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Caption: Malabar Slender Loris *Loris lydekkerianus malabaricus* © Dileep Anthikkad.



Ethnozoological use of primates in northeastern India

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Abstract: Ethnozoological practices to cure various diseases have a long history. Communities that reside near the forest collect wild animals and their derivatives to prepare medicines and get relief from diseases. Northeastern India is home to many tribes with vast traditional ethnobiological knowledge, and there are many reports of zootherapeutic uses in the region. In an attempt to understand primate-based ethnozoologic use in the area a literature survey was carried out using different sources. The findings revealed that *Hoolock hoolock* was the most used species among the primates (48 %), followed by *Macaca assamensis* (20 %) and *Macaca mulatta* (10 %). Among the materials used, the flesh of primates was the most dominant (43 %), followed by the blood (20 %) and brain (14 %). This paper highlights the negative effects of ethno-medicinal uses of primates to draw the attention of conservationists and encourage conservation education to address the damage to primates in the name of health care. Government agencies are also requested to strengthen health care systems to discourage the killing of valuable primate species.

Keywords: Biate tribe, Hoolock Gibbon, Mizoram, traditional medicine.

Dimasa: Manang gda nising ning Dao-Mi jadzi nising gibin gibin glim-gasa khe ham ri yaba yawaithai phai pha bu lang ba. Hagra ni rogong ha dongyaba jadzi buthu hagra ni dao mi nising muli sandi slamhi glim gasa khe hamridu. North-East India ha gibin gibin jadzi buthuni muli sandi slamma ni ringma bangbi odehe mitsiba lai tsikhade, Dao-Mi ni bahain bugur khe bo muli sandi ne yawai ba ibu hathan ha bangbi. Magusa khe lahi muli-sandi yawaiyaba khe mitsimane mashi survey khlaiba. Survey ni yahon ha mitsikha je, magusa jadzi ni bising ha 'hulao' hoolock khe yawaidaothao (48%), buni yahon ha *Macaca assamensis* (20%) odehe *Macaca mulatta* (10%). Buha, magusha ni bahain khe yawaidaothao (43%), buni yahon ha bitsi (20%) odehe bikhlim (14%). Ibu lai ha magusa ni basao khe muli sandi ne yawaiba hamya ba khe phunu du odehe dao-mi khasaoyarao ode raokhiyarao khe ibu sibringmane thiladu. Government khe bo health care hamdaorimane bilahadu nabani tsikhade healthcare hamkha she nolaisarao bo dao-mi ni beher jang muli sandi slamba sai dao ma.

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INTRODUCTION

Faunal resources play vital roles in human life and societies (Alves 2012), where the importance of animals is manifested in religion, culture, art, music, dance, literature, food, economy, and magico-religious practices (Alves 2012). Use of animals and animal products to cure ailments is popularly known as 'zootherapy' and has been passed down generations through cultural transmission in several ethnic communities around the globe (Berkes 2009; Solanki & Chutia 2009; Nekaris et al. 2010; Jugli et al. 2019).

Non-human primates are an integral element in ethnozoology (Alves et al. 2010; Lee 2010; Svensson et al. 2015), which has can a range of effects on animals and their habitats (Hockings 2016). In Asia, Africa, and America primates are protected and revered to some extent due to their significant role in a number of agricultural, religious and cultural practices (Hockings 2007). On the other hand, primates are also considered a menace in agricultural and urban areas for stealing crops and food from fields and kitchens, inflicting economic damage (Mittermeier et al. 2005, 2007). This forms the basis of man-animal conflict resulting in retaliation killing, illegal trade, hunting for meat, fur, ornamental and medicinal purposes, and capture to be kept as pets (Mittermeier et al. 2005, 2007; Srivastava 2006; Hockings 2007; Alves et al. 2010; Devi & Radhakrishna 2013). Hunting and trade of primates for their medicinal value is an important factor for the decline of their populations (Nekaris et al. 2010). Alves et al. (2010) recorded a total of 101 species of primates that were used in ethnozoological practices and in magico-religious rituals all over the globe. Out of the 101 recorded primate species, 12 were classified as 'Critically Endangered' (CR), 23 as 'Endangered' (EN), 22 as 'Vulnerable' (VU), seven as 'Near Threatened' (NT), 36 as 'Least Concern' (LC), and one as 'Data Deficient' (DD) (IUCN Red List 2020). The species recorded were also included in Appendices I or II of CITES.

