



ETHNO-ZOOLOGICAL STUDY OF MEDICINAL USE OF ANIMALS AND THEIR PRODUCTS AMONG THE INDIGENOUS PEOPLE OF KARBI TRIBE OF KARBI ANGLONG, ASSAM, INDIA

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AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration among all authors. Author NK designed, performed analysis of the study and wrote the manuscript. Author PS conceptualized, supervised the study and wrote the manuscript. Author RB collected the data and manage literature studies. All author read and approved the final manuscript.

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ABSTRACT

Bio-resources, both flora and fauna, are integral part of the indigenous healing practices used by human beings since prehistoric time. The traditional knowledge of the use of bio-resources for medicine has a significant contribution for maintaining the human health. Traditional medicine is not only a source of healing, but the practice is also an important part of their religion and culture. The study was carried out to survey and document the traditional knowledge related to medicinal uses of animals and their products among the ethnic groups of Karbi peoples. Data were collected using prepared questionnaires, personal interviews, and group discussions with the ethnic people of the tribe. A total of 42 animal species were identified to treat around 35 different ailments. Of the animals used therapeutically, 14 species were insects, 2 annelids, 1 gastropod, 2 arachnids, 2 amphibia, 4 were aves, 3 fishes, 4 were reptiles and 12 were mammals. Furthermore, the honey of the bee (*Apis mellifera*) was used to relieve many ailments and scored the highest fidelity value (FL=93.0%). However *Rana* sp. (FL=12.9%) and *Oecophylla smaragdina* (FL=15.7%) has the lowest fidelity level. The result shows that there is a wealth of ethnozoological knowledge if documented can be used in developing new drugs. Hence, it is hoped that the information contained in this paper will be useful in future ethno-zoological, ethnopharmacological, and conservation related research in the region.

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1. INTRODUCTION

Traditional Knowledge represents the understanding and use of skills and practices that are developed, sustained and passed from one generation to next within a community. The use of animals by indigenous people for health care or as medicine is called Zoo therapeutic practices. "The traditional medicinal knowledge of indigenous people across the globe has played an important role in identifying living organisms having medicinal values important for treating human and livestock health problems. Since ancient times, animals and their products have been used in the preparation of traditional remedies in various cultures" [1]. Many groups of people around the world still depend on traditional medicines for primary health care. "World health organization (WHO) defines traditional medicines as the sum total of knowledge, skills and practices based on the theories, beliefs and experiences indigenous to different cultures, whether explicable or not, used in the maintenance of health, as well in the prevention, diagnosis, improvement or treatment of physical and mental illnesses" [2].

"India shows extreme variation in geographical and climatic conditions with immense faunal and floral biodiversity. Different tribal and ethnic communities dispersed all over the country are highly knowledgeable about the animals and their medicinal value. In the rural areas, peoples are almost totally dependent on local traditional medicines for their health care needs because they generally reside in remote areas where hospitals and other modern medical facilities are not easily available. By and large, their traditional medicinal knowledge is passed through oral communication from generation to generation in the family" [3].

"Karbi Anglong district is the largest district of Assam with total land area of 10,434 sq. km. The district is situated in the central part of Assam. It is bounded by Golaghat district in the east, Meghalaya state and Marigaon district in the west, Nagaon and Golaghat district in the north and the Dima Hasao district and Nagaland in the South. The district with dense tropical forest having hills and plains is situated between 25°33' N to 26°35' N Latitude and 92°10' to S 93°50'E Longitude. The district has a population density of 93 inhabitants per sq. km". [4]. "Karbhis represent one of the prominent indigenous tribes of Northeast India, with unique traditions and cultures distinct from other ethnic groups of the region. The population of the district is 9, 56,313 which constituted 3.10% of total Assam population. Of the

total population, 8, 43,347 are rural and only 1, 12,966 are in urban areas of the district (Census of India, 2011). The district has three sub division i.e. Diphu, Hamren and Bokajan. Among these, Diphu is the head quarter of the district. The population of district is predominantly tribal with karbis being the main tribe" [4].

"Traditional medicine is still popular among the karbis as means of primary health care. Though Zootherapy is an integral part of traditional health care practices among the karbis, but there is a lack of reports in this regard. In the modern era, Zootherapy constitutes a major alternative among many other known therapeutic practices in the world. Wild as well as domestic animals and their by-products such as hooves, skins, bones, feathers, and tusks serve as important ingredients in the preparation of curative, protective, and preventive medicines" [5]. "It is important to document the traditional knowledge of human communities, since the majority of such communities are losing their socioeconomic and cultural characteristics" [6]. The traditional knowledge of using animals in health care practices is generally passed orally from one person to next, which can be lost if not well documented. Traditional healers are endowed with so much of traditional health care knowledge but due to lack of documentation with the death of these people all that treasure becomes lost. Few studies have been conducted on the Karbi tribes regarding its traditional knowledge about medicines but the knowledge of use of animals in health care practices is still underrated. So, it is vital to study and document these traditional informations before it vanished. Hence, the present study consists of study and documentation of use of animals as medicine by the Karbi tribe, which may help for sustainable utilization of the knowledge and also protect the information for future generations.

2. MATERIALS AND METHODS

2.1 Study Area

A Field study was undertaken during the period from September 2019 to February 2020. A total of 150 informants were selected from Howraghat, Bakalia, Dokmoka, Baithalangso etc.

2.2 Data Collection

As part of prior informed consent, the informants were apprised of the objectives of this study. Information was collected following both unstructured and structured interview methods.

Information so obtained was substantiated from elders of other localities and also by personal observation. Medicinal animals and their products used in health-care practices were collected with the help of local guides and identified using available literature. The figure below shows the Karbi Anglong District with all the different villages of field study (Fig. 1).

2.3 Data Analysis

The data obtained from the study were summarized and analyzed using descriptive statistical methods. The ethnozoological data that were obtained from the interviews on reported medicinal animals and associated informations, Relative frequency of citation (RFC) level and Fidelity level (FL) values were calculated.

2.3.1 RFC (relative frequency of citation):

It shows the local importance of each of the species mentioned here. The value was calculated by dividing the frequency of citation or FC (the number of informants mentioning a useful species) by the total number of informants (N).

