

## **ETHNOZOOLOGICAL REMEDIAL USES BY THE INDIGENOUS INHABITANTS IN ADJOINING AREAS OF THE POBITORA WILDLIFE SANCTUARY, ASSAM, INDIA**

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### **ABSTRACT**

**Objective:** To comprehend the traditional knowledge on zootherapeutic remedies used by indigenous people inhabiting in adjoining areas of the Pobitora wildlife sanctuary located in the Morigaon district of Assam State, India.

**Methods:** The adjoining villages of this wildlife sanctuary are inhabited by different indigenous communities and tribal groups of which Nath community and Karbis constitute the main population. In the present study, field survey was carried out from October 2014 to March 2015 by performing personal interviews through semi-structured questionnaires and in some cases where respondents were uncomfortable with the questionnaires, informal interviews and group discussions were conducted with a total of 50 respondents (33 male and 17 female), who provided the information regarding various uses of animals and their products (local name of animal, mode of preparation, application, etc) in their traditional medicine.

**Results:** A total of 26 ethnomedicinal animals and animal products that are used for the treatment of various ailments including asthma, jaundice, chicken pox, pneumonia, anemia, etc. were recorded. Some protected wild species like the golden jackal (*Canis aureus*), rhino (*Rhinoceros unicornis*) and Indian crested porcupine (*Hystrix indica*) were also mentioned to have important medicinal uses. The highest percentage of animals used for traditional treatment is mammals (~34.62%) followed by fishes (~30.77%) and birds (~15.38%). Most of the information are generally provided by the elderly person in the age group above 50 y.

**Conclusion:** The information on the remedial uses of different animals were collected from Nath community and Karbis who use a variety of zootherapeutic medicines for curing different ailments in their own ways. Such kind of information and documentation should be very helpful in the formulation of strategies on sustainable management and conservation of bio-resources so that the medicinal values of these traditional remedies would go a long way and may lead to novel drug(s) discovery.

**Keywords:** Pobitora wildlife sanctuary, Traditional medicine, Zotherapy

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### **INTRODUCTION**

Human beings depend on nature for food, clothing, shelter, medicines, etc. since time immemorial. Use of plants and animals by the indigenous people from generation to generation in their own ways for the health care is known as traditional or folk medicine. Traditional medicine remains the most available and affordable form of therapy in low-income countries [1]. About 70-80% of the world rural population depends on traditional medicine for its primary health care [2]. In fact, the percentage of the population using traditional medicines for primary health care is more (60-90%) in developing countries than that in developed countries (23-80%) [3]. Although plants and plant-derived materials constitute the principal source of ingredients for traditional medicine, identification of animal resources for medical cures is also gaining importance in human health care [4, 5]. Ethno zoology deals with the study of the past and present relationship between the human societies and the animal resources around them in their environment. The healing of human ailments by using medicines prepared from different animals and animal-derived byproducts is known as zoo therapy. Animals are also used for food and religious purposes, such as sacrifices, and they are an important part in magic rituals and mysticism [6]. The zootherapeutic resources constitute the vital ingredients in different traditional medicinal systems [7-9]. Wild and domestic animals and their byproducts (e. g. skin, bones, blood, meat, hooves, feathers, tusks) from essential ingredients in the preparation of protective, preventive and curative medicine [10, 11].

Biodiversity has been the source for therapy in different cultures since ancient times [12]. Due to extreme variation in geographical and climatic conditions prevailing in the country, India has a great biodiversity of fauna, accounting about 10% of the reported biological species on the planet and ranks first place in terms of

insects (54,600), followed by fishes (2546), aves (1232), reptilians (456), mammals (390) and amphibian (209) [13]. The use of different animal resources for traditional medicinal purposes has become more significant in the discussion on conservation biology, public health policies and sustainable management of natural resources, biological prospection, and patent [10]. Thus, in modern societies, zotherapy constitutes an important alternative treatment in various diseases among other known therapies practiced worldwide [9, 14].

Various studies on zootherapeutic traditional medicine in India have been reported and documented in great historical books like Ayurveda and Charaka Samhita. Different tribes and ethnic communities are dispersed all over the country, and they have a rich knowledge about animals and their medicinal values which are still being practiced for their primary health care needs. About 15-20% of the ayurvedic medicines is based on animal-derived substances [15].