Northeastern India comprises eight states, viz, Assam, Arunachal Pradesh, Mizoram, Manipur, Meghalaya, Nagaland, Sikkim, and Tripura. The entire area falls under the Indo-Burma hotspot that harbors diverse species of plants and animals, most of which are endemic to the region. The region is home to *Nycticebus bengalensis* (Bengal Slow Loris), *Macaca mulatta* (Rhesus Macaque), *Macaca arctoides* (Stump-tailed Macaque), *Macaca assamensis* (Assamese Macaque), *Macaca leonina* (Pig-tailed Macaque), *Macaca munzala* (Arunachal Macaque), *Macaca leucogenys*

(White-cheeked Macaque), *Macaca thibetana* (Milne-Edwards' Macaque, Tibetan Macaque), *Semnopithecus schistaceus* (Central Himalayan Langur, Nepal Grey Langur), *Trachypithecus pileatus* (Capped Langur), *Trachypithecus phayrei* (Phyare's Leaf Monkey), *Trachypithecus geei* (Golden Langur), *Hoolock hoolock* (Western Hoolock Gibbon) (Choudhury 2013; Talukdar et al. 2021). Their distribution varies, and some areas have higher diversity than others (Chetry et al. 2003; Choudhury 2013). The damaging scenario of ethno-primatology, i.e., the interactions between human and non-human primates, leading to decline of the latter is more or less same in northeastern India as elsewhere (Nekaris et al. 2010; Riley 2010; Riley & Feuntes 2011; Lee 2010; Alves 2012; Alexander et al. 2014; Svensson et al. 2015; Stafford et al. 2016). Most of the primates of northeastern India are categorized as vulnerable or threatened. The continuation of ethnozoological practices by the tribes is depriving them of modern medical advances and also resulting in rapid declines of primate populations in the region.

The Northeast region of India is the abode of about 145 tribes constituting around 12 % of the Indian ethnic population (Ali & Das 2003). In northeastern India, different workers have reported ethnozoological practices with various animals by different tribes (Solanki 2006; Solanki & Chutia 2009; Alves et al. 2010; Alves & Alves 2011; Ferreira et al. 2012; Betlu 2013; Devi & Radhakrishna 2013). Most recently, Jugli et al. (2019) studied the ethnozoological practice among the Tangsa and Wancho of eastern Arunachal Pradesh. However, none of the above studies have specifically focused on the detrimental scenario emanating out of the ethnozoological uses of primates. Therefore, the present study was attempted to identify the uses of primate species in traditional medicines in northeastern India and suggest remedial measures.

MATERIALS AND METHODS

To analyze the diversity of primates in the utilization of traditional medicines in northeastern India, available literature on folk remedies based on primate resources was reviewed. As majority of the works on ethnobiology have the primary focus on ethnobotany, a total of 11 papers were found related to the ethnozoological uses, especially in northeastern India. Scientific papers were downloaded from Google Scholar, PubMed, Research Gate and Academia using relevant keywords such as ethnozoology, ethno-zoology, traditional folk medicine,

zootherapy, and primate. A database was created containing detailed information on primate species, body part used for medicine, mode of usage and name of the tribes.

RESULTS AND DISCUSSION

The study found that seven out of eleven primates in northeastern India are used in traditional medicine for the treatment of various ailments by different indigenous tribes. The utility of primates in the field of health care by the indigenous tribes of northeastern India is diverse (Table 1). Primates of the northeastern India are reported to be used for 38 different ailments. Large percentages (48%) of these ailments were reported from a single tribe while others had no information (Figure 1). Diseases such as malaria (10 %), tuberculosis (9 %), small pox (7 %), and typhoid (7 %) were found to be treated by using primates by multiple tribes. Among the primate used for ethnozoological practices, Hoolock gibbon is mostly used (57 %), followed by different *Macaca* sp. (40 %) (Figure 2). Capped Langur was mentioned only in one work from Arunachal Pradesh (Solanki & Chutia 2009).