$RFC = FC/N$. The value varies from 0 to 1.

$RFC = 0$, means no one refers to the animal as useful.

$RFC = 1$, means in the survey all informants refer to the animal as useful.

2.3.2 Fidelity level (FL):

FL was calculated as the percentage of respondents claiming the use of a certain animal species for the same ailments. Fidelity level (FL) is useful for determining the most referred animals used by the informants for traditional health care practices. The FL value is calculated by:

$$FL (\%) = N_p \times 100/N$$

N_p refers the number of informants that refer to a particular animal to treat a particular ailment.

N refers the total number of informants who utilized the animals as a medicine. The range of fidelity level (FL) is from 1 to 100%; high values indicate that this particular animal species is used by large number of people, while a low value shows that respondents disagree on the usefulness of a species in treating ailments.

3. RESULTS

The study revealed the traditional knowledge of medicines and treatment of different kinds of ailments

using different animals and their parts or products by local inhabitants of the district. The survey recorded total of 42 different species (Table 1) out of which 14 species belong to insects, 2 annelids, 1 gastropod, 2 arachnids, 4 aves, 2 amphibians, 4 reptiles, 3 fishes, and 12 mammalian species which are used for the treatment 35 different kinds of ailments such as Fever, asthma, stomach ache, gastritis, cough, body pain, bleeding, Sinus, dysentery etc. In some diseases, the whole bodies of the animals are used for treatment and sometimes their body parts or products like milk, blood, visceral organ, flesh, teeth, bones and honey etc are used. Most of the information regarding the use of different animals or their products for preparing traditional medicines was given by aged people in the age groups of more than 55 years. This reveals that the aged peoples have greater knowledge and experience about the traditional practices and they are properly carrying and using the traditional knowledge's given by their elder ones. The data also indicate that the indigenous peoples of the Karbi Anglong district still dependent on the traditional medicines for their primary health care. The socio-demographic information of respondents in the survey area is also recorded in the study (Fig. 2).

3.1 Ethnozoological Analysis of data

The study recorded 44 species of animals (14 species belongs to insects, 2 annelids, 1 gastropode, 2 arachnids, 3 fishes, 4 aves, 2 amphibians, 4 reptiles, , and 12 mammalian species) which were used to treat 35 different types of diseases (Table 1).

Table1 Medicinal uses of animals and animal parts for traditional therapeutic practices by the indigenous people of Karbi Anglong.

Table1 provides all the information about the used animals such as their scientific name, common name, which part of the animals are used as medicines, different medicinal uses, about the method of prescription and also some statistical data. The study shows that among all these animals, insects and mammals are the most common followed by birds, reptiles and fishes (Fig. 3).

According to the data, whole body of animals for medicinal use was recorded to have the highest percentage (46%) followed by other animal parts and products like meat (18%), visceral organs (13.2%), bones (6.8%), excreta.fat and honey (each 4.6%) and cocoon having the lowest (2.28%) (Fig. 4).

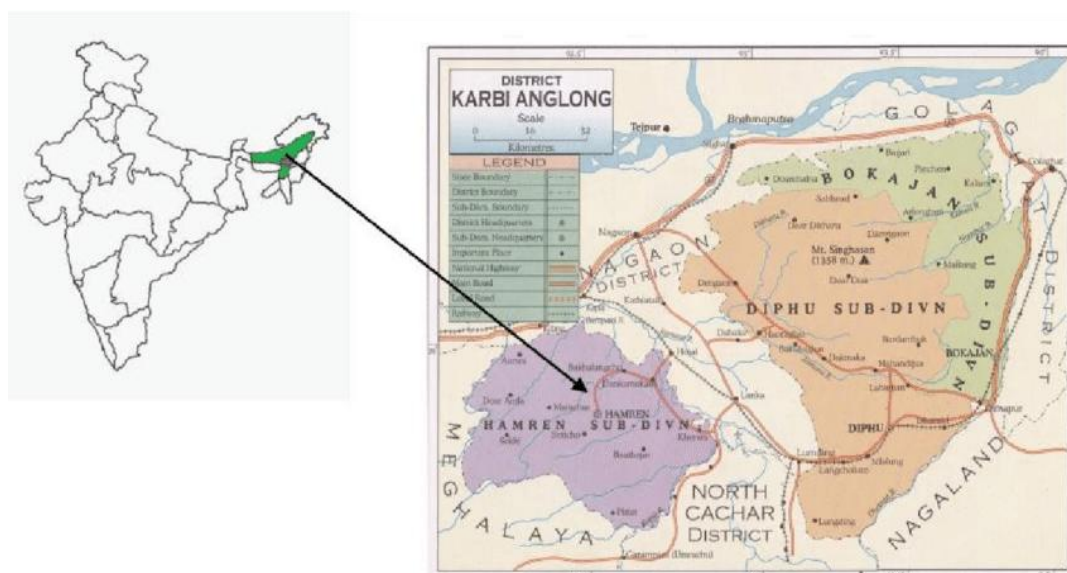


Fig. 1. Map of India, Assam and Karbi Anglong showing the villages of field study