North-eastern region of India comprising eight States-Assam, Arunachal Pradesh, Meghalaya, Mizoram, Manipur, Nagaland, Sikkim, and Tripura; is inhabited by various ethnic groups mainly belonging to different tribes with a wide cultural diversity and is mainly inhabited by the hill tribes of mongoloid origin [16]. As per 2011 census, the North-eastern region is inhabited by a total of 427 tribal groups. There are only a few reports available in this region about the use of animals in traditional medicine. The traditional methods of treating various ailments using 81 species of edible and therapeutic insects and 36 vertebrate species by the Nyishi and Galo tribes of Arunachal Pradesh were reported [17, 18]. Twenty-five animal species were reported for the treatment of different diseases like asthma, leukoderma, eczema, tuberculosis, rheumatism etc. by the Ao tribe of Nagaland [19].

Among the eight northeastern states of India, Assam is distinctive because of its rich, unique ethnic and cultural diversity, richness in forest resources and wildlife sanctuaries. Many reports on plant-based traditional medicines used by the people of Assam have been documented [20]. However, studies on zootherapeutic remedial uses have been very scantily done. The use of ichthyofauna in traditional health-care practices by the Karbis of Assam has been reported [21]. Among Kkarbi community, a total of 48 different animals were reported to be used for different ethnomedical purposes against various diseases like tuberculosis, asthma, cancer, etc. [22]. Thirty-four different species of animals have been recorded for the treatment of 34 different ailments among Biata tribe of Dima Hasao district of Assam [23].

The knowledge and use of animals and animal parts in traditional medicine by different ethnic groups are generally passed on through oral communication from generation to generation from one (elderly) person to another in the family, and this knowledge may be lost with the death of the knowledgeable elderly person [24]. It is therefore, vital to study and document the traditional uses of animals for the cure of different ailments.

Thus, the present study involving the documentation of traditional zootherapeutic medicinal remedies used by the indigenous people living in the adjoining areas of Pobitora Wildlife Sanctuary was undertaken as there is no information on the ethnozoological remedial awareness of these people. This study should also be very helpful in making strategies for sustainable utilization of natural resources and biodiversity.

## MATERIALS AND METHODS

### Location and naming of Pobitora wildlife sanctuary

The Pobitora wildlife sanctuary is situated in the south bank flood plains of the Brahmaputra at a distance of about 30 kilometers east of the capital city, Guwahati. It is located in the Mayang civil circle (Former Mayang Kingdom; the land of black magic) area in the Morigaon district of Assam. The sanctuary has an area of about 38.81 km<sup>2</sup> and extends between latitude 26°12'0"/N-26°16'48"/N and 91°58'48"/E-92°05'24"/E longitude. River Brahmaputra forms the northern boundary of the sanctuary (North Mayang Hills).

According to the native people, this sanctuary was believed to derive its name from two different views—firstly the 10<sup>th</sup> king of Mayang kingdom, "Sarasha Singha" named the sanctuary after his loving daughter "Pobitora" who died at a tender age (Rajaghariya Gaid). Secondly, it was believed to derive from two Assamese words i.e. "PURVA" meaning Eastern and "TARA" meaning Star, which was the eastern star of ancient Assamese Kingdom "Pragiyotishpur".

### Climate in and surrounding Pobitora wildlife sanctuary

The wildlife sanctuary is surrounded by agricultural land in the east, west and south. The climate of Pobitora wildlife sanctuary is generally subtropical monsoon type with an average annual rainfall of 1600-2000 mm during monsoon season, and temperature varies from 12 °C to 38 °C. The vegetation of the sanctuary is divided into four distinguished forest types, i.e. eastern west alluvial grassland, Barriuglonia swamp forest, low alluvial swamp (*Salomanialbizzia*) woodland and northern moist mixed deciduous forest (Burhamayong hillock) [25].

### Flora and fauna Pobitora wildlife sanctuary

The sanctuary is very rich in both floral and faunal diversity and harbors the second highest number of one-horned Rhino population after Kaziranga National Park and highest density of Rhino in the world. Besides the Rhinoceros, the sanctuary is also home to other fauna such as leopard, wild boar, barking deer, wild buffalo and more than 2000 migratory birds and various reptiles. The perennial water bodies (Beel) are the breeding ground of a different variety of fish species. This sanctuary possesses two critically endangered, four endangered, eight vulnerable and three near threatened bird species. Marsh Babbler (*Pellorneum palustre*) is the Assam plains endemic bird species recorded in Pobitora wildlife sanctuary.