Body parts of primates are used for treating various health conditions ranging from common ailments like headache and general body weakness to serious ones such as diabetes, malaria, typhoid, tuberculosis, and hernia (Table 1). Among the body parts of primates used for ethnozoological purposes, flesh was significantly preferred for the ethnozoological purposes ($\chi^2= 123$, $df= 9$, $p < 0.001$). It was found that flesh of primates was mostly used (43 %), followed by blood (20 %), brain (14 %), and bone (8 %) (Figure 3). Body parts used for the treatment of some diseases are common irrespective of the tribes. For example, blood of Hoolock gibbon is used for the treatment of colic, and flesh of primates is used for the treatment of small pox and typhoid. Such common patterns of uses of body parts by ethnic people are important to understand the hunting pressure on the species. Flesh of Hoolock Gibbon is used by the Biate tribe for remedy of pertussis (Ronghang et al. 2011). Flesh of the same primate is used for cure against fever, typhoid, malaria, pox, asthma, tuberculosis, and liver cirrhosis in Arunachal Pradesh (Solanki & Chutia 2004, 2009; Jugli et al. 2019). Pregnant women of Lushai tribes of Mizoram take gibbon flesh to gain physical strength (Lalramnghinglova 1999; Chinlambianga et al. 2013). Flesh of Assamese macaque is used against pathogenic diseases like malaria, typhoid, tuberculosis, and

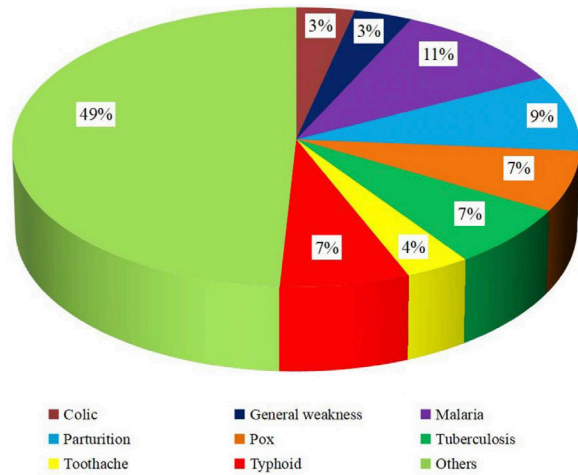


Figure 1. Ethnozoological practices of primate against various diseases in northeastern India.

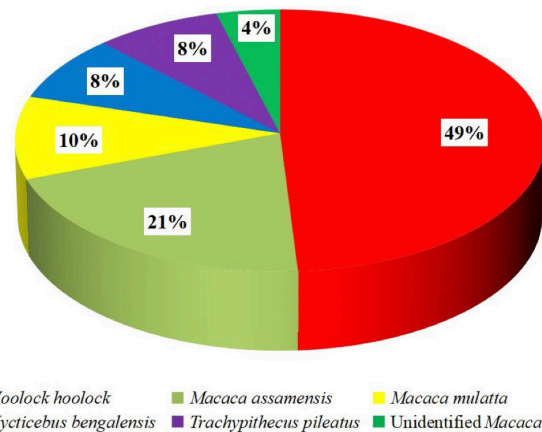


Figure 2. Contribution of different primates of northeastern India in ethno-zoological practices.

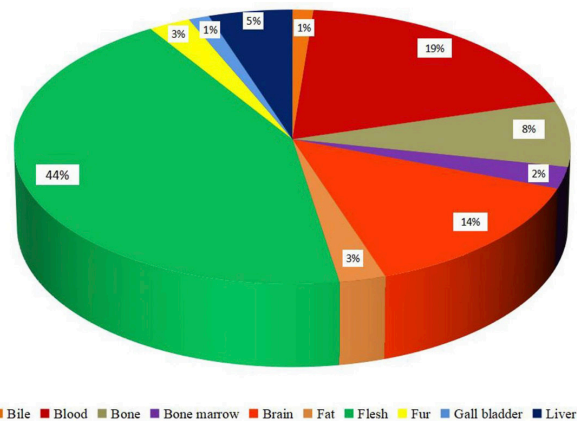


Figure 3. Body parts of primate use for the ethno-zoological practices in the northeastern India.