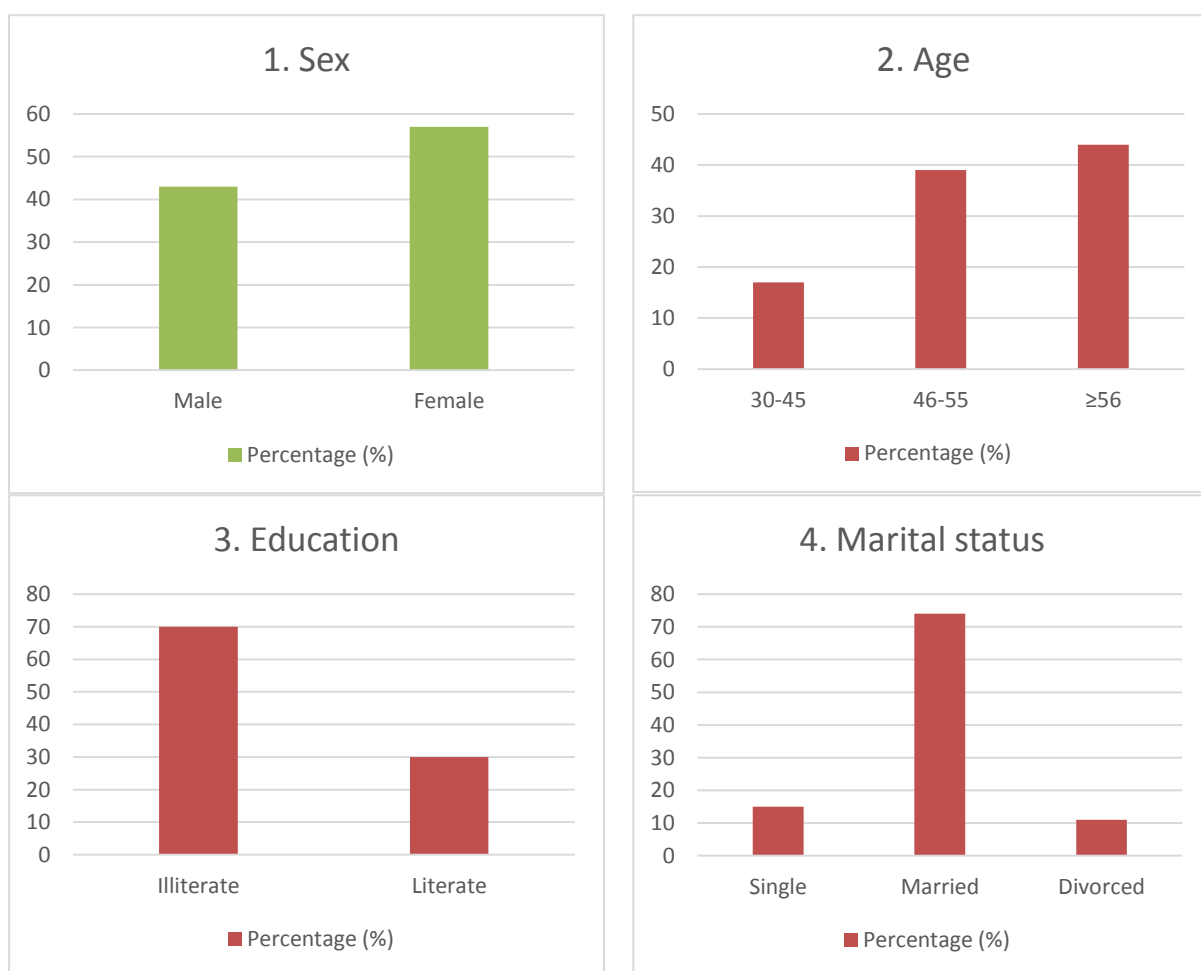


Fig. 2. Socio-demographic information of respondents in the survey area

Table 1. Medicinal uses of animals and animal parts for traditional therapeutic practices by the indigenous people of Karbi Anglong**(1) Insects**

Sl No	Animals	Scientific name	Common name	Therapeutic uses	Prescription	RFC	FL (%)
1	Insects	<i>Apis mellifera</i> (Linnaeus, 1758)	Honey bee	Cough Flu Asthma	Raw honey is prescribed to used	0.62	93.0 68.4 43.2
2	Insects	<i>Achaeta domestica</i> (Linnaeus, 1758)	House Cricket (Uisiringa)	Diuretic pain better eye sight	Burned on fire and eaten	0.26	64.4 38.7 25.8
3	Insects	<i>Leotocoris varicornis</i> (Fabricius, 1787)	Gandhi puk	Fever	Whole insect is boiled and eaten	0.13	48.4
4	Insects	<i>Mantis religiosa</i> (Linnaeus, 1758)	Praying mantis (Gagini foring)	Wound in ear	Cocoon with larva burned & mixed with oil and prescribed to apply on wound	0.09	64.0
5	Insects	<i>Musca domestica</i> (Linnaeus, 1758)	Housefly	Baldness	Body is roasted and then consumed	0.34	57.3
6	Insects	<i>Poekilocerus pictus</i> (Serville, 1831)	Grasshopper	Lung infection	Body is fried and eaten	0.23	44.6
7	Insects	<i>Trigona spimpipes</i> (Jurine, 1807)	Stingless bee	Throat inflammation	Raw honey is prescribed to consume	0.06	67.8
8	Insects	<i>Lylta vesicatoria</i> (Linnaeus, 1758)	Spanish fly	Anticancer	Body is dissolved in water and orally taken	0.15	18.4
9	Insects	<i>Scapteriscus borellii</i> (Giglio-Tos, 1894)	Mole Cricket (Kumoti)	Intestinal worm (thread worm)	Raw alimentary canal part is consumed	0.23	82.5
10	Insects	<i>Lampyridae spp.</i> (Latreille, 1817)	Fire Flies (Junaki Paruwa)	Cancer	3-5 raw fire flies are prescribed to eat daily.	0.05	16.4
11	Insects	<i>Phthiraptera</i> (Haeckel, 1896)	Louse	Clear urinary tract obstructions	Body is prescribed to eat in live condition	0.06	36.7
12	Insects	<i>Apis cerna indica</i> (Fabricius, 1793)	Honey bee (Mou makhi)	Cancer	Whole honey bee is ground in water and eat	0.09	24.4
13	Insects	<i>Periplaneta Americana</i> (Linnaeus, 1758)	Cockroach (Poitasura)	Asthma	Wings are removed and washed then boiled with water	0.26	92.6
14	Insects	<i>Oecophylla smaragdina</i> (Fabricius, 1775)	Green tree ant (Amoli poruwa)	Sinus Cancer Epistaxis	Ant is fried and prescribed to eat	0.38	65.8 16.8 15.7

(2) Annelids

1	Annelids	<i>Perionyx</i> (Perrier, 1872)	<i>spp.</i>	Earthworm (Kesu)	Gastric arthritis	Dried & turned into pill like form and grind mixed with water and eaten	0.43	79.3
2	Annelids	<i>Hirudinea</i> (Lamarck, 1818)		Leech	Pneumonia Piles muscle swelling	Leech is allowed to suck blood from the affected area or swelling portion	0.32	65 65 52.7

(3) Gastropods

1	Gastropod	<i>Pila spp.</i> (Roding, 1798)		Freshwater snail (Shamuk)	For better eye sight Pain	Raw snail is eaten Applied externally for massage	0.46	54.6 38.2
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(4) Arachnids

