<i>Hoplobatrachus</i> sp.	Bull Frog	Bamun bhekuli	Flesh	Tonsil	The flesh is cooked and consumed	—
Reptiles	<i>Pangshura sylhetensis</i>	Turtle	Dura kaso	Body fats	Burnt skin	To apply on the burnt area	—
Reptiles	<i>Varanus</i> sp.	Bengal Monitor	Gui	Flesh	Ringworm	The flesh is cooked and consumed	—
Aves	<i>Amauromis phoenicurus</i>	White breasted waterhen	Dauk	Hind limbs	Dizziness during pregnancy or general dizziness	Small grounded parts to wear in the left ear	—
Aves	<i>Columba livia</i>	Pigeon	Paro	Flesh	Low blood pressure	Cooked with black pepper	—
Aves	<i>Passer domesticus</i>	House sparrow	Gharchirika	Flesh	Weakness	Cook and eat	—
Mammal	<i>Bos taurus</i>	Cow	Goru	Ghee	Burning sensation during urination	Clarified ghee, black cardamom (<i>Amomum subulatum</i>), kalijira (<i>Nigella sativa</i>), and flax seed (<i>Linum usitatissimum</i>) are mixed and prepared in powder.	One teaspoon full of prepared powder mixed with water and is taken orally on an empty stomach in the morning
Mammal	<i>Bos taurus</i>	Cow	Goru	Milk	Nightfall/ Anaemia	Onion (<i>Allium cepa</i>), cardamom (<i>Elettaria cardamomum</i>), and sugar mixed with cow milk and boil	One teaspoon full of prepared medicine is taken orally twice a day
Mammal	<i>Capra aegagrus hircus</i>	Goat (castrated)	Sagoli/ Khahi	Fats	Skin allergy/ Itching/ Ringworm	Fat/oil of castrated goat is mixed with powders of neem leaves (<i>Azadirachta indica</i>), bitter gourd (<i>Momordica charantia</i>) and Chirata (<i>Swertia chirayita</i>) to make a paste.	Apply the paste on the affected area at night before bedtime.
Mammal	<i>Hystrix indica</i>	Porcupine	Ketela	Stomach &	Stomach ache and	Grinded parts of stomach or intestine is to be consumed	—

Table continued

Mammal	<i>Cervus</i> sps.	Deer	Horin	Intestine	gastric	with 100 ml of water	
	<i>Manis</i>	Pangolin	Bon Rou	Horn	Chest pain,	Deer horn, elephant chest	Apply the mixture
	<i>crassicaudata</i>	Asian	Hati	Shell	fever, head	bone and pangolin shell	in the affected
	<i>Elephas</i>	Elephant		Chest	ache, muscle	are grinded and mixed	area and
	<i>maximus</i>			Bone	pain	with mustard oil.	massage two to
Mammal	<i>Rattus rattus</i>	House rat	Nigoni	Flesh	Epilepsy	Flesh is cooked and	—
						consumed	
Mammal	<i>Pteropus</i> sp.	Bat	Baduli	Flesh	Asthma	Cook and consume	—
Mammal	<i>Herpestes</i> sp.	Mongoose	Neul	Flesh	Asthma	Boiled flesh is consumed	—

levels, and its meat was boiled with medicinal plants such as *Lippia geminata* to treat anaemia (Basumatary et al., 2023). Likewise, the raw blood of *O. cuchia* has been reported to treat asthma, jaundice, anaemia, kala-azar, weakness and diabetes (Prakash and Prakash, 2021). The present study also documented extensive use of *Pangasius pangasius* for treating cough, common cold, headache and fever. Fat extracted from this fish is mixed with garlic (*Allium sativum*), cloves (*Syzygium aromaticum*), nutmeg (*Myristica fragrans*), mace (*Myristica fragrans*) and peppermint (*Mentha piperita*). The resulting mixture is administered in different forms depending on the specific ailment (Table 1).