Table 1. List of primates and their body parts traditionally used as medicines for the treatment of various ailments by different ethnic tribes of northeast India.

State	Tribe	Animal	Body part used	Dried / fresh	Ailments	Mode of preparation	Reference	Conservation status		
								IUCN Red List status	WPA	CITES
Assam	Biaste	<i>Hoolock hoolock</i>	Brain	Fresh	Painless parturition	Brain tissues are cooked and consumed with rice	Betlu 2013	EN	Sch I (Part1)	I
			Bone	Dried	Rheumatism	Bone pieces are tied to affected body part of man				
			Skull bone	Dried	Dizziness	Gibbon skull bone pieces are tied to the head of human subject.				
			Hand	Dried	Hernia	Sun dried gibbon hands are rubbed onto the affected areas of man.				
		<i>Macaca assamensis</i>	Brain	Fresh	General weakness in pregnant women	Brain tissues are cooked and taken with rice to get body strength during pregnancy.		NT	Sch II (Part 1)	-
			Gall bladder	Dried	Diabetes	Dried up pieces are taken in with rice or sometimes with water.				
Limb	Dried		Mumps	Dried up pieces are used for massage on the affected area.						
Assam	Karbi	<i>Hoolock hoolock</i>	Flesh / Bones	Dried	Pertussis	The powdered bone of Hoolock gibbon is taken in combination with of the flesh of <i>Acridotheres tristis</i> (Common myna), salt and water and made into a tablet and thus consumed.	Ronghang et al. 2011	EN	Sch I (Part1)	I
Arunachal Pradesh	Monpa	<i>Hoolock hoolock</i>	Flesh	Fresh	Serious fever, Typhoid, Malaria, Pox	Flesh, liver and blood are cooked and consumed.	Solanki & Chutia 2004, 2009	EN	Sch I (Part1)	I
		<i>Macaca assamensis</i>	Flesh	Fresh	Malaria, typhoid, Tuberculosis, small pox	Cooked and ingested.		NT	Sch II (Part1)	-
		<i>Macaca mulatta</i>	Flesh	Fresh	Malaria, typhoid, small pox	Cooked and ingested.		NT	Sch II (Part1)	-
		<i>Trachypithecus pileatus</i>	Flesh	Fresh	Malaria, typhoid, dysentery, small pox	Cooked and ingested.		VU	Sch I (Part1)	I
	Tangsa	<i>Hoolock hoolock</i>	Flesh, Liver, Blood	Fresh	Asthma, Malaria, Tuberculosis, Liver cirrhosis	Flesh, liver and blood are cooked and consumed.	Jugli et al. 2019	EN	Sch I (Part1)	I
			Blood	Fresh	Hypovolemia	Fresh raw blood is drunk.				
		<i>Nycticebus bengalensis</i>	Body fat	Fresh	Body pain and burns	Fresh body fats are preserved in the bamboo jar made up of bamboo (or in glass bottle) and massage given on the affected area as and when required.	VU	Sch I (Part1)	I	
		<i>Macaca assamensis</i>	Brain	Fresh	Blood pressure, nausea	Brain is cooked and ingested directly.	NT	Sch II (Part 1)	-	