1	Arachnids	<i>Dermacentor variabilis</i> (Say, 1821)		Dogs tick (4 inch in size)	Used in snake bite as antidote	Raw ticks are used for the treatment	0.37	16.4
2	Arachnids			Scorpions	Treat its sting	Body is burn and eaten	0.17	44.5

(5) Amphibians

1	Amphibians	<i>Bufo sp.</i> (Linnaeus, 1758)		Common Toad (Suk vekuli)	Urinary retention Acne	Thigh muscle is cooked and consumed and fresh blood & heart is cooked	0.36	78.9 65.8 54.9
2	Amphibians	<i>Rana sp.</i> (Linnaeus, 1758)		Frog (Pani vekuli)	Pneumonia Wounds tongue blister Asthma	Skin oil is used and meat is cooked to eat	0.28	76.8 23.8 12.9

(6) Aves

1	Aves	<i>Passer domestica</i> (Linnaeus,1758)	House sparrow	Stammering	Cooked and consumed	0.07	32.6
2	Aves	<i>Columbo livia</i> (Gmelin,1789)	Pigeon	Typhoid toothache	The excreta is mixed with rice bear and consumed	0.35	54.7 23.0
3	Aves	<i>Gallus domesticus</i> (Linnaeus,1758)	Chicken	Nasal congestion	Raw fat is boiled	0.13	34.5
4	Aves	<i>Amaurornis phoenicurus</i> (Pennant,1769)	Water hen	Joint pain	Cooked and consumed	0.06	74.7

(7) Fish

1	Fish	<i>Amphipnous</i> (Hamilton, 1822)	<i>cuchia</i> Eel (Cuchia)	Anemia	Raw blood is prescribed to drink and cooked meat is eaten	0.54	92.7
2	Fish	<i>Clarias</i> (Linnaeus,1758)	<i>batrachus</i> Magur mas (Magur)	Body pain wound healing	Cooked with spices like black pepper and prescribed to eat	0.43	84.8 74.0
3	Fish	<i>Heteropneustes</i> (Bloch, 1794)	<i>fossilis</i> Stinging cat (Singhi mas)	Pain Wound healing	Cooked with spices like black pepper and prescribed to eat	0.52	45.7 86.9

(8) Reptiles

1	Reptiles	<i>Varanus</i> (Merrem, 1820)	Monitor Lizard	Itching	Rub in the affected areas	0.02	65.8
2	Reptiles	<i>Hemidactylus flaviviridis</i> (Ruppell,1835)	Wall Lizard (Jethi)	Pain	Fresh skin oil is used on wounds	0.4	34.5
3	Reptiles	<i>Echis coloratus</i> (Gunther,1878)	Viper	Joints pain of bones	Raw fat is melted	0.03	56.0
4	Reptiles	<i>Varanus bengalensis</i> (Daudin, 1802)	Bengal monitor (Gui)	Skin disease (Ring worm)	Boiled meat is prescribed to eat	0.21	67.5

(9) Mammals

1	Mammals	<i>Pholidota</i> (Weber, 1904)	Pangolin	Hiccup or hitchki	Cured by wearing pangolins scales	0.53	76.9
2	Mammals	<i>Mus musculus</i>	Mouse (Nigoni)	Baby drooling Skin diseases	Scales are made as necklace and wore it Flesh is cooked and consumed	0.35	65.8 45.0
3	Mammals	<i>Hystrix indica</i> (Linnaeus, 1758)	Porcupine (Ketela pohu)	Stomach problems Dysentery pre menstrual pain Itching(skin diseases)	Dried in the dried for several days and turned into powder form & mixed with water to drink Raw	0.26	92.8 34.8 23.4 79.9
4	Mammals	<i>Sus scrofa domesticus</i> (Linnaeus,1758)	Pig (gahori)	Tumors	Fats boiled and used	0.4	16.3
5	Mammals	<i>Vulpes</i> (Garsault, 1764)	Fox (Hiyal)	Used to treat people who are very foolish and dumb in nature	The skull is dried, crashed and mixed in liquid and given to the peoples.	0.13	34.8
6	Mammals	<i>Homo sapiens</i>	Human (manuh)	Skin disease	Fresh urine is used in the affected areas	0.4	89.3
7	Mammals	<i>Sciurus caroliniensis</i> (Gmelin,1788)	Squirrel (Kerketuwa)	Asthma Cough	Raw /boiled is consumed	0.13	87.8 54.3
8	Mammals	<i>Rhinolophus</i> spp. (Lacepede,1799)	Bat (Bor Baduli)	Asthma	Cooked and consumed	0.36	87.5
9	Mammals	<i>Herpestes edwardsii</i> (Saint-Hilaire, 1818)	Mongoose (Neola)	Cancer, Asthma, Rabies	Meat is boiled and eaten	0.3	45.7
10	Mammals	<i>Bubalus bubalus</i> (Linnaeus, 1758)	Buffalo (Moh)	Pre menstrual pain body pain	Horn is burned to ash and then mixed with water and drink	0.13	43.7 56.5