### Socio-cultural diversity surrounding Pobitora wildlife sanctuary

From the Socio-cultural point of view, the Pobitora wildlife sanctuary region exhibits a great ethnic and cultural diversity. The adjoining area is inhabited by different indigenous communities and tribal groups mainly Nath community and Karbis. The Nath people of Assam introduce themselves as Yogi (people with high meditation power) and believe as the descendants of Lord Shiva. Hence, they claim as Shiva gotra. They are patriarchal by nature and mainly divided into two (gotras) clans that is Siva and Kashyp. They linguistically belong to Assamese and use Assamese scripts [26].

The Karbi tribe also known as 'Mikir,' is the principal tribal community in the Karbi Anglong district of Assam [22, 27]. However, Karbis are also residing in other parts of the State as the Karbis constitute the third largest tribal community in Assam after the Bodos and the Mishings [27]. They are believed to have migrated from the Kuki-Chin area in Western Myanmar. Racially, Karbis belong to the Mongoloid group and speak a language belonging to the Tibeto-Burmese, particularly Kuki-Chin sub-group of language. Karbis follow a patrilineal system of family and communally divided into five major clans viz., Lijang, Hanjang, Ejang, Kronjang, and Tung Jung. These clans are further divided into different sub-clans. However, marriages among the members of the same clan are not allowed [21, 28, 29].

These people practice different traditional medicine for curing different ailments in their indigenous ways in which they use different ethnomedicinal plants, animals and animal byproducts. The present study was mainly conducted in villages surrounding the Pobitora wildlife sanctuary, India (fig. 1) and the information was mainly collected from the people of Nath and Karbi communities.

### Data collection

In the present study, data were obtained through carefully planned field survey on 37 villages surrounding the Pobitora wildlife sanctuary, Morigaon district of Assam. Survey was carried out from October 2014 to March 2015. The ethnomedicinal data regarding the use of animals and their products (local name of the animal, mode of preparation and administration) were collected through semi-structured questionnaires and in some cases where respondents were uncomfortable with the questionnaires, informal interviews and group discussions were employed [30, 31]. A total of 50 individuals were interviewed. The respondents were mainly selected on the basis of their experience, recognition as an expert and knowledgeable old aged person, traditional healers concerning traditional medicine. The age of respondents varied from 30 to 80 y. We interviewed 2 (~4%) informants within age group above 70, 23 (~46%) informants within age group 61-70, 16 (~32%) informants within age group 51-60, 6 (~12%) informants within age group 41-50 and 3 (~6%) informants within age group 31-40 y.

They were asked detailed information about the ailments, animal based remedial uses for disease(s), mode of preparation, application, proper dosage, ingredients of medicine whether they use only animal parts or mixed with other ingredients like plant material, whether dried or fresh, etc. The scientific name and species name of animals were identified using relevant and standard literature [32, 33]. Some animals were identified in association with Zoological Survey of India (ZSI), Shillong.

## RESULTS AND DISCUSSION

Personal interviews and group discussions with local inhabitants revealed some very valuable and specific information about the animals which were further authenticated by crosschecking. The present study describes the traditional medicinal knowledge of treating various kinds of diseases using different animals and animal byproducts by the local indigenous inhabitants of villages surrounding the Pobitora Wild Life sanctuary, India. All the respondents who shared their traditional knowledge during field survey belonged to two main ethnic groups viz Nath and Karbi communities. Further, the respondents from Nath community were about 70% while Karbis were 30%. The female respondents (~34%) were less as compared to the male respondents (~66%). The healers

had little formal education mostly up to secondary level while some of them had higher education qualification up to graduation level (table 1).

Only a few of the informants were formally employed in government sector mainly as a school teacher and others are mostly workers, farmer, and local healers.