State	Tribe	Animal	Body part used	Dried / fresh	Ailments	Mode of preparation	Reference	Conservation status		
								IUCN Red List status	WPA	CITES
Mizoram	Lushai	<i>Hoolock hoolock</i>	Flesh	Fresh or dried	Painless parturition	Cooked and consumed.	Lalramng-hinglova 1999; Chinlampaing et al. 2013	EN	Sch I (Part1)	I
			Blood	Fresh	Colic, Hepatitis, Hemicrania	10ml fresh blood is taken at a time				
					Tuberculosis, Colic, Anaemia	Blood and country liquor (homemade) are mixed and taken.				
					Fracture of bone	Blood of Hoolock gibbon is taken, mixed it with turpentine oil and applied on the affected area.				
			Brain	Fresh	Toothache, Headache	Hairs on skull are removed by fire; it is then cooked. After that applied on the affected teeth and also taken or eaten for cure against headache.				
			Brain	Dried	Tooth decay, Bee sting	Cooked brain preserved in a container over fire is grounded to powder and applied on tooth decay and bee sting				
			Bone marrow	Fresh	Sciatica, Paralysis	Bone marrow is taken out from Tibia fibula and is cooked and rubbed on the affected areas.				
		Bone	Dried	Prevent attack of diseases	A small part of the bone is tied with thread that hangs on the wrist or waist.					
		<i>Nycticebus bengalensis</i>	Fur	Dried	Wounds and cuts Haemostatics	Fur is wrapped around the affected area		VU	Sch I (Part1)	I
		<i>Macaca assamensis</i>	Flesh	Fresh	Easy labour during pregnancy	Flesh is cooked and consumed		NT	Sch II (Part1)	-
Brain	Fresh		General weakness	Brain is cooked and served to the children for consumption.						
Bile	Fresh		Malaria	Bile is cooked and taken.						
Manipur	Meitei community	<i>Macaca mulatta</i>	Brain	Fresh	Postnatal women	Brain is cooked and taken as food.	Devi & Radhakrishna 2013	NT	Sch II (Part 1)	-
Tripura	Tribes in Khowai district of Tripura.	<i>Macaca mulatta</i>	Flesh	Fresh	Joint pain	Flesh is cooked and taken as food.	Das 2015	NT	Sch II (Part 1)	
Nagaland	Naga	<i>Macaca sp.</i>	Flesh	Fresh	Tuberculosis, stomach disorder, general weakness	Flesh is cooked and taken as food.	Jamir & Lal 2005			

IUCN—International Union for Conservation of Nature and Natural Resource | WPA—Wildlife Protection Act of India, 1972 | CITES—Convention on International Trade in Endangered Species of Wild Flora and Fauna | EN—Endangered | VU—Vulnerable | NT—Not Threatened.



smallpox in Arunachal Pradesh, while in Mizoram, tribal people believe that consumption of flesh of the same species helps in painless parturition. Flesh of Stump-tailed Macaque is used against pathogenic diseases such as malaria, typhoid, and smallpox in Arunachal Pradesh, while Naga tribe of Nagaland use the flesh of the same species for cure of tuberculosis, stomach disorder and general weakness (Jamir & Lal 2005). Tribal people in Khowai district of Tripura use the flesh of Stump-tailed Macaque as pain killer (Das 2015). Flesh of Capped Langur is used against malaria, typhoid, dysentery, and smallpox by the tribes of Arunachal Pradesh.

Brain of Hoolock Gibbon, Rhesus and Assamese macaques was reported to be used against different diseases (Lalramnghinglova 1999; Betlu 2013; Chinlapianga et al. 2013; Devi & Radhakrishna 2013). Fresh brain tissues of Hoolock Gibbon was found to be used by Biatae tribes of Dima Hasao district, Assam as they believe that it acts as an invigorating stimulant for pregnant women (Betlu 2013). In Mizoram, brain tissue in paste form is applied for toothache, taken orally to get rid of headache, and sometimes the brain tissues are dried up, and the dry powder is used against tooth decay and as a cure for bee sting (Lalramnghinglova 1999; Chinlapianga et al. 2013). Brain of Assamese macaque is used to gain physical strength during pregnancy by the Biatae tribes of Dima Hasao district of Assam (Betlu 2013) while some local tribes of Arunachal Pradesh believe that the consumption of a fresh brain of the macaque controls blood pressure and cures one of nausea (Chinlapianga et al. 2013). Lushai tribes of Mizoram consume it for gaining physical strength (Lalramnghinglova 1999). The Meitei women of Manipur take the brain of Rhesus Macaque during postnatal period (Devi & Radhakrishna 2013). Blood of many primate species is used by various tribes of northeastern India for a variety of purposes. In Arunachal Pradesh, the Tangsa tribe use the fresh blood of Hoolock Gibbon to cure diseases such as asthma, malaria, tuberculosis, liver cirrhosis, and weakness caused by hypovolemia (decreased blood volume). Among the tribes of Mizoram, blood of Hoolock Gibbon was reported to be used for hepatitis, hemicrania, tuberculosis, anemia, bone fracture, and colic problem in children.