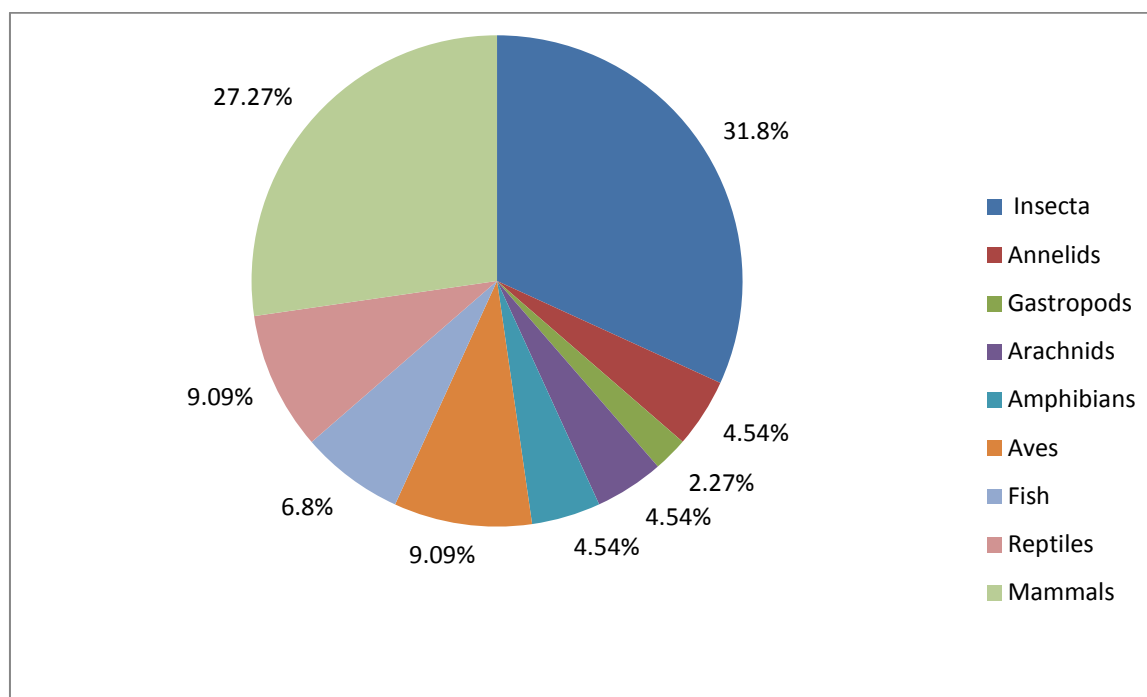


Fig. 3. Percentage of animal categories being used in zootherapeutic practices among the Karbi peoples of Assam

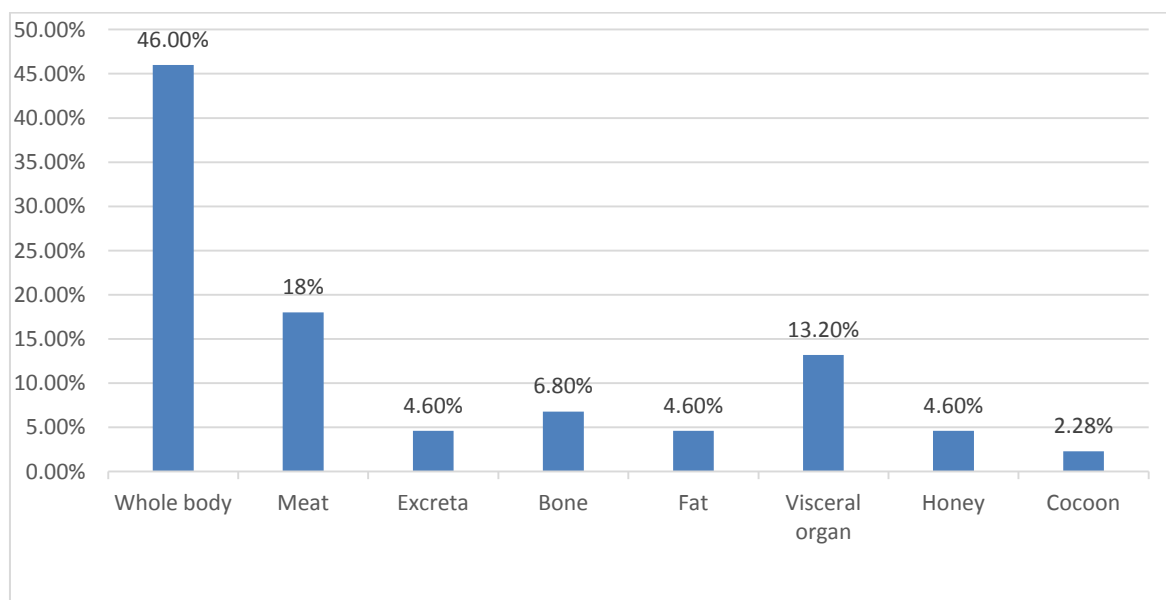


Fig. 4. Parts of animals used by local ethnic groups for the treatment of different disease

The result of the study indicates a total of 8 methods of preparation of medicines from animals, which varied according to the disease. Preparation includes cooking, boiling, burning, crushing, wrapping, powdering, and drying or the use of fresh animal parts/products. The most commonly used way of taking animals is by consuming raw (21.6%), followed by fried and boiled (each 16.2%), Cooked

(18.9%), juice and paste (each 5.4%), burned and smoke (each 8.1 %) (Fig. 5). Different kinds of animals are found of having medicinal properties to treat different kinds of diseases. Raw consumption of animals or animal parts in different therapeutic purposes is a common practice among different ethnic communities worldwide.