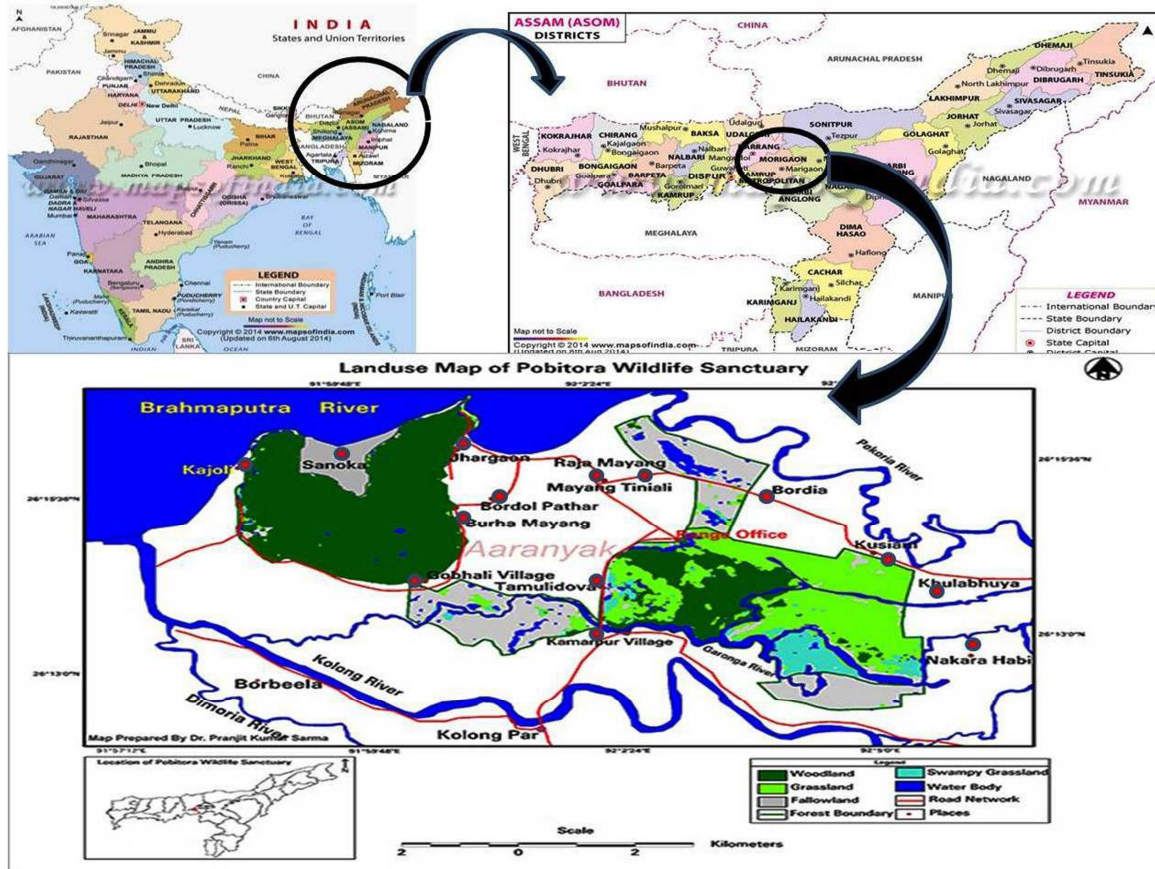


Fig. 1: Map of the study area showing the site of field survey (●marks)

Table 1: Demographic characteristic of respondents (n= 50)

Characteristic	Frequency
Gender	
Male	33
Female	17
Education	
Primary education	18
Secondary education	22
Graduate	10
Extra qualification	-
Ethnicity	
Nath community	35
Karbi community	15
Age of traditional healer	
Between 31-40 y	3
Between 41-50 y	6
Between 51-60 y	16
Between 61-70 y	23
Above 70 y	2

N=50

The survey recorded total of 26 animals which were used to treat different ailments such as asthma, jaundice, chicken pox, pneumonia, anemia, etc. Table 2 summarizes the local name, English name, scientific name, the part(s) of the species used, the ailments or diseases for which animal-derived medicine is

thought to be effective and ways the treatment is carried out. These animal species are distributed among 26 taxonomic groups which include overall 9 mammals, 8 fishes, 4 birds, 2 annelids, 2 insects and 1 reptile. These animals were used to treat 31 different diseases.

**Table 2: Medicinal uses of animals and animal parts in traditional therapy by the people inhabiting in adjoining areas of Pobitora wildlife sanctuary**