The present study also documented the use of amphibians and reptiles in ethnozoological therapeutic practices. The flesh of bull frog, *Hoplobatrachus* sp. is consumed to treat asthma and tonsillitis, while the common tree frog, *Polypedates* sp. is specifically used for treating Asthma. According to Alves (2012), many species of amphibians and reptiles have significant medicinal properties. The Nyishi and Galo tribes of Arunachal Pradesh apply crushed live frogs (*Rana* sp.) to treat wounds (Chakravorty et al., 2011), the Shoka tribe of Pithoragarh, Uttaranchal uses *Rana tigrina* for wound healing (Negi and Palyal, 2007). Products derived from the monitor lizard, *Varanus bengalensis*, hold notable medicinal value in India, and are traditionally used for treating haemorrhoids, rheumatism, body pain, burns and venomous bites of spiders and snakes (Subramanean and Reddy, 2012). In the Chhindwara district of Madhya Pradesh, this species is used as a remedy for arthritis and sexual stimulant, with its skin oil applied topically for massaging the penis, also its testis are consumed raw (Bagde and Jain, 2017). However, the present study reports the consumption of cooked flesh of *Varanus* sp. specifically for treating ringworm. The present study reported the use of specific bird-derived anatomical parts and tissues for medicinal purposes. The hind limbs of *Amauromis phoenicurus* is used to treat dizziness during pregnancy, while the flesh of *Columba livia* and *Passer domesticus* is used to treat low blood pressure and general weakness. Similar observations were recorded by Altaf et al. (2017), where the local communities in three districts around the river Chenab in Pakistan used *Passer domesticus* for the treatment of weakness and fever. Jugli et al. (2020) reported similar uses of *Columba livia* from the North-east India. Borah and Prasad (2016) also reported the use of this species for the treatment of low blood pressure in Assam.

The traditional use of animal-derived products such as milk, fat and ghee continues to play a significant role in folk medicine. For instance, old preserved ghee is applied to relieve arthritis, while cow milk (*Bos indicus*) from a mother with a calf of the same colour is reportedly administered for rabies (Gogoi and Chakravorty, 2023). In the present documentation, the ethnomedicinal use of milk and ghee exhibits unique formulations. A preparation consisting of clarified ghee, black cardamom (*Amomum subulatum*), kalijira (*Nigella sativa*) and flax seed (*Linum usitatissimum*) ground into powder is used to alleviate burning sensations during urination. Similarly, a mixture of cow milk boiled with onion (*Allium cepa*), cardamom (*Elettaria cardamomum*), and sugar is taken orally to treat nightfall and anaemia. Moreover, topical application of fat from castrated goat combined with neem powders (*Azadirachta indica*), bitter gourd (*Momordica charantia*) and chirata (*Swertia chirayita*) is recorded in the present study for the treatment of skin allergy, itching and ringworm. Similar ethnomedicinal uses of goat fat (*Capra aegagrus hircus*) have been reported from Tamil Nadu for wound healing and toothache (Raja et al., 2018). As regards ethnomedicinal use of mammals is concerned, the local tribes of Mizoram consume the intestinal and stomach sections of *Hystrix indica*, either with or without water, twice daily to treat fever, malaria, colic and stomach aches (Chinlapianga et al., 2013). Similarly, among the Nyishi and Galo tribes of Arunachal Pradesh, the boiled gall bladder, stomach and intestines of porcupine (*Hystrix* sp.) are consumed with rice as a preventive remedy for gastritis and diarrhoea (Chakravorty et al., 2011).