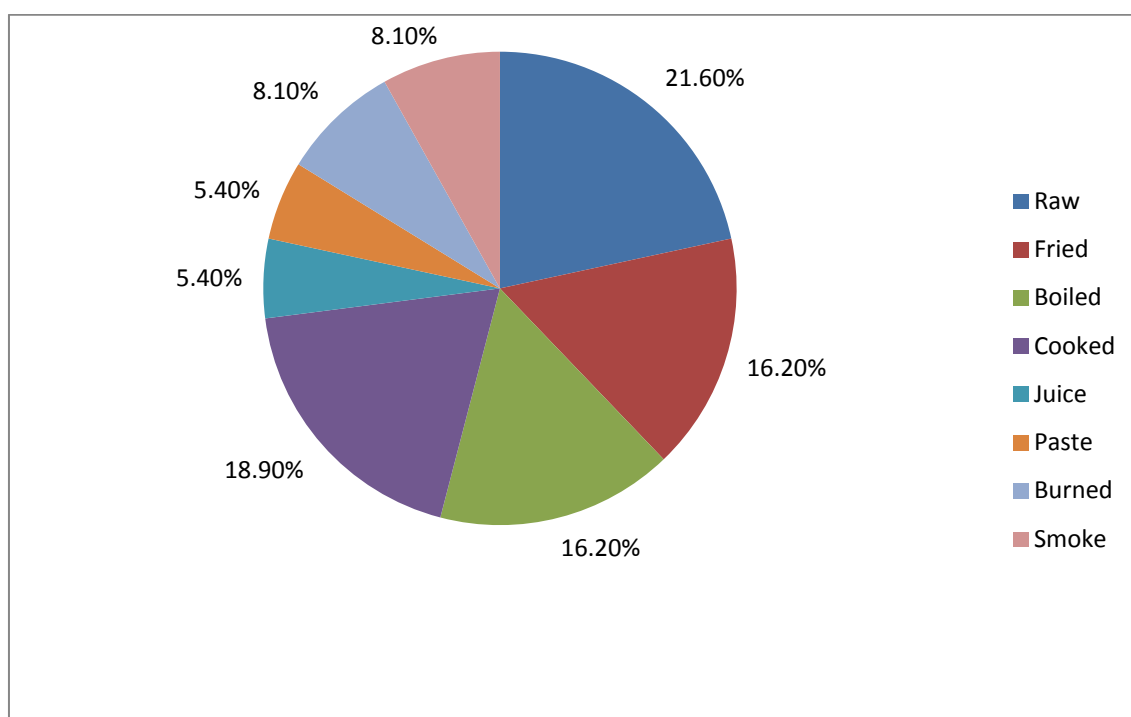


Fig. 5. Methods of preparation of medicines from different animals and animal parts (%)

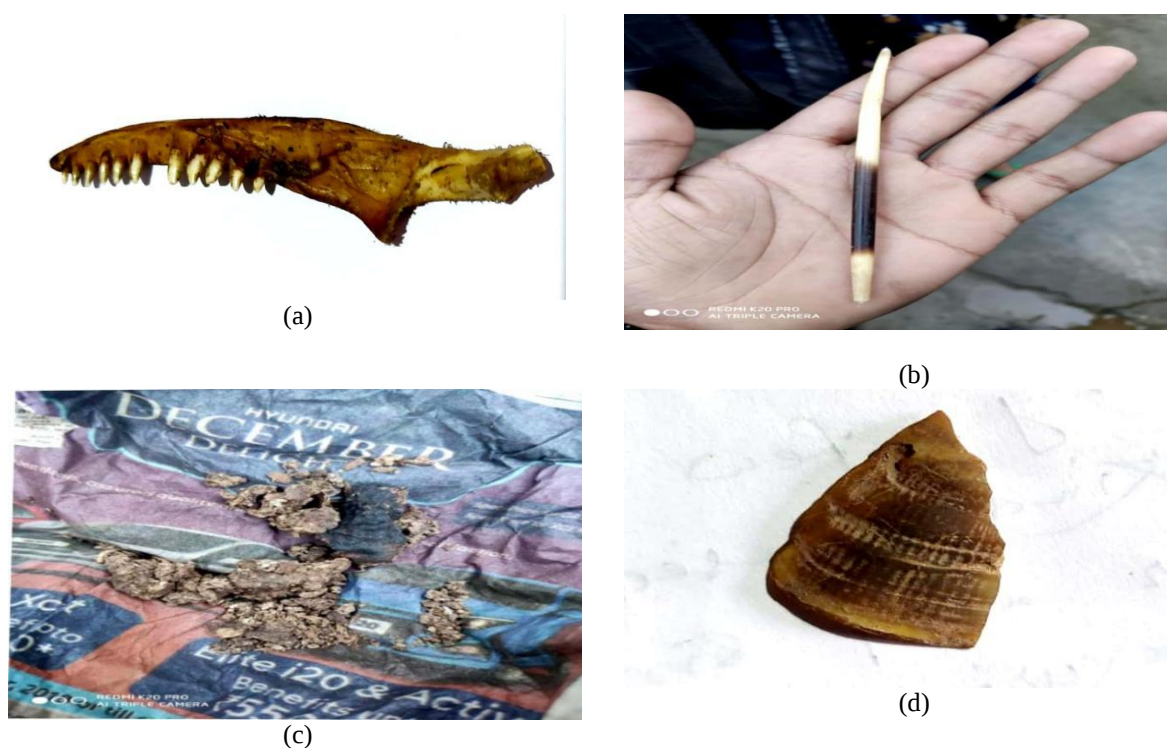


Fig. 6. Photograph taken during field survey showing some of the animal parts which are used as traditional medicines. (a) Teeth of monitor lizard (b) Porcupine spine (c) Intestine of Porcupine (d) Scales of Pangolin

The study also shows that the traditional medicines are prescribed to take via different modes where

eating, drinking, massage, fumigation and heating were the major modes of application (Table 1). Solids

and liquids products were prescribed to take orally and banding, heating, and massaging materials were applied on the skin surface directly. Medicinal fumes were prescribed to enter the body via the nose, while some parts of animals like bones, skin, and teeth were believed to serve as a healing method by wearing them on the neck or other parts of the body. Most of the remedies did not involve the addition of any additional substances like sugar, water, butter, honey, salt, spice, milk, egg, and coffee, but there were cases in which such additives were used.

3.2 Quantitative Analysis of Data

3.2.1 Relative frequency of citation (RFC):

It reveals the local importance of each medicinal animal species, used by the indigenous people of any area. The animal species having higher RFC were: *Apis mellifera* (RFC=0.62), *Amphipnous cuchia* (RFC=0.54), *Clarias batrachus* (RFC=0.43). The highest value of RFC was found in the species *Apis mellifera* which defines the importance of this animal species in that area as it was mentioned by a higher number of respondents. On the other hand, animal species with low RFC values were *Varanus* (0.02), *Echis coloratus* (0.03) and *Lampyridae spp.* (0.05), do not states that they do not have any local importance. The reason of having less RFC value of some species may be due to the less awareness of peoples about the medicinal importance of these species.

3.2.2 Fidelity level (FL)

FL was calculated as the percentage of respondents claiming the use of a certain animal species for the same ailments. The value varies from 1 % to 100% depending on the informants claiming the use of a particular animal species for the same disease. A high value of FL indicates that this particular animal species is used by large number of people, while a low value shows that respondents disagree on the usefulness of a species in treating ailments. The species having higher FL values were (Table 2) *Apis mellifera* (FL=93%) used for the treatment of cough, *Hystrix indica* for the treatment of stomach problems (92.8%), *Amphipnous cuchia* for the treatment of anemia (FL=92.7%), Porcupine, *Hystrix indica* alimentary canal used for stomach problem (92.8%) *Heteropneustes fossilis* for the treatment of wound healing (86.9%) *Clarias batrachus* for the treatment of body pain (84.8%) and *Scapteriscus borellii* for the treatment of intestinal worm (82.5%). Squirrel used against Asthma has FL value of 87.8%. Bat is used against Asthma with FL value is 87.8%. However Rana sp. (FL=12.9%) for the treatment of asthma and *Oecophylla smaragdina* (FL=15.7%) for the treatment

of epistaxis has the lowest fidelity level. The result of the survey shows that in some of the cases same animal species were prescribed to use for the treatment of more than one disease. However, sometimes different animal species were also used for the treatment of same disease.