Animal Group	Scientific name	English name	Local name	Part used	Medicinal use	Prescription
1. Bird	<i>Acridotheres tristis</i>	Common Myana or Indian Myna	Xalika sorai	Meat	Diarrhoea	Boiled meat is prescribed to eat.
2. Bird	<i>Columba livia</i>	Pigeon	Paro sorai	Meat	Low blood pressure	Meat is boiled and prescribed to eat.
3. Bird	<i>Tyto alba</i>	Brown Owl	Fesa (hudu)	Meat	Dysentery	Meat is boiled and eaten.
4. Bird	<i>Gallus domesticus</i>	Chicken	Murgi	Meat	Bone fracture	Meat is crushed, and paste is applied externally in bone fracture area.
5. Mammal	<i>Eonycteris spelaea</i>	Bat	Baduli	Meat	Asthma	Boiled meat is prescribed to eat.
6. Mammal	<i>Rhinoceros unicornis</i>	Rhino	Gaur	Urine	Jaundice	Urine is prescribed to drink.
				Skin	Chicken pox	Skin is soaked in water for overnight, and the water is prescribed to drink for 3 d during the morning.
7. Mammal	<i>Hystrix indica</i>	Indian crested Porcupine	Ketla pohu	Alimentary canal	Liver Disease, Tonsil	Alimentary canal part is boiled and prescribed to eat.
8. Mammal	<i>Canis aureus</i>	Golden jackal	Shial	Meat	Body ache, pain	Meat is boiled and prescribed to eat for body ache/pain.
9. Mammal	<i>Capra hircus</i>	Black Goat	Kola sagoli	Milk	Leucorrhoea (Whitish urine)	Goat milk and root of the hunborial tree ( <i>Sida cordifolia</i> ) are boiled together and drunk.
10. Mammal	<i>Bos indicus</i>	Cow	Garu	Milk	Jaundice	Black cow milk is prescribed with the bark of kuwa vaturi plant ( <i>Oitrullus colocynthis Scharf</i> ) juice.
					Liver problem	Milk and missiri mixed together and prescribed to drink.
					Leucorrhoea	Milk, missiri, joha rice, shimalu tree ( <i>Bombax cieba</i> ) root grined together and prescribed to eat.
				Dung	Skin disease (besu)	Cowdung is mixed with crushed powder formed of the root of Borborial tree ( <i>Sida rhombifolia</i> ) and applied externally.
11. Mammal	<i>Platanista gangetica</i>	River Dolphin	Shihu	Oil	Female infertility	Dolphin oil and Garlic paste is mixed properly and prescribed to eat for 3 d regularly.
12. Mammal	<i>Sus scrofa domesticus</i>	Pig	Gahori	Oil	Joint pain	Oil is prescribed to apply externally to overcome joint pain
13. Mammal	<i>Bos taurus</i>	Bull	Shar garu	Urine	Blood Cancer	1 glass of urine is prescribed to drink per day for 15 d
14. Insect	<i>Sceliphron sp.</i>	Wasp	Kumaroni	Whole insect	Pneumonia	Wasp along with clove, cinnamon, honey, and black pepper boiled together and prescribed to eat.
15. Insect	<i>Apis indica</i>	Honey bee	Mou makhi	Honey	Cough	Honey is prescribed with the sap of <i>Oscimum sanctum</i> (tulsi) leaf.
16. Annelida	<i>Metaphire houletti</i>	Earthworm	Bunda Kesu	Whole body	Burn	Earthworm is fried and oily substances are applied externally in the burned area
17. Annelida	<i>Perionyx sp.</i>	Earthworm	Kesu	Whole body	Piles	It is crushed and juice is prescribed to drink
18. Reptile	<i>Varanus bengalensis</i>	Bengal monitor	Gui	Meat	Skin disease/itching	Meat is prescribed to eat
19. Fish	<i>Channa gachua</i>	Smooth brassed snake head	Cheng mas	Whole fish	Abdominal pain	Boiled fish is prescribed to eat
20. Fish	<i>Xenentodon cancila</i>	Freshwater gar fish	Kokila mas	Whole fish	Joint pain, swelling	Cooked and consumed. Spine and bone is used to prick out the clotted blood.
21. Fish	<i>Amphipnous cuchia</i>	Eel	Cushia	Meat	Pre menstrual abdominal pain	Boiled meat is prescribed to eat
22. Fish	<i>Amblypharyngodon mola</i>	Mola/Indian carplet	Moa mas	Blood Whole fish	Aneamia Pre menstrual pain	Raw blood is consumed Fish is boiled and prescribed to eat
23. Fish	<i>Chaca chaca</i>	Devil fish	Kurkuri mas	Whole fish	Polio	Dried fish is boiled or cooked

24. Fish	<i>Anabas testudineus</i>	Climbing perch	Kaoi mas	Whole fish	Dysmenorrhoea (Kaoimuriabemar)	with vegetables and spices and prescribed to eat. Head portion of the fish, Tal tree leaf ( <i>Borsassus flabellifer</i> ) and chilly are boiled together and prescribed to eat.
25. Fish	<i>Channa punctatus</i>	Spotted snake head	Goroi mas	Whole fish	Tuberculosis	The fish is boiled with black pepper and prescribed to eat
26. Fish	<i>Notopterus notopterus</i>	Feather back	Kandhuli mas	Whole fish	Delivery pain, Abdominal pain	The fish is burned and cooked along with ingredient like mastered oil and black peeper and prescribed to eat.