Bones of primates are used for different ailments (Table 1). Dried bone of Assamese Macaque is used by the Biatae tribe to cure mumps. The bone of Hoolock gibbon is used by the Biatae tribe of Dima Hasao district (Assam) against hernia, rheumatism, dizziness, and against pertussis by the Karbi tribe of Karbi Anglong district, Assam (Ronghang et al. 2011). The tribal people

of Mizoram use bone of gibbon as they believe it acts as a vaccine and prevents attack of diseases. Gall bladder of non-human primates is used by the tribes of Arunachal Pradesh for getting relief from high fever caused by malaria and typhoid (Solanki & Chutia 2009).

In several cases, ethnic communities prepare the animal-based medicines either singly or in combination, and some are consumed raw or preserved. In some cases, the animal body parts are preserved by drying under the sun or are smoked or fire-dried (Betlu 2013; Jugli et al. 2019). Although Rhesus Macaque is commonly used as ethnozoological medicine among all the tribes of the region, there has been no published literature on this and the other primates except Hoolock gibbon, which is mostly reported for its uses against multiple diseases (Figure 3).

Apart from their uses as ethnomedicines, body parts of primates are also used for a variety of other purposes by the ethnic communities. They are hunted for food, sport or ceremonial and ritualistic purposes (Devi & Radhakrishna 2013). For instance, the fur of primates is used in making the local hat 'Yangcha' of the Monpa people of Arunachal Pradesh (Solanki & Chutia 2004). Betlu (2013) reported that Hoolock Gibbons are kept as pets by Biatae tribe of Dima Hasao district of Assam. It was also reported that the smoked meat of Capped Langur and Hoolock Gibbon was in high demand and would cost approximately INR 350–400 per kilogram.

The study found multiple ethnozoological uses of same organs of primates by the tribes while some organs are commonly used by the different tribes for the same disease. This needs to be prevented and deserves sincere attention of conservationists. Among a few tribes there exist myths or folktales about the demerits of consumption of animal species. Though most of the communities think that body parts of slow loris are useful, the tribal communities of Manipur believe that consuming their flesh causes severe illness. There also exist other beliefs among the tribal communities that are helpful in upholding the ethos of conservation. According to some communities of Manipur, Hoolock Gibbons reproduce at full moon and also die at full moon, thus a circle is maintained. For the sake of conservation, such belief systems need to be promoted on a large scale as they can contribute to reducing the hunting pressure for ethno medicines. As the primates in the area are also facing innumerable threats like scarcity of food, habitat fragmentation and shrinkage, the tribal people should be prevented from hunting them. The tribes should be made aware of the penal provisions as contained in the Wildlife (Protection) Act,

1972, CITES etc. To spread the message of conservation, sufficient numbers of awareness campaign needs to be given among the tribes to reduce their dependence on primates.

CONCLUSION

This study documents the negative uses of primate resources in traditional healthcare systems by the indigenous people of northeastern India. Many endangered and vulnerable primates that are used for zoo-therapeutical purposes are collected from the wild and killed to obtain the desired organs or body parts. This sets pressure on the survival of the species in particular and on the biodiversity of the region in general. All the primates of northeastern India are facing multiple threats, and hence the tribes should not be allowed to hunt them. Unlike plants, there is no scientific basis/evidence for the medicinal values of primates, and since cheaper and easier medicines are available almost everywhere, communities should be barred from killing such precious animals. Governments should also take up initiatives to open adequate health care centers and hospitals in the interior villages, so that the tribal people are exposed to scientific health care systems. In order to strengthen their conservation, community awareness needs to be undertaken to reduce dependency on primates for traditional healthcare.

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