Similar observations were recorded in the present study, where ground stomach or intestinal parts were mixed with 100 ml of water and consumed to alleviate gastritis and stomach aches. Additionally, a powdered mixture containing horn of *Cervus* sp., shell of *Manis crassicaudata* and chest bones of *Elephas maximus* was used to treat chest pain, fever, headache and muscle pain. The antler of *Cervus unicolor* has also been reported as a treatment for asthma among the Saharia tribes of Rajasthan (Mahawar and Jaroli, 2007), while Gupta et al. (2003) reported its use for eye ailments in the Kachchh region of Gujarat. Although majority of the medicinal applications of *Manis* sp. is attributed to its scales and carcass, they are also consumed as a supplementary protein source and as adornments (Soewu and Adekanola, 2011). Similarly, the use of elephant tooth in treating pimples, eczema, swellings and rheumatism has been

documented from different parts of the world (Nijman and Nekaris, 2016). The present study further reported the use of bat (*Pteropus* sp.) and mongoose (*Herpestes* sp.) flesh for treating asthma and cooked flesh of *Rattus rattus* to treat epilepsy. Comparable ethnomedicinal uses have been documented, such as the application of *Rattus rattus* leg and bile for treating nightmares (Kumera et al., 2022) and the utilization of bat species for asthma, pain management and mental health disorders across different countries (Tackett et al., 2022). In the South-western Nigeria, the limbs of mongoose (*Herpestes sanguineus*) are reportedly used to treat rheumatism (Soewu, 2008). However, the patterns observed in the present study diverge notably from previous reports, particularly concerning mongoose and rat.

The current investigation revealed a rich tradition of animal-based therapeutic practices among the ethnic communities of Goalpara district, Assam. A wide range of animal species and their derivatives are employed to treat diverse ailments, with certain preparations and administration methods being locally unique. However, several practices correspond with previous literature, reinforcing the influence of cultural and geographical influences on ethnozoological practices. Despite the fact that these traditional remedies remain integral to indigenous healthcare system, comprehensive scientific investigation is necessary to validate their pharmacological properties. Integrating ethnozoological knowledge with modern medicine could contribute to novel drug discovery, strengthen inclusive healthcare and address sustainable biodiversity management.

Many of the documented zootherapeutic practices involve significant toxicological or zoonotic risks. For example, ingestion of raw blood of *Ophichthys cuchia* risks infection depending on the health condition of the consumer. To ensure safety, it is generally recommended that raw fish blood undergoes thermal processing to inactivate microbial and parasitic contaminants while retaining its nutritional value (FAO, 2003; WHO, 2020). Additionally, it is crucial that the fish is freshly caught from clean, unpolluted water sources, as those inhabiting contaminated ecosystems are at risk of bioaccumulating heavy metals such as mercury, cadmium, lead, and arsenic, along with pesticide residues (Ali et al., 2019; Kumar et al., 2020). Moreover, cockroach flesh consumption (*Periplaneta americana*) may cause allergic or toxic reactions. Despite being an abundant source of protein, most cockroach species are considered unsafe for human consumption, as they can harbour harmful pathogens that pose significant health risks to humans if ingested. Furthermore, they may come into contact with pesticides or other pollutants in their surroundings, making them inappropriate for human consumption (Siddiqui et al., 2024). Use of bat meat (*Pteropus* sp.) poses zoonotic disease risks. Practices such as instilling raw honey in eyes may cause contamination by *Clostridium* spores (Ebrahimi et al., 2023). Therefore, it is necessary to undergo toxicological screening and public health advisories before promoting such remedies.

The inclusion of threatened species such as Pangolin (*Manis crassicaudata*), Asian Elephant (*Elephas maximus*) and

Deer (*Cervus* sp.) underscores the conservation dilemma. Conservation assessment reveals that these species are protected under International Union for Conservation of Nature (IUCN), Indian Wildlife (Protection) Act, 1972 and Convention for International Trade in Endangered species of Wild Fauna and Flora (CITES). Their use in ethnomedicine present significant ethical and legal challenges, which requires immediate attention. Therefore, community based awareness programmes, alternative sustainable practices and strict adherence to conservation laws are vital for balancing cultural practices with biodiversity conservation.

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