The percentages of animals which constitute the zootherapeutic practice in the study are shown in fig. 2. The information on the use of animals in traditional medicine was mainly provided by elderly people in the age group of more than 50 y (fig. 3). This indicated that the aged people of the society are more experienced in the traditional medicine practice, and they are carrying the knowledge gain from parents or elderly person of their society.

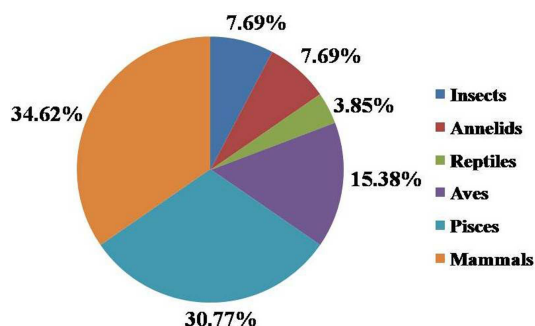


Fig. 2: Different taxonomic groups of animals being used in the zootherapeutic practices among the traditional healers in the adjoining areas of Pobitora wildlife sanctuary

Photographs of some of the most commonly used animals in traditional practices in the above-mentioned locality are shown in fig. 4. The use of different animal-based drugs to treat different ailments by different ethnic communities in different parts of India

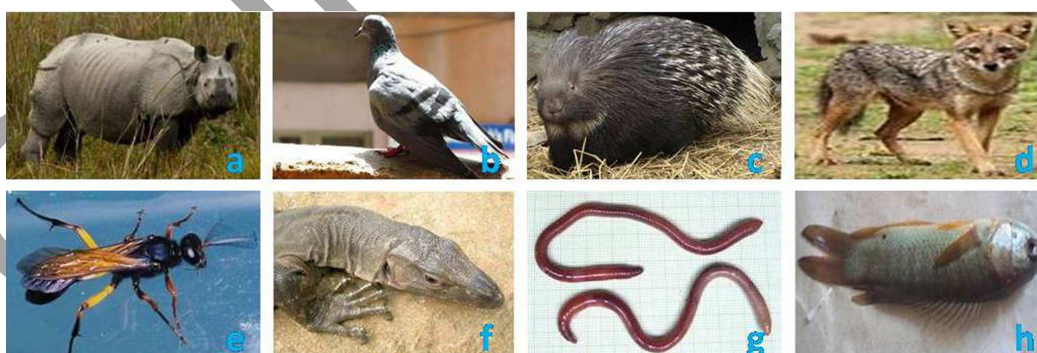


Fig. 4: Some of the animals being used in traditional medicine by people nearby Pobitora wildlife sanctuary, Assam. (a) Rhino, *Rhinoceros unicornis* (b) Pigeon, *Columba livia* (c) Porcupine, *Hystrix indica* (d) Golden jackal, *Canis aureus* (e) Wasp, *Sceliphron sp.* (f) Bengal monitor, *Varanus bengalensis* (g) Earthworm, *Metaphire houletti* (h) Climbing perch, *Anabas testudineus*. (Source: <http://www.google.com>)

From the study conducted it was found and recorded that most of the animal resources used in traditional medicine belong to the vertebrate group. The local people used different traditional zootherapeutic medicine for the treatment of various ailments including diarrhoea, low blood pressure, asthma, dysentery, jaundice, chicken pox, liver disease, body ache, leucorrhoea, skin

including North eastern region has been well established by different authors, where they reported the use of animals and animal products in medicine as well as food and other purposes like preparation of different tools using bone, teeth, clothes from animal skin and fur [22, 34-38].

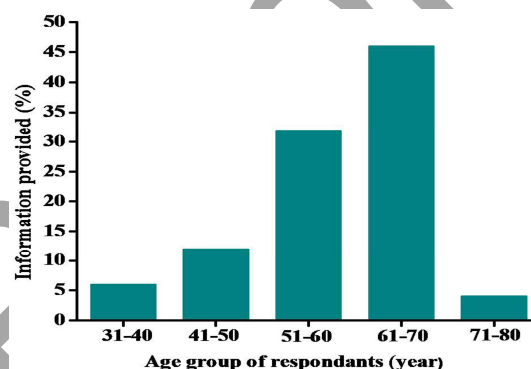


Fig. 3: Different age groups of traditional healers involved in information sharing

The native people also sacrifice animals for different ritual and religious purposes according to their mythological belief, myth associated with the therapeutics. For example, children were made to wear bear claws around their neck to protect them from evil forces; similarly animals like sheep and goat were sacrificed to bring healing as it is believed to please the local Gods [35, 38].