Based on our comprehensive literature survey, we could assess that Cough, cold, flu, asthma, pain, fever, wound in ear, baldness, lung infection, throat inflammation, intestinal worm, burn, urinary tract obstructions, sinus, arthritis, pneumonia, typhoid, nasal congestion, joint pain, anemia, body pain, itching, skin diseases, hiccup, dysentery, stomach disorders, liver problems and women's issues are the some of the most common diseases which were reported to be cured by the use of the traditional medicines. During the study, some of the respondents also informed that there were some people in the village who used to give medicines through some Chant (mantras) while giving the medicine. They thought that mantras have some religious, magical or spiritual powers. This may be a belief as there is not much sufficient proof regarding this. The data obtaining from the survey indicates that traditional medicines play a very important role in the primary health care among the indigenous peoples inhabiting in Karbi Anglong District, Assam, India. Hence, it is very important to take care of ecological balance and biodiversity conservation measures in terms of uses and sale of animals and their products for medicinal purpose. Further, due to death of elderly knowledgeable persons and rapid modernization, the traditional zootherapeutic knowledge is eroding and therefore, the data obtained from the present study should be helpful to preserve and document the knowledge of these ethnic groups on zootherapeutic usages for future.

4. DISCUSSION

In the present study, 42 animal species and their products were collected and identified that were believed to be used for treatment of 35 different kinds of ailments. A similar study was carried out by Verma et al (2014) on Karbi tribe where they reported about 48 different animals used for different ethno-medical purposes against various diseases [4]. Chinlapianga et al (2013) reported about 39 aquatic and terrestrial species being used by Adi tribe of East Siang districts of Arunachal Pradesh as food, medicine and 35 faunal species are used by people of Mizoram for ethno medicinal purposes [7]. Present study revealed the rich knowledge of Karbi people about the use of animals and their products. In this study Karbi tribes are reported to use whole body, meat, visceral organs, bone, excreta, fat and cocoon and many other parts

and products of animals and similar kinds of parts and products of animals were also reported to be used by Tigray people of Northern Ethiopia [8]. This indicates that ethno-zoological practices are common among the tribes of different countries. This present study shows that traditional medicines are mainly prescribed to take by eating, drinking, massaging and fumigating. Similar kinds of findings were also reported in the study of Yirga *et al.* (2011) [8]. Preparations varied according to disease to be treated which generally involved cooking, burning, crushing, wrapping, powdering and drying [9]. The honey of bee species (*Apis mellifera*) used by this tribe is known to relieve Cough, flu, asthma and diarrhea has the highest fidelity level similar effectiveness of this product was also reported by (Fasil AK. *et al.*, 2018) in his study [5]. Chinlapianga, M *et al.*, (2013) in his study involving traditional healers of Mizoram and Arunachal Pradesh also reported the effectiveness of honey from *Apis mellifera* in curing many diseases [7]. Bora, M. P. *et al.* (2017) in his study also mentioned that indigenous inhabitants of adjoining areas of Gibbon wildlife sanctuary of Assam are dependent on traditional medicinal system for primary health care and their study revealed that they used highest number of insect species (30.9%) followed by mammals (23.8%) [10]. This result is very much similar to the findings of the present study. The use of mammals and their body parts in traditional medicine has also been reported in other parts of India [4, 11].

The present study showed 10 animal species with FL value above 80% such as *Apis mellifera* used for treatment for cough (FL≈93%), *Scapteriscus borellii* (Kumoti) used against intestinal worm (FL≈82.5%), *Amphipnous cuchia* used for anemia (FL≈92.7%), *Periplanata americana* used against Asthma has FL value 92.6%, *Clarius batrachus* used against body pain (FL≈84.8%), *Heteropneustes fossilis* for wound healing (FL≈86.9%), *Hystrix indica* for stomach problem (92.8%), *Squirell* against Asthma (87.8%). Human Urine used against skin diseases (89.3%). *Rhinolophus* spp. Used against Asthma FL≈87.5%. Almost Similar FL value for *periplanata America* and *Amphipnous cuchia* were also reported by Borah, M.P. *et al.* in 2017 in his article. The study showed that same animal species is reported to be used for treating multiple disease [10]. Similar findings were also reported from different parts of the world [6,12].

Mishra and Panda (2011) have documented the use of cockroach excreta in the treatment of bronchitis from coastal region of Orissa, India. Moreover, the present findings recorded the use of cockroach whole body for the treatment of asthma [13]. It was also noted that

honey bees were used against treatment of cancer suspects and this observation could be in line with the findings of Jo *et al.* (2012) where honey bee venom toxin and melittin were suggested for anticancer effect in ovarian cancer cells through induction of death receptor and inhibition of JAK2/STAT 3 pathway [14]. According to Zhang *et al.* (1992) the medicinal usage of earthworms in China has a history of nearly 4000 years for the treatment of 80 different diseases like asthma, epilepsy, cancer etc. Present study also documented the use of earthworms against many diseases like Gastric arthritis and Pneumonia [15]. Pharmacological importance of earthworms is also supported by the study of Dinesh *et al.* (2013) where they showed the anticancer potential of peptides of coelomic fluid of earthworms [16]. However, ethnozoological application of animals is a matter of serious concern connected with illegal trade in wildlife where animal parts/animal products such as gallbladder of Himalayan Black Bear, goral horns, pangolin scales, monkey flesh, etc. are rarely available [17]. Furthermore, ethnic people should consider the alternative options such as the use of commonly found medicinal plants and other inorganic salts or compounds for the treatments of ailments. Any future economic gains obtained using indigenous knowledge should be shared with local communities to safeguard their intellectual property rights. The traditional healers need to be sensitized and made aware of the extant Acts and Rules pertaining to wildlife conservation [18].