disease, pneumonia, anaemia, piles, etc. While fat/oil of some animals particularly pig, the dolphin is warmed up and externally applied for massage to relief pain, but most of the other parts of animals is cooked, dried and crushed into powder or boiled and eaten. Flesh is taken after cooking, while other animal byproducts like milk, urine, honey, the raw blood of some animals are taken

fresh or mixed with other ingredients. The study also showed that a mixture of animal byproduct and plant part can also be used for the treatment of different diseases example, honey is most often used with the juice of tulsi (*Oscimum sanctum*), garlic paste is mixed with oil of river dolphin for the treatment of female infertility, etc.

It also emerged that the traditional medicinal knowledge of the people living in the nearby area of Pobitora wildlife sanctuary, India is quite old. Maximum nearby area comes under Mayong circle, where, from ancient times people used different rituals regarding tantric mantra and in different traditional health care practice. Most of the information were gathered from aged people of the society. The interest for traditional medicine among young generation is eroding due to modernization and assimilation of alien culture.

Although traditional medicine plays an important role in primary health care system right from ancient days, it is remarkable to state that while studying the traditional uses and sale of animals and animal by-products for medicinal purpose, one should take care of ecological balance and biodiversity conservation measures in mind. Many superstitions and myth may also be associated with traditional medicine. Therefore animal and animal byproducts should be tested for their appropriate medicinal component. Traditional healers should be aware of the protected and endangered animal resources and their importance in biodiversity balance. Proper awareness and scientific management of these animal resources may help in biodiversity conservation [18].

#### CONCLUSION

Knowledge about uses of animals and animal-derived byproducts for traditional medicinal purposes in the study site is continuing from the past and are still being used as a part of traditional medicine. A total of 26 animal species were noted to be used for 31 different kinds of ailments and other religious purposes by the people of surrounding villages of Pobitora wildlife sanctuary, India. Mammals constitute the highest number of these animals (~34.62%). This knowledge is important to science and human society for a better understanding of traditional medicine and its inter-relationship with the socio-economic and environmental perspective. The present study also provides baseline data for further laboratory research in finding of novel biological compound responsible for healing the ailment. Further studies are required for scientific validation to confirm the medicinal value of such products, and this knowledge must be included in strategies of biodiversity conservation and management of animal resources.