5. CONCLUSION

Traditional medicines prepared from animals has been playing an important role in the ethnic health system from ages. An integrated approach to the potential uses of traditional medicine using animals would not only conserve our rich natural resources, but also aid in preserving cultural heritage as well. All the people of the local communities have the considerable knowledge regarding traditional medicines. However, efforts to document, conserve, and manage the indigenous knowledge and skills were very rare, and important indigenous knowledge is getting lost together with the elders and experts. Hence, it is important to document, conserve, and manage the indigenous knowledge and further research should be done to test the products scientifically for product development. But it is of utmost importance to take care of our ecological balance and to conserve our biodiversity in terms of use and selling of animals and its byproducts. Therapeutic use of these animals can lead to indiscriminate killing of them which may lead to the extinction of many important species from our environment. Moreover many superstitions and myths are also associated with these practices therefore more

scientific approach is necessary to explore the appropriate use of those products.

The present study provides some information about traditional zoo therapeutic medicines and their uses as primary health care practices. It provides that there is a wealth of ethno zoological knowledge to be documented which could be of use in developing new drugs. Hence, it is hoped that the information contained in this paper will be useful in future ethnozoological, ethnopharmacological, and conservation related research of the region. Moreover, this study provides the base of further scientific validation of the therapeutic efficacy of various zootherapeutic traditional uses by these people and finding novel biological compounds towards discovery of new drugs. The Traditional medicine is not only significant for its pharmacological value, but also related to different cultural beliefs and sentiments of the indigenous people. Therefore, our study concluded that there is a necessity for documentation of detailed knowledge about the status and specific use of animals and also the transfer of knowledge from elders to the youths for sustainable use of ethno medicines in the place like the Karbi Anglong district.

CONSENT

As part of prior informed consent, the informants were apprised of the objectives of this study. Information was collected following both unstructured and structured interview methods. Information so obtained was substantiated from elders of other localities and also by personal observation.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Lev E. Traditional healing with animals (zootherapy); medieval to present-day Levantine practice. *J Ethnopharmacol.* 2003; 86:107-18.
2. World Health Organization, International Union for Conservation of Nature and Natural Resources & World Wide Fund for Nature. Guidelines on the conservation of medicinal plants. Gland: International Union for Conservation of Nature and Natural Resources. 1993; Available: <https://apps.who.int/iris/handle/10665/41651>
3. Jaroli DP, Mahawar MM, Vyas N. An ethanozoological study in the adjoining areas of Mount Abu wildlife sanctuary. India *J Ethnobiol Ethnomed.* 2010;6:6-13. DOI: 10.1186/1746-4269-6-6.
4. 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 Sci*; 2014; 6(8):593-600.
5. Kendie FA, Mekuriaw SA, Dagnew MA. Ethnozoological study of traditional medicinal appreciation of animals and their products among the indigenous people of Metema Woreda, North-Western Ethiopia. *J Ethnobiology Ethnomedicine.* 2018;14:37. Available: <https://doi.org/10.1186/s13002-018-0234-7>
6. Alves RR, Rosa IL. Why study the use of animal products in traditional medicines? *J Ethnobiol Ethnomed.* 2005;30:1-5. DOI: 10.1186/1746-4269-1-5. PMID: 16270931; PMCID: PMC1277085.
7. Chinlapianga M, Singh RK, Shukla, Amritesh AC. Ethnozoological Diversity of Northeast India: Empirical Learning with Traditional Knowledge Holders of Mizoram and Arunachal Pradesh. *Indian Journal of Traditional Knowledge.* 2013;12:18-30.
8. Yirga G, Teferi M, Gebreslassea Y. Ethnozoological study of traditional medicinal animals used by the people of Kafta-Humera District, Northern Ethiopia. *International Journal of Medicine and Medical Sciences.* 2011;3(10):316-20.
9. Meyer-Rochow VB. Therapeutic arthropods and other, largely terrestrial, folk-medicinally important invertebrates: a comparative survey and review. *Journal of Ethnobiology and Ethnomedicine.* 2017;13(1):1-31.
10. Borah MP, Prasad SB. Ethnozoological study of animals based medicine used by traditional healers and indigenous inhabitants in the adjoining areas of Gibbon Wildlife Sanctuary, Assam, India. *Journal of ethnobiology and ethnomedicine.* 2017;13(1):1-3.
11. Borah MP, Prasad SB. Ethnozoological remedial uses by the indigenous inhabitants in adjoining areas of Pobitora wildlife sanctuary, Assam. India. *Int J Pharm Pharm Sci.* 2016;8(4):90-6.

12. Teron R, Borthakur SK. Biological motifs and designs on traditional costumes among Karbis of Assam. *India J Tradit Know*. 2012;11:305-8.
13. Mishra N, Panda T. Zootherapeutical uses of animal diversity in coastal district of Orissa, India. *British Journal of Pharmacology and Toxicology*. 2011;2(3):154-8.
14. Jo M, Park MH, Kollipara PS, An BJ, Song HS, Han SB, Kim JH, Song MJ, Hong JT. Anti-cancer effect of bee venom toxin and melittin in ovarian cancer cells through induction of death receptors and inhibition of JAK2/STAT3 pathway. *Toxicology and applied pharmacology*. 2012;258(1):72-81.
15. Fu-Xia Z, Bao-Zhu G, Hui-Yun W. The spermatocidal effects of earthworm extract and its effective constituents. *Soil Biology and Biochemistry*. 1992;24(12):1247-51.
16. Dinesh MS, Sridhar S, Chandana PG, Pai V, Geetha KS, Hegdge RN. Anticancer potentials of peptides of coelomic fluid of earthworm *Eudrilus eugeniae*. *Biosci Biotechnol Res Asia*. 2013;10(2):601-6.
17. Dhakal P, Chettri B, Lepcha S, Acharya BK. Rich yet undocumented ethnozoological practices of socio-culturally diverse indigenous communities of Sikkim Himalaya, India. *Journal of Ethnopharmacology*. 2020;249: 112386.
18. Dkhar M, Tiwari BK. Traditional ecological knowledge of tribal communities of North East India. *Biodiversitas Journal of Biological Diversity*. 2020;21(7):3209-3224.