#### ACKNOWLEDGEMENT

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#### CONFLICT OF INTERESTS

The authors declare that they have no conflict of interest

#### REFERENCES

- World Health Organization. Traditional medicine strategy 2002–2005. Geneva, Switzerland; 2002. p. 1-74.
- World Health Organization. Guidelines on the conservation of medicinal plants. Geneva, Switzerland; 1993. p. 1-38.
- World Health Organization. Traditional medicine strategy; 2014. p. 2014-23.
- Costa-Neto EM. Animal-based medicines: biological prospect and the sustainable use of zootherapeutic resources. *Annals Acad Bras Cienc* 2005;77:33-43.
- Alves RR, Rosa IL. Why study the use of animal products in traditional medicines? *J Ethnobiol Ethnomed* 2005;1:1-5.
- Holland K. Medicine from animals: from mysticism to science. *Pharm Historian* 1994;24:9-12.
- Lohani U, Rajbhandari K, Katre S. Need for systematic ethnozoological studies in the conservation of ancient knowledge system of Nepal-A review. *Indian J Traditional Knowledge* 2008;7:634-7.
- Alves RR, Rosa IL, Santana GG. The role of animal-derived remedies as complementary medicine in Brazil. *Biosciences* 2007;57:949-55.
- Jaroli DP, Mahawar MM, Vyas N. An ethnozoological study in the adjoining areas of Mount Abu wildlife sanctuary, Indian. *J Ethnobiol Ethnomed* 2010;6:6-13.
- Adeola MO. The importance of wild animals and their parts in the culture, religious festivals, and traditional medicine of Nigeria. *Environ Cons* 1992;2:125-34.
- Anageletti LR, Agrimi U, Curia C, French D, Mariani-Constantini R. Healing rituals and sacred serpents. *Lancet* 1992;340:223-5.
- Vijayakumar S, Yabesh JEM, Prabhu S, Ayyanar M, Damodaran R. Ethnozoological study of animals used by traditional healers in the silent valley of kerala, India. *J Ethnopharmacol* 2015;162:296-305.
- Alfred JRB. Faunal diversity in India: an overview. In: 'Faunal Diversity in India'. Editors. JRB Alfred, AK Das, AK Sanyal. ENVIS Centre, Zoological Survey of India, Calcutta; 1998. p. 1–9.
- Quave CL, Lohani U, Verde A, Fajardo D, Obon C, Valdes A, et al. A comparative assessment of zootherapeutic remedies from selected areas in Albania, Italy, Spain, and Nepal. *J Ethnobiol* 2010;30:92-125.
- Unnikrishnan PM. Animals in Ayurveda. *J Amruth* 1998;3:1-15.
- Teron R, Borthakur SK. Biological motifs and designs on traditional costumes among Karbis of Assam. *Indian J Traditional Knowledge* 2012;2:305-8.
- Chakravorty J, Ghosh S, Meyer-Rochow VB. Practices of entomophagy and entomotherapy by members of the Nyshi and Galo tribes, two ethnic groups of the state of Arunachal Pradesh (North-East India). *J Ethnobiol Ethnomed* 2011;7:5-18.
- Chakravorty J, Meyer-Rochow VB, Ghosh S. Vertebrate used for medicinal purposes by members of the Nyishi and Galo tribes in Arunachal Pradesh (North-East India). *J Ethnobiol Ethnomed* 2011;7:13-26.
- Kakati LN, Bedang A, Doulo V. Indigenous knowledge of the zootherapeutic use of vertebrate origin by the Ao tribe of Nagaland. *J Human Ecology* 2006;19:163-7.
- Sajem AL, Gossai K. Traditional use of plants by the Jaintia tribes in North Cachar Hills district of Assam, northeast India. *J Ethnobiol Ethnomed* 2006;2:33-9.
- Teronpi V, Singh HT, Tamuli AK, Teron R. Ethnozoology of the Karbis of Assam, India: Use of ichthyofauna in traditional healthcare practices. *Ancient Sci Life* 2012;32:99-103.
- Verma AK, Prasad SB, Rongpi T, Arjun J. Traditional healing with animals (zootherapy) by the major ethnic group of Karbi Anglong district of Assam, India. *Int J Pharm Pharm Sci* 2014;6:1-8.
- Betula ALS. Indigenous knowledge of zootherapeutic use among the Biata tribe of Dima Hasao District, Assam, North-eastern India. *J Ethnobiol Ethnomed* 2013;9:1-15.
- Patel SB, Bhatt N, Patel KB. Review-traditional zootherapeutic uses of spiders. *Life Sci Leaflets* 2012;12:174-80.
- Champion HG, Seth SK. The forest type of India New Delhi: The Man-ager of publication; 1968.
- Sikdar M, Dutta U. Traditional phytotherapy among the Nath people of Assam. *Ethno-Med* 2008;2:39-45.
- Karbi people. [https://en.wikipedia.org/wiki/Karbi\\_people](https://en.wikipedia.org/wiki/Karbi_people). [Last accessed on 22 Dec 2015].
- Bhattacharjee T. Sociology of the Karbis, (BR publishing Corporation, Delhi); 1986. p. 19.
- Hanse R, Teron R. Ethnozoological practices among the Karbi tribes in Karbi Anglong district of Assam (India). *The Ecoscan* 2012;1:117-20.
- Huntington HP. Using traditional ecological knowledge in science: methods and applications. *Ecol Appl* 2000;10:1270-4.
- Alexiades MN. Selected guidelines for ethnobotanical research: A field manual. In: *Advances in Economic Botany*. Vol. 10. Bronx: The New York Botanical Garden; 1996.
- Ali S. The book of Indian Birds. Bombay: Bombay. Natural History Society; 1996.
- Prater SH. The book of indian animals. Bombay Natural History Society; 1996.
- Mahawar MM, Jaroli DP. Traditional Zootherapeutic studies in India: a review. *J Ethnobiol Ethnomed* 2008;4:17-29.

35. Solanki GS, Chutia P. Ethno-zoological and socio-cultural aspects of Monpas of Arunachal Pradesh. *J Human Ecol* 2004;4:251-4.
36. Jamir NS, Lal P. Ethnozoological practice among Naga tribes. *Indian J Traditional Knowledge* 2005;1:100-4.
37. Kakati LN, Doulo V. Indigenous knowledge system of zootherapeutic use by chakhesang tribe of Nagaland, India. *J Human Ecol* 2002;13:419-23.
38. Mahawar MM, Jaroli DP. Animals and their products utilized as medicine by the inhabitants surrounding the ranthambhore national park, India. *J Ethnobiol Ethnomed* 2006;2:46-51.

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